APPENDIX Q
HUMAN HEALTH, DOSE, AND RISK ANALYSIS

> This appendix presents methods and results for assessment of potential human health impacts due to releases of radionuclides and chemical contaminants from the high-level radioactive waste tanks, Fast Flux Test Facility decommissioning, and waste management activities over long periods of time following stabilization or closure.

Q.1 INTRODUCTION

Adverse impacts on human health and the environment may occur over long periods of time following stabilization or closure of the Hanford Site (Hanford) tanks, decommissioning of the Fast Flux Test Facility (FFTF), and the closure of the Integrated Disposal Facility in the 200-East (IDF-East) and 200-West (IDF-West) Areas and the River Protection Project Disposal Facility (RPPDF). Because these impacts would occur in the future and cannot be known solely from measurements made at this time, mathematical models are used to estimate the magnitude of the potential impacts. This appendix presents methods and results for assessment of potential human health impacts due to releases of radionuclides and chemical contaminants from the high-level radioactive waste (HLW) tanks, FFTF decommissioning, and waste management activities over long periods of time following stabilization or closure. The objectives of the analysis include development of (1) objective measures of potential impacts on human health, (2) quantitative measures for comparison with regulatory criteria, and (3) understanding of the dependence of human health impacts on facility designs and environmental processes.

Q.2 APPROACH FOR LONG-TERM PERFORMANCE ASSESSMENT

The approach used for estimation of long-term impacts on human health is development and analysis of a set of scenarios that provides a reasonable bound on potential impacts. Each scenario includes a combination of releases from a facility, transport through the environment, and exposure of receptors that could produce an adverse impact. Steps in the procedure include the following:

- Development of a conceptual model of the site
- Characterization of sources of residual contamination
- Identification of environmental transport pathways
- Identification of receptors
- Development of exposure scenarios
- Selection and development of models for the analysis of scenarios
- Estimation of impacts of reasonably conservative deterministic conditions
- Characterization of sensitivity and uncertainty

The process of impact analysis is iterative in nature, with execution of initial passes through the steps at a high level so as to screen out less important conditions and produce a manageable set of scenarios for analysis. An initial iteration through the procedure was used to establish the number of constituents to be included in the analysis. For radionuclides, groundwater release and direct intrusion scenarios were considered. For the groundwater release screening scenario, only drinking water consumption was considered, release was assumed to be partition limited, and decay during transport was considered. For the direct intrusion scenario, inadvertent soil ingestion and inhalation pathways were considered. The analysis involved estimation of relative impacts based on the distribution of radionuclides in all tanks, FFTF decommissioning, and waste proposed for disposal at IDF-East, IDF-West, and the RPPDF. Radionuclides contributing less than 1 percent of impacts for intruder or well scenarios were not included in the detailed analysis. The inventories for these sources are provided in Appendix D for the alternative sources and Appendix S for the cumulative impact analysis. To account for hazardous chemicals, drinking water impacts were estimated for each constituent and those contributing more than 99 percent of impacts were selected for detailed analysis. The list of radionuclides and chemicals used in the analysis is presented in Table Q–1. The screening resulted in reduction of the original set of radiological and chemical constituents to a final set of 14 radiological and 26 chemical constituents, which represent both alternatives and cumulative impact sources.

Table Q–1. Constituents Selected for Detailed Analysis

Radionuclides	Chemicals	
Hydrogen-3 (tritium)	1,2-Dichloroethane	Lead
Carbon-14	1,4-Dioxane	Manganese
Potassium-40	1-Butanol	Mercury
Strontium-90	2,4,6-Trichlorophenol	Molybdenum
Zirconium-93	Acetonitrile	Nickel (soluble salts)
Technetium-99	Arsenic, inorganic	Nitrate
Iodine-129	Benzene	Polychlorinated biphenyls
Cesium-137	Boron and compounds	Silver
Gadolinium-152	Cadmium	Strontium (stable)
Thorium-232	Carbon tetrachloride	Total uranium
Uranium isotopes (includes U-233, -234, -235, -238)	Chromium	Trichloroethylene
Neptunium-237	Dichloromethane	Vinyl chloride
Plutonium isotopes (includes Pu-239, -240)	Fluoride	
Americium-241	Hydrazine/hydrazine sulfate	

Q.2.1 Identification of Receptors

Identification of potential receptors is based on current demography and guidance developed by state and Federal agencies. Currently, there are no permanent onsite receptors, and the population using water of the Columbia River is approximately 5 million people. A detailed description of the population distribution is presented in Chapter 3 of this environmental impact statement (EIS). Recent agency guidance recommends consideration of the average member of the critical group as the basis for comparison with regulatory criteria (DOE 1995; NRC 2000). The average member of the critical group is a member of a group reasonably expected to receive the greatest exposure to releases from a facility. The range of activities of the average member of the critical group includes inhalation of contaminated air, ingestion of contaminated drinking water, establishment of a residence on or near contaminated material, and establishment of a garden on contaminated soil. For these scenarios, use of contaminated groundwater from a well is the source of contamination of the surface soil. Guidance for performance analysis of waste disposal facilities also recommends consideration of individuals directly intruding into residual contamination (DOE Guide 435.1-1). In addition, Executive Order 12898 directs Federal decisionmakers to identify and address high and adverse environmental impacts that disproportionately affect minority and low-income populations. On the basis of this agency guidance, onsite use of groundwater and offsite use of surface water were selected for consideration. The groundwater receptors are a drinking-water well user, a resident farmer and an American Indian resident farmer located on the site near the source of contamination, at the Core Zone Boundary, or at the Columbia River. In addition, an American Indian hunter-gatherer contacting a combination of groundwater and surface water is located on the Columbia River nearshore. The surface-water receptors are a resident farmer and American Indian located on the Columbia River near the site and a member of the population located downstream from the site. The final receptor is an intruder located on a tank farm barrier, waste disposal facility, or FFTF barrier whose activities lead to direct contact with residual contamination.

Q.2.2 Development of Exposure Scenarios

Scenarios identified for analysis are the combinations of the sources, environmental transport pathways, receptors, and locations described in the preceding paragraphs. The locations of the Core Zone Boundary, barriers, and Columbia River are illustrated in Appendix O, Figure O–1. Given 10 onsite locations (the 8 barriers, the Core Zone Boundary, and the Columbia River nearshore); 3 groundwater receptor types (drinking-water well user, resident farmer, and American Indian resident farmer); and 19 alternatives (as described in Chapter 2 of this EIS), a total of 570 onsite groundwater scenarios have been identified. Adding a river location with these surface-water receptors (resident farmer, American Indian resident farmer and American Indian hunter-gatherer, and downstream population) for 19 alternatives adds 76 scenarios, for a total of 646 scenarios. Each scenario involves release of radiological and chemical constituents to produce the impacts summarized in Section Q.3.

Q.2.2.1 Approach for Selection and Development of Mathematical Models

The preferred approach for impact analysis is use of generally available, peer-reviewed models. However, no single model is available for the variety of sources, environmental conditions, and receptors under consideration in this analysis. Thus, the approach selected is use of a combination of generally available and site-specific models representing physical processes expected to occur. The approach for development of site-specific models, involving conceptualization and the formulation, solution, and use of mathematical models, is summarized in Table Q–2. Details of groundwater flow, release from source, vadose zone transport and saturated zone transport are described in Appendices L, M, N, and O, respectively.

Table Q–2. Procedure for Development and Use of Site-Specific Models

Step	Action
1	Characterize physical processes
2	Develop conceptual model of physical processes
3	Formulate mathematical equations describing the concept
4	Develop algorithm for solution of equations
5	Implement algorithm in computer code
6	Verify computer code
7	Document procedure
8	Apply model

Q.2.2.2 Mathematical Models for Long-Term Performance Assessment

Two sets of mathematical models have been developed for analysis of scenarios describing potential human health impacts occurring over long periods of time following stabilization or closure of the HLW tanks at Hanford, final decommissioning of FFTF, and stabilization and closure of waste management disposal facilities. The first set of models assesses impacts of release to groundwater using modules simulating release to the vadose zone, transport through the vadose zone and transport through the unconfined aquifer. Potential receptors for the release-to-groundwater impact models indirectly contact contamination transported from the tank farm, six sets of cribs and trenches (ditches) analyzed in the alternatives, and waste disposal areas. The second set assesses impacts on individuals who directly intrude into residual contamination at the tank farms and waste disposal areas.

The release to groundwater impact analysis uses a set of physical mechanism specific release models described in Appendix M. The vadose zone transport analysis uses the STOMP [Subsurface Transport Over Multiple Phases] model (White and Oostrom 2000, 2006), which simulates transient movement of water through a three-dimensional study volume. Details of the vadose zone analysis using the STOMP model are presented in Appendix N. Direction and rate of movement of groundwater through the unconfined aquifer is simulated using MODFLOW [modular three-dimensional finite-difference groundwater flow model] (USGS 2004). MODFLOW is a transient, three-dimensional simulation of Hanford and is described in Appendix O. Transport of solutes through the unconfined aquifer is simulated using the particle tracking model described in Appendix O. For release to groundwater scenarios, concentrations of contaminants calculated using the above described sequence of models serve as input data for estimation of human health impacts. Methods used for estimation of human health impacts are described in the following section.

The intruder impact model evaluates impacts of construction of a home or drilling of a well at a tank farm. Residual contamination is brought to the surface, resulting in exposure of construction or drilling workers and subsequent exposure of resident farmers. A detailed description of the intruder model is presented in Section Q.2.3.

The health effects module estimates dose, hazard, and risk at a specified time for one of the following six exposure scenarios:

- Use of groundwater for drinking water only
- Use of surface water by a resident farmer
- Use of surface water by an American Indian resident farmer
- Use of groundwater by a resident farmer
- Use of groundwater by an American Indian resident farmer
- Use of a combination of groundwater and surface water by an American Indian hunter-gatherer

In the resident farmer scenarios (the second through the fifth cases) contaminated groundwater or surface water is used by the average member of the critical group for domestic purposes and irrigation of a garden. The primary functions performed in developing the estimate of health impact using a calculated value of contaminant concentration in water are calculation of contaminant concentration in soil and calculation of dose, hazard, and risk. Information used to initiate the calculations includes concentration of the contaminant in groundwater or surface water at the access point and physical constants such as distribution coefficient, irrigation rate, and infiltration rate affecting rate of buildup of contamination in soil irrigated with contaminated water. The concentration of contaminant in soil is calculated as:

$$C_s = (1\ f_v)\quad {}_d\, C_w$$

where:

C_s	=	contaminant concentration in soil, grams per gram
C_w	=	contaminant concentration in either groundwater or surface water in contact with the soil, grams per cubic meter
f_v	=	conversion constant, 1×10^6 milliliters per cubic meter
${}_d$	=	distribution coefficient for contaminant and water, milliliters per gram

This is a conservative approach, facilitating spreadsheet calculation of health impacts.

The exposure model calculates health impacts for a specified contaminant and time for one of the six scenarios identified above. Because of the differing nature of health endpoints, slightly different approaches are used for radionuclides and chemicals. For radionuclides, impacts are estimated as dose and risk. Cumulative impacts of a mixture of radionuclides are estimated as the sum of dose or risk of the individual radionuclides. For chemicals, health impacts are represented as Hazard Quotient for noncarcinogens and as risk for carcinogens. Cumulative impacts of a mixture are represented as the sum of the Hazard Quotients, termed "Hazard Index," of the individual chemicals or as the sum of risk of the individual chemicals. Methods used for each of the six exposure scenarios are described in the following paragraphs. Values for physical constants, dose and risk factors, and model parameters are presented in Section Q.2.4.

SCENARIO 1: USE OF GROUNDWATER FOR DRINKING WATER ONLY

For a radionuclide, the dose due to consumption of contaminated water is estimated as:

$$D_{dw} = C_r \, IR_{dw} \, DCF_{\mathrm{ing}}$$

where:

D_{dw} = drinking water dose for an individual radionuclide, rem per year
C_r = concentration of radionuclide in water, curies per cubic meter
IR_{dw} = drinking water consumption rate, cubic meters per year
DCF_{ing} = radionuclide-specific dose conversion factor for ingestion, rem per curie

Lifetime risk for the radionuclide is estimated as:

$$R_{dw} = f_a \, C_r \, IR_{dw} \, ED_{dw} \, SF_{dw}$$

where:

R_{dw} = lifetime risk due to ingestion of the radionuclide in drinking water, unitless
f_a = conversion constant, 1×10^{12} picocuries per curie
C_r = concentration of radionuclide in water, curies per cubic meter
IR_{dw} = drinking water consumption rate, cubic meters per year
ED_{dw} = exposure duration for the drinking water scenario, years
SF_{dw} = Health Effects Assessment Summary Tables (HEAST) radionuclide-specific slope factor for drinking water ingestion, 1 per picocurie

For ingestion of a chemical in drinking water, intake is defined as:

$$I_{dw} = (f_m \quad f_t) \, [\, (IR_{dw} \, EF_{dw} \, ED_{dw}) \, / \, (\quad W \, AT) \,] \, C_c$$

where:

I_{dw} = chronic intake rate of chemical contaminant in drinking water, milligrams per kilogram-day
f_m = conversion constant, 1,000 milligrams per gram
f_t = conversion constant, 365 days per year
IR_{dw} = drinking water consumption rate, cubic meters per year
EF_{dw} = exposure frequency for drinking water ingestion, days per year
ED_{dw} = exposure duration for the drinking water scenario, years
W = body weight, kilograms
AT = averaging time, days
C_c = concentration of chemical contaminant in water, grams per cubic meter

Hazard Quotient is calculated as:

$$H_{dw} = I_{dw} \quad RfD$$

where:

H_{dw} = Hazard Quotient for ingestion of the chemical contaminant in drinking water, unitless
I_{dw} = chronic intake rate of chemical contaminant in drinking water, milligrams per kilogram-day

RfD = Integrated Risk Information System (IRIS) reference dose for chronic ingestion of the chemical contaminant, milligrams per kilogram-day

Lifetime risk (R_{dw}) is estimated as:

$$R_{dw} = I_{dw} \, SF_{\text{ing}}$$

where:

I_{dw} = chronic intake rate of chemical contaminant in drinking water, milligrams per kilogram-day
SF_{ing} = IRIS slope factor for ingestion of the chemical contaminant, 1 milligram per kilogram-day

SCENARIOS 2 AND 3: USE OF SURFACE WATER

Use of contaminated surface water involves drinking water, fish consumption, and residential agriculture exposure. Resident farmers and American Indians differ in consumption rates and exposure conditions, but the same approach is used for each type of receptor. The receptors also differ in that the American Indian uses a sauna and produces more food and products and consequently has a larger area garden than the resident farmer. Dose, Hazard Quotient, and risk for ingestion of drinking water are calculated as described for Scenario 1.

For radionuclides, dose for fish consumption is calculated as:

$$D_f = C_{sw} \, ({}_f \, f_v) \, IR_f \, DCF_{\text{ing}}$$

where:

D_f = dose for a radionuclide due to consumption of fish, rem per year
C_{sw} = radionuclide concentration in surface water, curies per cubic meter
${}_f$ = radionuclide bioaccumulation factor for fish, picocuries per kilogram/picocuries per liter
f_v = conversion constant, 1,000 liters per cubic meter
IR_f = consumption rate for fish, kilograms per year
DCF_{ing} = radionuclide-specific dose conversion factor for ingestion, rem per curie

Lifetime risk due to ingestion of the radionuclide in fish is calculated as:

$$R_f = C_{sw} \, ({}_f \, f_v) \, IR_f \, f_a \, ED_f \, SF_{\text{ing}}$$

where:

R_f = lifetime risk for ingestion of contaminant in fish, unitless
C_{sw} = radionuclide concentration in surface water, curies per cubic meter
${}_f$ = radionuclide bioaccumulation factor for fish, picocuries per kilogram/picocuries per liter
f_v = conversion constant, 1,000 liters per cubic meter
IR_f = consumption rate for fish, kilograms per year
f_a = conversion constant, 1×10^{12} picocuries per curie
ED_f = exposure duration for fish consumption, years
SF_{ing} = HEAST radionuclide-specific slope factor for food ingestion, 1 per picocurie

For chemical contaminants, intake due to consumption of fish is calculated as:

$$I_f = (f_m\, f_v)\ [\ (IR_f\, ED_f \quad _f) / (\quad W\, AT\ )\ ]\ C_{sw}$$

where:

I_f	=	intake of chemical contaminant in fish, milligrams per kilogram-day
f_m	=	conversion constant, 1,000 milligrams per gram
f_v	=	conversion constant, 1,000 liters per cubic meter
IR_f	=	consumption rate of fish, kilograms per year
ED_f	=	exposure duration for fish consumption, years
$_f$	=	bioaccumulation factor of chemical contaminant in fish, milligrams per kilogram/milligrams per liter
W	=	body weight, kilograms
AT	=	averaging time, days
C_{sw}	=	concentration of chemical contaminant in surface water, grams per cubic meter

Body weight and averaging time are as defined above. Hazard Quotient for consumption of the chemical contaminant in fish is:

$$H \quad _f = I_f \quad RfD$$

where:

$H \quad _f$	=	Hazard Quotient for ingestion of chemical contaminant in fish, unitless
I_f	=	intake of chemical contaminant in fish, milligrams per kilogram-day
RfD	=	IRIS reference dose for ingestion of chemical constituent, milligrams per kilogram-day

Residential agriculture activities for the resident farmer and American Indian resident farmer involve exposure to radionuclides through a variety of pathways. These include:

- External exposure from radionuclides in soil
- Inadvertent ingestion of radionuclides in soil
- Inhalation of fugitive dust containing radionuclides
- Ingestion of crops grown on contaminated soil
- Ingestion of animal products (milk, beef, poultry, and egg) grown on contaminated soil
- Ingestion of animal products (milk, beef, poultry, and egg) drinking contaminated water

For radionuclides, Version 6.4 of the RESRAD computer code (Yu et al. 2001) is used to calculate unit dose and risk factors for those exposure pathways based on soil concentrations (the first five pathways). The last pathway, involving exposure via animal drinking water, is calculated outside of RESRAD.

Dose due to intake of a radionuclide is then estimated as:

$$D_{ra} = C_s\, DuRSRD \quad C_{sw} \quad _{\text{water-beef}}\, IR_{\text{beef-DW}}\, IR_{\text{beef}}\, DCF_{\text{ing}} \quad C_{sw} \quad _{\text{water-milk}} IR_{\text{dairy-DW}}\, IR_{\text{milk}}\, DCF_{\text{ing}}$$

where:

D_{ra}	=	dose for residential agriculture, rem per year
C_s	=	concentration of radionuclide in soil, picocuries per gram
$DuRSRD$	=	RESRAD unit dose factor for residential agriculture, rem per year/picocuries per gram

C_{sw}	=	concentration of the radionuclide *i* in the surface water, curies per liter
$_{\text{water-beef}}$	=	radionuclide-specific water-to-beef biotransfer factor, days per kilogram
$IR_{\text{beef-DW}}$	=	consumption rate of drinking water by beef cattle, liters per day
IR_{beef}	=	consumption rate of beef by the farmer, kilograms per year
DCF_{ing}	=	radionuclide-specific dose conversion factor for ingestion, rem per curie
$_{\text{water-milk}}$	=	radionuclide-specific water-to-milk biotransfer factor, days per liter
$IR_{\text{dairy-DW}}$	=	consumption rate of drinking water by dairy cattle, liters per day
IR_{milk}	=	consumption rate of milk by the resident farmer, liters per year

In general values for water-to-beef and water-to-milk biotransfer factors are not available and hence, the plant-to-beef and plant-to-milk biotransfer factors ($_{\text{plant-beef}}$, day per kilogram, and $_{\text{plant-milk}}$, day per liter) are used in their place:

$$_{\text{water-beef}} = \; _{\text{plant-beef}}$$

and

$$_{\text{water-milk}} = \; _{\text{plant-milk}} \; f_{\text{kg/L}}$$

where $f_{kg\text{L}}$ is the conversion factor, 1.0 kilogram per liter

Lifetime risk is calculated in a similar manner:

$$R_{ra} = C_s\ RuRSRD\ ED_{ra} \quad C_{sw}\ f_a\ (\; _{\text{water-beef}}\ IR_{\text{beef-DW}}\ IR_{\text{beef}} \quad _{\text{water-milk}} IR_{\text{dairy-DW}}\ IR_{\text{milk}}\ )\ ED_{ra}\ SF_{\text{ing}}$$

where:

R_{ra}	=	lifetime risk for residential agriculture, unitless
C_s	=	concentration of contaminant in soil, grams per gram
RuRSRD	=	RESRAD unit risk factor for residential agriculture, 1 per year/picocuries per gram
ED_{ra}	=	exposure duration for residential agriculture, years
C_{sw}	=	concentration of the radionuclide *i* in the surface water, curies per liter
f_a	=	conversion factor, 1×10^{12} picocuries per curie
$_{\text{water-beef}}$	=	radionuclide-specific water-to-beef biotransfer factor, days per kilogram
$IR_{\text{beef-DW}}$	=	consumption rate of drinking water by beef cattle, liters per day
IR_{beef}	=	consumption rate of beef by the farmer, kilograms per year
$_{\text{water-milk}}$	=	radionuclide-specific water-to-milk biotransfer factor, days per liter
$IR_{\text{dairy-DW}}$	=	consumption rate of drinking water by dairy cattle, liters per day
IR_{milk}	=	consumption rate of milk by the resident farmer, liters per year
SF_{ing}	=	HEAST radionuclide-specific slope factor for food ingestion, 1 per picocurie

The values of the RESRAD unit dose and risk factors differ for different radionuclides and for the resident farmer and American Indian resident farmer.

The agriculture activities of the resident farmer and American Indian resident farmer involve exposure to chemicals through all of the same pathways as radionuclides except the external (direct radiation) pathway. However, for hazardous chemicals, hazard and risk for residential agriculture exposures are estimated using individual algebraic equations for each of the pathways: inadvertent soil ingestion, fugitive dust inhalation, crop ingestion, and consumption of animal and dairy products consistent with agency guidance (EPA 1996, 2000a, 2000b).

For inadvertent ingestion of soil, intake of a chemical contaminant is estimated as:

$$I_{si} = [\ (\ IR_s\ EF_{si}\ ED_{si}\ )\ /\ (\quad W\ AT\ )\ ]\ C_s$$

where:

I_{si}	=	intake rate of chemical contaminant by inadvertent ingestion of soil, milligrams per kilogram-day
IR_s	=	rate of inadvertent ingestion of soil, milligrams per day
EF_{si}	=	exposure frequency for inadvertent ingestion of soil, days per year
ED_{si}	=	exposure duration for inadvertent ingestion of soil, years
W	=	body weight, kilograms
AT	=	averaging time, days
C_s	=	concentration of contaminant in soil, grams per gram

Body weight and averaging time are as defined above. Hazard Quotient for the chemical contaminant is calculated as:

$$H\quad_{si} = I_{si}\quad RfD$$

where:

$H\quad_{si}$	=	Hazard Quotient for ingestion of contaminant by inadvertent ingestion in soil, unitless
I_{si}	=	intake rate of chemical contaminant by inadvertent ingestion of soil, milligrams per kilogram-day
RfD	=	IRIS reference dose for ingestion of chemical constituent, milligrams per kilogram-day

Risk for the chemical by inadvertent ingestion in soil is calculated as:

$$R_{si} = I_{si}\ SF_{ing}$$

where:

R_{si}	=	lifetime risk (unitless), and
I_{si}	=	intake rate of chemical contaminant by inadvertent ingestion of soil, milligrams per kilogram-day
SF_{ing}	=	HEAST radionuclide-specific slope factor for food ingestion, 1 per picocurie

For inhalation of a contaminant in fugitive dust, intake concentration is calculated as:

$$I_{fd} = \{\ (f_m\ PEF)\ \mathrm{EF_{fd}}\ \mathrm{ED_{fd}}\ [\ \mathrm{ET_o} + (\ ET_i\ DF_i\ )\ ]\ C_s\ \}\quad AT$$

where:

I_{fd}	=	intake concentration of chemical contaminant in fugitive dust, milligrams per cubic meter
f_m	=	conversion constant, 1×10^6 milligrams per kilogram
PEF	=	particulate emission factor, cubic meters per kilogram
EF_{fd}	=	exposure frequency for inhalation of fugitive dust, days per year
ED_{fd}	=	exposure duration for inhalation of fugitive dust, years
ET_o	=	exposure time fraction, outdoors, unitless

ET_i	=	exposure time fraction, indoors, unitless
DF_i	=	dilution factor for indoor inhalation of fugitive dust, unitless
C_s	=	concentration of contaminant in soil, grams per gram
AT	=	averaging time, days

The Hazard Quotient is calculated as:

$$H_{fd} = I_{fd} \quad RfC$$

where:

H_{fd}	=	Hazard Quotient for inhalation of the chemical contaminant in fugitive dust, unitless
I_{fd}	=	intake concentration of chemical contaminant in fugitive dust, milligrams per cubic meter
RfC	=	IRIS reference concentration for inhalation of the chemical contaminant, milligrams per cubic meter

Lifetime risk due to inhalation of the contaminant in fugitive dust is:

$$R_{fd} = I_{fd} \, SF_{inh}$$

where:

R_{fd}	=	lifetime risk for inhalation of the chemical contaminant in fugitive dust, unitless
I_{fd}	=	intake concentration of chemical contaminant in fugitive dust, milligrams per cubic meter
SF_{inh}	=	IRIS slope factor for inhalation of the contaminant, 1 (milligrams per cubic meter)

For ingestion of a chemical contaminant in crops, intake is calculated as:

$$I_c = [\ (IR_{vf} \quad IR_{lv})\ (f_{m1}\ ED_c\ f_{m2})\ \mathrm{TF_p} / (\quad W\ AT)\ ]\ C_{cs}$$

where:

I_c	=	intake of chemical contaminant in crops, milligrams per kilogram-day
IR_{vf}	=	consumption rate of vegetables and fruit, kilograms per year
IR_{lv}	=	consumption rate for leafy vegetables, kilograms per year
F_{m1}	=	conversion factor, 1,000 grams per kilogram
ED_c	=	exposure duration for crop ingestion, years
f_{m2}	=	conversion constant, 1,000 milligrams per gram
TF_p	=	soil-to-plant transfer factor of chemical contaminant, milligrams per kilogram/ milligrams per kilogram
W	=	body weight, kilograms
AT	=	averaging time, days
C_{cs}	=	concentration of chemical contaminant in soil, grams per gram

Hazard Quotient for ingestion of the chemical contaminant in crops is calculated as:

$$H_c = I_c \quad RfD$$

where:

H_c	=	Hazard Quotient for ingestion of chemical contaminant in crops, unitless

I_c	=	intake of chemical contaminant in crops, milligrams per kilogram-day
RfD	=	IRIS reference dose for ingestion of chemical constituent, milligrams per kilogram-day

Lifetime risk due to ingestion of a chemical contaminant in crops is calculated as:

$$R_c = I_c\, SF_{\text{ing}}$$

where:

R_c	=	lifetime risk due to ingestion of chemical contaminant in crops, unitless
I_c	=	intake of chemical contaminant in crops, milligrams per kilogram-day
SF_{ing}	=	HEAST radionuclide-specific slope factor for food ingestion, 1 per picocurie

The farmer's intake I_{beef} for ingestion of a chemical contaminant in meat results from the consumption of an animal that has ingested fodder and/or forage grown in contaminated soil, directly ingested the soil, and ingested contaminated water:

$$I_{\text{beef}} = I_{\text{fodder}} \quad I_{\text{soil}} \quad I_{\text{water}}$$

where:

$$I_{\text{fodder}} = C_{cs}\, f_{m1}\, f_{m2}\, TF_p\, IR_{\text{beef;v}} \quad {}_{\text{plant-beef}}\ IR_{\text{beef}}\ ED_c \quad (\quad W\, AT)$$

$$I_{\text{soil}} = C_{cs}\, f_{m1}\, f_{m2} \quad {}_{\text{soil-beef}}\ IR_{\text{beef-soil}}\ IR_{\text{beef}}\ ED_c \quad (\quad W\, AT)$$

$$I_{\text{water}} = C_{sw}\ (f_{m2} \quad f_{m3})\ \mathrm{B}_{\text{water-beef}}\ \mathrm{IR}_{\text{beef-DW}}\ \mathrm{IR}_{\text{beef}}\ \mathrm{ED}_c / (\quad W\, AT)$$

and where:

I_{beef}	=	total intake for the farmer from the consumption of the beef, milligrams per kilogram per day
I_{fodder}	=	animal fodder related intake for the farmer from the consumption of the beef, milligrams per kilogram-day
I_{soil}	=	animal soil ingestion related intake for the farmer from the consumption of the beef, milligrams per kilogram-day
I_{water}	=	animal drinking water related intake for the farmer from the consumption of the beef, milligrams per kilogram-day
C_{cs}	=	concentration of chemical contaminant in soil, grams per gram
f_{m1}	=	conversion factor, 1,000 grams per kilogram
f_{m2}	=	conversion constant, 1,000 milligrams per gram
TF_p	=	soil-to-plant transfer factor of chemical contaminant, milligrams per kilogram/ milligrams per kilogram
$IR_{\text{beef;v}}$	=	consumption rate of fodder/forage by beef cattle, air dried kilograms per day
${}_{\text{plant-beef}}$	=	chemical-specific plant-to-beef biotransfer factor, days per kilogram
IR_{beef}	=	consumption rate for beef by farmer, kilograms per year
ED_c	=	exposure duration for crop ingestion, years
W	=	body weight, kilograms
AT	=	averaging time, days
${}_{\text{soil-beef}}$	=	chemical-specific soil-to-beef biotransfer factor, days per kilogram
$IR_{\text{beef-soil}}$	=	consumption rate of soil by beef cattle, kilograms per day
C_{sw}	=	concentration of the chemical in the surface water, grams per cubic meter
f_{m3}	=	conversion constant, 1,000 liters per cubic meter

$_{\text{water-beef}}$ = chemical-specific water-to-beef biotransfer factor, days per liter
$IR_{\text{beef-DW}}$ = consumption rate of drinking water by beef cattle, liters per day

In general, values for the soil-to-beef and water-to-beef biotransfer factors ($_{\text{soil-beef}}$ and $_{\text{water-beef}}$, respectively) are not available; hence, the plant-to-beef biotransfer factor ($_{\text{plant-beef}}$, days per kilogram) is used in their place, that is:

$$_{\text{soil-beef}} = \; _{\text{plant-beef}}$$

and

$$_{\text{water-beef}} = \; _{\text{plant-beef}} \; f_{\text{kgL}}$$

where f_{kg} is the conversion factor, 1.0 kilograms per liter

The Hazard Quotient for ingestion of the chemical contaminant in crops is calculated as:

$$H \;\; _c = I_c \quad RfD$$

where:

$H \;\; _c$ = Hazard Quotient for ingestion of chemical contaminant in crops, unitless
I_c = intake of chemical contaminant in crops, milligrams per kilogram-day
RfD = IRIS reference dose for ingestion of chemical constituent, milligrams per kilogram-day

Lifetime risk due to ingestion of a chemical contaminant in crops is calculated as:

$$R_c = I_c \, SF_{\text{ing}}$$

where:

R_c = lifetime risk due to ingestion of chemical contaminant in crops, unitless
I_c = intake of chemical contaminant in crops, milligrams per kilogram-day
SF_{ing} = HEAST radionuclide-specific slope factor for food ingestion, 1 per picocurie

Doses occurring in use of a sauna are due to inhalation of radionuclides in liquid droplets suspended in air and inhalation of radionuclides conveyed into the air during evaporation of water. In each case, the concentration of a radionuclide in the water used in the sauna is the concentration of the radionuclide in the source surface water. The approach for estimation of concentration of droplets in air is use of a value representative of that observed in fog (Mann and Puigh 2001). The approach for estimation of the concentration of a radionuclide in air due to evaporation of water is estimation of the quantity of liquid water evaporated to produce the quantity of water vapor present at equilibrium saturation at the temperature of the sauna followed by application of a radionuclide-specific decontamination factor to reflect incomplete entrainment of nonvolatile radionuclides (Mann and Puigh 2001).

The concentration of a radionuclide in air due to droplets in air was estimated as:

$$C_{sn,d} = VR_{d,a} \, C_{sw}$$

where:

$C_{sn,d}$ = concentration of a radionuclide in air in the sauna due to presence of droplets, curies per cubic meter

$VR_{d,a}$ = ratio of volume of droplets to volume of air in the sauna, unitless
C_{sw} = concentration of radionuclide in surface water, curies per cubic meter

The concentration of a radionuclide in the air in the sauna due to evaporation of water was estimated as:

$$C_{sn,e} = \{ DF_{sn,e} [(\rho_{wv} \quad V_{sn}) \quad \rho_{wl}] C_{sw} \} \quad V_{sn}$$

where:

$C_{sn,e}$ = concentration of a radionuclide in air in a sauna due to evaporation of water, curies per cubic meter
$DF_{sn,e}$ = entrainment factor for a radionuclide due to evaporation, unitless
ρ_{wv} = density of water vapor in air in the sauna, grams per cubic meter
V_{sn} = volume of the sauna, cubic meters
ρ_{wl} = density of liquid water, grams per cubic meter
C_{sw} = concentration of a radionuclide in surface water, curies per cubic meter

Annual dose due to inhalation of a radionuclide in the sauna was estimated as:

$$D_{sn} = (C_{sn,d} \quad C_{sn,e}) (\quad R_{sn} \, DCF_{\text{inh}} \, EF_{sn})$$

where:

D_{sn} = dose due to use of the sauna, rem per year
$C_{sn,d}$ = concentration of a radionuclide in air in the sauna due to presence of droplets, curies per cubic meter
$C_{sn,e}$ = concentration of a radionuclide in air in a sauna due to evaporation of water, curies per cubic meter
R_{sn} = breathing rate in the sauna, cubic meters per year
DCF_{inh} = dose conversion factor for inhalation, rem per curie
EF_{sn} = exposure frequency for the sauna, years per year

concentrations are as defined above. Lifetime risk due to inhalation of a radionuclide during use of the sauna was estimated as:

$$R_{sn} = (C_{sn,d} \quad C_{sn,e}) (\quad R_{sn} \, EF_{sn} \, ED_{sn} \, f_a \, SF_{\text{inh}})$$

where:

R_{sn} = lifetime risk for use of the sauna, unitless
$C_{sn,d}$ = concentration of a radionuclide in air in the sauna due to presence of droplets, curies per cubic meter
$C_{sn,e}$ = concentration of a radionuclide in air in a sauna due to evaporation of water, curies per cubic meter
R_{sn} = breathing rate in the sauna, cubic meters per year
EF_{sn} = exposure frequency for the sauna, years per year
ED_{sn} = exposure duration for use of the sauna, years
f_a = conversion factor, 1×10^{12} picocuries per curie
SF_{inh} = slope factor for inhalation, 1 per picocurie

other variables are as defined above.

Hazard Quotient and risk for exposure to chemical constituents in a sauna were estimated using the approach applied for radionuclides. The concentration of a chemical constituent in air due to droplets in air was estimated as:

$$C_{sn,d} = VR_{d,a}\, f_m\, C_{sw}$$

where:

$C_{sn,d}$	=	concentration of a chemical constituent in air in the sauna due to presence of droplets, milligrams per cubic meter
$VR_{d,a}$	=	ratio of volume of droplets to volume of air in the sauna, unitless
f_m	=	conversion factor, 1,000 milligrams per gram
C_{sw}	=	concentration of chemical constituent in surface water, grams per cubic meter

The concentration of a chemical constituent in the air in the sauna due to evaporation of water was estimated as:

$$C_{sn,e} = \{\ DF_{sn,e}\, f_m\, [(\rho_{wv}\, V_{sn})\quad \rho_{wl}\ ]\ C_{sw}\ \}\quad V_{sn}$$

where:

$C_{sn,e}$	=	concentration of a chemical constituent in air in the sauna due to evaporation of water, milligrams per cubic meter
$DF_{sn,e}$	=	entrainment factor for a chemical constituent due to evaporation, unitless
f_m	=	conversion factor, 1,000 milligrams per gram
ρ_{wv}	=	density of water vapor in air in the sauna, grams per cubic meter
V_{sn}	=	volume of the sauna, cubic meters
ρ_{wl}	=	density of liquid water, grams per cubic meter
C_{sw}	=	concentration of a chemical constituent in surface water, grams per cubic meter

Hazard Quotient for a chemical constituent for use of the sauna was estimated as:

$$H\quad_{sn} = \{\ (C_{sn,d}\quad C_{sn,e}\ )\ [(EF_{sn}\, ED_{sn}\, f_t\ )\quad AT\ ]\ \}\quad RfC$$

where:

$H\quad_{sn}$	=	Hazard Quotient for inhalation of a chemical constituent during use of a sauna, unitless
$C_{sn,d}$	=	concentration of a radionuclide in air in the sauna due to presence of droplets, curies per cubic meter
$C_{sn,e}$	=	concentration of a radionuclide in air in a sauna due to evaporation of water, curies per cubic meter
EF_{sn}	=	exposure frequency for use of the sauna, years per year
ED_{sn}	=	exposure duration for use of the sauna, years
f_t	=	conversion factor, 365 days per year
AT	=	averaging time, 25,550 days
RfC	=	reference concentration for the chemical constituent, milligrams per cubic meter

Lifetime risk for inhalation of a chemical constituent during use of a sauna was estimated as:

$$R_{sn} = (C_{sn,d}\quad C_{sn,e}\ )\ [(EF_{sn}\, ED_{sn}\, f_t\ )\quad AT\ ]\ SF_{inh}$$

where:

R_{sn} = lifetime risk for inhalation of a chemical constituent during use of the sauna, unitless
$C_{sn,d}$ = concentration of a radionuclide in air in the sauna due to presence of droplets, curies per cubic meter
$C_{sn,e}$ = concentration of a radionuclide in air in a sauna due to evaporation of water, curies per cubic meter
EF_{sn} = exposure frequency for use of the sauna, years per year
ED_{sn} = exposure duration for use of the sauna, years
f_t = conversion factor, 365 days per year
AT = averaging time, 25,550 days
SF_{inh} = risk factor for inhalation, cubic meters per milligram

concentrations are as defined above.

SCENARIOS 4 AND 5: USE OF GROUNDWATER

The methods and models used in the analysis of use of groundwater are the same as those described above for the drinking water scenario and for the residential agriculture pathway of the surface-water use scenarios. The differences are absence of fish consumption and the use of concentration of the contaminant in groundwater in place of concentration of the contaminant in surface water.

SCENARIO 6: AMERICAN INDIAN HUNTER-GATHERER PATHWAYS

This scenario is similar to the American Indian resident farmer scenarios in that it considers radionuclide and chemical exposures from the drinking of contaminated water, the consumption of contaminated meat, the inadvertent ingestion of soil, the consumption of contaminated fish, the inhalation of contaminated dust, and participation in ceremonial sweat lodge/sauna ceremonies. However, in this hunter-gatherer scenario the exposed adult American Indian is assumed to live a more traditional American Indian lifestyle. The domestic garden exposure pathway of the resident farmer scenarios is replaced by the consumption of wild plants and the consumption of domestic livestock is replaced with the consumption of game, specifically deer, although the annual consumption rates for plants, meats and fish regardless of origin are similar in magnitude. As is the case with the resident farmer and American Indian resident farmer assessments, this exposure assessment is directed toward a representative or typical adult member of the population of interest.

An important difference between this scenario and the resident farmer scenarios described in the preceding section is that the individual of interest or receptor in the scenario is exposed to contamination both from surface water and groundwater. In each of the resident farmer scenarios described in the preceding paragraphs the source of exposure is either surface water or groundwater, but not both. The American Indian hunter-gatherer is exposed to groundwater related contamination through the consumption of wild plants, consumption of deer meat, inadvertent soil ingestion and participation in sweatlodge ceremonies. The link with groundwater occurs as a direct result of the location of the scenario—near the river where groundwater, i.e., the saturated zone, is assumed to be near the land surface and extending up into the root zone. In the rootzone, groundwater contamination then is available for uptake by plants eaten by the receptor and by deer in turn consumed by the receptor. The proximity of the groundwater to the land surface is also assumed to be sufficient at times for soil at the land surface to become contaminated resulting in exposure through the inhalation of resuspended soil. Exposure pathways involving surface water, the Columbia River, include the hunter-gatherer's drinking water (100 percent) and consumption of fish. The deer are also assumed to use the river for drinking water (100 percent) resulting in an additional component to the exposure through the consumption of deer meat.

Depending on the purpose, sweat lodge ceremonies may use either groundwater or surface water and so this scenario assumes 50 percent use of the former and 50 percent use of the latter.

The equations needed for the estimation of the chemical health impacts in the hunter-gatherer scenario are the same as given above for the surface-water (and groundwater) estimates. However, the groundwater concentrations are used to arrive at soil concentrations used in the food (plants and deer [forage]), soil ingestion pathway and dust inhalation pathways; and surface-water concentrations are used in the drinking water, fish, and deer [drinking water] calculations. Like the deer pathway, the sweat lodge exposure pathway uses both groundwater and surface-water concentrations. Most of the exposure parameters in the hunter-gatherer scenario are the same as used in the American Indian resident farmer scenario. This includes annual intake of meat, produce/wild plants, duration of exposures, chemical-specific (and radionuclide-specific) parameters. Aside from the simultaneous use of groundwater and surface water, a primary difference in exposure parameterization for the two scenarios relates to animal sizes, animal forage intakes, animal soil ingestion, and animal drinking water intakes.

The radiological calculations for the hunter-gatherer are different from those of the American Indian resident farmer in that RESRAD was not employed in the calculation of agricultural activities unit dose factors or unit risk factors. The hunter-gatherer scenario evaluated in this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* represents a subsistence life style which is different than the domestic farmer considered in the RESRAD code. Therefore, the doses and risks from exposure to radionuclides for the hunter-gatherer are calculated using equations (EPA 2000a, 2000b) very similar to those used for the chemical impacts. However, the methodology is also similar to those used for radionuclides in the RESRAD code. The remainder of the discussion in the section presents the radiological dose and risk expressions needed for assessing the scenario.

The radiological expressions for dose and risk from drinking water, fish, and sweatlodge ceremonies are the same as used in the resident farmer and American Indian resident farmer scenarios and are applied in the hunter-gatherer scenario with the appropriate groundwater and/or surface-water concentrations. The beef-drinking water expressions added to the RESRAD based calculation in the resident farmer scenarios also apply, but with the use of deer parameterization. The consumption of diary products extensions does not occur in the hunter-gatherer scenario. Hence, most of the expressions needed have been given in the above paragraphs and overall there are only three pathways for which new dose and risk expressions are required—a forage component for the consumption of venison, soil ingestion by the deer, and direct exposure to external radiation due to soil contamination.

The estimated dose due to the hunter-gatherer's intake of deer that has eaten contaminated forage, ingested contaminated soil, and drank contaminated water is calculated using the equation below. Note that the forage the deer drinking water component (surface water) discussed previously is included in the expression for completeness:

$$D_{\text{deer}} = C_s \, (1 \; f_a) \, (TF_p \quad {}_{\text{forage-deer}} \, IR_{\text{forage-deer}} \qquad {}_{\text{soil-deer}} \, IR_{\text{soil-deer}}) \, f_m \, IR_{\text{deer}} \, DCF_{\text{ing}}$$

$$C_{sw} \quad {}_{\text{water-deer}} \, IR_{\text{deer-DW}} \, IR_{\text{deer}} \, DCF_{\text{ing}}$$

where:

D_{deer}	=	dose for consumption of deer meat, rem per year
C_s	=	concentration of the radionuclide in the soil, picocuries per gram, based on groundwater concentration
f_a	=	conversion factor, 1×10^{12} picocuries per curie
TF_p	=	radionuclide-specific soil-to-plant transfer factor, picocuries per kilogram/ picocuries per kilogram

$_{\text{forage-deer}}$	=	radionuclide-specific forage-to-venison biotransfer factor, days per kilogram
$IR_{\text{forage-deer}}$	=	consumption rate of forage by deer, dry kilograms per day
$_{\text{soil-deer}}$	=	radionuclide-specific soil-to-venison biotransfer factor, days per kilogram
$IR_{\text{soil-deer}}$	=	consumption rate of soil by the deer, kilograms per day
f_m	=	conversion factor, 1,000 grams per kilogram
IR_{deer}	=	consumption rate of deer by the hunter-gatherer, kilograms per year
DCF_{ing}	=	radionuclide-specific dose conversion factor for ingestion, rem per curie
C_{sw}	=	concentration of the radionuclide in the surface water, curies per liter
$_{\text{water-deer}}$	=	radionuclide-specific water-to-venison biotransfer factor, days per kilogram
$IR_{\text{deer-DW}}$	=	consumption rate of drinking water by deer, liters per day

The values for forage-to-venison biotransfer factors are not available and hence, the plant-to-beef biotransfer factors ($_{\text{plant-beef}}$, day per kilogram) are used in their place. The plant-to-beef biotransfer factors are also used as estimates of the water-to-venison biotransfer factors. The forage-to-venison biotransfer factors also are not available and the plant-to-beef biotransfer factors are used in their place, and the plant-to-beef biotransfer factors are again used in lieu of the water-to-venison biotransfer factors.

Lifetime risk from the intake of venison is calculated in a similar manner:

$$R_{\text{deer}} = C_s \, (TF_p \quad _{\text{forage-deer}} IR_{\text{forage-deer}} \qquad _{\text{soil-deer}} IR_{\text{soil-deer}}) \, f_m \, IR_{\text{deer}} \, ED_{\text{deer}} \, SF_{\text{ing}}$$

$$C_{sw} \, f_a \quad _{\text{water-deer}} IR_{\text{deer-DW}} \, IR_{\text{deer}} \, ED_{\text{deer}} \, SF_{\text{ing}}$$

where:

R_{deer}	=	lifetime risk for residential agriculture, unitless
C_s	=	concentration of the radionuclide in the soil, picocuries per gram, based on groundwater concentration
TF_p	=	radionuclide-specific soil-to-plant transfer factor, picocuries per kilogram/ picocuries per kilogram
$_{\text{forage-deer}}$	=	radionuclide-specific forage-to-venison biotransfer factor, days per kilogram
$IR_{\text{forage-deer}}$	=	consumption rate of forage by deer, dry kilograms per day
$_{\text{soil-deer}}$	=	radionuclide-specific soil-to-venison biotransfer factor, days per kilogram
$IR_{\text{soil-deer}}$	=	consumption rate of soil by the deer, kilograms per day
f_m	=	conversion factor, 1,000 grams per kilogram
IR_{deer}	=	consumption rate of deer by the hunter-gatherer, kilograms per year
ED_{deer}	=	exposure duration for the hunter-gatherer scenario, years
SF_{ing}	=	HEAST radionuclide-specific slope factor for food ingestion, 1 per picocurie
C_{sw}	=	concentration of the radionuclide in the surface water, curies per liter
f_a	=	conversion factor, 1×10^{12} picocuries per curie
$_{\text{water-deer}}$	=	radionuclide-specific water-to-venison biotransfer factor, days per kilogram
$IR_{\text{deer-DW}}$	=	intake of drinking water by deer, liters per day

The dose and risk expressions for the direct radiation exposure pathway are simple. The model used considers a uniformly contaminated semi-infinite plane with exposure at one meter above the surface. In these circumstances the dose from a radionuclide is given by:

$$D_{\text{ext}} = f_{\text{ext}} \, C_s \; DCF_{\text{ext}}$$

where:

D_{ext}	=	dose from external exposure, millirem per year

f_{ext} = external exposure occupancy factor based time outdoors, time indoors, and shielding when indoors, dimensionless
C_s = concentration of the radionuclide in the soil, based on groundwater concentration, picocuries per gram
DCF_{ext} = radionuclide-specific dose factor for external exposure, millirem per year picocuries per gram

The risk from direct radiation is given by:

$$R_{ext} = f_{ext}\, C_s\, ED_{ext}\, SF_{ext}$$

where:

R_{ext} = risk from external exposure, unitless
f_{ext} = correction factor based on time outdoors, time indoors, and shielding when indoors, dimensionless
C_s = concentration of the radionuclide in the soil, based on groundwater concentration, picocuries per gram
ED_{ext} = exposure duration for the scenario, years
SF_{ext} = radionuclide-specific risk factor for external exposure, 1 per year/picocuries per gram

Q.2.3 Intruder Scenario Models

Past practice, current regulatory frameworks, and site-specific conditions (DOE Guide 435.1-1; NRC 1982) were reviewed to develop two site-specific intrusion scenarios for exposure to radionuclides. These are characterized as home construction and well drilling, and each comprises two phases. For the home construction scenario, a worker excavates soil to construct the foundation for a home. In this activity, the worker is subject to inhalation of contaminated soil and external exposure from the floor and walls of the excavation. Subsequently, soil removed from the excavation is mixed across the surrounding area used for a residence and garden. In the well-drilling scenario, a worker completes a well intersecting subsurface contamination and deposits contaminated drill cuttings in a pond. In the course of this activity, the worker inhales suspended dust and experiences external exposure from the contamination in the pond. Subsequently, soil removed from the cuttings pond is mixed across the surrounding area used for a residence and garden. Impacts are estimated for receptors present at the site at a series of times specified for analysis, including a delay representing a period of institutional control. The first of the following sections discusses the upper-level organization of the model, while the second section discusses details of the dose calculation for each of the receptors. As in prior analysis, American Indian and resident farmer receptors are considered. For direct intrusion scenarios of limited extent in time as anticipated in U.S. Department of Energy (DOE) guidance, acceptance criteria have been established for radiological constituents but not for chemical constituents.

Q.2.3.1 Organization of the Model

The intruder model comprises two major elements: an executive routine and a dose module. Functions performed in the executive routine include interpretation of input data, control of sequence of calculations, and writing of results to output files. The overall organization of the code is represented in Figure Q–1. The input data include specification of radionuclides and radionuclide inventories and of time periods for which dose will be estimated. As indicated in this figure, the code cycles through each radionuclide and time step and calculates dose at each step in the process. Following completion of the calculation of dose at each time step, the code identifies the maximum dose and time of maximum dose.

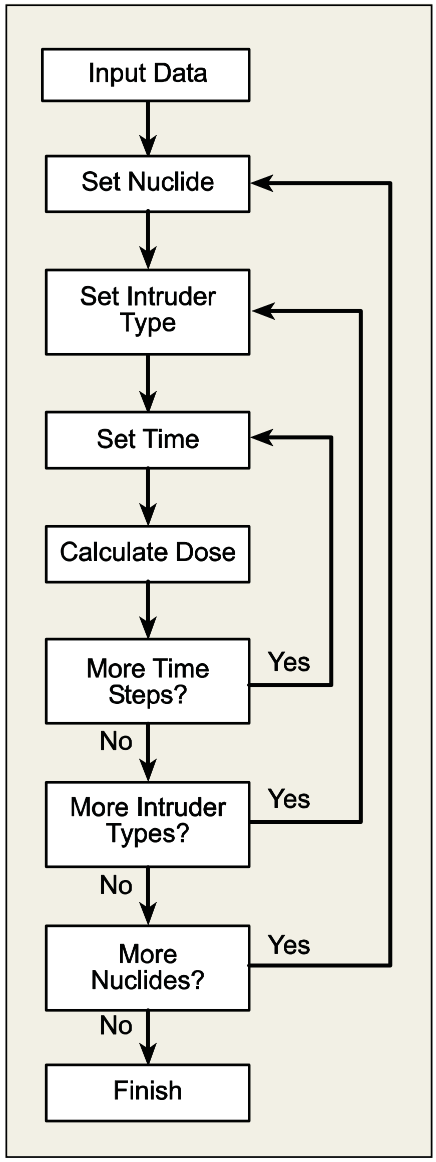

Figure Q–1. Algorithm for Intruder Scenario Analysis Computer Code

The time sequence of total dose and the dose for each radionuclide for the time of maximum dose for each intruder are provided as output data.

Q.2.3.2 Intruder Dose Models

The magnitude of dose estimated for each intruder depends in part on the range of intruder activities. The following sections present equations used for calculation of dose for each type of intruder. Intruder activities and scenario parameter values are consistent with past analyses and current guidance (DOE Guide 435.1-1; NRC 1982), and dose conversion factors used in the analysis are consistent with current Federal guidance (Eckerman and Ryman 1993; Eckerman et al. 1999). Values used for dose factors and model parameters are presented in the following subsection. At each time step during the calculation of dose, radionuclide concentrations are adjusted to reflect decay and ingrowth.

Q.2.3.2.1 Home Construction Worker

The home construction intruder excavates a foundation for a home, spending a specified length of time in the excavation. The excavation work generates airborne dust that is inhaled by the worker. The worker is also simultaneously exposed to direct radiation emitted from radioactive material in the surrounding soil. In the course of the work, residual contamination is brought to the surface. The amount of activity brought to the surface during home construction is estimated as:

$$A_{hc} = W_{\mathrm{exc}} \quad _{\mathrm{exc}} H_{\mathrm{rmvd}} \, \rho_w \, f_v \, C_w$$

where:

A_{hc}	=	activity of a radionuclide removed from the excavation during home construction, picocuries
W_{exc}	=	width of the excavation, meters
$_{\mathrm{exc}}$	=	length of the excavation, meters
H_{rmvd}	=	height of waste removed from the excavation, meters
ρ_w	=	density of waste removed from the excavation, grams per cubic centimeter
f_v	=	conversion constant, 1×10^6 cubic centimeters per cubic meter
C_w	=	concentration of radionuclide in waste, picocuries per gram

The dose due to inhalation of a given radionuclide was estimated as:

$$D_{\mathrm{inh}} = (1 \quad f_a \, f_m \,) \, M_{\mathrm{load}} \quad R \, T_{\mathrm{exc}} \, C_{\mathrm{soil}} \, DCF_{\mathrm{inh}}$$

where:

D_{inh}	=	inhalation dose, rem
f_{a}	=	conversion factor, 1×10^{12} picocuries per curie
f_m	=	conversion, 1,000 milligrams per gram
M_{load}	=	mass loading of dust in the air, milligrams per cubic meter
R	=	breathing rate, cubic meters per year
T_{exc}	=	time spent in the excavation, years
$\mathrm{C}_{\mathrm{soil}}$	=	radionuclide concentration in the soil, picocuries per gram
DCF_{inh}	=	dose conversion factor for inhalation, rem per curie

Direct external dose was estimated as:

$$D_{\mathrm{ext}} = N_s \, DEN_s \, C_s \, T_{\mathrm{exc}} \, DCF_{exV}$$

where:

D_{ext}	=	external dose, rem
N_s	=	number of surfaces in excavation, unitless
DEN_s	=	density of soil, grams per cubic centimeter
C_{s}	=	concentration of radionuclide in the soil, picocuries per gram
T_{exc}	=	time spent in the excavation, years
DCF_{exV}	=	dose conversion for external radiation from a volume source, rem per year/picocuries per cubic centimeter

Five surfaces, four walls and a floor, and dose factors for semi-infinite media not corrected for finite size of the excavation were used in the calculations.

Q.2.3.2.2 Well-Drilling Worker

In this scenario, a worker completing a well is assumed to inhale dust mobilized by drilling activity and to be exposed to radiation emitted by waste brought to the surface in drilling mud. Dose due to inhalation was estimated using the same approach and equation as described above for the home construction scenario worker. The drilling mud is pumped to a pond where it is covered by 0.6 meters (2 feet) of water. The worker remains in the vicinity of the pond and is exposed to direct radiation emitted from the radioactive material in the pond. The activity brought to the surface is:

$$A_{wd} = (\, f_v \;\; f_a) \, (\pi/4) \, (D_{\mathrm{well}})^2 \, Z_w \, DEN_w \, f_v \, \mathrm{C_w}$$

where:

A_{wd} = activity of a radionuclide deposited in the pond, picocuries
f_v = conversion factor, 1×10^6 cubic centimeters per cubic meter
f_a = conversion factor, 1×10^{12} picocuries per curie
D_{well} = diameter of the well, meters
Z_{w} = thickness of waste horizon intersected by the well, meters
DEN_w = density of waste, grams per cubic centimeter
C_w = radionuclide concentration in the waste, picocuries per gram

The activity was distributed at the upper surface of the mud layer, below the overlying water. The shielding of the pond water would reduce the dose by a factor of approximately 75. The dose to a receptor near the pond was estimated as:

$$D_{\mathrm{drill}} = [(A_{wd} \;\; f_a) \;\; A_p] \, (1.0 \;\; f_{\mathrm{shld}}) \, T_{\mathrm{drill}} \, DCF_{exS}$$

where:

D_{drill} = dose during drilling activity, rem
A_{wd} = activity of a radionuclide deposited in the pond, picocuries
f_a = conversion factor, 1×10^{12} picocuries per curie
A_p = area of pond, square meters
f_{shld} = factor for reduction of dose due to shielding by water in pond, unitless
T_{drill} = time of exposure near pond, years
DCF_{exS} = dose conversion factor for external radiation from a source of surface contamination, rem per year/curies per square meter

Q.2.3.2.3 Residential Agriculture Intruder

In the residential agriculture scenario, an individual lives in a home and cultivates a garden on soil containing residual contamination, resulting in exposure to radionuclides through a variety of direct radiation and inhalation and ingestion pathways. Analysis of this scenario was conducted using the RESRAD computer code (Yu et al. 2001) developed for the Formerly Utilized Sites Remedial Action Program. RESRAD estimates annual dose to an individual who establishes a residence on a site having residual contamination; raises and consumes crops; raises livestock and consumes meat, poultry, and milk; drinks contaminated groundwater; and obtains fish from a contaminated pond. Use of the model for site-specific application requires selection of appropriate operating modes of the model and specification of values for parameters characterizing site physical conditions and the range of likely activity of the individual. For this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, American Indian and resident farmer receptors having different production rates were selected for analysis. Parameter values for intruder analysis are the same as those presented for the residential agriculture scenarios of long-term analysis and are presented in the following section. For the above considerations, exposure pathways included in this analysis are as follows:

- Direct radiation
- Inhalation of volatile compounds
- Inhalation of dust
- Ingestion of vegetables, grain, fruit, meat, poultry, and milk
- Inadvertent ingestion of soil

Intrusion impacts for the above pathways result from transport of waste to the surface due to human activity and occur primarily in the near term. Impacts for the drinking water pathway involve transport of radionuclides through the vadose zone to groundwater and occur in the future, with reduction of dose due to decay of short-lived radionuclides. For these reasons, doses due to ingestion of drinking water are not included in the intruder analysis. Doses due to ingestion of drinking water are reported in the long-term impact analysis. The concentration of a radionuclide in the soil for residential agriculture is determined by the amount of activity brought to the surface, the area required for the residence and garden, and the mixing depth into the soil.

The concentration in soil for residential agriculture is estimated as:

$$C_{ra} = A_{\mathrm{rmvd}} \quad (A_{ra} H_{\mathrm{mix}} f_v \rho_s)$$

where:

C_{ra} = concentration of radionuclide in soil for residential agriculture, picocuries per gram
A_{rmvd} = activity removed from the home construction excavation or well borehole, picocuries
A_{ra} = area required for the residence and garden, square meters
H_{mix} = height for mixing activity into soil, meters
f_v = conversion constant, cubic centimeters per cubic meter
ρ_s = density of soil in the garden, grams per cubic centimeter

Unit impact factors derived using RESRAD allow calculation of dose as:

$$D_{ra} = C_{ra}\, DCF_{ra}$$

where:

D_{ra} = dose to a resident farmer, rem per year
C_{ra} = radionuclide concentration in soil, picocuries per gram
DCF_{ra} = unit dose factor reflecting dose through RESRAD pathways, rem per year/picocuries per gram

Q.2.4 Values of Physical Constants and Parameters for Long-Term Impact Analysis

A variety of physical constants and parameters appears in mathematical models used for estimation of long-term human health impacts. This section presents a summary of the values used for these constants and parameters. First, values of constants and parameters used in radionuclide and chemical contaminant release and transport analysis are presented. Next, values of dose and health effect coefficients are presented. Lastly, values used in scenario analysis are presented.

Q.2.4.1 Values for Health Effect Conversion Factors

Health effect conversion factors are used for estimation of dose, hazard, and risk for radionuclides and chemical contaminants. For radionuclide dose conversion factors, Federal guidance (Eckerman and Ryman 1993; Eckerman et al. 1999) was used. The recommended factors apply to the average adult members of the population, taking into account averaging over age and gender. Values for radionuclide-specific dose conversion factors are presented in Table Q–3. For carcinogenicity slope factors (risk coefficients) for radionuclides, values recommended in Federal guidance (EPA 2002a) were used. These values are summarized in Table Q–4. For chemical contaminants, Federal guidance recommends health coefficient values for measures of noncancer and cancer impacts (EPA 2009). Values for these parameters used in this EIS are presented in Table Q–5.

Table Q–3. Values of Radionuclide Dose Conversion Factors

Radionuclide	Ingestion[a] (rem per curie)	Inhalation[a] (rem per curie)	External Surface Source[b] (rem per year)/ (curies per square meter)	External Volume Source[b] (rem per year)/ (picocuries per cubic meter)
Hydrogen-3 (tritium)	1.60×10^{2}	2.30×10^{1}	0.00	0.00
Carbon-14	2.20×10^{3}	7.60×10^{2}	1.90	8.40×10^{-9}
Potassium-40	2.28×10^{4}	3.14×10^{5}	1.70×10^{4}	6.50×10^{-4}
Strontium-90	1.00×10^{5}	8.90×10^{4}	3.30×10^{1}	4.40×10^{-7}
Zirconium-93	4.11×10^{3}	9.28×10^{4}	0.00	0.00
Technetium-99	2.40×10^{3}	1.10×10^{3}	9.10	7.90×10^{-8}
Iodine-129	3.90×10^{5}	1.30×10^{5}	3.00×10^{3}	8.10×10^{-6}
Cesium-137	5.00×10^{4}	1.70×10^{4}	6.50×10^{4}	2.10×10^{-3}
Gadolinium-152	1.52×10^{5}	7.04×10^{7}	0.00	0.00
Thorium-232	8.50×10^{5}	4.10×10^{8}	6.40×10^{1}	3.30×10^{-7}
Uranium-238	1.70×10^{5}	1.10×10^{7}	6.40×10^{1}	6.50×10^{-8}
Neptunium-237	4.00×10^{5}	1.80×10^{8}	3.40×10^{3}	4.90×10^{-5}
Plutonium-239	9.30×10^{5}	4.40×10^{8}	4.30×10^{1}	1.80×10^{-7}
Americium-241	7.60×10^{5}	3.60×10^{8}	3.20×10^{3}	2.70×10^{-5}

a Eckerman et al. 1999.
b Eckerman and Ryman 1993.

Table Q–4. Radionuclide Carcinogenicity Slope Factors[a]

Radionuclide	Water Ingestion (1 per picocurie)	Food Ingestion (1 per picocurie)	Inhalation (1 per picocurie)
Hydrogen-3 (tritium)	5.07×10^{-14}	6.51×10^{-14}	5.62×10^{-14}
Carbon-14	1.55×10^{-12}	2.00×10^{-12}	7.07×10^{-12}
Potassium-40	2.47×10^{-11}	3.43×10^{-11}	1.03×10^{-11}
Strontium-90	5.59×10^{-11}	6.88×10^{-11}	1.05×10^{-10}
Zirconium-93	1.11×10^{-12}	1.44×10^{-12}	7.29×10^{-12}
Technetium-99	2.75×10^{-12}	4.00×10^{-12}	1.41×10^{-11}
Iodine-129	1.48×10^{-10}	3.22×10^{-10}	6.07×10^{-11}
Cesium-137	3.04×10^{-11}	3.74×10^{-11}	1.19×10^{-11}
Gadolinium-152	2.97×10^{-11}	3.85×10^{-11}	9.10×10^{-9}
Thorium-232	1.01×10^{-10}	1.33×10^{-10}	4.33×10^{-8}
Uranium-238	6.40×10^{-11}	8.66×10^{-11}	9.32×10^{-9}
Neptunium-237	6.18×10^{-11}	8.29×10^{-11}	1.77×10^{-8}
Plutonium-239	1.35×10^{-10}	1.74×10^{-10}	3.33×10^{-8}
Americium-241	1.04×10^{-10}	1.34×10^{-10}	2.81×10^{-8}

a EPA 2002a.

Table Q–5. Health Effect Factors for Chemical Contaminants[a]

Constituent	Ingestion Reference Dose (mg/kg-d)	Inhalation Reference Concentration (mg/m^3)	Slope Factor	
			Ingestion [1/(mg/kg-d)]	Inhalation [1/(mg/m3)]
1,2-Dichloroethane	2.00×10^{-2}[b]	N/A	9.10×10^{-2}	2.60×10^{-2}
1,4-Dioxane	N/A	N/A	1.09×10^{-2}[c]	N/A
1-Butanol	1.00×10^{-1}[b]	N/A	N/A	N/A
2,4,6-Trichlorophenol	N/A	N/A	1.09×10^{-2}[c]	3.10×10^{-3}[d]
Acetonitrile	6.00×10^{-3}[b]	6.00×10^{-2}	N/A	N/A
Arsenic, inorganic	3.00×10^{-4}	N/A	1.50	4.30
Benzene	4.00×10^{-3}	3.00×10^{-2}	5.50×10^{-2}	7.80×10^{-3}
Boron and compounds	2.00×10^{-1}	2.00×10^{-2}[b]	N/A	N/A
Cadmium	1.00×10^{-3}	N/A	N/A	1.80
Carbon tetrachloride	7.00×10^{-4}	N/A	1.30×10^{-1}	1.50×10^{-2}
Chromium	3.00×10^{-3}	8.00×10^{-6}	N/A	1.20×10^{1}
Dichloromethane	6.00×10^{-2}	3.00[b]	7.50×10^{-3}	4.70×10^{-4}
Fluoride	6.00×10^{-2}	N/A	N/A	N/A
Hydrazine/hydrazine sulfate	N/A	N/A	3.00	4.90
Lead	N/A	N/A	N/A	N/A
Manganese	1.40×10^{-1}	5.00×10^{-5}	N/A	N/A
Mercury	3.00×10^{-4}	N/A	N/A	N/A
Molybdenum	5.00×10^{-3}	N/A	N/A	N/A
Nickel (soluble salts)	2.00×10^{-2}	N/A	N/A	N/A
Nitrate	1.60	N/A	N/A	N/A
Polychlorinated biphenyls (PCBs)	N/A	N/A	4.00×10^{-1}	1.00×10^{-1}
Silver	5.00×10^{-3}	N/A	N/A	N/A
Strontium (stable)	6.00×10^{-1}	N/A	N/A	N/A
Total uranium	3.00×10^{-3}	N/A	N/A	N/A
Trichloroethylene (TCE)	3.00×10^{-4}[b]	4.00×10^{-2}[b]	4.00×10^{-1}[b]	N/A
Vinyl chloride	3.00×10^{-3}	1.00×10^{-1}	1.50	8.80×10^{-3}

[a] EPA IRIS database (EPA 2009).
[b] Oak Ridge National Laboratory Risk Assessment Information System Toxicity database (RAIS 2007).
[c] Calculated from EPA IRIS oral Unit Risk (EPA 2009).
[d] Calculated from EPA IRIS inhalation Unit Risk (EPA 2009).
Note: To convert kilograms to pounds, multiply by 2.2046; cubic meters to cubic yards, by 1.308.
Key: EPA=U.S. Environmental Protection Agency; IRIS=Integrated Risk Information System; mg/kg-d=milligrams per kilogram-day; mg/m^3=milligrams per cubic meter; N/A=not assessed in guidance document.

Q.2.4.2 Values for Physical Constants and Parameters Used in Scenario Analysis

Values for physical constants and parameters are used in analysis of drinking water and residential agriculture scenarios. For consumption of drinking water, the primary parameter is ingestion rate, for which a value of 2.0 liters (0.53 gallons) per day was used. This corresponds to the 90th percentile of use for the United States (Beyeler et al. 1999). As described in Section Q.2.2.2, different models are used in evaluation of impacts due to exposure to radionuclides and chemical contaminants. The following paragraphs present the values for the two approaches.

For impacts due to exposure to radionuclides in the residential garden scenario, the RESRAD computer code (Yu et al. 2001) was used to estimate impacts. A set of approximately 70 parameters was employed in this model. The initial step in development of this information is specification of physical conditions of the site and identification of activities and utilization rates for the selected average member of the critical group. Physical characteristics of soil were based on site-specific measurements, description of the soil as silty clay loam (Mann et al. 2001), and use of national average values of physical properties for that soil texture (Beyeler et al. 1999) where site-specific data were unavailable. Activities include occupation of a residence and cultivation of a garden for crops and animal products. Two types of average member of the critical group were considered. The first is a resident farmer whose consumption rates for vegetables and produce are approximately 25 percent of national average values. This receptor is consistent with the *Hanford Site Risk Assessment Methodology* (DOE 1995). The second type of receptor is an American Indian who produces 100 percent of the national average utilization rates of produce and animal products. Based upon these utilization rates; site-specific crop yields (Napier et al. 2004), where available; and national average yields (Beyeler et al. 1999), where site data was unavailable, the area of the garden was estimated as the quotient of utilization rate and yield. The values of the RESRAD parameters are summarized in Tables Q–6 through Q–12. The final set of information used in the analysis was values of distribution coefficients for radioactive elements. Literature values for sand (Sheppard and Thibault 1990), presented in Appendix M, Table M–6 under the grout category, were used in analysis of the residential agriculture scenario.

Table Q–6. Contaminated Zone Data

Parameter	Parameter Value		Source
	American Indian Scenario	Residential Agriculture Scenario	
Area	4,200 square meters	1,500 square meters	Kennedy and Strenge 1992[a]
Thickness	1 meter	1 meter	Site specific[b]
Length parallel to aquifer flow	65 meters	40 meters	Derived from area
Bulk density	1.6 grams per cubic centimeter	1.6 grams per cubic centimeter	Site specific[b]
Erosion rate	1×10^{-5} meters per year	1×10^{-5} meters per year	Site specific[b]
Total porosity	0.43	0.43	Site specific[b]
Effective porosity	0.35	0.35	Site specific[b]
Hydraulic conductivity	4.7 meters per year	4.7 meters per year	Site specific[b]
b parameter	7.1	7.1	Site specific[b]
Evapotranspiration coefficient	0.98	0.98	Site specific
Windspeed	3.0 meters per second	3.0 meters per second	Site specific
Precipitation	0.17 meters per year	0.17 meters per year	Site specific
Irrigation rate	0.66 meters per year	0.66 meters per year	Kennedy and Strenge 1992[c]
Runoff coefficient	0	0	Site specific

[a] Estimated using method and national average production rates from Kennedy and Strenge 1992 and site-specific crop yields and site-specific utilization rates from Table 5.

[b] Value for silty clay loam (Meyer and Gee 1999) is based on site conditions.

[c] Average value for State of Washington (Beyeler et al. 1999).

Note: To convert meters to feet, multiply by 3.281; square meters to square feet, by 10.7639; cubic meters to cubic feet, by 35.315; grams to ounces, by 0.03527.

Table Q–7. Saturated Zone Hydrologic Data

Parameter	Parameter Value	Source
Bulk density	1.6 grams per cubic centimeter	Site specific[a]
Total porosity	0.43	Site specific[a]
Effective porosity	0.35	Site specific[a]
Hydraulic conductivity	4.7 meter per year	Site specific[a]
Hydraulic gradient	0.01	Site specific[a]
Water table drop rate	0 meters per year	Site specific
Well pump intake depth	2 meters (below water table)	Site specific
Mixing model	Non-dispersion	Site specific
Well pumping rate	0 cubic meters per year	Site specific

[a] Value for silty clay loam (Meyer and Gee 1999) is based on site conditions.

Note: To convert grams to ounces, multiply by 0.03527; meters to feet, by 3.281; cubic meters to cubic feet, by 35.315.

Table Q–8. Uncontaminated and Unsaturated Zone Hydrologic Data

Parameter	Parameter Value	Source
Number of strata	1	Site specific
Thickness	75 meters	Site specific
Bulk density	1.6 grams per cubic centimeter	Site specific[a]
Total porosity	0.43	Site specific[a]
Effective porosity	0.35	Site specific[a]
Hydraulic conductivity	4.7 meters per year	Site specific[a]
b parameter	7.1	Site specific[a]

[a] Value for silty clay loam (Meyer and Gee 1999) is based on site conditions.

Note: To convert meters to feet, multiply by 3.281; cubic centimeters to cubic inches, by 0.06102; grams to ounces, by 0.03527.

Table Q–9. Dust Inhalation and External Gamma Data

Parameter	Parameter Value	Source
Inhalation rate	8,400 cubic meters per year	Kennedy and Strenge 1992[a]
Mass loading for inhalation	4.5×10^{-6} grams per cubic meter	Kennedy and Strenge 1992[b]
Exposure duration	1 year	Site specific
Indoor dust filtration factor	1	Site specific
Shielding factor, external gamma	0.59	Kennedy and Strenge 1992[c]
Fraction of time indoors, on site	0.66	Kennedy and Strenge 1992[a]
Fraction of time outdoors, on site	.012	Kennedy and Strenge 1992[a]
Shape factor, external gamma	1	RESRAD[d]

[a] National average values (Beyeler et al. 1999).

[b] Activity at time average of national average values (Beyeler et al. 1999).

[c] Sum of products of the means of the fraction of time and shielding factors for indoor and outdoor exposure (Beyeler et al. 1999).

[d] Default parameter value from RESRAD (Yu et al. 2001).

Note: To convert cubic meters to cubic feet, multiply by 35.315; grams to ounces, by 0.03527.

Table Q–10. Dietary Data

Parameter	Parameter Value		Residential Agriculture Scenario	Source
	American Indian Scenario	American Indian Hunter-Gatherer		
Fruit, vegetable, and grain consumption rate	330 kilograms per year	330 kilograms per year	58 kilograms per year	Site specific, *HSRAM*[a, b]
Leafy vegetable consumption rate	65 kilograms per year	65 kilograms per year	21 kilograms per year	Site specific, *HSRAM*[a]
Milk consumption	219 liters per year	0 liters per year	110 liters per year	Site specific, *HSRAM*[a]
Meat and poultry consumption	154 kilograms per year	154 kilograms per year	57 kilograms per year	Site specific, *HSRAM*[a, c]
Soil ingestion rate	0.044 kilograms per year	0.044 kilograms per year	0.044 kilograms per year	Agency guidance[d]
Fraction contaminated livestock water	1	1	1	Site specific
Fraction contaminated irrigation water	1	1	1	Site specific
Fraction contaminated plant food	1	1	1	Site specific
Fraction contaminated meat	1	1	1	Site specific
Fraction contaminated milk	1	1	1	Site specific

[a] Value from *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (DOE and Ecology 1996) for American Indian scenario and *Hanford Site Risk Assessment Methodology* (DOE 1995) for residential agricultural scenario.

[b] Sum of individual means for other vegetables, fruit, and grain.

[c] Sum of individual means for meat and poultry.

[d] Exposure duration weighted average of child and adult ingestion rates (EPA 1996).

Note: To convert kilograms to pounds, multiply by 2.2046; liters to gallons, by 0.26417.

Key: *HSRAM=Hanford Site Risk Assessment Methodology*.

Table Q–11. Nondietary Data

Parameter	Parameter Value	Source
Livestock fodder intake for meat	27.3 kilograms per day	Kennedy and Strenge 1992[a]
Livestock fodder intake for milk	64.2 kilograms per day	Kennedy and Strenge 1992[b]
Deer forage intake for meat	1.63 kilograms per day	ORNL 1997
Livestock water intake for meat	50 liters per day	Site specific
Livestock water intake for milk	60 liters per day	Site specific
Livestock intake of soil	0.5 kilograms per day	RESRAD[c]
Deer water intake for meat	3.27 liters per day	ORNL 1997
Deer intake of soil	0.033 kilograms per day	ORNL 1997
Mass loading for foliar deposition	4×10^{-4} grams per cubic meter	Kennedy and Strenge 1992[d]
Depth of soil mixing layer	0.15 meters	Kennedy and Strenge 1992
Depth of roots	0.9 meters	RESRAD[c]
Fraction livestock water from groundwater	0	Site specific
Fraction irrigation water from groundwater	0	Site specific

[a] National average values (Beyeler et al. 1999).

[b] Sum of individual medians for forage, hay, and grain (Beyeler et al. 1999).

[c] Default parameter value from RESRAD (Yu et al. 2001).

[d] Value for gardening (Beyeler et al. 1999).

Note: To convert kilograms to pounds, multiply by 2.2046; liters to gallons, by 0.26417; grams to ounces, by 0.03527; cubic meter to cubic yard, by 1.308; meters to feet, by 3.281.

Table Q–12. Soil-to-Plant Transfer Factors for Radionuclides

Constituent	Value	Source
Hydrogen-3 (tritium)	4.80	Staven et al. 2003
Carbon-14	1.37×10^{-1}	Staven et al. 2003
Potassium-40	1.07×10^{-1}	Staven et al. 2003
Strontium-90	9.75×10^{-2}	Staven et al. 2003
Zirconium-93	1.95×10^{-4}	Staven et al. 2003
Technetium-99	4.68×10^{-2}	Staven et al. 2003
Iodine-129	7.80×10^{-3}	Staven et al. 2003
Cesium-137	9.00×10^{-1}	Staven et al. 2003
Gadolinium-152	3.90×10^{-3}	Staven et al. 2003
Thorium-232	6.44×10^{-5}	Staven et al. 2003
Uranium-238	2.34×10^{-3}	Staven et al. 2003
Neptunium-237	2.54×10^{-3}	Staven et al. 2003
Plutonium-239	2.15×10^{-4}	Staven et al. 2003
Americium-241	6.83×10^{-5}	Staven et al. 2003

For impacts due to ingestion or inhalation of chemical contaminants in the residential agriculture scenario, the set of algebraic equations presented in Section Q.2.2.2 was used. Values for crop ingestion rates were the same as for the analysis of impacts for radionuclides, while other model-specific values were based on agency guidance (EPA 1991, 1996, 2000a, 2002b). Values for the parameters are summarized in Table Q–13. Values of parameters common to each of the contributing pathways were the exposure frequency of 365 days per year, exposure duration of 30 years, and averaging time of 70 years. Values for soil-to-plant transfer factors of chemical contaminants are presented in Table Q–14. For fish consumption, three values were used:

1. 9 kilograms per year (19.8 pounds per year) for the resident farmer using surface water (EPA 1999).
2. 62 kilograms per year (136 pounds per year) for the American Indian using surface water (EPA 1999).
3. 0.003 kilograms per year for the average members of the offsite population using surface water (Mann and Puigh 2001).

Table Q–13. Parameter Values for the Residential Agriculture Scenario for Chemical Contaminants

Parameter/Pathway	Value	Source
Inadvertent Soil Ingestion		
Ingestion rate[a]	120 milligrams per day	EPA 2000b
Fugitive Dust Inhalation		
Particulate emission factor	1.36×10^{9}	EPA 2002b
Exposure time fraction, outdoors	0.073	EPA 2000b
Exposure time fraction, indoors	0.683	EPA 2000b
Dilution factor, indoors	0.4	EPA 2000b
Crop Ingestion		
Ingestion rate, vegetables, and fruit Ingestion rate, leafy vegetables	330 kilograms per year (AI&AIHG)/ 58 kilograms per year (RF) 65 kilograms per year (AI&AIHG)/ 21 kilograms per year (RF)	Beyeler et al. 1999 DOE 1995 Beyeler et al. 1999 DOE 1995

[a] Age-averaged for child (6 years at 200 milligrams per day) and adult (24 years at 120 milligrams per day).
Note: To convert milligrams to ounces, multiply by 0.00003527; kilograms to pounds, by 2.2046.
Key: AI=American Indian receptor; AIHG=American Indian hunter-gatherer receptor; RF=resident farmer receptor.

Table Q–14. Soil-to-Plant Transfer Factors for Chemical Contaminants

Constituent	Value[a]	Source
1,2-Dichloroethane	1.048	Travis and Arms 1988
1,4-Dioxane	1.061×10^{1}	Travis and Arms 1988
1-Butanol	2.391	Travis and Arms 1988
2,4,6-Trichlorophenol	5.458×10^{-2}	Travis and Arms 1988
Acetonitrile	1.165×10^{1}	Travis and Arms 1988
Arsenic, inorganic	1.170×10^{-3}	Staven et al. 2003
Benzene	4.352×10^{-1}	Travis and Arms 1988
Boron and compounds	3.900×10^{-2}	Baes et al. 1984
Cadmium	2.930×10^{-2}	Staven et al. 2003
Carbon tetrachloride	1.958×10^{-1}	Travis and Arms 1988
Chromium	8.780×10^{-4}	Staven et al. 2003
Dichloromethane	1.404	Travis and Arms 1988
Fluoride	1.170×10^{-3}	Baes et al. 1984
Hydrazine/hydrazine sulfate	1.300×10^{2}	RAIS 2007
Lead	1.170×10^{-3}	Staven et al. 2003
Manganese	3.900×10^{-2}	Staven et al. 2003
Mercury	3.900×10^{-2}	Staven et al. 2003
Molybdenum	1.560×10^{-1}	Staven et al. 2003
Nickel (soluble salts)	1.170×10^{-2}	Staven et al. 2003
Nitrate	5.850	RAIS 2007
Polychlorinated biphenyls (PCBs)	4.411×10^{-3}	Travis and Arms 1988
Silver	2.535×10^{-4}	Baes et al. 1984
Strontium (stable)	9.750×10^{-2}	Staven et al. 2003
Total uranium	2.340×10^{-3}	Staven et al. 2003
Trichloroethylene (TCE)	2.011×10^{-1}	Travis and Arms 1988
Vinyl chloride	1.007	Travis and Arms 1988

a Values are for wet basis.

For impacts due to use of a sauna, the scenario-specific parameters are those related to temperature of the sauna and amounts of water droplets and water vapor in the air in the sauna. Values for scenario-specific parameters are summarized in Table Q–15. Description of the scenario and equations for estimation of impact are presented in Section Q.2.2.2.

Physical constants and parameters also appear in the site-specific direct intrusion scenario model described in Section Q.2.3. For the home construction intruder scenarios, parameter values for worker impacts are an excavation depth of 3 meters (10 feet), a breathing rate of 8,400 cubic meters per year (297,000 cubic feet per year), a mass loading for inhalation of 0.4 milligrams per cubic meter (2.5×10^{-8} pounds per cubic foot), and an exposure duration of 0.057 years (500 hours). For the well drilling intruder scenario, parameter values for worker impacts are a drill diameter of 0.15 meters (0.5 feet), a drill advance rate of 80,000 meters per year (30 feet per hour), a mass loading for inhalation of 0.4 milligrams per cubic meter (2.5×10^{-8} pounds per cubic foot), and a breathing rate of 8,400 cubic meters per year (297,000 cubic feet per year). For the resident farmer exposure initiated by both home construction and well drilling, values of exposure parameters are those presented in Tables Q–6 through Q–11 and dose impacts were estimated using Version 6.4 of the RESRAD computer code (Yu et al. 2001).

Table Q–15. Values of Parameters for Estimation of Impact Due to Use of a Sauna

Parameter	Value
Temperature of sauna,[a] degrees Celsius	50
Ratio of volume of airborne droplets to volume of air in the sauna,[a] unitless	1.0×10^{-8}
Entrainment factor for evaporation,[a] unitless	1.0 for hydrogen-3 (tritium), organics and hydrazine 0.01 for all other constituents
Density of water vapor in the sauna,[b] grams per cubic meter	82.6
Density of liquid water, grams per cubic meter	1.0×10^{6}
Frequency of use,[c] year per year	0.042

[a] Value adopted from (Mann and Puigh 2001).

[b] Calculated using the ideal gas law and assumption of water vapor at saturation pressure (1.79 pound per square inch absolute) at the temperature of the sauna.

[c] Assumes use of 1 hour per day each day of the year.

Note: To convert degrees Celsius to degrees Fahrenheit, multiply by 1.8, then add 32; grams to ounces, by 0.03527; cubic meters to cubic feet, by 35.315.

Q.3 RESULTS OF HUMAN HEALTH IMPACTS

This section discusses the potential long-term human health impacts of each of the sets of proposed actions. Section Q.3.1 discusses the potential long-term human health impacts for the Tank Closure alternatives. Section Q.3.2 discusses the potential long-term human health impacts for the FFTF Decommissioning alternatives. Section Q.3.3 discusses the potential long-term impacts for the Waste Management alternatives.

Q.3.1 Long-Term Human Health Impacts of Tank Closure Alternatives

Impacts on human health over the long time period following stabilization or closure of the HLW tanks would be due primarily to discharges to cribs and trenches (ditches) and releases from the tanks and related equipment. These releases would involve both radiological and chemical constituents. Because a large number of constituents, sources, and scenarios have been considered, screening analysis was used to identify a reduced number of controlling scenarios. The results of this analysis of impacts on human health for onsite, offsite, and intruder receptors are summarized in the following sections.

Q.3.1.1 Impacts on Onsite and Offsite Receptors of Expected Conditions for Tank Closure Alternatives

Implementation of activities defined for the Tank Closure alternatives could lead to releases of radiological and chemical constituents to the environment over long periods of time. In the case of Tank Closure Alternatives 1 and 2A, these releases would not be controlled by engineered closure of the tanks, while under the other Tank Closure alternatives, releases would be controlled by stabilization of the tanks and of wastes generated in retrieval and closure activities. Potential human health impacts due to release of radiological constituents are estimated as dose and as lifetime risk of incidence of cancer. Potential human health effects due to release of chemical constituents include both carcinogenic effects and other forms of toxicity. Impacts of carcinogenic chemicals are estimated as lifetime risk of incidence of cancer. Noncarcinogenic effects are estimated as Hazard Quotient, the ratio of the long-term intake of a single chemical to intake that produces no observable effect, and as Hazard Index, the sum of the Hazard Quotients of a group of chemicals. Further information on the nature of human health effects in response to exposure to radiological and chemical constituents is provided in Appendix K, Section K.1. As previously discussed in Section Q.1 of this appendix, the screening analysis identified 14 radiological and 26 chemical constituents as contributing the greatest risk of adverse impacts. Impacts due to exposure to these constituents are presented in this appendix.

The four measures of human health impacts considered in this analysis—lifetime risks of developing cancer from radiological and chemical constituents, dose from radiological constituents, and Hazard Index from chemical constituents—are calculated for each year for 10,000 years for each receptor at eight locations (i.e., A, B, S, T and U Barriers, Core Zone Boundary, Columbia River nearshore, and Columbia River surface water). This is a large amount of information that must be summarized to allow interpretation of results. The method chosen is to present dose for the year of maximum dose, risk for the year of maximum risk, and Hazard Index for the year of maximum Hazard Index. This choice is based on regulation of radiological impacts as dose and the observation that peak risk and peak noncarcinogenic impacts expressed as Hazard Index may occur at times other than that of peak dose. The significance of dose impacts is evaluated by comparison against the 100-millirem-per-year all-exposure-modes standard specified for protection of the public and the environment in DOE Order 5400.5. Population doses are compared against total effective dose equivalent from background sources of 365 millirem per year for a member of the population of the United States (NCRP 1987). The significance of noncarcinogenic chemical impacts is evaluated by comparison against a guideline value of unity for Hazard Index. The level of protection provided for the drinking water pathway is evaluated by comparison against the maximum contaminant levels (MCLs) of 40 CFR 141 and other benchmarks presented in Appendix O. In addition, only those radiological and chemical constituents that resulted in a lifetime risk or Hazard Index greater than 1×10^{-10} are presented in the tables in order to reduce the size of the tables.

Impacts related to tank farm operations, retrieval and closure are due to three types of release. The first type of release is the past practice of direct discharge of liquid to cribs and trenches (ditches). The second type of release is due to past activity at the tank farms and includes past leaks from damaged tanks. The third type of release is due to future activities and includes leaks during retrieval of waste from the tanks, and long-term leaching of waste material in tanks and ancillary equipment.

The balance of this section summarizes the potential human health effects due to implementation of each Tank Closure alternative. Seven onsite locations at which an individual may contact groundwater and an offsite location were selected for analysis. The seven onsite locations are the boundaries of tank farm barriers, the Core Zone Boundary, and the Columbia River nearshore. The offsite location is an access point to surface water of the Columbia River, which could be at various points near the site and at population centers downstream of the site. Total offsite population is 5 million people.

Consistent with DOE guidance (DOE Guide 453.1-1), the potential consequences of loss of administrative or institutional control are considered by estimation of impacts on onsite receptors. Because DOE does not anticipate loss of control of the site, these onsite receptors are considered hypothetical and are applied to develop estimates for past and future periods of time.

Four types of receptors are considered. The first type, a drinking-water well user, uses groundwater as a source of drinking water. The second type, a resident farmer, uses groundwater for drinking water consumption and irrigation of crops. Garden size and crop yield are adequate to produce approximately 25 percent of average requirements of crops and animal products. The third type, an American Indian resident farmer, also uses groundwater for drinking water consumption and irrigation of crops. Garden size and crop yield are adequate to produce the entirety of average requirements of crops and animal products. The fourth type, an American Indian hunter-gatherer, is impacted by both groundwater and surface water because he uses surface water for drinking water consumption and consumes wild plant materials, which use groundwater, and game, which use surface water. In subsequent subsections, estimates of impacts are presented in two sets of tables, one set for receptors using groundwater and one set for users of surface water. In order to facilitate presentation, estimates of impact on the American Indian hunter-gatherer are presented in the set of tables for surface-water users. Impacts that depend upon or would be affected by Tank Closure alternatives would be evident after calendar year 2050, the approximate time assumed for placement of engineered caps. However, releases to the vadose zone associated with past practices such as planned discharges to cribs and trenches (ditches) and with leaks from tanks occurring after calendar year 1940 but before calendar year 2050, may continue to produce impacts into the future. Because of uncertainties in estimates of the time of occurrence of impacts and the perspective that could be added by knowledge of past impacts, estimates of peak impacts are provided for time periods beginning in calendar year 1940 and in calendar year 2050. In addition, a time series of estimates of radiological risk for the drinking-water well user at the Core Zone Boundary is presented to provide a view of the evolution of impacts over the entire period of analysis. Further discussion on these receptors is provided in Section Q.2 of this appendix.

The results of the analysis for drinking-water well users after the year 2050 are summarized in Tables Q–16 through Q–19 for radiological and chemical constituents. Impacts due to ingestion of drinking water under Tank Closure Alternative 1, which assumes catastrophic failure of the tanks, would be higher than the 100-millirem-per-year dose standard at the A and B Barriers and the Core Zone Boundary. For the other Tank Closure alternatives, the results indicate that planned discharges to cribs and trenches (ditches) and past leaks at the B, BX, BY, T, and TX tank farms would be important contributors to radiological and chemical impacts. Under Tank Closure Alternatives 2A, 2B, 3A, 3B, 3C, 4, 5, 6A (Base and Option Cases), 6B (Base and Option Cases), and 6C, doses would be not be greater than the 100-millirem-per-year standard at any location. Under all Tank Closure alternatives, except for Tank Closure Alternative 1, doses estimated for drinking water ingestion are less than 10 millirem per year at the Columbia River nearshore location. For peak impacts occurring prior to calendar year 5000, radiological impacts would be due to hydrogen-3 (tritium), technetium-99 and iodine-129 and chemical impacts would be due to chromium and nitrate. For peak impacts occurring after calendar year 5000, radiological impacts would be due to uranium isotopes and chemical impacts would be due to total uranium.

Table Q–16. Summary of Radiological Dose at Year of Peak Dose for Drinking-Water Well User (millirem per year)

Location	Tank Closure Alternative								
	1	2A	2B, 3A, 3B, 3C, 6C	4	5	6A, Base Case	6A, Option Case	6B, Base Case	6B, Option Case
A Barrier	1.43×10^{2} (2114)	3.60 (2055)	3.27 (2058)	3.28 (2058)	5.46 (4338)	3.03 (2058)	3.03 (2058)	3.21 (2050)	3.21 (2050)
B Barrier	3.69×10^{2} (3837)	6.83×10^{1} (2076)	6.31×10^{1} (2050)	5.92×10^{1} (2050)	4.96×10^{1} (2050)	6.15×10^{1} (2050)	5.61×10^{1} (2057)	6.17×10^{1} (2050)	5.79×10^{1} (2058)
S Barrier	8.33×10^{1} (3238)	6.31 (2050)	6.09 (2050)	4.77×10^{-1} (2060)	6.04 (3931)	6.14 (2050)	6.14 (2050)	5.86 (2050)	5.86 (2050)
T Barrier	3.52×10^{1} (2051)	3.53×10^{1} (2051)	3.55×10^{1} (2050)	3.55×10^{1} (2050)	3.26×10^{1} (2051)	3.53×10^{1} (2051)	3.54×10^{1} (2050)	3.61×10^{1} (2051)	3.61×10^{1} (2051)
U Barrier	3.43×10^{1} (3536)	1.33 (11,763)	1.04 (11,441)	1.02 (11,441)	3.24 (4022)	3.39×10^{-1} (2064)	3.39×10^{-1} (2064)	3.23×10^{-1} (2060)	3.23×10^{-1} (2060)
Core Zone Boundary	7.44×10^{2} (3837)	5.92×10^{1} (2076)	5.42×10^{1} (2050)	5.02×10^{1} (2050)	6.50×10^{1} (4326)	5.14×10^{1} (2050)	4.51×10^{1} (2057)	5.16×10^{1} (2050)	4.79×10^{1} (2058)
Columbia River nearshore	1.19×10^{1} (4106)	4.39×10^{-1} (2406)	4.28×10^{-1} (2541)	3.91×10^{-1} (2480)	1.37 (5017)	3.55×10^{-1} (2520)	3.73×10^{-1} (2502)	3.38×10^{-1} (2214)	3.38×10^{-1} (2304)

Note: Dose for year of peak dose, with calendar year of peak dose in parentheses.

Table Q–17. Summary of Radiological Risk at Year of Peak Radiological Risk for Drinking-Water Well User (unitless)

	Tank Closure Alternative								
Location	**1**	**2A**	**2B, 3A, 3B, 3C, 6C**	**4**	**5**	**6A, Base Case**	**6A, Option Case**	**6B, Base Case**	**6B, Option Case**
A Barrier	4.45×10^{-3} (2114)	1.05×10^{-4} (2055)	9.56×10^{-5} (2058)	9.61×10^{-5} (2058)	1.84×10^{-4} (4338)	8.88×10^{-5} (2058)	8.88×10^{-5} (2058)	9.24×10^{-5} (2050)	9.24×10^{-5} (2050)
B Barrier	1.13×10^{-2} (3837)	2.05×10^{-3} (2076)	1.93×10^{-3} (2050)	1.81×10^{-3} (2050)	1.47×10^{-3} (2050)	1.87×10^{-3} (2050)	1.64×10^{-3} (2057)	1.88×10^{-3} (2050)	1.75×10^{-3} (2058)
S Barrier	2.51×10^{-3} (3238)	1.85×10^{-4} (2050)	1.77×10^{-4} (2050)	1.40×10^{-5} (2060)	2.03×10^{-4} (3931)	1.78×10^{-4} (2050)	1.78×10^{-4} (2050)	1.70×10^{-4} (2050)	1.70×10^{-4} (2050)
T Barrier	1.00×10^{-3} (2051)	1.01×10^{-3} (2051)	1.02×10^{-3} (2050)	1.02×10^{-3} (2050)	9.86×10^{-4} (2050)	1.01×10^{-3} (2051)	1.01×10^{-3} (2051)	1.03×10^{-3} (2051)	1.04×10^{-3} (2051)
U Barrier	9.87×10^{-4} (3536)	3.57×10^{-5} (2096)	1.79×10^{-5} (3499)	1.18×10^{-5} (2060)	1.08×10^{-4} (4022)	9.91×10^{-6} (2064)	9.91×10^{-6} (2064)	9.33×10^{-6} (2060)	9.33×10^{-6} (2060)
Core Zone Boundary	2.26×10^{-2} (3837)	1.80×10^{-3} (2076)	1.66×10^{-3} (2050)	1.54×10^{-3} (2050)	2.18×10^{-3} (4326)	1.58×10^{-3} (2050)	1.35×10^{-3} (2056)	1.59×10^{-3} (2050)	1.46×10^{-3} (2058)
Columbia River nearshore	3.40×10^{-4} (4032)	1.32×10^{-5} (3464)	1.30×10^{-5} (2480)	1.21×10^{-5} (2480)	4.47×10^{-5} (5017)	1.07×10^{-5} (2515)	1.15×10^{-5} (2502)	1.06×10^{-5} (2214)	1.04×10^{-5} (2304)

Note: Radiological risk for year of peak radiological risk, with calendar year of peak radiological risk in parentheses.

Table Q–18. Summary of Hazard Index at Year of Peak Hazard Index for Drinking-Water Well User (unitless)

	Tank Closure Alternative								
Location	**1**	**2A**	**2B, 3A, 3B, 3C, 6C**	**4**	**5**	**6A, Base Case**	**6A, Option Case**	**6B, Base Case**	**6B, Option Case**
A Barrier	4.13 (2119)	3.16×10^{-1} (2070)	1.84×10^{-1} (2057)	1.79×10^{-1} (2057)	4.06×10^{-1} (4094)	8.36×10^{-2} (2050)	8.36×10^{-2} (2050)	7.68×10^{-2} (2050)	7.68×10^{-2} (2050)
B Barrier	6.95×10^{1} (2087)	6.89×10^{1} (2085)	5.79×10^{1} (2050)	5.77×10^{1} (2050)	5.79×10^{1} (2050)	5.77×10^{1} (2050)	6.46×10^{1} (2091)	5.78×10^{1} (2050)	6.37×10^{1} (2087)
S Barrier	1.73×10^{1} (3172)	2.94 (2050)	2.74 (2050)	3.61×10^{-1} (2057)	2.91 (2050)	2.91 (2050)	2.91 (2050)	2.85 (2050)	2.85 (2050)
T Barrier	1.18×10^{1} (2050)	9.90 (2050)	9.63 (2050)	9.63 (2051)	9.77 (2050)	9.56 (2050)	9.64 (2051)	9.65 (2050)	9.58 (2051)
U Barrier	3.42 (3577)	2.60×10^{-1} (2083)	1.18×10^{-1} (11,599)	1.15×10^{-1} (11,599)	4.01×10^{-1} (3869)	1.03×10^{-1} (2050)	1.03×10^{-1} (2050)	9.89×10^{-2} (2050)	9.89×10^{-2} (2050)
Core Zone Boundary	1.31×10^{2} (3524)	3.78×10^{1} (2066)	3.39×10^{1} (2050)	3.36×10^{1} (2050)	3.38×10^{1} (2050)	3.38×10^{1} (2050)	3.67×10^{1} (2056)	3.38×10^{1} (2050)	3.52×10^{1} (2053)
Columbia River nearshore	1.88 (4019)	4.36×10^{-1} (2527)	4.35×10^{-1} (2695)	4.31×10^{-1} (2695)	4.43×10^{-1} (2695)	4.20×10^{-1} (2695)	3.91×10^{-1} (2303)	4.22×10^{-1} (2695)	3.79×10^{-1} (2166)

Note: Hazard Index for year of peak Hazard Index, with calendar year of Hazard Index peak in parentheses.

Table Q–19. Summary of Nonradiological Risk at Year of Peak Nonradiological Risk for Drinking-Water Well User (unitless)

Location	Tank Closure Alternative								
	1	2A	2B, 3A, 3B, 3C, 6C	4	5	6A, Base Case	6A, Option Case	6B, Base Case	6B, Option Case
A Barrier	2.40×10^{-11} (11,777)	1.16×10^{-13} (11,822)	8.57×10^{-14} (11,785)	N/A	4.90×10^{-13} (11,755)	N/A	N/A	N/A	N/A
B Barrier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S Barrier	1.36×10^{-11} (11,797)	N/A	N/A	N/A	3.37×10^{-13} (11,776)	N/A	N/A	N/A	N/A
T Barrier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
U Barrier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Core Zone Boundary	2.99×10^{-11} (11,849)	4.67×10^{-14} (11,833)	3.26×10^{-14} (11,815)	N/A	4.72×10^{-13} (11,848)	N/A	N/A	N/A	N/A
Columbia River nearshore	6.19×10^{-13} (11,876)	1.53×10^{-15} (11,838)	1.07×10^{-15} (11,691)	N/A	7.09×10^{-15} (11,707)	N/A	N/A	N/A	N/A

Note: Nonradiological risk for year of peak radiological risk, with calendar year of peak nonradiological risk in parentheses. The nonradiological risk driver is 2,4,6-trichlorophenol, which is below the 1×10^{-10} cutoff concentration and is therefore not shown in the alternative-specific table.

Key: N/A=not applicable.

Q.3.1.1.1 Tank Closure Alternative 1

Under Tank Closure Alternative 1, the tank farms would be maintained in the current condition indefinitely but, for the purpose of analysis, are assumed to fail after an institutional control period of 100 years. At this time, the salt cake in the single-shell tanks is assumed available for leaching into the vadose zone, and the liquid contents of the double-shell tanks are assumed to be discharged directly to the vadose zone. Potential human health impacts of this alternative related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–20 through Q–24. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–25 through Q–32. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–33 through Q–40.

Table Q–20. Tank Closure Alternative 1 Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.86×10^{-3}	3.34×10^{2}	3.17×10^{-3}	2.86×10^{-3}	5.31×10^{2}	5.55×10^{-3}	2.86×10^{-3}	9.76×10^{2}	1.11×10^{-2}
Technetium-99	1.44×10^{-4}	2.52×10^{2}	8.67×10^{-3}	1.44×10^{-4}	6.47×10^{2}	2.84×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.20×10^{-2}
Iodine-129	1.88×10^{-7}	5.35×10^{1}	6.09×10^{-4}	1.88×10^{-7}	6.21×10^{1}	8.22×10^{-4}	1.88×10^{-7}	7.67×10^{1}	1.18×10^{-3}
Total	3.00×10^{-3}	6.39×10^{2}	1.24×10^{-2}	3.00×10^{-3}	1.24×10^{3}	3.48×10^{-2}	3.00×10^{-3}	2.37×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.05×10^{1}	4.81×10^{2}	0.00	5.05×10^{1}	4.82×10^{2}	1.98×10^{-7}	5.05×10^{1}	7.04×10^{2}	9.10×10^{-3}
Nitrate	1.72×10^{4}	3.07×10^{2}	0.00	1.72×10^{4}	4.04×10^{2}	0.00	1.72×10^{4}	7.93×10^{2}	0.00
Total	1.72×10^{4}	7.88×10^{2}	0.00	1.72×10^{4}	8.86×10^{2}	1.98×10^{-7}	1.72×10^{4}	1.50×10^{3}	9.10×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–21. Tank Closure Alternative 1 Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.24×10^{-2}	1.44×10^{3}	1.37×10^{-2}	1.24×10^{-2}	2.30×10^{3}	2.40×10^{-2}	1.24×10^{-2}	4.22×10^{3}	4.78×10^{-2}
Technetium-99	1.28×10^{-7}	2.25×10^{-1}	7.72×10^{-6}	1.28×10^{-7}	5.77×10^{-1}	2.53×10^{-5}	1.28×10^{-7}	1.18	5.53×10^{-5}
Iodine-129	1.11×10^{-9}	3.17×10^{-1}	3.61×10^{-6}	1.11×10^{-9}	3.68×10^{-1}	4.87×10^{-6}	1.11×10^{-9}	4.54×10^{-1}	7.01×10^{-6}
Uranium-238	4.71×10^{-11}	5.84×10^{-3}	6.60×10^{-8}	4.71×10^{-11}	6.06×10^{-3}	7.06×10^{-8}	4.71×10^{-11}	6.50×10^{-3}	7.99×10^{-8}
Total	1.24×10^{-2}	1.44×10^{3}	1.37×10^{-2}	1.24×10^{-2}	2.30×10^{3}	2.40×10^{-2}	1.24×10^{-2}	4.22×10^{3}	4.79×10^{-2}
Year of peak impact	1975	1975	1975	1975	1975	1975	1975	1975	1975
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.01	8.58×10^{1}	0.00	9.01	8.59×10^{1}	3.54×10^{-8}	9.01	1.25×10^{2}	1.62×10^{-3}
Nitrate	2.10×10^{3}	3.75×10^{1}	0.00	2.10×10^{3}	4.94×10^{1}	0.00	2.10×10^{3}	9.68×10^{1}	0.00
Total	2.11×10^{3}	1.23×10^{2}	0.00	2.11×10^{3}	1.35×10^{2}	3.54×10^{-8}	2.11×10^{3}	2.22×10^{2}	1.62×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–22. Tank Closure Alternative 1 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.86×10^{-3}	3.34×10^{2}	3.17×10^{-3}	2.86×10^{-3}	5.31×10^{2}	5.55×10^{-3}	2.86×10^{-3}	9.76×10^{2}	1.11×10^{-2}
Technetium-99	1.44×10^{-4}	2.52×10^{2}	8.67×10^{-3}	1.44×10^{-4}	6.47×10^{2}	2.84×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.20×10^{-2}
Iodine-129	1.88×10^{-7}	5.35×10^{1}	6.09×10^{-4}	1.88×10^{-7}	6.21×10^{1}	8.22×10^{-4}	1.88×10^{-7}	7.67×10^{1}	1.18×10^{-3}
Total	3.00×10^{-3}	6.39×10^{2}	1.24×10^{-2}	3.00×10^{-3}	1.24×10^{3}	3.48×10^{-2}	3.00×10^{-3}	2.37×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.87×10^{1}	2.73×10^{2}	0.00	2.87×10^{1}	2.73×10^{2}	1.13×10^{-7}	2.87×10^{1}	4.00×10^{2}	5.17×10^{-3}
Nitrate	1.34×10^{4}	2.39×10^{2}	0.00	1.34×10^{4}	3.14×10^{2}	0.00	1.34×10^{4}	6.16×10^{2}	0.00
Total	1.34×10^{4}	5.12×10^{2}	0.00	1.34×10^{4}	5.88×10^{2}	1.13×10^{-7}	1.34×10^{4}	1.02×10^{3}	5.17×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–23. Tank Closure Alternative 1 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.72×10^{-6}	2.01×10^{-1}	1.79×10^{-17}	1.72×10^{-6}	3.20×10^{-1}	3.12×10^{-17}	1.72×10^{-6}	5.89×10^{-1}	6.23×10^{-17}
Technetium-99	2.54×10^{-8}	4.45×10^{-2}	4.78×10^{-6}	2.54×10^{-8}	1.14×10^{-1}	1.57×10^{-5}	2.54×10^{-8}	2.33×10^{-1}	3.42×10^{-5}
Iodine-129	1.77×10^{-11}	5.05×10^{-3}	1.06×10^{-7}	1.77×10^{-11}	5.86×10^{-3}	1.43×10^{-7}	1.77×10^{-11}	7.24×10^{-3}	2.06×10^{-7}
Uranium-238	0.00	0.00	7.68×10^{-10}	0.00	0.00	8.22×10^{-10}	0.00	0.00	9.30×10^{-10}
Total	1.75×10^{-6}	2.51×10^{-1}	4.89×10^{-6}	1.75×10^{-6}	4.40×10^{-1}	1.58×10^{-5}	1.75×10^{-6}	8.29×10^{-1}	3.44×10^{-5}
Year of peak impact	1998	1998	2457	1998	1998	2457	1998	1998	2457

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.25×10^{-2}	3.10×10^{-1}	0.00	3.25×10^{-2}	3.10×10^{-1}	1.28×10^{-10}	3.25×10^{-2}	4.53×10^{-1}	5.86×10^{-6}
Nitrate	8.23	1.47×10^{-1}	0.00	8.23	1.94×10^{-1}	0.00	8.23	3.80×10^{-1}	0.00
Uranium	8.11×10^{-7}	7.72×10^{-6}	0.00	8.11×10^{-7}	7.81×10^{-6}	0.00	8.11×10^{-7}	8.08×10^{-6}	0.00
Total	8.26	4.57×10^{-1}	0.00	8.26	5.04×10^{-1}	1.28×10^{-10}	8.26	8.33×10^{-1}	5.86×10^{-6}
Year of peak impact	2408	2408	N/A	2408	2408	2408	2408	2408	2408

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–24. Tank Closure Alternative 1 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.64×10^{-10}	6.76×10^{-5}	7.07×10^{-10}	3.64×10^{-10}	1.26×10^{-4}	1.43×10^{-9}	1.72×10^{-6}	5.44×10^{-1}	6.67×10^{-6}
Technetium-99	2.55×10^{-11}	1.15×10^{-4}	5.03×10^{-9}	2.55×10^{-11}	2.65×10^{-4}	1.25×10^{-8}	2.54×10^{-8}	2.97×10^{-4}	1.61×10^{-8}
Iodine-129	3.11×10^{-14}	1.03×10^{-5}	1.36×10^{-10}	3.11×10^{-14}	1.68×10^{-4}	4.04×10^{-9}	1.77×10^{-11}	8.11×10^{-5}	1.97×10^{-9}
Total	3.89×10^{-10}	1.93×10^{-4}	5.88×10^{-9}	3.89×10^{-10}	5.59×10^{-4}	1.80×10^{-8}	1.75×10^{-6}	5.44×10^{-1}	6.69×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1998	1998	1998

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	8.64×10^{-6}	8.24×10^{-5}	3.39×10^{-14}	8.64×10^{-6}	1.32×10^{-4}	1.56×10^{-9}	1.44×10^{-2}	3.21×10^{-2}	2.93×10^{-6}
Nitrate	2.23×10^{-3}	7.71×10^{-5}	0.00	2.23×10^{-3}	2.10×10^{-1}	0.00	7.85	7.85×10^{-1}	0.00
Total	2.24×10^{-3}	1.60×10^{-4}	3.39×10^{-14}	2.24×10^{-3}	2.10×10^{-1}	1.56×10^{-9}	7.86	8.17×10^{-1}	2.93×10^{-6}
Year of peak impact	1984	1984	1984	1984	1984	1984	1984	1984	2408

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–25. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.65×10^{-6}	4.27×10^{-1}	4.06×10^{-6}	3.65×10^{-6}	6.79×10^{-1}	7.10×10^{-6}	3.65×10^{-6}	1.25	1.42×10^{-5}
Technetium-99	1.23×10^{-5}	2.16×10^{1}	7.44×10^{-4}	1.23×10^{-5}	5.55×10^{1}	2.44×10^{-3}	1.23×10^{-5}	1.13×10^{2}	5.32×10^{-3}
Iodine-129	2.33×10^{-8}	6.62	7.54×10^{-5}	2.33×10^{-8}	7.69	1.02×10^{-4}	2.33×10^{-8}	9.49	1.47×10^{-4}
Total	1.60×10^{-5}	2.87×10^{1}	8.23×10^{-4}	1.60×10^{-5}	6.39×10^{1}	2.55×10^{-3}	1.60×10^{-5}	1.24×10^{2}	5.48×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.85×10^{-2}	5.57×10^{-1}	0.00	5.85×10^{-2}	5.58×10^{-1}	2.30×10^{-10}	5.85×10^{-2}	8.15×10^{-1}	1.05×10^{-5}
Nitrate	4.27	7.63×10^{-2}	0.00	4.27	1.00×10^{-1}	0.00	4.27	1.97×10^{-1}	0.00
Total	4.33	6.34×10^{-1}	0.00	4.33	6.58×10^{-1}	2.30×10^{-10}	4.33	1.01	1.05×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–26. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	6.09×10^{-8}	7.11×10^{-3}	6.76×10^{-8}	6.09×10^{-8}	1.13×10^{-2}	1.18×10^{-7}	6.09×10^{-8}	2.08×10^{-2}	2.36×10^{-7}
Technetium-99	9.11×10^{-6}	1.60×10^{1}	5.48×10^{-4}	9.11×10^{-6}	4.10×10^{1}	1.80×10^{-3}	9.11×10^{-6}	8.35×10^{1}	3.92×10^{-3}
Iodine-129	1.58×10^{-8}	4.51	5.13×10^{-5}	1.58×10^{-8}	5.23	6.92×10^{-5}	1.58×10^{-8}	6.46	9.97×10^{-5}
Total	9.18×10^{-6}	2.05×10^{1}	6.00×10^{-4}	9.18×10^{-6}	4.62×10^{1}	1.87×10^{-3}	9.18×10^{-6}	8.99×10^{1}	4.02×10^{-3}
Year of peak impact	2052	2052	2052	2052	2052	2052	2052	2052	2052
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.03×10^{-1}	9.79×10^{-1}	0.00	1.03×10^{-1}	9.80×10^{-1}	4.04×10^{-10}	1.03×10^{-1}	1.43	1.85×10^{-5}
Nitrate	1.56×10^{1}	2.79×10^{-1}	0.00	1.56×10^{1}	3.68×10^{-1}	0.00	1.56×10^{1}	7.22×10^{-1}	0.00
Total	1.57×10^{1}	1.26	0.00	1.57×10^{1}	1.35	4.04×10^{-10}	1.57×10^{1}	2.15	1.85×10^{-5}
Year of peak impact	2051	2051	N/A	2051	2051	2051	2051	2051	2051

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–27. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.59×10^{-7}	4.19×10^{-2}	3.98×10^{-7}	3.59×10^{-7}	6.67×10^{-2}	7.62×10^{-7}	3.59×10^{-7}	1.23×10^{-1}	1.52×10^{-6}
Technetium-99	3.97×10^{-6}	6.96	2.39×10^{-4}	3.97×10^{-6}	1.79×10^{1}	7.87×10^{-4}	3.97×10^{-6}	3.64×10^{1}	1.72×10^{-3}
Iodine-129	7.47×10^{-9}	2.13	2.42×10^{-5}	7.47×10^{-9}	2.47	3.15×10^{-5}	7.47×10^{-9}	3.05	4.53×10^{-5}
Total	4.34×10^{-6}	9.13	2.64×10^{-4}	4.34×10^{-6}	2.04×10^{1}	8.19×10^{-4}	4.34×10^{-6}	3.96×10^{1}	1.76×10^{-3}
Year of peak impact	2023	2023	2023	2023	2023	2022	2023	2023	2022

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.19×10^{-1}	3.99	0.00	4.19×10^{-1}	3.99	1.65×10^{-9}	4.19×10^{-1}	5.84	7.55×10^{-5}
Nitrate	1.13×10^{1}	2.02×10^{-1}	0.00	1.13×10^{1}	2.66×10^{-1}	0.00	1.13×10^{1}	5.22×10^{-1}	0.00
Total	1.17×10^{1}	4.19	0.00	1.17×10^{1}	4.26	1.65×10^{-9}	1.17×10^{1}	6.36	7.55×10^{-5}
Year of peak impact	2030	2030	N/A	2030	2030	2030	2030	2030	2030

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–28. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.21×10^{-6}	3.75×10^{-1}	3.56×10^{-6}	3.21×10^{-6}	5.97×10^{-1}	5.00×10^{-6}	3.21×10^{-6}	1.10	9.98×10^{-6}
Technetium-99	2.31×10^{-5}	4.04×10^{1}	1.39×10^{-3}	2.31×10^{-5}	1.04×10^{2}	4.57×10^{-3}	2.31×10^{-5}	2.11×10^{2}	9.97×10^{-3}
Iodine-129	4.51×10^{-8}	1.28×10^{1}	1.46×10^{-4}	4.51×10^{-8}	1.49×10^{1}	1.90×10^{-4}	4.51×10^{-8}	1.84×10^{1}	2.73×10^{-4}
Total	2.63×10^{-5}	5.36×10^{1}	1.54×10^{-3}	2.63×10^{-5}	1.19×10^{2}	4.76×10^{-3}	2.63×10^{-5}	2.31×10^{2}	1.02×10^{-2}
Year of peak impact	2027	2027	2027	2027	2027	2029	2027	2027	2029

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	5.39×10^{-1}	5.13	0.00	5.39×10^{-1}	5.14	2.12×10^{-9}	5.34×10^{-1}	7.44	9.70×10^{-5}
Nitrate	3.80×10^{1}	6.78×10^{-1}	0.00	3.80×10^{1}	8.93×10^{-1}	0.00	3.93×10^{1}	1.81	0.00
Total	3.85×10^{1}	5.81	0.00	3.85×10^{1}	6.03	2.12×10^{-9}	3.98×10^{1}	9.26	9.70×10^{-5}
Year of peak impact	2025	2025	N/A	2025	2025	2025	2028	2028	2025

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–29. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	0.00	0.00	0.00	0.00	0.00	1.07×10^{-8}	5.53×10^{-9}	1.89×10^{-3}	2.14×10^{-8}
Technetium-99	0.00	0.00	0.00	0.00	0.00	3.03×10^{-5}	1.53×10^{-7}	1.40	6.60×10^{-5}
Iodine-129	0.00	0.00	0.00	0.00	0.00	1.10×10^{-6}	2.52×10^{-10}	1.03×10^{-1}	1.59×10^{-6}
Uranium-238	7.95×10^{-9}	9.86×10^{-1}	1.11×10^{-5}	7.95×10^{-9}	1.02	0.00	0.00	0.00	0.00
Total	7.95×10^{-9}	9.86×10^{-1}	1.11×10^{-5}	7.95×10^{-9}	1.02	3.14×10^{-5}	1.59×10^{-7}	1.51	6.76×10^{-5}
Year of peak impact	11,759	11,759	11,759	11,759	11,759	2065	2065	2065	2065
Chemical Constituent	**Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)**	**Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)**	**Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)**	**American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.35×10^{-2}	1.28×10^{-1}	0.00	1.35×10^{-2}	1.28×10^{-1}	5.29×10^{-11}	1.35×10^{-2}	1.88×10^{-1}	2.42×10^{-6}
Nitrate	5.96×10^{-1}	1.06×10^{-2}	0.00	5.96×10^{-1}	1.40×10^{-2}	0.00	5.96×10^{-1}	2.75×10^{-2}	0.00
Total	6.09×10^{-1}	1.39×10^{-1}	0.00	6.09×10^{-1}	1.42×10^{-1}	5.29×10^{-11}	6.09×10^{-1}	2.15×10^{-1}	2.42×10^{-6}
Year of peak impact	2020	2020	N/A	2020	2020	2020	2020	2020	2020

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–30. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.37×10^{-14}	3.94×10^{-9}	3.74×10^{-14}	3.37×10^{-14}	6.26×10^{-9}	6.55×10^{-14}	3.37×10^{-14}	1.15×10^{-8}	1.31×10^{-13}
Technetium-99	5.47×10^{-6}	9.59	3.30×10^{-4}	5.47×10^{-6}	2.46×10^{1}	1.08×10^{-3}	5.47×10^{-6}	5.01×10^{1}	2.36×10^{-3}
Iodine-129	8.45×10^{-9}	2.41	2.74×10^{-5}	8.45×10^{-9}	2.79	3.70×10^{-5}	8.45×10^{-9}	3.45	5.32×10^{-5}
Total	5.48×10^{-6}	1.20×10^{1}	3.57×10^{-4}	5.48×10^{-6}	2.74×10^{1}	1.12×10^{-3}	5.48×10^{-6}	5.36×10^{1}	2.41×10^{-3}
Year of peak impact	2310	2310	2310	2310	2310	2310	2310	2310	2310
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.49×10^{-1}	4.28	0.00	4.49×10^{-1}	4.28	1.76×10^{-9}	4.49×10^{-1}	6.26	8.09×10^{-5}
Nitrate	1.50×10^{1}	2.68×10^{-1}	0.00	1.50×10^{1}	3.53×10^{-1}	0.00	1.50×10^{1}	6.92×10^{-1}	0.00
Total	1.54×10^{1}	4.55	0.00	1.54×10^{1}	4.63	1.76×10^{-9}	1.54×10^{1}	6.95	8.09×10^{-5}
Year of peak impact	2271	2271	N/A	2271	2271	2271	2271	2271	2271

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–31. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	4.34×10^{-13}	5.07×10^{-8}	4.82×10^{-13}	4.34×10^{-13}	8.06×10^{-8}	8.42×10^{-13}	4.34×10^{-13}	1.48×10^{-7}	1.68×10^{-12}
Technetium-99	1.46×10^{-7}	2.55×10^{-1}	8.78×10^{-6}	1.46×10^{-7}	6.56×10^{-1}	2.88×10^{-5}	1.46×10^{-7}	1.34	6.28×10^{-5}
Iodine-129	2.07×10^{-10}	5.90×10^{-2}	6.72×10^{-7}	2.07×10^{-10}	6.85×10^{-2}	9.07×10^{-7}	2.07×10^{-10}	8.46×10^{-2}	1.31×10^{-6}
Total	1.46×10^{-7}	3.14×10^{-1}	9.45×10^{-6}	1.46×10^{-7}	7.24×10^{-1}	2.97×10^{-5}	1.46×10^{-7}	1.42	6.41×10^{-5}
Year of peak impact	2211	2211	2211	2211	2211	2211	2211	2211	2211
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.00×10^{-3}	3.81×10^{-2}	0.00	4.00×10^{-3}	3.81×10^{-2}	1.60×10^{-11}	4.00×10^{-3}	5.57×10^{-2}	7.34×10^{-7}
Nitrate	2.14×10^{-1}	3.83×10^{-3}	0.00	2.14×10^{-1}	5.04×10^{-3}	0.00	2.14×10^{-1}	9.88×10^{-3}	0.00
Total	2.18×10^{-1}	4.19×10^{-2}	0.00	2.18×10^{-1}	4.32×10^{-2}	1.60×10^{-11}	2.18×10^{-1}	6.56×10^{-2}	7.34×10^{-7}
Year of peak impact	2171	2171	N/A	2171	2171	2137	2171	2171	2137

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–32. Tank Closure Alternative 1 Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.06×10^{-15}	1.97×10^{-10}	2.06×10^{-15}	1.33×10^{-15}	4.59×10^{-10}	5.20×10^{-15}	1.73×10^{-19}	4.24×10^{-14}	1.68×10^{-12}
Technetium-99	6.40×10^{-12}	2.88×10^{-5}	1.26×10^{-9}	6.32×10^{-12}	6.57×10^{-5}	3.11×10^{-9}	3.39×10^{-9}	3.70×10^{-5}	8.84×10^{-8}
Iodine-129	1.19×10^{-14}	3.95×10^{-6}	5.24×10^{-11}	1.23×10^{-14}	6.66×10^{-5}	1.60×10^{-9}	7.32×10^{-12}	1.10×10^{-5}	1.03×10^{-8}
Uranium-238	0.00	0.00	0.00	0.00	0.00	0.00	7.63×10^{-10}	7.59×10^{-3}	0.00
Total	6.41×10^{-12}	3.27×10^{-5}	1.32×10^{-9}	6.34×10^{-12}	1.32×10^{-4}	4.72×10^{-9}	4.16×10^{-9}	7.64×10^{-3}	9.87×10^{-8}
Year of peak impact	2144	2144	2144	2140	2140	2140	11,573	11,573	2211
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.91×10^{-7}	1.82×10^{-6}	7.48×10^{-16}	1.67×10^{-7}	2.55×10^{-6}	3.43×10^{-11}	4.00×10^{-3}	8.84×10^{-3}	3.67×10^{-7}
Nitrate	9.62×10^{-6}	3.32×10^{-7}	0.00	1.12×10^{-5}	1.05×10^{-3}	0.00	2.14×10^{-1}	9.75×10^{-3}	0.00
Total	9.81×10^{-6}	2.15×10^{-6}	7.48×10^{-16}	1.13×10^{-5}	1.05×10^{-3}	3.43×10^{-11}	2.18×10^{-1}	1.86×10^{-2}	3.67×10^{-7}
Year of peak impact	2172	2172	2172	2151	2151	2172	2171	2171	2137

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–33. Tank Closure Alternative 1 Human Health Impacts at the A Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	4.06×10^{-6}	4.75×10^{-1}	4.51×10^{-6}	4.06×10^{-6}	7.55×10^{-1}	7.89×10^{-6}	4.06×10^{-6}	1.39	1.57×10^{-5}
Technetium-99	7.01×10^{-5}	1.23×10^{2}	4.22×10^{-3}	7.01×10^{-5}	3.15×10^{2}	1.38×10^{-2}	7.01×10^{-5}	6.42×10^{2}	3.02×10^{-2}
Iodine-129	7.12×10^{-8}	2.03×10^{1}	2.31×10^{-4}	7.12×10^{-8}	2.35×10^{1}	3.11×10^{-4}	7.12×10^{-8}	2.90×10^{1}	4.48×10^{-4}
Total	7.42×10^{-5}	1.43×10^{2}	4.45×10^{-3}	7.42×10^{-5}	3.39×10^{2}	1.42×10^{-2}	7.42×10^{-5}	6.72×10^{2}	3.07×10^{-2}
Year of peak impact	2114	2114	2114	2114	2114	2114	2114	2114	2114

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.17×10^{-1}	5.57×10^{-1}	0.00	1.17×10^{-1}	6.95×10^{-1}	0.00	1.17×10^{-1}	1.26	0.00
Chromium	2.45×10^{-1}	2.33	0.00	2.45×10^{-1}	2.33	1.12×10^{-9}	2.45×10^{-1}	3.41	5.12×10^{-5}
Nitrate	6.96×10^{1}	1.24	0.00	6.96×10^{1}	1.64	0.00	6.96×10^{1}	3.21	0.00
Total	6.99×10^{1}	4.13	2.40×10^{-11}	6.99×10^{1}	4.66	1.12×10^{-9}	6.99×10^{1}	7.87	5.12×10^{-5}
Year of peak impact	2119	2119	11,777	2119	2119	2114	2119	2119	2114

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–34. Tank Closure Alternative 1 Human Health Impacts at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.75×10^{-4}	3.07×10^{2}	1.06×10^{-2}	1.75×10^{-4}	7.89×10^{2}	3.47×10^{-2}	1.75×10^{-4}	1.61×10^{3}	7.56×10^{-2}
Iodine-129	2.15×10^{-7}	6.12×10^{1}	6.96×10^{-4}	2.15×10^{-7}	7.10×10^{1}	9.40×10^{-4}	2.15×10^{-7}	8.77×10^{1}	1.35×10^{-3}
Uranium-238	2.46×10^{-11}	3.05×10^{-3}	3.44×10^{-8}	2.46×10^{-11}	3.16×10^{-3}	3.69×10^{-8}	2.46×10^{-11}	3.39×10^{-3}	4.17×10^{-8}
Total	1.76×10^{-4}	3.69×10^{2}	1.13×10^{-2}	1.76×10^{-4}	8.60×10^{2}	3.56×10^{-2}	1.76×10^{-4}	1.70×10^{3}	7.70×10^{-2}
Year of peak impact	3837	3837	3837	3837	3837	3837	3837	3837	3837
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.03	3.84×10^{1}	0.00	4.03	3.84×10^{1}	1.98×10^{-8}	4.03	5.61×10^{1}	9.10×10^{-4}
Nitrate	1.74×10^{3}	3.11×10^{1}	0.00	1.74×10^{3}	4.10×10^{1}	0.00	1.74×10^{3}	8.04×10^{1}	0.00
Total	1.75×10^{3}	6.95×10^{1}	0.00	1.75×10^{3}	7.94×10^{1}	1.98×10^{-8}	1.75×10^{3}	1.37×10^{2}	9.10×10^{-4}
Year of peak impact	2087	2087	N/A	2087	2087	3628	2087	2087	3628

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A/=not applicable.

Table Q–35. Tank Closure Alternative 1 Human Health Impacts at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.87×10^{-5}	6.79×10^{1}	2.33×10^{-3}	3.87×10^{-5}	1.74×10^{2}	7.65×10^{-3}	3.87×10^{-5}	3.55×10^{2}	1.67×10^{-2}
Iodine-129	5.42×10^{-8}	1.54×10^{1}	1.76×10^{-4}	5.42×10^{-8}	1.79×10^{1}	2.37×10^{-4}	5.42×10^{-8}	2.21×10^{1}	3.41×10^{-4}
Uranium-238	2.58×10^{-1}	3.20×10^{-3}	3.61×10^{-8}	2.58×10^{-11}	3.32×10^{-3}	3.87×10^{-8}	2.58×10^{-11}	3.56×10^{-3}	4.38×10^{-8}
Total	3.88×10^{-5}	8.33×10^{1}	2.51×10^{-3}	3.88×10^{-5}	1.92×10^{2}	7.89×10^{-3}	3.88×10^{-5}	3.77×10^{2}	1.70×10^{-2}
Year of peak impact	3238	3238	3238	3238	3238	3238	3238	3238	3238
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.42×10^{-2}	6.78×10^{-2}	0.00	1.42×10^{-2}	8.47×10^{-2}	0.00	1.42×10^{-2}	1.53×10^{-1}	0.00
Chromium	1.65	1.57×10^{1}	0.00	1.65	1.57×10^{1}	6.49×10^{-9}	1.65	2.30×10^{1}	2.97×10^{-4}
Nitrate	8.48×10^{1}	1.51	0.00	8.48×10^{1}	1.99	0.00	8.48×10^{1}	3.91	0.00
Total uranium	3.59×10^{-5}	3.42×10^{-4}	0.00	3.59×10^{-5}	3.45×10^{-4}	0.00	3.59×10^{-5}	3.57×10^{-4}	0.00
Total	8.65×10^{1}	1.73×10^{1}	1.36×10^{-11}	8.65×10^{1}	1.78×10^{1}	6.49×10^{-9}	8.65×10^{1}	2.71×10^{1}	2.97×10^{-4}
Year of peak impact	3172	3172	11,797	3172	3172	3172	3172	3172	3172

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–36. Tank Closure Alternative 1 Human Health Impacts at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	4.67×10^{-6}	5.45×10^{-1}	5.18×10^{-6}	4.67×10^{-6}	8.68×10^{-1}	9.07×10^{-6}	4.67×10^{-6}	1.60	1.81×10^{-5}
Technetium-99	1.50×10^{-5}	2.62×10^{1}	9.02×10^{-4}	1.50×10^{-5}	6.74×10^{1}	2.96×10^{-3}	1.50×10^{-5}	1.37×10^{2}	6.46×10^{-3}
Iodine-129	2.94×10^{-8}	8.36	9.52×10^{-5}	2.94×10^{-8}	9.70	1.28×10^{-4}	2.94×10^{-8}	1.20×10^{1}	1.85×10^{-4}
Uranium-238	1.07×10^{-10}	1.33×10^{-2}	1.50×10^{-7}	1.07×10^{-10}	1.38×10^{-2}	1.61×10^{-7}	1.07×10^{-10}	1.48×10^{-2}	1.82×10^{-7}
Total	1.97×10^{-5}	3.52×10^{1}	1.00×10^{-3}	1.97×10^{-5}	7.80×10^{1}	3.10×10^{-3}	1.97×10^{-5}	1.51×10^{2}	6.66×10^{-3}
Year of peak impact	2051	2051	2051	2051	2051	2051	2051	2051	2051

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.11×10^{-1}	8.68	0.00	8.96×10^{-1}	8.55	3.58×10^{-9}	8.96×10^{-1}	1.25×10^{1}	1.64×10^{-4}
Nitrate	1.73×10^{2}	3.10	0.00	1.81×10^{2}	4.26	0.00	1.81×10^{2}	8.35	0.00
Total uranium	1.78×10^{-4}	1.70×10^{-3}	0.00	1.84×10^{-4}	1.77×10^{-3}	0.00	1.84×10^{-4}	1.83×10^{-3}	0.00
Total	1.74×10^{2}	1.18×10^{1}	0.00	1.82×10^{2}	1.28×10^{1}	3.58×10^{-9}	1.82×10^{2}	2.08×10^{1}	1.64×10^{-4}
Year of peak impact	2050	2050	N/A	2051	2051	2050	2051	2051	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–37. Tank Closure Alternative 1 Human Health Impacts at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.48×10^{-5}	2.60×10^{1}	8.93×10^{-4}	1.48×10^{-5}	6.67×10^{1}	2.93×10^{-3}	1.48×10^{-5}	1.36×10^{2}	6.39×10^{-3}
Iodine-129	2.92×10^{-8}	8.30	9.45×10^{-5}	2.92×10^{-8}	9.64	1.28×10^{-4}	2.92×10^{-8}	1.19×10^{1}	1.84×10^{-4}
Total	1.49×10^{-5}	3.43×10^{1}	9.87×10^{-4}	1.49×10^{-5}	7.63×10^{1}	3.06×10^{-3}	1.49×10^{-5}	1.48×10^{2}	6.57×10^{-3}
Year of peak impact	3536	3536	3536	3536	3536	3536	3536	3536	3536

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.04×10^{-1}	2.89	0.00	3.04×10^{-1}	2.90	1.21×10^{-9}	3.04×10^{-1}	4.23	5.56×10^{-5}
Nitrate	2.94×10^{1}	5.26×10^{-1}	0.00	2.94×10^{1}	6.92×10^{-1}	0.00	2.94×10^{1}	1.36	0.00
Total	2.98×10^{1}	3.42	0.00	2.98×10^{1}	3.59	1.21×10^{-9}	2.98×10^{1}	5.59	5.56×10^{-5}
Year of peak impact	3577	3577	N/A	3577	3577	3587	3577	3577	3587

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–38. Tank Closure Alternative 1 Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.50×10^{-4}	6.13×10^{2}	2.11×10^{-2}	3.50×10^{-4}	1.57×10^{3}	6.91×10^{-2}	3.50×10^{-4}	3.21×10^{3}	1.51×10^{-1}
Iodine-129	4.59×10^{-7}	1.31×10^{2}	1.49×10^{-3}	4.59×10^{-7}	1.52×10^{2}	2.01×10^{-3}	4.59×10^{-7}	1.88×10^{2}	2.89×10^{-3}
Uranium-238	1.85×10^{-10}	2.30×10^{-2}	2.60×10^{-7}	1.85×10^{-10}	2.39×10^{-2}	2.78×10^{-7}	1.85×10^{-10}	2.56×10^{-2}	3.15×10^{-7}
Total	3.50×10^{-4}	7.44×10^{2}	2.26×10^{-2}	3.50×10^{-4}	1.73×10^{3}	7.12×10^{-2}	3.50×10^{-4}	3.40×10^{3}	1.54×10^{-1}
Year of peak impact	3837	3837	3837	3837	3837	3837	3837	3837	3837
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	6.21×10^{-2}	2.96×10^{-1}	0.00	6.21×10^{-2}	3.69×10^{-1}	0.00	6.21×10^{-2}	6.67×10^{-1}	0.00
Chromium	1.22×10^{1}	1.16×10^{2}	0.00	1.22×10^{1}	1.16×10^{2}	4.79×10^{-8}	1.22×10^{1}	1.70×10^{2}	2.20×10^{-3}
Nitrate	8.04×10^{2}	1.44×10^{1}	0.00	8.04×10^{2}	1.89×10^{1}	0.00	8.04×10^{2}	3.71×10^{1}	0.00
Total uranium	2.77×10^{-5}	2.63×10^{-4}	0.00	2.77×10^{-5}	2.66×10^{-4}	0.00	2.77×10^{-5}	2.76×10^{-4}	0.00
Total	8.17×10^{2}	1.31×10^{2}	2.99×10^{-11}	8.17×10^{2}	1.35×10^{2}	4.79×10^{-8}	8.17×10^{2}	2.08×10^{2}	2.20×10^{-3}
Year of peak impact	3524	3524	11,849	3524	3524	3524	3524	3524	3524

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–39. Tank Closure Alternative 1 Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	5.05×10^{-6}	8.85	3.15×10^{-4}	5.05×10^{-6}	2.27×10^{1}	1.03×10^{-3}	5.23×10^{-6}	4.79×10^{1}	2.25×10^{-3}
Iodine-129	1.05×10^{-8}	3.00	2.52×10^{-5}	1.05×10^{-8}	3.48	3.40×10^{-5}	7.78×10^{-9}	3.17	4.90×10^{-5}
Uranium-238	1.10×10^{-12}	1.36×10^{-4}	1.54×10^{-9}	1.10×10^{-12}	1.42×10^{-4}	1.65×10^{-9}	1.10×10^{-12}	1.52×10^{-4}	1.87×10^{-9}
Total	5.06×10^{-6}	1.19×10^{1}	3.40×10^{-4}	5.06×10^{-6}	2.62×10^{1}	1.07×10^{-3}	5.24×10^{-6}	5.11×10^{1}	2.30×10^{-3}
Year of peak impact	4106	4106	4032	4106	4106	4032	4032	4032	4032

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	3.89×10^{-3}	1.85×10^{-2}	0.00	3.89×10^{-3}	2.31×10^{-2}	0.00	3.89×10^{-3}	4.17×10^{-2}	0.00
Chromium	1.65×10^{-1}	1.57	0.00	1.65×10^{-1}	1.57	6.47×10^{-10}	1.65×10^{-1}	2.29	2.97×10^{-5}
Nitrate	1.65×10^{1}	2.94×10^{-1}	0.00	1.65×10^{1}	3.88×10^{-1}	0.00	1.65×10^{1}	7.60×10^{-1}	0.00
Total uranium	8.14×10^{-7}	7.75×10^{-6}	0.00	8.14×10^{-7}	7.84×10^{-6}	0.00	8.14×10^{-7}	8.11×10^{-6}	0.00
Total	1.67×10^{1}	1.88	6.19×10^{-13}	1.67×10^{1}	1.98	6.47×10^{-10}	1.67×10^{1}	3.10	2.97×10^{-5}
Year of peak impact	4019	4019	11,876	4019	4019	4019	4019	4019	4019

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–40. Tank Closure Alternative 1 Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.02×10^{-14}	3.75×10^{-9}	3.92×10^{-14}	6.64×10^{-14}	2.30×10^{-8}	7.92×10^{-14}	2.10×10^{-19}	5.13×10^{-14}	4.55×10^{-18}
Technetium-99	1.35×10^{-10}	6.06×10^{-4}	2.66×10^{-8}	1.30×10^{-10}	1.35×10^{-3}	6.63×10^{-8}	5.05×10^{-6}	5.55×10^{-2}	3.15×10^{-6}
Iodine-129	2.14×10^{-13}	7.09×10^{-5}	9.41×10^{-10}	2.33×10^{-13}	1.26×10^{-3}	2.78×10^{-8}	1.05×10^{-8}	1.76×10^{-2}	3.36×10^{-7}
Uranium-238	1.71×10^{-18}	2.21×10^{-10}	2.57×10^{-15}	5.38×10^{-18}	1.91×10^{-9}	8.61×10^{-15}	1.10×10^{-12}	1.09×10^{-5}	1.38×10^{-10}
Total	1.35×10^{-10}	6.77×10^{-4}	2.76×10^{-8}	1.30×10^{-10}	2.61×10^{-3}	9.42×10^{-8}	5.06×10^{-6}	7.31×10^{-2}	3.49×10^{-6}
Year of peak impact	3467	3467	3467	3516	3516	3467	4106	4106	4032
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.60×10^{-7}	9.51×10^{-7}	0.00	1.41×10^{-7}	1.52×10^{-6}	0.00	4.36×10^{-3}	2.59×10^{-2}	0.00
Chromium	3.07×10^{-6}	2.92×10^{-5}	1.24×10^{-14}	2.60×10^{-6}	3.97×10^{-5}	5.68×10^{-10}	9.63×10^{-2}	2.13×10^{-1}	1.48×10^{-5}
Nitrate	3.99×10^{-4}	1.38×10^{-5}	0.00	4.19×10^{-4}	3.94×10^{-2}	0.00	2.35×10^{1}	8.99×10^{-1}	0.00
Total uranium	8.88×10^{-12}	8.55×10^{-11}	0.00	0.00	0.00	0.00	1.63×10^{-6}	7.22×10^{-7}	0.00
Total	4.02×10^{-4}	4.39×10^{-5}	1.24×10^{-14}	4.22×10^{-4}	3.94×10^{-2}	5.68×10^{-10}	2.36×10^{1}	1.14	1.48×10^{-5}
Year of peak impact	3556	3556	3668	3579	3579	3668	3911	3911	4019

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Due to the large magnitude of the liquid release, transport through the vadose zone is rapid, and impacts exceeding dose standards are estimated for onsite locations. The largest contributor at the year of peak dose is the cribs and trenches (ditches) and the presence of tritium, technetium-99, iodine-129, uranium-238, chromium, nitrates, and total uranium. Due to large dilution in the Columbia River, offsite impacts on individuals are small. Population dose was estimated as 3.39 person-rem per year for the year of maximum impact.

Figure Q–2 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, other sources, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2300 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129. The peak radiological risk resulting from all three sources occurs around the year 3800 and is dominated by technetium-99 and iodine-129. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

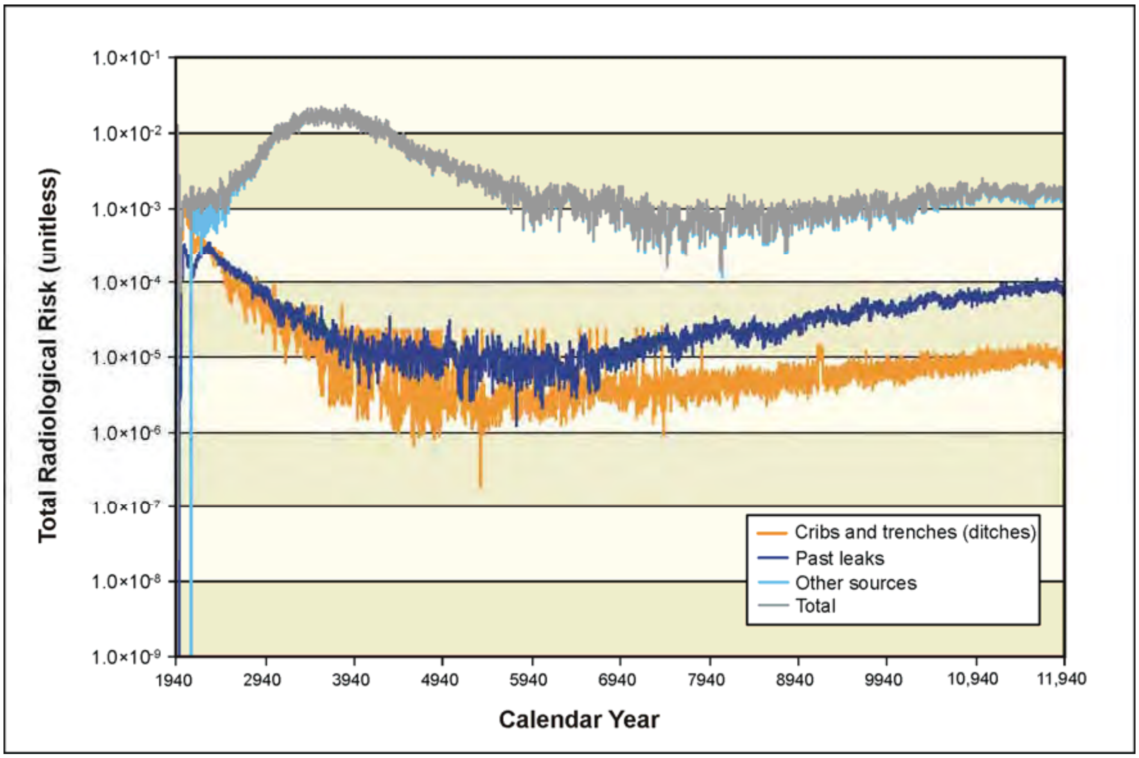

Figure Q–2. Tank Closure Alternative 1 Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.1.1.2 Tank Closure Alternative 2A

Under Tank Closure Alternative 2A, tank waste would be retrieved to a volume corresponding to 99 percent retrieval, but the residual material in tanks would not be stabilized. After an institutional control period of 100 years, salt cake in the tanks was assumed available for dissolution in infiltrating water.

Potential human health impacts of this alternative related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–41 through Q–45. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–46 through Q–53. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–54 through Q–61.

Table Q–41. Tank Closure Alternative 2A Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.96×10^{-3}	3.45×10^{2}	3.28×10^{-3}	2.96×10^{-3}	5.49×10^{2}	5.74×10^{-3}	2.96×10^{-3}	1.01×10^{3}	1.15×10^{-2}
Technetium-99	1.49×10^{-4}	2.60×10^{2}	8.95×10^{-3}	1.49×10^{-4}	6.68×10^{2}	2.93×10^{-2}	1.49×10^{-4}	1.36×10^{3}	6.40×10^{-2}
Iodine-129	1.95×10^{-7}	5.54×10^{1}	6.31×10^{-4}	1.95×10^{-7}	6.43×10^{1}	8.51×10^{-4}	1.95×10^{-7}	7.94×10^{1}	1.23×10^{-3}
Total	3.10×10^{-3}	6.61×10^{2}	1.29×10^{-2}	3.10×10^{-3}	1.28×10^{3}	3.59×10^{-2}	3.10×10^{-3}	2.45×10^{3}	7.67×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.59×10^{1}	4.37×10^{2}	0.00	4.59×10^{1}	4.37×10^{2}	1.80×10^{-7}	4.59×10^{1}	6.39×10^{2}	8.27×10^{-3}
Nitrate	1.81×10^{4}	3.23×10^{2}	0.00	1.81×10^{4}	4.26×10^{2}	0.00	1.81×10^{4}	8.35×10^{2}	0.00
Total	1.81×10^{4}	7.60×10^{2}	0.00	1.81×10^{4}	8.63×10^{2}	1.80×10^{-7}	1.81×10^{4}	1.47×10^{3}	8.27×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–42. Tank Closure Alternative 2A Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.23×10^{-2}	1.43×10^{3}	1.36×10^{-2}	1.23×10^{-2}	2.28×10^{3}	2.38×10^{-2}	1.23×10^{-2}	4.19×10^{3}	4.75×10^{-2}
Technetium-99	1.33×10^{-7}	2.33×10^{-1}	8.02×10^{-6}	1.33×10^{-7}	5.99×10^{-1}	2.63×10^{-5}	1.33×10^{-7}	1.22	5.74×10^{-5}
Iodine-129	1.10×10^{-9}	3.13×10^{-1}	3.56×10^{-6}	1.10×10^{-9}	3.63×10^{-1}	4.81×10^{-6}	1.10×10^{-9}	4.49×10^{-1}	6.92×10^{-6}
Uranium-238	6.26×10^{-11}	7.77×10^{-3}	8.77×10^{-8}	6.26×10^{-11}	8.06×10^{-3}	9.40×10^{-8}	6.26×10^{-11}	8.64×10^{-3}	1.06×10^{-7}
Total	1.23×10^{-2}	1.43×10^{3}	1.36×10^{-2}	1.23×10^{-2}	2.28×10^{3}	2.39×10^{-2}	1.23×10^{-2}	4.19×10^{3}	4.76×10^{-2}
Year of peak impact	1975	1975	1975	1975	1975	1975	1975	1975	1975

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.12	8.68×10^{1}	0.00	9.12	8.69×10^{1}	3.58×10^{-8}	9.12	1.27×10^{2}	1.64×10^{-3}
Nitrate	2.12×10^{3}	3.78×10^{1}	0.00	2.12×10^{3}	4.97×10^{1}	0.00	2.12×10^{3}	9.76×10^{1}	0.00
Total	2.12×10^{3}	1.25×10^{2}	0.00	2.12×10^{3}	1.37×10^{2}	3.58×10^{-8}	2.12×10^{3}	2.25×10^{2}	1.64×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–43. Tank Closure Alternative 2A Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.96×10^{-3}	3.45×10^{2}	3.28×10^{-3}	2.96×10^{-3}	5.49×10^{2}	5.74×10^{-3}	2.96×10^{-3}	1.01×10^{3}	1.15×10^{-2}
Technetium-99	1.49×10^{-4}	2.60×10^{2}	8.95×10^{-3}	1.49×10^{-4}	6.68×10^{2}	2.93×10^{-2}	1.49×10^{-4}	1.36×10^{3}	6.40×10^{-2}
Iodine-129	1.95×10^{-7}	5.54×10^{1}	6.31×10^{-4}	1.95×10^{-7}	6.43×10^{1}	8.51×10^{-4}	1.95×10^{-7}	7.94×10^{1}	1.23×10^{-3}
Total	3.10×10^{-3}	6.61×10^{2}	1.29×10^{-2}	3.10×10^{-3}	1.28×10^{3}	3.59×10^{-2}	3.10×10^{-3}	2.45×10^{3}	7.67×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.72×10^{1}	2.59×10^{2}	0.00	2.72×10^{1}	2.59×10^{2}	1.07×10^{-7}	2.72×10^{1}	3.79×10^{2}	4.89×10^{-3}
Nitrate	1.35×10^{4}	2.41×10^{2}	0.00	1.35×10^{4}	3.17×10^{2}	0.00	1.35×10^{4}	6.22×10^{2}	0.00
Total	1.35×10^{4}	5.00×10^{2}	0.00	1.35×10^{4}	5.76×10^{2}	1.07×10^{-7}	1.35×10^{4}	1.00×10^{3}	4.89×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–44. Tank Closure Alternative 2A Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.38×10^{-6}	1.62×10^{-1}	6.10×10^{-22}	1.38×10^{-6}	2.57×10^{-1}	1.07×10^{-21}	1.38×10^{-6}	4.73×10^{-1}	2.13×10^{-21}
Technetium-99	2.54×10^{-8}	4.46×10^{-2}	4.03×10^{-6}	2.54×10^{-8}	1.14×10^{-1}	1.32×10^{-5}	2.54×10^{-8}	2.33×10^{-1}	2.88×10^{-5}
Iodine-129	3.37×10^{-11}	9.60×10^{-3}	2.08×10^{-7}	3.37×10^{-11}	1.11×10^{-2}	2.80×10^{-7}	3.37×10^{-11}	1.38×10^{-2}	4.03×10^{-7}
Uranium-238	0.00	0.00	7.84×10^{-10}	0.00	0.00	8.40×10^{-10}	0.00	0.00	9.50×10^{-10}
Total	1.41×10^{-6}	2.16×10^{-1}	4.24×10^{-6}	1.41×10^{-6}	3.83×10^{-1}	1.35×10^{-5}	1.41×10^{-6}	7.20×10^{-1}	2.92×10^{-5}
Year of peak impact	1998	1998	2645	1998	1998	2645	1998	1998	2645
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.79×10^{-2}	2.66×10^{-1}	0.00	2.79×10^{-2}	2.66×10^{-1}	1.15×10^{-10}	2.79×10^{-2}	3.89×10^{-1}	5.29×10^{-6}
Nitrate	7.34	1.31×10^{-1}	0.00	7.34	1.73×10^{-1}	0.00	7.34	3.39×10^{-1}	0.00
Total uranium	8.28×10^{-7}	7.88×10^{-6}	0.00	8.28×10^{-7}	7.97×10^{-6}	0.00	8.28×10^{-7}	8.25×10^{-6}	0.00
Total	7.37	3.97×10^{-1}	0.00	7.37	4.39×10^{-1}	1.15×10^{-10}	7.37	7.27×10^{-1}	5.29×10^{-6}
Year of peak impact	2527	2527	N/A	2527	2527	2603	2527	2527	2603

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–45. Tank Closure Alternative 2A Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.64×10^{-10}	6.76×10^{-5}	7.06×10^{-10}	3.64×10^{-10}	1.26×10^{-4}	1.43×10^{-9}	1.38×10^{-6}	4.37×10^{-1}	5.36×10^{-6}
Technetium-99	2.44×10^{-11}	1.10×10^{-4}	4.83×10^{-9}	2.44×10^{-11}	2.54×10^{-4}	1.20×10^{-8}	2.54×10^{-8}	2.95×10^{-4}	1.60×10^{-8}
Iodine-129	3.25×10^{-14}	1.08×10^{-5}	1.43×10^{-10}	3.25×10^{-14}	1.76×10^{-4}	4.22×10^{-9}	3.37×10^{-11}	1.01×10^{-4}	2.47×10^{-9}
Total	3.88×10^{-10}	1.88×10^{-4}	5.67×10^{-9}	3.88×10^{-10}	5.55×10^{-4}	1.77×10^{-8}	1.41×10^{-6}	4.37×10^{-1}	5.38×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1998	1998	1998
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.88×10^{-6}	8.47×10^{-5}	3.49×10^{-14}	4.34×10^{-6}	6.62×10^{-5}	1.60×10^{-9}	1.49×10^{-2}	3.32×10^{-2}	2.65×10^{-6}
Nitrate	2.17×10^{-3}	7.49×10^{-5}	0.00	2.22×10^{-3}	2.09×10^{-1}	0.00	4.27	6.45×10^{-1}	0.00
Total	2.18×10^{-3}	1.60×10^{-4}	3.49×10^{-14}	2.23×10^{-3}	2.09×10^{-1}	1.60×10^{-9}	4.29	6.78×10^{-1}	2.65×10^{-6}
Year of peak impact	1984	1984	1984	1962	1962	1984	1984	1984	2603

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–46. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.53×10^{-6}	4.12×10^{-1}	3.92×10^{-6}	3.53×10^{-6}	6.56×10^{-1}	6.86×10^{-6}	3.53×10^{-6}	1.21	1.37×10^{-5}
Technetium-99	1.19×10^{-5}	2.08×10^{1}	7.16×10^{-4}	1.19×10^{-5}	5.35×10^{1}	2.35×10^{-3}	1.19×10^{-5}	1.09×10^{2}	5.12×10^{-3}
Iodine-129	2.32×10^{-8}	6.61	7.53×10^{-5}	2.32×10^{-8}	7.67	1.02×10^{-4}	2.32×10^{-8}	9.48	1.46×10^{-4}
Total	1.54×10^{-5}	2.79×10^{1}	7.95×10^{-4}	1.54×10^{-5}	6.18×10^{1}	2.46×10^{-3}	1.54×10^{-5}	1.20×10^{2}	5.28×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	5.86×10^{-2}	5.58×10^{-1}	0.00	5.86×10^{-2}	5.58×10^{-1}	2.30×10^{-10}	5.86×10^{-2}	8.16×10^{-1}	1.05×10^{-5}
Nitrate	4.13	7.37×10^{-2}	0.00	4.13	9.70×10^{-2}	0.00	4.13	1.90×10^{-1}	0.00
Total	4.19	6.31×10^{-1}	0.00	4.19	6.55×10^{-1}	2.30×10^{-10}	4.19	1.01	1.05×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–47. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	7.01×10^{-8}	8.19×10^{-3}	7.78×10^{-8}	7.01×10^{-8}	1.30×10^{-2}	1.36×10^{-7}	7.01×10^{-8}	2.40×10^{-2}	2.72×10^{-7}
Technetium-99	9.47×10^{-6}	1.66×10^{1}	5.71×10^{-4}	9.47×10^{-6}	4.26×10^{1}	1.87×10^{-3}	9.47×10^{-6}	8.68×10^{1}	4.08×10^{-3}
Iodine-129	1.44×10^{-8}	4.11	4.68×10^{-5}	1.44×10^{-8}	4.77	6.32×10^{-5}	1.44×10^{-8}	5.90	9.10×10^{-5}
Total	9.56×10^{-6}	2.07×10^{1}	6.17×10^{-4}	9.56×10^{-6}	4.74×10^{1}	1.93×10^{-3}	9.56×10^{-6}	9.27×10^{1}	4.17×10^{-3}
Year of peak impact	2052	2052	2052	2052	2052	2052	2052	2052	2052

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
1-Butanol	1.94×10^{-8}	5.54×10^{-9}	0.00	1.94×10^{-8}	1.00×10^{-8}	0.00	0.00	0.00	0.00
Chromium	0.00	0.00	0.00	0.00	0.00	3.75×10^{-10}	9.42×10^{-2}	1.31	1.72×10^{-5}
Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	1.85×10^{1}	8.52×10^{-1}	0.00
Total uranium	1.63×10^{-1}	1.55	0.00	1.63×10^{-1}	1.57	0.00	0.00	0.00	0.00
Total	1.63×10^{-1}	1.55	0.00	1.63×10^{-1}	1.57	3.75×10^{-10}	1.86×10^{1}	2.16	1.72×10^{-5}
Year of peak impact	11,836	11,836	N/A	11,836	11,836	2052	2049	2049	2052

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–48. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.45×10^{-7}	2.86×10^{-2}	2.72×10^{-7}	2.45×10^{-7}	4.55×10^{-2}	4.76×10^{-7}	2.45×10^{-7}	8.37×10^{-2}	9.49×10^{-7}
Technetium-99	3.94×10^{-6}	6.91	2.37×10^{-4}	3.94×10^{-6}	1.77×10^{1}	7.79×10^{-4}	3.94×10^{-6}	3.61×10^{1}	1.70×10^{-3}
Iodine-129	7.55×10^{-9}	2.15	2.45×10^{-5}	7.55×10^{-9}	2.49	3.30×10^{-5}	7.55×10^{-9}	3.08	4.75×10^{-5}
Total	4.19×10^{-6}	9.08	2.62×10^{-4}	4.19×10^{-6}	2.03×10^{1}	8.12×10^{-4}	4.19×10^{-6}	3.93×10^{1}	1.75×10^{-3}
Year of peak impact	2028	2028	2028	2028	2028	2028	2028	2028	2028

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.07×10^{-1}	3.87	0.00	4.07×10^{-1}	3.88	1.60×10^{-9}	4.07×10^{-1}	5.67	7.33×10^{-5}
Nitrate	1.16×10^{1}	2.07×10^{-1}	0.00	1.16×10^{1}	2.72×10^{-1}	0.00	1.16×10^{1}	5.34×10^{-1}	0.00
Total	1.20×10^{1}	4.08	0.00	1.20×10^{1}	4.15	1.60×10^{-9}	1.20×10^{1}	6.20	7.33×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–49. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.28×10^{-6}	3.83×10^{-1}	3.64×10^{-6}	3.28×10^{-6}	6.09×10^{-1}	6.36×10^{-6}	3.28×10^{-6}	1.12	1.27×10^{-5}
Technetium-99	2.28×10^{-5}	3.99×10^{1}	1.37×10^{-3}	2.28×10^{-5}	1.02×10^{2}	4.50×10^{-3}	2.28×10^{-5}	2.09×10^{2}	9.82×10^{-3}
Iodine-129	4.47×10^{-8}	1.27×10^{1}	1.45×10^{-4}	4.47×10^{-8}	1.48×10^{1}	1.95×10^{-4}	4.47×10^{-8}	1.82×10^{1}	2.81×10^{-4}
Total	2.61×10^{-5}	5.30×10^{1}	1.52×10^{-3}	2.61×10^{-5}	1.18×10^{2}	4.70×10^{-3}	2.61×10^{-5}	2.28×10^{2}	1.01×10^{-2}
Year of peak impact	2026	2026	2026	2026	2026	2026	2026	2026	2026

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	5.29×10^{-1}	5.04	0.00	5.29×10^{-1}	5.04	2.08×10^{-9}	5.28×10^{-1}	7.35	9.53×10^{-5}
Nitrate	3.86×10^{1}	6.89×10^{-1}	0.00	3.86×10^{1}	9.07×10^{-1}	0.00	3.91×10^{1}	1.80	0.00
Total	3.91×10^{1}	5.73	0.00	3.91×10^{1}	5.95	2.08×10^{-9}	3.96×10^{1}	9.15	9.53×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2023	2023	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–50. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	0.00	0.00	0.00	0.00	0.00	1.37×10^{-8}	7.07×10^{-9}	2.41×10^{-3}	2.74×10^{-8}
Technetium-99	0.00	0.00	0.00	0.00	0.00	3.02×10^{-5}	1.53×10^{-7}	1.40	6.60×10^{-5}
Iodine-129	0.00	0.00	0.00	0.00	0.00	1.17×10^{-6}	2.67×10^{-10}	1.09×10^{-1}	1.68×10^{-6}
Uranium-238	1.00×10^{-8}	1.24	1.40×10^{-5}	1.00×10^{-8}	1.29	0.00	0.00	0.00	0.00
Neptunium-237	4.04×10^{-14}	1.18×10^{-5}	5.47×10^{-11}	4.04×10^{-14}	1.20×10^{-5}	0.00	0.00	0.00	0.00
Total	1.00×10^{-8}	1.24	1.40×10^{-5}	1.00×10^{-8}	1.29	3.14×10^{-5}	1.60×10^{-7}	1.51	6.77×10^{-5}
Year of peak impact	11,763	11,763	11,763	11,763	11,763	2064	2064	2064	2064

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.39×10^{-2}	1.32×10^{-1}	0.00	1.39×10^{-2}	1.32×10^{-1}	5.48×10^{-11}	1.39×10^{-2}	1.93×10^{-1}	2.51×10^{-6}
Nitrate	6.89×10^{-1}	1.23×10^{-2}	0.00	6.89×10^{-1}	1.62×10^{-2}	0.00	6.89×10^{-1}	3.18×10^{-2}	0.00
Total	7.03×10^{-1}	1.44×10^{-1}	0.00	7.03×10^{-1}	1.48×10^{-1}	5.48×10^{-11}	7.03×10^{-1}	2.25×10^{-1}	2.51×10^{-6}
Year of peak impact	2029	2029	N/A	2029	2029	2028	2029	2029	2028

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–51. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	8.64×10^{-248}	1.01×10^{-242}	2.78×10^{-13}	2.50×10^{-13}	4.65×10^{-8}	4.86×10^{-13}	2.50×10^{-13}	8.54×10^{-8}	9.68×10^{-13}
Carbon-14	2.24×10^{-16}	3.59×10^{-10}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Technetium-99	7.53×10^{-9}	1.32×10^{-2}	3.03×10^{-4}	5.03×10^{-6}	2.26×10^{1}	9.94×10^{-4}	5.03×10^{-6}	4.61×10^{1}	2.17×10^{-3}
Iodine-129	8.60×10^{-11}	2.45×10^{-2}	2.67×10^{-5}	8.25×10^{-9}	2.73	3.61×10^{-5}	8.25×10^{-9}	3.37	5.20×10^{-5}
Uranium-238	1.10×10^{-7}	1.37×10^{1}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Neptunium-237	1.76×10^{-15}	5.13×10^{-7}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.18×10^{-7}	1.37×10^{1}	3.30×10^{-4}	5.04×10^{-6}	2.54×10^{1}	1.03×10^{-3}	5.04×10^{-6}	4.95×10^{1}	2.22×10^{-3}
Year of peak impact	11,837	11,837	2275	2275	2275	2275	2275	2275	2275

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.97×10^{-1}	4.73	0.00	4.97×10^{-1}	4.74	1.95×10^{-9}	4.97×10^{-1}	6.92	8.95×10^{-5}
Nitrate	1.24×10^{1}	2.21×10^{-1}	0.00	1.24×10^{1}	2.90×10^{-1}	0.00	1.24×10^{1}	5.70×10^{-1}	0.00
Total	1.29×10^{1}	4.95	0.00	1.29×10^{1}	5.03	1.95×10^{-9}	1.29×10^{1}	7.49	8.95×10^{-5}
Year of peak impact	2277	2277	N/A	2277	2277	2277	2277	2277	2277

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–52. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.43×10^{-7}	2.51×10^{-1}	8.63×10^{-6}	1.43×10^{-7}	6.44×10^{-1}	2.83×10^{-5}	1.43×10^{-7}	1.31	6.17×10^{-5}
Iodine-129	1.99×10^{-10}	5.66×10^{-2}	6.44×10^{-7}	1.99×10^{-10}	6.57×10^{-2}	8.69×10^{-7}	1.99×10^{-10}	8.11×10^{-2}	1.25×10^{-6}
Total	1.43×10^{-7}	3.08×10^{-1}	9.27×10^{-6}	1.43×10^{-7}	7.10×10^{-1}	2.92×10^{-5}	1.43×10^{-7}	1.39	6.30×10^{-5}
Year of peak impact	2406	2406	2406	2406	2406	2406	2406	2406	2406

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.10×10^{-3}	3.91×10^{-2}	0.00	3.92×10^{-3}	3.73×10^{-2}	1.61×10^{-11}	3.92×10^{-3}	5.46×10^{-2}	7.39×10^{-7}
Nitrate	1.15×10^{-1}	2.06×10^{-3}	0.00	2.11×10^{-1}	4.96×10^{-3}	0.00	2.11×10^{-1}	9.74×10^{-3}	0.00
Total	1.20×10^{-1}	4.11×10^{-2}	0.00	2.15×10^{-1}	4.23×10^{-2}	1.61×10^{-11}	2.15×10^{-1}	6.43×10^{-2}	7.39×10^{-7}
Year of peak impact	2500	2500	N/A	2504	2504	2500	2504	2504	2500

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–53. Tank Closure Alternative 2A Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	9.37×10^{-16}	1.74×10^{-10}	1.82×10^{-15}	1.10×10^{-15}	3.82×10^{-10}	3.68×10^{-15}	0.00	0.00	1.78×10^{-19}
Technetium-99	6.39×10^{-12}	2.87×10^{-5}	1.26×10^{-9}	6.27×10^{-12}	6.52×10^{-5}	3.14×10^{-9}	2.39×10^{-9}	2.60×10^{-5}	6.50×10^{-9}
Iodine-129	1.26×10^{-14}	4.16×10^{-6}	5.52×10^{-11}	1.30×10^{-14}	7.00×10^{-5}	1.63×10^{-9}	6.98×10^{-13}	1.20×10^{-6}	7.21×10^{-10}
Uranium-238	0.00	0.00	0.00	0.00	0.00	0.00	1.07×10^{-9}	1.06×10^{-2}	1.31×10^{-7}
Neptunium-237	0.00	0.00	0.00	0.00	0.00	0.00	4.81×10^{-17}	1.52×10^{-9}	0.00
Total	6.40×10^{-12}	3.29×10^{-5}	1.32×10^{-9}	6.28×10^{-12}	1.35×10^{-4}	4.78×10^{-9}	3.45×10^{-9}	1.06×10^{-2}	1.38×10^{-7}
Year of peak impact	2144	2144	2144	2140	2140	2144	11,336	11,336	9679
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.97×10^{-7}	1.88×10^{-6}	7.74×10^{-16}	1.52×10^{-7}	2.32×10^{-6}	3.55×10^{-11}	2.49×10^{-3}	5.50×10^{-3}	3.70×10^{-7}
Nitrate	1.11×10^{-5}	3.85×10^{-7}	0.00	1.14×10^{-5}	1.07×10^{-3}	0.00	2.72×10^{-1}	1.16×10^{-2}	0.00
Total	1.13×10^{-5}	2.26×10^{-6}	7.74×10^{-16}	1.16×10^{-5}	1.08×10^{-3}	3.55×10^{-11}	2.74×10^{-1}	1.71×10^{-2}	3.70×10^{-7}
Year of peak impact	2177	2177	2177	2145	2145	2177	2211	2211	2500

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–54. Tank Closure Alternative 2A Human Health Impacts at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.01×10^{-8}	2.35×10^{-3}	2.23×10^{-8}	2.01×10^{-8}	3.74×10^{-3}	3.91×10^{-8}	2.01×10^{-8}	6.87×10^{-3}	7.79×10^{-8}
Technetium-99	1.59×10^{-6}	2.78	9.55×10^{-5}	1.59×10^{-6}	7.14	3.13×10^{-4}	1.59×10^{-6}	1.45×10^{1}	6.84×10^{-4}
Iodine-129	2.89×10^{-9}	8.21×10^{-1}	9.35×10^{-6}	2.89×10^{-9}	9.53×10^{-1}	1.26×10^{-5}	2.89×10^{-9}	1.18	1.82×10^{-5}
Total	1.61×10^{-6}	3.60	1.05×10^{-4}	1.61×10^{-6}	8.09	3.26×10^{-4}	1.61×10^{-6}	1.57×10^{1}	7.02×10^{-4}
Year of peak impact	2055	2055	2055	2055	2055	2055	2055	2055	2055
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.20×10^{-2}	1.15×10^{-1}	0.00	1.20×10^{-2}	1.15×10^{-1}	4.73×10^{-11}	1.20×10^{-2}	1.68×10^{-1}	2.17×10^{-6}
Nitrate	1.13×10^{1}	2.01×10^{-1}	0.00	1.13×10^{1}	2.65×10^{-1}	0.00	1.13×10^{1}	5.20×10^{-1}	0.00
Total	1.13×10^{1}	3.16×10^{-1}	1.16×10^{-13}	1.13×10^{1}	3.80×10^{-1}	4.73×10^{-11}	1.13×10^{1}	6.87×10^{-1}	2.17×10^{-6}
Year of peak impact	2070	2070	11,822	2070	2070	2070	2070	2070	2070

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–55. Tank Closure Alternative 2A Human Health Impacts at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.10×10^{-7}	2.45×10^{-2}	2.33×10^{-7}	2.10×10^{-7}	3.90×10^{-2}	4.08×10^{-7}	2.10×10^{-7}	7.17×10^{-2}	8.13×10^{-7}
Technetium-99	3.17×10^{-5}	5.55×10^{1}	1.91×10^{-3}	3.17×10^{-5}	1.42×10^{2}	6.25×10^{-3}	3.17×10^{-5}	2.90×10^{2}	1.36×10^{-2}
Iodine-129	4.49×10^{-8}	1.28×10^{1}	1.45×10^{-4}	4.49×10^{-8}	1.48×10^{1}	1.96×10^{-4}	4.49×10^{-8}	1.83×10^{1}	2.83×10^{-4}
Total	3.19×10^{-5}	6.83×10^{1}	2.05×10^{-3}	3.19×10^{-5}	1.57×10^{2}	6.45×10^{-3}	3.19×10^{-5}	3.08×10^{2}	1.39×10^{-2}
Year of peak impact	2076	2076	2076	2076	2076	2076	2076	2076	2076
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.26	4.06×10^{1}	0.00	4.26	4.06×10^{1}	1.67×10^{-8}	4.26	5.94×10^{1}	7.68×10^{-4}
Nitrate	1.58×10^{3}	2.82×10^{1}	0.00	1.58×10^{3}	3.72×10^{1}	0.00	1.58×10^{3}	7.30×10^{1}	0.00
Total	1.59×10^{3}	6.89×10^{1}	0.00	1.59×10^{3}	7.78×10^{1}	1.67×10^{-8}	1.59×10^{3}	1.32×10^{2}	7.68×10^{-4}
Year of peak impact	2085	2085	N/A	2085	2085	2085	2085	2085	2085

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–56. Tank Closure Alternative 2A Human Health Impacts at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.10×10^{-8}	5.95×10^{-3}	5.66×10^{-8}	5.10×10^{-8}	9.48×10^{-3}	9.90×10^{-8}	5.10×10^{-8}	1.74×10^{-2}	1.97×10^{-7}
Technetium-99	2.82×10^{-6}	4.94	1.70×10^{-4}	2.82×10^{-6}	1.27×10^{1}	5.57×10^{-4}	2.82×10^{-6}	2.58×10^{1}	1.22×10^{-3}
Iodine-129	4.80×10^{-9}	1.37	1.56×10^{-5}	4.80×10^{-9}	1.59	2.10×10^{-5}	4.80×10^{-9}	1.96	3.02×10^{-5}
Total	2.88×10^{-6}	6.31	1.85×10^{-4}	2.88×10^{-6}	1.43×10^{1}	5.78×10^{-4}	2.88×10^{-6}	2.78×10^{1}	1.25×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.90×10^{-1}	2.76	0.00	2.90×10^{-1}	2.77	1.14×10^{-9}	2.90×10^{-1}	4.04	5.23×10^{-5}
Nitrate	9.71	1.73×10^{-1}	0.00	9.71	2.28×10^{-1}	0.00	9.71	4.48×10^{-1}	0.00
Total	1.00×10^{1}	2.94	0.00	1.00×10^{1}	2.99	1.14×10^{-9}	1.00×10^{1}	4.49	5.23×10^{-5}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–57. Tank Closure Alternative 2A Human Health Impacts at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.06×10^{-6}	3.58×10^{-1}	3.40×10^{-6}	3.06×10^{-6}	5.69×10^{-1}	5.95×10^{-6}	3.06×10^{-6}	1.05	1.19×10^{-5}
Technetium-99	1.50×10^{-5}	2.63×10^{1}	9.06×10^{-4}	1.50×10^{-5}	6.76×10^{1}	2.97×10^{-3}	1.50×10^{-5}	1.38×10^{2}	6.48×10^{-3}
Iodine-129	3.03×10^{-8}	8.62	9.81×10^{-5}	3.03×10^{-8}	1.00×10^{1}	1.32×10^{-4}	3.03×10^{-8}	1.24×10^{1}	1.91×10^{-4}
Uranium-238	1.10×10^{-10}	1.36×10^{-2}	1.54×10^{-7}	1.10×10^{-10}	1.41×10^{-2}	1.64×10^{-7}	1.10×10^{-10}	1.51×10^{-2}	1.86×10^{-7}
Total	1.81×10^{-5}	3.53×10^{1}	1.01×10^{-3}	1.81×10^{-5}	7.82×10^{1}	3.11×10^{-3}	1.81×10^{-5}	1.51×10^{2}	6.68×10^{-3}
Year of peak impact	2051	2051	2051	2051	2051	2051	2051	2051	2051

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	8.00×10^{-1}	7.62	0.00	8.00×10^{-1}	7.63	3.14×10^{-9}	8.00×10^{-1}	1.11×10^{1}	1.44×10^{-4}
Nitrate	1.28×10^{2}	2.28	0.00	1.28×10^{2}	3.00	0.00	1.28×10^{2}	5.90	0.00
Total uranium	1.60×10^{-4}	1.52×10^{-3}	0.00	1.60×10^{-4}	1.54×10^{-3}	0.00	1.60×10^{-4}	1.59×10^{-3}	0.00
Total	1.29×10^{2}	9.90	0.00	1.29×10^{2}	1.06×10^{1}	3.14×10^{-9}	1.29×10^{2}	1.70×10^{1}	1.44×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–58. Tank Closure Alternative 2A Human Health Impacts at the U Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	0.00	0.00	4.05×10^{-9}	3.65×10^{-9}	6.78×10^{-4}	7.08×10^{-9}	3.65×10^{-9}	1.25×10^{-3}	1.41×10^{-8}
Technetium-99	0.00	0.00	3.29×10^{-5}	5.46×10^{-7}	2.46	1.08×10^{-4}	5.46×10^{-7}	5.00	2.35×10^{-4}
Iodine-129	0.00	0.00	2.83×10^{-6}	8.74×10^{-10}	2.89×10^{-1}	3.82×10^{-6}	8.74×10^{-10}	3.57×10^{-1}	5.51×10^{-6}
Uranium-238	1.07×10^{-8}	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Neptunium-237	4.04×10^{-14}	1.18×10^{-5}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.07×10^{-8}	1.33	3.57×10^{-5}	5.50×10^{-7}	2.74	1.12×10^{-4}	5.50×10^{-7}	5.36	2.41×10^{-4}
Year of peak impact	11,763	11,763	2096	2096	2096	2096	2096	2096	2096

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.64×10^{-2}	1.57×10^{-1}	0.00	1.64×10^{-2}	1.57×10^{-1}	6.66×10^{-11}	1.64×10^{-2}	2.29×10^{-1}	3.05×10^{-6}
Nitrate	5.80	1.03×10^{-1}	0.00	5.80	1.36×10^{-1}	0.00	5.80	2.67×10^{-1}	0.00
Total	5.81	2.60×10^{-1}	0.00	5.81	2.93×10^{-1}	6.66×10^{-11}	5.81	4.96×10^{-1}	3.05×10^{-6}
Year of peak impact	2083	2083	N/A	2083	2083	2086	2083	2083	2086

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–59. Tank Closure Alternative 2A Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	5.75×10^{-7}	6.72×10^{-2}	6.39×10^{-7}	5.75×10^{-7}	1.07×10^{-1}	1.12×10^{-6}	5.75×10^{-7}	1.97×10^{-1}	2.23×10^{-6}
Technetium-99	2.78×10^{-5}	4.88×10^{1}	1.68×10^{-3}	2.78×10^{-5}	1.25×10^{2}	5.50×10^{-3}	2.78×10^{-5}	2.55×10^{2}	1.20×10^{-2}
Iodine-129	3.65×10^{-8}	1.04×10^{1}	1.18×10^{-4}	3.65×10^{-8}	1.21×10^{1}	1.60×10^{-4}	3.65×10^{-8}	1.49×10^{1}	2.30×10^{-4}
Uranium-238	5.59×10^{-13}	6.93×10^{-5}	7.83×10^{-10}	5.59×10^{-13}	7.20×10^{-5}	8.39×10^{-10}	5.59×10^{-13}	7.71×10^{-5}	9.49×10^{-10}
Total	2.84×10^{-5}	5.92×10^{1}	1.80×10^{-3}	2.84×10^{-5}	1.37×10^{2}	5.66×10^{-3}	2.84×10^{-5}	2.70×10^{2}	1.22×10^{-2}
Year of peak impact	2076	2076	2076	2076	2076	2076	2076	2076	2076
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.96	1.87×10^{1}	0.00	1.96	1.87×10^{1}	7.69×10^{-9}	1.96	2.73×10^{1}	3.53×10^{-4}
Nitrate	1.07×10^{3}	1.91×10^{1}	0.00	1.07×10^{3}	2.52×10^{1}	0.00	1.07×10^{3}	4.94×10^{1}	0.00
Total	1.07×10^{3}	3.78×10^{1}	4.67×10^{-14}	1.07×10^{3}	4.38×10^{1}	7.69×10^{-9}	1.07×10^{3}	7.67×10^{1}	3.53×10^{-4}
Year of peak impact	2066	2066	11,833	2066	2066	2066	2066	2066	2066

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–60. Tank Closure Alternative 2A Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.02×10^{-7}	3.54×10^{-1}	1.23×10^{-5}	2.04×10^{-7}	9.17×10^{-1}	4.03×10^{-5}	2.04×10^{-7}	1.87	8.79×10^{-5}
Iodine-129	2.99×10^{-10}	8.52×10^{-2}	9.00×10^{-7}	2.78×10^{-10}	9.18×10^{-2}	1.22×10^{-6}	2.78×10^{-10}	1.13×10^{-1}	1.75×10^{-6}
Uranium-238	5.59×10^{-13}	6.94×10^{-5}	7.86×10^{-10}	5.61×10^{-13}	7.22×10^{-5}	8.42×10^{-10}	5.61×10^{-13}	7.74×10^{-5}	9.52×10^{-10}
Total	2.02×10^{-7}	4.39×10^{-1}	1.32×10^{-5}	2.04×10^{-7}	1.01	4.15×10^{-5}	2.04×10^{-7}	1.98	8.96×10^{-5}
Year of peak impact	2406	2406	3464	3464	3464	3464	3464	3464	3464

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.15×10^{-2}	3.00×10^{-1}	0.00	3.15×10^{-2}	3.01×10^{-1}	1.26×10^{-10}	3.15×10^{-2}	4.39×10^{-1}	5.78×10^{-6}
Nitrate	7.62	1.36×10^{-1}	0.00	7.62	1.79×10^{-1}	0.00	7.62	3.52×10^{-1}	0.00
Total uranium	8.28×10^{-7}	7.88×10^{-6}	0.00	8.28×10^{-7}	7.97×10^{-6}	0.00	8.28×10^{-7}	8.25×10^{-6}	0.00
Total	7.65	4.36×10^{-1}	1.53×10^{-15}	7.65	4.80×10^{-1}	1.26×10^{-10}	7.65	7.91×10^{-1}	5.78×10^{-6}
Year of peak impact	2527	2527	11,838	2527	2527	2603	2527	2527	2603

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–61. Tank Closure Alternative 2A Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	7.09×10^{-14}	1.32×10^{-8}	1.38×10^{-13}	1.23×10^{-13}	4.26×10^{-8}	6.24×10^{-13}	1.35×10^{-7}	4.27×10^{-2}	5.24×10^{-7}
Technetium-99	8.61×10^{-12}	3.87×10^{-5}	1.70×10^{-9}	8.18×10^{-12}	8.50×10^{-5}	4.22×10^{-9}	6.26×10^{-8}	7.03×10^{-4}	3.84×10^{-8}
Iodine-129	1.49×10^{-14}	4.92×10^{-6}	6.53×10^{-11}	1.61×10^{-14}	8.68×10^{-5}	1.97×10^{-9}	5.12×10^{-11}	1.42×10^{-4}	3.46×10^{-9}
Total	8.70×10^{-12}	4.37×10^{-5}	1.77×10^{-9}	8.32×10^{-12}	1.72×10^{-4}	6.19×10^{-9}	1.98×10^{-7}	4.36×10^{-2}	5.66×10^{-7}
Year of peak impact	2162	2162	2162	2140	2140	2149	2050	2050	2050
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.69×10^{-7}	9.24×10^{-6}	3.91×10^{-15}	9.69×10^{-7}	1.48×10^{-5}	1.79×10^{-10}	2.10×10^{-2}	4.64×10^{-2}	2.89×10^{-6}
Nitrate	3.11×10^{-4}	1.07×10^{-5}	0.00	3.11×10^{-4}	2.93×10^{-2}	0.00	9.10	3.53×10^{-1}	0.00
Total	3.12×10^{-4}	2.00×10^{-5}	3.91×10^{-15}	3.12×10^{-4}	2.93×10^{-2}	1.79×10^{-10}	9.12	3.99×10^{-1}	2.89×10^{-6}
Year of peak impact	2052	2052	2061	2052	2052	2061	2400	2400	2603

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

The dose standard would be exceeded at the B Barrier, T Barrier, and Core Zone Boundary for the drinking-water well user, resident farmer, and American Indian resident farmer due to the presence of tritium, technetium-99, and iodine-129 released from the cribs and trenches (ditches), but would not be exceeded at the other locations. For the drinking-water well user, resident farmer, and American Indian resident farmer, the Hazard Index guideline would be exceeded at the B Barrier, T Barrier, and Core Zone Boundary primarily due to release of chromium and nitrate from the cribs and trenches (ditches).

The dose standard would be exceeded at the A Barrier for the American Indian resident farmer and at the T Barrier for the resident farmer and American Indian resident farmer due to the presence of tritium, technetium-99, and iodine-129 released in past leaks. The Hazard Index would be exceeded for the drinking-water well user, resident farmer, and American Indian resident farmer at the B Barrier, S Barrier, T Barrier, and the Core Zone Boundary primarily due to release of chromium and nitrate from past leaks. The Hazard Index guideline would be exceeded for the American Indian resident farmer at the A Barrier primarily due to chromium and nitrate. The Hazard Index guideline would be exceeded for the American Indian resident farmer at the T Barrier (primarily due to the release of nitrate) from past leaks.

After the year 2050, the dose standard would be exceeded at the B Barrier and Core Zone Boundary for the resident farmer and American Indian resident farmer due to the presence of tritium, technetium-99, and iodine-129 and the dose standard would be exceeded at the T Barrier for the American Indian resident farmer due to the presence of tritium, technetium-99, iodine-129, and uranium-238. The Hazard Index guideline would be exceeded at the B Barrier, S Barrier, T Barrier, and Core Zone Boundary for the drinking-water well user, resident farmer, and the American Indian resident farmer primarily due to chromium, nitrate, and total uranium. Population dose was estimated as 2.18×10^{-1} person-rem per year for the year of maximum impact.

Figure Q–3 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, other sources, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2300 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from all three sources occurs around the year 2070 and is dominated by tritium, technetium-99, iodine-129, and uranium-238. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

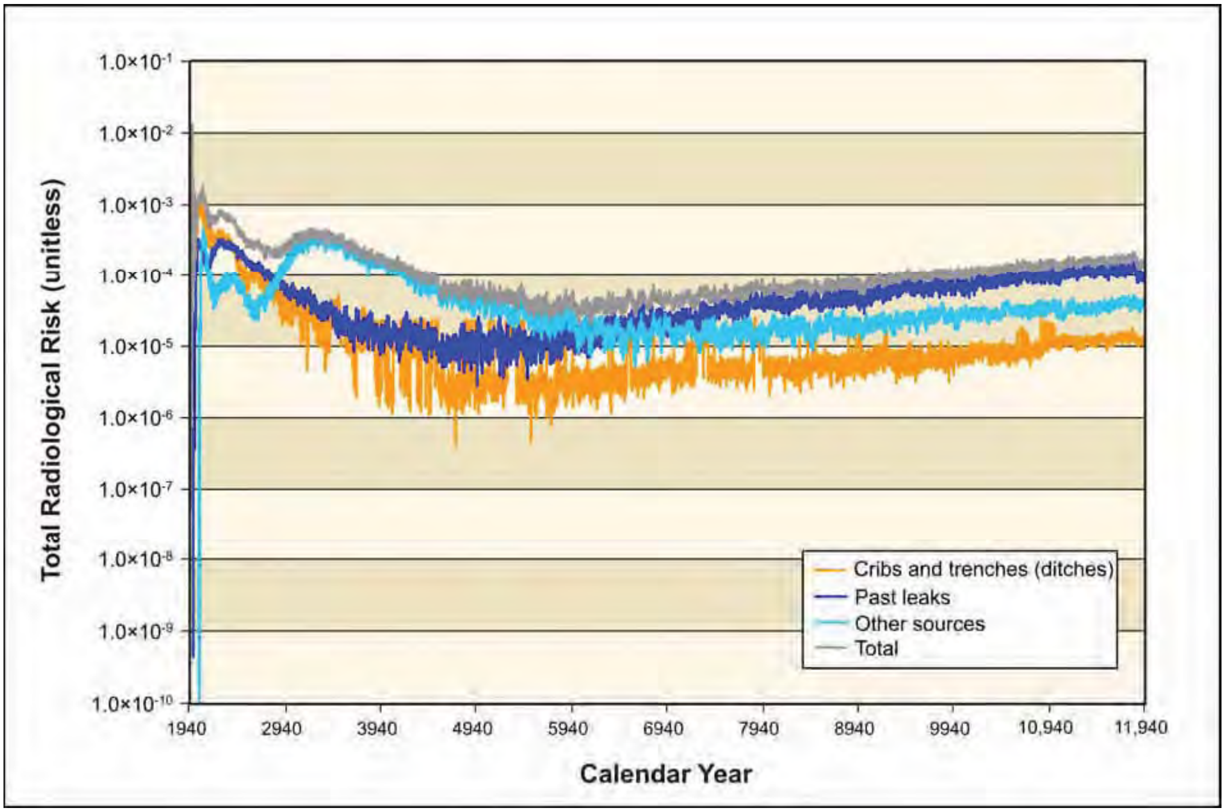

Figure Q–3. Tank Closure Alternative 2A Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.1.1.3 Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C

Activities under Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C would be similar to those of Tank Closure Alternative 2A, except that residual material in tanks would be stabilized in place. Soil would be removed down to 4.6 meters (15 feet) for the BX and SX tank farms and replaced with clean soils from onsite sources. The tank farms and six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified Resource Conservation and Recovery Act (RCRA) Subtitle C barrier.

Potential human health impacts of this alternative related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–62 through Q–66. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–67 through Q–74. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–75 through Q–82.

The risk and hazard drivers are: tritium, technetium-99, and iodine-129, uranium-238, chromium, nitrate, and total uranium. Impacts would be slightly less than under Alternative 2A, and standards would be exceeded, as under Alternative 2A. Population dose was estimated as 1.95×10^{-1} person-rem per year for the year of maximum impact.

Table Q–62. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.08×10^{1}	4.84×10^{2}	0.00	5.08×10^{1}	4.85×10^{2}	2.00×10^{-7}	5.08×10^{1}	7.08×10^{2}	9.16×10^{-3}
Nitrate	1.74×10^{4}	3.11×10^{2}	0.00	1.74×10^{4}	4.10×10^{2}	0.00	1.74×10^{4}	8.03×10^{2}	0.00
Total	1.75×10^{4}	7.95×10^{2}	0.00	1.75×10^{4}	8.94×10^{2}	2.00×10^{-7}	1.75×10^{4}	1.51×10^{3}	9.16×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–63. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.84×10^{-2}
Technetium-99	1.35×10^{-7}	2.36×10^{-1}	8.12×10^{-6}	1.35×10^{-7}	6.07×10^{-1}	2.66×10^{-5}	1.35×10^{-7}	1.24	5.81×10^{-5}
Iodine-129	1.14×10^{-9}	3.25×10^{-1}	3.71×10^{-6}	1.14×10^{-9}	3.78×10^{-1}	5.00×10^{-6}	1.14×10^{-9}	4.67×10^{-1}	7.20×10^{-6}
Uranium-238	1.18×10^{-11}	1.46×10^{-3}	1.65×10^{-8}	1.18×10^{-11}	1.52×10^{-3}	1.77×10^{-8}	1.18×10^{-11}	1.62×10^{-3}	2.00×10^{-8}
Total	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.85×10^{-2}
Year of peak impact	1974	1974	1974	1974	1974	1974	1974	1974	1974

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.32	8.88×10^{1}	0.00	9.32	8.89×10^{1}	3.66×10^{-8}	9.32	1.30×10^{2}	1.68×10^{-3}
Nitrate	2.11×10^{3}	3.77×10^{1}	0.00	2.11×10^{3}	4.97×10^{1}	0.00	2.11×10^{3}	9.74×10^{1}	0.00
Total	2.12×10^{3}	1.27×10^{2}	0.00	2.12×10^{3}	1.39×10^{2}	3.66×10^{-8}	2.12×10^{3}	2.27×10^{2}	1.68×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–64. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.80×10^{1}	2.67×10^{2}	0.00	2.80×10^{1}	2.67×10^{2}	1.10×10^{-7}	2.80×10^{1}	3.91×10^{2}	5.05×10^{-3}
Nitrate	1.29×10^{4}	2.30×10^{2}	0.00	1.29×10^{4}	3.03×10^{2}	0.00	1.29×10^{4}	5.95×10^{2}	0.00
Total	1.29×10^{4}	4.97×10^{2}	0.00	1.29×10^{4}	5.70×10^{2}	1.10×10^{-7}	1.29×10^{4}	9.85×10^{2}	5.05×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–65. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.46×10^{-7}	4.04×10^{-2}	3.84×10^{-7}	3.46×10^{-7}	6.43×10^{-2}	6.72×10^{-7}	3.46×10^{-7}	1.18×10^{-1}	1.34×10^{-6}
Technetium-99	8.94×10^{-8}	1.57×10^{-1}	5.38×10^{-6}	8.94×10^{-8}	4.02×10^{-1}	1.77×10^{-5}	8.94×10^{-8}	8.19×10^{-1}	3.85×10^{-5}
Iodine-129	3.88×10^{-11}	1.10×10^{-2}	1.26×10^{-7}	3.88×10^{-11}	1.28×10^{-2}	1.70×10^{-7}	3.88×10^{-11}	1.58×10^{-2}	2.44×10^{-7}
Total	4.35×10^{-7}	2.08×10^{-1}	5.89×10^{-6}	4.35×10^{-7}	4.79×10^{-1}	1.85×10^{-5}	4.35×10^{-7}	9.53×10^{-1}	4.01×10^{-5}
Year of peak impact	2025	2025	2025	2025	2025	2025	2025	2025	2025
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.14×10^{-2}	2.99×10^{-1}	0.00	3.14×10^{-2}	2.99×10^{-1}	1.23×10^{-10}	3.14×10^{-2}	4.37×10^{-1}	5.66×10^{-6}
Nitrate	5.75	1.03×10^{-1}	0.00	5.75	1.35×10^{-1}	0.00	5.75	2.65×10^{-1}	0.00
Total	5.78	4.02×10^{-1}	0.00	5.78	4.35×10^{-1}	1.23×10^{-10}	5.78	7.03×10^{-1}	5.66×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–66. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.56×10^{-10}	6.62×10^{-5}	6.92×10^{-10}	3.56×10^{-10}	1.23×10^{-4}	1.40×10^{-9}	1.28×10^{-6}	4.04×10^{-1}	4.96×10^{-6}
Technetium-99	2.53×10^{-11}	1.14×10^{-4}	4.99×10^{-9}	2.53×10^{-11}	2.63×10^{-4}	1.24×10^{-8}	2.55×10^{-8}	2.99×10^{-4}	1.62×10^{-8}
Iodine-129	3.20×10^{-14}	1.06×10^{-5}	1.41×10^{-10}	3.20×10^{-14}	1.73×10^{-4}	4.16×10^{-9}	3.57×10^{-11}	1.09×10^{-4}	2.65×10^{-9}
Total	3.82×10^{-10}	1.91×10^{-4}	5.83×10^{-9}	3.82×10^{-10}	5.59×10^{-4}	1.80×10^{-8}	1.31×10^{-6}	4.04×10^{-1}	4.97×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1994	1994	1994
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.95×10^{-6}	8.53×10^{-5}	3.52×10^{-14}	8.95×10^{-6}	1.37×10^{-4}	1.61×10^{-9}	2.24×10^{-2}	4.97×10^{-2}	2.83×10^{-6}
Nitrate	2.24×10^{-3}	7.74×10^{-5}	0.00	2.24×10^{-3}	2.11×10^{-1}	0.00	4.36	6.64×10^{-1}	0.00
Total	2.25×10^{-3}	1.63×10^{-4}	3.52×10^{-14}	2.25×10^{-3}	2.11×10^{-1}	1.61×10^{-9}	4.38	7.14×10^{-1}	2.83×10^{-6}
Year of peak impact	1984	1984	1984	1984	1984	1984	1984	1984	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–67. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.63×10^{-6}	4.24×10^{-1}	4.03×10^{-6}	3.63×10^{-6}	6.75×10^{-1}	7.06×10^{-6}	3.63×10^{-6}	1.24	1.41×10^{-5}
Technetium-99	1.16×10^{-5}	2.03×10^{1}	6.99×10^{-4}	1.16×10^{-5}	5.22×10^{1}	2.29×10^{-3}	1.16×10^{-5}	1.06×10^{2}	5.00×10^{-3}
Iodine-129	2.36×10^{-8}	6.72	7.65×10^{-5}	2.36×10^{-8}	7.80	1.03×10^{-4}	2.36×10^{-8}	9.64	1.49×10^{-4}
Total	1.53×10^{-5}	2.75×10^{1}	7.79×10^{-4}	1.53×10^{-5}	6.07×10^{1}	2.40×10^{-3}	1.53×10^{-5}	1.17×10^{2}	5.16×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	6.06×10^{-2}	5.77×10^{-1}	0.00	6.06×10^{-2}	5.78×10^{-1}	2.38×10^{-10}	6.06×10^{-2}	8.45×10^{-1}	1.09×10^{-5}
Nitrate	4.17	7.45×10^{-2}	0.00	4.17	9.81×10^{-2}	0.00	4.17	1.92×10^{-1}	0.00
Total	4.23	6.52×10^{-1}	0.00	4.23	6.76×10^{-1}	2.38×10^{-10}	4.23	1.04	1.09×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–68. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	6.96×10^{-8}	8.13×10^{-3}	7.73×10^{-8}	6.96×10^{-8}	1.29×10^{-2}	1.35×10^{-7}	6.96×10^{-8}	2.38×10^{-2}	2.70×10^{-7}
Technetium-99	8.42×10^{-6}	1.47×10^{1}	5.07×10^{-4}	8.42×10^{-6}	3.79×10^{1}	1.66×10^{-3}	8.42×10^{-6}	7.71×10^{1}	3.63×10^{-3}
Iodine-129	1.55×10^{-8}	4.40	5.01×10^{-5}	1.55×10^{-8}	5.11	6.77×10^{-5}	1.55×10^{-8}	6.31	9.74×10^{-5}
Total	8.50×10^{-6}	1.92×10^{1}	5.57×10^{-4}	8.50×10^{-6}	4.30×10^{1}	1.73×10^{-3}	8.50×10^{-6}	8.35×10^{1}	3.72×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.57×10^{-2}	9.12×10^{-1}	0.00	9.57×10^{-2}	9.13×10^{-1}	3.76×10^{-10}	9.57×10^{-2}	1.33	1.72×10^{-5}
Nitrate	1.75×10^{1}	3.13×10^{-1}	0.00	1.75×10^{1}	4.12×10^{-1}	0.00	1.75×10^{1}	8.08×10^{-1}	0.00
Total	1.76×10^{1}	1.22	0.00	1.76×10^{1}	1.32	3.76×10^{-10}	1.76×10^{1}	2.14	1.72×10^{-5}
Year of peak impact	2047	2047	N/A	2047	2047	2047	2047	2047	2047

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–69. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the S Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.52×10^{-7}	4.11×10^{-2}	3.91×10^{-7}	3.52×10^{-7}	6.54×10^{-2}	6.84×10^{-7}	3.52×10^{-7}	1.20×10^{-1}	1.36×10^{-6}
Technetium-99	4.10×10^{-6}	7.18	2.47×10^{-4}	4.10×10^{-6}	1.84×10^{1}	8.09×10^{-4}	4.10×10^{-6}	3.75×10^{1}	1.77×10^{-3}
Iodine-129	7.73×10^{-9}	2.20	2.50×10^{-5}	7.73×10^{-9}	2.55	3.38×10^{-5}	7.73×10^{-9}	3.15	4.87×10^{-5}
Total	4.46×10^{-6}	9.42	2.72×10^{-4}	4.46×10^{-6}	2.10×10^{1}	8.44×10^{-4}	4.46×10^{-6}	4.08×10^{1}	1.82×10^{-3}
Year of peak impact	2026	2026	2026	2026	2026	2026	2026	2026	2026
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.13×10^{-1}	3.93	0.00	4.13×10^{-1}	3.94	1.62×10^{-9}	4.13×10^{-1}	5.75	7.44×10^{-5}
Nitrate	1.21×10^{1}	2.16×10^{-1}	0.00	1.21×10^{1}	2.84×10^{-1}	0.00	1.21×10^{1}	5.58×10^{-1}	0.00
Total	1.25×10^{1}	4.15	0.00	1.25×10^{1}	4.22	1.62×10^{-9}	1.25×10^{1}	6.31	7.44×10^{-5}
Year of peak impact	2030	2030	N/A	2030	2030	2030	2030	2030	2030

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–70. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the T Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.31×10^{-6}	3.87×10^{-1}	2.93×10^{-6}	3.31×10^{-6}	6.16×10^{-1}	5.12×10^{-6}	3.31×10^{-6}	1.13	1.02×10^{-5}
Technetium-99	2.26×10^{-5}	3.96×10^{1}	1.36×10^{-3}	2.26×10^{-5}	1.02×10^{2}	4.47×10^{-3}	2.26×10^{-5}	2.07×10^{2}	9.75×10^{-3}
Iodine-129	4.48×10^{-8}	1.27×10^{1}	1.44×10^{-4}	4.48×10^{-8}	1.48×10^{1}	1.94×10^{-4}	4.48×10^{-8}	1.83×10^{1}	2.79×10^{-4}
Total	2.59×10^{-5}	5.27×10^{1}	1.51×10^{-3}	2.59×10^{-5}	1.17×10^{2}	4.67×10^{-3}	2.59×10^{-5}	2.26×10^{2}	1.00×10^{-2}
Year of peak impact	2027	2027	2029	2027	2027	2029	2027	2027	2029

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.28×10^{-1}	5.03	0.00	5.28×10^{1}	5.04	2.07×10^{-9}	5.28×10^{-1}	7.36	9.52×10^{-5}
Nitrate	4.01×10^{1}	7.16×10^{-1}	0.00	4.01×10^{1}	9.42×10^{-1}	0.00	4.01×10^{1}	1.85	0.00
Total	4.06×10^{1}	5.75	0.00	4.06×10^{1}	5.98	2.07×10^{-9}	4.06×10^{1}	9.21	9.52×10^{-5}
Year of peak impact	2027	2027	N/A	2027	2027	2027	2027	2027	2027

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–71. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	0.00	0.00	0.00	0.00	0.00	2.37×10^{-8}	1.22×10^{-8}	4.17×10^{-3}	4.73×10^{-8}
Technetium-99	0.00	0.00	0.00	0.00	0.00	2.84×10^{-5}	1.44×10^{-7}	1.32	6.20×10^{-5}
Iodine-129	0.00	0.00	0.00	0.00	0.00	1.20×10^{-6}	2.74×10^{-10}	1.12×10^{-1}	1.72×10^{-6}
Uranium-238	7.98×10^{-9}	9.90×10^{-1}	1.12×10^{-5}	7.98×10^{-9}	1.03	0.00	0.00	0.00	0.00
Total	7.98×10^{-9}	9.90×10^{-1}	1.12×10^{-5}	7.98×10^{-9}	1.03	2.97×10^{-5}	1.56×10^{-7}	1.44	6.38×10^{-5}
Year of peak impact	11,441	11,441	11,441	11,441	11,441	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.35×10^{-2}	1.29×10^{-1}	0.00	1.35×10^{-2}	1.29×10^{-1}	5.31×10^{-11}	1.35×10^{-2}	1.88×10^{-1}	2.44×10^{-6}
Nitrate	6.05×10^{-1}	1.08×10^{-2}	0.00	6.05×10^{-1}	1.42×10^{-2}	0.00	6.05×10^{-1}	2.79×10^{-2}	0.00
Total	6.18×10^{-1}	1.40×10^{-1}	0.00	6.18×10^{-1}	1.43×10^{-1}	5.31×10^{-11}	6.18×10^{-1}	2.16×10^{-1}	2.44×10^{-6}
Year of peak impact	2028	2028	N/A	2028	2028	2028	2028	2028	2028

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–72. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.42×10^{-7}	1.66×10^{-2}	1.58×10^{-7}	1.42×10^{-7}	2.65×10^{-2}	2.76×10^{-7}	1.42×10^{-7}	4.86×10^{-2}	5.51×10^{-7}
Technetium-99	4.86×10^{-6}	8.51	2.93×10^{-4}	4.86×10^{-6}	2.19×10^{1}	9.60×10^{-4}	4.86×10^{-6}	4.45×10^{1}	2.09×10^{-3}
Iodine-129	8.83×10^{-9}	2.51	2.86×10^{-5}	8.83×10^{-9}	2.92	3.86×10^{-5}	8.83×10^{-9}	3.60	5.56×10^{-5}
Total	5.01×10^{-6}	1.10×10^{1}	3.21×10^{-4}	5.01×10^{-6}	2.48×10^{1}	9.99×10^{-4}	5.01×10^{-6}	4.82×10^{1}	2.15×10^{-3}
Year of peak impact	2034	2034	2034	2034	2034	2034	2034	2034	2034

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.03×10^{-1}	3.84	0.00	4.03×10^{-1}	3.84	1.58×10^{-9}	4.03×10^{-1}	5.62	7.26×10^{-5}
Nitrate	1.09×10^{1}	1.95×10^{-1}	0.00	1.09×10^{1}	2.57×10^{-1}	0.00	1.09×10^{1}	5.05×10^{-1}	0.00
Total	1.13×10^{1}	4.03	0.00	1.13×10^{1}	4.10	1.58×10^{-9}	1.13×10^{1}	6.12	7.26×10^{-5}
Year of peak impact	2258	2258	N/A	2258	2258	2258	2258	2258	2258

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–73. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.40×10^{-7}	2.46×10^{-1}	8.46×10^{-6}	1.40×10^{-7}	6.32×10^{-1}	2.77×10^{-5}	1.40×10^{-7}	1.29	6.05×10^{-5}
Iodine-129	1.29×10^{-10}	3.66×10^{-2}	4.17×10^{-7}	1.29×10^{-10}	4.25×10^{-2}	5.63×10^{-7}	1.29×10^{-10}	5.25×10^{-2}	8.10×10^{-7}
Total	1.41×10^{-7}	2.83×10^{-1}	8.87×10^{-6}	1.41×10^{-7}	6.74×10^{-1}	2.83×10^{-5}	1.41×10^{-7}	1.34	6.13×10^{-5}
Year of peak impact	2480	2480	2480	2480	2480	2480	2480	2480	2480
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.00×10^{-3}	3.81×10^{-2}	0.00	4.00×10^{-3}	3.82×10^{-2}	1.57×10^{-11}	4.00×10^{-3}	5.58×10^{-2}	7.21×10^{-7}
Nitrate	2.23×10^{-1}	3.98×10^{-3}	0.00	2.23×10^{-1}	5.24×10^{-3}	0.00	2.23×10^{-1}	1.03×10^{-2}	0.00
Total	2.27×10^{-1}	4.21×10^{-2}	0.00	2.27×10^{-1}	4.34×10^{-2}	1.57×10^{-11}	2.27×10^{-1}	6.61×10^{-2}	7.21×10^{-7}
Year of peak impact	2190	2190	N/A	2190	2190	2190	2190	2190	2190

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–74. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	7.16×10^{-16}	1.33×10^{-10}	1.39×10^{-15}	1.89×10^{-15}	6.54×10^{-10}	3.72×10^{-15}	2.96×10^{-233}	9.35×10^{-228}	3.74×10^{-17}
Technetium-99	6.22×10^{-12}	2.80×10^{-5}	1.23×10^{-9}	5.80×10^{-12}	6.03×10^{-5}	3.00×10^{-9}	1.02×10^{-8}	1.10×10^{-4}	8.44×10^{-8}
Iodine-129	1.08×10^{-14}	3.58×10^{-6}	4.74×10^{-11}	1.20×10^{-14}	6.46×10^{-5}	1.48×10^{-9}	1.52×10^{-12}	2.62×10^{-6}	5.70×10^{-9}
Uranium-238	0.00	0.00	0.00	0.00	0.00	0.00	6.66×10^{-10}	6.63×10^{-3}	0.00
Total	6.23×10^{-12}	3.15×10^{-5}	1.28×10^{-9}	5.81×10^{-12}	1.25×10^{-4}	4.48×10^{-9}	1.08×10^{-8}	6.74×10^{-3}	9.01×10^{-8}
Year of peak impact	2148	2148	2148	2133	2133	2145	11,147	11,147	2480

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.82×10^{-7}	1.73×10^{-6}	7.23×10^{-16}	1.69×10^{-7}	2.58×10^{-6}	3.32×10^{-11}	4.00×10^{-3}	8.84×10^{-3}	3.61×10^{-7}
Nitrate	9.69×10^{-6}	3.35×10^{-7}	0.00	1.08×10^{-5}	1.02×10^{-3}	0.00	2.23×10^{-1}	1.00×10^{-2}	0.00
Total	9.88×10^{-6}	2.07×10^{-6}	7.23×10^{-16}	1.10×10^{-5}	1.02×10^{-3}	3.32×10^{-11}	2.27×10^{-1}	1.89×10^{-2}	3.61×10^{-7}
Year of peak impact	2182	2182	2186	2157	2157	2186	2190	2190	2190

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–75. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.22×10^{-8}	1.42×10^{-3}	1.35×10^{-8}	1.22×10^{-8}	2.26×10^{-3}	2.36×10^{-8}	1.22×10^{-8}	4.16×10^{-3}	4.71×10^{-8}
Technetium-99	1.45×10^{-6}	2.54	8.72×10^{-5}	1.45×10^{-6}	6.52	2.86×10^{-4}	1.45×10^{-6}	1.33×10^{1}	6.24×10^{-4}
Iodine-129	2.56×10^{-9}	7.30×10^{-1}	8.31×10^{-6}	2.56×10^{-9}	8.47×10^{-1}	1.12×10^{-5}	2.56×10^{-9}	1.05	1.62×10^{-5}
Total	1.46×10^{-6}	3.27	9.56×10^{-5}	1.46×10^{-6}	7.37	2.97×10^{-4}	1.46×10^{-6}	1.43×10^{1}	6.40×10^{-4}
Year of peak impact	2058	2058	2058	2058	2058	2058	2058	2058	2058

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	8.74×10^{-3}	8.32×10^{-2}	0.00	8.74×10^{-3}	8.33×10^{-2}	3.43×10^{-11}	8.74×10^{-3}	1.22×10^{-1}	1.57×10^{-6}
Nitrate	5.65	1.01×10^{-1}	0.00	5.65	1.33×10^{-1}	0.00	5.65	2.61×10^{-1}	0.00
Total	5.66	1.84×10^{-1}	8.57×10^{-14}	5.66	2.16×10^{-1}	3.43×10^{-11}	5.66	3.82×10^{-1}	1.57×10^{-6}
Year of peak impact	2057	2057	11,785	2057	2057	2057	2057	2057	2057

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–76. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	4.42×10^{-7}	5.16×10^{-2}	4.91×10^{-7}	4.42×10^{-7}	8.21×10^{-2}	8.58×10^{-7}	4.42×10^{-7}	1.51×10^{-1}	1.71×10^{-6}
Technetium-99	3.00×10^{-5}	5.25×10^{1}	1.80×10^{-3}	3.00×10^{-5}	1.35×10^{2}	5.92×10^{-3}	3.00×10^{-5}	2.75×10^{2}	1.29×10^{-2}
Iodine-129	3.70×10^{-8}	1.05×10^{1}	1.20×10^{-4}	3.70×10^{-8}	1.22×10^{1}	1.62×10^{-4}	3.70×10^{-8}	1.51×10^{1}	2.33×10^{-4}
Total	3.04×10^{-5}	6.31×10^{1}	1.93×10^{-3}	3.04×10^{-5}	1.47×10^{2}	6.08×10^{-3}	3.04×10^{-5}	2.90×10^{2}	1.31×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.19	3.04×10^{1}	0.00	3.19	3.04×10^{1}	1.27×10^{-8}	3.19	4.45×10^{1}	5.82×10^{-4}
Nitrate	1.54×10^{3}	2.75×10^{1}	0.00	1.54×10^{3}	3.63×10^{1}	0.00	1.54×10^{3}	7.11×10^{1}	0.00
Total	1.55×10^{3}	5.79×10^{1}	0.00	1.55×10^{3}	6.67×10^{1}	1.27×10^{-8}	1.55×10^{3}	1.16×10^{2}	5.82×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2055	2050	2050	2055

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–77. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the S Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	5.21×10^{-8}	6.08×10^{-3}	5.78×10^{-8}	5.21×10^{-8}	9.68×10^{-3}	1.01×10^{-7}	5.21×10^{-8}	1.78×10^{-2}	2.02×10^{-7}
Technetium-99	2.66×10^{-6}	4.66	1.60×10^{-4}	2.66×10^{-6}	1.20×10^{1}	5.26×10^{-4}	2.66×10^{-6}	2.44×10^{1}	1.15×10^{-3}
Iodine-129	5.00×10^{-9}	1.42	1.62×10^{-5}	5.00×10^{-9}	1.65	2.19×10^{-5}	5.00×10^{-9}	2.04	3.15×10^{-5}
Total	2.72×10^{-6}	6.09	1.77×10^{-4}	2.72×10^{-6}	1.36×10^{1}	5.48×10^{-4}	2.72×10^{-6}	2.64×10^{1}	1.18×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.71×10^{-1}	2.58	0.00	2.71×10^{-1}	2.59	1.07×10^{-9}	2.71×10^{-1}	3.78	4.89×10^{-5}
Nitrate	8.95	1.60×10^{-1}	0.00	8.95	2.11×10^{-1}	0.00	8.95	4.13×10^{-1}	0.00
Total	9.23	2.74	0.00	9.23	2.80	1.07×10^{-9}	9.23	4.19	4.89×10^{-5}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–78. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.10×10^{-6}	3.62×10^{-1}	3.44×10^{-6}	3.10×10^{-6}	5.76×10^{-1}	6.02×10^{-6}	3.10×10^{-6}	1.06	1.20×10^{-5}
Technetium-99	1.52×10^{-5}	2.67×10^{1}	9.17×10^{-4}	1.52×10^{-5}	6.85×10^{1}	3.01×10^{-3}	1.52×10^{-5}	1.39×10^{2}	6.56×10^{-3}
Iodine-129	2.96×10^{-8}	8.44	9.61×10^{-5}	2.96×10^{-8}	9.79	1.30×10^{-4}	2.96×10^{-8}	1.21×10^{1}	1.87×10^{-4}
Uranium-238	1.54×10^{-10}	1.91×10^{-2}	2.16×10^{-7}	1.54×10^{-10}	1.99×10^{-2}	2.31×10^{-7}	1.54×10^{-10}	2.13×10^{-2}	2.62×10^{-7}
Total	1.83×10^{-5}	3.55×10^{1}	1.02×10^{-3}	1.83×10^{-5}	7.89×10^{1}	3.14×10^{-3}	1.83×10^{-5}	1.53×10^{2}	6.76×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	7.68×10^{-1}	7.32	0.00	7.63×10^{-1}	7.28	3.02×10^{-9}	7.63×10^{-1}	1.06×10^{1}	1.38×10^{-4}
Nitrate	1.29×10^{2}	2.31	0.00	1.32×10^{2}	3.09	0.00	1.32×10^{2}	6.07	0.00
Total uranium	1.85×10^{-4}	1.76×10^{-3}	0.00	1.73×10^{-4}	1.66×10^{-3}	0.00	1.73×10^{-4}	1.72×10^{-3}	0.00
Total	1.30×10^{2}	9.63	0.00	1.32×10^{2}	1.04×10^{1}	3.02×10^{-9}	1.32×10^{2}	1.67×10^{1}	1.38×10^{-4}
Year of peak impact	2050	2050	N/A	2051	2051	2050	2051	2051	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–79. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	0.00	0.00	1.71×10^{-5}	2.84×10^{-7}	1.28	5.60×10^{-5}	2.84×10^{-7}	2.60	1.22×10^{-4}
Iodine-129	7.66×10^{-12}	2.18×10^{-3}	8.62×10^{-7}	2.66×10^{-10}	8.79×10^{-2}	1.16×10^{-6}	2.66×10^{-10}	1.09×10^{-1}	1.67×10^{-6}
Uranium-238	8.38×10^{-9}	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	8.39×10^{-9}	1.04	1.79×10^{-5}	2.84×10^{-7}	1.36	5.72×10^{-5}	2.84×10^{-7}	2.71	1.24×10^{-4}
Year of peak impact	11,441	11,441	3499	3499	3499	3499	3499	3499	3499
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	0.00	0.00	0.00	0.00	0.00	3.91×10^{-11}	8.64×10^{-3}	1.20×10^{-1}	1.79×10^{-6}
Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	1.37	6.33×10^{-2}	0.00
Total uranium	1.24×10^{-2}	1.18×10^{-1}	0.00	1.24×10^{-2}	1.19×10^{-1}	0.00	0.00	0.00	0.00
Total	1.24×10^{-2}	1.18×10^{-1}	0.00	1.24×10^{-2}	1.19×10^{-1}	3.91×10^{-11}	1.38	1.84×10^{-1}	1.79×10^{-6}
Year of peak impact	11,599	11,599	N/A	11,599	11,599	2050	2060	2060	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–80. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.12×10^{-6}	2.48×10^{-1}	2.36×10^{-6}	2.12×10^{-6}	3.95×10^{-1}	4.12×10^{-6}	2.12×10^{-6}	7.25×10^{-1}	8.22×10^{-6}
Technetium-99	2.59×10^{-5}	4.54×10^{1}	1.56×10^{-3}	2.59×10^{-5}	1.16×10^{2}	5.11×10^{-3}	2.59×10^{-5}	2.37×10^{2}	1.12×10^{-2}
Iodine-129	3.00×10^{-8}	8.55	9.73×10^{-5}	3.00×10^{-8}	9.92	1.31×10^{-4}	3.00×10^{-8}	1.23×10^{1}	1.89×10^{-4}
Total	2.80×10^{-5}	5.42×10^{1}	1.66×10^{-3}	2.80×10^{-5}	1.27×10^{2}	5.25×10^{-3}	2.80×10^{-5}	2.50×10^{2}	1.14×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.67	1.59×10^{1}	0.00	1.67	1.59×10^{1}	6.55×10^{-9}	1.67	2.32×10^{1}	3.00×10^{-4}
Nitrate	1.01×10^{3}	1.80×10^{1}	0.00	1.01×10^{3}	2.38×10^{1}	0.00	1.01×10^{3}	4.66×10^{1}	0.00
Total	1.01×10^{3}	3.39×10^{1}	3.26×10^{-14}	1.01×10^{3}	3.96×10^{1}	6.55×10^{-9}	1.01×10^{3}	6.98×10^{1}	3.00×10^{-4}
Year of peak impact	2050	2050	11,815	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–81. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.01×10^{-7}	3.53×10^{-1}	1.23×10^{-5}	2.01×10^{-7}	9.06×10^{-1}	4.04×10^{-5}	2.05×10^{-7}	1.87	8.81×10^{-5}
Iodine-129	2.62×10^{-10}	7.46×10^{-2}	7.11×10^{-7}	2.62×10^{-10}	8.66×10^{-2}	9.60×10^{-7}	2.19×10^{-10}	8.96×10^{-2}	1.38×10^{-6}
Uranium-238	5.36×10^{-13}	6.65×10^{-5}	7.50×10^{-10}	5.36×10^{-13}	6.90×10^{-5}	8.04×10^{-10}	5.35×10^{-13}	7.39×10^{-5}	9.09×10^{-10}
Total	2.02×10^{-7}	4.28×10^{-1}	1.30×10^{-5}	2.02×10^{-7}	9.93×10^{-1}	4.14×10^{-5}	2.05×10^{-7}	1.96	8.95×10^{-5}
Year of peak impact	2541	2541	2480	2541	2541	2480	2480	2480	2480

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.43×10^{-2}	3.26×10^{-1}	0.00	3.43×10^{-2}	3.27×10^{-1}	1.35×10^{-10}	3.43×10^{-2}	4.77×10^{-1}	6.17×10^{-6}
Nitrate	6.10	1.09×10^{-1}	0.00	6.10	1.43×10^{-1}	0.00	6.10	2.81×10^{-1}	0.00
Total	6.13	4.35×10^{-1}	1.07×10^{-15}	6.13	4.70×10^{-1}	1.35×10^{-10}	6.13	7.58×10^{-1}	6.17×10^{-6}
Year of peak impact	2695	2695	11,691	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–82. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Hunter-Gatherer: Dose at Year of Peak Dose (millirem per year)	American Indian Hunter-Gatherer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.70×10^{-14}	1.06×10^{-8}	1.11×10^{-13}	5.70×10^{-14}	1.97×10^{-8}	2.24×10^{-13}	1.78×10^{-7}	5.61×10^{-2}	6.89×10^{-7}
Technetium-99	7.64×10^{-12}	3.44×10^{-5}	1.51×10^{-9}	7.64×10^{-12}	7.94×10^{-5}	3.76×10^{-9}	5.08×10^{-8}	5.74×10^{-4}	3.13×10^{-8}
Iodine-129	1.38×10^{-14}	4.56×10^{-6}	6.04×10^{-11}	1.38×10^{-14}	7.43×10^{-5}	1.79×10^{-9}	7.22×10^{-11}	1.75×10^{-4}	4.28×10^{-9}
Total	7.71×10^{-12}	3.89×10^{-5}	1.57×10^{-9}	7.71×10^{-12}	1.54×10^{-4}	5.55×10^{-9}	2.29×10^{-7}	5.69×10^{-2}	7.24×10^{-7}
Year of peak impact	2145	2145	2145	2145	2145	2145	2050	2050	2050

Chemical Constituent	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Hunter-Gatherer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Hunter-Gatherer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.41×10^{-7}	8.97×10^{-6}	3.96×10^{-15}	9.41×10^{-7}	1.44×10^{-5}	1.82×10^{-10}	2.33×10^{-2}	5.15×10^{-2}	3.09×10^{-6}
Nitrate	2.94×10^{-4}	1.02×10^{-5}	0.00	2.94×10^{-4}	2.77×10^{-2}	0.00	8.58	3.32×10^{-1}	0.00
Total uranium	0.00	0.00	0.00	0.00	0.00	0.00	4.20×10^{-12}	1.14×10^{-10}	0.00
Total	2.95×10^{-4}	1.91×10^{-5}	3.96×10^{-15}	2.95×10^{-4}	2.77×10^{-2}	1.82×10^{-10}	8.60	3.84×10^{-1}	3.09×10^{-6}
Year of peak impact	2067	2067	2066	2067	2067	2066	2450	2450	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figure Q–4 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, other sources, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2030 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from all three sources occurs around the year 2050 and is dominated by tritium, technetium-99, and iodine-129. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

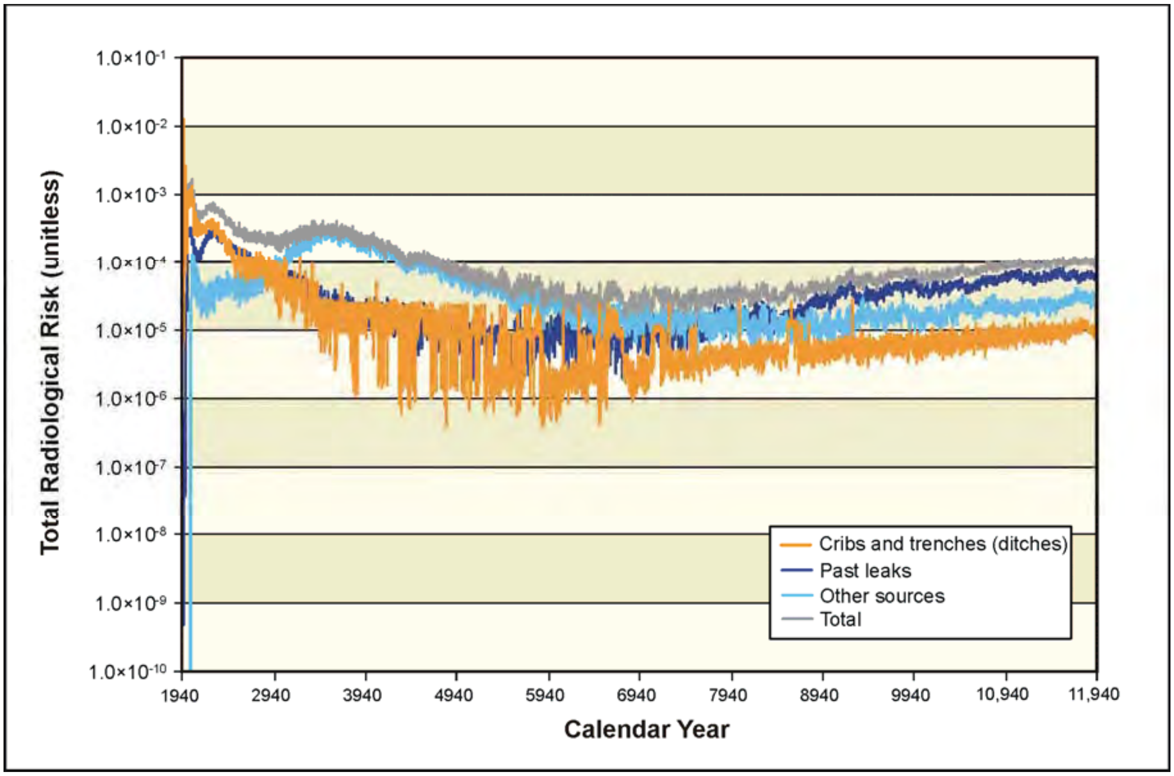

Figure Q–4. Tank Closure Alternatives 2B, 3A, 3B, 3C, and 6C Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.1.1.4 Tank Closure Alternative 4

Under Tank Closure Alternative 4, tank waste would be retrieved to a volume corresponding to 99.9 percent retrieval. Except for the BX and SX tank farms, residual material in tanks would be stabilized in place and the tank farms and adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier. The BX and SX tank farms would be clean closed by removing the tanks, ancillary equipment, and soils to a depth of 3 meters (10 feet) below the tank base. Where necessary, deep soil excavation would also be conducted to remove contamination plumes within the soil column.

Potential human health impacts of this alternative related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–83 through Q–87. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–88 through Q–95. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–96 through Q–103.

Table Q–83. Tank Closure Alternative 4 Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.08×10^{1}	4.84×10^{2}	0.00	5.08×10^{1}	4.85×10^{2}	2.00×10^{-7}	5.08×10^{1}	7.08×10^{2}	9.16×10^{-3}
Nitrate	1.74×10^{4}	3.11×10^{2}	0.00	1.74×10^{4}	4.10×10^{2}	0.00	1.74×10^{4}	8.03×10^{2}	0.00
Total	1.75×10^{4}	7.95×10^{2}	0.00	1.75×10^{4}	8.94×10^{2}	2.00×10^{-7}	1.75×10^{4}	1.51×10^{3}	9.16×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–84. Tank Closure Alternative 4 Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.84×10^{-2}
Technetium-99	1.35×10^{-7}	2.36×10^{-1}	8.12×10^{-6}	1.35×10^{-7}	6.07×10^{-1}	2.66×10^{-5}	1.35×10^{-7}	1.24	5.81×10^{-5}
Iodine-129	1.14×10^{-9}	3.25×10^{-1}	3.71×10^{-6}	1.14×10^{-9}	3.78×10^{-1}	5.00×10^{-6}	1.14×10^{-9}	4.67×10^{-1}	7.20×10^{-6}
Uranium-238	1.18×10^{-11}	1.46×10^{-3}	1.65×10^{-8}	1.18×10^{-11}	1.52×10^{-3}	1.77×10^{-8}	1.18×10^{-11}	1.62×10^{-3}	2.00×10^{-8}
Total	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.85×10^{-2}
Year of peak impact	1974	1974	1974	1974	1974	1974	1974	1974	1974

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.32	8.88×10^{1}	0.00	9.32	8.89×10^{1}	3.66×10^{-8}	9.32	1.30×10^{2}	1.68×10^{-3}
Nitrate	2.11×10^{3}	3.77×10^{1}	0.00	2.11×10^{3}	4.97×10^{1}	0.00	2.11×10^{3}	9.74×10^{1}	0.00
Total	2.12×10^{3}	1.27×10^{2}	0.00	2.12×10^{3}	1.39×10^{2}	3.66×10^{-8}	2.12×10^{3}	2.27×10^{2}	1.68×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–85. Tank Closure Alternative 4 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.80×10^{1}	2.67×10^{2}	0.00	2.80×10^{1}	2.67×10^{2}	1.10×10^{-7}	2.80×10^{1}	3.91×10^{2}	5.05×10^{-3}
Nitrate	1.29×10^{4}	2.30×10^{2}	0.00	1.29×10^{4}	3.03×10^{2}	0.00	1.29×10^{4}	5.95×10^{2}	0.00
Total	1.29×10^{4}	4.97×10^{2}	0.00	1.29×10^{4}	5.70×10^{2}	1.10×10^{-7}	1.29×10^{4}	9.85×10^{2}	5.05×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–86. Tank Closure Alternative 4 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.46×10^{-7}	4.04×10^{-2}	3.84×10^{-7}	3.46×10^{-7}	6.43×10^{-2}	6.72×10^{-7}	3.46×10^{-7}	1.18×10^{-1}	1.34×10^{-6}
Technetium-99	8.94×10^{-8}	1.57×10^{-1}	5.38×10^{-6}	8.94×10^{-8}	4.02×10^{-1}	1.77×10^{-5}	8.94×10^{-8}	8.19×10^{-1}	3.85×10^{-5}
Iodine-129	3.88×10^{-11}	1.10×10^{-2}	1.26×10^{-7}	3.88×10^{-11}	1.28×10^{-2}	1.70×10^{-7}	3.88×10^{-11}	1.58×10^{-2}	2.44×10^{-7}
Total	4.35×10^{-7}	2.08×10^{-1}	5.89×10^{-6}	4.35×10^{-7}	4.79×10^{-1}	1.85×10^{-5}	4.35×10^{-7}	9.53×10^{-1}	4.01×10^{-5}
Year of peak impact	2025	2025	2025	2025	2025	2025	2025	2025	2025

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.14×10^{-2}	2.99×10^{-1}	0.00	3.14×10^{-2}	2.99×10^{-1}	1.23×10^{-10}	3.14×10^{-2}	4.37×10^{-1}	5.66×10^{-6}
Nitrate	5.75	1.03×10^{-1}	0.00	5.75	1.35×10^{-1}	0.00	5.75	2.65×10^{-1}	0.00
Total	5.78	4.02×10^{-1}	0.00	5.78	4.35×10^{-1}	1.23×10^{-10}	5.78	7.03×10^{-1}	5.66×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–87. Tank Closure Alternative 4 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.56×10^{-10}	6.62×10^{-5}	6.92×10^{-10}	3.56×10^{-10}	1.23×10^{-4}	1.40×10^{-9}	1.28×10^{-6}	4.04×10^{-1}	4.96×10^{-6}
Technetium-99	2.53×10^{-11}	1.14×10^{-4}	4.99×10^{-9}	2.53×10^{-11}	2.63×10^{-4}	1.24×10^{-8}	2.55×10^{-8}	2.99×10^{-4}	1.62×10^{-8}
Iodine-129	3.20×10^{-14}	1.06×10^{-5}	1.41×10^{-10}	3.20×10^{-14}	1.73×10^{-4}	4.16×10^{-9}	3.57×10^{-11}	1.09×10^{-4}	2.65×10^{-9}
Total	3.82×10^{-10}	1.91×10^{-4}	5.83×10^{-9}	3.82×10^{-10}	5.59×10^{-4}	1.80×10^{-8}	1.31×10^{-6}	4.04×10^{-1}	4.97×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1994	1994	1994
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.95×10^{-6}	8.53×10^{-5}	3.52×10^{-14}	8.95×10^{-6}	1.37×10^{-4}	1.61×10^{-9}	2.24×10^{-2}	4.97×10^{-2}	2.83×10^{-6}
Nitrate	2.24×10^{-3}	7.74×10^{-5}	0.00	2.24×10^{-3}	2.11×10^{-1}	0.00	4.36	6.64×10^{-1}	0.00
Total	2.25×10^{-3}	1.63×10^{-4}	3.52×10^{-14}	2.25×10^{-3}	2.11×10^{-1}	1.61×10^{-9}	4.38	7.14×10^{-1}	2.83×10^{-6}
Year of peak impact	1984	1984	1984	1984	1984	1984	1984	1984	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–88. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.63×10^{-6}	4.24×10^{-1}	4.03×10^{-6}	3.63×10^{-6}	6.75×10^{-1}	7.06×10^{-6}	3.63×10^{-6}	1.24	1.41×10^{-5}
Technetium-99	1.16×10^{-5}	2.03×10^{1}	6.99×10^{-4}	1.16×10^{-5}	5.22×10^{1}	2.29×10^{-3}	1.16×10^{-5}	1.06×10^{2}	5.00×10^{-3}
Iodine-129	2.36×10^{-8}	6.72	7.65×10^{-5}	2.36×10^{-8}	7.80	1.03×10^{-4}	2.36×10^{-8}	9.64	1.49×10^{-4}
Total	1.53×10^{-5}	2.75×10^{1}	7.79×10^{-4}	1.53×10^{-5}	6.07×10^{1}	2.40×10^{-3}	1.53×10^{-5}	1.17×10^{2}	5.16×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	6.06×10^{-2}	5.77×10^{-1}	0.00	6.06×10^{-2}	5.78×10^{-1}	2.38×10^{-10}	6.06×10^{-2}	8.45×10^{-1}	1.09×10^{-5}
Nitrate	4.17	7.45×10^{-2}	0.00	4.17	9.81×10^{-2}	0.00	4.17	1.92×10^{-1}	0.00
Total	4.23	6.52×10^{-1}	0.00	4.23	6.76×10^{-1}	2.38×10^{-10}	4.23	1.04	1.09×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–89. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	7.77×10^{-8}	9.08×10^{-3}	8.63×10^{-8}	7.77×10^{-8}	1.44×10^{-2}	1.51×10^{-7}	7.77×10^{-8}	2.66×10^{-2}	3.01×10^{-7}
Technetium-99	7.66×10^{-6}	1.34×10^{1}	4.61×10^{-4}	7.66×10^{-6}	3.44×10^{1}	1.51×10^{-3}	7.66×10^{-6}	7.02×10^{1}	3.30×10^{-3}
Iodine-129	1.41×10^{-8}	4.02	4.58×10^{-5}	1.41×10^{-8}	4.67	6.18×10^{-5}	1.41×10^{-8}	5.76	8.89×10^{-5}
Total	7.75×10^{-6}	1.74×10^{1}	5.07×10^{-4}	7.75×10^{-6}	3.91×10^{1}	1.57×10^{-3}	7.75×10^{-6}	7.60×10^{1}	3.39×10^{-3}
Year of peak impact	2044	2044	2044	2044	2044	2044	2044	2044	2044
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.62×10^{-2}	8.21×10^{-1}	0.00	8.62×10^{-2}	8.22×10^{-1}	3.39×10^{-10}	8.02×10^{-2}	1.12	1.55×10^{-5}
Nitrate	1.51×10^{1}	2.70×10^{-1}	0.00	1.51×10^{1}	3.55×10^{-1}	0.00	1.75×10^{1}	8.06×10^{-1}	0.00
Total	1.52×10^{1}	1.09	0.00	1.52×10^{1}	1.18	3.39×10^{-10}	1.76×10^{1}	1.92	1.55×10^{-5}
Year of peak impact	2043	2043	N/A	2043	2043	2043	2038	2038	2043

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–90. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.60×10^{-7}	4.21×10^{-2}	4.23×10^{-7}	3.60×10^{-7}	6.70×10^{-2}	7.40×10^{-7}	3.81×10^{-7}	1.30×10^{-1}	1.48×10^{-6}
Technetium-99	3.81×10^{-6}	6.67	2.31×10^{-4}	3.81×10^{-6}	1.71×10^{1}	7.58×10^{-4}	3.84×10^{-6}	3.52×10^{1}	1.65×10^{-3}
Iodine-129	7.75×10^{-9}	2.21	2.35×10^{-5}	7.75×10^{-9}	2.56	3.18×10^{-5}	7.26×10^{-9}	2.96	4.57×10^{-5}
Total	4.17×10^{-6}	8.92	2.55×10^{-4}	4.17×10^{-6}	1.98×10^{1}	7.90×10^{-4}	4.22×10^{-6}	3.83×10^{1}	1.70×10^{-3}
Year of peak impact	2026	2026	2022	2026	2026	2022	2022	2022	2022
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.97×10^{-1}	3.78	0.00	3.97×10^{-1}	3.78	1.56×10^{-9}	3.97×10^{-1}	5.53	7.15×10^{-5}
Nitrate	1.20×10^{1}	2.14×10^{-1}	0.00	1.20×10^{1}	2.81×10^{-1}	0.00	1.20×10^{1}	5.52×10^{-1}	0.00
Total	1.24×10^{1}	3.99	0.00	1.24×10^{1}	4.06	1.56×10^{-9}	1.24×10^{1}	6.08	7.15×10^{-5}
Year of peak impact	2030	2030	N/A	2030	2030	2030	2030	2030	2030

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–91. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.31×10^{-6}	3.87×10^{-1}	2.93×10^{-6}	3.31×10^{-6}	6.16×10^{-1}	5.12×10^{-6}	3.31×10^{-6}	1.13	1.02×10^{-5}
Technetium-99	2.26×10^{-5}	3.96×10^{1}	1.36×10^{-3}	2.26×10^{-5}	1.02×10^{2}	4.47×10^{-3}	2.26×10^{-5}	2.07×10^{2}	9.75×10^{-3}
Iodine-129	4.48×10^{-8}	1.27×10^{1}	1.44×10^{-4}	4.48×10^{-8}	1.48×10^{1}	1.94×10^{-4}	4.48×10^{-8}	1.83×10^{1}	2.79×10^{-4}
Total	2.59×10^{-5}	5.27×10^{1}	1.51×10^{-3}	2.59×10^{-5}	1.17×10^{2}	4.67×10^{-3}	2.59×10^{-5}	2.26×10^{2}	1.00×10^{-2}
Year of peak impact	2027	2027	2029	2027	2027	2029	2027	2027	2029
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.28×10^{-1}	5.03	0.00	5.28×10^{-1}	5.04	2.07×10^{-9}	5.28×10^{-1}	7.36	9.52×10^{-5}
Nitrate	4.01×10^{1}	7.16×10^{-1}	0.00	4.01×10^{1}	9.42×10^{-1}	0.00	4.01×10^{1}	1.85	0.00
Total	4.06×10^{1}	5.75	0.00	4.06×10^{1}	5.98	2.07×10^{-9}	4.06×10^{1}	9.21	9.52×10^{-5}
Year of peak impact	2027	2027	N/A	2027	2027	2027	2027	2027	2027

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–92. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	0.00	0.00	0.00	0.00	0.00	2.37×10^{-8}	1.22×10^{-8}	4.17×10^{-3}	4.73×10^{-8}
Technetium-99	0.00	0.00	0.00	0.00	0.00	2.84×10^{-5}	1.44×10^{-7}	1.32	6.20×10^{-5}
Iodine-129	0.00	0.00	0.00	0.00	0.00	1.20×10^{-6}	2.74×10^{-10}	1.12×10^{-1}	1.72×10^{-6}
Uranium-238	7.98×10^{-9}	9.90×10^{-1}	1.12×10^{-5}	7.98×10^{-9}	1.03	0.00	0.00	0.00	0.00
Total	7.98×10^{-9}	9.90×10^{-1}	1.12×10^{-5}	7.98×10^{-9}	1.03	2.97×10^{-5}	1.56×10^{-7}	1.44	6.38×10^{-5}
Year of peak impact	11,441	11,441	11,441	11,441	11,441	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.35×10^{-2}	1.29×10^{-1}	0.00	1.35×10^{-2}	1.29×10^{-1}	5.31×10^{-11}	1.35×10^{-2}	1.88×10^{-1}	2.44×10^{-6}
Nitrate	6.05×10^{-1}	1.08×10^{-2}	0.00	6.05×10^{-1}	1.42×10^{-2}	0.00	6.05×10^{-1}	2.79×10^{-2}	0.00
Total	6.18×10^{-1}	1.40×10^{-1}	0.00	6.18×10^{-1}	1.43×10^{-1}	5.31×10^{-11}	6.18×10^{-1}	2.16×10^{-1}	2.44×10^{-6}
Year of peak impact	2028	2028	N/A	2028	2028	2028	2028	2028	2028

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–93. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.42×10^{-7}	1.66×10^{-2}	1.58×10^{-7}	1.42×10^{-7}	2.64×10^{-2}	2.76×10^{-7}	1.42×10^{-7}	4.86×10^{-2}	5.51×10^{-7}
Technetium-99	4.95×10^{-6}	8.67	2.98×10^{-4}	4.95×10^{-6}	2.23×10^{1}	9.78×10^{-4}	4.95×10^{-6}	4.54×10^{1}	2.13×10^{-3}
Iodine-129	8.68×10^{-9}	2.47	2.81×10^{-5}	8.68×10^{-9}	2.87	3.80×10^{-5}	8.68×10^{-9}	3.54	5.47×10^{-5}
Total	5.10×10^{-6}	1.12×10^{1}	3.26×10^{-4}	5.10×10^{-6}	2.52×10^{1}	1.02×10^{-3}	5.10×10^{-6}	4.90×10^{1}	2.19×10^{-3}
Year of peak impact	2034	2034	2034	2034	2034	2034	2034	2034	2034
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.55×10^{-1}	2.43	0.00	2.55×10^{-1}	2.43	1.00×10^{-9}	2.55×10^{-1}	3.55	4.59×10^{-5}
Nitrate	7.52	1.34×10^{-1}	0.00	7.52	1.77×10^{-1}	0.00	7.52	3.47×10^{-1}	0.00
Total	7.77	2.56	0.00	7.77	2.61	1.00×10^{-9}	7.77	3.90	4.59×10^{-5}
Year of peak impact	2197	2197	N/A	2197	2197	2197	2197	2197	2197

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–94. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	6.68×10^{-12}	7.80×10^{-7}	7.42×10^{-12}	6.68×10^{-12}	1.24×10^{-6}	1.91×10^{-19}	9.81×10^{-20}	3.35×10^{-14}	3.80×10^{-19}
Technetium-99	1.30×10^{-7}	2.28×10^{-1}	7.85×10^{-6}	1.30×10^{-7}	5.86×10^{-1}	2.63×10^{-5}	1.33×10^{-7}	1.22	5.73×10^{-5}
Iodine-129	1.77×10^{-10}	5.04×10^{-2}	5.74×10^{-7}	1.77×10^{-10}	5.85×10^{-2}	5.31×10^{-7}	1.21×10^{-10}	4.95×10^{-2}	7.64×10^{-7}
Total	1.31×10^{-7}	2.79×10^{-1}	8.42×10^{-6}	1.31×10^{-7}	6.45×10^{-1}	2.68×10^{-5}	1.33×10^{-7}	1.27	5.81×10^{-5}
Year of peak impact	2165	2165	2165	2165	2165	2480	2480	2480	2480
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.31×10^{-3}	3.16×10^{-2}	0.00	3.31×10^{-3}	3.16×10^{-2}	1.30×10^{-11}	3.31×10^{-3}	4.62×10^{-2}	5.97×10^{-7}
Nitrate	1.66×10^{-1}	2.96×10^{-3}	0.00	1.66×10^{-1}	3.90×10^{-3}	0.00	1.66×10^{-1}	7.65×10^{-3}	0.00
Total	1.69×10^{-1}	3.45×10^{-2}	0.00	1.69×10^{-1}	3.55×10^{-2}	1.30×10^{-11}	1.69×10^{-1}	5.38×10^{-2}	5.97×10^{-7}
Year of peak impact	2382	2382	N/A	2382	2382	2382	2382	2382	2382

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–95. Tank Closure Alternative 4 Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	7.15×10^{-16}	1.33×10^{-10}	1.39×10^{-15}	3.12×10^{-15}	1.08×10^{-9}	2.12×10^{-14}	1.63×10^{-19}	4.00×10^{-14}	2.59×10^{-11}
Technetium-99	6.07×10^{-12}	2.73×10^{-5}	1.20×10^{-9}	5.92×10^{-12}	6.15×10^{-5}	2.95×10^{-9}	6.44×10^{-9}	7.00×10^{-5}	7.95×10^{-8}
Iodine-129	1.06×10^{-14}	3.52×10^{-6}	4.67×10^{-11}	1.15×10^{-14}	6.20×10^{-5}	1.46×10^{-9}	1.93×10^{-12}	3.13×10^{-6}	9.37×10^{-9}
Uranium-238	0.00	0.00	0.00	0.00	0.00	0.00	6.13×10^{-10}	6.10×10^{-3}	0.00
Total	6.08×10^{-12}	3.08×10^{-5}	1.25×10^{-9}	5.93×10^{-12}	1.23×10^{-4}	4.41×10^{-9}	7.05×10^{-9}	6.17×10^{-3}	8.89×10^{-8}
Year of peak impact	2148	2148	2148	2121	2121	2113	11,147	11,147	2165
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.59×10^{-7}	1.51×10^{-6}	6.26×10^{-16}	1.47×10^{-7}	2.24×10^{-6}	2.87×10^{-11}	2.75×10^{-3}	6.08×10^{-3}	2.99×10^{-7}
Nitrate	9.76×10^{-6}	3.37×10^{-7}	0.00	1.04×10^{-5}	9.77×10^{-4}	0.00	2.16×10^{-1}	9.57×10^{-3}	0.00
Total	9.92×10^{-6}	1.85×10^{-6}	6.26×10^{-16}	1.05×10^{-5}	9.79×10^{-4}	2.87×10^{-11}	2.18×10^{-1}	1.56×10^{-2}	2.99×10^{-7}
Year of peak impact	2154	2154	2145	2148	2148	2145	2190	2190	2382

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–96. Tank Closure Alternative 4 Human Health Impacts at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.22×10^{-8}	1.42×10^{-3}	1.35×10^{-8}	1.22×10^{-8}	2.26×10^{-3}	2.36×10^{-8}	1.22×10^{-8}	4.16×10^{-3}	4.71×10^{-8}
Technetium-99	1.46×10^{-6}	2.55	8.78×10^{-5}	1.46×10^{-6}	6.55	2.88×10^{-4}	1.46×10^{-6}	1.34×10^{1}	6.28×10^{-4}
Iodine-129	2.56×10^{-9}	7.29×10^{-1}	8.30×10^{-6}	2.56×10^{-9}	8.47×10^{-1}	1.12×10^{-5}	2.56×10^{-9}	1.05	1.61×10^{-5}
Total	1.47×10^{-6}	3.28	9.61×10^{-5}	1.47×10^{-6}	7.40	2.99×10^{-4}	1.47×10^{-6}	1.44×10^{1}	6.44×10^{-4}
Year of peak impact	2058	2058	2058	2058	2058	2058	2058	2058	2058
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.84×10^{-3}	8.42×10^{-2}	0.00	8.84×10^{-3}	8.43×10^{-2}	3.47×10^{-11}	8.21×10^{-3}	1.14×10^{-1}	1.59×10^{-6}
Nitrate	5.29	9.45×10^{-2}	0.00	5.29	1.24×10^{-1}	0.00	5.53	2.55×10^{-1}	0.00
Total	5.30	1.79×10^{-1}	0.00	5.30	2.09×10^{-1}	3.47×10^{-11}	5.54	3.70×10^{-1}	1.59×10^{-6}
Year of peak impact	2057	2057	N/A	2057	2057	2057	2056	2056	2057

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–97. Tank Closure Alternative 4 Human Health Impacts at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	4.33×10^{-7}	5.06×10^{-2}	4.81×10^{-7}	4.33×10^{-7}	8.05×10^{-2}	8.41×10^{-7}	4.33×10^{-7}	1.48×10^{-1}	1.68×10^{-6}
Technetium-99	2.82×10^{-5}	4.93×10^{1}	1.70×10^{-3}	2.82×10^{-5}	1.27×10^{2}	5.56×10^{-3}	2.82×10^{-5}	2.58×10^{2}	1.21×10^{-2}
Iodine-129	3.43×10^{-8}	9.78	1.11×10^{-4}	3.43×10^{-8}	1.14×10^{1}	1.50×10^{-4}	3.43×10^{-8}	1.40×10^{1}	2.16×10^{-4}
Total	2.86×10^{-5}	5.92×10^{1}	1.81×10^{-3}	2.86×10^{-5}	1.38×10^{2}	5.71×10^{-3}	2.86×10^{-5}	2.72×10^{2}	1.24×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.17	3.02×10^{1}	0.00	3.17	3.02×10^{1}	1.26×10^{-8}	3.17	4.42×10^{1}	5.80×10^{-4}
Nitrate	1.54×10^{3}	2.75×10^{1}	0.00	1.54×10^{3}	3.61×10^{1}	0.00	1.54×10^{3}	7.09×10^{1}	0.00
Total	1.54×10^{3}	5.77×10^{1}	0.00	1.54×10^{3}	6.64×10^{1}	1.26×10^{-8}	1.54×10^{3}	1.15×10^{2}	5.80×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2055	2050	2050	2055

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–98. Tank Closure Alternative 4 Human Health Impacts at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.80×10^{-9}	4.44×10^{-4}	4.22×10^{-9}	3.80×10^{-9}	7.07×10^{-4}	7.39×10^{-9}	3.80×10^{-9}	1.30×10^{-3}	1.47×10^{-8}
Technetium-99	2.14×10^{-7}	3.74×10^{-1}	1.29×10^{-5}	2.14×10^{-7}	9.61×10^{-1}	4.22×10^{-5}	2.14×10^{-7}	1.96	9.20×10^{-5}
Iodine-129	3.58×10^{-10}	1.02×10^{-1}	1.16×10^{-6}	3.58×10^{-10}	1.18×10^{-1}	1.57×10^{-6}	3.58×10^{-10}	1.46×10^{-1}	2.25×10^{-6}
Total	2.18×10^{-7}	4.77×10^{-1}	1.40×10^{-5}	2.18×10^{-7}	1.08	4.38×10^{-5}	2.18×10^{-7}	2.10	9.43×10^{-5}
Year of peak impact	2060	2060	2060	2060	2060	2060	2060	2060	2060

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.56×10^{-2}	3.39×10^{-1}	0.00	3.56×10^{-2}	3.39×10^{-1}	1.40×10^{-10}	3.56×10^{-2}	4.95×10^{-1}	6.41×10^{-6}
Nitrate	1.24	2.21×10^{-2}	0.00	1.24	2.91×10^{-2}	0.00	1.24	5.71×10^{-2}	0.00
Total	1.27	3.61×10^{-1}	0.00	1.27	3.68×10^{-1}	1.40×10^{-10}	1.27	5.52×10^{-1}	6.41×10^{-6}
Year of peak impact	2057	2057	N/A	2057	2057	2057	2057	2057	2057

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–99. Tank Closure Alternative 4 Human Health Impacts at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.10×10^{-6}	3.62×10^{-1}	3.44×10^{-6}	3.10×10^{-6}	5.76×10^{-1}	6.02×10^{-6}	3.10×10^{-6}	1.06	1.20×10^{-5}
Technetium-99	1.52×10^{-5}	2.67×10^{1}	9.18×10^{-4}	1.52×10^{-5}	6.86×10^{1}	3.01×10^{-3}	1.52×10^{-5}	1.40×10^{2}	6.57×10^{-3}
Iodine-129	2.96×10^{-8}	8.43	9.60×10^{-5}	2.96×10^{-8}	9.79	1.30×10^{-4}	2.96×10^{-8}	1.21×10^{1}	1.87×10^{-4}
Uranium-238	1.54×10^{-10}	1.91×10^{-2}	2.16×10^{-7}	1.54×10^{-10}	1.99×10^{-2}	2.31×10^{-7}	1.54×10^{-10}	2.13×10^{-2}	2.62×10^{-7}
Total	1.84×10^{-5}	3.55×10^{1}	1.02×10^{-3}	1.84×10^{-5}	7.90×10^{1}	3.15×10^{-3}	1.84×10^{-5}	1.53×10^{2}	6.77×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	7.64×10^{-1}	7.28	0.00	7.64×10^{-1}	7.28	3.02×10^{-9}	7.64×10^{-1}	1.06×10^{1}	1.38×10^{-4}
Nitrate	1.32×10^{2}	2.35	0.00	1.32×10^{2}	3.09	0.00	1.32×10^{2}	6.07	0.00
Total uranium	1.73×10^{-4}	1.64×10^{-3}	0.00	1.73×10^{-4}	1.66×10^{-3}	0.00	1.73×10^{-4}	1.72×10^{-3}	0.00
Total	1.32×10^{2}	9.63	0.00	1.32×10^{2}	1.04×10^{1}	3.02×10^{-9}	1.32×10^{2}	1.67×10^{1}	1.38×10^{-4}
Year of peak impact	2051	2051	N/A	2051	2051	2050	2051	2051	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–100. Tank Closure Alternative 4 Human Health Impacts at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	0.00	0.00	9.73×10^{-9}	0.00	0.00	1.70×10^{-8}	8.76×10^{-9}	2.99×10^{-3}	3.39×10^{-8}
Technetium-99	0.00	0.00	1.08×10^{-5}	0.00	0.00	3.55×10^{-5}	1.80×10^{-7}	1.65	7.75×10^{-5}
Iodine-129	0.00	0.00	9.26×10^{-7}	0.00	0.00	1.25×10^{-6}	2.86×10^{-10}	1.17×10^{-1}	1.80×10^{-6}
Uranium-238	8.22×10^{-9}	1.02	0.00	8.22×10^{-9}	1.06	0.00	0.00	0.00	0.00
Total	8.22×10^{-9}	1.02	1.18×10^{-5}	8.22×10^{-9}	1.06	3.68×10^{-5}	1.89×10^{-7}	1.77	7.93×10^{-5}
Year of peak impact	11,441	11,441	2060	11,441	11,441	2060	2060	2060	2060

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	0.00	0.00	0.00	9.57×10^{-3}	9.12×10^{-2}	3.87×10^{-11}	9.57×10^{-3}	1.33×10^{-1}	1.78×10^{-6}
Nitrate	0.00	0.00	0.00	1.13	2.66×10^{-2}	0.00	1.13	5.21×10^{-2}	0.00
Total uranium	1.20×10^{-2}	1.15×10^{-1}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.20×10^{-2}	1.15×10^{-1}	0.00	1.14	1.18×10^{-1}	3.87×10^{-11}	1.14	1.85×10^{-1}	1.78×10^{-6}
Year of peak impact	11,599	11,599	N/A	2059	2059	2050	2059	2059	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–101. Tank Closure Alternative 4 Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.11×10^{-6}	2.47×10^{-1}	2.35×10^{-6}	2.11×10^{-6}	3.93×10^{-1}	4.11×10^{-6}	2.11×10^{-6}	7.22×10^{-1}	8.19×10^{-6}
Technetium-99	2.41×10^{-5}	4.21×10^{1}	1.45×10^{-3}	2.41×10^{-5}	1.08×10^{2}	4.75×10^{-3}	2.41×10^{-5}	2.20×10^{2}	1.04×10^{-2}
Iodine-129	2.73×10^{-8}	7.77	8.85×10^{-5}	2.73×10^{-8}	9.02	1.19×10^{-4}	2.73×10^{-8}	1.11×10^{1}	1.72×10^{-4}
Total	2.62×10^{-5}	5.02×10^{1}	1.54×10^{-3}	2.62×10^{-5}	1.18×10^{2}	4.88×10^{-3}	2.62×10^{-5}	2.32×10^{2}	1.05×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.65	1.57×10^{1}	0.00	1.65	1.57×10^{1}	6.47×10^{-9}	1.65	2.29×10^{1}	2.97×10^{-4}
Nitrate	1.01×10^{3}	1.80×10^{1}	0.00	1.01×10^{3}	2.36×10^{1}	0.00	1.01×10^{3}	4.64×10^{1}	0.00
Total	1.01×10^{3}	3.36×10^{1}	0.00	1.01×10^{3}	3.93×10^{1}	6.47×10^{-9}	1.01×10^{3}	6.93×10^{1}	2.97×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–102. Tank Closure Alternative 4 Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.91×10^{-7}	3.34×10^{-1}	1.15×10^{-5}	1.91×10^{-7}	8.57×10^{-1}	3.76×10^{-5}	1.91×10^{-7}	1.75	8.21×10^{-5}
Iodine-129	2.02×10^{-10}	5.76×10^{-2}	6.55×10^{-7}	2.02×10^{-10}	6.68×10^{-2}	8.84×10^{-7}	2.02×10^{-10}	8.25×10^{-2}	1.27×10^{-6}
Uranium-238	5.35×10^{-13}	6.64×10^{-5}	7.50×10^{-10}	5.35×10^{-13}	6.90×10^{-5}	8.04×10^{-10}	5.35×10^{-13}	7.39×10^{-5}	9.09×10^{-10}
Total	1.91×10^{-7}	3.91×10^{-1}	1.21×10^{-5}	1.91×10^{-7}	9.24×10^{-1}	3.85×10^{-5}	1.91×10^{-7}	1.83	8.34×10^{-5}
Year of peak impact	2480	2480	2480	2480	2480	2480	2480	2480	2480

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.39×10^{-2}	3.22×10^{-1}	0.00	3.39×10^{-2}	3.23×10^{-1}	1.33×10^{-10}	3.39×10^{-2}	4.72×10^{-1}	6.10×10^{-6}
Nitrate	6.06	1.08×10^{-1}	0.00	6.06	1.42×10^{-1}	0.00	6.06	2.79×10^{-1}	0.00
Total	6.09	4.31×10^{-1}	0.00	6.09	4.65×10^{-1}	1.33×10^{-10}	6.09	7.51×10^{-1}	6.10×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–103. Tank Closure Alternative 4 Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.66×10^{-13}	6.81×10^{-8}	7.12×10^{-13}	5.70×10^{-14}	1.97×10^{-8}	1.44×10^{-12}	1.78×10^{-7}	5.61×10^{-2}	6.89×10^{-7}
Technetium-99	7.53×10^{-12}	3.39×10^{-5}	1.49×10^{-9}	7.47×10^{-12}	7.76×10^{-5}	3.71×10^{-9}	5.03×10^{-8}	5.68×10^{-4}	3.10×10^{-8}
Iodine-129	1.37×10^{-14}	4.53×10^{-6}	6.01×10^{-11}	1.38×10^{-14}	7.47×10^{-5}	1.78×10^{-9}	7.30×10^{-11}	1.76×10^{-4}	4.30×10^{-9}
Total	7.91×10^{-12}	3.85×10^{-5}	1.55×10^{-9}	7.54×10^{-12}	1.52×10^{-4}	5.49×10^{-9}	2.28×10^{-7}	5.69×10^{-2}	7.24×10^{-7}
Year of peak impact	2121	2121	2121	2145	2145	2121	2050	2050	2050
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.41×10^{-7}	8.97×10^{-6}	3.96×10^{-15}	9.41×10^{-7}	1.44×10^{-5}	1.81×10^{-10}	2.27×10^{-2}	5.02×10^{-2}	3.05×10^{-6}
Nitrate	2.94×10^{-4}	1.02×10^{-5}	0.00	2.94×10^{-4}	2.77×10^{-2}	0.00	8.49	3.29×10^{-1}	0.00
Total uranium	0.00	0.00	0.00	0.00	0.00	0.00	4.20×10^{-12}	1.14×10^{-10}	0.00
Total	2.95×10^{-4}	1.91×10^{-5}	3.96×10^{-15}	2.95×10^{-4}	2.77×10^{-2}	1.81×10^{-10}	8.51	3.79×10^{-1}	3.05×10^{-6}
Year of peak impact	2067	2067	2066	2067	2067	2066	2450	2450	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Similar to Alternatives 2A, 2B, 3A, 3B, and 3C, the risk and hazard drivers are: tritium, technetium-99, and iodine-129, uranium-238, chromium, nitrate, and total uranium. The dose standard and Hazardous Index guidelines would be exceeded at the same locations and for the same receptors as under Alternative 2A, 2B, 3A, 3B, and 3C for releases from cribs and trenches (ditches). The dose standard would be exceeded at the same locations and for the same receptors as under Alternative 2A, 2B, 3A, 3B, and 3C for releases from past leaks with slightly less impacts at the B Barrier, S Barrier, and Core Zone Boundary as a result of clean closure at the two tank farms located within the B and S Barriers. Impacts would be slightly less than under Alternative 2B, 3A, 3B, 3C, and 6C as a result of the combination of cribs and trenches (ditches), past leaks, and other sources with the exception of the S Barrier where no exceedances were identified. Overall the Population dose was estimated as 1.92×10^{-1} person-rem per year for the year of maximum impact.

Figure Q–5 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, other sources, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2030 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from all three sources occurs around the year 2050 and is dominated by tritium, technetium-99, and iodine-129. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

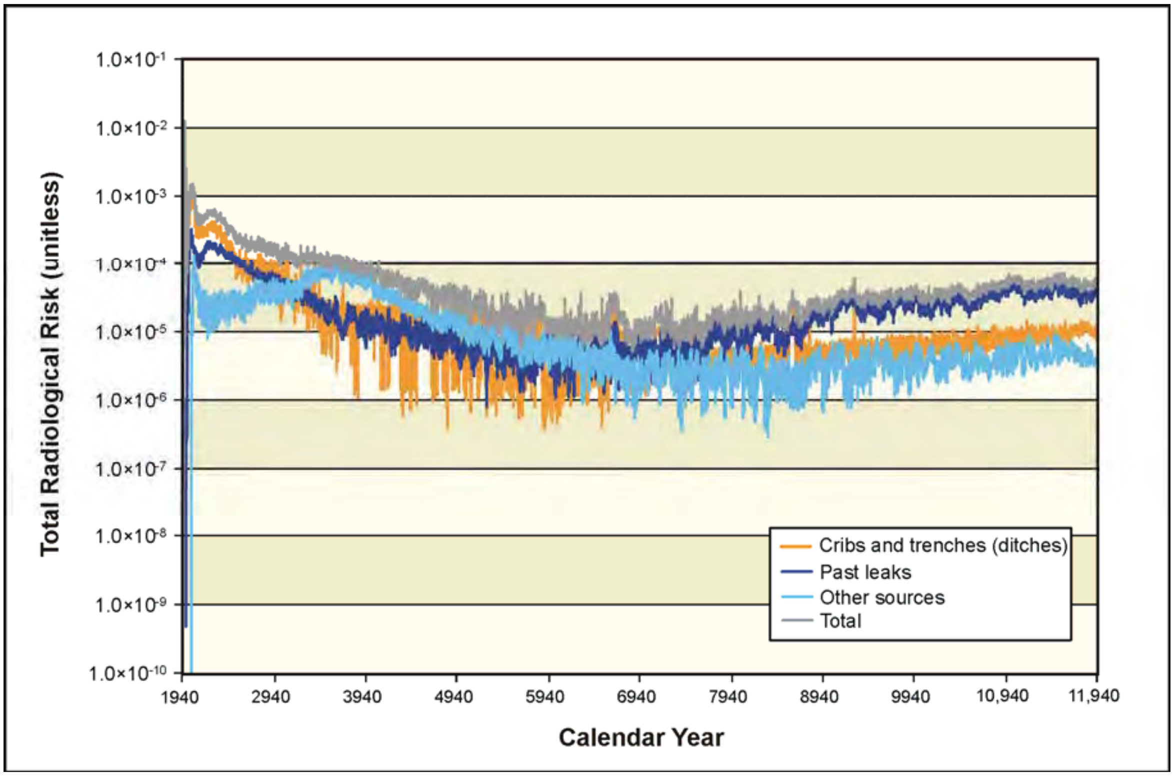

Figure Q–5. Tank Closure Alternative 4 Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.1.1.5 Tank Closure Alternative 5

Under Tank Closure Alternative 5, tank waste would be retrieved to a volume corresponding to 90 percent retrieval, residual material in tanks would be stabilized in place, and the tank farms and adjacent cribs and trenches (ditches) would be covered with a Hanford barrier. Potential human health impacts of this alternative related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–104 through Q–108. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–109 through Q–116. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–117 through Q–124.

The dose standard and Hazard Index guideline would be exceeded at the same locations and for the same receptors as under Alternative 2A, 2B, 3A, 3B, 3C, and 4 for releases from cribs and trenches (ditches). The dose standard and Hazard Index guideline would be exceeded at the same locations and for the same receptors as under Alternative 2A, 2B, 3A, 3B, and 3C, but slightly higher than these alternatives. Impacts would occur at a later date than under Alternative 2B, 3A, 3B, 3C, and 6C for onsite locations as a result of the combination of cribs and trenches (ditches), past leaks, and other sources. This may be due to the Hanford barrier. However, exceedances at the offsite locations are higher. Population dose was estimated as 3.39×10^{-1} person-rem per year for the year of maximum impact.

Table Q–104. Tank Closure Alternative 5 Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.08×10^{1}	4.84×10^{2}	0.00	5.08×10^{1}	4.85×10^{2}	2.00×10^{-7}	5.08×10^{1}	7.08×10^{2}	9.16×10^{-3}
Nitrate	1.74×10^{4}	3.11×10^{2}	0.00	1.74×10^{4}	4.10×10^{2}	0.00	1.74×10^{4}	8.03×10^{2}	0.00
Total	1.75×10^{4}	7.95×10^{2}	0.00	1.75×10^{4}	8.94×10^{2}	2.00×10^{-7}	1.75×10^{4}	1.51×10^{3}	9.16×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–105. Tank Closure Alternative 5 Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.84×10^{-2}
Technetium-99	1.35×10^{-7}	2.36×10^{-1}	8.12×10^{-6}	1.35×10^{-7}	6.07×10^{-1}	2.66×10^{-5}	1.35×10^{-7}	1.24	5.81×10^{-5}
Iodine-129	1.14×10^{-9}	3.25×10^{-1}	3.71×10^{-6}	1.14×10^{-9}	3.78×10^{-1}	5.00×10^{-6}	1.14×10^{-9}	4.67×10^{-1}	7.20×10^{-6}
Uranium-238	1.18×10^{-11}	1.46×10^{-3}	1.65×10^{-8}	1.18×10^{-11}	1.52×10^{-3}	1.77×10^{-8}	1.18×10^{-11}	1.62×10^{-3}	2.00×10^{-8}
Total	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.85×10^{-2}
Year of peak impact	1974	1974	1974	1974	1974	1974	1974	1974	1974

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.32	8.88×10^{1}	0.00	9.32	8.89×10^{1}	3.66×10^{-8}	9.32	1.30×10^{2}	1.68×10^{-3}
Nitrate	2.11×10^{3}	3.77×10^{1}	0.00	2.11×10^{3}	4.97×10^{1}	0.00	2.11×10^{3}	9.74×10^{1}	0.00
Total	2.12×10^{3}	1.27×10^{2}	0.00	2.12×10^{3}	1.39×10^{2}	3.66×10^{-8}	2.12×10^{3}	2.27×10^{2}	1.68×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–106. Tank Closure Alternative 5 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.80×10^{1}	2.67×10^{2}	0.00	2.80×10^{1}	2.67×10^{2}	1.10×10^{-7}	2.80×10^{1}	3.91×10^{2}	5.05×10^{-3}
Nitrate	1.29×10^{4}	2.30×10^{2}	0.00	1.29×10^{4}	3.03×10^{2}	0.00	1.29×10^{4}	5.95×10^{2}	0.00
Total	1.29×10^{4}	4.97×10^{2}	0.00	1.29×10^{4}	5.70×10^{2}	1.10×10^{-7}	1.29×10^{4}	9.85×10^{2}	5.05×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–107. Tank Closure Alternative 5 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.46×10^{-7}	4.04×10^{-2}	3.84×10^{-7}	3.46×10^{-7}	6.43×10^{-2}	6.72×10^{-7}	3.46×10^{-7}	1.18×10^{-1}	1.34×10^{-6}
Technetium-99	8.94×10^{-8}	1.57×10^{-1}	5.38×10^{-6}	8.94×10^{-8}	4.02×10^{-1}	1.77×10^{-5}	8.94×10^{-8}	8.19×10^{-1}	3.85×10^{-5}
Iodine-129	3.88×10^{-11}	1.10×10^{-2}	1.26×10^{-7}	3.88×10^{-11}	1.28×10^{-2}	1.70×10^{-7}	3.88×10^{-11}	1.58×10^{-2}	2.44×10^{-7}
Total	4.35×10^{-7}	2.08×10^{-1}	5.89×10^{-6}	4.35×10^{-7}	4.79×10^{-1}	1.85×10^{-5}	4.35×10^{-7}	9.53×10^{-1}	4.01×10^{-5}
Year of peak impact	2025	2025	2025	2025	2025	2025	2025	2025	2025
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.14×10^{-2}	2.99×10^{-1}	0.00	3.14×10^{-2}	2.99×10^{-1}	1.23×10^{-10}	3.14×10^{-2}	4.37×10^{-1}	5.66×10^{-6}
Nitrate	5.75	1.03×10^{-1}	0.00	5.75	1.35×10^{-1}	0.00	5.75	2.65×10^{-1}	0.00
Total	5.78	4.02×10^{-1}	0.00	5.78	4.35×10^{-1}	1.23×10^{-10}	5.78	7.03×10^{-1}	5.66×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–108. Tank Closure Alternative 5 Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.56×10^{-10}	6.62×10^{-5}	6.92×10^{-10}	3.56×10^{-10}	1.23×10^{-4}	1.40×10^{-9}	1.28×10^{-6}	4.04×10^{-1}	4.96×10^{-6}
Technetium-99	2.53×10^{-11}	1.14×10^{-4}	4.99×10^{-9}	2.53×10^{-11}	2.63×10^{-4}	1.24×10^{-8}	2.55×10^{-8}	2.99×10^{-4}	1.62×10^{-8}
Iodine-129	3.20×10^{-14}	1.06×10^{-5}	1.41×10^{-10}	3.20×10^{-14}	1.73×10^{-4}	4.16×10^{-9}	3.57×10^{-11}	1.09×10^{-4}	2.65×10^{-9}
Total	3.82×10^{-10}	1.91×10^{-4}	5.83×10^{-9}	3.82×10^{-10}	5.59×10^{-4}	1.80×10^{-8}	1.31×10^{-6}	4.04×10^{-1}	4.97×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1994	1994	1994
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.95×10^{-6}	8.53×10^{-5}	3.52×10^{-14}	8.95×10^{-6}	1.37×10^{-4}	1.61×10^{-9}	2.24×10^{-2}	4.97×10^{-2}	2.83×10^{-6}
Nitrate	2.24×10^{-3}	7.74×10^{-5}	0.00	2.24×10^{-3}	2.11×10^{-1}	0.00	4.36	6.64×10^{-1}	0.00
Total	2.25×10^{-3}	1.63×10^{-4}	3.52×10^{-14}	2.25×10^{-3}	2.11×10^{-1}	1.61×10^{-9}	4.38	7.14×10^{-1}	2.83×10^{-6}
Year of peak impact	1984	1984	1984	1984	1984	1984	1984	1984	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–109. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.63×10^{-6}	4.24×10^{-1}	4.03×10^{-6}	3.63×10^{-6}	6.75×10^{-1}	7.06×10^{-6}	3.63×10^{-6}	1.24	1.41×10^{-5}
Technetium-99	1.24×10^{-5}	2.16×10^{1}	7.44×10^{-4}	1.24×10^{-5}	5.56×10^{1}	2.44×10^{-3}	1.24×10^{-5}	1.13×10^{2}	5.32×10^{-3}
Iodine-129	2.32×10^{-8}	6.61	7.52×10^{-5}	2.32×10^{-8}	7.67	1.02×10^{-4}	2.32×10^{-8}	9.47	1.46×10^{-4}
Total	1.60×10^{-5}	2.87×10^{1}	8.23×10^{-4}	1.60×10^{-5}	6.39×10^{1}	2.55×10^{-3}	1.60×10^{-5}	1.24×10^{2}	5.48×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	6.23×10^{-2}	5.93×10^{-1}	0.00	6.23×10^{-2}	5.94×10^{-1}	2.45×10^{-10}	6.23×10^{-2}	8.67×10^{-1}	1.12×10^{-5}
Nitrate	4.17	7.45×10^{-2}	0.00	4.17	9.81×10^{-2}	0.00	4.17	1.92×10^{-1}	0.00
Total	4.23	6.67×10^{-1}	0.00	4.23	6.92×10^{-1}	2.45×10^{-10}	4.23	1.06	1.12×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–110. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	6.96×10^{-8}	8.13×10^{-3}	7.73×10^{-8}	6.96×10^{-8}	1.29×10^{-2}	1.35×10^{-7}	6.96×10^{-8}	2.38×10^{-2}	2.70×10^{-7}
Technetium-99	2.05×10^{-6}	3.58	1.23×10^{-4}	2.05×10^{-6}	9.20	4.04×10^{-4}	2.05×10^{-6}	1.88×10^{1}	8.82×10^{-4}
Iodine-129	1.53×10^{-8}	4.35	4.95×10^{-5}	1.53×10^{-8}	5.05	6.69×10^{-5}	1.53×10^{-8}	6.24	9.63×10^{-5}
Total	2.13×10^{-6}	7.95	1.73×10^{-4}	2.13×10^{-6}	1.43×10^{1}	4.71×10^{-4}	2.13×10^{-6}	2.50×10^{1}	9.78×10^{-4}
Year of peak impact	2048	2048	2048	2048	2048	2048	2048	2048	2048

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.34×10^{-2}	8.89×10^{-1}	0.00	9.34×10^{-2}	8.90×10^{-1}	3.81×10^{-10}	9.34×10^{-2}	1.30	1.75×10^{-5}
Nitrate	1.91×10^{1}	3.40×10^{-1}	0.00	1.91×10^{1}	4.48×10^{-1}	0.00	1.91×10^{1}	8.79×10^{-1}	0.00
Total	1.91×10^{1}	1.23	0.00	1.91×10^{1}	1.34	3.81×10^{-10}	1.91×10^{1}	2.18	1.75×10^{-5}
Year of peak impact	2050	2050	N/A	2050	2050	2051	2050	2050	2051

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–111. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the S Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.54×10^{-7}	2.97×10^{-2}	2.82×10^{-7}	2.54×10^{-7}	4.72×10^{-2}	4.94×10^{-7}	2.54×10^{-7}	8.68×10^{-2}	9.84×10^{-7}
Technetium-99	4.05×10^{-6}	7.10	2.44×10^{-4}	4.05×10^{-6}	1.82×10^{1}	8.01×10^{-4}	4.05×10^{-6}	3.71×10^{1}	1.75×10^{-3}
Iodine-129	7.58×10^{-9}	2.16	2.46×10^{-5}	7.58×10^{-9}	2.51	3.32×10^{-5}	7.58×10^{-9}	3.09	4.77×10^{-5}
Total	4.31×10^{-6}	9.29	2.69×10^{-4}	4.31×10^{-6}	2.08×10^{1}	8.34×10^{-4}	4.31×10^{-6}	4.03×10^{1}	1.80×10^{-3}
Year of peak impact	2030	2030	2030	2030	2030	2030	2030	2030	2030
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.21×10^{-1}	4.01	0.00	4.21×10^{-1}	4.02	1.65×10^{-9}	4.21×10^{-1}	5.87	7.59×10^{-5}
Nitrate	1.06×10^{1}	1.89×10^{-1}	0.00	1.06×10^{1}	2.49×10^{-1}	0.00	1.06×10^{1}	4.88×10^{-1}	0.00
Total	1.10×10^{1}	4.20	0.00	1.10×10^{1}	4.26	1.65×10^{-9}	1.10×10^{1}	6.36	7.59×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–112. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the T Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.31×10^{-6}	3.87×10^{-1}	3.68×10^{-6}	3.31×10^{-6}	6.16×10^{-1}	6.43×10^{-6}	3.31×10^{-6}	1.13	1.28×10^{-5}
Technetium-99	2.36×10^{-5}	4.13×10^{1}	1.42×10^{-3}	2.36×10^{-5}	1.06×10^{2}	4.66×10^{-3}	2.36×10^{-5}	2.16×10^{2}	1.02×10^{-2}
Iodine-129	2.06×10^{-8}	5.87	6.69×10^{-5}	2.06×10^{-8}	6.82	9.03×10^{-5}	2.06×10^{-8}	8.42	1.30×10^{-4}
Total	2.69×10^{-5}	4.76×10^{1}	1.49×10^{-3}	2.69×10^{-5}	1.14×10^{2}	4.76×10^{-3}	2.69×10^{-5}	2.26×10^{2}	1.03×10^{-2}
Year of peak impact	2027	2027	2027	2027	2027	2027	2027	2027	2027
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.27×10^{-1}	5.02	0.00	5.27×10^{-1}	5.02	2.07×10^{-9}	5.27×10^{-1}	7.34	9.49×10^{-5}
Nitrate	4.03×10^{1}	7.20×10^{-1}	0.00	4.03×10^{1}	9.48×10^{-1}	0.00	4.03×10^{1}	1.86	0.00
Total	4.08×10^{1}	5.74	0.00	4.08×10^{1}	5.97	2.07×10^{-9}	4.08×10^{1}	9.20	9.49×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–113. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the U Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	0.00	0.00	0.00	0.00	0.00	2.84×10^{-8}	1.63×10^{-8}	5.58×10^{-3}	5.66×10^{-8}
Technetium-99	0.00	0.00	0.00	0.00	0.00	2.89×10^{-5}	1.45×10^{-7}	1.33	6.31×10^{-5}
Iodine-129	0.00	0.00	0.00	0.00	0.00	1.09×10^{-6}	2.77×10^{-10}	1.13×10^{-1}	1.57×10^{-6}
Uranium-238	7.97×10^{-9}	9.89×10^{-1}	1.12×10^{-5}	7.97×10^{-9}	1.03	0.00	0.00	0.00	0.00
Total	7.97×10^{-9}	9.89×10^{-1}	1.12×10^{-5}	7.97×10^{-9}	1.03	3.00×10^{-5}	1.62×10^{-7}	1.45	6.47×10^{-5}
Year of peak impact	11,750	11,750	11,750	11,750	11,750	2048	2047	2047	2048
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.38×10^{-2}	1.31×10^{-1}	0.00	1.38×10^{-2}	1.31×10^{-1}	5.40×10^{-11}	1.38×10^{-2}	1.92×10^{-1}	2.48×10^{-6}
Nitrate	6.02×10^{-1}	1.08×10^{-2}	0.00	6.02×10^{-1}	1.42×10^{-2}	0.00	6.02×10^{-1}	2.78×10^{-2}	0.00
Total	6.16×10^{-1}	1.42×10^{-1}	0.00	6.16×10^{-1}	1.45×10^{-1}	5.40×10^{-11}	6.16×10^{-1}	2.19×10^{-1}	2.48×10^{-6}
Year of peak impact	2025	2025	N/A	2025	2025	2025	2025	2025	2025

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–114. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.27×10^{-7}	2.65×10^{-2}	1.57×10^{-12}	1.41×10^{-12}	2.62×10^{-7}	2.74×10^{-12}	1.41×10^{-12}	4.82×10^{-7}	5.47×10^{-12}
Technetium-99	4.94×10^{-6}	8.66	3.05×10^{-4}	5.07×10^{-6}	2.28×10^{1}	1.00×10^{-3}	5.07×10^{-6}	4.65×10^{1}	2.19×10^{-3}
Iodine-129	8.46×10^{-9}	2.41	2.28×10^{-5}	7.03×10^{-9}	2.32	3.08×10^{-5}	7.03×10^{-9}	2.87	4.43×10^{-5}
Total	5.18×10^{-6}	1.11×10^{1}	3.28×10^{-4}	5.08×10^{-6}	2.51×10^{1}	1.03×10^{-3}	5.08×10^{-6}	4.93×10^{1}	2.23×10^{-3}
Year of peak impact	2023	2023	2247	2247	2247	2247	2247	2247	2247

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.52×10^{-1}	4.30	0.00	4.52×10^{-1}	4.31	1.77×10^{-9}	4.52×10^{-1}	6.29	8.14×10^{-5}
Nitrate	1.07×10^{1}	1.91×10^{-1}	0.00	1.07×10^{1}	2.52×10^{-1}	0.00	1.07×10^{1}	4.94×10^{-1}	0.00
Total	1.12×10^{1}	4.49	0.00	1.12×10^{1}	4.56	1.77×10^{-9}	1.12×10^{1}	6.79	8.14×10^{-5}
Year of peak impact	2244	2244	N/A	2244	2244	2244	2244	2244	2244

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–115. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.07×10^{-11}	1.25×10^{-6}	3.15×10^{-11}	2.84×10^{-11}	5.28×10^{-6}	5.52×10^{-11}	2.84×10^{-11}	9.71×10^{-6}	1.10×10^{-10}
Technetium-99	1.17×10^{-7}	2.04×10^{-1}	7.31×10^{-6}	1.21×10^{-7}	5.46×10^{-1}	2.40×10^{-5}	1.21×10^{-7}	1.11	5.23×10^{-5}
Iodine-129	1.86×10^{-10}	5.29×10^{-2}	5.06×10^{-7}	1.56×10^{-10}	5.16×10^{-2}	6.83×10^{-7}	1.56×10^{-10}	6.37×10^{-2}	9.83×10^{-7}
Total	1.17×10^{-7}	2.57×10^{-1}	7.81×10^{-6}	1.21×10^{-7}	5.97×10^{-1}	2.46×10^{-5}	1.21×10^{-7}	1.18	5.33×10^{-5}
Year of peak impact	2171	2171	2153	2153	2153	2153	2153	2153	2153
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.51×10^{-3}	4.30×10^{-2}	0.00	4.51×10^{-3}	4.30×10^{-2}	1.77×10^{-11}	4.51×10^{-3}	6.28×10^{-2}	8.13×10^{-7}
Nitrate	1.82×10^{-1}	3.25×10^{-3}	0.00	1.82×10^{-1}	4.28×10^{-3}	0.00	1.82×10^{-1}	8.40×10^{-3}	0.00
Total	1.87×10^{-1}	4.62×10^{-2}	0.00	1.87×10^{-1}	4.73×10^{-2}	1.77×10^{-11}	1.87×10^{-1}	7.12×10^{-2}	8.13×10^{-7}
Year of peak impact	2182	2182	N/A	2182	2182	2503	2182	2182	2503

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–116. Tank Closure Alternative 5 Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.97×10^{-15}	3.67×10^{-10}	3.83×10^{-15}	7.75×10^{-16}	2.68×10^{-10}	3.04×10^{-15}	0.00	0.00	0.00
Technetium-99	6.42×10^{-12}	2.89×10^{-5}	1.27×10^{-9}	6.34×10^{-12}	6.59×10^{-5}	3.12×10^{-9}	1.58×10^{-8}	1.72×10^{-4}	9.47×10^{-9}
Iodine-129	1.08×10^{-14}	3.58×10^{-6}	4.75×10^{-11}	1.15×10^{-14}	6.22×10^{-5}	1.50×10^{-9}	2.09×10^{-12}	3.16×10^{-6}	7.76×10^{-11}
Uranium-238	0.00	0.00	0.00	0.00	0.00	0.00	6.20×10^{-10}	6.17×10^{-3}	7.80×10^{-8}
Total	6.44×10^{-12}	3.25×10^{-5}	1.32×10^{-9}	6.35×10^{-12}	1.28×10^{-4}	4.62×10^{-9}	1.65×10^{-8}	6.35×10^{-3}	8.75×10^{-8}
Year of peak impact	2134	2134	2134	2146	2146	2146	11,594	11,594	11,594

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.83×10^{-7}	1.74×10^{-6}	7.17×10^{-16}	1.70×10^{-7}	2.60×10^{-6}	3.29×10^{-11}	3.18×10^{-3}	7.03×10^{-3}	4.06×10^{-7}
Nitrate	8.71×10^{-6}	3.01×10^{-7}	0.00	1.08×10^{-5}	1.02×10^{-3}	0.00	2.78×10^{-1}	1.18×10^{-2}	0.00
Total	8.90×10^{-6}	2.04×10^{-6}	7.17×10^{-16}	1.10×10^{-5}	1.02×10^{-3}	3.29×10^{-11}	2.81×10^{-1}	1.89×10^{-2}	4.06×10^{-7}
Year of peak impact	2175	2175	2175	2163	2163	2175	2196	2196	2503

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–117. Tank Closure Alternative 5 Human Health Impacts at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.04×10^{-6}	5.32	1.83×10^{-4}	3.04×10^{-6}	1.37×10^{1}	6.00×10^{-4}	3.04×10^{-6}	2.78×10^{1}	1.31×10^{-3}
Iodine-129	4.79×10^{-10}	1.36×10^{-1}	1.55×10^{-6}	4.79×10^{-10}	1.58×10^{-1}	2.09×10^{-6}	4.79×10^{-10}	1.95×10^{-1}	3.02×10^{-6}
Total	3.04×10^{-6}	5.46	1.84×10^{-4}	3.04×10^{-6}	1.38×10^{1}	6.02×10^{-4}	3.04×10^{-6}	2.80×10^{1}	1.31×10^{-3}
Year of peak impact	4338	4338	4338	4338	4338	4338	4338	4338	4338

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	6.50×10^{-3}	3.10×10^{-2}	0.00	6.50×10^{-3}	3.86×10^{-2}	0.00	6.50×10^{-3}	6.98×10^{-2}	0.00
Chromium	2.90×10^{-2}	2.76×10^{-1}	0.00	2.90×10^{-2}	2.77×10^{-1}	1.14×10^{-10}	2.90×10^{-2}	4.04×10^{-1}	5.23×10^{-6}
Nitrate	5.52	9.85×10^{-2}	0.00	5.52	1.30×10^{-1}	0.00	5.52	2.55×10^{-1}	0.00
Total	5.55	4.06×10^{-1}	4.90×10^{-13}	5.55	4.45×10^{-1}	1.14×10^{-10}	5.55	7.28×10^{-1}	5.23×10^{-6}
Year of peak impact	4094	4094	11,755	4094	4094	4094	4094	4094	4094

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–118. Tank Closure Alternative 5 Human Health Impacts at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	4.45×10^{-7}	5.20×10^{-2}	4.94×10^{-7}	4.45×10^{-7}	8.27×10^{-2}	8.64×10^{-7}	4.45×10^{-7}	1.52×10^{-1}	1.72×10^{-6}
Technetium-99	2.25×10^{-5}	3.95×10^{1}	1.36×10^{-3}	2.25×10^{-5}	1.01×10^{2}	4.45×10^{-3}	2.25×10^{-5}	2.06×10^{2}	9.71×10^{-3}
Iodine-129	3.55×10^{-8}	1.01×10^{1}	1.15×10^{-4}	3.55×10^{-8}	1.17×10^{1}	1.55×10^{-4}	3.55×10^{-8}	1.45×10^{1}	2.24×10^{-4}
Total	2.30×10^{-5}	4.96×10^{1}	1.47×10^{-3}	2.30×10^{-5}	1.13×10^{2}	4.61×10^{-3}	2.30×10^{-5}	2.21×10^{2}	9.93×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.18	3.03×10^{1}	0.00	3.18	3.03×10^{1}	1.26×10^{-8}	3.18	4.43×10^{1}	5.77×10^{-4}
Nitrate	1.54×10^{3}	2.76×10^{1}	0.00	1.54×10^{3}	3.63×10^{1}	0.00	1.54×10^{3}	7.12×10^{1}	0.00
Total	1.55×10^{3}	5.79×10^{1}	0.00	1.55×10^{3}	6.66×10^{1}	1.26×10^{-8}	1.55×10^{3}	1.16×10^{2}	5.77×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2055	2050	2050	2055

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–119. Tank Closure Alternative 5 Human Health Impacts at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.34×10^{-6}	5.85	2.01×10^{-4}	3.34×10^{-6}	1.50×10^{1}	6.59×10^{-4}	3.34×10^{-6}	3.06×10^{1}	1.44×10^{-3}
Iodine-129	6.93×10^{-10}	1.97×10^{-1}	2.25×10^{-6}	6.93×10^{-10}	2.29×10^{-1}	3.03×10^{-6}	6.93×10^{-10}	2.83×10^{-1}	4.37×10^{-6}
Total	3.34×10^{-6}	6.04	2.03×10^{-4}	3.34×10^{-6}	1.52×10^{1}	6.62×10^{-4}	3.34×10^{-6}	3.09×10^{1}	1.44×10^{-3}
Year of peak impact	3931	3931	3931	3931	3931	3931	3931	3931	3931
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.89×10^{-1}	2.75	0.00	2.89×10^{-1}	2.76	1.14×10^{-9}	2.89×10^{-1}	4.03	5.21×10^{-5}
Nitrate	8.72	1.56×10^{-1}	0.00	8.72	2.05×10^{-1}	0.00	8.72	4.02×10^{-1}	0.00
Total	9.00	2.91	3.37×10^{-13}	9.00	2.96	1.14×10^{-9}	9.00	4.43	5.21×10^{-5}
Year of peak impact	2050	2050	11,776	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–120. Tank Closure Alternative 5 Human Health Impacts at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.14×10^{-6}	6.00×10^{-1}	3.44×10^{-6}	3.10×10^{-6}	5.76×10^{-1}	6.02×10^{-6}	3.10×10^{-6}	1.06	1.20×10^{-5}
Technetium-99	1.52×10^{-5}	2.66×10^{1}	9.23×10^{-4}	1.53×10^{-5}	6.89×10^{1}	3.03×10^{-3}	1.53×10^{-5}	1.40×10^{2}	6.60×10^{-3}
Iodine-129	1.89×10^{-8}	5.39	5.94×10^{-5}	1.83×10^{-8}	6.05	8.01×10^{-5}	1.83×10^{-8}	7.48	1.15×10^{-4}
Uranium-238	1.62×10^{-10}	2.01×10^{-2}	2.16×10^{-7}	1.54×10^{-10}	1.99×10^{-2}	2.31×10^{-7}	1.54×10^{-10}	2.13×10^{-2}	2.62×10^{-7}
Total	2.03×10^{-5}	3.26×10^{1}	9.86×10^{-4}	1.84×10^{-5}	7.56×10^{1}	3.11×10^{-3}	1.84×10^{-5}	1.49×10^{2}	6.73×10^{-3}
Year of peak impact	2051	2051	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	7.82×10^{-1}	7.45	0.00	7.82×10^{-1}	7.45	3.07×10^{-9}	7.82×10^{-1}	1.09×10^{1}	1.41×10^{-4}
Nitrate	1.30×10^{2}	2.33	0.00	1.30×10^{2}	3.06	0.00	1.30×10^{2}	6.01	0.00
Total uranium	1.85×10^{-4}	1.76×10^{-3}	0.00	1.85×10^{-4}	1.78×10^{-3}	0.00	1.85×10^{-4}	1.85×10^{-3}	0.00
Total	1.31×10^{2}	9.77	0.00	1.31×10^{2}	1.05×10^{1}	3.07×10^{-9}	1.31×10^{2}	1.69×10^{1}	1.41×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–121. Tank Closure Alternative 5 Human Health Impacts at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.78×10^{-6}	3.11	1.07×10^{-4}	1.78×10^{-6}	7.99	3.51×10^{-4}	1.78×10^{-6}	1.63×10^{1}	7.65×10^{-4}
Iodine-129	4.34×10^{-10}	1.23×10^{-1}	1.41×10^{-6}	4.34×10^{-10}	1.43×10^{-1}	1.90×10^{-6}	4.34×10^{-10}	1.77×10^{-1}	2.73×10^{-6}
Total	1.78×10^{-6}	3.24	1.08×10^{-4}	1.78×10^{-6}	8.13	3.53×10^{-4}	1.78×10^{-6}	1.65×10^{1}	7.68×10^{-4}
Year of peak impact	4022	4022	4022	4022	4022	4022	4022	4022	4022

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.48×10^{-2}	3.31×10^{-1}	0.00	3.48×10^{-2}	3.32×10^{-1}	1.41×10^{-10}	3.48×10^{-2}	4.84×10^{-1}	6.45×10^{-6}
Nitrate	3.90	6.96×10^{-2}	0.00	3.90	9.17×10^{-2}	0.00	3.90	1.80×10^{-1}	0.00
Total	3.93	4.01×10^{-1}	0.00	3.93	4.23×10^{-1}	1.41×10^{-10}	3.93	6.64×10^{-1}	6.45×10^{-6}
Year of peak impact	3869	3869	N/A	3869	3869	3847	3869	3869	3847

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–122. Tank Closure Alternative 5 Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.57×10^{-5}	6.26×10^{1}	2.15×10^{-3}	3.57×10^{-5}	1.61×10^{2}	7.06×10^{-3}	3.57×10^{-5}	3.28×10^{2}	1.54×10^{-2}
Iodine-129	8.48×10^{-9}	2.41	2.75×10^{-5}	8.48×10^{-9}	2.80	3.71×10^{-5}	8.48×10^{-9}	3.46	5.34×10^{-5}
Uranium-238	1.14×10^{-11}	1.42×10^{-3}	1.60×10^{-8}	1.14×10^{-11}	1.47×10^{-3}	1.71×10^{-8}	1.14×10^{-11}	1.58×10^{-3}	1.94×10^{-8}
Total	3.58×10^{-5}	6.50×10^{1}	2.18×10^{-3}	3.58×10^{-5}	1.64×10^{2}	7.10×10^{-3}	3.58×10^{-5}	3.31×10^{2}	1.55×10^{-2}
Year of peak impact	4326	4326	4326	4326	4326	4326	4326	4326	4326

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.65	1.57×10^{1}	0.00	1.65	1.58×10^{1}	6.79×10^{-9}	1.65	2.30×10^{1}	3.11×10^{-4}
Nitrate	1.01×10^{3}	1.80×10^{1}	0.00	1.01×10^{3}	2.38×10^{1}	0.00	1.01×10^{3}	4.66×10^{1}	0.00
Total	1.01×10^{3}	3.38×10^{1}	4.72×10^{-13}	1.01×10^{3}	3.95×10^{1}	6.79×10^{-9}	1.01×10^{3}	6.96×10^{1}	3.11×10^{-4}
Year of peak impact	2050	2050	11,848	2050	2050	3891	2050	2050	3891

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–123. Tank Closure Alternative 5 Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	7.24×10^{-7}	1.27	4.36×10^{-5}	7.24×10^{-7}	3.26	1.43×10^{-4}	7.24×10^{-7}	6.64	3.12×10^{-4}
Iodine-129	3.43×10^{-10}	9.78×10^{-2}	1.11×10^{-6}	3.43×10^{-10}	1.14×10^{-1}	1.50×10^{-6}	3.43×10^{-10}	1.40×10^{-1}	2.16×10^{-6}
Uranium-238	5.38×10^{-13}	6.68×10^{-5}	7.54×10^{-10}	5.38×10^{-13}	6.93×10^{-5}	8.08×10^{-10}	5.38×10^{-13}	7.43×10^{-5}	9.14×10^{-10}
Total	7.25×10^{-7}	1.37	4.47×10^{-5}	7.25×10^{-7}	3.37	1.45×10^{-4}	7.25×10^{-7}	6.78	3.14×10^{-4}
Year of peak impact	5017	5017	5017	5017	5017	5017	5017	5017	5017

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.48×10^{-2}	3.31×10^{-1}	0.00	3.48×10^{-2}	3.31×10^{-1}	1.37×10^{-10}	3.48×10^{-2}	4.84×10^{-1}	6.26×10^{-6}
Nitrate	6.28	1.12×10^{-1}	0.00	6.28	1.48×10^{-1}	0.00	6.28	2.90×10^{-1}	0.00
Total	6.31	4.43×10^{-1}	7.09×10^{-15}	6.31	4.79×10^{-1}	1.37×10^{-10}	6.31	7.74×10^{-1}	6.26×10^{-6}
Year of peak impact	2695	2695	11,707	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–124. Tank Closure Alternative 5 Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	6.83×10^{-18}	1.27×10^{-12}	1.33×10^{-17}	6.83×10^{-18}	2.36×10^{-12}	2.68×10^{-17}	1.78×10^{-7}	5.61×10^{-2}	6.89×10^{-7}
Technetium-99	1.48×10^{-11}	6.67×10^{-5}	2.93×10^{-9}	1.48×10^{-11}	1.54×10^{-4}	7.30×10^{-9}	4.47×10^{-8}	5.06×10^{-4}	2.76×10^{-8}
Iodine-129	3.28×10^{-15}	1.09×10^{-6}	1.44×10^{-11}	3.28×10^{-15}	1.77×10^{-5}	4.26×10^{-10}	5.93×10^{-11}	1.57×10^{-4}	3.83×10^{-9}
Uranium-238	5.39×10^{-18}	6.94×10^{-10}	8.09×10^{-15}	5.39×10^{-18}	1.92×10^{-9}	2.71×10^{-14}	0.00	0.00	0.00
Total	1.48×10^{-11}	6.78×10^{-5}	2.94×10^{-9}	1.48×10^{-11}	1.72×10^{-4}	7.73×10^{-9}	2.23×10^{-7}	5.68×10^{-2}	7.20×10^{-7}
Year of peak impact	4635	4635	4635	4635	4635	4635	2050	2050	2050
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.45×10^{-7}	9.01×10^{-6}	3.97×10^{-15}	9.45×10^{-7}	1.44×10^{-5}	1.82×10^{-10}	2.54×10^{-2}	5.60×10^{-2}	3.13×10^{-6}
Nitrate	2.94×10^{-4}	1.02×10^{-5}	0.00	2.94×10^{-4}	2.76×10^{-2}	0.00	8.75	3.38×10^{-1}	0.00
Total uranium	0.00	0.00	0.00	0.00	0.00	0.00	4.20×10^{-12}	1.14×10^{-10}	0.00
Total	2.95×10^{-4}	1.92×10^{-5}	3.97×10^{-15}	2.95×10^{-4}	2.77×10^{-2}	1.82×10^{-10}	8.77	3.94×10^{-1}	3.13×10^{-6}
Year of peak impact	2067	2067	2074	2067	2067	2074	2450	2450	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figure Q–6 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, other sources, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2250 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from all three sources occurs around the year 4320 and is dominated by technetium-99, iodine-129, and uranium-238. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

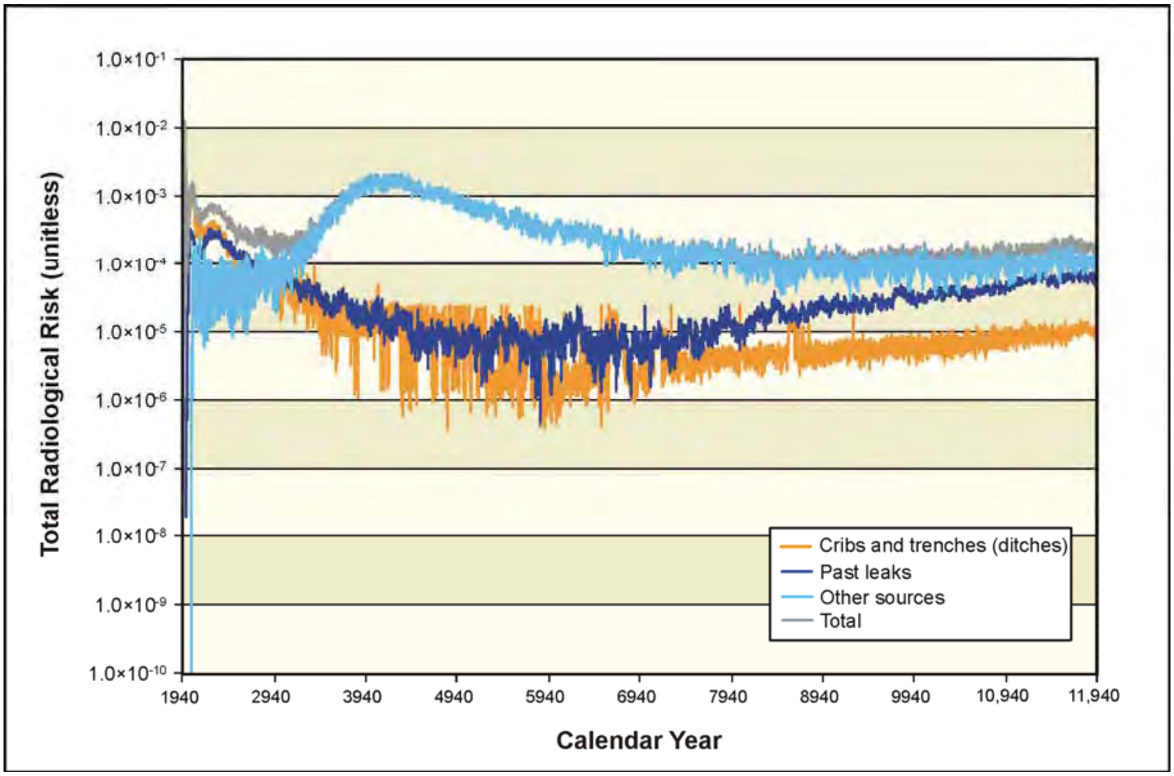

Figure Q–6. Tank Closure Alternative 5 Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.1.1.6 Tank Closure Alternative 6A, Base and Option Cases

Under Tank Closure Alternative 6A, Base Case, tank waste would be retrieved to a volume corresponding to 99.9 percent retrieval, all tanks farms would be clean closed by removing the tanks, ancillary equipment, and soils to a depth of 3 meters (10 feet) below the tank base. Where necessary, deep soil excavation would also be conducted to remove contamination plumes within the soil column. The adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier. Potential human health impacts of this alternative related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–125 through Q–129. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–130 through Q–137. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–138 through Q–145.

Table Q–125. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.08×10^{1}	4.84×10^{2}	0.00	5.08×10^{1}	4.85×10^{2}	2.00×10^{-7}	5.08×10^{1}	7.08×10^{2}	9.16×10^{-3}
Nitrate	1.74×10^{4}	3.11×10^{2}	0.00	1.74×10^{4}	4.10×10^{2}	0.00	1.74×10^{4}	8.03×10^{2}	0.00
Total	1.75×10^{4}	7.95×10^{2}	0.00	1.75×10^{4}	8.94×10^{2}	2.00×10^{-7}	1.75×10^{4}	1.51×10^{3}	9.16×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–126. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.84×10^{-2}
Technetium-99	1.35×10^{-7}	2.36×10^{-1}	8.12×10^{-6}	1.35×10^{-7}	6.07×10^{-1}	2.66×10^{-5}	1.35×10^{-7}	1.24	5.81×10^{-5}
Iodine-129	1.14×10^{-9}	3.25×10^{-1}	3.71×10^{-6}	1.14×10^{-9}	3.78×10^{-1}	5.00×10^{-6}	1.14×10^{-9}	4.67×10^{-1}	7.20×10^{-6}
Uranium-238	1.18×10^{-11}	1.46×10^{-3}	1.65×10^{-8}	1.18×10^{-11}	1.52×10^{-3}	1.77×10^{-8}	1.18×10^{-11}	1.62×10^{-3}	2.00×10^{-8}
Total	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.85×10^{-2}
Year of peak impact	1974	1974	1974	1974	1974	1974	1974	1974	1974
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.32	8.88×10^{1}	0.00	9.32	8.89×10^{1}	3.66×10^{-8}	9.32	1.30×10^{2}	1.68×10^{-3}
Nitrate	2.11×10^{3}	3.77×10^{1}	0.00	2.11×10^{3}	4.97×10^{1}	0.00	2.11×10^{3}	9.74×10^{1}	0.00
Total	2.12×10^{3}	1.27×10^{2}	0.00	2.12×10^{3}	1.39×10^{2}	3.66×10^{-8}	2.12×10^{3}	2.27×10^{2}	1.68×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–127. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.80×10^{1}	2.67×10^{2}	0.00	2.80×10^{1}	2.67×10^{2}	1.10×10^{-7}	2.80×10^{1}	3.91×10^{2}	5.05×10^{-3}
Nitrate	1.29×10^{4}	2.30×10^{2}	0.00	1.29×10^{4}	3.03×10^{2}	0.00	1.29×10^{4}	5.95×10^{2}	0.00
Total	1.29×10^{4}	4.97×10^{2}	0.00	1.29×10^{4}	5.70×10^{2}	1.10×10^{-7}	1.29×10^{4}	9.85×10^{2}	5.05×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–128. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.46×10^{-7}	4.04×10^{-2}	3.84×10^{-7}	3.46×10^{-7}	6.43×10^{-2}	6.72×10^{-7}	3.46×10^{-7}	1.18×10^{-1}	1.34×10^{-6}
Technetium-99	8.94×10^{-8}	1.57×10^{-1}	5.38×10^{-6}	8.94×10^{-8}	4.02×10^{-1}	1.77×10^{-5}	8.94×10^{-8}	8.19×10^{-1}	3.85×10^{-5}
Iodine-129	3.88×10^{-11}	1.10×10^{-2}	1.26×10^{-7}	3.88×10^{-11}	1.28×10^{-2}	1.70×10^{-7}	3.88×10^{-11}	1.58×10^{-2}	2.44×10^{-7}
Total	4.35×10^{-7}	2.08×10^{-1}	5.89×10^{-6}	4.35×10^{-7}	4.79×10^{-1}	1.85×10^{-5}	4.35×10^{-7}	9.53×10^{-1}	4.01×10^{-5}
Year of peak impact	2025	2025	2025	2025	2025	2025	2025	2025	2025

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.14×10^{-2}	2.99×10^{-1}	0.00	3.14×10^{-2}	2.99×10^{-1}	1.23×10^{-10}	3.14×10^{-2}	4.37×10^{-1}	5.66×10^{-6}
Nitrate	5.75	1.03×10^{-1}	0.00	5.75	1.35×10^{-1}	0.00	5.75	2.65×10^{-1}	0.00
Total	5.78	4.02×10^{-1}	0.00	5.78	4.35×10^{-1}	1.23×10^{-10}	5.78	7.03×10^{-1}	5.66×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–129. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.56×10^{-10}	6.62×10^{-5}	6.92×10^{-10}	3.56×10^{-10}	1.23×10^{-4}	1.40×10^{-9}	1.28×10^{-6}	4.04×10^{-1}	4.96×10^{-6}
Technetium-99	2.53×10^{-11}	1.14×10^{-4}	4.99×10^{-9}	2.53×10^{-11}	2.63×10^{-4}	1.24×10^{-8}	2.55×10^{-8}	2.99×10^{-4}	1.62×10^{-8}
Iodine-129	3.20×10^{-14}	1.06×10^{-5}	1.41×10^{-10}	3.20×10^{-14}	1.73×10^{-4}	4.16×10^{-9}	3.57×10^{-11}	1.09×10^{-4}	2.65×10^{-9}
Total	3.82×10^{-10}	1.91×10^{-4}	5.83×10^{-9}	3.82×10^{-10}	5.59×10^{-4}	1.80×10^{-8}	1.31×10^{-6}	4.04×10^{-1}	4.97×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1994	1994	1994
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.95×10^{-6}	8.53×10^{-5}	3.52×10^{-14}	8.95×10^{-6}	1.37×10^{-4}	1.61×10^{-9}	2.24×10^{-2}	4.97×10^{-2}	2.83×10^{-6}
Nitrate	2.24×10^{-3}	7.74×10^{-5}	0.00	2.24×10^{-3}	2.11×10^{-1}	0.00	4.36	6.64×10^{-1}	0.00
Total	2.25×10^{-3}	1.63×10^{-4}	3.52×10^{-14}	2.25×10^{-3}	2.11×10^{-1}	1.61×10^{-9}	4.38	7.14×10^{-1}	2.83×10^{-6}
Year of peak impact	1984	1984	1984	1984	1984	1984	1984	1984	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–130. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.58×10^{-6}	4.18×10^{-1}	3.97×10^{-6}	3.58×10^{-6}	6.65×10^{-1}	6.95×10^{-6}	3.58×10^{-6}	1.22	1.39×10^{-5}
Technetium-99	1.20×10^{-5}	2.09×10^{1}	7.20×10^{-4}	1.20×10^{-5}	5.38×10^{1}	2.36×10^{-3}	1.20×10^{-5}	1.10×10^{2}	5.15×10^{-3}
Iodine-129	2.33×10^{-8}	6.62	7.54×10^{-5}	2.33×10^{-8}	7.69	1.02×10^{-4}	2.33×10^{-8}	9.49	1.46×10^{-4}
Total	1.56×10^{-5}	2.80×10^{1}	7.99×10^{-4}	1.56×10^{-5}	6.21×10^{1}	2.47×10^{-3}	1.56×10^{-5}	1.20×10^{2}	5.31×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	6.08×10^{-2}	5.80×10^{-1}	0.00	6.08×10^{-2}	5.80×10^{-1}	2.39×10^{-10}	6.08×10^{-2}	8.48×10^{-1}	1.10×10^{-5}
Nitrate	4.33	7.74×10^{-2}	0.00	4.33	1.02×10^{-1}	0.00	4.33	2.00×10^{-1}	0.00
Total	4.40	6.57×10^{-1}	0.00	4.40	6.82×10^{-1}	2.39×10^{-10}	4.40	1.05	1.10×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–131. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	6.87×10^{-8}	8.02×10^{-3}	7.63×10^{-8}	6.87×10^{-8}	1.28×10^{-2}	1.33×10^{-7}	6.87×10^{-8}	2.35×10^{-2}	2.66×10^{-7}
Technetium-99	8.32×10^{-6}	1.46×10^{1}	5.01×10^{-4}	8.32×10^{-6}	3.74×10^{1}	1.64×10^{-3}	8.32×10^{-6}	7.63×10^{1}	3.59×10^{-3}
Iodine-129	1.69×10^{-8}	4.80	5.47×10^{-5}	1.69×10^{-8}	5.58	7.38×10^{-5}	1.69×10^{-8}	6.89	1.06×10^{-4}
Total	8.41×10^{-6}	1.94×10^{1}	5.56×10^{-4}	8.41×10^{-6}	4.30×10^{1}	1.72×10^{-3}	8.41×10^{-6}	8.32×10^{1}	3.69×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.02×10^{-2}	8.59×10^{-1}	0.00	9.02×10^{-2}	8.60×10^{-1}	3.64×10^{-10}	9.02×10^{-2}	1.26	1.67×10^{-5}
Nitrate	1.79×10^{1}	3.20×10^{-1}	0.00	1.79×10^{1}	4.22×10^{-1}	0.00	1.79×10^{1}	8.28×10^{-1}	0.00
Total	1.80×10^{1}	1.18	0.00	1.80×10^{1}	1.28	3.64×10^{-10}	1.80×10^{1}	2.08	1.67×10^{-5}
Year of peak impact	2047	2047	N/A	2047	2047	2048	2047	2047	2048

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–132. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the S Barrier Boundary

Radiological Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.93×10^{-7}	3.42×10^{-2}	3.25×10^{-7}	2.93×10^{-7}	5.45×10^{-2}	5.69×10^{-7}	2.93×10^{-7}	1.00×10^{-1}	1.13×10^{-6}
Technetium-99	3.96×10^{-6}	6.94	2.39×10^{-4}	3.96×10^{-6}	1.78×10^{1}	7.83×10^{-4}	3.96×10^{-6}	3.63×10^{1}	1.71×10^{-3}
Iodine-129	7.95×10^{-9}	2.26	2.58×10^{-5}	7.95×10^{-9}	2.63	3.48×10^{-5}	7.95×10^{-9}	3.25	5.01×10^{-5}
Total	4.26×10^{-6}	9.24	2.65×10^{-4}	4.26×10^{-6}	2.05×10^{1}	8.18×10^{-4}	4.26×10^{-6}	3.97×10^{1}	1.76×10^{-3}
Year of peak impact	2027	2027	2027	2027	2027	2027	2027	2027	2027
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.97×10^{-1}	3.79	0.00	3.97×10^{-1}	3.79	1.56×10^{-9}	3.97×10^{-1}	5.54	7.16×10^{-5}
Nitrate	1.12×10^{1}	2.00×10^{-1}	0.00	1.12×10^{1}	2.64×10^{-1}	0.00	1.12×10^{1}	5.17×10^{-1}	0.00
Total	1.16×10^{1}	3.99	0.00	1.16×10^{1}	4.05	1.56×10^{-9}	1.16×10^{1}	6.05	7.16×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–133. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.20×10^{-6}	3.74×10^{-1}	3.56×10^{-6}	3.20×10^{-6}	5.95×10^{-1}	6.22×10^{-6}	3.20×10^{-6}	1.09	1.24×10^{-5}
Technetium-99	2.28×10^{-5}	3.99×10^{1}	1.37×10^{-3}	2.28×10^{-5}	1.02×10^{2}	4.50×10^{-3}	2.28×10^{-5}	2.09×10^{2}	9.81×10^{-3}
Iodine-129	4.29×10^{-8}	1.22×10^{1}	1.39×10^{-4}	4.29×10^{-8}	1.42×10^{1}	1.88×10^{-4}	4.29×10^{-8}	1.75×10^{1}	2.70×10^{-4}
Total	2.60×10^{-5}	5.25×10^{1}	1.51×10^{-3}	2.60×10^{-5}	1.17×10^{2}	4.69×10^{-3}	2.60×10^{-5}	2.27×10^{2}	1.01×10^{-2}
Year of peak impact	2026	2026	2026	2026	2026	2026	2026	2026	2026

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	5.33×10^{-1}	5.07	0.00	5.33×10^{-1}	5.08	2.09×10^{-9}	5.33×10^{-1}	7.42	9.59×10^{-5}
Nitrate	3.94×10^{1}	7.04×10^{-1}	0.00	3.94×10^{1}	9.27×10^{-1}	0.00	3.94×10^{1}	1.82	0.00
Total	4.00×10^{1}	5.78	0.00	4.00×10^{1}	6.00	2.09×10^{-9}	4.00×10^{1}	9.24	9.59×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–134. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.33×10^{-9}	6.23×10^{-4}	5.92×10^{-9}	5.33×10^{-9}	9.92×10^{-4}	1.04×10^{-8}	5.33×10^{-9}	1.82×10^{-3}	2.07×10^{-8}
Technetium-99	1.50×10^{-7}	2.63×10^{-1}	9.05×10^{-6}	1.50×10^{-7}	6.76×10^{-1}	2.97×10^{-5}	1.50×10^{-7}	1.38	6.48×10^{-5}
Iodine-129	2.65×10^{-10}	7.53×10^{-2}	8.58×10^{-7}	2.65×10^{-10}	8.74×10^{-2}	1.16×10^{-6}	2.65×10^{-10}	1.08×10^{-1}	1.67×10^{-6}
Total	1.56×10^{-7}	3.39×10^{-1}	9.91×10^{-6}	1.56×10^{-7}	7.64×10^{-1}	3.09×10^{-5}	1.56×10^{-7}	1.49	6.64×10^{-5}
Year of peak impact	2064	2064	2064	2064	2064	2064	2064	2064	2064
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.30×10^{-2}	1.24×10^{-1}	0.00	1.30×10^{-2}	1.24×10^{-1}	5.15×10^{-11}	1.30×10^{-2}	1.82×10^{-1}	2.36×10^{-6}
Nitrate	6.84×10^{-1}	1.22×10^{-2}	0.00	6.84×10^{-1}	1.61×10^{-2}	0.00	6.84×10^{-1}	3.15×10^{-2}	0.00
Total	6.97×10^{-1}	1.36×10^{-1}	0.00	6.97×10^{-1}	1.40×10^{-1}	5.15×10^{-11}	6.97×10^{-1}	2.13×10^{-1}	2.36×10^{-6}
Year of peak impact	2026	2026	N/A	2026	2026	2024	2026	2026	2024

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–135. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	7.06×10^{-13}	8.25×10^{-8}	9.04×10^{-14}	8.14×10^{-14}	1.51×10^{-8}	1.58×10^{-13}	8.14×10^{-14}	2.78×10^{-8}	3.15×10^{-13}
Technetium-99	4.76×10^{-6}	8.33	2.96×10^{-4}	4.92×10^{-6}	2.21×10^{1}	9.71×10^{-4}	4.92×10^{-6}	4.51×10^{1}	2.12×10^{-3}
Iodine-129	9.31×10^{-9}	2.65	2.48×10^{-5}	7.65×10^{-9}	2.53	3.34×10^{-5}	7.65×10^{-9}	3.12	4.82×10^{-5}
Total	4.76×10^{-6}	1.10×10^{1}	3.21×10^{-4}	4.92×10^{-6}	2.46×10^{1}	1.00×10^{-3}	4.92×10^{-6}	4.82×10^{1}	2.17×10^{-3}
Year of peak impact	2257	2257	2292	2292	2292	2292	2292	2292	2292
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.01×10^{-1}	3.82	0.00	4.01×10^{-1}	3.83	1.58×10^{-9}	4.01×10^{-1}	5.59	7.23×10^{-5}
Nitrate	1.22×10^{1}	2.18×10^{-1}	0.00	1.22×10^{1}	2.87×10^{-1}	0.00	1.22×10^{1}	5.63×10^{-1}	0.00
Total uranium	2.50×10^{-10}	2.39×10^{-9}	0.00	2.50×10^{-10}	2.41×10^{-9}	0.00	2.50×10^{-10}	2.50×10^{-9}	0.00
Total	1.26×10^{1}	4.04	0.00	1.26×10^{1}	4.11	1.58×10^{-9}	1.26×10^{1}	6.15	7.23×10^{-5}
Year of peak impact	2251	2251	N/A	2251	2251	2251	2251	2251	2251

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–136. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.47×10^{-7}	2.57×10^{-1}	8.85×10^{-6}	1.47×10^{-7}	6.61×10^{-1}	2.90×10^{-5}	1.47×10^{-7}	1.35	6.33×10^{-5}
Iodine-129	1.63×10^{-10}	4.63×10^{-2}	5.27×10^{-7}	1.63×10^{-10}	5.37×10^{-2}	7.12×10^{-7}	1.63×10^{-10}	6.64×10^{-2}	1.02×10^{-6}
Total	1.47×10^{-7}	3.04×10^{-1}	9.37×10^{-6}	1.47×10^{-7}	7.15×10^{-1}	2.97×10^{-5}	1.47×10^{-7}	1.41	6.43×10^{-5}
Year of peak impact	2502	2502	2502	2502	2502	2502	2502	2502	2502

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.04×10^{-3}	3.85×10^{-2}	0.00	4.04×10^{-3}	3.85×10^{-2}	1.59×10^{-11}	4.04×10^{-3}	5.63×10^{-2}	7.27×10^{-7}
Nitrate	1.83×10^{-1}	3.27×10^{-3}	0.00	1.83×10^{-1}	4.30×10^{-3}	0.00	1.83×10^{-1}	8.44×10^{-3}	0.00
Total	1.87×10^{-1}	4.17×10^{-2}	0.00	1.87×10^{-1}	4.28×10^{-2}	1.59×10^{-11}	1.87×10^{-1}	6.47×10^{-2}	7.27×10^{-7}
Year of peak impact	2413	2413	N/A	2413	2413	2413	2413	2413	2413

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–137. Tank Closure Alternative 6A, Base Case, Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

Radiological Constituent	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Hunter-Gatherer: Dose at Year of Peak Dose (millirem per year)	American Indian Hunter-Gatherer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.84×10^{-15}	3.43×10^{-10}	3.58×10^{-15}	1.84×10^{-15}	6.38×10^{-10}	7.24×10^{-15}	7.37×10^{-12}	2.32×10^{-6}	4.60×10^{-17}
Technetium-99	6.67×10^{-12}	3.00×10^{-5}	1.32×10^{-9}	6.67×10^{-12}	6.93×10^{-5}	3.28×10^{-9}	1.36×10^{-7}	1.52×10^{-3}	8.82×10^{-8}
Iodine-129	1.19×10^{-14}	3.93×10^{-6}	5.21×10^{-11}	1.19×10^{-14}	6.41×10^{-5}	1.54×10^{-9}	1.48×10^{-10}	3.64×10^{-4}	6.63×10^{-9}
Total	6.68×10^{-12}	3.39×10^{-5}	1.37×10^{-9}	6.68×10^{-12}	1.33×10^{-4}	4.83×10^{-9}	1.36×10^{-7}	1.89×10^{-3}	9.48×10^{-8}
Year of peak impact	2134	2134	2134	2134	2134	2134	2153	2153	2502

Chemical Constituent	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Hunter-Gatherer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Hunter-Gatherer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.96×10^{-07}	1.86×10^{-06}	7.68×10^{-16}	1.74×10^{-7}	2.65×10^{-6}	3.52×10^{-11}	4.04×10^{-3}	8.91×10^{-3}	3.64×10^{-7}
Nitrate	1.03×10^{-5}	3.55×10^{-7}	0.00	1.13×10^{-5}	1.06×10^{-3}	0.00	1.83×10^{-1}	7.28×10^{-3}	0.00
Total	1.05×10^{-5}	2.22×10^{-6}	7.68×10^{-16}	1.15×10^{-5}	1.06×10^{-3}	3.52×10^{-11}	1.87×10^{-1}	1.62×10^{-2}	3.64×10^{-7}
Year of peak impact	2168	2168	2168	2187	2187	2168	2413	2413	2413

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–138. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the A Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.39×10^{-8}	1.62×10^{-3}	1.54×10^{-8}	1.39×10^{-8}	2.58×10^{-3}	3.81×10^{-8}	1.39×10^{-8}	4.74×10^{-3}	7.59×10^{-8}
Technetium-99	1.35×10^{-6}	2.36	8.12×10^{-5}	1.35×10^{-6}	6.06	2.67×10^{-4}	1.35×10^{-6}	1.24×10^{1}	5.83×10^{-4}
Iodine-129	2.36×10^{-9}	6.71×10^{-1}	7.64×10^{-6}	2.36×10^{-9}	7.79×10^{-1}	9.93×10^{-6}	2.36×10^{-9}	9.62×10^{-1}	1.43×10^{-5}
Total	1.36×10^{-6}	3.03	8.88×10^{-5}	1.36×10^{-6}	6.85	2.77×10^{-4}	1.36×10^{-6}	1.33×10^{1}	5.97×10^{-4}
Year of peak impact	2058	2058	2058	2058	2058	2056	2058	2058	2056

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	7.92×10^{-3}	7.54×10^{-2}	0.00	7.92×10^{-3}	7.55×10^{-2}	3.11×10^{-11}	7.92×10^{-3}	1.10×10^{-1}	1.43×10^{-6}
Nitrate	4.62×10^{-1}	8.24×10^{-3}	0.00	4.62×10^{-1}	1.09×10^{-2}	0.00	4.62×10^{-1}	2.13×10^{-2}	0.00
Total	4.70×10^{-1}	8.36×10^{-2}	0.00	4.70×10^{-1}	8.63×10^{-2}	3.11×10^{-11}	4.70×10^{-1}	1.32×10^{-1}	1.43×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–139. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	4.02×10^{-7}	4.70×10^{-2}	4.47×10^{-7}	4.02×10^{-7}	7.48×10^{-2}	7.82×10^{-7}	4.02×10^{-7}	1.38×10^{-1}	1.56×10^{-6}
Technetium-99	2.90×10^{-5}	5.09×10^{1}	1.75×10^{-3}	2.90×10^{-5}	1.31×10^{2}	5.74×10^{-3}	2.90×10^{-5}	2.66×10^{2}	1.25×10^{-2}
Iodine-129	3.69×10^{-8}	1.05×10^{1}	1.20×10^{-4}	3.69×10^{-8}	1.22×10^{1}	1.62×10^{-4}	3.69×10^{-8}	1.51×10^{1}	2.33×10^{-4}
Total	2.95×10^{-5}	6.15×10^{1}	1.87×10^{-3}	2.95×10^{-5}	1.43×10^{2}	5.90×10^{-3}	2.95×10^{-5}	2.81×10^{2}	1.28×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.18	3.02×10^{1}	0.00	3.18	3.03×10^{1}	1.25×10^{-8}	3.18	4.42×10^{1}	5.72×10^{-4}
Nitrate	1.54×10^{3}	2.75×10^{1}	0.00	1.54×10^{3}	3.62×10^{1}	0.00	1.54×10^{3}	7.11×10^{1}	0.00
Total	1.54×10^{3}	5.77×10^{1}	0.00	1.54×10^{3}	6.65×10^{1}	1.25×10^{-8}	1.54×10^{3}	1.15×10^{2}	5.72×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–140. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the S Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	5.10×10^{-8}	5.96×10^{-3}	5.67×10^{-8}	5.10×10^{-8}	9.49×10^{-3}	9.92×10^{-8}	5.10×10^{-8}	1.74×10^{-2}	1.98×10^{-7}
Technetium-99	2.68×10^{-6}	4.69	1.61×10^{-4}	2.68×10^{-6}	1.21×10^{1}	5.29×10^{-4}	2.68×10^{-6}	2.46×10^{1}	1.15×10^{-3}
Iodine-129	5.07×10^{-9}	1.44	1.64×10^{-5}	5.07×10^{-9}	1.67	2.22×10^{-5}	5.07×10^{-9}	2.07	3.19×10^{-5}
Total	2.74×10^{-6}	6.14	1.78×10^{-4}	2.74×10^{-6}	1.37×10^{1}	5.52×10^{-4}	2.74×10^{-6}	2.66×10^{1}	1.19×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.89×10^{-1}	2.75	0.00	2.89×10^{-1}	2.76	1.14×10^{-9}	2.89×10^{-1}	4.03	5.21×10^{-5}
Nitrate	8.55	1.53×10^{-1}	0.00	8.55	2.01×10^{-1}	0.00	8.55	3.94×10^{-1}	0.00
Total	8.84	2.91	0.00	8.84	2.96	1.14×10^{-9}	8.84	4.42	5.21×10^{-5}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–141. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the T Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	5.16×10^{-6}	6.03×10^{-1}	5.73×10^{-6}	5.16×10^{-6}	9.59×10^{-1}	1.00×10^{-5}	5.16×10^{-6}	1.76	2.00×10^{-5}
Technetium-99	1.52×10^{-5}	2.66×10^{1}	9.15×10^{-4}	1.52×10^{-5}	6.84×10^{1}	3.00×10^{-3}	1.52×10^{-5}	1.39×10^{2}	6.55×10^{-3}
Iodine-129	2.85×10^{-8}	8.10	9.22×10^{-5}	2.85×10^{-8}	9.40	1.24×10^{-4}	2.85×10^{-8}	1.16×10^{1}	1.79×10^{-4}
Uranium-238	1.62×10^{-10}	2.01×10^{-2}	2.27×10^{-7}	1.62×10^{-10}	2.08×10^{-2}	2.43×10^{-7}	1.62×10^{-10}	2.23×10^{-2}	2.75×10^{-7}
Total	2.04×10^{-5}	3.53×10^{1}	1.01×10^{-3}	2.04×10^{-5}	7.87×10^{1}	3.14×10^{-3}	2.04×10^{-5}	1.53×10^{2}	6.75×10^{-3}
Year of peak impact	2051	2051	2051	2051	2051	2051	2051	2051	2051
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	7.61×10^{-1}	7.24	0.00	7.61×10^{-1}	7.25	2.99×10^{-9}	7.61×10^{-1}	1.06×10^{1}	1.37×10^{-4}
Nitrate	1.30×10^{2}	2.32	0.00	1.30×10^{2}	3.05	0.00	1.30×10^{2}	5.99	0.00
Total uranium	1.85×10^{-4}	1.76×10^{-3}	0.00	1.85×10^{-4}	1.78×10^{-3}	0.00	1.85×10^{-4}	1.85×10^{-3}	0.00
Total	1.31×10^{2}	9.56	0.00	1.31×10^{2}	1.03×10^{1}	2.99×10^{-9}	1.31×10^{2}	1.66×10^{1}	1.37×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–142. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.33×10^{-9}	6.23×10^{-4}	5.92×10^{-9}	5.33×10^{-9}	9.92×10^{-4}	1.04×10^{-8}	5.33×10^{-9}	1.82×10^{-3}	2.07×10^{-8}
Technetium-99	1.50×10^{-7}	2.63×10^{-1}	9.05×10^{-6}	1.50×10^{-7}	6.76×10^{-1}	2.97×10^{-5}	1.50×10^{-7}	1.38	6.48×10^{-5}
Iodine-129	2.65×10^{-10}	7.53×10^{-2}	8.58×10^{-7}	2.65×10^{-10}	8.74×10^{-2}	1.16×10^{-6}	2.65×10^{-10}	1.08×10^{-1}	1.67×10^{-6}
Total	1.56×10^{-7}	3.39×10^{-1}	9.91×10^{-6}	1.56×10^{-7}	7.64×10^{-1}	3.09×10^{-5}	1.56×10^{-7}	1.49	6.64×10^{-5}
Year of peak impact	2064	2064	2064	2064	2064	2064	2064	2064	2064

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.63×10^{-3}	9.17×10^{-2}	0.00	9.63×10^{-3}	9.18×10^{-2}	3.78×10^{-11}	9.63×10^{-3}	1.34×10^{-1}	1.73×10^{-6}
Nitrate	6.28×10^{-1}	1.12×10^{-2}	0.00	6.28×10^{-1}	1.48×10^{-2}	0.00	6.28×10^{-1}	2.89×10^{-2}	0.00
Total	6.37×10^{-1}	1.03×10^{-1}	0.00	6.37×10^{-1}	1.07×10^{-1}	3.78×10^{-11}	6.37×10^{-1}	1.63×10^{-1}	1.73×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–143. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.08×10^{-6}	2.43×10^{-1}	2.31×10^{-6}	2.08×10^{-6}	3.87×10^{-1}	4.04×10^{-6}	2.08×10^{-6}	7.11×10^{-1}	8.06×10^{-6}
Technetium-99	2.47×10^{-5}	4.32×10^{1}	1.49×10^{-3}	2.47×10^{-5}	1.11×10^{2}	4.87×10^{-3}	2.47×10^{-5}	2.26×10^{2}	1.06×10^{-2}
Iodine-129	2.80×10^{-8}	7.96	9.07×10^{-5}	2.80×10^{-8}	9.24	1.22×10^{-4}	2.80×10^{-8}	1.14×10^{1}	1.76×10^{-4}
Total	2.68×10^{-5}	5.14×10^{1}	1.58×10^{-3}	2.68×10^{-5}	1.21×10^{2}	5.00×10^{-3}	2.68×10^{-5}	2.38×10^{2}	1.08×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.66	1.58×10^{1}	0.00	1.66	1.58×10^{1}	6.52×10^{-9}	1.66	2.31×10^{1}	2.99×10^{-4}
Nitrate	1.01×10^{3}	1.80×10^{1}	0.00	1.01×10^{3}	2.37×10^{1}	0.00	1.01×10^{3}	4.65×10^{1}	0.00
Total	1.01×10^{3}	3.38×10^{1}	0.00	1.01×10^{3}	3.95×10^{1}	6.52×10^{-9}	1.01×10^{3}	6.97×10^{1}	2.99×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–144. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.63×10^{-7}	2.85×10^{-1}	1.02×10^{-5}	1.69×10^{-7}	7.60×10^{-1}	3.34×10^{-5}	1.69×10^{-7}	1.55	7.28×10^{-5}
Iodine-129	2.44×10^{-10}	6.96×10^{-2}	5.51×10^{-7}	1.70×10^{-10}	5.62×10^{-2}	7.44×10^{-7}	1.70×10^{-10}	6.94×10^{-2}	1.07×10^{-6}
Uranium-238	5.36×10^{-13}	6.65×10^{-5}	7.51×10^{-10}	5.36×10^{-13}	6.90×10^{-5}	8.04×10^{-10}	5.36×10^{-13}	7.39×10^{-5}	9.09×10^{-10}
Total	1.63×10^{-7}	3.55×10^{-1}	1.07×10^{-5}	1.69×10^{-7}	8.16×10^{-1}	3.41×10^{-5}	1.69×10^{-7}	1.62	7.39×10^{-5}
Year of peak impact	2520	2520	2515	2515	2515	2515	2515	2515	2515

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.31×10^{-2}	3.15×10^{-1}	0.00	3.31×10^{-2}	3.16×10^{-1}	1.30×10^{-10}	3.31×10^{-2}	4.61×10^{-1}	5.97×10^{-6}
Nitrate	5.88	1.05×10^{-1}	0.00	5.88	1.38×10^{-1}	0.00	5.88	2.71×10^{-1}	0.00
Total uranium	4.42×10^{-11}	4.21×10^{-10}	0.00	4.42×10^{-11}	4.26×10^{-10}	0.00	4.42×10^{-11}	4.41×10^{-10}	0.00
Total	5.92	4.20×10^{-1}	0.00	5.92	4.54×10^{-1}	1.30×10^{-10}	5.92	7.33×10^{-1}	5.97×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–145. Tank Closure Alternative 6A, Base Case, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.17×10^{-13}	4.03×10^{-8}	4.21×10^{-13}	2.17×10^{-13}	7.50×10^{-8}	8.51×10^{-13}	1.78×10^{-7}	5.61×10^{-2}	6.89×10^{-7}
Technetium-99	8.17×10^{-12}	3.67×10^{-5}	1.61×10^{-9}	8.17×10^{-12}	8.49×10^{-5}	4.02×10^{-9}	4.69×10^{-8}	5.30×10^{-4}	2.89×10^{-8}
Iodine-129	1.38×10^{-14}	4.58×10^{-6}	6.08×10^{-11}	1.38×10^{-14}	7.48×10^{-5}	1.80×10^{-9}	7.36×10^{-11}	1.79×10^{-4}	4.36×10^{-9}
Total	8.40×10^{-12}	4.14×10^{-5}	1.67×10^{-9}	8.40×10^{-12}	1.60×10^{-4}	5.82×10^{-9}	2.25×10^{-7}	5.68×10^{-2}	7.22×10^{-7}
Year of peak impact	2134	2134	2134	2134	2134	2134	2050	2050	2050
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.51×10^{-7}	9.07×10^{-6}	3.96×10^{-15}	9.51×10^{-7}	1.45×10^{-5}	1.82×10^{-10}	2.28×10^{-2}	5.03×10^{-2}	2.98×10^{-6}
Nitrate	2.94×10^{-4}	1.02×10^{-5}	0.00	2.94×10^{-4}	2.77×10^{-2}	0.00	8.41	3.26×10^{-1}	0.00
Total uranium	0.00	0.00	0.00	0.00	0.00	0.00	8.13×10^{-12}	1.16×10^{-10}	0.00
Total	2.95×10^{-4}	1.92×10^{-5}	3.96×10^{-15}	2.95×10^{-4}	2.77×10^{-2}	1.82×10^{-10}	8.43	3.76×10^{-1}	2.98×10^{-6}
Year of peak impact	2067	2067	2066	2067	2067	2066	2450	2450	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

The dose standard and Hazard Index guideline would be exceeded at the same locations and for the same receptors as under Alternative 2A, 2B, 3A, 3B, 3C, 4, and 5 for releases from cribs and trenches (ditches). The dose standard and Hazard Index guideline would be exceeded at the same locations and for the same receptors as under Alternative 2B, 3A, 3B, 3C, and 4 for releases from past leaks. Impacts would be slightly higher than under Alternative 2B, 3A, 3B, 3C, and 6C for onsite locations as a result of the combination of cribs and trenches (ditches), past leaks, and other sources. However, after the year 2940 the impacts drop significantly as a result of tank farm removal and clean closure activities. Population dose was estimated as 2.07×10^{-1} person-rem per year for the year of maximum impact.

Figure Q–7 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2290 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from the two sources occurs around the year 2050 and is dominated by technetium-99, iodine-129, and uranium-238. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

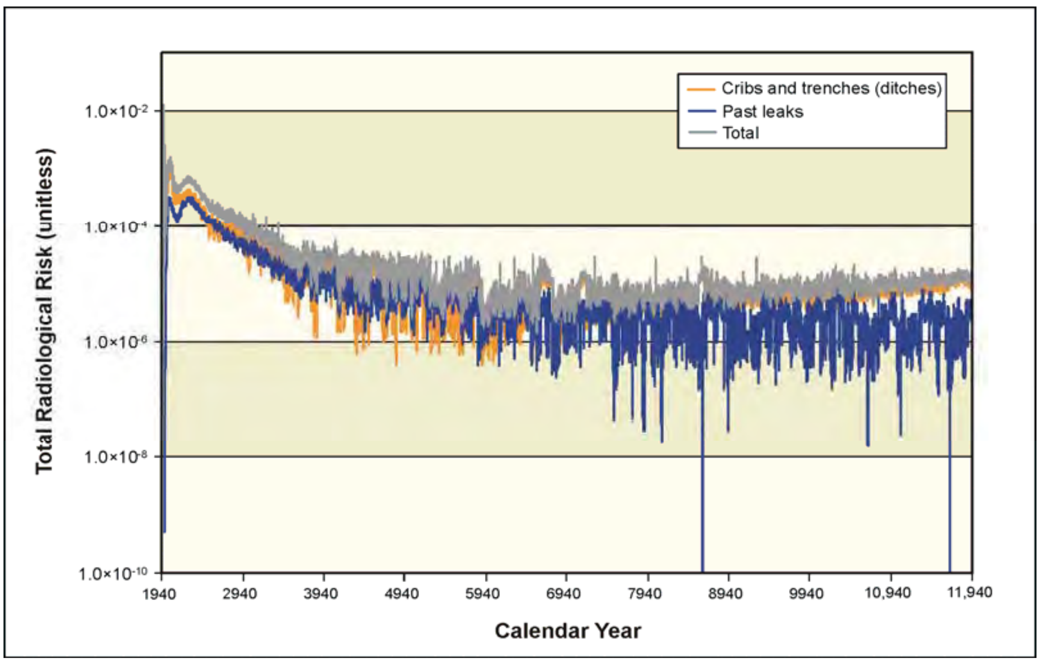

Figure Q–7. Tank Closure Alternative 6A, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Under Tank Closure Alternative 6A, Option Case, tank waste would be retrieved to a volume corresponding to 99.9 percent retrieval, all tanks farms would be clean closed by removing the tanks, ancillary equipment, and soils to a depth of 3 meters (10 feet) below the tank base. Where necessary, deep soil excavation would also be conducted to remove contamination plumes within the soil column. In addition, the adjacent cribs and trenches (ditches) would be clean closed. Potential human health impacts of this alternative related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–146 through Q–150. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–151 through Q–158. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–159 through Q–166.

Table Q–146. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.84×10^{-3}	3.31×10^{2}	3.15×10^{-3}	2.84×10^{-3}	5.27×10^{2}	5.51×10^{-3}	2.84×10^{-3}	9.69×10^{2}	1.10×10^{-2}
Iodine-129	1.45×10^{-4}	2.53×10^{2}	8.70×10^{-3}	1.45×10^{-4}	6.50×10^{2}	2.86×10^{-2}	1.45×10^{-4}	1.32×10^{3}	6.23×10^{-2}
Uranium-238	1.88×10^{-7}	5.36×10^{1}	6.10×10^{-4}	1.88×10^{-7}	6.22×10^{1}	8.24×10^{-4}	1.88×10^{-7}	7.69×10^{1}	1.19×10^{-3}
Total	2.98×10^{-3}	6.38×10^{2}	1.25×10^{-2}	2.98×10^{-3}	1.24×10^{3}	3.49×10^{-2}	2.98×10^{-3}	2.37×10^{3}	7.45×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.10×10^{1}	4.85×10^{2}	0.00	5.10×10^{1}	4.86×10^{2}	2.00×10^{-7}	5.10×10^{1}	7.10×10^{2}	9.18×10^{-3}
Nitrate	1.73×10^{4}	3.09×10^{2}	0.00	1.73×10^{4}	4.07×10^{2}	0.00	1.73×10^{4}	7.99×10^{2}	0.00
Total uranium	6.36×10^{-8}	6.06×10^{-7}	0.00	6.36×10^{-8}	6.13×10^{-7}	0.00	6.36×10^{-8}	6.34×10^{-7}	0.00
Total	1.74×10^{4}	7.95×10^{2}	0.00	1.74×10^{4}	8.93×10^{2}	2.00×10^{-7}	1.74×10^{4}	1.51×10^{3}	9.18×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–147. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.24×10^{-2}	1.44×10^{3}	1.37×10^{-2}	1.24×10^{-2}	2.30×10^{3}	2.40×10^{-2}	1.24×10^{-2}	4.22×10^{3}	4.78×10^{-2}
Technetium-99	1.30×10^{-7}	2.27×10^{-1}	7.81×10^{-6}	1.30×10^{-7}	5.84×10^{-1}	2.56×10^{-5}	1.30×10^{-7}	1.19	5.59×10^{-5}
Iodine-129	1.16×10^{-9}	3.31×10^{-1}	3.77×10^{-6}	1.16×10^{-9}	3.85×10^{-1}	5.09×10^{-6}	1.16×10^{-9}	4.75×10^{-1}	7.33×10^{-6}
Uranium-238	7.51×10^{-10}	9.32×10^{-2}	1.05×10^{-6}	7.51×10^{-10}	9.67×10^{-2}	1.13×10^{-6}	7.51×10^{-10}	1.04×10^{-1}	1.28×10^{-6}
Total	1.24×10^{-2}	1.44×10^{3}	1.37×10^{-2}	1.24×10^{-2}	2.30×10^{3}	2.40×10^{-2}	1.24×10^{-2}	4.22×10^{3}	4.79×10^{-2}
Year of peak impact	1975	1975	1975	1975	1975	1975	1975	1975	1975

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	8.86	8.44×10^{1}	0.00	8.86	8.45×10^{1}	3.48×10^{-8}	8.86	1.23×10^{2}	1.60×10^{-3}
Nitrate	2.10×10^{3}	3.75×10^{1}	0.00	2.10×10^{3}	4.93×10^{1}	0.00	2.10×10^{3}	9.67×10^{1}	0.00
Total	2.11×10^{3}	1.22×10^{2}	0.00	2.11×10^{3}	1.34×10^{2}	3.48×10^{-8}	2.11×10^{3}	2.20×10^{2}	1.60×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–148. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.84×10^{-3}	3.31×10^{2}	3.15×10^{-3}	2.84×10^{-3}	5.27×10^{2}	5.51×10^{-3}	2.84×10^{-3}	9.69×10^{2}	1.10×10^{-2}
Technetium-99	1.45×10^{-4}	2.53×10^{2}	8.70×10^{-3}	1.45×10^{-4}	6.50×10^{2}	2.86×10^{-2}	1.45×10^{-4}	1.32×10^{3}	6.23×10^{-2}
Iodine-129	1.88×10^{-7}	5.36×10^{1}	6.10×10^{-4}	1.88×10^{-7}	6.22×10^{1}	8.24×10^{-4}	1.88×10^{-7}	7.69×10^{1}	1.19×10^{-3}
Total	2.98×10^{-3}	6.38×10^{2}	1.25×10^{-2}	2.98×10^{-3}	1.24×10^{3}	3.49×10^{-2}	2.98×10^{-3}	2.37×10^{3}	7.45×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.84×10^{1}	2.70×10^{2}	0.00	2.84×10^{1}	2.71×10^{2}	1.11×10^{-7}	2.84×10^{1}	3.95×10^{2}	5.11×10^{-3}
Nitrate	1.34×10^{4}	2.39×10^{2}	0.00	1.34×10^{4}	3.14×10^{2}	0.00	1.34×10^{4}	6.17×10^{2}	0.00
Total	1.34×10^{4}	5.09×10^{2}	0.00	1.34×10^{4}	5.85×10^{2}	1.11×10^{-7}	1.34×10^{4}	1.01×10^{3}	5.11×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–149. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.27×10^{-6}	1.48×10^{-1}	6.71×10^{-7}	6.04×10^{-7}	1.12×10^{-1}	1.17×10^{-6}	6.04×10^{-7}	2.07×10^{-1}	2.34×10^{-6}
Technetium-99	2.21×10^{-8}	3.86×10^{-2}	3.98×10^{-6}	6.61×10^{-8}	2.97×10^{-1}	1.31×10^{-5}	6.61×10^{-8}	6.06×10^{-1}	2.85×10^{-5}
Iodine-129	4.29×10^{-11}	1.22×10^{-2}	1.03×10^{-7}	3.18×10^{-11}	1.05×10^{-2}	1.39×10^{-7}	3.18×10^{-11}	1.30×10^{-2}	2.00×10^{-7}
Uranium-238	3.97×10^{-15}	4.92×10^{-7}	5.56×10^{-12}	3.97×10^{-15}	5.11×10^{-7}	5.96×10^{-12}	3.97×10^{-15}	5.48×10^{-7}	6.74×10^{-12}
Total	1.29×10^{-6}	1.99×10^{-1}	4.76×10^{-6}	6.71×10^{-7}	4.20×10^{-1}	1.44×10^{-5}	6.71×10^{-7}	8.26×10^{-1}	3.10×10^{-5}
Year of peak impact	2016	2016	2027	2027	2027	2027	2027	2027	2027

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.46×10^{-2}	2.34×10^{-1}	0.00	2.46×10^{-2}	2.35×10^{-1}	1.02×10^{-10}	2.46×10^{-2}	3.43×10^{-1}	4.69×10^{-6}
Nitrate	7.39	1.32×10^{-1}	0.00	7.39	1.74×10^{-1}	0.00	7.39	3.41×10^{-1}	0.00
Total uranium	3.00×10^{-7}	2.86×10^{-6}	0.00	3.00×10^{-7}	2.89×10^{-6}	0.00	3.00×10^{-7}	2.99×10^{-6}	0.00
Total	7.41	3.66×10^{-1}	0.00	7.41	4.08×10^{-1}	1.02×10^{-10}	7.41	6.84×10^{-1}	4.69×10^{-6}
Year of peak impact	2303	2303	N/A	2303	2303	2256	2303	2303	2256

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–150. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.56×10^{-10}	6.61×10^{-5}	6.91×10^{-10}	3.56×10^{-10}	1.23×10^{-4}	1.40×10^{-9}	1.27×10^{-6}	4.00×10^{-1}	4.91×10^{-6}
Technetium-99	2.49×10^{-11}	1.12×10^{-4}	4.92×10^{-9}	2.49×10^{-11}	2.59×10^{-4}	1.23×10^{-8}	2.21×10^{-8}	2.57×10^{-4}	1.39×10^{-8}
Iodine-129	3.19×10^{-14}	1.06×10^{-5}	1.40×10^{-10}	3.19×10^{-14}	1.72×10^{-4}	4.14×10^{-9}	4.29×10^{-11}	1.11×10^{-4}	2.71×10^{-9}
Uranium-238	0.00	0.00	0.00	0.00	0.00	0.00	3.97×10^{-15}	3.96×10^{-8}	5.01×10^{-13}
Total	3.80×10^{-10}	1.89×10^{-4}	5.75×10^{-9}	3.80×10^{-10}	5.54×10^{-4}	1.78×10^{-8}	1.29×10^{-6}	4.00×10^{-1}	4.92×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	2016	2016	2016

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	8.68×10^{-6}	8.27×10^{-5}	3.41×10^{-14}	4.38×10^{-6}	6.69×10^{-5}	1.56×10^{-9}	1.10×10^{-2}	2.44×10^{-2}	2.34×10^{-6}
Nitrate	2.22×10^{-3}	7.67×10^{-5}	0.00	2.27×10^{-3}	2.13×10^{-1}	0.00	3.92	6.44×10^{-1}	0.00
Total	2.23×10^{-3}	1.59×10^{-4}	3.41×10^{-14}	2.27×10^{-3}	2.13×10^{-1}	1.56×10^{-9}	3.94	6.69×10^{-1}	2.34×10^{-6}
Year of peak impact	1984	1984	1984	1962	1962	1984	1984	1984	2256

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–151. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.58×10^{-6}	4.18×10^{-1}	3.97×10^{-6}	3.58×10^{-6}	6.65×10^{-1}	6.95×10^{-6}	3.58×10^{-6}	1.22	1.39×10^{-5}
Technetium-99	1.20×10^{-5}	2.09×10^{1}	7.20×10^{-4}	1.20×10^{-5}	5.38×10^{1}	2.36×10^{-3}	1.20×10^{-5}	1.10×10^{2}	5.15×10^{-3}
Iodine-129	2.33×10^{-8}	6.62	7.54×10^{-5}	2.33×10^{-8}	7.69	1.02×10^{-4}	2.33×10^{-8}	9.49	1.46×10^{-4}
Total	1.56×10^{-5}	2.80×10^{1}	7.99×10^{-4}	1.56×10^{-5}	6.21×10^{1}	2.47×10^{-3}	1.56×10^{-5}	1.20×10^{2}	5.31×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	6.08×10^{-2}	5.80×10^{-1}	0.00	6.08×10^{-2}	5.80×10^{-1}	2.39×10^{-10}	6.08×10^{-2}	8.48×10^{-1}	1.10×10^{-5}
Nitrate	4.33	7.74×10^{-2}	0.00	4.33	1.02×10^{-1}	0.00	4.33	2.00×10^{-1}	0.00
Total	4.40	6.57×10^{-1}	0.00	4.40	6.82×10^{-1}	2.39×10^{-10}	4.40	1.05	1.10×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–152. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	6.87×10^{-8}	8.02×10^{-3}	7.63×10^{-8}	6.87×10^{-8}	1.28×10^{-2}	1.33×10^{-7}	6.87×10^{-8}	2.35×10^{-2}	2.66×10^{-7}
Technetium-99	8.32×10^{-6}	1.46×10^{1}	5.01×10^{-4}	8.32×10^{-6}	3.74×10^{1}	1.64×10^{-3}	8.32×10^{-6}	7.63×10^{1}	3.59×10^{-3}
Iodine-129	1.69×10^{-8}	4.80	5.47×10^{-5}	1.69×10^{-8}	5.58	7.38×10^{-5}	1.69×10^{-8}	6.89	1.06×10^{-4}
Total	8.41×10^{-6}	1.94×10^{1}	5.56×10^{-4}	8.41×10^{-6}	4.30×10^{1}	1.72×10^{-3}	8.41×10^{-6}	8.32×10^{1}	3.69×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.02×10^{-2}	8.59×10^{-1}	0.00	9.02×10^{-2}	8.60×10^{-1}	3.64×10^{-10}	9.02×10^{-2}	1.26	1.67×10^{-5}
Nitrate	1.79×10^{1}	3.20×10^{-1}	0.00	1.79×10^{1}	4.22×10^{-1}	0.00	1.79×10^{1}	8.28×10^{-1}	0.00
Total	1.80×10^{1}	1.18	0.00	1.80×10^{1}	1.28	3.64×10^{-10}	1.80×10^{1}	2.08	1.67×10^{-5}
Year of peak impact	2047	2047	N/A	2047	2047	2048	2047	2047	2048

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–153. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.93×10^{-7}	3.42×10^{-2}	3.25×10^{-7}	2.93×10^{-7}	5.45×10^{-2}	5.69×10^{-7}	2.93×10^{-7}	1.00×10^{-1}	1.13×10^{-6}
Technetium-99	3.96×10^{-6}	6.94	2.39×10^{-4}	3.96×10^{-6}	1.78×10^{1}	7.83×10^{-4}	3.96×10^{-6}	3.63×10^{1}	1.71×10^{-3}
Iodine-129	7.95×10^{-9}	2.26	2.58×10^{-5}	7.95×10^{-9}	2.63	3.48×10^{-5}	7.95×10^{-9}	3.25	5.01×10^{-5}
Total	4.26×10^{-6}	9.24	2.65×10^{-4}	4.26×10^{-6}	2.05×10^{1}	8.18×10^{-4}	4.26×10^{-6}	3.97×10^{1}	1.76×10^{-3}
Year of peak impact	2027	2027	2027	2027	2027	2027	2027	2027	2027

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.97×10^{-1}	3.79	0.00	3.97×10^{-1}	3.79	1.56×10^{-9}	3.97×10^{-1}	5.54	7.16×10^{-5}
Nitrate	1.12×10^{1}	2.00×10^{-1}	0.00	1.12×10^{1}	2.64×10^{-1}	0.00	1.12×10^{1}	5.17×10^{-1}	0.00
Total	1.16×10^{1}	3.99	0.00	1.16×10^{1}	4.05	1.56×10^{-9}	1.16×10^{1}	6.05	7.16×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–154. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the T Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.20×10^{-6}	3.74×10^{-1}	3.56×10^{-6}	3.20×10^{-6}	5.95×10^{-1}	6.22×10^{-6}	3.20×10^{-6}	1.09	1.24×10^{-5}
Technetium-99	2.28×10^{-5}	3.99×10^{1}	1.37×10^{-3}	2.28×10^{-5}	1.02×10^{2}	4.50×10^{-3}	2.28×10^{-5}	2.09×10^{2}	9.81×10^{-3}
Iodine-129	4.29×10^{-8}	1.22×10^{1}	1.39×10^{-4}	4.29×10^{-8}	1.42×10^{1}	1.88×10^{-4}	4.29×10^{-8}	1.75×10^{1}	2.70×10^{-4}
Total	2.60×10^{-5}	5.25×10^{1}	1.51×10^{-3}	2.60×10^{-5}	1.17×10^{2}	4.69×10^{-3}	2.60×10^{-5}	2.27×10^{2}	1.01×10^{-2}
Year of peak impact	2026	2026	2026	2026	2026	2026	2026	2026	2026

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	5.33×10^{-1}	5.07	0.00	5.33×10^{-1}	5.08	2.09×10^{-9}	5.33×10^{-1}	7.42	9.59×10^{-5}
Nitrate	3.94×10^{1}	7.04×10^{-1}	0.00	3.94×10^{1}	9.27×10^{-1}	0.00	3.94×10^{1}	1.82	0.00
Total	4.00×10^{1}	5.78	0.00	4.00×10^{1}	6.00	2.09×10^{-9}	4.00×10^{1}	9.24	9.59×10^{-5}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–155. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the U Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	5.33×10^{-9}	6.23×10^{-4}	5.92×10^{-9}	5.33×10^{-9}	9.92×10^{-4}	1.04×10^{-8}	5.33×10^{-9}	1.82×10^{-3}	2.07×10^{-8}
Technetium-99	1.50×10^{-7}	2.63×10^{-1}	9.05×10^{-6}	1.50×10^{-7}	6.76×10^{-1}	2.97×10^{-5}	1.50×10^{-7}	1.38	6.48×10^{-5}
Iodine-129	2.65×10^{-10}	7.53×10^{-2}	8.58×10^{-7}	2.65×10^{-10}	8.74×10^{-2}	1.16×10^{-6}	2.65×10^{-10}	1.08×10^{-1}	1.67×10^{-6}
Total	1.56×10^{-7}	3.39×10^{-1}	9.91×10^{-6}	1.56×10^{-7}	7.64×10^{-1}	3.09×10^{-5}	1.56×10^{-7}	1.49	6.64×10^{-5}
Year of peak impact	2064	2064	2064	2064	2064	2064	2064	2064	2064
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.30×10^{-2}	1.24×10^{-1}	0.00	1.30×10^{-2}	1.24×10^{-1}	5.15×10^{-11}	1.30×10^{-2}	1.82×10^{-1}	2.36×10^{-6}
Nitrate	6.84×10^{-1}	1.22×10^{-2}	0.00	6.84×10^{-1}	1.61×10^{-2}	0.00	6.84×10^{-1}	3.15×10^{-2}	0.00
Total	6.97×10^{-1}	1.36×10^{-1}	0.00	6.97×10^{-1}	1.40×10^{-1}	5.15×10^{-11}	6.97×10^{-1}	2.13×10^{-1}	2.36×10^{-6}
Year of peak impact	2026	2026	N/A	2026	2026	2024	2026	2026	2024

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–156. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	7.06×10^{-13}	8.25×10^{-8}	9.04×10^{-14}	8.14×10^{-14}	1.51×10^{-8}	1.58×10^{-13}	8.14×10^{-14}	2.78×10^{-8}	3.15×10^{-13}
Technetium-99	4.76×10^{-6}	8.33	2.96×10^{-4}	4.92×10^{-6}	2.21×10^{1}	9.71×10^{-4}	4.92×10^{-6}	4.51×10^{1}	2.12×10^{-3}
Iodine-129	9.31×10^{-9}	2.65	2.48×10^{-5}	7.65×10^{-9}	2.53	3.34×10^{-5}	7.65×10^{-9}	3.12	4.82×10^{-5}
Total	4.76×10^{-6}	1.10×10^{1}	3.21×10^{-4}	4.92×10^{-6}	2.46×10^{1}	1.00×10^{-3}	4.92×10^{-6}	4.82×10^{1}	2.17×10^{-3}
Year of peak impact	2257	2257	2292	2292	2292	2292	2292	2292	2292
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.01×10^{-1}	3.82	0.00	4.01×10^{-1}	3.83	1.58×10^{-9}	4.01×10^{-1}	5.59	7.23×10^{-5}
Nitrate	1.22×10^{1}	2.18×10^{-1}	0.00	1.22×10^{1}	2.87×10^{-1}	0.00	1.22×10^{1}	5.63×10^{-1}	0.00
Total uranium	2.50×10^{-10}	2.39×10^{-9}	0.00	2.50×10^{-10}	2.41×10^{-9}	0.00	2.50×10^{-10}	2.50×10^{-9}	0.00
Total	1.26×10^{1}	4.04	0.00	1.26×10^{1}	4.11	1.58×10^{-9}	1.26×10^{1}	6.15	7.23×10^{-5}
Year of peak impact	2251	2251	N/A	2251	2251	2251	2251	2251	2251

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–157. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.47×10^{-7}	2.57×10^{-1}	8.85×10^{-6}	1.47×10^{-7}	6.61×10^{-1}	2.90×10^{-5}	1.47×10^{-7}	1.35	6.33×10^{-5}
Iodine-129	1.63×10^{-10}	4.63×10^{-2}	5.27×10^{-7}	1.63×10^{-10}	5.37×10^{-2}	7.12×10^{-7}	1.63×10^{-10}	6.64×10^{-2}	1.02×10^{-6}
Total	1.47×10^{-7}	3.04×10^{-1}	9.37×10^{-6}	1.47×10^{-7}	7.15×10^{-1}	2.97×10^{-5}	1.47×10^{-7}	1.41	6.43×10^{-5}
Year of peak impact	2502	2502	2502	2502	2502	2502	2502	2502	2502

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	4.04×10^{-3}	3.85×10^{-2}	0.00	4.04×10^{-3}	3.85×10^{-2}	1.59×10^{-11}	4.04×10^{-3}	5.63×10^{-2}	7.27×10^{-7}
Nitrate	1.83×10^{-1}	3.27×10^{-3}	0.00	1.83×10^{-1}	4.30×10^{-3}	0.00	1.83×10^{-1}	8.44×10^{-3}	0.00
Total	1.87×10^{-1}	4.17×10^{-2}	0.00	1.87×10^{-1}	4.28×10^{-2}	1.59×10^{-11}	1.87×10^{-1}	6.47×10^{-2}	7.27×10^{-7}
Year of peak impact	2413	2413	N/A	2413	2413	2413	2413	2413	2413

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–158. Tank Closure Alternative 6A, Option Case, Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.84×10^{-15}	3.43×10^{-10}	3.58×10^{-15}	1.84×10^{-15}	6.38×10^{-10}	7.24×10^{-15}	7.37×10^{-12}	2.32×10^{-6}	4.60×10^{-17}
Technetium-99	6.67×10^{-12}	3.00×10^{-5}	1.32×10^{-9}	6.67×10^{-12}	6.93×10^{-5}	3.28×10^{-9}	1.36×10^{-7}	1.52×10^{-3}	8.82×10^{-8}
Iodine-129	1.19×10^{-14}	3.93×10^{-6}	5.21×10^{-11}	1.19×10^{-14}	6.41×10^{-5}	1.54×10^{-9}	1.48×10^{-10}	3.64×10^{-4}	6.63×10^{-9}
Total	6.68×10^{-12}	3.39×10^{-5}	1.37×10^{-9}	6.68×10^{-12}	1.33×10^{-4}	4.83×10^{-9}	1.36×10^{-7}	1.89×10^{-3}	9.48×10^{-8}
Year of peak impact	2134	2134	2134	2134	2134	2134	2153	2153	2502
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.96×10^{-7}	1.86×10^{-6}	7.68×10^{-16}	1.74×10^{-7}	2.65×10^{-6}	3.52×10^{-11}	4.04×10^{-3}	8.91×10^{-3}	3.64×10^{-7}
Nitrate	1.03×10^{-5}	3.55×10^{-7}	0.00	1.13×10^{-5}	1.06×10^{-3}	0.00	1.83×10^{-1}	7.28×10^{-3}	0.00
Total	1.05×10^{-5}	2.22×10^{-6}	7.68×10^{-16}	1.15×10^{-5}	1.06×10^{-3}	3.52×10^{-11}	1.87×10^{-1}	1.62×10^{-2}	3.64×10^{-7}
Year of peak impact	2168	2168	2168	2187	2187	2168	2413	2413	2413

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–159. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.39×10^{-8}	1.62×10^{-3}	1.54×10^{-8}	1.39×10^{-8}	2.58×10^{-3}	3.81×10^{-8}	1.39×10^{-8}	4.74×10^{-3}	7.59×10^{-8}
Technetium-99	1.35×10^{-6}	2.36	8.12×10^{-5}	1.35×10^{-6}	6.06	2.67×10^{-4}	1.35×10^{-6}	1.24×10^{1}	5.83×10^{-4}
Iodine-129	2.36×10^{-9}	6.71×10^{-1}	7.64×10^{-6}	2.36×10^{-9}	7.79×10^{-1}	9.93×10^{-6}	2.36×10^{-9}	9.62×10^{-1}	1.43×10^{-5}
Total	1.36×10^{-6}	3.03	8.88×10^{-5}	1.36×10^{-6}	6.85	2.77×10^{-4}	1.36×10^{-6}	1.33×10^{1}	5.97×10^{-4}
Year of peak impact	2058	2058	2058	2058	2058	2056	2058	2058	2056

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	7.92×10^{-3}	7.54×10^{-2}	0.00	7.92×10^{-3}	7.55×10^{-2}	3.11×10^{-11}	7.92×10^{-3}	1.10×10^{-1}	1.43×10^{-6}
Nitrate	4.62×10^{-1}	8.24×10^{-3}	0.00	4.62×10^{-1}	1.09×10^{-2}	0.00	4.62×10^{-1}	2.13×10^{-2}	0.00
Total	4.70×10^{-1}	8.36×10^{-2}	0.00	4.70×10^{-1}	8.63×10^{-2}	3.11×10^{-11}	4.70×10^{-1}	1.32×10^{-1}	1.43×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–160. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.20×10^{-7}	3.74×10^{-2}	3.56×10^{-7}	3.20×10^{-7}	5.95×10^{-2}	9.44×10^{-6}	3.20×10^{-7}	1.09×10^{-1}	1.88×10^{-5}
Technetium-99	2.48×10^{-5}	4.34×10^{1}	1.49×10^{-3}	2.48×10^{-5}	1.11×10^{2}	4.94×10^{-3}	2.48×10^{-5}	2.27×10^{2}	1.08×10^{-2}
Iodine-129	4.47×10^{-8}	1.27×10^{1}	1.45×10^{-4}	4.47×10^{-8}	1.48×10^{1}	1.38×10^{-4}	4.47×10^{-8}	1.83×10^{1}	1.98×10^{-4}
Uranium-238	5.60×10^{-12}	6.95×10^{-4}	7.85×10^{-9}	5.60×10^{-12}	7.21×10^{-4}	9.04×10^{-9}	5.60×10^{-12}	7.73×10^{-4}	1.02×10^{-8}
Total	2.51×10^{-5}	5.61×10^{1}	1.64×10^{-3}	2.51×10^{-5}	1.26×10^{2}	5.09×10^{-3}	2.51×10^{-5}	2.45×10^{2}	1.10×10^{-2}
Year of peak impact	2057	2057	2057	2057	2057	2055	2057	2057	2055

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.76	3.58×10^{1}	0.00	3.76	3.58×10^{1}	1.49×10^{-8}	3.76	5.23×10^{1}	6.82×10^{-4}
Nitrate	1.62×10^{3}	2.88×10^{1}	0.00	1.62×10^{3}	3.80×10^{1}	0.00	1.62×10^{3}	7.45×10^{1}	0.00
Total uranium	7.01×10^{-6}	6.68×10^{-5}	0.00	7.01×10^{-6}	6.75×10^{-5}	0.00	7.01×10^{-6}	6.99×10^{-5}	0.00
Total	1.62×10^{3}	6.46×10^{1}	0.00	1.62×10^{3}	7.38×10^{1}	1.49×10^{-8}	1.62×10^{3}	1.27×10^{2}	6.82×10^{-4}
Year of peak impact	2091	2091	N/A	2091	2091	2088	2091	2091	2088

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–161. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.10×10^{-8}	5.96×10^{-3}	5.67×10^{-8}	5.10×10^{-8}	9.49×10^{-3}	9.92×10^{-8}	5.10×10^{-8}	1.74×10^{-2}	1.98×10^{-7}
Technetium-99	2.68×10^{-6}	4.69	1.61×10^{-4}	2.68×10^{-6}	1.21×10^{1}	5.29×10^{-4}	2.68×10^{-6}	2.46×10^{1}	1.15×10^{-3}
Iodine-129	5.07×10^{-9}	1.44	1.64×10^{-5}	5.07×10^{-9}	1.67	2.22×10^{-5}	5.07×10^{-9}	2.07	3.19×10^{-5}
Total	2.74×10^{-6}	6.14	1.78×10^{-4}	2.74×10^{-6}	1.37×10^{1}	5.52×10^{-4}	2.74×10^{-6}	2.66×10^{1}	1.19×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.89×10^{-1}	2.75	0.00	2.89×10^{-1}	2.76	1.14×10^{-9}	2.89×10^{-1}	4.03	5.21×10^{-5}
Nitrate	8.55	1.53×10^{-1}	0.00	8.55	2.01×10^{-1}	0.00	8.55	3.94×10^{-1}	0.00
Total	8.84	2.91	0.00	8.84	2.96	1.14×10^{-9}	8.84	4.42	5.21×10^{-5}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–162. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.19×10^{-6}	6.06×10^{-1}	5.54×10^{-7}	4.99×10^{-7}	9.27×10^{-2}	9.69×10^{-7}	4.99×10^{-7}	1.70×10^{-1}	1.93×10^{-6}
Technetium-99	1.48×10^{-5}	2.60×10^{1}	9.15×10^{-4}	1.52×10^{-5}	6.84×10^{1}	3.00×10^{-3}	1.52×10^{-5}	1.39×10^{2}	6.55×10^{-3}
Iodine-129	3.09×10^{-8}	8.80	9.23×10^{-5}	2.85×10^{-8}	9.41	1.25×10^{-4}	2.85×10^{-8}	1.16×10^{1}	1.79×10^{-4}
Uranium-238	1.36×10^{-10}	1.68×10^{-2}	1.85×10^{-7}	1.32×10^{-10}	1.70×10^{-2}	1.98×10^{-7}	1.32×10^{-10}	1.82×10^{-2}	2.24×10^{-7}
Total	2.00×10^{-5}	3.54×10^{1}	1.01×10^{-3}	1.57×10^{-5}	7.79×10^{1}	3.13×10^{-3}	1.57×10^{-5}	1.51×10^{2}	6.73×10^{-3}
Year of peak impact	2050	2050	2051	2051	2051	2051	2051	2051	2051

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	7.72×10^{-1}	7.35	0.00	7.72×10^{-1}	7.36	3.03×10^{-9}	7.72×10^{-1}	1.08×10^{1}	1.39×10^{-4}
Nitrate	1.28×10^{2}	2.29	0.00	1.28×10^{2}	3.01	0.00	1.28×10^{2}	5.91	0.00
Total uranium	1.96×10^{-4}	1.86×10^{-3}	0.00	1.96×10^{-4}	1.88×10^{-3}	0.00	1.96×10^{-4}	1.95×10^{-3}	0.00
Total	1.29×10^{2}	9.64	0.00	1.29×10^{2}	1.04×10^{1}	3.03×10^{-9}	1.29×10^{2}	1.67×10^{1}	1.39×10^{-4}
Year of peak impact	2051	2051	N/A	2051	2051	2051	2051	2051	2051

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–163. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.33×10^{-9}	6.23×10^{-4}	5.92×10^{-9}	5.33×10^{-9}	9.92×10^{-4}	1.04×10^{-8}	5.33×10^{-9}	1.82×10^{-3}	2.07×10^{-8}
Technetium-99	1.50×10^{-7}	2.63×10^{-1}	9.05×10^{-6}	1.50×10^{-7}	6.76×10^{-1}	2.97×10^{-5}	1.50×10^{-7}	1.38	6.48×10^{-5}
Iodine-129	2.65×10^{-10}	7.53×10^{-2}	8.58×10^{-7}	2.65×10^{-10}	8.74×10^{-2}	1.16×10^{-6}	2.65×10^{-10}	1.08×10^{-1}	1.67×10^{-6}
Total	1.56×10^{-7}	3.39×10^{-1}	9.91×10^{-6}	1.56×10^{-7}	7.64×10^{-1}	3.09×10^{-5}	1.56×10^{-7}	1.49	6.64×10^{-5}
Year of peak impact	2064	2064	2064	2064	2064	2064	2064	2064	2064

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.63×10^{-3}	9.17×10^{-2}	0.00	9.63×10^{-3}	9.18×10^{-2}	3.78×10^{-11}	9.63×10^{-3}	1.34×10^{-1}	1.73×10^{-6}
Nitrate	6.28×10^{-1}	1.12×10^{-2}	0.00	6.28×10^{-1}	1.48×10^{-2}	0.00	6.28×10^{-1}	2.89×10^{-2}	0.00
Total	6.37×10^{-1}	1.03×10^{-1}	0.00	6.37×10^{-1}	1.07×10^{-1}	3.78×10^{-11}	6.37×10^{-1}	1.63×10^{-1}	1.73×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.
Key: N/A=not applicable.

Table Q–164. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.33×10^{-6}	1.55×10^{-1}	8.70×10^{-7}	7.84×10^{-7}	1.46×10^{-1}	1.52×10^{-6}	7.84×10^{-7}	2.68×10^{-1}	3.04×10^{-6}
Technetium-99	1.99×10^{-5}	3.49×10^{1}	1.26×10^{-3}	2.10×10^{-5}	9.44×10^{1}	4.14×10^{-3}	2.10×10^{-5}	1.92×10^{2}	9.04×10^{-3}
Iodine-129	3.52×10^{-8}	1.00×10^{1}	8.88×10^{-5}	2.74×10^{-8}	9.06	1.20×10^{-4}	2.74×10^{-8}	1.12×10^{1}	1.73×10^{-4}
Uranium-238	5.60×10^{-12}	6.95×10^{-4}	7.41×10^{-9}	5.29×10^{-12}	6.81×10^{-4}	7.93×10^{-9}	5.29×10^{-12}	7.29×10^{-4}	8.98×10^{-9}
Total	2.13×10^{-5}	4.51×10^{1}	1.35×10^{-3}	2.18×10^{-5}	1.04×10^{2}	4.27×10^{-3}	2.18×10^{-5}	2.04×10^{2}	9.21×10^{-3}
Year of peak impact	2057	2057	2056	2056	2056	2056	2056	2056	2056
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.63	1.55×10^{1}	0.00	1.63	1.56×10^{1}	6.53×10^{-9}	1.63	2.27×10^{1}	3.00×10^{-4}
Nitrate	1.18×10^{3}	2.11×10^{1}	0.00	1.18×10^{3}	2.78×10^{1}	0.00	1.18×10^{3}	5.46×10^{1}	0.00
Total uranium	9.72×10^{-6}	9.26×10^{-5}	0.00	9.72×10^{-6}	9.36×10^{-5}	0.00	9.72×10^{-6}	9.69×10^{-5}	0.00
Total	1.19×10^{3}	3.67×10^{1}	0.00	1.19×10^{3}	4.34×10^{1}	6.53×10^{-9}	1.19×10^{3}	7.74×10^{1}	3.00×10^{-4}
Year of peak impact	2056	2056	N/A	2056	2056	2051	2056	2056	2051

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–165. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.81×10^{-7}	3.18×10^{-1}	1.09×10^{-5}	1.81×10^{-7}	8.16×10^{-1}	3.58×10^{-5}	1.81×10^{-7}	1.66	7.82×10^{-5}
Iodine-129	1.93×10^{-10}	5.50×10^{-2}	6.27×10^{-7}	1.93×10^{-10}	6.39×10^{-2}	8.46×10^{-7}	1.93×10^{-10}	7.89×10^{-2}	1.22×10^{-6}
Uranium-238	2.23×10^{-13}	2.76×10^{-5}	3.12×10^{-10}	2.23×10^{-13}	2.87×10^{-5}	3.34×10^{-10}	2.23×10^{-13}	3.07×10^{-5}	3.78×10^{-10}
Total	1.82×10^{-7}	3.73×10^{-1}	1.15×10^{-5}	1.82×10^{-7}	8.80×10^{-1}	3.67×10^{-5}	1.82×10^{-7}	1.74	7.94×10^{-5}
Year of peak impact	2502	2502	2502	2502	2502	2502	2502	2502	2502
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.70×10^{-2}	2.57×10^{-1}	0.00	2.70×10^{-2}	2.57×10^{-1}	1.13×10^{-10}	2.70×10^{-2}	3.76×10^{-1}	5.19×10^{-6}
Nitrate	7.52	1.34×10^{-1}	0.00	7.52	1.77×10^{-1}	0.00	7.52	3.47×10^{-1}	0.00
Total uranium	3.00×10^{-7}	2.86×10^{-6}	0.00	3.00×10^{-7}	2.89×10^{-6}	0.00	3.00×10^{-7}	2.99×10^{-6}	0.00
Total	7.55	3.91×10^{-1}	0.00	7.55	4.34×10^{-1}	1.13×10^{-10}	7.55	7.23×10^{-1}	5.19×10^{-6}
Year of peak impact	2303	2303	N/A	2303	2303	2256	2303	2303	2256

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–166. Tank Closure Alternative 6A, Option Case, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.31×10^{-13}	2.43×10^{-8}	2.54×10^{-13}	1.92×10^{-13}	6.63×10^{-8}	5.13×10^{-13}	1.70×10^{-7}	5.35×10^{-2}	6.57×10^{-7}
Technetium-99	8.07×10^{-12}	3.63×10^{-5}	1.60×10^{-9}	7.67×10^{-12}	7.97×10^{-5}	3.98×10^{-9}	4.37×10^{-8}	5.01×10^{-4}	2.72×10^{-8}
Iodine-129	1.39×10^{-14}	4.59×10^{-6}	6.08×10^{-11}	1.47×10^{-14}	7.94×10^{-5}	1.80×10^{-9}	9.41×10^{-11}	2.24×10^{-4}	5.47×10^{-9}
Uranium-238	7.55×10^{-20}	9.73×10^{-12}	1.13×10^{-16}	5.87×10^{-20}	2.09×10^{-11}	3.79×10^{-16}	3.97×10^{-15}	3.97×10^{-8}	5.02×10^{-13}
Total	8.22×10^{-12}	4.09×10^{-5}	1.66×10^{-9}	7.87×10^{-12}	1.59×10^{-4}	5.78×10^{-9}	2.13×10^{-7}	5.42×10^{-2}	6.89×10^{-7}
Year of peak impact	2134	2134	2134	2121	2121	2134	2057	2057	2057
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.06×10^{-6}	1.01×10^{-5}	4.17×10^{-15}	9.21×10^{-7}	1.41×10^{-5}	1.91×10^{-10}	2.70×10^{-2}	5.96×10^{-2}	2.60×10^{-6}
Nitrate	2.86×10^{-4}	9.89×10^{-6}	0.00	2.87×10^{-4}	2.70×10^{-2}	0.00	7.52	2.93×10^{-1}	0.00
Total uranium	3.89×10^{-13}	3.74×10^{-12}	0.00	3.39×10^{-13}	4.51×10^{-12}	0.00	3.00×10^{-7}	1.33×10^{-7}	0.00
Total	2.88×10^{-4}	2.00×10^{-5}	4.17×10^{-15}	2.88×10^{-4}	2.70×10^{-2}	1.91×10^{-10}	7.55	3.52×10^{-1}	2.60×10^{-6}
Year of peak impact	2052	2052	2052	2050	2050	2052	2303	2303	2256

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

The dose standard and Hazard Index guideline would be exceeded at the same locations and for the same receptors as under Alternatives 2A, 2B, 3A, 3B, 3C, 4, 5, and 6A, Base Case, for releases from cribs and trenches (ditches). Similar to Alternative 6A, Base Case, the dose standard and Hazard Index guideline would be exceeded at the same locations and for the same receptors as under Alternatives 2A, 2B, 3A, 3B, and 3C, but slightly higher than these alternatives. Impacts would be slightly higher than under Alternatives 2B, 3A, 3B, 3C, and 6C for onsite locations as a result of the combination of cribs and trenches (ditches), past leaks, and other sources. However, after the year 2940 the impacts drop significantly as a result of tank farm removal. Population dose was estimated as 2.05×10^{-1} person-rem per year for the year of maximum impact.

Figure Q–8 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2290 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from the two sources occurs around the year 2056 and is dominated by technetium-99, iodine-129, and uranium-238. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

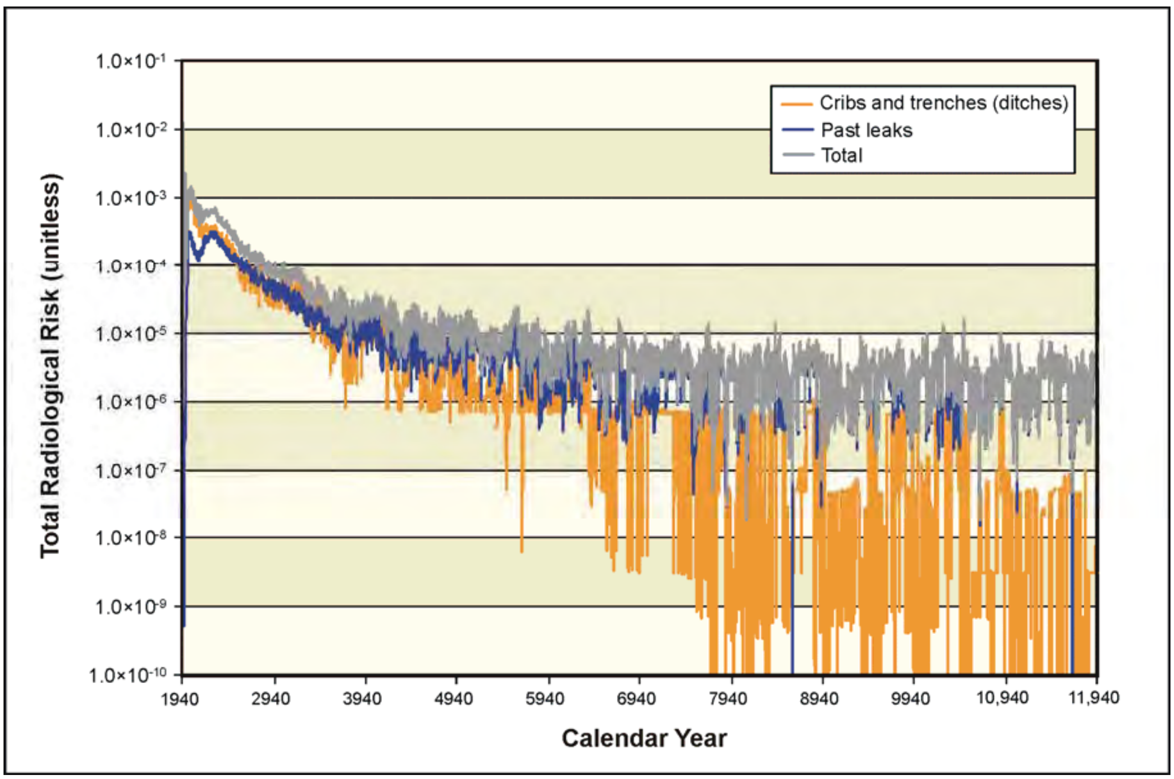

Figure Q–8. Tank Closure Alternative 6A, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.1.1.7 Tank Closure Alternative 6B, Base and Option Cases

Tank Closure Alternative 6B, Base and Option Cases, resembles Tank Closure Alternative 6A, Base and Option Cases, except that waste retrieval and processing would proceed at a faster rate and closure would occur at an earlier date. All tank farms would be clean closed and for the Base Case, the adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier and for the Option Case, the adjacent cribs and trenches (ditches) would be clean closed.

Potential human health impacts of Alternative 6B, Base Case, related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–167 through Q–171. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–172 through Q–179. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–180 through Q–187. Impacts would be similar to Alternative 6A, and standards would be exceeded, as under Alternative 6A. Population dose was estimated as 2.04×10^{-1} person-rem per year for the year of maximum impact.

Table Q–167. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	5.08×10^{1}	4.84×10^{2}	0.00	5.08×10^{1}	4.85×10^{2}	2.00×10^{-7}	5.08×10^{1}	7.08×10^{2}	9.16×10^{-3}
Nitrate	1.74×10^{4}	3.11×10^{2}	0.00	1.74×10^{4}	4.10×10^{2}	0.00	1.74×10^{4}	8.03×10^{2}	0.00
Total	1.75×10^{4}	7.95×10^{2}	0.00	1.75×10^{4}	8.94×10^{2}	2.00×10^{-7}	1.75×10^{4}	1.51×10^{3}	9.16×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–168. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.84×10^{-2}
Technetium-99	1.35×10^{-7}	2.36×10^{-1}	8.12×10^{-6}	1.35×10^{-7}	6.07×10^{-1}	2.66×10^{-5}	1.35×10^{-7}	1.24	5.81×10^{-5}
Iodine-129	1.14×10^{-9}	3.25×10^{-1}	3.71×10^{-6}	1.14×10^{-9}	3.78×10^{-1}	5.00×10^{-6}	1.14×10^{-9}	4.67×10^{-1}	7.20×10^{-6}
Uranium-238	1.18×10^{-11}	1.46×10^{-3}	1.65×10^{-8}	1.18×10^{-11}	1.52×10^{-3}	1.77×10^{-8}	1.18×10^{-11}	1.62×10^{-3}	2.00×10^{-8}
Total	1.25×10^{-2}	1.46×10^{3}	1.39×10^{-2}	1.25×10^{-2}	2.32×10^{3}	2.43×10^{-2}	1.25×10^{-2}	4.27×10^{3}	4.85×10^{-2}
Year of peak impact	1974	1974	1974	1974	1974	1974	1974	1974	1974
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.32	8.88×10^{1}	0.00	9.32	8.89×10^{1}	3.66×10^{-8}	9.32	1.30×10^{2}	1.68×10^{-3}
Nitrate	2.11×10^{3}	3.77×10^{1}	0.00	2.11×10^{3}	4.97×10^{1}	0.00	2.11×10^{3}	9.74×10^{1}	0.00
Total	2.12×10^{3}	1.27×10^{2}	0.00	2.12×10^{3}	1.39×10^{2}	3.66×10^{-8}	2.12×10^{3}	2.27×10^{2}	1.68×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–169. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.82×10^{-3}	3.30×10^{2}	3.13×10^{-3}	2.82×10^{-3}	5.25×10^{2}	5.48×10^{-3}	2.82×10^{-3}	9.65×10^{2}	1.09×10^{-2}
Technetium-99	1.44×10^{-4}	2.53×10^{2}	8.68×10^{-3}	1.44×10^{-4}	6.49×10^{2}	2.85×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.21×10^{-2}
Iodine-129	1.87×10^{-7}	5.32×10^{1}	6.06×10^{-4}	1.87×10^{-7}	6.18×10^{1}	8.18×10^{-4}	1.87×10^{-7}	7.63×10^{1}	1.18×10^{-3}
Total	2.97×10^{-3}	6.36×10^{2}	1.24×10^{-2}	2.97×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.97×10^{-3}	2.36×10^{3}	7.43×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.80×10^{1}	2.67×10^{2}	0.00	2.80×10^{1}	2.67×10^{2}	1.10×10^{-7}	2.80×10^{1}	3.91×10^{2}	5.05×10^{-3}
Nitrate	1.29×10^{4}	2.30×10^{2}	0.00	1.29×10^{4}	3.03×10^{2}	0.00	1.29×10^{4}	5.95×10^{2}	0.00
Total	1.29×10^{4}	4.97×10^{2}	0.00	1.29×10^{4}	5.70×10^{2}	1.10×10^{-7}	1.29×10^{4}	9.85×10^{2}	5.05×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–170. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.46×10^{-7}	4.04×10^{-2}	3.84×10^{-7}	3.46×10^{-7}	6.43×10^{-2}	6.72×10^{-7}	3.46×10^{-7}	1.18×10^{-1}	1.34×10^{-6}
Technetium-99	8.94×10^{-8}	1.57×10^{-1}	5.38×10^{-6}	8.94×10^{-8}	4.02×10^{-1}	1.77×10^{-5}	8.94×10^{-8}	8.19×10^{-1}	3.85×10^{-5}
Iodine-129	3.88×10^{-11}	1.10×10^{-2}	1.26×10^{-7}	3.88×10^{-11}	1.28×10^{-2}	1.70×10^{-7}	3.88×10^{-11}	1.58×10^{-2}	2.44×10^{-7}
Total	4.35×10^{-7}	2.08×10^{-1}	5.89×10^{-6}	4.35×10^{-7}	4.79×10^{-1}	1.85×10^{-5}	4.35×10^{-7}	9.53×10^{-1}	4.01×10^{-5}
Year of peak impact	2025	2025	2025	2025	2025	2025	2025	2025	2025

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.14×10^{-2}	2.99×10^{-1}	0.00	3.14×10^{-2}	2.99×10^{-1}	1.23×10^{-10}	3.14×10^{-2}	4.37×10^{-1}	5.66×10^{-6}
Nitrate	5.75	1.03×10^{-1}	0.00	5.75	1.35×10^{-1}	0.00	5.75	2.65×10^{-1}	0.00
Total	5.78	4.02×10^{-1}	0.00	5.78	4.35×10^{-1}	1.23×10^{-10}	5.78	7.03×10^{-1}	5.66×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–171. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.56×10^{-10}	6.62×10^{-5}	6.92×10^{-10}	3.56×10^{-10}	1.23×10^{-4}	1.40×10^{-9}	1.28×10^{-6}	4.04×10^{-1}	4.96×10^{-6}
Technetium-99	2.53×10^{-11}	1.14×10^{-4}	4.99×10^{-9}	2.53×10^{-11}	2.63×10^{-4}	1.24×10^{-8}	2.55×10^{-8}	2.99×10^{-4}	1.62×10^{-8}
Iodine-129	3.20×10^{-14}	1.06×10^{-5}	1.41×10^{-10}	3.20×10^{-14}	1.73×10^{-4}	4.16×10^{-9}	3.57×10^{-11}	1.09×10^{-4}	2.65×10^{-9}
Total	3.82×10^{-10}	1.91×10^{-4}	5.83×10^{-9}	3.82×10^{-10}	5.59×10^{-4}	1.80×10^{-8}	1.31×10^{-6}	4.04×10^{-1}	4.97×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1994	1994	1994
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.95×10^{-6}	8.53×10^{-5}	3.52×10^{-14}	8.95×10^{-6}	1.37×10^{-4}	1.61×10^{-9}	2.24×10^{-2}	4.97×10^{-2}	2.83×10^{-6}
Nitrate	2.24×10^{-3}	7.74×10^{-5}	0.00	2.24×10^{-3}	2.11×10^{-1}	0.00	4.36	6.64×10^{-1}	0.00
Total	2.25×10^{-3}	1.63×10^{-4}	3.52×10^{-14}	2.25×10^{-3}	2.11×10^{-1}	1.61×10^{-9}	4.38	7.14×10^{-1}	2.83×10^{-6}
Year of peak impact	1984	1984	1984	1984	1984	1984	1984	1984	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–172. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the A Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.61×10^{-6}	4.22×10^{-1}	4.01×10^{-6}	3.61×10^{-6}	6.71×10^{-1}	7.01×10^{-6}	3.61×10^{-6}	1.23	1.40×10^{-5}
Technetium-99	1.24×10^{-5}	2.17×10^{1}	7.46×10^{-4}	1.24×10^{-5}	5.57×10^{1}	2.45×10^{-3}	1.24×10^{-5}	1.13×10^{2}	5.34×10^{-3}
Iodine-129	2.39×10^{-8}	6.79	7.73×10^{-5}	2.39×10^{-8}	7.88	1.04×10^{-4}	2.39×10^{-8}	9.74	1.50×10^{-4}
Total	1.60×10^{-5}	2.89×10^{1}	8.27×10^{-4}	1.60×10^{-5}	6.42×10^{1}	2.56×10^{-3}	1.60×10^{-5}	1.24×10^{2}	5.50×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	6.31×10^{-2}	6.01×10^{-1}	0.00	6.31×10^{-2}	6.01×10^{-1}	2.48×10^{-10}	6.31×10^{-2}	8.78×10^{-1}	1.14×10^{-5}
Nitrate	4.19	7.49×10^{-2}	0.00	4.19	9.86×10^{-2}	0.00	4.19	1.93×10^{-1}	0.00
Total	4.26	6.75×10^{-1}	0.00	4.26	7.00×10^{-1}	2.48×10^{-10}	4.26	1.07	1.14×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–173. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	7.34×10^{-8}	8.58×10^{-3}	8.15×10^{-8}	7.34×10^{-8}	1.37×10^{-2}	1.43×10^{-7}	7.34×10^{-8}	2.51×10^{-2}	2.85×10^{-7}
Technetium-99	8.55×10^{-6}	1.50×10^{1}	5.15×10^{-4}	8.55×10^{-6}	3.85×10^{1}	1.69×10^{-3}	8.55×10^{-6}	7.84×10^{1}	3.69×10^{-3}
Iodine-129	1.62×10^{-8}	4.60	5.24×10^{-5}	1.62×10^{-8}	5.34	7.07×10^{-5}	1.62×10^{-8}	6.60	1.02×10^{-4}
Total	8.64×10^{-6}	1.96×10^{1}	5.68×10^{-4}	8.64×10^{-6}	4.38×10^{1}	1.76×10^{-3}	8.64×10^{-6}	8.50×10^{1}	3.79×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.09×10^{-2}	8.66×10^{-1}	0.00	9.09×10^{-2}	8.66×10^{-1}	3.57×10^{-10}	9.09×10^{-2}	1.27	1.64×10^{-5}
Nitrate	1.76×10^{1}	3.15×10^{-1}	0.00	1.76×10^{1}	4.15×10^{-1}	0.00	1.76×10^{1}	8.14×10^{-1}	0.00
Total	1.77×10^{1}	1.18	0.00	1.77×10^{1}	1.28	3.57×10^{-10}	1.77×10^{1}	2.08	1.64×10^{-5}
Year of peak impact	2049	2049	N/A	2049	2049	2049	2049	2049	2049

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–174. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the S Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.32×10^{-7}	2.71×10^{-2}	2.58×10^{-7}	2.32×10^{-7}	4.31×10^{-2}	4.51×10^{-7}	2.32×10^{-7}	7.93×10^{-2}	8.99×10^{-7}
Technetium-99	3.90×10^{-6}	6.83	2.35×10^{-4}	3.90×10^{-6}	1.75×10^{1}	7.70×10^{-4}	3.90×10^{-6}	3.57×10^{1}	1.68×10^{-3}
Iodine-129	7.62×10^{-9}	2.17	2.47×10^{-5}	7.62×10^{-9}	2.52	3.33×10^{-5}	7.62×10^{-9}	3.11	4.80×10^{-5}
Total	4.14×10^{-6}	9.02	2.60×10^{-4}	4.14×10^{-6}	2.01×10^{1}	8.04×10^{-4}	4.14×10^{-6}	3.89×10^{1}	1.73×10^{-3}
Year of peak impact	2030	2030	2030	2030	2030	2030	2030	2030	2030
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.07×10^{-1}	3.87	0.00	4.07×10^{-1}	3.88	1.60×10^{-9}	4.07×10^{-1}	5.67	7.33×10^{-5}
Nitrate	1.13×10^{1}	2.02×10^{-1}	0.00	1.13×10^{1}	2.67×10^{-1}	0.00	1.13×10^{1}	5.23×10^{-1}	0.00
Total	1.17×10^{1}	4.08	0.00	1.17×10^{1}	4.14	1.60×10^{-9}	1.17×10^{1}	6.19	7.33×10^{-5}
Year of peak impact	2029	2029	N/A	2029	2029	2029	2029	2029	2029

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–175. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the T Barrier Boundary

Radioactive Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.30×10^{-6}	3.85×10^{-1}	3.66×10^{-6}	3.30×10^{-6}	6.13×10^{-1}	6.41×10^{-6}	3.30×10^{-6}	1.13	1.28×10^{-5}
Technetium-99	2.35×10^{-5}	4.11×10^{1}	1.41×10^{-3}	2.35×10^{-5}	1.06×10^{2}	4.64×10^{-3}	2.35×10^{-5}	2.15×10^{2}	1.01×10^{-2}
Iodine-129	4.40×10^{-8}	1.25×10^{1}	1.42×10^{-4}	4.40×10^{-8}	1.45×10^{1}	1.92×10^{-4}	4.40×10^{-8}	1.79×10^{1}	2.77×10^{-4}
Total	2.68×10^{-5}	5.40×10^{1}	1.56×10^{-3}	2.68×10^{-5}	1.21×10^{2}	4.83×10^{-3}	2.68×10^{-5}	2.34×10^{2}	1.04×10^{-2}
Year of peak impact	2026	2026	2026	2026	2026	2026	2026	2026	2026
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.31×10^{-1}	5.06	0.00	5.30×10^{-1}	5.05	2.09×10^{-9}	5.30×10^{-1}	7.38	9.59×10^{-5}
Nitrate	3.87×10^{1}	6.92×10^{-1}	0.00	3.92×10^{1}	9.22×10^{-1}	0.00	3.92×10^{1}	1.81	0.00
Total	3.93×10^{1}	5.75	0.00	3.98×10^{1}	5.97	2.09×10^{-9}	3.98×10^{1}	9.19	9.59×10^{-5}
Year of peak impact	2028	2028	N/A	2029	2029	2027	2029	2029	2027

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–176. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the U Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.73×10^{-8}	2.02×10^{-3}	1.38×10^{-8}	1.25×10^{-8}	2.32×10^{-3}	2.42×10^{-8}	1.25×10^{-8}	4.26×10^{-3}	4.83×10^{-8}
Technetium-99	1.41×10^{-7}	2.46×10^{-1}	8.57×10^{-6}	1.42×10^{-7}	6.40×10^{-1}	2.81×10^{-5}	1.42×10^{-7}	1.30	6.13×10^{-5}
Iodine-129	2.64×10^{-10}	7.53×10^{-2}	8.15×10^{-7}	2.51×10^{-10}	8.31×10^{-2}	1.10×10^{-6}	2.51×10^{-10}	1.03×10^{-1}	1.58×10^{-6}
Total	1.58×10^{-7}	3.24×10^{-1}	9.40×10^{-6}	1.55×10^{-7}	7.25×10^{-1}	2.92×10^{-5}	1.55×10^{-7}	1.41	6.29×10^{-5}
Year of peak impact	2046	2046	2049	2049	2049	2049	2049	2049	2049

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.35×10^{-2}	1.29×10^{-1}	0.00	1.35×10^{-2}	1.29×10^{-1}	5.31×10^{-11}	1.35×10^{-2}	1.88×10^{-1}	2.44×10^{-6}
Nitrate	6.28×10^{-1}	1.12×10^{-2}	0.00	6.28×10^{-1}	1.48×10^{-2}	0.00	6.28×10^{-1}	2.90×10^{-2}	0.00
Total	6.41×10^{-1}	1.40×10^{-1}	0.00	6.41×10^{-1}	1.44×10^{-1}	5.31×10^{-11}	6.41×10^{-1}	2.17×10^{-1}	2.44×10^{-6}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–177. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.50×10^{-7}	1.75×10^{-2}	1.67×10^{-7}	1.50×10^{-7}	2.79×10^{-2}	2.91×10^{-7}	1.50×10^{-7}	5.13×10^{-2}	5.81×10^{-7}
Technetium-99	4.59×10^{-6}	8.05	2.77×10^{-4}	4.59×10^{-6}	2.07×10^{1}	9.07×10^{-4}	4.59×10^{-6}	4.21×10^{1}	1.98×10^{-3}
Iodine-129	7.69×10^{-9}	2.19	2.49×10^{-5}	7.69×10^{-9}	2.54	3.36×10^{-5}	7.69×10^{-9}	3.14	4.84×10^{-5}
Total	4.75×10^{-6}	1.03×10^{1}	3.02×10^{-4}	4.75×10^{-6}	2.32×10^{1}	9.41×10^{-4}	4.75×10^{-6}	4.53×10^{1}	2.03×10^{-3}
Year of peak impact	2034	2034	2034	2034	2034	2034	2034	2034	2034
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.17×10^{-1}	3.97	0.00	4.17×10^{-1}	3.97	1.64×10^{-9}	4.17×10^{-1}	5.80	7.51×10^{-5}
Nitrate	9.63	1.72×10^{-1}	0.00	9.63	2.26×10^{-1}	0.00	9.63	4.44×10^{-1}	0.00
Total	1.00×10^{1}	4.14	0.00	1.00×10^{1}	4.20	1.64×10^{-9}	1.00×10^{1}	6.25	7.51×10^{-5}
Year of peak impact	2224	2224	N/A	2224	2224	2224	2224	2224	2224

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–178. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.78×10^{-11}	4.42×10^{-6}	4.20×10^{-11}	3.78×10^{-11}	7.03×10^{-6}	7.35×10^{-11}	3.78×10^{-11}	1.29×10^{-5}	1.47×10^{-10}
Technetium-99	1.42×10^{-7}	2.48×10^{-1}	8.53×10^{-6}	1.42×10^{-7}	6.37×10^{-1}	2.80×10^{-5}	1.42×10^{-7}	1.30	6.10×10^{-5}
Iodine-129	1.10×10^{-10}	3.12×10^{-2}	3.55×10^{-7}	1.10×10^{-10}	3.62×10^{-2}	4.79×10^{-7}	1.10×10^{-10}	4.47×10^{-2}	6.90×10^{-7}
Total	1.42×10^{-7}	2.79×10^{-1}	8.88×10^{-6}	1.42×10^{-7}	6.73×10^{-1}	2.84×10^{-5}	1.42×10^{-7}	1.34	6.17×10^{-5}
Year of peak impact	2133	2133	2133	2133	2133	2133	2133	2133	2133
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.53×10^{-3}	3.36×10^{-2}	0.00	3.53×10^{-3}	3.36×10^{-2}	1.38×10^{-11}	3.53×10^{-3}	4.91×10^{-2}	6.35×10^{-7}
Nitrate	1.58×10^{-1}	2.82×10^{-3}	0.00	1.58×10^{-1}	3.71×10^{-3}	0.00	1.58×10^{-1}	7.27×10^{-3}	0.00
Total	1.61×10^{-1}	3.64×10^{-2}	0.00	1.61×10^{-1}	3.73×10^{-2}	1.38×10^{-11}	1.61×10^{-1}	5.64×10^{-2}	6.35×10^{-7}
Year of peak impact	2152	2152	N/A	2152	2152	2152	2152	2152	2152

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–179. Tank Closure Alternative 6B, Base Case, Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

Radiological Constituent	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Hunter-Gatherer: Dose at Year of Peak Dose (millirem per year)	American Indian Hunter-Gatherer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.04×10^{-15}	1.93×10^{-10}	2.02×10^{-15}	1.04×10^{-15}	3.60×10^{-10}	4.08×10^{-15}	3.78×10^{-11}	1.19×10^{-5}	1.46×10^{-10}
Technetium-99	6.54×10^{-12}	2.94×10^{-5}	1.29×10^{-9}	6.54×10^{-12}	6.80×10^{-5}	3.22×10^{-9}	1.42×10^{-7}	1.58×10^{-3}	8.64×10^{-8}
Iodine-129	1.17×10^{-14}	3.89×10^{-6}	5.15×10^{-11}	1.17×10^{-14}	6.34×10^{-5}	1.53×10^{-9}	1.10×10^{-10}	3.11×10^{-4}	7.58×10^{-9}
Total	6.55×10^{-12}	3.33×10^{-5}	1.34×10^{-9}	6.55×10^{-12}	1.31×10^{-4}	4.75×10^{-9}	1.42×10^{-7}	1.90×10^{-3}	9.41×10^{-8}
Year of peak impact	2143	2143	2143	2143	2143	2143	2133	2133	2133

Chemical Constituent	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Hunter-Gatherer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Hunter-Gatherer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.81×10^{-7}	1.73×10^{-6}	7.12×10^{-16}	1.53×10^{-7}	2.33×10^{-6}	3.26×10^{-11}	3.03×10^{-3}	6.69×10^{-3}	3.18×10^{-7}
Nitrate	9.96×10^{-6}	3.44×10^{-7}	0.00	1.06×10^{-5}	9.99×10^{-4}	0.00	1.94×10^{-1}	8.98×10^{-3}	0.00
Total	1.01×10^{-5}	2.07×10^{-6}	7.12×10^{-16}	1.08×10^{-5}	1.00×10^{-3}	3.26×10^{-11}	1.97×10^{-1}	1.57×10^{-2}	3.18×10^{-7}
Year of peak impact	2165	2165	2165	2150	2150	2165	2181	2181	2152

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–180. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.68×10^{-8}	3.13×10^{-3}	2.98×10^{-8}	2.68×10^{-8}	4.98×10^{-3}	5.21×10^{-8}	2.68×10^{-8}	9.16×10^{-3}	1.04×10^{-7}
Technetium-99	1.39×10^{-6}	2.43	8.35×10^{-5}	1.39×10^{-6}	6.24	2.74×10^{-4}	1.39×10^{-6}	1.27×10^{1}	5.97×10^{-4}
Iodine-129	2.75×10^{-9}	7.82×10^{-1}	8.91×10^{-6}	2.75×10^{-9}	9.08×10^{-1}	1.20×10^{-5}	2.75×10^{-9}	1.12	1.73×10^{-5}
Total	1.42×10^{-6}	3.21	9.24×10^{-5}	1.42×10^{-6}	7.15	2.86×10^{-4}	1.42×10^{-6}	1.38×10^{1}	6.15×10^{-4}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	7.24×10^{-3}	6.89×10^{-2}	0.00	7.24×10^{-3}	6.90×10^{-2}	2.84×10^{-11}	7.24×10^{-3}	1.01×10^{-1}	1.30×10^{-6}
Nitrate	4.43×10^{-1}	7.91×10^{-3}	0.00	4.43×10^{-1}	1.04×10^{-2}	0.00	4.43×10^{-1}	2.04×10^{-2}	0.00
Total	4.50×10^{-1}	7.68×10^{-2}	0.00	4.50×10^{-1}	7.94×10^{-2}	2.84×10^{-11}	4.50×10^{-1}	1.21×10^{-1}	1.30×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–181. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	4.07×10^{-7}	4.76×10^{-2}	4.52×10^{-7}	4.07×10^{-7}	7.57×10^{-2}	7.91×10^{-7}	4.07×10^{-7}	1.39×10^{-1}	1.58×10^{-6}
Technetium-99	2.93×10^{-5}	5.13×10^{1}	1.76×10^{-3}	2.93×10^{-5}	1.32×10^{2}	5.78×10^{-3}	2.93×10^{-5}	2.68×10^{2}	1.26×10^{-2}
Iodine-129	3.62×10^{-8}	1.03×10^{1}	1.17×10^{-4}	3.62×10^{-8}	1.20×10^{1}	1.58×10^{-4}	3.62×10^{-8}	1.48×10^{1}	2.28×10^{-4}
Total	2.97×10^{-5}	6.17×10^{1}	1.88×10^{-3}	2.97×10^{-5}	1.44×10^{2}	5.94×10^{-3}	2.97×10^{-5}	2.83×10^{2}	1.28×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.18	3.02×10^{1}	0.00	3.18	3.03×10^{1}	1.25×10^{-8}	3.18	4.42×10^{1}	5.72×10^{-4}
Nitrate	1.54×10^{3}	2.75×10^{1}	0.00	1.54×10^{3}	3.62×10^{1}	0.00	1.54×10^{3}	7.10×10^{1}	0.00
Total	1.54×10^{3}	5.78×10^{1}	0.00	1.54×10^{3}	6.65×10^{1}	1.25×10^{-8}	1.54×10^{3}	1.15×10^{2}	5.72×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2055	2050	2050	2055

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–182. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the S Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	4.62×10^{-8}	5.39×10^{-3}	5.13×10^{-8}	4.62×10^{-8}	8.58×10^{-3}	8.97×10^{-8}	4.62×10^{-8}	1.58×10^{-2}	1.79×10^{-7}
Technetium-99	2.56×10^{-6}	4.49	1.54×10^{-4}	2.56×10^{-6}	1.15×10^{1}	5.06×10^{-4}	2.56×10^{-6}	2.35×10^{1}	1.10×10^{-3}
Iodine-129	4.80×10^{-9}	1.37	1.56×10^{-5}	4.80×10^{-9}	1.59	2.10×10^{-5}	4.80×10^{-9}	1.96	3.02×10^{-5}
Total	2.61×10^{-6}	5.86	1.70×10^{-4}	2.61×10^{-6}	1.31×10^{1}	5.27×10^{-4}	2.61×10^{-6}	2.55×10^{1}	1.13×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.83×10^{-1}	2.70	0.00	2.83×10^{-1}	2.70	1.11×10^{-9}	2.83×10^{-1}	3.95	5.10×10^{-5}
Nitrate	8.65	1.55×10^{-1}	0.00	8.65	2.03×10^{-1}	0.00	8.65	3.99×10^{-1}	0.00
Total	8.94	2.85	0.00	8.94	2.90	1.11×10^{-9}	8.94	4.35	5.10×10^{-5}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–183. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the T Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	5.16×10^{-6}	6.02×10^{-1}	5.72×10^{-6}	5.16×10^{-6}	9.58×10^{-1}	1.00×10^{-5}	5.16×10^{-6}	1.76	2.00×10^{-5}
Technetium-99	1.55×10^{-5}	2.72×10^{1}	9.35×10^{-4}	1.55×10^{-5}	6.98×10^{1}	3.07×10^{-3}	1.55×10^{-5}	1.42×10^{2}	6.69×10^{-3}
Iodine-129	2.90×10^{-8}	8.26	9.40×10^{-5}	2.90×10^{-8}	9.59	1.27×10^{-4}	2.90×10^{-8}	1.18×10^{1}	1.83×10^{-4}
Uranium-238	1.62×10^{-10}	2.01×10^{-2}	2.27×10^{-7}	1.62×10^{-10}	2.08×10^{-2}	2.43×10^{-7}	1.62×10^{-10}	2.23×10^{-2}	2.75×10^{-7}
Total	2.07×10^{-5}	3.61×10^{1}	1.03×10^{-3}	2.07×10^{-5}	8.04×10^{1}	3.20×10^{-3}	2.07×10^{-5}	1.56×10^{2}	6.89×10^{-3}
Year of peak impact	2051	2051	2051	2051	2051	2051	2051	2051	2051
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	7.71×10^{-1}	7.35	0.00	7.71×10^{-1}	7.35	3.03×10^{-9}	7.71×10^{-1}	1.07×10^{1}	1.39×10^{-4}
Nitrate	1.29×10^{2}	2.31	0.00	1.29×10^{2}	3.04	0.00	1.29×10^{2}	5.96	0.00
Total uranium	1.85×10^{-4}	1.76×10^{-3}	0.00	1.85×10^{-4}	1.78×10^{-3}	0.00	1.85×10^{-4}	1.85×10^{-3}	0.00
Total	1.30×10^{2}	9.65	0.00	1.30×10^{2}	1.04×10^{1}	3.03×10^{-9}	1.30×10^{2}	1.67×10^{1}	1.39×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–184. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the U Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	6.84×10^{-9}	7.99×10^{-4}	7.60×10^{-9}	6.84×10^{-9}	1.27×10^{-3}	1.33×10^{-8}	6.84×10^{-9}	2.34×10^{-3}	2.65×10^{-8}
Technetium-99	1.40×10^{-7}	2.46×10^{-1}	8.45×10^{-6}	1.40×10^{-7}	6.31×10^{-1}	2.77×10^{-5}	1.40×10^{-7}	1.29	6.05×10^{-5}
Iodine-129	2.69×10^{-10}	7.66×10^{-2}	8.72×10^{-7}	2.69×10^{-10}	8.89×10^{-2}	1.18×10^{-6}	2.69×10^{-10}	1.10×10^{-1}	1.69×10^{-6}
Total	1.47×10^{-7}	3.23×10^{-1}	9.33×10^{-6}	1.47×10^{-7}	7.22×10^{-1}	2.89×10^{-5}	1.47×10^{-7}	1.40	6.22×10^{-5}
Year of peak impact	2060	2060	2060	2060	2060	2060	2060	2060	2060
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.25×10^{-3}	8.81×10^{-2}	0.00	9.25×10^{-3}	8.81×10^{-2}	3.63×10^{-11}	9.25×10^{-3}	1.29×10^{-1}	1.67×10^{-6}
Nitrate	6.06×10^{-1}	1.08×10^{-2}	0.00	6.06×10^{-1}	1.42×10^{-2}	0.00	6.06×10^{-1}	2.80×10^{-2}	0.00
Total	6.15×10^{-1}	9.89×10^{-2}	0.00	6.15×10^{-1}	1.02×10^{-1}	3.63×10^{-11}	6.15×10^{-1}	1.57×10^{-1}	1.67×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–185. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.08×10^{-6}	2.43×10^{-1}	2.31×10^{-6}	2.08×10^{-6}	3.87×10^{-1}	4.05×10^{-6}	2.08×10^{-6}	7.12×10^{-1}	8.07×10^{-6}
Technetium-99	2.48×10^{-5}	4.34×10^{1}	1.49×10^{-3}	2.48×10^{-5}	1.11×10^{2}	4.89×10^{-3}	2.48×10^{-5}	2.27×10^{2}	1.07×10^{-2}
Iodine-129	2.81×10^{-8}	7.99	9.09×10^{-5}	2.81×10^{-8}	9.27	1.23×10^{-4}	2.81×10^{-8}	1.15×10^{1}	1.77×10^{-4}
Total	2.69×10^{-5}	5.16×10^{1}	1.59×10^{-3}	2.69×10^{-5}	1.21×10^{2}	5.02×10^{-3}	2.69×10^{-5}	2.39×10^{2}	1.09×10^{-2}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.66	1.58×10^{1}	0.00	1.66	1.58×10^{1}	6.50×10^{-9}	1.66	2.31×10^{1}	2.98×10^{-4}
Nitrate	1.01×10^{3}	1.80×10^{1}	0.00	1.01×10^{3}	2.37×10^{1}	0.00	1.01×10^{3}	4.65×10^{1}	0.00
Total	1.01×10^{3}	3.38×10^{1}	0.00	1.01×10^{3}	3.95×10^{1}	6.50×10^{-9}	1.01×10^{3}	6.96×10^{1}	2.98×10^{-4}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–186. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.76×10^{-10}	2.06×10^{-5}	1.96×10^{-10}	1.76×10^{-10}	3.27×10^{-5}	3.42×10^{-10}	1.76×10^{-10}	6.02×10^{-5}	6.83×10^{-10}
Technetium-99	1.68×10^{-7}	2.95×10^{-1}	1.01×10^{-5}	1.68×10^{-7}	7.56×10^{-1}	3.32×10^{-5}	1.68×10^{-7}	1.54	7.25×10^{-5}
Iodine-129	1.52×10^{-10}	4.33×10^{-2}	4.93×10^{-7}	1.52×10^{-10}	5.03×10^{-2}	6.66×10^{-7}	1.52×10^{-10}	6.21×10^{-2}	9.58×10^{-7}
Total	1.68×10^{-7}	3.38×10^{-1}	1.06×10^{-5}	1.68×10^{-7}	8.07×10^{-1}	3.39×10^{-5}	1.68×10^{-7}	1.60	7.34×10^{-5}
Year of peak impact	2214	2214	2214	2214	2214	2214	2214	2214	2214
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.33×10^{-2}	3.17×10^{-1}	0.00	3.33×10^{-2}	3.17×10^{-1}	1.31×10^{-10}	3.33×10^{-2}	4.64×10^{-1}	6.00×10^{-6}
Nitrate	5.88	1.05×10^{-1}	0.00	5.88	1.38×10^{-1}	0.00	5.88	2.71×10^{-1}	0.00
Total	5.91	4.22×10^{-1}	0.00	5.91	4.56×10^{-1}	1.31×10^{-10}	5.91	7.35×10^{-1}	6.00×10^{-6}
Year of peak impact	2695	2695	N/A	2695	2695	2695	2695	2695	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–187. Tank Closure Alternative 6B, Base Case, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	6.29×10^{-14}	1.17×10^{-8}	1.22×10^{-13}	6.29×10^{-14}	2.17×10^{-8}	2.47×10^{-13}	1.78×10^{-7}	5.61×10^{-2}	6.88×10^{-7}
Technetium-99	8.09×10^{-12}	3.64×10^{-5}	1.60×10^{-9}	8.09×10^{-12}	8.41×10^{-5}	3.98×10^{-9}	4.73×10^{-8}	5.35×10^{-4}	2.91×10^{-8}
Iodine-129	1.34×10^{-14}	4.45×10^{-6}	5.90×10^{-11}	1.34×10^{-14}	7.26×10^{-5}	1.75×10^{-9}	7.28×10^{-11}	1.77×10^{-4}	4.33×10^{-9}
Total	8.17×10^{-12}	4.09×10^{-5}	1.66×10^{-9}	8.17×10^{-12}	1.57×10^{-4}	5.73×10^{-9}	2.25×10^{-7}	5.68×10^{-2}	7.22×10^{-7}
Year of peak impact	2143	2143	2143	2143	2143	2143	2050	2050	2050
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.39×10^{-7}	8.96×10^{-6}	3.98×10^{-15}	9.39×10^{-7}	1.43×10^{-5}	1.82×10^{-10}	2.30×10^{-2}	5.07×10^{-2}	3.00×10^{-6}
Nitrate	2.94×10^{-4}	1.01×10^{-5}	0.00	2.94×10^{-4}	2.76×10^{-2}	0.00	8.42	3.26×10^{-1}	0.00
Total uranium	0.00	0.00	0.00	0.00	0.00	0.00	4.20×10^{-12}	1.14×10^{-10}	0.00
Total	2.95×10^{-4}	1.91×10^{-5}	3.98×10^{-15}	2.95×10^{-4}	2.76×10^{-2}	1.82×10^{-10}	8.44	3.77×10^{-1}	3.00×10^{-6}
Year of peak impact	2067	2067	2066	2067	2067	2066	2450	2450	2695

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figure Q–9 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2034 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from the two sources occurs around the year 2050 and is dominated by technetium-99, and iodine-129. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

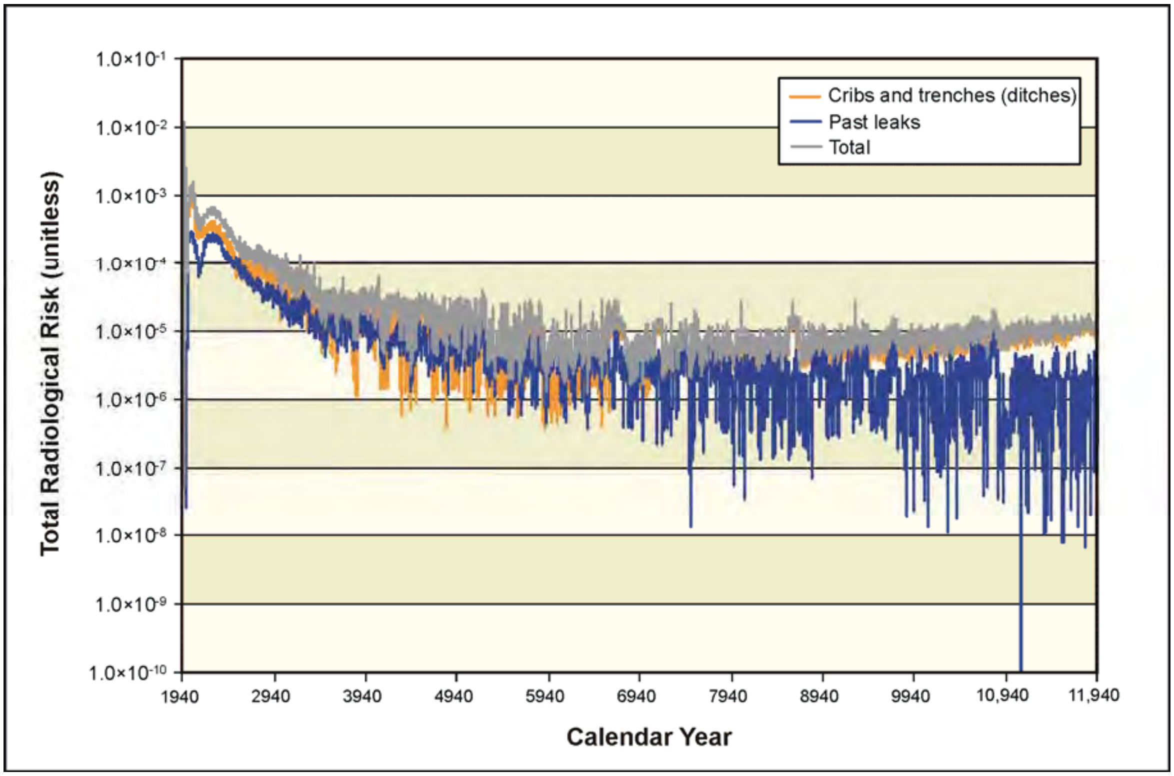

Figure Q–9. Tank Closure Alternative 6B, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Potential human health impacts of Alternative 6B, Option Case, related to cribs and trenches (ditches) after year 1940 are summarized in Tables Q–188 through Q–192. Potential human health impacts of this alternative related to past leaks after year 1940 are summarized in Tables Q–193 through Q–200. Potential human health impacts of this alternative related to the combination of cribs and trenches (ditches), past leaks, and other sources (i.e., tank farms) after the year 2050 are summarized in Tables Q–201 through Q–208. Impacts would be slightly less than under Alternative 6B, Base Case, and standards would be exceeded, as under Alternative 6B, Base Case. Population dose was estimated as 2.00×10^{-1} person-rem per year for the year of maximum impact.

Table Q–188. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the B Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.84×10^{-3}	3.32×10^{2}	3.16×10^{-3}	2.84×10^{-3}	5.29×10^{2}	5.52×10^{-3}	2.84×10^{-3}	9.72×10^{2}	1.10×10^{-2}
Technetium-99	1.44×10^{-4}	2.52×10^{2}	8.66×10^{-3}	1.44×10^{-4}	6.47×10^{2}	2.84×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.20×10^{-2}
Iodine-129	1.87×10^{-7}	5.33×10^{1}	6.07×10^{-4}	1.87×10^{-7}	6.19×10^{1}	8.20×10^{-4}	1.87×10^{-7}	7.65×10^{1}	1.18×10^{-3}
Total	2.99×10^{-3}	6.37×10^{2}	1.24×10^{-2}	2.99×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.99×10^{-3}	2.37×10^{3}	7.42×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.12×10^{1}	4.88×10^{2}	0.00	5.12×10^{1}	4.88×10^{2}	2.01×10^{-7}	5.12×10^{1}	7.14×10^{2}	9.23×10^{-3}
Nitrate	1.78×10^{4}	3.18×10^{2}	0.00	1.78×10^{4}	4.19×10^{2}	0.00	1.78×10^{4}	8.21×10^{2}	0.00
Total Uranium	6.33×10^{-8}	6.03×10^{-7}	0.00	6.33×10^{-8}	6.10×10^{-7}	0.00	6.33×10^{-8}	6.31×10^{-7}	0.00
Total	1.79×10^{4}	8.06×10^{2}	0.00	1.79×10^{4}	9.07×10^{2}	2.01×10^{-7}	1.79×10^{4}	1.54×10^{3}	9.23×10^{-3}
Year of peak impact	1955	1955	N/A	1955	1955	1955	1955	1955	1955

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–189. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.24×10^{-2}	1.45×10^{3}	1.38×10^{-2}	1.24×10^{-2}	2.31×10^{3}	2.42×10^{-2}	1.24×10^{-2}	4.25×10^{3}	4.82×10^{-2}
Technetium-99	1.29×10^{-7}	2.26×10^{-1}	7.78×10^{-6}	1.29×10^{-7}	5.81×10^{-1}	2.55×10^{-5}	1.29×10^{-7}	1.18	5.56×10^{-5}
Iodine-129	1.05×10^{-9}	3.00×10^{-1}	3.42×10^{-6}	1.05×10^{-9}	3.49×10^{-1}	4.62×10^{-6}	1.05×10^{-9}	4.31×10^{-1}	6.64×10^{-6}
Uranium-238	3.68×10^{-11}	4.57×10^{-3}	5.16×10^{-8}	3.68×10^{-11}	4.74×10^{-3}	5.53×10^{-8}	3.68×10^{-11}	5.08×10^{-3}	6.25×10^{-8}
Total	1.24×10^{-2}	1.45×10^{3}	1.38×10^{-2}	1.24×10^{-2}	2.31×10^{3}	2.42×10^{-2}	1.24×10^{-2}	4.25×10^{3}	4.83×10^{-2}
Year of peak impact	1974	1974	1974	1974	1974	1974	1974	1974	1974
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.14	8.70×10^{1}	0.00	9.14	8.71×10^{1}	3.59×10^{-8}	9.14	1.27×10^{2}	1.65×10^{-3}
Nitrate	2.14×10^{3}	3.81×10^{1}	0.00	2.14×10^{3}	5.02×10^{1}	0.00	2.14×10^{3}	9.85×10^{1}	0.00
Total	2.14×10^{3}	1.25×10^{2}	0.00	2.14×10^{3}	1.37×10^{2}	3.59×10^{-8}	2.14×10^{3}	2.26×10^{2}	1.65×10^{-3}
Year of peak impact	1961	1961	N/A	1961	1961	1961	1961	1961	1961

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–190. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.84×10^{-3}	3.32×10^{2}	3.16×10^{-3}	2.84×10^{-3}	5.29×10^{2}	5.52×10^{-3}	2.84×10^{-3}	9.72×10^{2}	1.10×10^{-2}
Technetium-99	1.44×10^{-4}	2.52×10^{2}	8.66×10^{-3}	1.44×10^{-4}	6.47×10^{2}	2.84×10^{-2}	1.44×10^{-4}	1.32×10^{3}	6.20×10^{-2}
Iodine-129	1.87×10^{-7}	5.33×10^{1}	6.07×10^{-4}	1.87×10^{-7}	6.19×10^{1}	8.20×10^{-4}	1.87×10^{-7}	7.65×10^{1}	1.18×10^{-3}
Total	2.99×10^{-3}	6.37×10^{2}	1.24×10^{-2}	2.99×10^{-3}	1.24×10^{3}	3.48×10^{-2}	2.99×10^{-3}	2.37×10^{3}	7.42×10^{-2}
Year of peak impact	1956	1956	1956	1956	1956	1956	1956	1956	1956
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.83×10^{1}	2.70×10^{2}	0.00	2.83×10^{1}	2.70×10^{2}	1.11×10^{-7}	2.83×10^{1}	3.95×10^{2}	5.10×10^{-3}
Nitrate	1.37×10^{4}	2.45×10^{2}	0.00	1.37×10^{4}	3.22×10^{2}	0.00	1.37×10^{4}	6.32×10^{2}	0.00
Total	1.37×10^{4}	5.15×10^{2}	0.00	1.37×10^{4}	5.92×10^{2}	1.11×10^{-7}	1.37×10^{4}	1.03×10^{3}	5.10×10^{-3}
Year of peak impact	1956	1956	N/A	1956	1956	1956	1956	1956	1956

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–191. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.61×10^{-6}	1.88×10^{-1}	3.87×10^{-7}	1.61×10^{-6}	2.99×10^{-1}	6.77×10^{-7}	3.49×10^{-7}	1.19×10^{-1}	1.35×10^{-6}
Technetium-99	1.03×10^{-8}	1.80×10^{-2}	3.55×10^{-6}	1.03×10^{-8}	4.62×10^{-2}	1.16×10^{-5}	5.89×10^{-8}	5.40×10^{-1}	2.54×10^{-5}
Iodine-129	2.65×10^{-11}	7.53×10^{-3}	2.09×10^{-7}	2.65×10^{-11}	8.75×10^{-3}	2.82×10^{-7}	6.44×10^{-11}	2.63×10^{-2}	4.06×10^{-7}
Total	1.62×10^{-6}	2.13×10^{-1}	4.14×10^{-6}	1.62×10^{-6}	3.54×10^{-1}	1.26×10^{-5}	4.08×10^{-7}	6.85×10^{-1}	2.71×10^{-5}
Year of peak impact	1997	1997	2019	1997	1997	2019	2019	2019	2019

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.57×10^{-2}	2.45×10^{-1}	0.00	2.57×10^{-2}	2.45×10^{-1}	1.01×10^{-10}	2.57×10^{-2}	3.58×10^{-1}	4.63×10^{-6}
Nitrate	6.25	1.12×10^{-1}	0.00	6.25	1.47×10^{-1}	0.00	6.25	2.88×10^{-1}	0.00
Total uranium	1.12×10^{-8}	1.06×10^{-7}	0.00	1.12×10^{-8}	1.08×10^{-7}	0.00	1.12×10^{-8}	1.11×10^{-7}	0.00
Total	6.27	3.56×10^{-1}	0.00	6.27	3.92×10^{-1}	1.01×10^{-10}	6.27	6.46×10^{-1}	4.63×10^{-6}
Year of peak impact	2166	2166	N/A	2166	2166	2166	2166	2166	2166

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–192. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Cribs and Trenches (Ditches) at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	3.62×10^{-10}	6.74×10^{-5}	7.04×10^{-10}	3.62×10^{-10}	1.25×10^{-4}	1.42×10^{-9}	1.61×10^{-6}	5.07×10^{-1}	6.22×10^{-6}
Technetium-99	2.54×10^{-11}	1.14×10^{-4}	5.01×10^{-9}	2.54×10^{-11}	2.64×10^{-4}	1.25×10^{-8}	1.03×10^{-8}	1.33×10^{-4}	7.02×10^{-9}
Iodine-129	3.15×10^{-14}	1.04×10^{-5}	1.38×10^{-10}	3.15×10^{-14}	1.70×10^{-4}	4.09×10^{-9}	2.65×10^{-11}	1.00×10^{-4}	2.44×10^{-9}
Total	3.88×10^{-10}	1.92×10^{-4}	5.86×10^{-9}	3.88×10^{-10}	5.59×10^{-4}	1.80×10^{-8}	1.62×10^{-6}	5.07×10^{-1}	6.23×10^{-6}
Year of peak impact	1962	1962	1962	1962	1962	1962	1997	1997	1997
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.90×10^{-6}	8.49×10^{-5}	3.50×10^{-14}	4.33×10^{-6}	6.61×10^{-5}	1.60×10^{-9}	1.60×10^{-2}	3.55×10^{-2}	2.31×10^{-6}
Nitrate	2.18×10^{-3}	7.54×10^{-5}	0.00	2.19×10^{-3}	2.06×10^{-1}	0.00	4.55	6.58×10^{-1}	0.00
Total	2.19×10^{-3}	1.60×10^{-4}	3.50×10^{-14}	2.20×10^{-3}	2.06×10^{-1}	1.60×10^{-9}	4.57	6.93×10^{-1}	2.31×10^{-6}
Year of peak impact	1984	1984	1984	1962	1962	1984	1984	1984	2166

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–193. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.61×10^{-6}	4.22×10^{-1}	4.01×10^{-6}	3.61×10^{-6}	6.71×10^{-1}	7.01×10^{-6}	3.61×10^{-6}	1.23	1.40×10^{-5}
Technetium-99	1.24×10^{-5}	2.17×10^{1}	7.46×10^{-4}	1.24×10^{-5}	5.57×10^{1}	2.45×10^{-3}	1.24×10^{-5}	1.13×10^{2}	5.34×10^{-3}
Iodine-129	2.39×10^{-8}	6.79	7.73×10^{-5}	2.39×10^{-8}	7.88	1.04×10^{-4}	2.39×10^{-8}	9.74	1.50×10^{-4}
Total	1.60×10^{-5}	2.89×10^{1}	8.27×10^{-4}	1.60×10^{-5}	6.42×10^{1}	2.56×10^{-3}	1.60×10^{-5}	1.24×10^{2}	5.50×10^{-3}
Year of peak impact	1999	1999	1999	1999	1999	1999	1999	1999	1999
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	6.31×10^{-2}	6.01×10^{-1}	0.00	6.31×10^{-2}	6.01×10^{-1}	2.48×10^{-10}	6.31×10^{-2}	8.78×10^{-1}	1.14×10^{-5}
Nitrate	4.19	7.49×10^{-2}	0.00	4.19	9.86×10^{-2}	0.00	4.19	1.93×10^{-1}	0.00
Total	4.26	6.75×10^{-1}	0.00	4.26	7.00×10^{-1}	2.48×10^{-10}	4.26	1.07	1.14×10^{-5}
Year of peak impact	1999	1999	N/A	1999	1999	1999	1999	1999	1999

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–194. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	7.34×10^{-8}	8.58×10^{-3}	8.15×10^{-8}	7.34×10^{-8}	1.37×10^{-2}	1.43×10^{-7}	7.34×10^{-8}	2.51×10^{-2}	2.85×10^{-7}
Technetium-99	8.55×10^{-6}	1.50×10^{1}	5.15×10^{-4}	8.55×10^{-6}	3.85×10^{1}	1.69×10^{-3}	8.55×10^{-6}	7.84×10^{1}	3.69×10^{-3}
Iodine-129	1.62×10^{-8}	4.60	5.24×10^{-5}	1.62×10^{-8}	5.34	7.07×10^{-5}	1.62×10^{-8}	6.60	1.02×10^{-4}
Total	8.64×10^{-6}	1.96×10^{1}	5.68×10^{-4}	8.64×10^{-6}	4.38×10^{1}	1.76×10^{-3}	8.64×10^{-6}	8.50×10^{1}	3.79×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.09×10^{-2}	8.66×10^{-1}	0.00	9.09×10^{-2}	8.66×10^{-1}	3.57×10^{-10}	9.09×10^{-2}	1.27	1.64×10^{-5}
Nitrate	1.76×10^{1}	3.15×10^{-1}	0.00	1.76×10^{1}	4.15×10^{-1}	0.00	1.76×10^{1}	8.14×10^{-1}	0.00
Total	1.77×10^{1}	1.18	0.00	1.77×10^{1}	1.28	3.57×10^{-10}	1.77×10^{1}	2.08	1.64×10^{-5}
Year of peak impact	2049	2049	N/A	2049	2049	2049	2049	2049	2049

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–195. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.32×10^{-7}	2.71×10^{-2}	2.58×10^{-7}	2.32×10^{-7}	4.31×10^{-2}	4.51×10^{-7}	2.32×10^{-7}	7.93×10^{-2}	8.99×10^{-7}
Technetium-99	3.90×10^{-6}	6.83	2.35×10^{-4}	3.90×10^{-6}	1.75×10^{1}	7.70×10^{-4}	3.90×10^{-6}	3.57×10^{1}	1.68×10^{-3}
Iodine-129	7.62×10^{-9}	2.17	2.47×10^{-5}	7.62×10^{-9}	2.52	3.33×10^{-5}	7.62×10^{-9}	3.11	4.80×10^{-5}
Total	4.14×10^{-6}	9.02	2.60×10^{-4}	4.14×10^{-6}	2.01×10^{1}	8.04×10^{-4}	4.14×10^{-6}	3.89×10^{1}	1.73×10^{-3}
Year of peak impact	2030	2030	2030	2030	2030	2030	2030	2030	2030
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.07×10^{-1}	3.87	0.00	4.07×10^{-1}	3.88	1.60×10^{-9}	4.07×10^{-1}	5.67	7.33×10^{-5}
Nitrate	1.13×10^{1}	2.02×10^{-1}	0.00	1.13×10^{1}	2.67×10^{-1}	0.00	1.13×10^{1}	5.23×10^{-1}	0.00
Total	1.17×10^{1}	4.08	0.00	1.17×10^{1}	4.14	1.60×10^{-9}	1.17×10^{1}	6.19	7.33×10^{-5}
Year of peak impact	2029	2029	N/A	2029	2029	2029	2029	2029	2029

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–196. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.30×10^{-6}	3.85×10^{-1}	3.66×10^{-6}	3.30×10^{-6}	6.13×10^{-1}	6.41×10^{-6}	3.30×10^{-6}	1.13	1.28×10^{-5}
Technetium-99	2.35×10^{-5}	4.11×10^{1}	1.41×10^{-3}	2.35×10^{-5}	1.06×10^{2}	4.64×10^{-3}	2.35×10^{-5}	2.15×10^{2}	1.01×10^{-2}
Iodine-129	4.40×10^{-8}	1.25×10^{1}	1.42×10^{-4}	4.40×10^{-8}	1.45×10^{1}	1.92×10^{-4}	4.40×10^{-8}	1.79×10^{1}	2.77×10^{-4}
Total	2.68×10^{-5}	5.40×10^{1}	1.56×10^{-3}	2.68×10^{-5}	1.21×10^{2}	4.83×10^{-3}	2.68×10^{-5}	2.34×10^{2}	1.04×10^{-2}
Year of peak impact	2026	2026	2026	2026	2026	2026	2026	2026	2026
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.31×10^{-1}	5.06	0.00	5.30×10^{-1}	5.05	2.09×10^{-9}	5.30×10^{-1}	7.38	9.59×10^{-5}
Nitrate	3.87×10^{1}	6.92×10^{-1}	0.00	3.92×10^{1}	9.22×10^{-1}	0.00	3.92×10^{1}	1.81	0.00
Total	3.93×10^{1}	5.75	0.00	3.98×10^{1}	5.97	2.09×10^{-9}	3.98×10^{1}	9.19	9.59×10^{-5}
Year of peak impact	2028	2028	N/A	2029	2029	2027	2029	2029	2027

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–197. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the U Barrier Boundary

	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.73×10^{-8}	2.02×10^{-3}	1.38×10^{-8}	1.25×10^{-8}	2.32×10^{-3}	2.42×10^{-8}	1.25×10^{-8}	4.26×10^{-3}	4.83×10^{-8}
Technetium-99	1.41×10^{-7}	2.46×10^{-1}	8.57×10^{-6}	1.42×10^{-7}	6.40×10^{-1}	2.81×10^{-5}	1.42×10^{-7}	1.30	6.13×10^{-5}
Iodine-129	2.64×10^{-10}	7.53×10^{-2}	8.15×10^{-7}	2.51×10^{-10}	8.31×10^{-2}	1.10×10^{-6}	2.51×10^{-10}	1.03×10^{-1}	1.58×10^{-6}
Total	1.58×10^{-7}	3.24×10^{-1}	9.40×10^{-6}	1.55×10^{-7}	7.25×10^{-1}	2.92×10^{-5}	1.55×10^{-7}	1.41	6.29×10^{-5}
Year of peak impact	2046	2046	2049	2049	2049	2049	2049	2049	2049
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.35×10^{-2}	1.29×10^{-1}	0.00	1.35×10^{-2}	1.29×10^{-1}	5.31×10^{-11}	1.35×10^{-2}	1.88×10^{-1}	2.44×10^{-6}
Nitrate	6.28×10^{-1}	1.12×10^{-2}	0.00	6.28×10^{-1}	1.48×10^{-2}	0.00	6.28×10^{-1}	2.90×10^{-2}	0.00
Total	6.41×10^{-1}	1.40×10^{-1}	0.00	6.41×10^{-1}	1.44×10^{-1}	5.31×10^{-11}	6.41×10^{-1}	2.17×10^{-1}	2.44×10^{-6}
Year of peak impact	2026	2026	N/A	2026	2026	2026	2026	2026	2026

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–198. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	1.50×10^{-7}	1.75×10^{-2}	1.67×10^{-7}	1.50×10^{-7}	2.79×10^{-2}	2.91×10^{-7}	1.50×10^{-7}	5.13×10^{-2}	5.81×10^{-7}
Technetium-99	4.59×10^{-6}	8.05	2.77×10^{-4}	4.59×10^{-6}	2.07×10^{1}	9.07×10^{-4}	4.59×10^{-6}	4.21×10^{1}	1.98×10^{-3}
Iodine-129	7.69×10^{-9}	2.19	2.49×10^{-5}	7.69×10^{-9}	2.54	3.36×10^{-5}	7.69×10^{-9}	3.14	4.84×10^{-5}
Total	4.75×10^{-6}	1.03×10^{1}	3.02×10^{-4}	4.75×10^{-6}	2.32×10^{1}	9.41×10^{-4}	4.75×10^{-6}	4.53×10^{1}	2.03×10^{-3}
Year of peak impact	2034	2034	2034	2034	2034	2034	2034	2034	2034
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.17×10^{-1}	3.97	0.00	4.17×10^{-1}	3.97	1.64×10^{-9}	4.17×10^{-1}	5.80	7.51×10^{-5}
Nitrate	9.63	1.72×10^{-1}	0.00	9.63	2.26×10^{-1}	0.00	9.63	4.44×10^{-1}	0.00
Total	1.00×10^{1}	4.14	0.00	1.00×10^{1}	4.20	1.64×10^{-9}	1.00×10^{1}	6.25	7.51×10^{-5}
Year of peak impact	2224	2224	N/A	2224	2224	2224	2224	2224	2224

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–199. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.78×10^{-11}	4.42×10^{-6}	4.20×10^{-11}	3.78×10^{-11}	7.03×10^{-6}	7.35×10^{-11}	3.78×10^{-11}	1.29×10^{-5}	1.47×10^{-10}
Technetium-99	1.42×10^{-7}	2.48×10^{-1}	8.53×10^{-6}	1.42×10^{-7}	6.37×10^{-1}	2.80×10^{-5}	1.42×10^{-7}	1.30	6.10×10^{-5}
Iodine-129	1.10×10^{-10}	3.12×10^{-2}	3.55×10^{-7}	1.10×10^{-10}	3.62×10^{-2}	4.79×10^{-7}	1.10×10^{-10}	4.47×10^{-2}	6.90×10^{-7}
Total	1.42×10^{-7}	2.79×10^{-1}	8.88×10^{-6}	1.42×10^{-7}	6.73×10^{-1}	2.84×10^{-5}	1.42×10^{-7}	1.34	6.17×10^{-5}
Year of peak impact	2133	2133	2133	2133	2133	2133	2133	2133	2133
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.53×10^{-3}	3.36×10^{-2}	0.00	3.53×10^{-3}	3.36×10^{-2}	1.38×10^{-11}	3.53×10^{-3}	4.91×10^{-2}	6.35×10^{-7}
Nitrate	1.58×10^{-1}	2.82×10^{-3}	0.00	1.58×10^{-1}	3.71×10^{-3}	0.00	1.58×10^{-1}	7.27×10^{-3}	0.00
Total	1.61×10^{-1}	3.64×10^{-2}	0.00	1.61×10^{-1}	3.73×10^{-2}	1.38×10^{-11}	1.61×10^{-1}	5.64×10^{-2}	6.35×10^{-7}
Year of peak impact	2152	2152	N/A	2152	2152	2152	2152	2152	2152

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–200. Tank Closure Alternative 6B, Option Case, Human Health Impacts Related to Past Leaks at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.04×10^{-15}	1.93×10^{-10}	2.02×10^{-15}	1.04×10^{-15}	3.60×10^{-10}	4.08×10^{-15}	3.78×10^{-11}	1.19×10^{-5}	1.46×10^{-10}
Technetium-99	6.54×10^{-12}	2.94×10^{-5}	1.29×10^{-9}	6.54×10^{-12}	6.80×10^{-5}	3.22×10^{-9}	1.42×10^{-7}	1.58×10^{-3}	8.64×10^{-8}
Iodine-129	1.17×10^{-14}	3.89×10^{-6}	5.15×10^{-11}	1.17×10^{-14}	6.34×10^{-5}	1.53×10^{-9}	1.10×10^{-10}	3.11×10^{-4}	7.58×10^{-9}
Total	6.55×10^{-12}	3.33×10^{-5}	1.34×10^{-9}	6.55×10^{-12}	1.31×10^{-4}	4.75×10^{-9}	1.42×10^{-7}	1.90×10^{-3}	9.41×10^{-8}
Year of peak impact	2143	2143	2143	2143	2143	2143	2133	2133	2133
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.81×10^{-7}	1.73×10^{-6}	7.12×10^{-16}	1.53×10^{-7}	2.33×10^{-6}	3.26×10^{-11}	3.03×10^{-3}	6.69×10^{-3}	3.18×10^{-7}
Nitrate	9.96×10^{-6}	3.44×10^{-7}	0.00	1.06×10^{-5}	9.99×10^{-4}	0.00	1.94×10^{-1}	8.98×10^{-3}	0.00
Total	1.01×10^{-5}	2.07×10^{-6}	7.12×10^{-16}	1.08×10^{-5}	1.00×10^{-3}	3.26×10^{-11}	1.97×10^{-1}	1.57×10^{-2}	3.18×10^{-7}
Year of peak impact	2165	2165	2165	2150	2150	2165	2181	2181	2152

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–201. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the A Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3	2.68×10^{-8}	3.13×10^{-3}	2.98×10^{-8}	2.68×10^{-8}	4.98×10^{-3}	5.21×10^{-8}	2.68×10^{-8}	9.16×10^{-3}	1.04×10^{-7}
Technetium-99	1.39×10^{-6}	2.43	8.35×10^{-5}	1.39×10^{-6}	6.24	2.74×10^{-4}	1.39×10^{-6}	1.27×10^{1}	5.97×10^{-4}
Iodine-129	2.75×10^{-9}	7.82×10^{-1}	8.91×10^{-6}	2.75×10^{-9}	9.08×10^{-1}	1.20×10^{-5}	2.75×10^{-9}	1.12	1.73×10^{-5}
Total	1.42×10^{-6}	3.21	9.24×10^{-5}	1.42×10^{-6}	7.15	2.86×10^{-4}	1.42×10^{-6}	1.38×10^{1}	6.15×10^{-4}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	7.24×10^{-3}	6.89×10^{-2}	0.00	7.24×10^{-3}	6.90×10^{-2}	2.84×10^{-11}	7.24×10^{-3}	1.01×10^{-1}	1.30×10^{-6}
Nitrate	4.43×10^{-1}	7.91×10^{-3}	0.00	4.43×10^{-1}	1.04×10^{-2}	0.00	4.43×10^{-1}	2.04×10^{-2}	0.00
Total	4.50×10^{-1}	7.68×10^{-2}	0.00	4.50×10^{-1}	7.94×10^{-2}	2.84×10^{-11}	4.50×10^{-1}	1.21×10^{-1}	1.30×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–202. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the B Barrier Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.64×10^{-6}	3.08×10^{-1}	2.93×10^{-6}	2.64×10^{-6}	4.90×10^{-1}	5.12×10^{-6}	2.64×10^{-6}	9.01×10^{-1}	1.02×10^{-5}
Technetium-99	2.70×10^{-5}	4.74×10^{1}	1.63×10^{-3}	2.70×10^{-5}	1.22×10^{2}	5.34×10^{-3}	2.70×10^{-5}	2.48×10^{2}	1.17×10^{-2}
Iodine-129	3.58×10^{-8}	1.02×10^{1}	1.16×10^{-4}	3.58×10^{-8}	1.18×10^{1}	1.57×10^{-4}	3.58×10^{-8}	1.46×10^{1}	2.26×10^{-4}
Uranium-238	6.17×10^{-12}	7.65×10^{-4}	8.64×10^{-9}	6.17×10^{-12}	7.94×10^{-4}	9.25×10^{-9}	6.17×10^{-12}	8.51×10^{-4}	1.05×10^{-8}
Total	2.97×10^{-5}	5.79×10^{1}	1.75×10^{-3}	2.97×10^{-5}	1.34×10^{2}	5.50×10^{-3}	2.97×10^{-5}	2.63×10^{2}	1.19×10^{-2}
Year of peak impact	2058	2058	2058	2058	2058	2058	2058	2058	2058
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.77	3.59×10^{1}	0.00	3.77	3.59×10^{1}	1.48×10^{-8}	3.77	5.25×10^{1}	6.79×10^{-4}
Nitrate	1.56×10^{3}	2.78×10^{1}	0.00	1.56×10^{3}	3.66×10^{1}	0.00	1.56×10^{3}	7.18×10^{1}	0.00
Total uranium	8.49×10^{-6}	8.09×10^{-5}	0.00	8.49×10^{-6}	8.18×10^{-5}	0.00	8.49×10^{-6}	8.47×10^{-5}	0.00
Total	1.56×10^{3}	6.37×10^{1}	0.00	1.56×10^{3}	7.25×10^{1}	1.48×10^{-8}	1.56×10^{3}	1.24×10^{2}	6.79×10^{-4}
Year of peak impact	2087	2087	N/A	2087	2087	2087	2087	2087	2087

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–203. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the S Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	4.62×10^{-8}	5.39×10^{-3}	5.13×10^{-8}	4.62×10^{-8}	8.58×10^{-3}	8.97×10^{-8}	4.62×10^{-8}	1.58×10^{-2}	1.79×10^{-7}
Technetium-99	2.56×10^{-6}	4.49	1.54×10^{-4}	2.56×10^{-6}	1.15×10^{1}	5.06×10^{-4}	2.56×10^{-6}	2.35×10^{1}	1.10×10^{-3}
Iodine-129	4.80×10^{-9}	1.37	1.56×10^{-5}	4.80×10^{-9}	1.59	2.10×10^{-5}	4.80×10^{-9}	1.96	3.02×10^{-5}
Total	2.61×10^{-6}	5.86	1.70×10^{-4}	2.61×10^{-6}	1.31×10^{1}	5.27×10^{-4}	2.61×10^{-6}	2.55×10^{1}	1.13×10^{-3}
Year of peak impact	2050	2050	2050	2050	2050	2050	2050	2050	2050

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.83×10^{-1}	2.70	0.00	2.83×10^{-1}	2.70	1.11×10^{-9}	2.83×10^{-1}	3.95	5.10×10^{-5}
Nitrate	8.65	1.55×10^{-1}	0.00	8.65	2.03×10^{-1}	0.00	8.65	3.99×10^{-1}	0.00
Total	8.94	2.85	0.00	8.94	2.90	1.11×10^{-9}	8.94	4.35	5.10×10^{-5}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–204. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the T Barrier Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.60×10^{-6}	6.55×10^{-1}	6.22×10^{-6}	5.60×10^{-6}	1.04	1.09×10^{-5}	5.60×10^{-6}	1.92	2.17×10^{-5}
Technetium-99	1.55×10^{-5}	2.72×10^{1}	9.35×10^{-4}	1.55×10^{-5}	6.98×10^{1}	3.07×10^{-3}	1.55×10^{-5}	1.42×10^{2}	6.69×10^{-3}
Iodine-129	2.90×10^{-8}	8.26	9.41×10^{-5}	2.90×10^{-8}	9.59	1.27×10^{-4}	2.90×10^{-8}	1.18×10^{1}	1.83×10^{-4}
Uranium-238	1.25×10^{-10}	1.55×10^{-2}	1.76×10^{-7}	1.25×10^{-10}	1.61×10^{-2}	1.88×10^{-7}	1.25×10^{-10}	1.73×10^{-2}	2.13×10^{-7}
Total	2.12×10^{-5}	3.61×10^{1}	1.04×10^{-3}	2.12×10^{-5}	8.05×10^{1}	3.20×10^{-3}	2.12×10^{-5}	1.56×10^{2}	6.89×10^{-3}
Year of peak impact	2051	2051	2051	2051	2051	2051	2051	2051	2051

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	7.68×10^{-1}	7.31	0.00	7.68×10^{-1}	7.32	3.05×10^{-9}	7.68×10^{-1}	1.07×10^{1}	1.40×10^{-4}
Nitrate	1.27×10^{2}	2.26	0.00	1.27×10^{2}	2.98	0.00	1.27×10^{2}	5.85	0.00
Total uranium	1.99×10^{-4}	1.90×10^{-3}	0.00	1.99×10^{-4}	1.92×10^{-3}	0.00	1.99×10^{-4}	1.99×10^{-3}	0.00
Total	1.28×10^{2}	9.58	0.00	1.28×10^{2}	1.03×10^{1}	3.05×10^{-9}	1.28×10^{2}	1.65×10^{1}	1.40×10^{-4}
Year of peak impact	2051	2051	N/A	2051	2051	2050	2051	2051	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–205. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the U Barrier Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	6.84×10^{-9}	7.99×10^{-4}	7.60×10^{-9}	6.84×10^{-9}	1.27×10^{-3}	1.33×10^{-8}	6.84×10^{-9}	2.34×10^{-3}	2.65×10^{-8}
Technetium-99	1.40×10^{-7}	2.46×10^{-1}	8.45×10^{-6}	1.40×10^{-7}	6.31×10^{-1}	2.77×10^{-5}	1.40×10^{-7}	1.29	6.05×10^{-5}
Iodine-129	2.69×10^{-10}	7.66×10^{-2}	8.72×10^{-7}	2.69×10^{-10}	8.89×10^{-2}	1.18×10^{-6}	2.69×10^{-10}	1.10×10^{-1}	1.69×10^{-6}
Total	1.47×10^{-7}	3.23×10^{-1}	9.33×10^{-6}	1.47×10^{-7}	7.22×10^{-1}	2.89×10^{-5}	1.47×10^{-7}	1.40	6.22×10^{-5}
Year of peak impact	2060	2060	2060	2060	2060	2060	2060	2060	2060
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.25×10^{-3}	8.81×10^{-2}	0.00	9.25×10^{-3}	8.81×10^{-2}	3.63×10^{-11}	9.25×10^{-3}	1.29×10^{-1}	1.67×10^{-6}
Nitrate	6.06×10^{-1}	1.08×10^{-2}	0.00	6.06×10^{-1}	1.42×10^{-2}	0.00	6.06×10^{-1}	2.80×10^{-2}	0.00
Total	6.15×10^{-1}	9.89×10^{-2}	0.00	6.15×10^{-1}	1.02×10^{-1}	3.63×10^{-11}	6.15×10^{-1}	1.57×10^{-1}	1.67×10^{-6}
Year of peak impact	2050	2050	N/A	2050	2050	2050	2050	2050	2050

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–206. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.16×10^{-6}	3.69×10^{-1}	3.51×10^{-6}	3.16×10^{-6}	5.88×10^{-1}	6.14×10^{-6}	3.16×10^{-6}	1.08	1.23×10^{-5}
Technetium-99	2.27×10^{-5}	3.98×10^{1}	1.37×10^{-3}	2.27×10^{-5}	1.02×10^{2}	4.48×10^{-3}	2.27×10^{-5}	2.08×10^{2}	9.78×10^{-3}
Iodine-129	2.73×10^{-8}	7.77	8.85×10^{-5}	2.73×10^{-8}	9.02	1.19×10^{-4}	2.73×10^{-8}	1.11×10^{1}	1.72×10^{-4}
Uranium-238	6.17×10^{-12}	7.65×10^{-4}	8.64×10^{-9}	6.17×10^{-12}	7.94×10^{-4}	9.25×10^{-9}	6.17×10^{-12}	8.51×10^{-4}	1.05×10^{-8}
Total	2.59×10^{-5}	4.79×10^{1}	1.46×10^{-3}	2.59×10^{-5}	1.12×10^{2}	4.61×10^{-3}	2.59×10^{-5}	2.20×10^{2}	9.96×10^{-3}
Year of peak impact	2058	2058	2058	2058	2058	2058	2058	2058	2058

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	1.39	1.33×10^{1}	0.00	1.39	1.33×10^{1}	6.92×10^{-9}	1.39	1.94×10^{1}	3.17×10^{-4}
Nitrate	1.23×10^{3}	2.19×10^{1}	0.00	1.23×10^{3}	2.89×10^{1}	0.00	1.23×10^{3}	5.66×10^{1}	0.00
Total uranium	1.01×10^{-5}	9.60×10^{-5}	0.00	1.01×10^{-5}	9.71×10^{-5}	0.00	1.01×10^{-5}	1.01×10^{-4}	0.00
Total	1.23×10^{3}	3.52×10^{1}	0.00	1.23×10^{3}	4.21×10^{1}	6.92×10^{-9}	1.23×10^{3}	7.60×10^{1}	3.17×10^{-4}
Year of peak impact	2053	2053	N/A	2053	2053	2061	2053	2053	2061

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–207. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	9.21×10^{-14}	1.08×10^{-8}	1.02×10^{-13}	9.21×10^{-14}	1.71×10^{-8}	1.79×10^{-13}	9.21×10^{-14}	3.15×10^{-8}	3.57×10^{-13}
Technetium-99	1.62×10^{-7}	2.83×10^{-1}	9.73×10^{-6}	1.62×10^{-7}	7.27×10^{-1}	3.19×10^{-5}	1.62×10^{-7}	1.48	6.96×10^{-5}
Iodine-129	1.93×10^{-10}	5.50×10^{-2}	6.26×10^{-7}	1.93×10^{-10}	6.38×10^{-2}	8.45×10^{-7}	1.93×10^{-10}	7.88×10^{-2}	1.22×10^{-6}
Uranium-238	5.72×10^{-15}	7.10×10^{-7}	8.01×10^{-12}	5.72×10^{-15}	7.36×10^{-7}	8.58×10^{-12}	5.72×10^{-15}	7.89×10^{-7}	9.71×10^{-12}
Total	1.62×10^{-7}	3.38×10^{-1}	1.04×10^{-5}	1.62×10^{-7}	7.91×10^{-1}	3.28×10^{-5}	1.62×10^{-7}	1.56	7.09×10^{-5}
Year of peak impact	2304	2304	2304	2304	2304	2304	2304	2304	2304
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.78×10^{-2}	2.65×10^{-1}	0.00	2.78×10^{-2}	2.65×10^{-1}	1.09×10^{-10}	2.78×10^{-2}	3.88×10^{-1}	5.01×10^{-6}
Nitrate	6.40	1.14×10^{-1}	0.00	6.40	1.50×10^{-1}	0.00	6.40	2.95×10^{-1}	0.00
Total uranium	1.12×10^{-8}	1.06×10^{-7}	0.00	1.12×10^{-8}	1.08×10^{-7}	0.00	1.12×10^{-8}	1.11×10^{-7}	0.00
Total	6.42	3.79×10^{-1}	0.00	6.42	4.16×10^{-1}	1.09×10^{-10}	6.42	6.83×10^{-1}	5.01×10^{-6}
Year of peak impact	2166	2166	N/A	2166	2166	2166	2166	2166	2166

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–208. Tank Closure Alternative 6B, Option Case, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	1.18×10^{-13}	2.20×10^{-8}	2.30×10^{-13}	1.19×10^{-13}	4.11×10^{-8}	4.64×10^{-13}	1.72×10^{-7}	5.44×10^{-2}	6.67×10^{-7}
Technetium-99	7.89×10^{-12}	3.55×10^{-5}	1.56×10^{-9}	7.85×10^{-12}	8.16×10^{-5}	3.88×10^{-9}	5.68×10^{-8}	6.61×10^{-4}	3.58×10^{-8}
Iodine-129	1.34×10^{-14}	4.42×10^{-6}	5.86×10^{-11}	1.35×10^{-14}	7.29×10^{-5}	1.74×10^{-9}	9.29×10^{-11}	2.79×10^{-4}	6.79×10^{-9}
Uranium-238	5.98×10^{-20}	7.70×10^{-12}	8.97×10^{-17}	8.59×10^{-20}	3.05×10^{-11}	3.00×10^{-16}	1.12×10^{-14}	1.12×10^{-7}	1.41×10^{-12}
Total	8.02×10^{-12}	3.99×10^{-5}	1.62×10^{-9}	7.98×10^{-12}	1.54×10^{-4}	5.62×10^{-9}	2.29×10^{-7}	5.53×10^{-2}	7.10×10^{-7}
Year of peak impact	2140	2140	2140	2143	2143	2140	2088	2088	2088
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.94×10^{-7}	9.48×10^{-6}	4.02×10^{-15}	9.94×10^{-7}	1.52×10^{-5}	1.84×10^{-10}	1.55×10^{-2}	3.43×10^{-2}	2.51×10^{-6}
Nitrate	2.86×10^{-4}	9.86×10^{-6}	0.00	2.86×10^{-4}	2.68×10^{-2}	0.00	7.11	3.11×10^{-1}	0.00
Total uranium	3.14×10^{-13}	3.02×10^{-12}	0.00	3.14×10^{-13}	4.17×10^{-12}	0.00	1.11×10^{-8}	4.95×10^{-9}	0.00
Total	2.87×10^{-4}	1.93×10^{-5}	4.02×10^{-15}	2.87×10^{-4}	2.69×10^{-2}	1.84×10^{-10}	7.12	3.45×10^{-1}	2.51×10^{-6}
Year of peak impact	2052	2052	2059	2052	2052	2059	2056	2056	2166

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figure Q–10 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time for cribs and trenches (ditches), past leaks, and the total of all three sources. The peak radiological risk resulting from cribs and trenches (ditches) occurs around the year 1956 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from past leaks occurs around the year 2034 for the Core Zone Boundary and is dominated by tritium, technetium-99, and iodine-129. The peak radiological risk resulting from the two sources occurs around the year 2058 and is dominated by technetium-99, and iodine-129. Tritium, technetium-99, and iodine-129 move at the same velocity as groundwater.

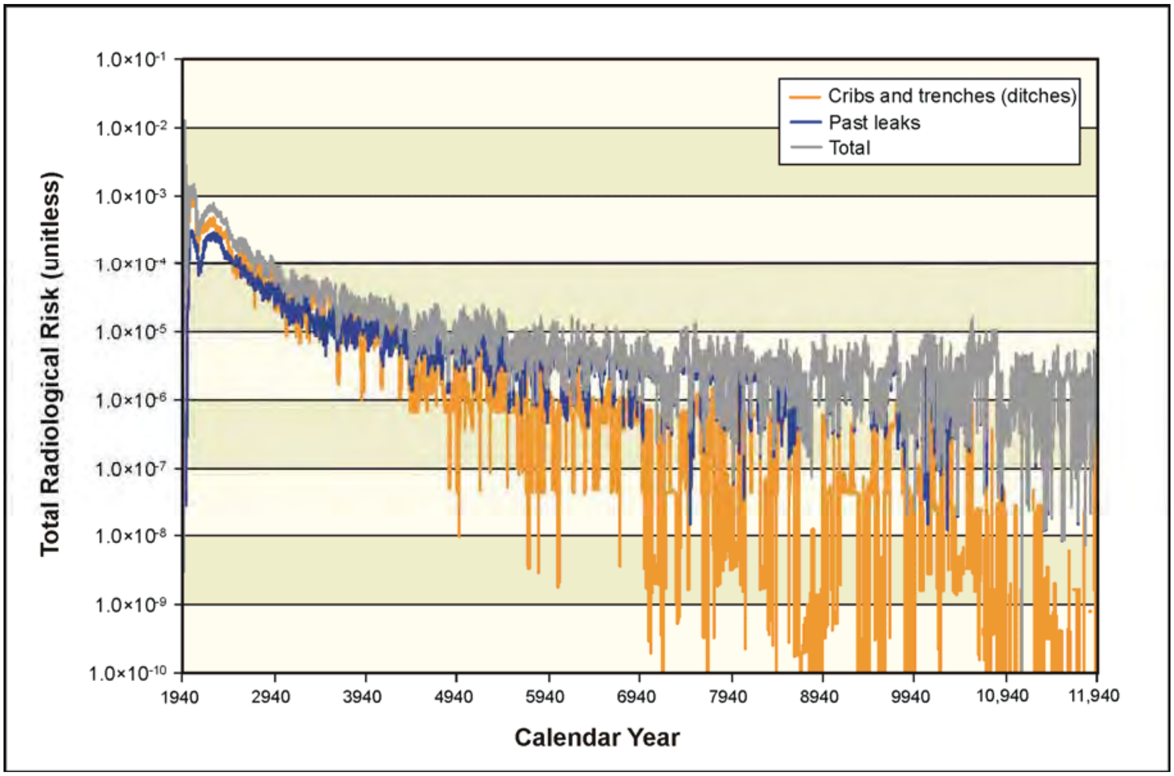

Figure Q–10. Tank Closure Alternative 6B, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.1.1.8 Tank Closure Intruder Scenario

Intruders are individuals who enter a tank farm area and engage in activity that could cause direct contact with residual contamination in the stabilized or closed tanks. Two types of receptors and two types of scenarios were considered. The receptor types were the American Indian resident farmer and the resident farmer, and the scenario types were home construction and well drilling. Because the majority of the waste at the tank farms is at a depth greater than that of the foundation for a home, the home construction scenario was screened from the analysis. Also, sensitivity analysis determined that in all cases for residential agriculture, impacts on the American Indian resident farmer exceeded impacts on the resident farmer. Screening analysis also determined that impacts of intrusion were dominated by contact with short-lived radionuclides, strontium-90 and cesium-137. Consequently, impacts of intrusion at the tank farms are represented by the well-drilling scenario in which a worker inhales dust and receives external radiation while drilling the well, and an American Indian resident farmer contacting residual contamination brought to the surface during development of the well. Because complete removal of tanks is proposed under Tank Closure Alternatives 6A, Base and Option Cases, and 6B, Base and Option Cases, no tank farm intruder impacts would occur for these alternatives. Estimates of impact under this intrusion scenario for the eighteen tank farms and remaining nine Tank Closure alternatives are summarized in

Table Q–209 for American Indian resident farmer intruders. For all tank farms and alternatives, resident farmer impacts are dominated by exposure to strontium-90 and cesium-137. Because inhalation and external exposure are the only exposure modes for the well-drilling worker, impacts on the worker involved in well drilling would be the same for resident farmer and American Indian receptors. Estimates of impact on the drilling worker are presented in Table Q–210. For all tank farms and alternatives, drilling worker doses are dominated by external exposure from cesium-137 and inhalation exposure of plutonium-239. For both the resident farmer and drilling worker, impacts are presented as dose for the year of peak dose. Because doses are dominated by radionuclides with short half-lives, the year of peak dose occurs immediately after loss of institutional control. Due to high concentrations of strontium-90 and cesium-137, the DOE intruder dose guideline of 500 millirem (DOE Guide 453.1-1) is exceeded for single shell tank farms under Alternative 1 and 5.

Table Q–209. Doses to an American Indian Engaged in Residential Agriculture Following Well Drilling at the Tank Farms

Tank Farm	Dose (rem per year)					
	Tank Closure Alternative					
	1	2	3	4	5	6C
A	48.2	0.482	0.482	0.048	4.82	0.482
AX	36.6	0.366	0.366	0.0366	3.66	0.366
B	6.8	0.068	0.068	0.0068	0.68	0.068
BX	5.69	0.0569	0.0569	0.0057	0.569	0.0569
BY	27.8	0.278	0.278	0.0278	2.78	0.0278
C	24.9	0.249	0.249	0.0249	2.49	0.249
S	33.1	0.331	0.331	0.0331	3.31	0.331
SX	30.7	0.307	0.307	0.0307	3.07	0.0307
T	2.37	0.0237	0.0237	0.0024	0.237	0.0237
TX	19.5	0.195	0.195	0.0195	1.95	0.195
TY	2.21	0.0221	0.0221	0.0022	0.221	0.0221
U	26.8	0.268	0.268	0.0268	2.68	0.268
AN	166	1.66	1.66	0.166	16.6	1.66
AP	90.3	0.903	0.903	0.0903	9.03	0.903
AW	74.1	0.741	0.741	0.0741	7.41	0.741
AY	81.8	0.818	0.818	0.0818	8.18	0.818
AZ	737	7.37	7.37	0.737	73.7	7.37
SY	117	1.17	1.17	0.117	11.7	1.17

Table Q–210. Doses to a Well-Drilling Worker at the Tank Farms

Tank Farm	Dose (rem)					
	Tank Closure Alternative					
	1	2	3	4	5	6B
A	9.77×10^{-2}	7.51×10^{-4}	7.51×10^{-4}	7.51×10^{-5}	7.51×10^{-3}	7.51×10^{-4}
AX	6.40×10^{-2}	5.44×10^{-4}	5.44×10^{-4}	5.44×10^{-5}	5.44×10^{-3}	5.44×10^{-4}
B	1.56×10^{-2}	1.13×10^{-4}	1.13×10^{-4}	1.13×10^{-5}	1.13×10^{-3}	1.13×10^{-4}
BX	1.84×10^{-2}	1.19×10^{-4}	1.19×10^{-4}	1.19×10^{-5}	1.19×10^{-3}	1.19×10^{-4}
BY	5.96×10^{-2}	5.55×10^{-4}	5.55×10^{-4}	5.55×10^{-5}	5.55×10^{-3}	5.55×10^{-4}
C	1.29×10^{-1}	6.46×10^{-4}	6.46×10^{-4}	6.46×10^{-5}	6.46×10^{-3}	6.46×10^{-4}

Table Q–210. Doses to a Well-Drilling Worker at the Tank Farms *(continued)*

Tank Farm	Dose (rem)					
	Tank Closure Alternative					
	1	2	3	4	5	6B
S	8.67×10^{-2}	7.14×10^{-4}	7.13×10^{-4}	7.13×10^{-5}	7.13×10^{-3}	7.13×10^{-4}
SX	7.94×10^{-2}	6.21×10^{-4}	6.21×10^{-4}	6.21×10^{-5}	6.21×10^{-3}	6.21×10^{-4}
T	1.08×10^{-2}	6.50×10^{-5}	6.50×10^{-5}	6.50×10^{-6}	6.50×10^{-4}	6.50×10^{-5}
TX	9.83×10^{-2}	6.12×10^{-4}	6.12×10^{-4}	6.12×10^{-5}	6.12×10^{-3}	6.12×10^{-4}
TY	6.67×10^{-3}	4.16×10^{-5}	4.16×10^{-5}	4.16×10^{-6}	4.16×10^{-4}	4.16×10^{-5}
U	7.42×10^{-2}	6.07×10^{-4}	6.07×10^{-4}	6.07×10^{-5}	6.07×10^{-3}	6.07×10^{-4}
AN	3.46×10^{-1}	3.44×10^{-3}	3.44×10^{-3}	3.44×10^{-4}	3.44×10^{-2}	3.44×10^{-3}
AP	1.90×10^{-1}	1.90×10^{-3}	1.90×10^{-3}	1.90×10^{-4}	1.90×10^{-2}	1.90×10^{-3}
AW	1.84×10^{-1}	1.65×10^{-3}	1.65×10^{-3}	1.65×10^{-4}	1.65×10^{-2}	1.65×10^{-3}
AY	1.32×10^{-1}	8.10×10^{-4}	8.10×10^{-4}	8.10×10^{-5}	8.10×10^{-3}	8.10×10^{-4}
AZ	1.51	1.44×10^{-2}	1.44×10^{-2}	1.44×10^{-3}	1.44×10^{-1}	1.44×10^{-2}
SY	3.40×10^{-1}	2.80×10^{-3}	2.80×10^{-3}	2.80×10^{-4}	2.80×10^{-2}	2.80×10^{-3}

Q.3.2 Long-Term Human Health Impacts of FFTF Decommissioning Alternatives

Impacts on human health over the long time period following decommissioning of the FFTF would be due primarily to the materials left in place following no action, entombment, or removal. These releases would involve both radiological and chemical constituents. The results of this analysis of impacts on human health for onsite, offsite, and intruder receptors are summarized in the following sections.

Q.3.2.1 Impacts on Onsite and Offsite Receptors of Expected Conditions for FFTF Decommissioning Alternatives

Implementation of activities defined for the FFTF Decommissioning alternatives could lead to releases of radiological and chemical constituents to the environment over long periods of time. In the case of FFTF Decommissioning Alternative 1, these releases would not be controlled by final decommissioning activities. In the case of FFTF Decommissioning Alternative 2, these releases would be controlled by removal of all aboveground structures and minimal removal of below-grade structures, equipment, and materials. An RCRA-compliant barrier would be constructed over the Reactor Containment Building and any other remaining below-grade structures (including the reactor vessel). For FFTF Decommissioning Alternative 3, these releases would be further controlled by removal of all aboveground structures, as well as contaminated below-grade structures (including the reactor vessel), equipment and materials.

Potential human health impacts of the release of radiological constituents are estimated as dose and as lifetime risk of incidence of cancer. Potential human health effects due to release of chemical constituents include both carcinogenic effects and other forms of toxicity. Impacts of carcinogenic chemicals are estimated as lifetime risk of incidence of cancer. Noncarcinogenic effects are estimated as Hazard Quotient, the ratio of the long-term intake of a single chemical to intake that produces no observable effect, and as Hazard Index, the sum of the Hazard Quotients of a group of chemicals. Further information on the nature of human health effects in response to exposure to radiological and chemical constituents is provided in Appendix K, Section K.1. Impacts due to exposure to these constituents are presented in this appendix.

The four measures of human health impacts considered in this analysis—lifetime risks of developing cancer from radiological and chemical constituents, dose from radionuclides, and Hazard Index from chemical constituents—are calculated for each year for 10,000 years for each receptor at three locations (i.e., FFTF barrier, Columbia River nearshore, and Columbia River surface water). This is a large amount of information that must be summarized to allow interpretation of results. The method chosen is to present dose for the year of maximum dose, risk for the year of maximum risk, and Hazard Index for the year of maximum Hazard Index. This choice is based on regulation of radiological impacts as dose and the observation that peak risk and peak noncarcinogenic impacts expressed as Hazard Index may occur at times other than that of peak dose. The significance of dose impacts is evaluated by comparison against the 100-millirem-per-year all-exposure-modes standard specified for protection of the public and the environment in DOE Order 5400.5. Population doses are compared with total effective dose equivalents from background sources of 365 millirem per year for a member of the population of the United States (NCRP 1987). The significance of noncarcinogenic chemical impacts is evaluated by comparison against a guideline value of unity for Hazard Index. The level of protection provided for the drinking water pathway is evaluated by comparison against the MCLs of 40 CFR 141 and other benchmarks presented in Appendix O. In addition, only those radiological and chemical constituents that resulted in a lifetime risk or Hazard Index greater than 1×10^{-10} are presented in the tables in order to reduce the size of the tables.

The results of the analysis for drinking-water well user are summarized in Tables Q–211 and Q–212 for radiological and chemical constituents, respectively. Impacts due to ingestion of drinking water under FFTF Decommissioning Alternatives 1 and 2 would not be higher than the 100-millirem-per-year dose standard at the FFTF barrier. Under both FFTF Decommissioning Alternatives 1 and 2, doses estimated for drinking water ingestion are less than 10 millirem per year at the Columbia River nearshore location. The peak radiological impacts would be due to technetium-99 and chemical impacts would be due to chromium. As a result of removal of all contaminated material under FFTF Decommissioning Alternative 3, there would be no impacts on groundwater and no impacts on human health.

Table Q–211. Summary of Radiological Human Health Impacts on Drinking-Water Well User

Location	Alternative 1		Alternative 2	
	Radiological Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Radiological Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Fast Flux Test Facility Barrier	7.29×10^{-1} (2425)	2.51×10^{-5} (2425)	7.13×10^{-1} (2819)	2.45×10^{-5} (2819)
Columbia River nearshore	2.16×10^{-2} (2702)	7.42×10^{-7} (2702)	2.16×10^{-2} (2965)	7.42×10^{-7} (2965)

Note: Calendar year of peak impact presented in parentheses.

Table Q–212. Summary of Chemical Human Health Impacts on Drinking-Water Well User

Location	Alternative 1		Alternative 2	
	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Fast Flux Test Facility Barrier	3.19×10^{-6} (7484)	Not applicable	Not applicable	Not applicable
Columbia River nearshore	1.01×10^{-7} (7088)	Not applicable	Not applicable	Not applicable

Note: Calendar year of peak impact presented in parentheses.

Q.3.2.1.1 FFTF Decommissioning Alternative 1: No Action

Under FFTF Decommissioning Alternative 1, only those actions consistent with previous U.S. Department of Energy actions under the National Environmental Policy Act would be completed. Final decommissioning of FFTF would not occur. For purpose of analysis, the remaining waste would be available for release to the environment after an institutional control period of 100 years. Potential human health impacts of this alternative are summarized in Tables Q–213 through Q–215. For radionuclides, the key constituent contributors to human health risk are tritium and technetium-99. Dose standards would not be exceeded at any location and the Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 9.80×10^{-3} person-rem per year for the year of maximum impact.

Table Q–213. FFTF Decommissioning Alternative 1 Human Health Impacts at the Fast Flux Test Facility Barrier

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	5.45×10^{-11}	6.36×10^{-6}	6.05×10^{-11}	5.45×10^{-11}	1.01×10^{-5}	1.06×10^{-10}	5.45×10^{-11}	1.86×10^{-5}	2.11×10^{-10}
Technetium-99	4.16×10^{-7}	7.29×10^{-1}	2.51×10^{-5}	4.16×10^{-7}	1.87	8.23×10^{-5}	4.16×10^{-7}	3.82	1.79×10^{-4}
Total	$\mathbf{4.16\times10^{-7}}$	$\mathbf{7.29\times10^{-1}}$	$\mathbf{2.51\times10^{-5}}$	$\mathbf{4.16\times10^{-7}}$	**1.87**	$\mathbf{8.23\times10^{-5}}$	$\mathbf{4.16\times10^{-7}}$	**3.82**	$\mathbf{1.79\times10^{-4}}$
Year of peak impact	2425	2425	2425	2425	2425	2425	2425	2425	2425
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	0.00	0.00	0.00	0.00	0.00	3.48×10^{-16}	0.00	0.00	1.60×10^{-11}
Total uranium	$\mathbf{3.35\times10^{-7}}$	$\mathbf{3.19\times10^{-6}}$	**0.00**	$\mathbf{3.35\times10^{-7}}$	$\mathbf{3.22\times10^{-6}}$	**0.00**	$\mathbf{3.35\times10^{-7}}$	$\mathbf{3.33\times10^{-6}}$	**0.00**
Total	$\mathbf{3.35\times10^{-7}}$	$\mathbf{3.19\times10^{-6}}$	**0.00**	$\mathbf{3.35\times10^{-7}}$	$\mathbf{3.22\times10^{-6}}$	$\mathbf{3.48\times10^{-16}}$	$\mathbf{3.35\times10^{-7}}$	$\mathbf{3.33\times10^{-6}}$	$\mathbf{1.60\times10^{-11}}$
Year of peak impact	7484	7484	N/A	7484	7484	2465	7484	7484	2465

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: FFTF=Fast Flux Test Facility; N/A=not applicable.

Table Q–214. FFTF Decommissioning Alternative 1 Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	8.89×10^{-14}	1.04×10^{-8}	9.88×10^{-14}	8.89×10^{-14}	1.65×10^{-8}	1.73×10^{-13}	8.89×10^{-14}	3.04×10^{-8}	3.45×10^{-13}
Technetium-99	1.23×10^{-8}	2.16×10^{-2}	7.42×10^{-7}	1.23×10^{-8}	5.54×10^{-2}	2.43×10^{-6}	1.23×10^{-8}	1.13×10^{-1}	5.31×10^{-6}
Total	$\mathbf{1.23\times10^{-8}}$	$\mathbf{2.16\times10^{-2}}$	$\mathbf{7.42\times10^{-7}}$	$\mathbf{1.23\times10^{-8}}$	$\mathbf{5.54\times10^{-2}}$	$\mathbf{2.43\times10^{-6}}$	$\mathbf{1.23\times10^{-8}}$	$\mathbf{1.13\times10^{-1}}$	$\mathbf{5.31\times10^{-6}}$
Year of peak impact	2702	2702	2702	2702	2702	2702	2702	2702	2702
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	0.00	0.00	0.00	0.00	0.00	1.02×10^{-17}	0.00	0.00	4.67×10^{-13}
Total uranium	$\mathbf{1.06\times10^{-8}}$	$\mathbf{1.01\times10^{-7}}$	**0.00**	$\mathbf{1.06\times10^{-8}}$	$\mathbf{1.02\times10^{-7}}$	**0.00**	$\mathbf{1.06\times10^{-8}}$	$\mathbf{1.06\times10^{-7}}$	**0.00**
Total	$\mathbf{1.06\times10^{-8}}$	$\mathbf{1.01\times10^{-7}}$	**0.00**	$\mathbf{1.06\times10^{-8}}$	$\mathbf{1.02\times10^{-7}}$	$\mathbf{1.02\times10^{-17}}$	$\mathbf{1.06\times10^{-8}}$	$\mathbf{1.06\times10^{-7}}$	$\mathbf{4.67\times10^{-13}}$
Year of peak impact	7088	7088	N/A	7088	7088	2810	7088	7088	2810

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: FFTF=Fast Flux Test Facility; N/A=not applicable.

Table Q–215. FFTF Decommissioning Alternative 1 Human Health Impacts the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Hydrogen-3 (tritium)	2.32×10^{-18}	4.32×10^{-13}	4.51×10^{-18}	2.32×10^{-18}	8.04×10^{-13}	9.12×10^{-18}	8.89×10^{-14}	2.81×10^{-8}	3.44×10^{-13}
Technetium-99	4.35×10^{-13}	1.96×10^{-6}	8.60×10^{-11}	4.35×10^{-13}	4.53×10^{-6}	2.14×10^{-10}	1.23×10^{-8}	1.36×10^{-4}	7.43×10^{-9}
Total	$\mathbf{4.35\times10^{-13}}$	$\mathbf{1.96\times10^{-6}}$	$\mathbf{8.60\times10^{-11}}$	$\mathbf{4.35\times10^{-13}}$	$\mathbf{4.53\times10^{-6}}$	$\mathbf{2.14\times10^{-10}}$	$\mathbf{1.23\times10^{-8}}$	$\mathbf{1.36\times10^{-4}}$	$\mathbf{7.43\times10^{-9}}$
Year of peak impact	2542	2542	2542	2542	2542	2542	2702	2702	2702
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	8.88×10^{-14}	8.47×10^{-13}	3.49×10^{-22}	8.88×10^{-14}	1.36×10^{-12}	1.60×10^{-17}	2.59×10^{-9}	5.72×10^{-9}	2.34×10^{-13}
Total	$\mathbf{1.52\times10^{-13}}$	$\mathbf{8.56\times10^{-13}}$	$\mathbf{3.49\times10^{-22}}$	$\mathbf{1.52\times10^{-13}}$	$\mathbf{1.37\times10^{-12}}$	$\mathbf{1.60\times10^{-17}}$	$\mathbf{4.15\times10^{-9}}$	$\mathbf{5.74\times10^{-9}}$	$\mathbf{2.34\times10^{-13}}$
Year of peak impact	2543	2543	2543	2543	2543	2543	2602	2602	2602

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: FFTF=Fast Flux Test Facility.

Figure Q–11 depicts the cumulative radiological lifetime risk of incidence of cancer at the FFTF barrier for the drinking-water well user over time. The peak radiological risk occurs around the year 2400 for the FFTF barrier and is dominated by technetium-99. Technetium-99 is a relatively mobile radionuclide that moves at the same velocity as groundwater.

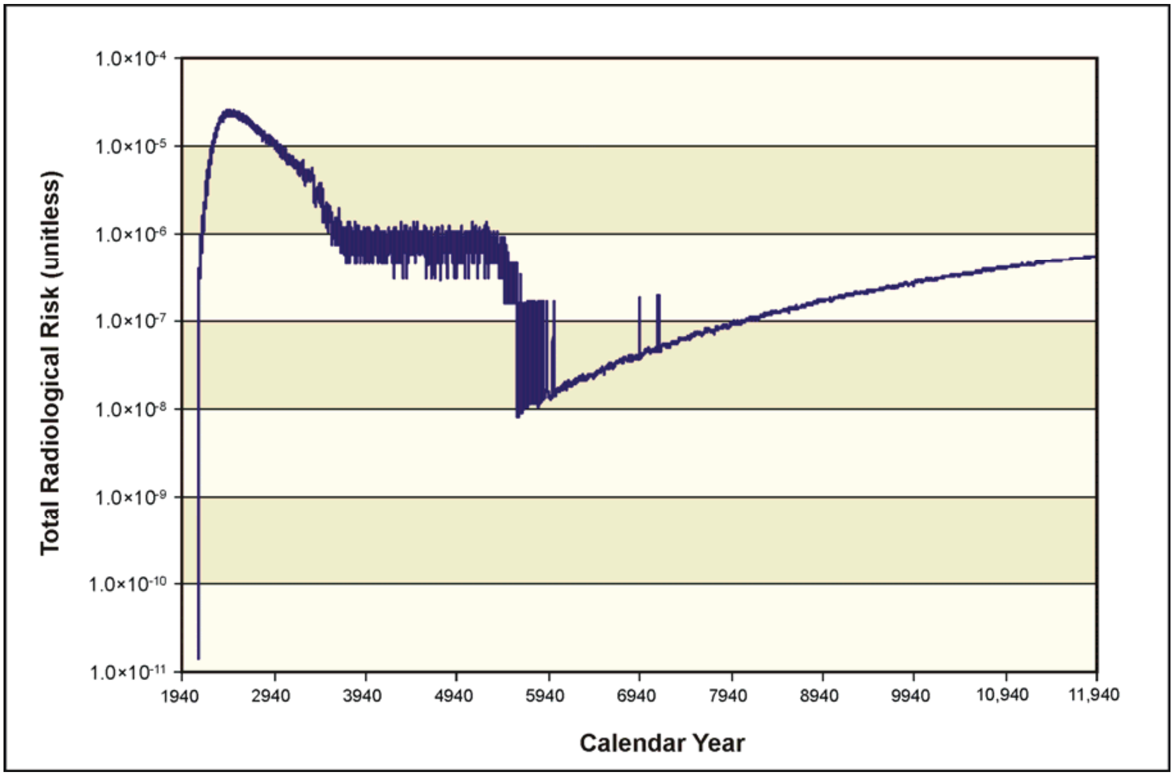

Figure Q–11. FFTF Decommissioning Alternative 1 Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Fast Flux Test Facility Barrier

Q.3.2.1.2 FFTF Decommissioning Alternative 2: Entombment

Under FFTF Decommissioning Alternative 2, all aboveground structures and minimal below-grade structures, equipment, and materials would be removed. An RCRA-compliant barrier would be constructed over the Reactor Containment Building and any other remaining below-grade structures (including the reactor vessel). Potential human health impacts of this alternative are summarized in Tables Q–216 through Q–218. The key constituent contributor to human health risk is technetium-99. The chemical risk and hazard drivers are essentially negligible. For radionuclides, the dose standard would not be exceeded at any location. In addition, the Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 8.90×10^{-3} person-rem per year for the year of maximum impact.

Table Q–216. FFTF Decommissioning Alternative 2 Human Health Impacts at the Fast Flux Test Facility Barrier

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	4.07×10^{-7}	7.13×10^{-1}	2.45×10^{-5}	4.07×10^{-7}	1.83	8.04×10^{-5}	4.07×10^{-7}	3.73	1.75×10^{-4}
Total	4.07×10^{-7}	7.13×10^{-1}	2.45×10^{-5}	4.07×10^{-7}	1.83	8.04×10^{-5}	4.07×10^{-7}	3.73	1.75×10^{-4}
Year of peak impact	2819	2819	2819	2819	2819	2819	2819	2819	2819

Table Q–217. FFTF Decommissioning Alternative 2 Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.23×10^{-8}	2.16×10^{-2}	7.42×10^{-7}	1.23×10^{-8}	5.55×10^{-2}	2.44×10^{-6}	1.23×10^{-8}	1.13×10^{-1}	5.31×10^{-6}
Total	1.23×10^{-8}	2.16×10^{-2}	7.42×10^{-7}	1.23×10^{-8}	5.55×10^{-2}	2.44×10^{-6}	1.23×10^{-8}	1.13×10^{-1}	5.31×10^{-6}
Year of peak impact	2965	2965	2965	2965	2965	2965	2965	2965	2965

Table Q–218. FFTF Decommissioning Alternative 2 Human Health Impacts at Point of Access to Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.96×10^{-13}	1.78×10^{-6}	7.81×10^{-11}	3.96×10^{-13}	4.11×10^{-6}	1.95×10^{-10}	1.23×10^{-8}	1.36×10^{-4}	7.46×10^{-9}
Total	3.96×10^{-13}	1.78×10^{-6}	7.81×10^{-11}	3.96×10^{-13}	4.11×10^{-6}	1.95×10^{-10}	1.23×10^{-8}	1.36×10^{-4}	7.46×10^{-9}
Year of peak impact	2873	2873	2873	2873	2873	2873	2965	2965	2965

Figure Q–12 depicts the cumulative radiological lifetime risk of incidence of cancer at the FFTF barrier for the drinking-water well user over time. The peak radiological risk occurs around the year 2800 for the FFTF barrier and is dominated by technetium-99. Technetium-99 is a relatively mobile radionuclide that moves at the same velocity as groundwater.

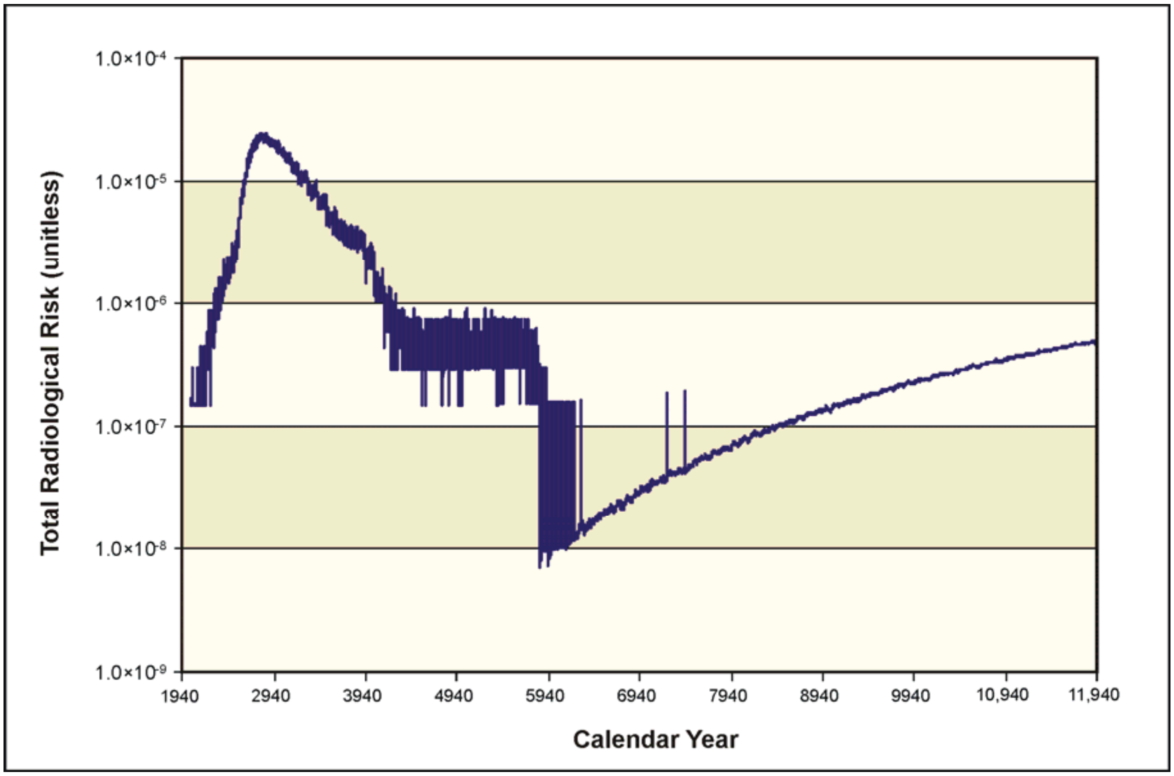

Figure Q–12. FFTF Decommissioning Alternative 2 Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Fast Flux Test Facility Barrier

Q.3.2.1.3 FFTF Decommissioning Alternative 3: Removal

Under FFTF Decommissioning Alternative 3, all aboveground structures, as well as contaminated below-grade structures, equipment and materials would be removed. As a result of removal of all contaminated material, there are no impacts on the groundwater or on human health.

Q.3.2.1.4 FFTF Decommissioning Intruder Scenario

Intruders are individuals who enter the FFTF area and engage in activity that could cause direct contact with residual contamination in the abandoned or stabilized structures. As in the case of Tank Closure alternatives, two types of receptors and two types of scenarios were considered. The receptor types were the American Indian resident farmer and the resident farmer, and the scenario types were home construction and well drilling. Because the majority of radionuclides at the FFTF areas are in hardware at a depth greater than that of the foundation for a home, the home construction scenario was screened from the analysis. Also, sensitivity analysis determined that in all cases for residential agriculture, impacts on the American Indian resident farmer exceeded impacts on the resident farmer. Because inhalation and external exposure are the only exposure modes for the well-drilling worker, impacts on the worker involved in well drilling would be the same for the resident farmer and American Indian resident farmer. For the FFTF, estimates of inventory indicate that the greatest hazard is due to quantities of the long-lived radionuclides carbon-14 and technetium-99 remaining at the site. Relatively small amounts of short-lived radionuclides are estimated to remain at the site. Consequently, impacts of intrusion at the FFTF area are represented by the well-drilling scenario in which a worker inhales dust and receives external radiation while drilling the well and an American Indian resident farmer contacts residual contamination brought to the surface during development of the well. The impacts under this intrusion scenario for the three FFTF Decommissioning alternatives are summarized in Table Q–219 for the drilling worker and American Indian resident farmer intruders. Resident farmer impacts are dominated by exposure to carbon-14 while for the worker both carbon-14 and technetium-99 contribute to dose through the direct external and inhalation pathways. For both the resident farmer and drilling worker, impacts are presented as dose for the year of peak dose. Because doses are dominated by radionuclides with short half-lives, the year of peak dose occurs immediately after loss of institutional control. The DOE intruder dose guideline of 500 millirem is not exceeded for any alternative.

Table Q–219. Doses to a Well-Drilling Worker and an American Indian Engaged in Residential Agriculture Following Well Drilling at the FFTF Area

Receptor	Dose (rem per year)		
	FFTF Decommissioning Alternative		
	1	2	3
Worker	1.92×10^{-8}	1.90×10^{-8}	1.34×10^{-13}
Resident farmer	2.80×10^{-3}	2.81×10^{-3}	4.71×10^{-8}

Key: FFTF=Fast Flux Test Facility.

Q.3.3 Long-Term Human Health Impacts of Waste Management Alternatives

Impacts on human health over the long time period following stabilization and closure of the waste management disposal facilities would be due primarily to naturally occurring release mechanisms and the degradation of waste forms over time. These releases would involve both radiological and chemical constituents. Because a large number of constituents, sources, and scenarios have been considered, screening analysis was used to identify a reduced number of controlling scenarios. The results of this analysis of impacts on human health for onsite, offsite, and intruder receptors are summarized in the following sections.

Q.3.3.1 Impacts on Onsite and Offsite Receptors of Expected Conditions for Waste Management Alternatives

Implementation of activities defined for the Waste Management alternatives could lead to releases of radiological and chemical constituents to the environment over long periods of time. In the case of Waste Management Alternative 1, these releases would come from low-level radioactive waste burial ground (LLBG) 218-W-5, trenches 31 and 34. In the case of Waste Management Alternative 2, these releases would come from IDF-East and the RPPDF. For Waste Management Alternative 3, these releases would come from IDF-East, IDF-West, and the RPPDF. Potential human health impacts due to release of radionuclides are estimated as dose and as lifetime risk of incidence of cancer. Potential human health effects due to release of chemical constituents include both carcinogenic effects and other forms of toxicity. Impacts of carcinogenic chemicals are estimated as lifetime risk of incidence of cancer. Noncarcinogenic effects are estimated as Hazard Quotient, the ratio of the long-term intake of a single chemical to intake that produces no observable effect, and as Hazard Index, the sum of the Hazard Quotients of a group of chemicals. Further information on the nature of human health effects in response to exposure to radiological and chemical constituents is provided in Appendix K, Section K.1. As previously discussed in Section Q.1 of this appendix, the screening analysis identified 14 radiological and 27 chemical constituents as contributing the greatest risk of adverse impacts. Impacts due to exposure to these constituents are presented in this appendix.

The four measures of human health impacts considered in this analysis—lifetime risks of developing cancer from radiological and chemical constituents, dose from radionuclides, and Hazard Index from chemical constituents—are calculated for each year for 10,000 years for each receptor at six locations (i.e., IDF-East, IDF-West, RPPDF, Core Zone Boundary, Columbia River nearshore, and Columbia River surface water). This is a large amount of information that must be summarized to allow interpretation of results. The method chosen is to present dose for the year of maximum dose, risk for the year of maximum risk, and Hazard Index for the year of maximum Hazard Index. This choice is based on regulation of radiological impacts as dose and the observations that peak risks and noncarcinogenic impacts expressed as Hazard Index may occur at times other than that of peak dose. The significance of dose impacts is evaluated by comparison against the 100-millirem-per-year all-exposure-modes standard specified for protection of the public and the environment in DOE Order 5400.5. Population doses are compared against total effective dose equivalent from background sources of 365 millirem per year for a member of the population of the United States (NCRP 1987). The significance of noncarcinogenic chemical impacts is evaluated by comparison to a Hazard Index guidelines value or unity. The level of protection provided for the drinking water pathway is evaluated by comparison against the MCLs of 40 CFR 141 presented in Appendix O. In addition, only those radiological and chemical constituents that resulted in a lifetime risk greater than 1×10^{-10} are presented in the tables in order to reduce the size of the tables.

The results of the analysis for drinking-water well users are summarized in Tables Q–220 through Q–226 for radiological and chemical constituents. Under all the Waste Management alternatives and disposal groups, doses would not be greater than the 100-millirem-per-year standard at any location. Under all Waste Management alternatives except for Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, and Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, doses estimated for drinking water ingestion are less than 10 millirem per year at the Columbia River nearshore location. Peak radiological impacts would be due to technetium-99 and iodine-129 and chemical impacts would be due to boron and boron compounds, chromium, fluoride, and nitrate. For peak impacts occurring after calendar year 5000, radiological impacts would be due to uranium isotopes and chemical impacts would be due to total uranium.

Table Q–220. Waste Management Alternative 1 Summary of Human Health Impacts on Drinking-Water Well User

Location	Radiological Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Trenches 31 and 34	4.48×10^{-2} (3499)	1.39×10^{-6} (3499)	3.08×10^{-2} (3526)	0.00 N/A
Core Zone Boundary	7.96×10^{-3} (3471)	2.53×10^{-7} (3474)	5.92×10^{-3} (3615)	0.00 N/A
Columbia River nearshore	1.29×10^{-3} (3974)	4.12×10^{-8} (3974)	9.93×10^{-4} (4147)	0.00 N/A

Note: Calendar year of peak impact presented in parentheses.

Key: N/A= not applicable.

Table Q–221. Waste Management Alternative 2 Summary of Radiological Dose at Year of Peak Dose (millirem per year) for Drinking-Water Well User

Location	Waste Management Alternative 2											
	Disposal Group 1							Disposal Group 2			Disposal Group 3	
	Subgroup							Subgroup				
	1-A	1-B	1-C	1-D	1-E	1-F	1-G	2-A	2-B, Base Case	2-B, Option Case	Base Case	Option Case
IDF-East	7.49 (8276)	8.81 (8739)	1.22×10^{1} (9509)	5.65×10^{1} (9032)	1.38×10^{1} (8944)	1.02×10^{1} (8276)	7.59 (8739)	1.12×10^{1} (8706)	1.14×10^{1} (8706)	1.14×10^{1} (8706)	1.08×10^{1} (8290)	1.08×10^{1} (8290)
RPPDF	6.92×10^{-2} (3804)	6.92×10^{-2} (3804)	6.92×10^{-2} (3804)	6.92×10^{-2} (3804)	2.15×10^{-1} (3822)	N/A	6.92×10^{-2} (3804)	N/A	5.92×10^{-1} (3889)	6.96×10^{-1} (4213)	6.35×10^{-1} (3987)	7.87×10^{-1} (4013)
Core Zone Boundary	3.13 (8438)	3.68 (8079)	1.59×10^{1} (9163)	4.42×10^{1} (9067)	5.91 (9576)	3.89 (8885)	3.07 (8858)	3.98 (9188)	3.96 (9188)	3.96 (9188)	3.59 (8393)	4.10 (8393)
Columbia River nearshore	2.58 (8700)	2.77 (8700)	4.15 (8927)	1.48×10^{1} (9207)	4.36 (8117)	2.97 (8700)	2.61 (8700)	1.92 (9652)	1.92 (9652)	1.94 (9652)	2.31 (9282)	2.34 (9284)

Note: Calendar year of peak impact presented in parentheses.

Key: IDF-East=200-East Area Integrated Disposal Facility; N/A=not applicable; RPPDF=River Protection Project Disposal Facility.

Table Q–222. Waste Management Alternative 2 Summary of Radiological Risk at Year of Peak Radiological Risk (unitless) for Drinking-Water Well User

Location	Waste Management Alternative 2											
	Disposal Group 1							Disposal Group 2			Disposal Group 3	
	Subgroup							Subgroup				
	1-A	1-B	1-C	1-D	1-E	1-F	1-G	2-A	2-B, Base Case	2-B, Option Case	Base Case	Option Case
IDF-East	1.63×10^{-4} (8276)	2.12×10^{-4} (8827)	3.64×10^{-4} (9048)	1.86×10^{-3} (9032)	4.10×10^{-4} (9035)	2.57×10^{-4} (8276)	1.60×10^{-4} (8276)	2.32×10^{-4} (8706)	2.34×10^{-4} (8706)	2.34×10^{-4} (8706)	2.29×10^{-4} (8290)	2.29×10^{-4} (8290)
RPPDF	2.11×10^{-6} (3825)	2.11×10^{-6} (3825)	2.11×10^{-6} (3825)	2.11×10^{-6} (3825)	6.59×10^{-6} (3822)	N/A	2.11×10^{-6} (3825)	N/A	1.82×10^{-5} (3889)	2.16×10^{-5} (4213)	1.94×10^{-5} (3987)	2.45×10^{-5} (4013)
Core Zone Boundary	8.02×10^{-5} (9155)	8.47×10^{-5} (7998)	5.09×10^{-4} (9163)	1.50×10^{-3} (9067)	1.92×10^{-4} (9499)	9.97×10^{-5} (9155)	7.86×10^{-5} (9155)	8.27×10^{-5} (8365)	8.23×10^{-5} (8365)	8.33×10^{-5} (4466)	7.77×10^{-5} (8173)	8.54×10^{-5} (8393)
Columbia River nearshore	4.99×10^{-5} (9451)	5.54×10^{-5} (8611)	1.15×10^{-4} (8927)	4.73×10^{-4} (9209)	1.31×10^{-4} (8117)	6.15×10^{-5} (8854)	4.98×10^{-5} (9451)	4.52×10^{-5} (8478)	4.73×10^{-5} (8477)	4.81×10^{-5} (8477)	6.03×10^{-5} (9284)	6.13×10^{-5} (9284)

Note: Calendar year of peak impact presented in parentheses.

Key: IDF-East=200-East Area Integrated Disposal Facility; N/A=not applicable; RPPDF=River Protection Project Disposal Facility.

Table Q–223. Waste Management Alternative 2 Summary of Hazard Index at Year of Peak Hazard Index (unitless) for Drinking-Water Well User

	Waste Management Alternative 2											
	Disposal Group 1							Disposal Group 2			Disposal Group 3	
	Subgroup							Subgroup				
Location	1-A	1-B	1-C	1-D	1-E	1-F	1-G	2-A	2-B, Base Case	2-B, Option Case	Base Case	Option Case
IDF-East	2.73×10^{-1} (8522)	2.66×10^{-1} (7821)	4.86 (8940)	4.30 (8442)	2.48 (9318)	3.51 (8735)	2.68×10^{-1} (8168)	2.98×10^{-1} (8216)	3.21×10^{-1} (8414)	3.21×10^{-1} (8414)	3.07×10^{-1} (8236)	3.07×10^{-1} (8236)
RPPDF	2.19×10^{-2} (3856)	2.19×10^{-2} (3856)	2.19×10^{-2} (3856)	2.19×10^{-2} (3856)	5.86×10^{-2} (3804)	N/A	2.19×10^{-2} (3856)	N/A	5.96×10^{-2} (3868)	3.91×10^{-1} (4260)	5.89×10^{-2} (4109)	4.29×10^{-1} (4387)
Core Zone Boundary	1.04×10^{-1} (9653)	1.06×10^{-1} (8905)	2.73 (8760)	1.69 (8397)	1.02 (9599)	1.47 (8764)	1.04×10^{-1} (9653)	1.05×10^{-1} (7905)	1.16×10^{-1} (3995)	1.38 (4564)	1.21×10^{-1} (9877)	1.35 (4628)
Columbia River nearshore	4.78×10^{-2} (8044)	6.74×10^{-2} (8144)	1.24 (9310)	1.12 (9878)	6.59×10^{-1} (8069)	1.09 (8819)	4.79×10^{-2} (8821)	7.46×10^{-2} (8055)	6.48×10^{-2} (7829)	2.29×10^{-1} (5180)	6.81×10^{-2} (7710)	2.29×10^{-1} (4954)

Note: Calendar year of peak impact presented in parentheses.

Key: IDF-East=200-East Area Integrated Disposal Facility; N/A=not applicable; RPPDF=River Protection Project Disposal Facility.

Table Q–224. Waste Management Alternative 3 Summary of Radiological Dose at Year of Peak Dose (millirem per year) for Drinking-Water Well User

	Waste Management Alternative 3											
	Disposal Group 1							Disposal Group 2			Disposal Group 3	
	Subgroup							Subgroup				
Location	1-A	1-B	1-C	1-D	1-E	1-F	1-G	2-A	2-B, Base Case	2-B, Option Case	Base Case	Option Case
IDF-East	1.04 (11,257)	3.00 (8486)	8.88 (9048)	5.28×10^{1} (9032)	1.01×10^{1} (9826)	4.34 (9701)	9.07×10^{-1} (10,032)	8.64×10^{-1} (9988)	8.97×10^{-1} (11,141)	8.97×10^{-1} (11,141)	8.62×10^{-1} (11,896)	8.62×10^{-1} (11,896)
IDF-West	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)	8.08×10^{1} (3723)
RPPDF	6.92×10^{-2} (3804)	6.92×10^{-2} (3804)	6.92×10^{-2} (3804)	6.92×10^{-2} (3804)	2.15×10^{-1} (3822)	N/A	6.92×10^{-2} (3804)	N/A	5.92×10^{-1} (3889)	6.96×10^{-1} (4213)	6.35×10^{-1} (3987)	7.87×10^{-1} (4013)
Core Zone Boundary	2.73×10^{1} (3709)	2.73×10^{1} (3709)	2.73×10^{1} (3709)	4.39×10^{1} (9067)	2.73×10^{1} (3709)	2.72×10^{1} (3709)	2.73×10^{1} (3709)	2.72×10^{1} (3709)	2.76×10^{1} (3709)	2.77×10^{1} (3709)	2.75×10^{1} (3709)	2.76×10^{1} (3709)
Columbia River nearshore	3.37 (4388)	3.37 (4388)	3.37 (8939)	1.40×10^{1} (7821)	3.98 (8117)	3.36 (4388)	3.37 (4388)	3.36 (4388)	3.53 (4389)	3.49 (4388)	3.45 (4389)	3.58 (4388)

Note: Calendar year of peak impact presented in parentheses.

Key: IDF-East=200-East Area Integrated Disposal Facility; IDF-West=200-West Area Integrated Disposal Facility; N/A=not applicable; RPPDF=River Protection Project Disposal Facility.

Table Q–225. Waste Management Alternative 3 Summary of Radiological Risk at Year of Peak Radiological Risk (unitless) for Drinking-Water Well User

Location	Waste Management Alternative 3											
	Disposal Group 1							Disposal Group 2			Disposal Group 3	
	Subgroup							Subgroup				
	1-A	1-B	1-C	1-D	1-E	1-F	1-G	2-A	2-B, Base Case	2-B, Option Case	Base Case	Option Case
IDF-East	3.05×10^{-5} (8991)	9.88×10^{-5} (8486)	3.03×10^{-4} (9048)	1.78×10^{-3} (9032)	3.42×10^{-4} (9826)	1.46×10^{-4} (9701)	2.70×10^{-5} (10,032)	2.25×10^{-5} (9823)	2.38×10^{-5} (11,141)	2.38×10^{-5} (11,141)	2.50×10^{-5} (9324)	2.50×10^{-5} (9324)
IDF-West	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)	1.70×10^{-3} (3713)
RPPDF	2.11×10^{-6} (3825)	2.11×10^{-6} (3825)	2.11×10^{-6} (3825)	2.11×10^{-6} (3825)	6.59×10^{-6} (3822)	N/A	2.11×10^{-6} (3825)	N/A	1.82×10^{-5} (3889)	2.16×10^{-5} (4213)	1.94×10^{-5} (3987)	2.45×10^{-5} (4013)
Core Zone Boundary	5.79×10^{-4} (3690)	5.79×10^{-4} (3690)	5.79×10^{-4} (3690)	1.49×10^{-3} (9067)	5.82×10^{-4} (3690)	5.78×10^{-4} (3690)	5.79×10^{-4} (3690)	5.78×10^{-4} (3690)	5.92×10^{-4} (3751)	5.88×10^{-4} (3895)	6.01×10^{-4} (3895)	6.03×10^{-4} (3690)
Columbia River nearshore	8.13×10^{-5} (4191)	8.13×10^{-5} (4191)	1.06×10^{-4} (8939)	4.60×10^{-4} (7821)	1.27×10^{-4} (8117)	8.11×10^{-5} (4191)	8.13×10^{-5} (4191)	8.11×10^{-5} (4191)	8.35×10^{-5} (4191)	8.53×10^{-5} (4189)	8.36×10^{-5} (4191)	8.69×10^{-5} (4066)

Note: Calendar year of peak impact presented in parentheses.

Key: IDF-East=200-East Area Integrated Disposal Facility; IDF-West=200-West Area Integrated Disposal Facility; N/A=not applicable; RPPDF=River Protection Project Disposal Facility.

Table Q–226. Waste Management Alternative 3 Summary of Hazard Index at Year of Peak Hazard Index (unitless) for Drinking-Water Well User

Location	Waste Management Alternative 2											
	Disposal Group 1							Disposal Group 2			Disposal Group 3	
	Subgroup							Subgroup				
	1-A	1-B	1-C	1-D	1-E	1-F	1-G	2-A	2-B, Base Case	2-B, Option Case	Base Case	Option Case
IDF-East	2.71×10^{-1} (8522)	2.64×10^{-1} (7821)	4.86 (8940)	4.30 (8442)	2.48 (9318)	3.51 (8735)	2.66×10^{-1} (8168)	2.96×10^{-1} (8216)	3.18×10^{-1} (8414)	3.18×10^{-1} (8414)	3.06×10^{-1} (8236)	3.06×10^{-1} (8236)
IDF-West	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)	1.95×10^{-2} (3756)
RPPDF	2.19×10^{-2} (3856)	2.19×10^{-2} (3856)	2.19×10^{-2} (3856)	2.19×10^{-2} (3856)	5.86×10^{-2} (3804)	N/A	2.19×10^{-2} (3856)	N/A	5.96×10^{-2} (3868)	3.91×10^{-1} (4260)	5.89×10^{-2} (4109)	4.29×10^{-1} (4387)
Core Zone Boundary	1.04×10^{-1} (9653)	1.06×10^{-1} (8905)	2.73 (8760)	1.69 (8397)	1.02 (9599)	1.47 (8764)	1.04×10^{-1} (9653)	1.05×10^{-1} (7905)	1.25×10^{-1} (4042)	1.38 (4564)	1.20×10^{-1} (9877)	1.36 (4628)
Columbia River nearshore	4.76×10^{-2} (8044)	6.71×10^{-2} (8144)	1.24 (9310)	1.12 (9878)	6.59×10^{-1} (8069)	1.09 (8819)	4.78×10^{-2} (8821)	7.45×10^{-2} (8055)	6.48×10^{-2} (7831)	2.30×10^{-1} (5180)	6.80×10^{-2} (7710)	2.30×10^{-1} (4954)

Note: Calendar year of peak impact presented in parentheses.

Key: IDF-East=200-East Area Integrated Disposal Facility; IDF-West=200-West Area Integrated Disposal Facility; N/A=not applicable; RPPDF=River Protection Project Disposal Facility.

Q.3.3.1.1 Waste Management Alternative 1: No Action

Under Waste Management Alternative 1, only those wastes currently generated onsite at Hanford from non–Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) actions would continue to be disposed of in LLBG 218-W-5, trenches 31 and 34. Although the short-term impacts do not address the impacts associated with closure activities for this site, for purposes of analysis for long-term impacts it is assumed that these trenches will be closed using an RCRA-compliant barrier consistent with the closure plans for these burial grounds. As a result, the non-CERCLA waste disposed of in these trenches from 2008 to 2035 would become available for release to the environment. Potential human health impacts of this alternative at the disposal area boundary, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–227 through Q–230, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides and boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. In addition, the Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 3.18×10^{-4} person-rem per year for the year of maximum impact.

Table Q–227. Waste Management Alternative 1 Human Health Impacts at Low-Level Radioactive Waste Burial Ground 218-W-5, Trenches 31 and 34

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.18×10^{-8}	3.82×10^{-2}	1.31×10^{-6}	2.18×10^{-8}	9.80×10^{-2}	4.30×10^{-6}	2.18×10^{-8}	2.00×10^{-1}	9.39×10^{-6}
Iodine-129	2.32×10^{-11}	6.60×10^{-3}	7.51×10^{-8}	2.32×10^{-11}	7.66×10^{-3}	1.01×10^{-7}	2.32×10^{-11}	9.46×10^{-3}	1.46×10^{-7}
Total	2.18×10^{-8}	4.48×10^{-2}	1.39×10^{-6}	2.18×10^{-8}	1.06×10^{-1}	4.40×10^{-6}	2.18×10^{-8}	2.09×10^{-1}	9.53×10^{-6}
Year of Peak Impact	3499	3499	3499	3499	3499	3499	3499	3499	3499
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	4.84×10^{-5}	6.92×10^{-6}	0.00	4.84×10^{-5}	7.01×10^{-6}	0.00	4.84×10^{-5}	7.45×10^{-6}	0.00
Chromium	2.96×10^{-3}	2.82×10^{-2}	0.00	2.96×10^{-3}	2.82×10^{-2}	1.16×10^{-11}	2.96×10^{-3}	4.13×10^{-2}	5.33×10^{-7}
Fluoride	3.89×10^{-3}	1.85×10^{-3}	0.00	3.89×10^{-3}	1.90×10^{-3}	0.00	3.89×10^{-3}	2.05×10^{-3}	0.00
Nitrate	3.89×10^{-2}	6.95×10^{-4}	0.00	3.89×10^{-2}	9.15×10^{-4}	0.00	3.89×10^{-2}	1.79×10^{-3}	0.00
Total	4.58×10^{-2}	3.08×10^{-2}	0.00	4.58×10^{-2}	3.11×10^{-2}	1.16×10^{-11}	4.58×10^{-2}	4.51×10^{-2}	5.33×10^{-7}
Year of Peak Impact	3526	3526	N/A	3526	3526	3526	3526	3526	3526

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–228. Waste Management Alternative 1 Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.78×10^{-9}	6.61×10^{-3}	2.44×10^{-7}	4.05×10^{-9}	1.82×10^{-2}	8.00×10^{-7}	4.05×10^{-9}	3.71×10^{-2}	1.74×10^{-6}
Iodine-129	4.72×10^{-12}	1.34×10^{-3}	9.46×10^{-9}	2.92×10^{-12}	9.65×10^{-4}	1.28×10^{-8}	2.92×10^{-12}	1.19×10^{-3}	1.84×10^{-8}
Total	3.78×10^{-9}	7.96×10^{-3}	2.53×10^{-7}	4.05×10^{-9}	1.92×10^{-2}	8.13×10^{-7}	4.05×10^{-9}	3.83×10^{-2}	1.76×10^{-6}
Year of Peak Impact	3471	3471	3474	3474	3474	3474	3474	3474	3474

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	8.93×10^{-6}	1.28×10^{-6}	0.00	8.93×10^{-6}	1.29×10^{-6}	0.00	8.93×10^{-6}	1.37×10^{-6}	0.00
Chromium	5.78×10^{-4}	5.50×10^{-3}	0.00	5.78×10^{-4}	5.51×10^{-3}	2.27×10^{-12}	5.78×10^{-4}	8.05×10^{-3}	1.04×10^{-7}
Fluoride	6.07×10^{-4}	2.89×10^{-4}	0.00	6.07×10^{-4}	2.97×10^{-4}	0.00	6.07×10^{-4}	3.20×10^{-4}	0.00
Nitrate	6.87×10^{-3}	1.23×10^{-4}	0.00	6.87×10^{-3}	1.62×10^{-4}	0.00	6.87×10^{-3}	3.17×10^{-4}	0.00
Total	8.06×10^{-3}	5.92×10^{-3}	0.00	8.06×10^{-3}	5.97×10^{-3}	2.27×10^{-12}	8.06×10^{-3}	8.69×10^{-3}	1.04×10^{-7}
Year of Peak Impact	3615	3615	N/A	3615	3615	3615	3615	3615	3615

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–229. Waste Management Alternative 1 Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	6.58×10^{-10}	1.15×10^{-3}	3.96×10^{-8}	6.58×10^{-10}	2.96×10^{-3}	1.30×10^{-7}	6.58×10^{-10}	6.03×10^{-3}	2.83×10^{-7}
Iodine-129	4.78×10^{-13}	1.36×10^{-4}	1.55×10^{-9}	4.78×10^{-13}	1.58×10^{-4}	2.09×10^{-9}	4.78×10^{-13}	1.95×10^{-4}	3.01×10^{-9}
Total	6.58×10^{-10}	1.29×10^{-3}	4.12×10^{-8}	6.58×10^{-10}	3.12×10^{-3}	1.32×10^{-7}	6.58×10^{-10}	6.22×10^{-3}	2.86×10^{-7}
Year of Peak Impact	3974	3974	3974	3974	3974	3974	3974	3974	3974
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.16×10^{-6}	1.66×10^{-7}	0.00	1.16×10^{-6}	1.68×10^{-7}	0.00	1.16×10^{-6}	1.79×10^{-7}	0.00
Chromium	9.77×10^{-5}	9.31×10^{-4}	0.00	9.77×10^{-5}	9.32×10^{-4}	3.84×10^{-13}	9.77×10^{-5}	1.36×10^{-3}	1.76×10^{-8}
Fluoride	9.94×10^{-5}	4.73×10^{-5}	0.00	9.94×10^{-5}	4.87×10^{-5}	0.00	9.94×10^{-5}	5.24×10^{-5}	0.00
Nitrate	8.11×10^{-4}	1.45×10^{-5}	0.00	8.11×10^{-4}	1.91×10^{-5}	0.00	8.11×10^{-4}	3.74×10^{-5}	0.00
Total	1.01×10^{-3}	9.93×10^{-4}	0.00	1.01×10^{-3}	1.00×10^{-3}	3.84×10^{-13}	1.01×10^{-3}	1.45×10^{-3}	1.76×10^{-8}
Year of Peak Impact	4147	4147	N/A	4147	4147	4353	4147	4147	4353

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–230. Waste Management Alternative 1 Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.34×10^{-14}	6.02×10^{-8}	2.64×10^{-12}	1.27×10^{-14}	1.32×10^{-7}	6.24×10^{-12}	6.58×10^{-10}	7.21×10^{-6}	3.96×10^{-10}
Iodine-129	9.82×10^{-18}	3.25×10^{-9}	4.31×10^{-14}	1.51×10^{-17}	8.14×10^{-8}	1.96×10^{-12}	4.78×10^{-13}	8.09×10^{-7}	1.98×10^{-11}
Total	1.34×10^{-14}	6.35×10^{-8}	2.69×10^{-12}	1.27×10^{-14}	2.13×10^{-7}	8.20×10^{-12}	6.58×10^{-10}	8.02×10^{-6}	4.16×10^{-10}
Year of Peak Impact	3749	3749	3749	3667	3667	3667	3974	3974	3974

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	3.56×10^{-11}	5.15×10^{-12}	0.00	3.98×10^{-11}	6.32×10^{-12}	0.00	1.16×10^{-6}	1.16×10^{-8}	0.00
Chromium	1.90×10^{-9}	1.82×10^{-8}	7.48×10^{-18}	1.55×10^{-9}	2.37×10^{-8}	3.43×10^{-13}	9.77×10^{-5}	2.16×10^{-4}	8.81×10^{-9}
Fluoride	2.27×10^{-9}	1.11×10^{-9}	0.00	2.67×10^{-9}	1.85×10^{-9}	0.00	9.94×10^{-5}	1.45×10^{-5}	0.00
Nitrate	2.71×10^{-8}	9.37×10^{-10}	0.00	3.06×10^{-8}	2.88×10^{-6}	0.00	8.11×10^{-4}	3.18×10^{-5}	0.00
Total	3.14×10^{-8}	2.02×10^{-8}	7.48×10^{-18}	3.49×10^{-8}	2.90×10^{-6}	3.43×10^{-13}	1.01×10^{-3}	2.62×10^{-4}	8.81×10^{-9}
Year of Peak Impact	3741	3741	3741	3685	3685	3741	4147	4147	4353

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figure Q–13 depicts the cumulative radiological lifetime risk of incidence of cancer at the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3470 and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in LLBG 218-W-5, trenches 31 and 34. These are relatively mobile radionuclides that move at the same velocity as groundwater.

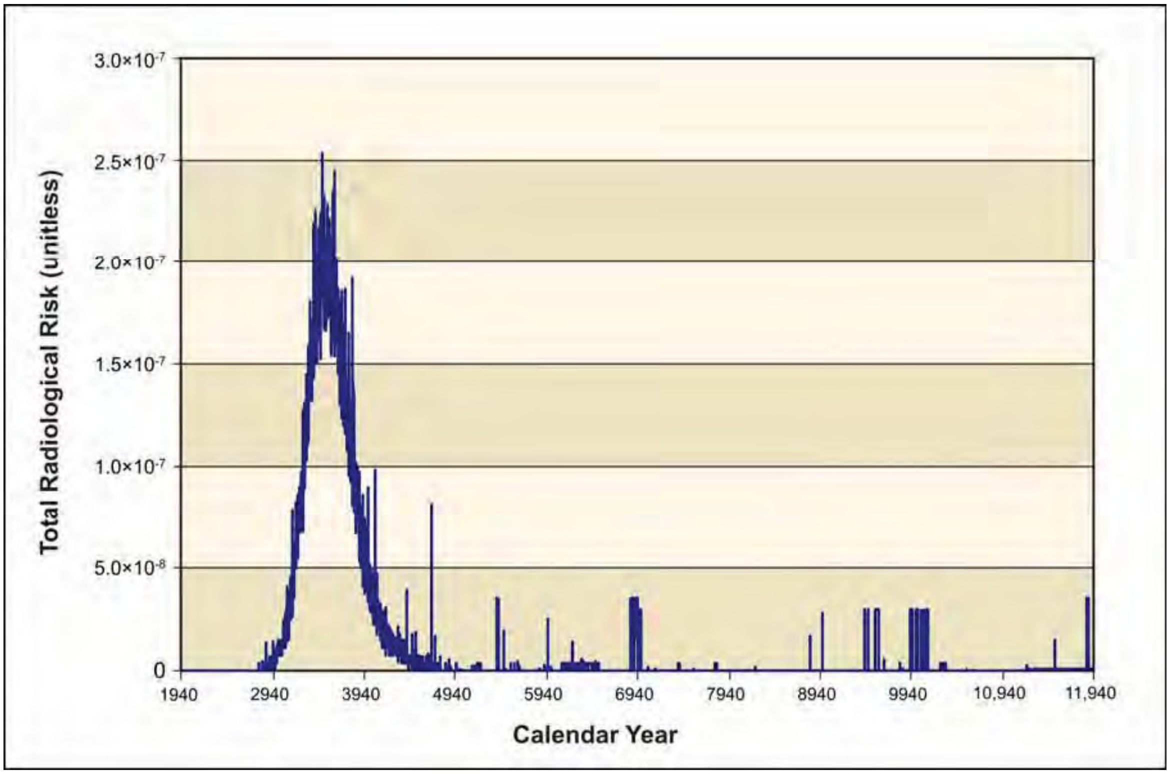

Figure Q–13. Waste Management Alternative 1 Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2 Waste Management Alternative 2: Disposal in IDF, 200-East Area Only

Under Waste Management Alternative 2, waste from tank treatment operations, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites would be disposed of in IDF-East. Waste from tank farm cleanup activities would be disposed of in the RPPDF. As a result, the waste disposed of in these two facilities would become available for release to the environment. Because different waste types would result from the Tank Closure action alternatives, three disposal groups were considered to account for the different IDF-East sizes and operational time periods. In addition, within these three disposal groups, subgroups were identified to allow consideration of the different waste types resulting from the Tank Closure alternatives. Potential human health impacts of these subgroups under this alternative are discussed in the following sections.

Q.3.3.1.2.1 Waste Management Alternative 2; Disposal Group 1, Subgroup 1-A

Disposal Group 1, Subgroup 1-A, addresses the waste resulting from Tank Closure Alternative 2B, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- Immobilized low-activity waste (ILAW) glass
- LAW melters

- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 2B.

Potential human health impacts at the IDF-East barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia nearshore, and the Columbia River surface-water locations are summarized in Tables Q–231 through Q–235, respectively. The key constituent contributors to human health risk are technetium-99, iodine-129 for radionuclides and boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. In addition, the Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 3.05×10^{-1} person-rem per year for the year] of maximum impact.

Table Q–231. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.92×10^{-6}	3.36	1.15×10^{-4}	1.92×10^{-6}	8.63	3.79×10^{-4}	1.92×10^{-6}	1.76×10^{1}	8.80×10^{-4}
Iodine-129	1.45×10^{-8}	4.13	4.70×10^{-5}	1.45×10^{-8}	4.80	6.35×10^{-5}	1.45×10^{-8}	5.92	4.68×10^{-5}
Total	1.93×10^{-6}	7.49	1.63×10^{-4}	1.93×10^{-6}	1.34×10^{1}	4.42×10^{-4}	1.93×10^{-6}	2.35×10^{1}	9.26×10^{-4}
Year of Peak Impact	8276	8276	8276	8276	8276	8276	8276	8276	9004
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	2.97×10^{-6}	4.25×10^{-7}	0.00	2.97×10^{-6}	4.30×10^{-7}	0.00	2.97×10^{-6}	4.57×10^{-7}	0.00
Chromium	1.92×10^{-3}	1.83×10^{-2}	0.00	1.92×10^{-3}	1.83×10^{-2}	1.69×10^{-11}	1.92×10^{-3}	2.68×10^{-2}	7.77×10^{-7}
Fluoride	1.98×10^{-4}	9.42×10^{-5}	0.00	1.98×10^{-4}	9.69×10^{-5}	0.00	1.98×10^{-4}	1.04×10^{-4}	0.00
Nitrate	1.42×10^{1}	2.54×10^{-1}	0.00	1.42×10^{1}	3.35×10^{-1}	0.00	1.42×10^{1}	6.57×10^{-1}	0.00
Total	1.42×10^{1}	2.73×10^{-1}	0.00	1.42×10^{1}	3.53×10^{-1}	1.69×10^{-11}	1.42×10^{1}	6.84×10^{-1}	7.77×10^{-7}
Year of Peak Impact	8522	8522	N/A	8522	8522	8511	8522	8522	8511

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–232. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{2}	1.67×10^{-3}	0.00	9.37×10^{2}	2.20×10^{-3}	0.00	9.37×10^{1}	4.32×10^{-1}	0.00
Total	9.58×10^{2}	2.19×10^{-2}	0.00	9.58×10^{2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{1}	3.40×10^{-1}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–233. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.73×10^{-7}	1.53	7.09×10^{-5}	1.18×10^{-6}	5.30	2.33×10^{-4}	1.18×10^{-6}	1.08×10^{1}	5.07×10^{-4}
Iodine-129	5.61×10^{-9}	1.60	9.26×10^{-6}	2.86×10^{-9}	9.45×10^{-1}	1.25×10^{-5}	2.86×10^{-9}	1.17	1.80×10^{-5}
Total	8.79×10^{-7}	3.13	8.02×10^{-5}	1.18×10^{-6}	6.24	2.45×10^{-4}	1.18×10^{-6}	1.20×10^{1}	5.25×10^{-4}
Year of Peak Impact	8438	8438	9155	9155	9155	9155	9155	9155	9155
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	3.95×10^{-4}	3.76×10^{-3}	0.00	3.95×10^{-4}	3.76×10^{-3}	8.42×10^{-12}	3.95×10^{-4}	5.50×10^{-3}	3.86×10^{-7}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	5.63	1.01×10^{-1}	0.00	5.63	1.32×10^{-1}	0.00	5.63	2.60×10^{-1}	0.00
Total	5.63	1.04×10^{-1}	0.00	5.63	1.36×10^{-1}	8.42×10^{-12}	5.63	2.65×10^{-1}	3.86×10^{-7}
Year of Peak Impact	9653	9653	N/A	9653	9653	3889	9653	9653	3889

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–234. Waste Management Alternative 2, Disposal Group 1, Subgroup1-A, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.33×10^{-7}	5.83×10^{-1}	4.07×10^{-5}	6.75×10^{-7}	3.04	1.33×10^{-4}	6.75×10^{-7}	6.19	2.91×10^{-4}
Iodine-129	7.00×10^{-9}	1.99	9.26×10^{-6}	2.86×10^{-9}	9.44×10^{-1}	1.25×10^{-5}	2.86×10^{-9}	1.17	1.80×10^{-5}
Total	3.40×10^{-7}	2.58	4.99×10^{-5}	6.78×10^{-7}	3.98	1.46×10^{-4}	6.78×10^{-7}	7.36	3.09×10^{-4}
Year of Peak Impact	8700	8700	9451	9451	9451	9451	9451	9451	9451
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	6.60×10^{-7}	9.43×10^{-8}	0.00	6.60×10^{-7}	9.56×10^{-8}	0.00	6.60×10^{-7}	1.01×10^{-7}	0.00
Chromium	4.36×10^{-4}	4.15×10^{-3}	0.00	4.36×10^{-4}	4.16×10^{-3}	2.93×10^{-12}	4.36×10^{-4}	6.07×10^{-3}	1.34×10^{-7}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	2.44	4.36×10^{-2}	0.00	2.44	5.74×10^{-2}	0.00	2.44	1.13×10^{-1}	0.00
Total	2.44	4.78×10^{-2}	0.00	2.44	6.16×10^{-2}	2.93×10^{-12}	2.44	1.19×10^{-1}	1.34×10^{-7}
Year of Peak Impact	8044	8044	N/A	8044	8044	8898	8044	8044	8898

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–235. Waste Management Alternative 2, Disposal Group 1, Subgroup1-A, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	9.21×10^{-12}	4.14×10^{-5}	1.88×10^{-9}	5.36×10^{-12}	5.57×10^{-5}	2.64×10^{-9}	3.33×10^{-7}	3.66×10^{-3}	4.05×10^{-7}
Iodine-129	5.92×10^{-14}	1.96×10^{-5}	2.15×10^{-10}	8.32×10^{-14}	4.49×10^{-4}	1.08×10^{-8}	7.00×10^{-9}	1.11×10^{-2}	1.17×10^{-7}
Total	9.27×10^{-12}	6.10×10^{-5}	2.09×10^{-9}	5.44×10^{-12}	5.05×10^{-4}	1.35×10^{-8}	3.40×10^{-7}	1.47×10^{-2}	5.22×10^{-7}
Year of Peak Impact	8704	8704	8979	9273	9273	9273	8700	8700	9451

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.08×10^{-11}	1.56×10^{-12}	0.00	1.08×10^{-11}	1.72×10^{-12}	0.00	9.91×10^{-7}	9.88×10^{-9}	0.00
Chromium	7.07×10^{-9}	6.74×10^{-8}	4.26×10^{-17}	7.07×10^{-9}	1.08×10^{-7}	1.95×10^{-12}	2.62×10^{-4}	5.78×10^{-4}	6.72×10^{-8}
Fluoride	8.86×10^{-10}	4.34×10^{-10}	0.00	8.86×10^{-10}	6.15×10^{-10}	0.00	2.47×10^{-5}	3.62×10^{-6}	0.00
Nitrate	4.48×10^{-5}	1.55×10^{-6}	0.00	4.48×10^{-5}	4.21×10^{-3}	0.00	2.44	9.51×10^{-2}	0.00
Total	4.48×10^{-5}	1.61×10^{-6}	4.26×10^{-17}	4.48×10^{-5}	4.21×10^{-3}	1.95×10^{-12}	2.44	9.57×10^{-2}	6.72×10^{-8}
Year of Peak Impact	8016	8016	8736	8016	8016	8736	8085	8085	8898

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–14 and Q–15, respectively, depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 8400 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

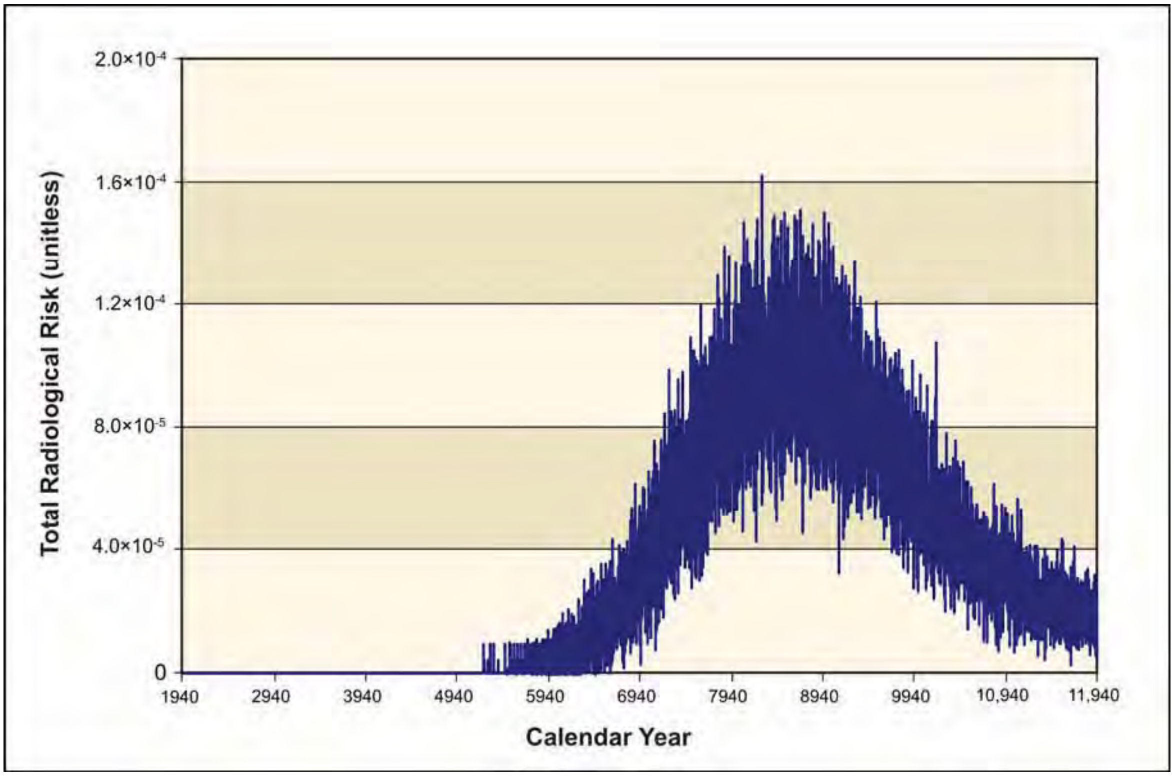

Figure Q–14. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

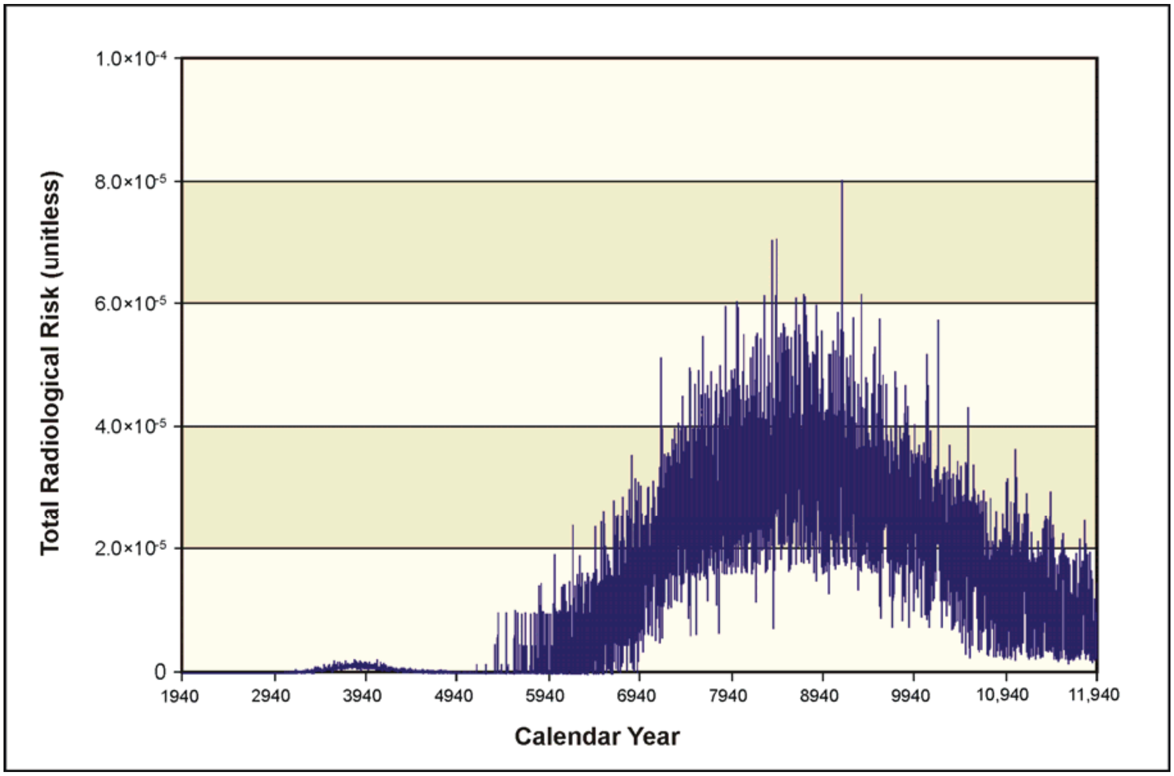

Figure Q–15. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.2 Waste Management Alternative 2; Disposal Group 1, Subgroup 1-B

Disposal Group 1, Subgroup 1-B, addresses the waste resulting from Tank Closure Alternative 3A, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Bulk vitrification glass
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 3A.

Potential human health impacts at the IDF-East barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–236 through Q–240, respectively. The key constituent contributors to human health risk are technetium-99, iodine-129 for radionuclides and boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. In addition, the Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 3.88×10^{-1} person-rem per year for the year of maximum impact.

Table Q–236. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.08×10^{-6}	3.64	1.73×10^{-4}	2.87×10^{-6}	1.29×10^{1}	5.66×10^{-4}	2.87×10^{-6}	2.63×10^{1}	1.24×10^{-3}
Iodine-129	1.81×10^{-8}	5.16	3.89×10^{-5}	1.20×10^{-8}	3.97	5.25×10^{-5}	1.20×10^{-8}	4.90	7.56×10^{-5}
Total	2.10×10^{-6}	8.81	2.12×10^{-4}	2.88×10^{-6}	1.69×10^{1}	6.19×10^{-4}	2.88×10^{-6}	3.12×10^{1}	1.31×10^{-3}
Year of Peak Impact	8739	8739	8827	8827	8827	8827	8827	8827	8827
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	2.64×10^{-6}	3.77×10^{-7}	0.00	2.64×10^{-6}	3.82×10^{-7}	0.00	2.64×10^{-6}	4.06×10^{-7}	0.00
Chromium	9.89×10^{-4}	9.42×10^{-3}	0.00	9.89×10^{-4}	9.43×10^{-3}	6.93×10^{-12}	9.89×10^{-4}	1.38×10^{-2}	3.18×10^{-7}
Fluoride	1.48×10^{-4}	7.06×10^{-5}	0.00	1.48×10^{-4}	7.27×10^{-5}	0.00	1.48×10^{-4}	7.82×10^{-5}	0.00
Nitrate	1.44×10^{1}	2.57×10^{-1}	0.00	1.44×10^{1}	3.38×10^{-1}	0.00	1.44×10^{1}	6.63×10^{-1}	0.00
Total	1.44×10^{1}	2.66×10^{-1}	0.00	1.44×10^{1}	3.48×10^{-1}	6.93×10^{-12}	1.44×10^{1}	6.77×10^{-1}	3.18×10^{-7}
Year of Peak Impact	7821	7821	N/A	7821	7821	8278	7821	7821	8278

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–237. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–238. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	9.65×10^{-7}	1.69	7.54×10^{-5}	9.65×10^{-7}	4.34	2.47×10^{-4}	1.25×10^{-6}	1.15×10^{1}	5.40×10^{-4}
Iodine-129	7.00×10^{-9}	1.99	9.29×10^{-6}	7.00×10^{-9}	2.31	1.25×10^{-5}	2.87×10^{-9}	1.17	1.81×10^{-5}
Total	9.72×10^{-7}	3.68	8.47×10^{-5}	9.72×10^{-7}	6.65	2.60×10^{-4}	1.26×10^{-6}	1.27×10^{1}	5.58×10^{-4}
Year of Peak Impact	8079	8079	7998	8079	8079	7998	7998	7998	7998
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	1.93×10^{-4}	1.84×10^{-3}	0.00	1.93×10^{-4}	1.84×10^{-3}	8.42×10^{-12}	1.93×10^{-4}	2.68×10^{-3}	3.86×10^{-7}
Fluoride	7.42×10^{-5}	3.53×10^{-5}	0.00	7.42×10^{-5}	3.63×10^{-5}	0.00	7.42×10^{-5}	3.91×10^{-5}	0.00
Nitrate	5.86	1.05×10^{-1}	0.00	5.86	1.38×10^{-1}	0.00	5.86	2.70×10^{-1}	0.00
Total	5.86	1.06×10^{-1}	0.00	5.86	1.40×10^{-1}	8.42×10^{-12}	5.86	2.73×10^{-1}	3.86×10^{-7}
Year of Peak Impact	8905	8905	N/A	8905	8905	3889	8905	8905	3889

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–239. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	4.45×10^{-7}	7.80×10^{-1}	4.61×10^{-5}	7.66×10^{-7}	3.44	1.61×10^{-4}	7.66×10^{-7}	7.02	3.51×10^{-4}
Iodine-129	7.00×10^{-9}	1.99	9.28×10^{-6}	2.86×10^{-9}	9.47×10^{-1}	6.50×10^{-6}	2.86×10^{-9}	1.17	9.36×10^{-6}
Total	4.52×10^{-7}	2.77	5.54×10^{-5}	7.69×10^{-7}	4.39	1.68×10^{-4}	7.69×10^{-7}	8.19	3.61×10^{-4}
Year of Peak Impact	8700	8700	8611	8611	8611	8273	8611	8611	8273
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron Compounds	6.60×10^{-7}	9.43×10^{-8}	0.00	6.60×10^{-7}	9.56×10^{-8}	0.00	6.60×10^{-7}	1.01×10^{-7}	0.00
Chromium	1.73×10^{-4}	1.65×10^{-3}	0.00	1.73×10^{-4}	1.65×10^{-3}	1.48×10^{-12}	1.73×10^{-4}	2.41×10^{-3}	6.77×10^{-8}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	3.68	6.57×10^{-2}	0.00	3.68	8.65×10^{-2}	0.00	3.68	1.70×10^{-1}	0.00
Total	3.68	6.74×10^{-2}	0.00	3.68	8.82×10^{-2}	1.48×10^{-12}	3.68	1.72×10^{-1}	6.77×10^{-8}
Year of Peak Impact	8144	8144	N/A	8144	8144	4826	8144	8144	4826

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–240. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.22×10^{-11}	5.48×10^{-5}	2.55×10^{-9}	8.92×10^{-12}	9.27×10^{-5}	4.39×10^{-9}	4.45×10^{-7}	4.90×10^{-3}	4.61×10^{-7}
Iodine-129	6.83×10^{-14}	2.26×10^{-5}	2.13×10^{-10}	8.25×10^{-14}	4.46×10^{-4}	1.07×10^{-8}	7.00×10^{-9}	1.11×10^{-2}	1.19×10^{-7}
Total	1.23×10^{-11}	7.75×10^{-5}	2.76×10^{-9}	9.00×10^{-12}	5.38×10^{-4}	1.51×10^{-8}	4.52×10^{-7}	1.60×10^{-2}	5.80×10^{-7}
Year of Peak Impact	8794	8794	8979	9273	9273	9273	8700	8700	8611
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron Compounds	1.10×10^{-11}	1.59×10^{-12}	0.00	1.10×10^{-11}	1.74×10^{-12}	0.00	6.60×10^{-7}	6.59×10^{-9}	0.00
Chromium	3.54×10^{-9}	3.38×10^{-8}	2.10×10^{-17}	3.54×10^{-9}	5.41×10^{-8}	9.65×10^{-13}	1.73×10^{-4}	3.82×10^{-4}	3.38×10^{-8}
Fluoride	7.67×10^{-10}	3.76×10^{-10}	0.00	7.67×10^{-10}	5.33×10^{-10}	0.00	4.94×10^{-5}	7.23×10^{-6}	0.00
Nitrate	4.29×10^{-5}	1.48×10^{-6}	0.00	4.29×10^{-5}	4.03×10^{-3}	0.00	3.68	1.35×10^{-1}	0.00
Total	4.29×10^{-5}	1.52×10^{-6}	2.10×10^{-17}	4.29×10^{-5}	4.03×10^{-3}	9.65×10^{-13}	3.68	1.36×10^{-1}	3.38×10^{-8}
Year of Peak Impact	8558	8558	3934	8558	8558	3934	8144	8144	4826

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–16 and Q–17 depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary, respectively, for the drinking-water well user over time. The peak radiological risk occurs around the year 8000 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

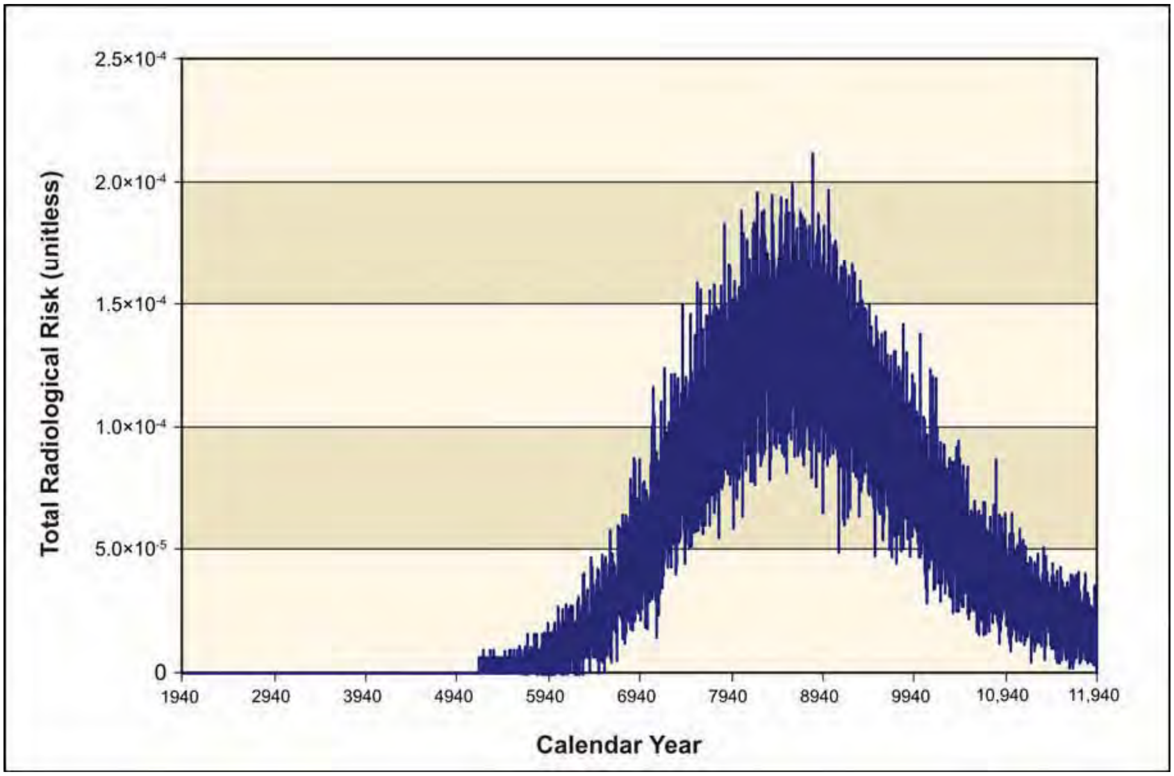

Figure Q–16. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-B, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

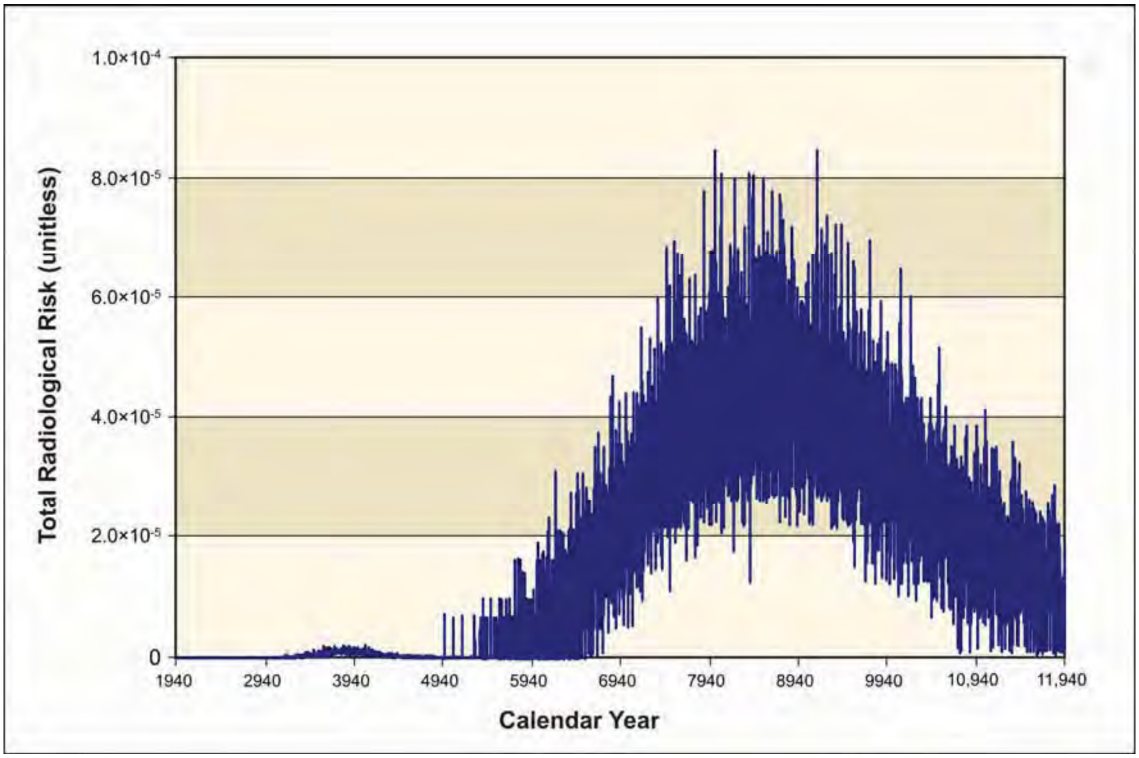

Figure Q–17. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-B, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.3 Waste Management Alternative 2; Disposal Group 1, Subgroup 1-C

Disposal Group 1, Subgroup 1-C, addresses the waste resulting from Tank Closure Alternative 3B, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Cast stone
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 3B.

Potential human health impacts are summarized in Tables Q–241 through Q–245, respectively. The key constituent contributors to human health risk are technetium-99, iodine-129 for radionuclides and acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. However, the Hazard Index guideline would be exceeded primarily due to chromium and nitrate at the IDF-East barrier, the Core Zone Boundary, and the Columbia River nearshore location for the drinking-water well user, the resident farmer, and the American Indian resident farmer. Population dose was estimated as 5.55×10^{-1} person-rem per year for the year of maximum impact.

Table Q–241. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	5.56×10^{-6}	9.75	3.41×10^{-4}	5.56×10^{-6}	2.50×10^{1}	1.12×10^{-3}	5.66×10^{-6}	5.19×10^{1}	2.44×10^{-3}
Iodine-129	8.56×10^{-9}	2.44	2.33×10^{-5}	8.56×10^{-9}	2.83	3.14×10^{-5}	7.18×10^{-9}	2.93	4.53×10^{-5}
Total	5.57×10^{-6}	1.22×10^{1}	3.64×10^{-4}	5.57×10^{-6}	2.79×10^{1}	1.15×10^{-3}	5.67×10^{-6}	5.48×10^{1}	2.48×10^{-3}
Year of Peak Impact	9509	9509	9048	9509	9509	9048	9048	9048	9048

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	1.26×10^{-2}	6.02×10^{-2}	0.00	1.26×10^{-2}	7.51×10^{-2}	0.00	1.26×10^{-2}	1.36×10^{-1}	0.00
Boron Compounds	3.30×10^{-6}	4.72×10^{-7}	0.00	3.30×10^{-6}	4.78×10^{-7}	0.00	3.30×10^{-6}	5.07×10^{-7}	0.00
Chromium	4.37×10^{-1}	4.16	0.00	4.37×10^{-1}	4.16	1.71×10^{-9}	4.37×10^{-1}	6.08	7.86×10^{-5}
Fluoride	1.24×10^{-4}	5.89×10^{-5}	0.00	1.24×10^{-4}	6.06×10^{-5}	0.00	1.24×10^{-4}	6.52×10^{-5}	0.00
Nitrate	3.58×10^{1}	6.40×10^{-1}	0.00	3.58×10^{1}	8.43×10^{-1}	0.00	3.58×10^{1}	1.65	0.00
Total	3.63×10^{1}	4.86	0.00	3.63×10^{1}	5.08	1.71×10^{-9}	3.63×10^{1}	7.87	7.86×10^{-5}
Year of Peak Impact	8940	8940	N/A	8940	8940	8940	8940	8940	8940

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–242. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–243. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	8.16×10^{-6}	1.43×10^{1}	4.91×10^{-4}	8.16×10^{-6}	3.67×10^{1}	1.61×10^{-3}	8.16×10^{-6}	7.47×10^{1}	3.51×10^{-3}
Iodine-129	5.61×10^{-9}	1.60	1.82×10^{-5}	5.61×10^{-9}	1.85	2.45×10^{-5}	5.61×10^{-9}	2.29	3.53×10^{-5}
Total	8.16×10^{-6}	1.59×10^{1}	5.09×10^{-4}	8.16×10^{-6}	3.85×10^{1}	1.64×10^{-3}	8.16×10^{-6}	7.70×10^{1}	3.55×10^{-3}
Year of Peak Impact	9163	9163	9163	9163	9163	9163	9163	9163	9163
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	5.42×10^{-3}	2.58×10^{-2}	0.00	5.42×10^{-3}	3.22×10^{-2}	0.00	5.42×10^{-3}	5.82×10^{-2}	0.00
Boron and Compounds	6.60×10^{-7}	9.43×10^{-8}	0.00	6.60×10^{-7}	9.56×10^{-8}	0.00	6.60×10^{-7}	1.01×10^{-7}	0.00
Chromium	2.65×10^{-1}	2.52	0.00	2.65×10^{-1}	2.52	1.04×10^{-9}	2.65×10^{-1}	3.69	4.77×10^{-5}
Fluoride	7.42×10^{-5}	3.53×10^{-5}	0.00	7.42×10^{-5}	3.63×10^{-5}	0.00	7.42×10^{-5}	3.91×10^{-5}	0.00
Nitrate	1.05×10^{1}	1.87×10^{-1}	0.00	1.05×10^{1}	2.47×10^{-1}	0.00	1.05×10^{1}	4.84×10^{-1}	0.00
Total	1.08×10^{1}	2.73	0.00	1.08×10^{1}	2.80	1.04×10^{-9}	1.08×10^{1}	4.23	4.77×10^{-5}
Year of Peak Impact	8760	8760	N/A	8760	8760	8760	8760	8760	8760

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–244. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.69×10^{-6}	2.95	1.02×10^{-4}	1.69×10^{-6}	7.59	3.33×10^{-4}	1.69×10^{-6}	1.55×10^{1}	7.27×10^{-4}
Iodine-129	4.20×10^{-9}	1.19	1.36×10^{-5}	4.20×10^{-9}	1.39	1.84×10^{-5}	4.20×10^{-9}	1.71	2.64×10^{-5}
Total	1.69×10^{-6}	4.15	1.15×10^{-4}	1.69×10^{-6}	8.97	3.51×10^{-4}	1.69×10^{-6}	1.72×10^{1}	7.53×10^{-4}
Year of Peak Impact	8927	8927	8927	8927	8927	8927	8927	8927	8927

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	1.81×10^{-3}	8.60×10^{-3}	0.00	1.81×10^{-3}	1.07×10^{-2}	0.00	1.81×10^{-3}	1.94×10^{-2}	0.00
Boron and Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	1.16×10^{-1}	1.11	0.00	1.16×10^{-1}	1.11	4.57×10^{-10}	1.16×10^{-1}	1.62	2.10×10^{-5}
Fluoride	2.47×10^{-5}	1.18×10^{-5}	0.00	2.47×10^{-5}	1.21×10^{-5}	0.00	2.47×10^{-5}	1.30×10^{-5}	0.00
Nitrate	7.07	1.26×10^{-1}	0.00	7.07	1.66×10^{-1}	0.00	7.07	3.26×10^{-1}	0.00
Total	7.19	1.24	0.00	7.19	1.29	4.57×10^{-10}	7.19	1.97	2.10×10^{-5}
Year of Peak Impact	9310	9310	N/A	9310	9310	9311	9310	9310	9311

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–245. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.03×10^{-11}	9.15×10^{-5}	4.02×10^{-9}	1.36×10^{-11}	1.41×10^{-4}	8.94×10^{-9}	1.69×10^{-6}	1.85×10^{-2}	1.01×10^{-6}
Iodine-129	5.87×10^{-14}	1.94×10^{-5}	2.58×10^{-10}	8.23×10^{-14}	4.44×10^{-4}	9.03×10^{-9}	4.20×10^{-9}	6.93×10^{-3}	1.70×10^{-7}
Total	2.04×10^{-11}	1.11×10^{-4}	4.28×10^{-9}	1.36×10^{-11}	5.85×10^{-4}	1.80×10^{-8}	1.69×10^{-6}	2.54×10^{-2}	1.18×10^{-6}
Year of Peak Impact	9040	9040	9040	9273	9273	8839	8927	8927	8927
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	6.80×10^{-8}	4.04×10^{-7}	0.00	7.98×10^{-8}	8.57×10^{-7}	0.00	1.81×10^{-3}	1.07×10^{-2}	0.00
Boron and Compounds	1.01×10^{-11}	1.46×10^{-12}	0.00	7.87×10^{-12}	1.25×10^{-12}	0.00	3.30×10^{-7}	3.30×10^{-9}	0.00
Chromium	1.41×10^{-6}	1.34×10^{-5}	5.84×10^{-15}	1.01×10^{-6}	1.54×10^{-5}	2.68×10^{-10}	5.82×10^{-2}	1.28×10^{-1}	1.05×10^{-5}
Fluoride	7.57×10^{-10}	3.71×10^{-10}	0.00	5.87×10^{-10}	4.07×10^{-10}	0.00	2.47×10^{-5}	3.62×10^{-6}	0.00
Nitrate	1.53×10^{-4}	5.28×10^{-6}	0.00	1.91×10^{-4}	1.80×10^{-2}	0.00	1.39×10^{1}	5.20×10^{-1}	0.00
Total	1.54×10^{-4}	1.91×10^{-5}	5.84×10^{-15}	1.92×10^{-4}	1.80×10^{-2}	2.68×10^{-10}	1.40×10^{1}	6.60×10^{-1}	1.05×10^{-5}
Year of Peak Impact	9141	9141	9446	9138	9138	9446	9451	9451	9311

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–18 and Q–19 depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary, respectively for the drinking-water well user over time. The peak radiological risk occurs around the year 9100 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

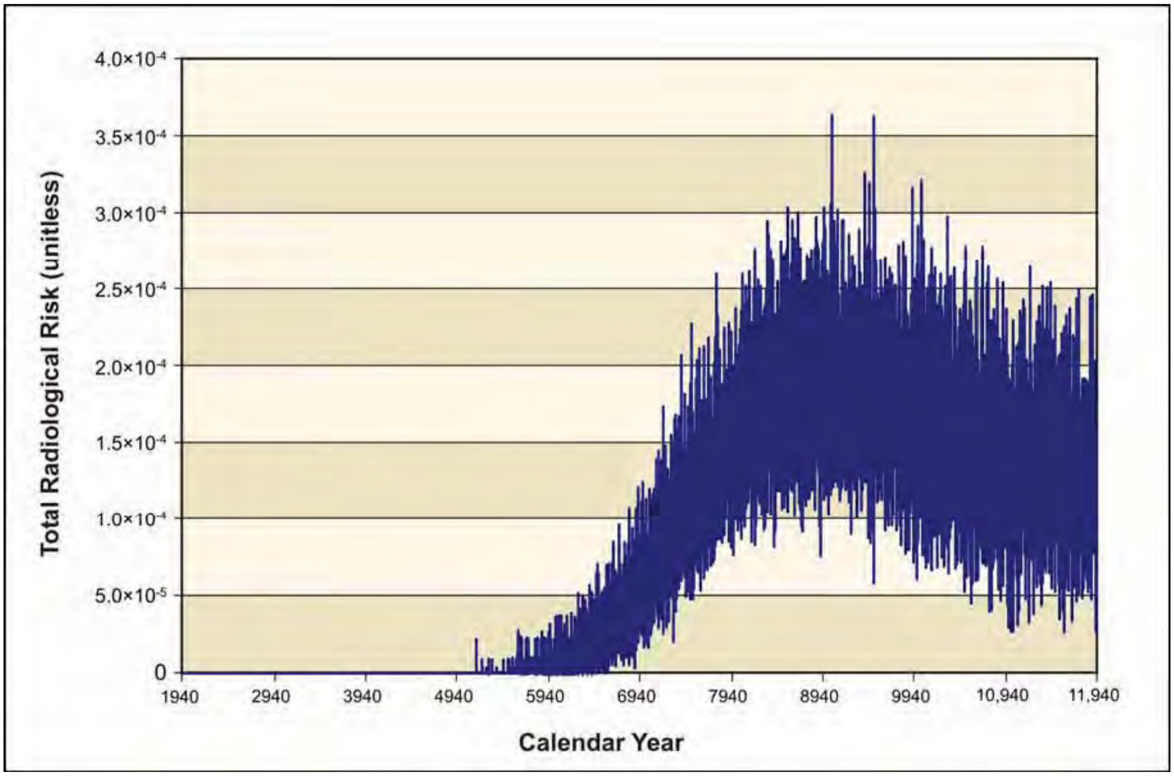

Figure Q–18. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-C, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

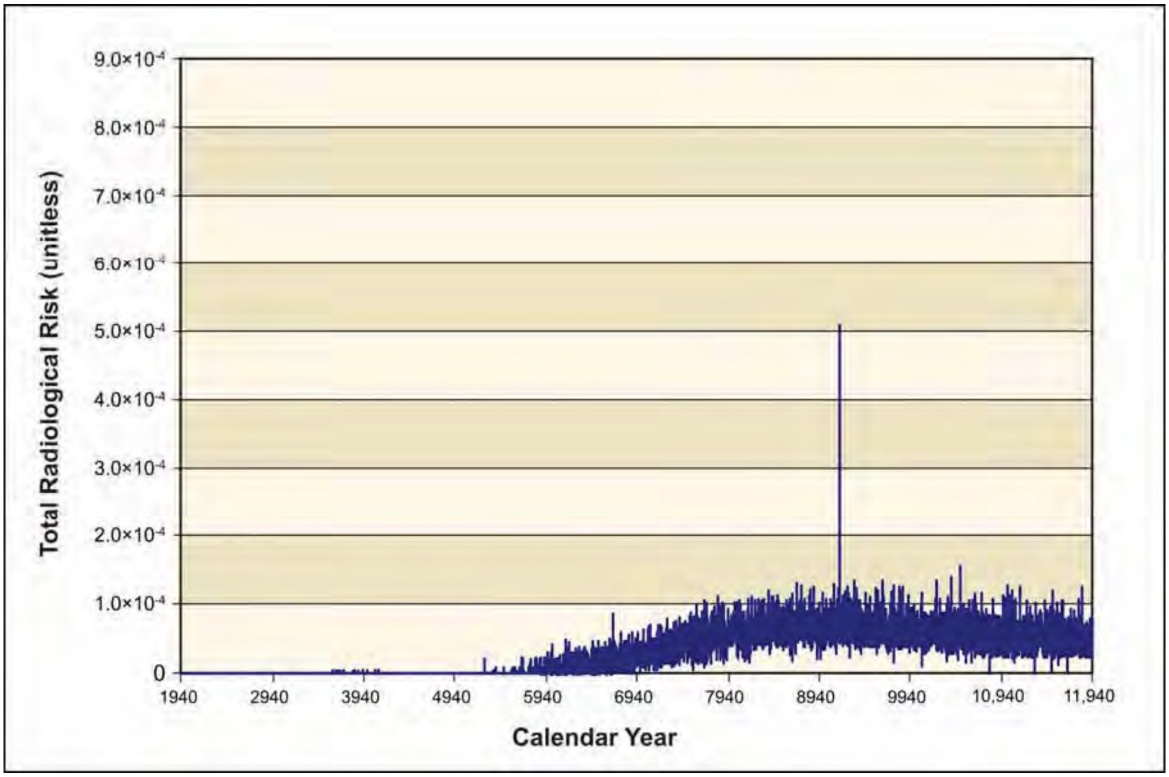

Figure Q–19. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-C, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.4 Waste Management Alternative 2; Disposal Group 1, Subgroup 1-D

Disposal Group 1, Subgroup 1-D, addresses the waste resulting from Tank Closure Alternative 3C, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Steam reforming waste
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 3C.

Potential human health impacts are summarized in Tables Q–246 through Q–250, respectively. The key constituent contributors to human health risk are technetium-99, iodine-129 for radionuclides and boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would be exceeded at the IDF-East barrier and the Core Zone Boundary for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would be exceeded primarily due to chromium and nitrate at the IDF-East barrier, the Core Zone Boundary, and the Columbia River nearshore location for the drinking-water well user, the resident farmer, and the American Indian resident farmer. Population dose was estimated as 2.40 person-rem per year for the year of maximum impact.

Table Q–246. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.01×10^{-5}	5.28×10^{1}	1.81×10^{-3}	3.01×10^{-5}	1.36×10^{2}	5.95×10^{-3}	3.01×10^{-5}	2.76×10^{2}	1.30×10^{-2}
Iodine-129	1.29×10^{-8}	3.67	4.18×10^{-5}	1.29×10^{-8}	4.26	5.64×10^{-5}	1.29×10^{-8}	5.27	8.13×10^{-5}
Total	3.01×10^{-5}	5.65×10^{1}	1.86×10^{-3}	3.01×10^{-5}	1.40×10^{2}	6.01×10^{-3}	3.01×10^{-5}	2.81×10^{2}	1.31×10^{-2}
Year of Peak Impact	9032	9032	9032	9032	9032	9032	9032	9032	9032
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	2.97×10^{-6}	4.25×10^{-7}	0.00	2.97×10^{-6}	4.30×10^{-7}	0.00	2.97×10^{-6}	4.57×10^{-7}	0.00
Chromium	4.35×10^{-1}	4.15	0.00	4.35×10^{-1}	4.15	1.71×10^{-9}	4.35×10^{-1}	6.06	7.85×10^{-5}
Fluoride	2.97×10^{-4}	1.41×10^{-4}	0.00	2.97×10^{-4}	1.45×10^{-4}	0.00	2.97×10^{-4}	1.56×10^{-4}	0.00
Nitrate	8.54	1.52×10^{-1}	0.00	8.54	2.01×10^{-1}	0.00	8.54	3.94×10^{-1}	0.00
Total	8.97	4.30	0.00	8.97	4.35	1.71×10^{-9}	8.97	6.46	7.85×10^{-5}
Year of Peak Impact	8442	8442	N/A	8442	8442	9071	8442	8442	9071

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–247. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–248. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.48×10^{-5}	4.34×10^{1}	1.49×10^{-3}	2.48×10^{-5}	1.11×10^{2}	4.90×10^{-3}	2.48×10^{-5}	2.27×10^{2}	1.07×10^{-2}
Iodine-129	2.71×10^{-9}	7.70×10^{-1}	8.77×10^{-6}	2.71×10^{-9}	8.94×10^{-1}	1.18×10^{-5}	2.71×10^{-9}	1.10	1.70×10^{-5}
Total	2.48×10^{-5}	4.42×10^{1}	1.50×10^{-3}	2.48×10^{-5}	1.12×10^{2}	4.91×10^{-3}	2.48×10^{-5}	2.28×10^{2}	1.07×10^{-2}
Year of Peak Impact	9067	9067	9067	9067	9067	9067	9067	9067	9067
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	1.74×10^{-1}	1.66	0.00	1.74×10^{-1}	1.66	6.84×10^{-10}	1.74×10^{-1}	2.43	3.14×10^{-5}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	1.66	2.96×10^{-2}	0.00	1.66	3.90×10^{-2}	0.00	1.66	7.64×10^{-2}	0.00
Total	1.83	1.69	0.00	1.83	1.70	6.84×10^{-10}	1.83	2.50	3.14×10^{-5}
Year of Peak Impact	8397	8397	N/A	8397	8397	8397	8397	8397	8397

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–249. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	7.45×10^{-6}	1.30×10^{1}	4.58×10^{-4}	7.61×10^{-6}	3.42×10^{1}	1.50×10^{-3}	7.61×10^{-6}	6.97×10^{1}	3.28×10^{-3}
Iodine-129	6.06×10^{-9}	1.73	1.52×10^{-5}	4.69×10^{-9}	1.55	2.05×10^{-5}	4.69×10^{-9}	1.91	2.95×10^{-5}
Total	7.45×10^{-6}	1.48×10^{1}	4.73×10^{-4}	7.61×10^{-6}	3.58×10^{1}	1.52×10^{-3}	7.61×10^{-6}	7.16×10^{1}	3.31×10^{-3}
Year of Peak Impact	9207	9207	9209	9209	9209	9209	9209	9209	9209

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	1.16×10^{-1}	1.11	0.00	1.16×10^{-1}	1.11	4.56×10^{-10}	1.16×10^{-1}	1.62	2.09×10^{-5}
Fluoride	2.47×10^{-5}	1.18×10^{-5}	0.00	2.47×10^{-5}	1.21×10^{-5}	0.00	2.47×10^{-5}	1.30×10^{-5}	0.00
Nitrate	8.29×10^{-1}	1.48×10^{-2}	0.00	8.29×10^{-1}	1.95×10^{-2}	0.00	8.29×10^{-1}	3.82×10^{-2}	0.00
Total	9.45×10^{-1}	1.12	0.00	9.45×10^{-1}	1.13	4.56×10^{-10}	9.45×10^{-1}	1.66	2.09×10^{-5}
Year of Peak Impact	9878	9878	N/A	9878	9878	9878	9878	9878	9878

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–250. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.01×10^{-10}	4.56×10^{-4}	2.00×10^{-8}	9.97×10^{-11}	1.04×10^{-3}	4.91×10^{-8}	7.45×10^{-6}	8.15×10^{-2}	4.57×10^{-6}
Iodine-129	6.88×10^{-14}	2.28×10^{-5}	3.02×10^{-10}	7.91×10^{-14}	4.27×10^{-4}	1.03×10^{-8}	6.06×10^{-9}	9.68×10^{-3}	1.89×10^{-7}
Total	1.01×10^{-10}	4.79×10^{-4}	2.03×10^{-8}	9.98×10^{-11}	1.46×10^{-3}	5.94×10^{-8}	7.45×10^{-6}	9.11×10^{-2}	4.75×10^{-6}
Year of Peak Impact	9193	9193	9193	9275	9275	9275	9207	9207	9209
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	8.99×10^{-12}	1.30×10^{-12}	0.00	9.58×10^{-12}	1.52×10^{-12}	0.00	3.30×10^{-7}	3.29×10^{-9}	0.00
Chromium	1.66×10^{-6}	1.58×10^{-5}	6.52×10^{-15}	7.11×10^{-7}	1.09×10^{-5}	2.99×10^{-10}	1.16×10^{-1}	2.56×10^{-1}	1.05×10^{-5}
Fluoride	8.52×10^{-10}	4.18×10^{-10}	0.00	8.35×10^{-10}	5.79×10^{-10}	0.00	2.47×10^{-5}	3.61×10^{-6}	0.00
Nitrate	3.01×10^{-5}	1.04×10^{-6}	0.00	5.04×10^{-5}	4.73×10^{-3}	0.00	8.29×10^{-1}	3.16×10^{-2}	0.00
Total	3.18×10^{-5}	1.69×10^{-5}	6.52×10^{-15}	5.11×10^{-5}	4.74×10^{-3}	2.99×10^{-10}	9.45×10^{-1}	2.88×10^{-1}	1.05×10^{-5}
Year of Peak Impact	8877	8877	8877	8446	8446	8877	9878	9878	9878

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–20 and Q–21 depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary, respectively for the drinking-water well user over time. The peak radiological risk occurs around the year 9000 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

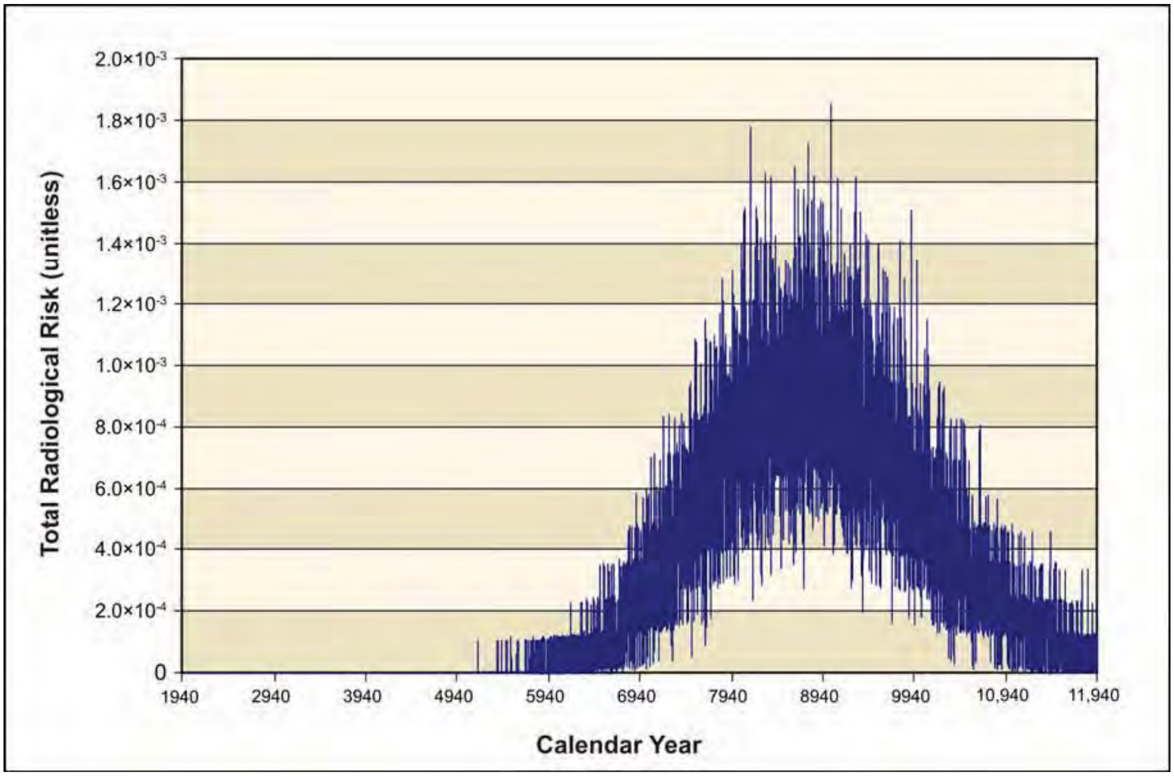

Figure Q–20. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

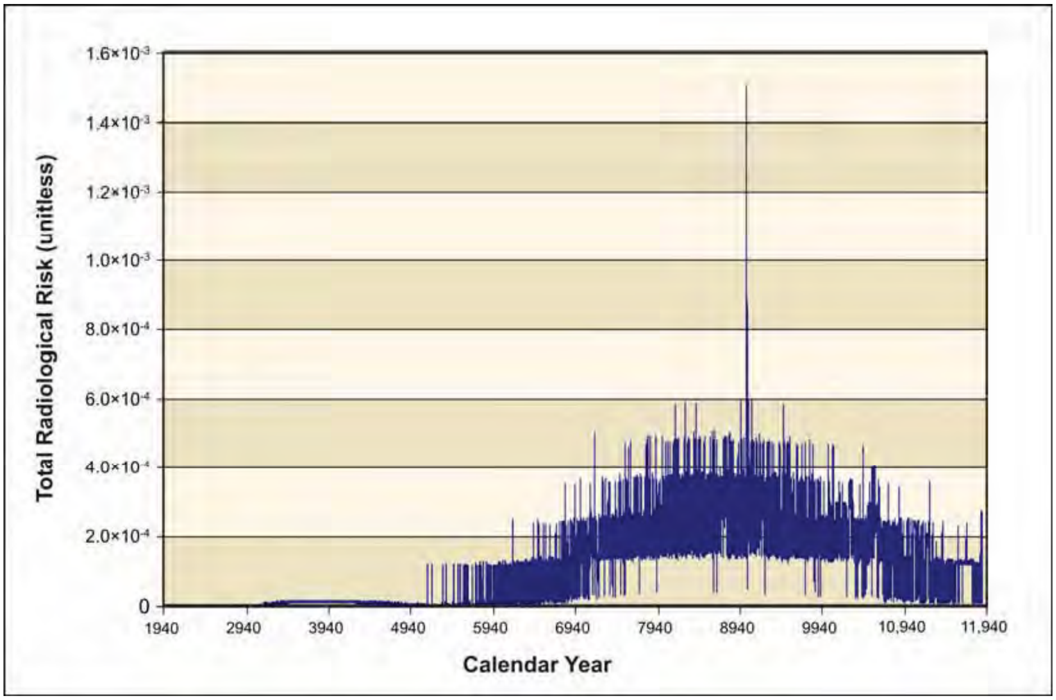

Figure Q–21. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-D, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.5 Waste Management Alternative 2; Disposal Group 1, Subgroup 1-E

Disposal Group 1, Subgroup 1-E, addresses the waste resulting from Tank Closure Alternative 4, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Bulk vitrification glass
- Cast stone
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 4.

Potential human health impacts at the IDF-East barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–251 through Q–255, respectively. The key constituent contributors to human health risk are technetium-99, iodine-129 for radionuclides and boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. The Hazard Index guideline would be exceeded primarily due to chromium and nitrate at the IDF-East barrier and the Core Zone Boundary for the drinking-water well user, the resident farmer, and the American Indian resident farmer, and would be exceeded primarily due to fluoride and total uranium at the

Columbia River nearshore for the American Indian resident farmer. Population dose was estimated as 6.25×10^{-1} person-rem per year for the year of maximum impact.

Table Q–251. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	5.58×10^{-6}	9.78	3.91×10^{-4}	6.49×10^{-6}	2.92×10^{1}	1.28×10^{-3}	6.49×10^{-6}	5.95×10^{1}	2.80×10^{-3}
Iodine-129	1.42×10^{-8}	4.05	1.87×10^{-5}	5.77×10^{-9}	1.91	2.53×10^{-5}	5.77×10^{-9}	2.36	3.64×10^{-5}
Total	5.59×10^{-6}	1.38×10^{1}	4.10×10^{-4}	6.50×10^{-6}	3.11×10^{1}	1.31×10^{-3}	6.50×10^{-6}	6.19×10^{1}	2.84×10^{-3}
Year of Peak Impact	8944	8944	9035	9035	9035	9035	9035	9035	9035
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	7.01×10^{-3}	3.34×10^{-2}	0.00	7.01×10^{-3}	4.17×10^{-2}	0.00	7.01×10^{-3}	7.53×10^{-2}	0.00
Boron and Compounds	1.65×10^{-6}	2.36×10^{-7}	0.00	1.65×10^{-6}	2.39×10^{-7}	0.00	1.65×10^{-6}	2.54×10^{-7}	0.00
Chromium	2.24×10^{-1}	2.13	0.00	2.24×10^{-1}	2.13	8.78×10^{-10}	2.24×10^{-1}	3.11	4.03×10^{-5}
Fluoride	7.42×10^{-5}	3.53×10^{-5}	0.00	7.42×10^{-5}	3.63×10^{-5}	0.00	7.42×10^{-5}	3.91×10^{-5}	0.00
Nitrate	1.77×10^{1}	3.16×10^{-1}	0.00	1.77×10^{1}	4.16×10^{-1}	0.00	1.77×10^{1}	8.16×10^{-1}	0.00
Total	1.79×10^{1}	2.48	0.00	1.79×10^{1}	2.59	8.78×10^{-10}	1.79×10^{1}	4.01	4.03×10^{-5}
Year of Peak Impact	9318	9318	N/A	9318	9318	9069	9318	9318	9069

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–252. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.03×10^{-7}	1.80×10^{-1}	6.19×10^{-6}	1.03×10^{-7}	4.63×10^{-1}	2.03×10^{-5}	1.03×10^{-7}	9.42×10^{-1}	4.43×10^{-5}
Iodine-129	1.22×10^{-10}	3.47×10^{-2}	3.95×10^{-7}	1.22×10^{-10}	4.02×10^{-2}	5.33×10^{-7}	1.22×10^{-10}	4.97×10^{-2}	7.67×10^{-7}
Total	1.03×10^{-7}	2.15×10^{-1}	6.59×10^{-6}	1.03×10^{-7}	5.03×10^{-1}	2.08×10^{-5}	1.03×10^{-7}	9.92×10^{-1}	4.51×10^{-5}
Year of Peak Impact	3822	3822	3822	3822	3822	3822	3822	3822	3822
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	5.86×10^{-3}	5.59×10^{-2}	0.00	5.86×10^{-3}	5.59×10^{-2}	2.30×10^{-11}	5.86×10^{-3}	8.17×10^{-2}	1.06×10^{-6}
Nitrate	1.53×10^{-1}	2.73×10^{-3}	0.00	1.53×10^{-1}	3.59×10^{-3}	0.00	1.53×10^{-1}	7.04×10^{-3}	0.00
Total	1.59×10^{-1}	5.86×10^{-2}	0.00	1.59×10^{-1}	5.95×10^{-2}	2.30×10^{-11}	1.59×10^{-1}	8.87×10^{-2}	1.06×10^{-6}
Year of Peak Impact	3804	3804	N/A	3804	3804	3804	3804	3804	3804

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–253. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.68×10^{-6}	4.69	1.86×10^{-4}	3.09×10^{-6}	1.39×10^{1}	6.11×10^{-4}	3.09×10^{-6}	2.84×10^{1}	1.33×10^{-3}
Iodine-129	4.29×10^{-9}	1.22	5.22×10^{-6}	1.61×10^{-9}	5.33×10^{-1}	7.05×10^{-6}	1.61×10^{-9}	6.58×10^{-1}	1.02×10^{-5}
Total	2.68×10^{-6}	5.91	1.92×10^{-4}	3.10×10^{-6}	1.45×10^{1}	6.18×10^{-4}	3.10×10^{-6}	2.90×10^{1}	1.34×10^{-3}
Year of Peak Impact	9576	9576	9499	9499	9499	9499	9499	9499	9499
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.00×10^{-3}	4.77×10^{-3}	0.00	1.00×10^{-3}	5.95×10^{-3}	0.00	1.00×10^{-3}	1.08×10^{-2}	0.00
Chromium	9.57×10^{-2}	9.11×10^{-1}	0.00	9.57×10^{-2}	9.12×10^{-1}	3.76×10^{-10}	9.57×10^{-2}	1.33	1.72×10^{-5}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	6.02	1.07×10^{-1}	0.00	6.02	1.41×10^{-1}	0.00	6.02	2.78×10^{-1}	0.00
Total Uranium	6.77×10^{-11}	6.45×10^{-10}	0.00	6.77×10^{-11}	6.52×10^{-10}	0.00	6.77×10^{-11}	6.75×10^{-10}	0.00
Total	6.11	1.02	0.00	6.11	1.06	3.76×10^{-10}	6.11	1.62	1.72×10^{-5}
Year of Peak Impact	9599	9599	N/A	9599	9599	8643	9599	9599	8643

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–254. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.03×10^{-6}	3.56	1.22×10^{-4}	2.03×10^{-6}	9.13	4.01×10^{-4}	2.03×10^{-6}	1.86×10^{1}	8.75×10^{-4}
Iodine-129	2.84×10^{-9}	8.08×10^{-1}	9.20×10^{-6}	2.84×10^{-9}	9.38×10^{-1}	1.24×10^{-5}	2.84×10^{-9}	1.16	1.79×10^{-5}
Total	2.03×10^{-6}	4.36	1.31×10^{-4}	2.03×10^{-6}	1.01×10^{1}	4.13×10^{-4}	2.03×10^{-6}	1.98×10^{1}	8.93×10^{-4}
Year of Peak Impact	8117	8117	8117	8117	8117	8117	8117	8117	8117
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.00×10^{-3}	4.77×10^{-3}	0.00	1.00×10^{-3}	5.95×10^{-3}	0.00	1.00×10^{-3}	1.08×10^{-2}	0.00
Chromium	6.60×10^{-7}	9.43×10^{-8}	0.00	6.60×10^{-7}	9.56×10^{-8}	0.00	6.60×10^{-7}	1.01×10^{-7}	0.00
Fluoride	6.38×10^{-2}	6.07×10^{-1}	0.00	6.38×10^{-2}	6.08×10^{-1}	2.50×10^{-10}	6.38×10^{-2}	8.88×10^{-1}	1.15×10^{-5}
Nitrate	2.47×10^{-5}	1.18×10^{-5}	0.00	2.47×10^{-5}	1.21×10^{-5}	0.00	2.47×10^{-5}	1.30×10^{-5}	0.00
Total Uranium	2.61	4.67×10^{-2}	0.00	2.61	6.14×10^{-2}	0.00	2.61	1.21×10^{-1}	0.00
Total	2.68	6.59×10^{-1}	0.00	2.68	6.75×10^{-1}	2.50×10^{-10}	2.68	1.02	1.15×10^{-5}
Year of Peak Impact	8069	8069	N/A	8069	8069	8079	8069	8069	8079

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–255. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.46×10^{-11}	1.11×10^{-4}	4.86×10^{-9}	1.60×10^{-11}	1.67×10^{-4}	1.13×10^{-8}	2.03×10^{-6}	2.22×10^{-2}	1.22×10^{-6}
Iodine-129	4.32×10^{-14}	1.43×10^{-5}	1.90×10^{-10}	8.40×10^{-14}	4.54×10^{-4}	8.16×10^{-9}	2.84×10^{-9}	4.77×10^{-3}	1.17×10^{-7}
Total	2.46×10^{-11}	1.25×10^{-4}	5.05×10^{-9}	1.61×10^{-11}	6.20×10^{-4}	1.94×10^{-8}	2.03×10^{-6}	2.69×10^{-2}	1.33×10^{-6}
Year of Peak Impact	9835	9835	9835	9273	9273	9223	8117	8117	8117

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	3.43×10^{-8}	2.04×10^{-7}	0.00	3.30×10^{-8}	3.54×10^{-7}	0.00	1.00×10^{-3}	5.96×10^{-3}	0.00
Chromium	1.06×10^{-11}	1.54×10^{-12}	0.00	1.08×10^{-11}	1.71×10^{-12}	0.00	3.30×10^{-7}	3.30×10^{-9}	0.00
Fluoride	9.29×10^{-7}	8.86×10^{-6}	3.65×10^{-15}	5.38×10^{-7}	8.21×10^{-6}	1.67×10^{-10}	4.80×10^{-2}	1.06×10^{-1}	5.74×10^{-6}
Nitrate	8.95×10^{-10}	4.39×10^{-10}	0.00	8.85×10^{-10}	6.14×10^{-10}	0.00	2.47×10^{-5}	3.61×10^{-6}	0.00
Total Uranium	7.09×10^{-5}	2.45×10^{-6}	0.00	1.11×10^{-4}	1.05×10^{-2}	0.00	6.02	2.28×10^{-1}	0.00
Total	7.19×10^{-5}	1.15×10^{-5}	3.65×10^{-15}	1.12×10^{-4}	1.05×10^{-2}	1.67×10^{-10}	6.07	3.40×10^{-1}	5.74×10^{-6}
Year of Peak Impact	8553	8553	8553	8888	8888	8553	8691	8691	8079

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–22 and Q–23 depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary, respectively, for the drinking-water well user over time. The peak radiological risk occurs around the year 9500 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

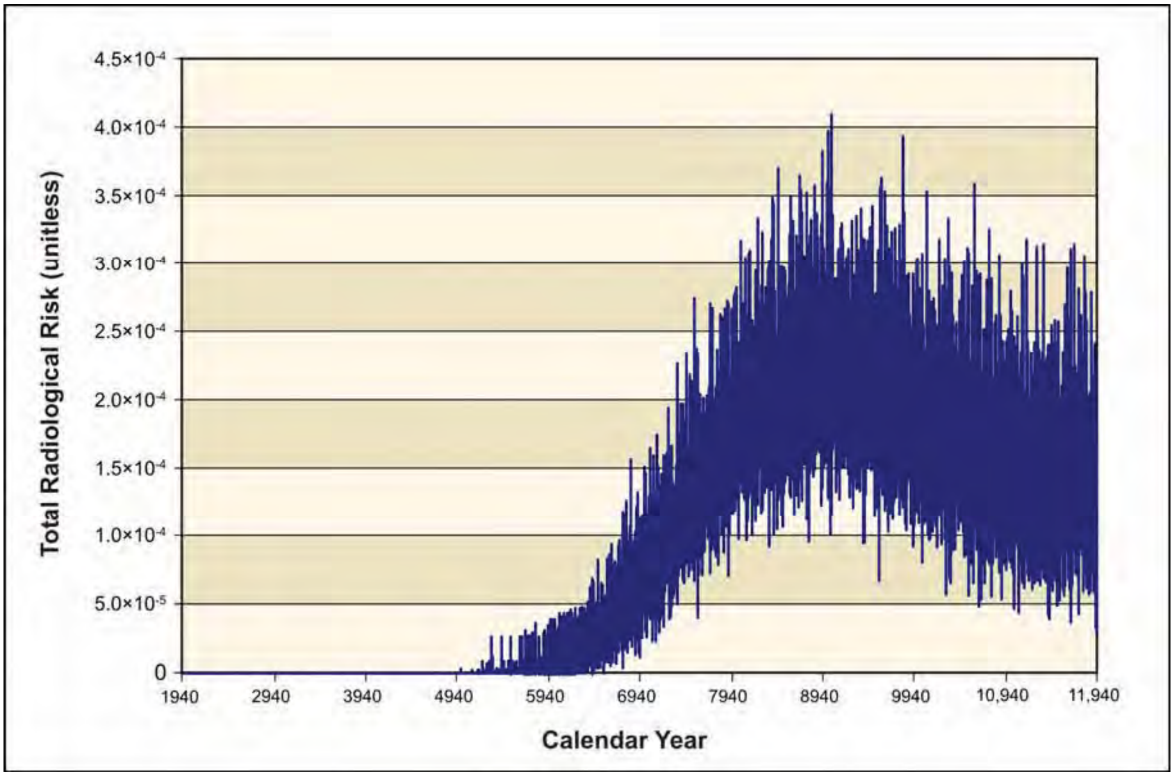

Figure Q–22. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-E, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

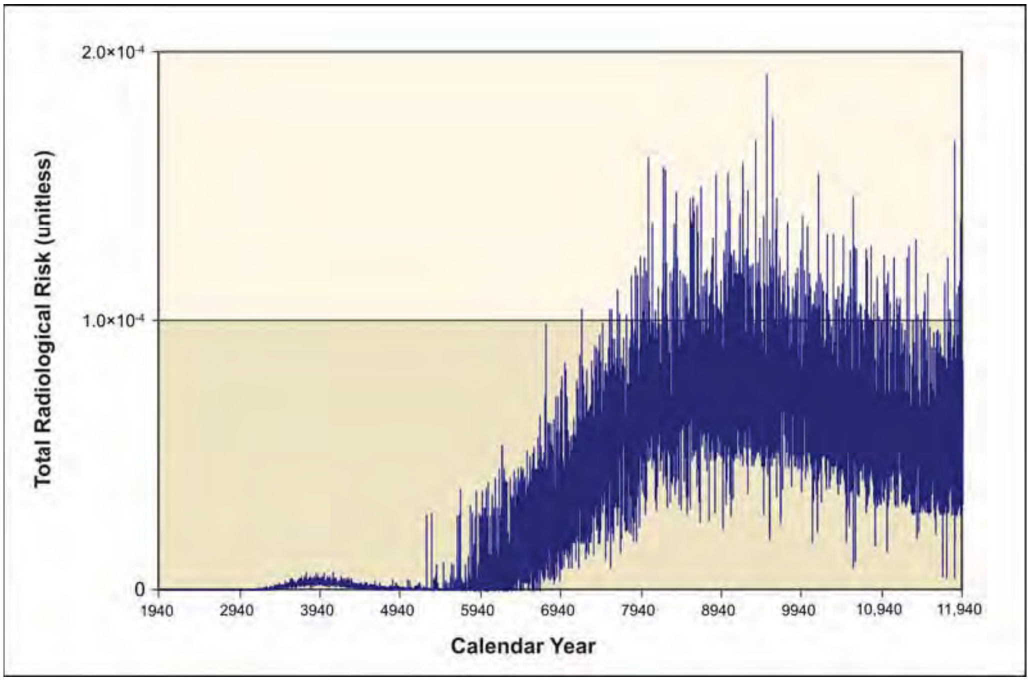

Figure Q–23. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-E, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.6 Waste Management Alternative 2; Disposal Group 1, Subgroup 1-F

Disposal Group 1, Subgroup 1-F, addresses the waste resulting from Tank Closure Alternative 5, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Bulk vitrification glass
- Cast stone
- Sulfate grout
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

The RPPDF would not be constructed or operated for Tank Closure Alternative 5 because tank closure cleanup activities would not be conducted.

Potential human health impacts at the IDF-East barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–256 through Q–259, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides; and acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. The Hazard Index guideline would be exceeded primarily due to chromium at the IDF-East barrier, Core Zone Boundary, and Columbia River nearshore for the drinking-water well user, the resident farmer, and the American Indian resident farmer. Population dose was estimated as 4.18×10^{-1} person-rem per year for the year of maximum impact.

Table Q–256. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.51×10^{-6}	6.16	2.12×10^{-4}	3.51×10^{-6}	1.58×10^{1}	6.94×10^{-4}	3.51×10^{-6}	3.22×10^{1}	1.51×10^{-3}
Iodine-129	1.41×10^{-8}	4.01	4.57×10^{-5}	1.41×10^{-8}	4.66	6.17×10^{-5}	1.41×10^{-8}	5.75	8.88×10^{-5}
Total	3.53×10^{-6}	1.02×10^{1}	2.57×10^{-4}	3.53×10^{-6}	2.05×10^{1}	7.56×10^{-4}	3.53×10^{-6}	3.80×10^{1}	1.60×10^{-3}
Year of Peak Impact	8276	8276	8276	8276	8276	8276	8276	8276	8276
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	2.65×10^{-3}	1.26×10^{-2}	0.00	2.65×10^{-3}	1.58×10^{-2}	0.00	2.65×10^{-3}	2.85×10^{-2}	0.00
Chromium	3.63×10^{-6}	5.19×10^{-7}	0.00	3.63×10^{-6}	5.26×10^{-7}	0.00	3.63×10^{-6}	5.58×10^{-7}	0.00
Fluoride	3.35×10^{-1}	3.19	0.00	3.35×10^{-1}	3.20	1.32×10^{-9}	3.35×10^{-1}	4.67	6.04×10^{-5}
Nitrate	2.47×10^{-4}	1.18×10^{-4}	0.00	2.47×10^{-4}	1.21×10^{-4}	0.00	2.47×10^{-4}	1.30×10^{-4}	0.00
Total Uranium	1.73×10^{1}	3.08×10^{-1}	0.00	1.73×10^{1}	4.06×10^{-1}	0.00	1.73×10^{1}	7.97×10^{-1}	0.00
Total	1.76×10^{1}	3.51	0.00	1.76×10^{1}	3.62	1.32×10^{-9}	1.76×10^{1}	5.50	6.04×10^{-5}
Year of Peak Impact	8735	8735	1940	8735	8735	8735	8735	8735	8735

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–257. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.06×10^{-6}	1.86	9.01×10^{-5}	1.50×10^{-6}	6.73	2.96×10^{-4}	1.50×10^{-6}	1.37×10^{1}	6.45×10^{-4}
Iodine-129	7.15×10^{-9}	2.04	9.51×10^{-6}	2.93×10^{-9}	9.70×10^{-1}	1.28×10^{-5}	2.93×10^{-9}	1.20	1.85×10^{-5}
Total	1.07×10^{-6}	3.89	9.97×10^{-5}	1.50×10^{-6}	7.70	3.09×10^{-4}	1.50×10^{-6}	1.49×10^{1}	6.64×10^{-4}
Year of Peak Impact	8885	8885	9155	9155	9155	9155	9155	9155	9155
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.33×10^{-3}	6.32×10^{-3}	0.00	1.33×10^{-3}	7.89×10^{-3}	0.00	1.33×10^{-3}	1.42×10^{-2}	0.00
Boron and Compounds	6.60×10^{-7}	9.43×10^{-8}	0.00	6.60×10^{-7}	9.56×10^{-8}	0.00	6.60×10^{-7}	1.01×10^{-7}	0.00
Chromium	1.48×10^{-1}	1.41	0.00	1.48×10^{-1}	1.41	5.81×10^{-10}	1.48×10^{-1}	2.06	2.67×10^{-5}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	3.27	5.84×10^{-2}	0.00	3.27	7.69×10^{-2}	0.00	3.27	1.51×10^{-1}	0.00
Total	3.42	1.47	0.00	3.42	1.50	5.81×10^{-10}	3.42	2.23	2.67×10^{-5}
Year of Peak Impact	8764	8764	1940	8764	8764	8764	8764	8764	8764

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–258. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	5.77×10^{-7}	1.01	5.20×10^{-5}	6.77×10^{-7}	3.05	1.71×10^{-4}	8.64×10^{-7}	7.92	3.84×10^{-4}
Iodine-129	6.90×10^{-9}	1.96	9.48×10^{-6}	5.59×10^{-9}	1.85	1.28×10^{-5}	2.92×10^{-9}	1.19	9.24×10^{-6}
Total	5.84×10^{-7}	2.97	6.15×10^{-5}	6.83×10^{-7}	4.89	1.83×10^{-4}	8.67×10^{-7}	9.11	3.93×10^{-4}
Year of Peak Impact	8700	8700	8854	8377	8377	8854	8854	8854	8090

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	3.32×10^{-4}	1.58×10^{-3}	0.00	3.32×10^{-4}	1.97×10^{-3}	0.00	3.32×10^{-4}	3.56×10^{-3}	0.00
Boron and Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	1.10×10^{-1}	1.05	0.00	1.10×10^{-1}	1.05	4.32×10^{-10}	1.10×10^{-1}	1.53	1.98×10^{-5}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	2.16	3.86×10^{-2}	0.00	2.16	5.09×10^{-2}	0.00	2.16	9.98×10^{-2}	0.00
Total	2.27	1.09	0.00	2.27	1.10	4.32×10^{-10}	2.27	1.63	1.98×10^{-5}
Year of Peak Impact	8819	8819	1940	8819	8819	8819	8819	8819	8819

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–259. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.36×10^{-11}	6.12×10^{-5}	2.87×10^{-9}	1.06×10^{-11}	1.10×10^{-4}	5.20×10^{-9}	5.77×10^{-7}	6.35×10^{-3}	5.20×10^{-7}
Iodine-129	6.76×10^{-14}	2.24×10^{-5}	2.33×10^{-10}	8.26×10^{-14}	4.46×10^{-4}	1.07×10^{-8}	6.90×10^{-9}	1.09×10^{-2}	1.21×10^{-7}
Total	1.37×10^{-11}	8.36×10^{-5}	3.10×10^{-9}	1.06×10^{-11}	5.56×10^{-4}	1.59×10^{-8}	5.84×10^{-7}	1.73×10^{-2}	6.40×10^{-7}
Year of Peak Impact	9251	9251	9151	9273	9273	9273	8700	8700	8854
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.04×10^{-8}	6.16×10^{-8}	0.00	8.56×10^{-9}	9.20×10^{-8}	0.00	3.32×10^{-4}	1.97×10^{-3}	0.00
Boron and Compounds	8.22×10^{-12}	1.19×10^{-12}	0.00	1.11×10^{-11}	1.76×10^{-2}	0.00	3.30×10^{-7}	3.30×10^{-9}	0.00
Chromium	1.17×10^{-6}	1.12×10^{-5}	4.79×10^{-15}	9.44×10^{-7}	1.44×10^{-5}	2.20×10^{-10}	7.03×10^{-2}	1.55×10^{-1}	9.90×10^{-6}
Fluoride	6.36×10^{-10}	3.11×10^{-10}	0.00	8.47×10^{-10}	5.88×10^{-10}	0.00	4.94×10^{-5}	7.23×10^{-6}	0.00
Nitrate	5.79×10^{-5}	2.00×10^{-6}	0.00	7.39×10^{-5}	6.94×10^{-3}	0.00	4.56	1.74×10^{-1}	0.00
Total	5.90×10^{-5}	1.32×10^{-5}	4.79×10^{-15}	7.48×10^{-5}	6.96×10^{-3}	2.20×10^{-10}	4.63	3.31×10^{-1}	9.90×10^{-6}
Year of Peak Impact	9128	9128	8667	8316	8316	8667	8787	8787	8819

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–24 and Q–25, respectively, depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 9000 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

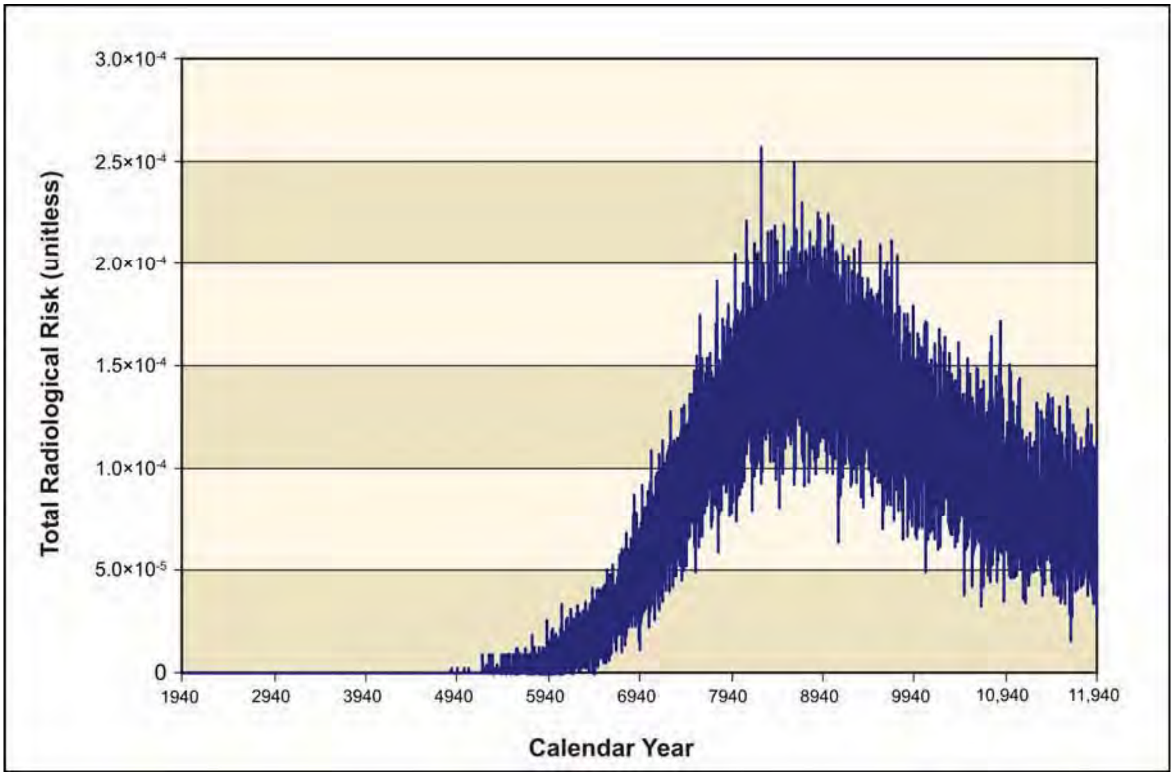

Figure Q–24. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-F, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

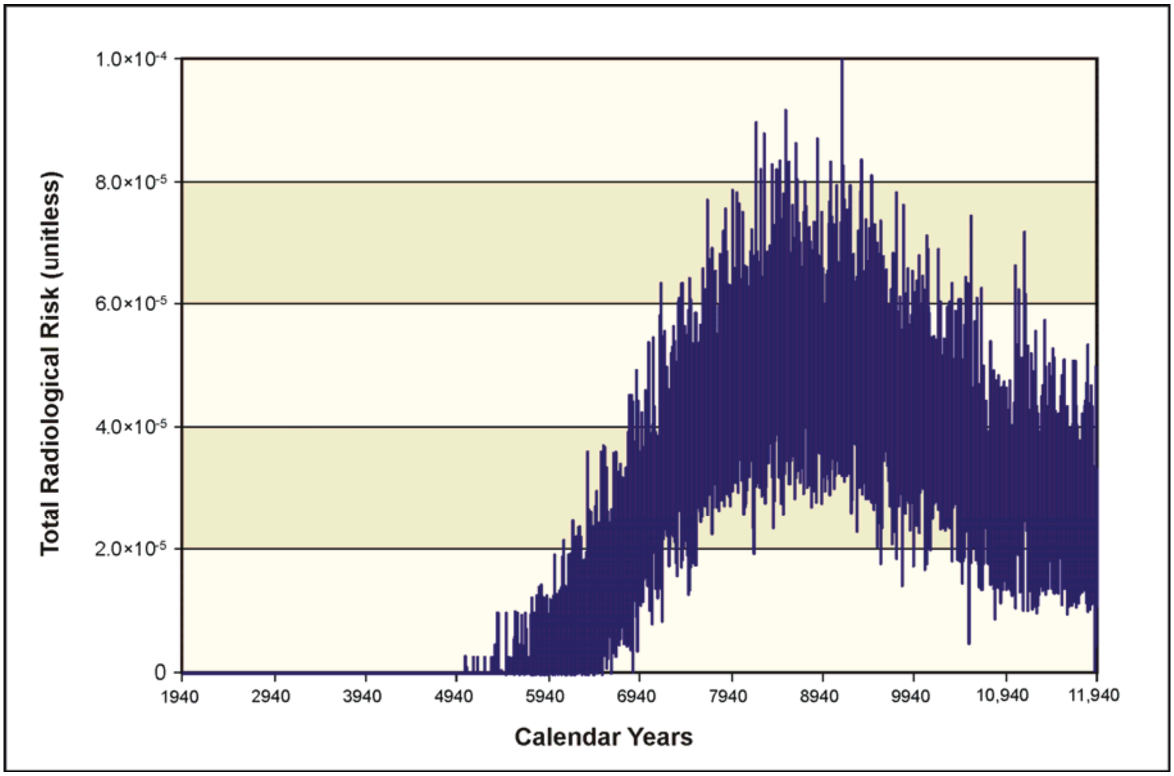

Figure Q–25. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-F, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.7 Waste Management Alternative 2; Disposal Group 1, Subgroup 1-G

Disposal Group 1, Subgroup 1-G, addresses the waste resulting from Tank Closure Alternative 6C, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 6C.

Potential human health impacts at the IDF-East barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–260 through Q–264, respectively. The key constituent contributors to human health risk are technetium-99, iodine-129 for radionuclides and acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. In addition, the Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 3.06×10^{-1} person-rem per year for the year of maximum impact.

Table Q–260. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.29×10^{-6}	2.26	1.13×10^{-4}	1.88×10^{-6}	8.46	4.32×10^{-4}	1.88×10^{-6}	1.72×10^{1}	9.42×10^{-4}
Iodine-129	1.87×10^{-8}	5.34	4.70×10^{-5}	1.45×10^{-8}	4.79	3.24×10^{-5}	1.45×10^{-8}	5.92	4.67×10^{-5}
Total	1.31×10^{-6}	7.59	1.60×10^{-4}	1.90×10^{-6}	1.33×10^{1}	4.64×10^{-4}	1.90×10^{-6}	2.32×10^{1}	9.88×10^{-4}
Year of Peak Impact	8739	8739	8276	8276	8276	9004	8276	8276	9004

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	2.97×10^{-6}	4.25×10^{-7}	0.00	2.97×10^{-6}	4.30×10^{-7}	0.00	2.97×10^{-6}	4.57×10^{-7}	0.00
Chromium	2.99×10^{-3}	2.85×10^{-2}	0.00	1.02×10^{-3}	9.73×10^{-3}	1.52×10^{-11}	1.02×10^{-3}	1.42×10^{-2}	6.96×10^{-7}
Fluoride	2.47×10^{-4}	1.18×10^{-4}	0.00	1.98×10^{-4}	9.69×10^{-5}	0.00	1.98×10^{-4}	1.04×10^{-4}	0.00
Nitrate	1.34×10^{1}	2.39×10^{-1}	0.00	1.42×10^{1}	3.35×10^{-1}	0.00	1.42×10^{1}	6.57×10^{-1}	0.00
Total	1.34×10^{1}	2.68×10^{-1}	0.00	1.42×10^{1}	3.45×10^{-1}	1.52×10^{-11}	1.42×10^{1}	6.71×10^{-1}	6.96×10^{-7}
Year of Peak Impact	8168	8168	N/A	8522	8522	8618	8522	8522	8618

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–261. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–262. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.76×10^{-7}	6.58×10^{-1}	6.94×10^{-5}	1.15×10^{-6}	5.18	2.28×10^{-4}	1.15×10^{-6}	1.06×10^{1}	4.96×10^{-4}
Iodine-129	8.47×10^{-9}	2.41	9.26×10^{-6}	2.86×10^{-9}	9.45×10^{-1}	1.25×10^{-5}	2.86×10^{-9}	1.17	1.80×10^{-5}
Total	3.84×10^{-7}	3.07	7.86×10^{-5}	1.15×10^{-6}	6.13	2.40×10^{-4}	1.15×10^{-6}	1.17×10^{1}	5.14×10^{-4}
Year of Peak Impact	8858	8858	9155	9155	9155	9155	9155	9155	9155

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	3.85×10^{-4}	3.67×10^{-3}	0.00	3.85×10^{-4}	3.67×10^{-3}	8.42×10^{-12}	3.85×10^{-4}	5.37×10^{-3}	3.86×10^{-7}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	5.63	1.01×10^{-1}	0.00	5.63	1.32×10^{-1}	0.00	5.63	2.60×10^{-1}	0.00
Total	5.63	1.04×10^{-1}	0.00	5.63	1.36×10^{-1}	8.42×10^{-12}	5.63	2.65×10^{-1}	3.86×10^{-7}
Year of Peak Impact	9653	9653	N/A	9653	9653	3889	9653	9653	3889

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–263. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.54×10^{-7}	6.21×10^{-1}	4.06×10^{-5}	6.74×10^{-7}	3.03	1.33×10^{-4}	6.74×10^{-7}	6.17	2.90×10^{-4}
Iodine-129	6.99×10^{-9}	1.99	9.26×10^{-6}	2.86×10^{-9}	9.44×10^{-1}	1.25×10^{-5}	2.86×10^{-9}	1.17	1.80×10^{-5}
Total	3.61×10^{-7}	2.61	4.98×10^{-5}	6.77×10^{-7}	3.98	1.46×10^{-4}	6.77×10^{-7}	7.34	3.08×10^{-4}
Year of Peak Impact	8700	8700	9451	9451	9451	9451	9451	9451	9451
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.30×10^{-7}	4.72×10^{-8}	0.00	3.30×10^{-7}	4.78×10^{-8}	0.00	3.30×10^{-7}	5.07×10^{-8}	0.00
Chromium	4.48×10^{-4}	4.27×10^{-3}	0.00	4.48×10^{-4}	4.27×10^{-3}	3.16×10^{-12}	4.48×10^{-4}	6.24×10^{-3}	1.45×10^{-7}
Fluoride	4.94×10^{-5}	2.35×10^{-5}	0.00	4.94×10^{-5}	2.42×10^{-5}	0.00	4.94×10^{-5}	2.61×10^{-5}	0.00
Nitrate	2.44	4.36×10^{-2}	0.00	2.44	5.74×10^{-2}	0.00	2.44	1.13×10^{-1}	0.00
Total	2.44	4.79×10^{-2}	0.00	2.44	6.17×10^{-2}	3.16×10^{-12}	2.44	1.19×10^{-1}	1.45×10^{-7}
Year of Peak Impact	8821	8821	N/A	8821	8821	8528	8821	8821	8528

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–264. Waste Management Alternative 2, Disposal Group 1, Subgroup 2-G, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.71×10^{-12}	3.92×10^{-5}	1.88×10^{-9}	5.35×10^{-12}	5.56×10^{-5}	2.63×10^{-9}	3.54×10^{-7}	3.89×10^{-3}	4.04×10^{-7}
Iodine-129	6.65×10^{-14}	2.20×10^{-5}	2.15×10^{-10}	8.32×10^{-14}	4.49×10^{-4}	1.08×10^{-8}	6.99×10^{-9}	1.11×10^{-2}	1.17×10^{-7}
Total	8.78×10^{-12}	6.12×10^{-5}	2.10×10^{-9}	5.43×10^{-12}	5.05×10^{-4}	1.34×10^{-8}	3.61×10^{-7}	1.49×10^{-2}	5.21×10^{-7}
Year of Peak Impact	8794	8794	8979	9273	9273	9273	8700	8700	9451
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.08×10^{-11}	1.56×10^{-12}	0.00	1.08×10^{-11}	1.72×10^{-12}	0.00	9.91×10^{-7}	9.88×10^{-9}	0.00
Chromium	6.96×10^{-9}	6.64×10^{-8}	4.03×10^{-17}	6.96×10^{-9}	1.06×10^{-7}	1.85×10^{-12}	4.31×10^{-4}	9.52×10^{-4}	7.25×10^{-8}
Fluoride	8.86×10^{-10}	4.34×10^{-10}	0.00	8.86×10^{-10}	6.15×10^{-10}	0.00	2.47×10^{-5}	3.62×10^{-6}	0.00
Nitrate	4.48×10^{-5}	1.55×10^{-6}	0.00	4.48×10^{-5}	4.21×10^{-3}	0.00	2.44	9.51×10^{-2}	0.00
Total	4.48×10^{-5}	1.61×10^{-6}	4.03×10^{-17}	4.48×10^{-5}	4.21×10^{-3}	1.85×10^{-12}	2.44	9.61×10^{-2}	7.25×10^{-8}
Year of Peak Impact	8016	8016	8400	8016	8016	8400	8085	8085	8528

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–26 and Q–27 depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary, respectively, for the drinking-water well user over time. The peak radiological risk occurs around the year 9100 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

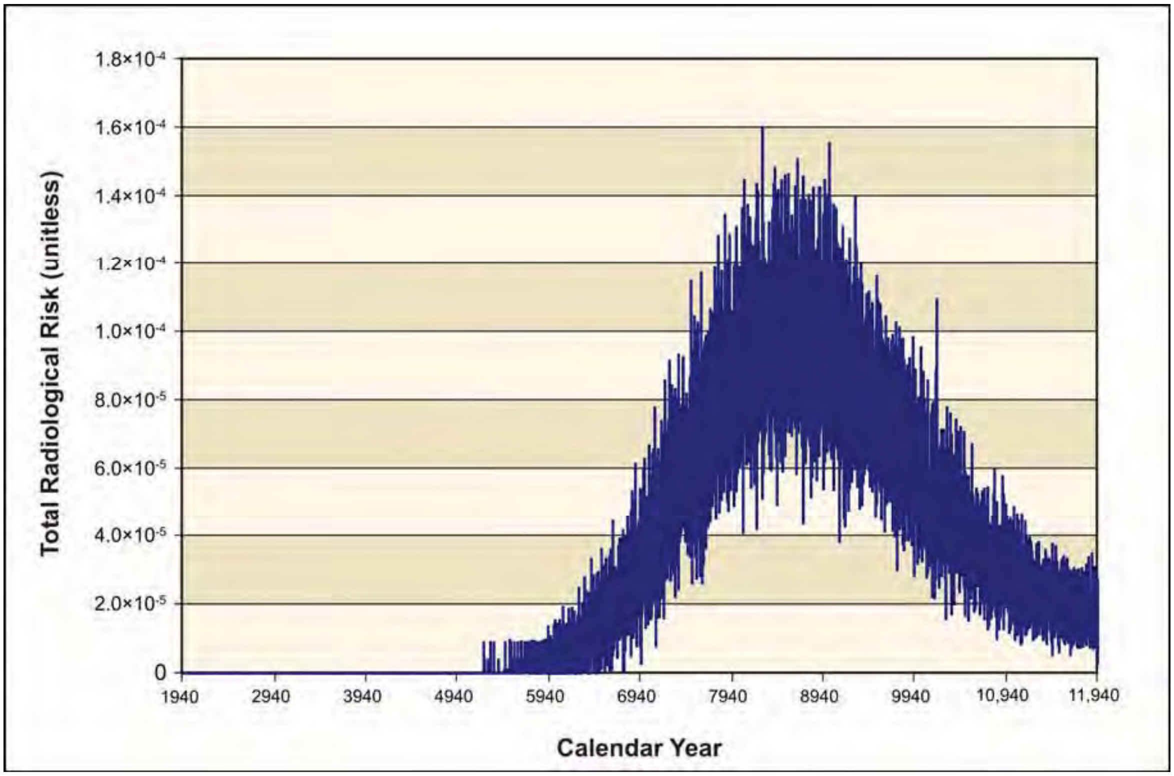

Figure Q–26. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-G, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

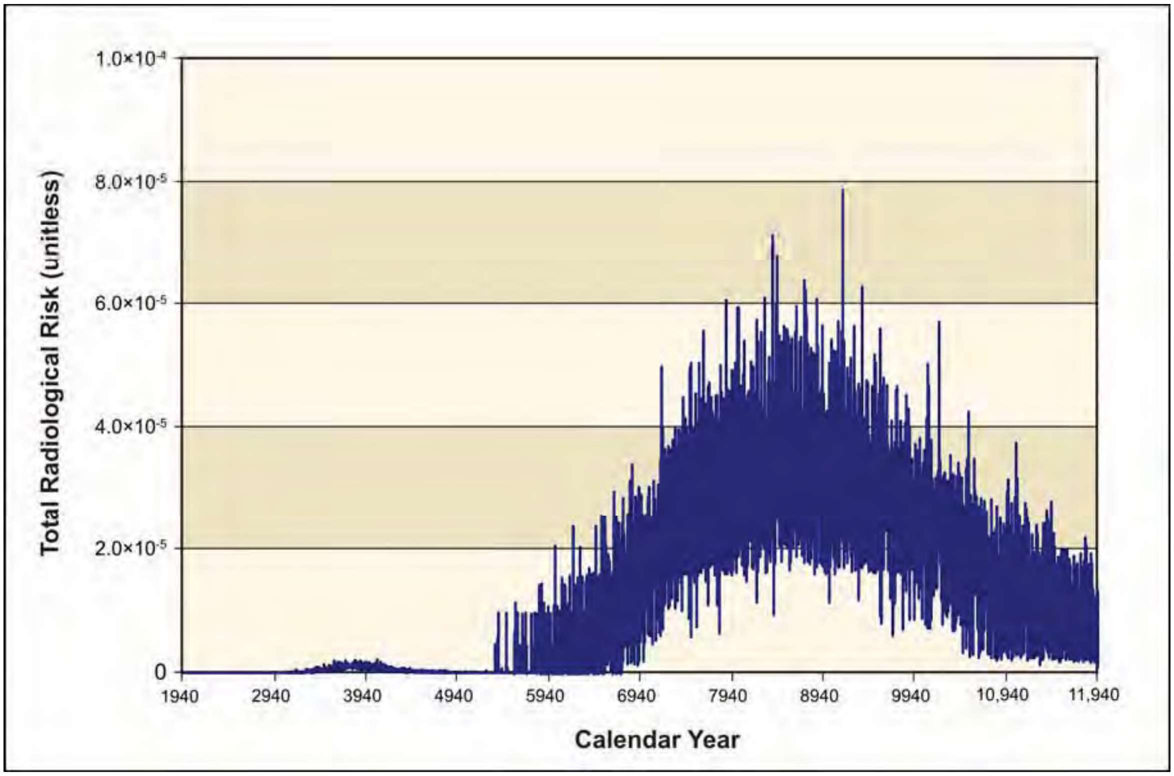

Figure Q–27. Waste Management Alternative 2, Disposal Group 1, Subgroup 1-G, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.8 Waste Management Alternative 2; Disposal Group 2, Subgroup 2-A

Disposal Group 2, Subgroup 2-A, addresses the waste resulting from Tank Closure Alternative 2A, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

The RPPDF would not be constructed or operated for Tank Closure Alternative 2A because tank closure cleanup activities would not be conducted.

Potential human health impacts at the IDF-East barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–265 through Q–268, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides and boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would not be exceeded at any location. In addition, the Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 3.18×10^{-1} person-rem per year for the year of maximum impact.

Table Q–265. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.58×10^{-6}	4.53	1.56×10^{-4}	2.58×10^{-6}	1.16×10^{1}	5.58×10^{-4}	2.58×10^{-6}	2.37×10^{1}	1.22×10^{-3}
Iodine-129	2.36×10^{-8}	6.72	7.65×10^{-5}	2.36×10^{-8}	7.80	6.57×10^{-5}	2.36×10^{-8}	9.63	9.46×10^{-5}
Total	2.61×10^{-6}	1.12×10^{1}	2.32×10^{-4}	2.61×10^{-6}	1.94×10^{1}	6.24×10^{-4}	2.61×10^{-6}	3.33×10^{1}	1.31×10^{-3}
Year of Peak Impact	8706	8706	8706	8706	8706	8580	8706	8706	8580

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	2.36×10^{-6}	3.38×10^{-7}	0.00	2.36×10^{-6}	3.42×10^{-7}	0.00	2.36×10^{-6}	3.63×10^{-7}	0.00
Chromium	2.22×10^{-3}	2.12×10^{-2}	0.00	2.22×10^{-3}	2.12×10^{-2}	1.25×10^{-11}	2.22×10^{-3}	3.09×10^{-2}	5.75×10^{-7}
Fluoride	2.05×10^{-4}	9.75×10^{-5}	0.00	2.05×10^{-4}	1.00×10^{-4}	0.00	2.05×10^{-4}	1.08×10^{-4}	0.00
Nitrate	1.55×10^{1}	2.77×10^{-1}	0.00	1.55×10^{1}	3.65×10^{-1}	0.00	1.55×10^{1}	7.15×10^{-1}	0.00
Total	1.55×10^{1}	2.98×10^{-1}	0.00	1.55×10^{1}	3.86×10^{-1}	1.25×10^{-11}	1.55×10^{1}	7.47×10^{-1}	5.75×10^{-7}
Year of Peak Impact	8216	8216	N/A	8216	8216	9308	8216	8216	9308

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–266. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.92×10^{-7}	1.21	6.90×10^{-5}	1.15×10^{-6}	5.15	2.26×10^{-4}	1.15×10^{-6}	1.05×10^{1}	4.94×10^{-4}
Iodine-129	9.73×10^{-9}	2.77	1.37×10^{-5}	4.24×10^{-9}	1.40	1.85×10^{-5}	4.24×10^{-9}	1.73	2.67×10^{-5}
Total	7.02×10^{-7}	3.98	8.27×10^{-5}	1.15×10^{-6}	6.55	2.45×10^{-4}	1.15×10^{-6}	1.22×10^{1}	5.20×10^{-4}
Year of Peak Impact	9188	9188	8365	8365	8365	8365	8365	8365	8365

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	6.56×10^{-7}	9.37×10^{-8}	0.00	6.56×10^{-7}	9.49×10^{-8}	0.00	6.56×10^{-7}	1.01×10^{-7}	0.00
Chromium	3.92×10^{-4}	3.73×10^{-3}	0.00	3.92×10^{-4}	3.74×10^{-3}	6.51×10^{-12}	3.92×10^{-4}	5.46×10^{-3}	2.99×10^{-7}
Fluoride	4.91×10^{-5}	2.34×10^{-5}	0.00	4.91×10^{-5}	2.41×10^{-5}	0.00	4.91×10^{-5}	2.59×10^{-5}	0.00
Nitrate	5.70	1.02×10^{-1}	0.00	5.70	1.34×10^{-1}	0.00	5.70	2.63×10^{-1}	0.00
Total	5.70	1.05×10^{-1}	0.00	5.70	1.38×10^{-1}	6.51×10^{-12}	5.70	2.68×10^{-1}	2.99×10^{-7}
Year of Peak Impact	7905	7905	N/A	7905	7905	8982	7905	7905	8982

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–267. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.87×10^{-7}	3.27×10^{-1}	4.04×10^{-5}	6.71×10^{-7}	3.02	1.33×10^{-4}	6.71×10^{-7}	6.15	2.89×10^{-4}
Iodine-129	5.61×10^{-9}	1.60	4.80×10^{-6}	1.48×10^{-9}	4.89×10^{-1}	6.47×10^{-6}	1.48×10^{-9}	6.04×10^{-1}	9.32×10^{-6}
Total	1.92×10^{-7}	1.92	4.52×10^{-5}	6.72×10^{-7}	3.51	1.39×10^{-4}	6.72×10^{-7}	6.75	2.98×10^{-4}
Year of Peak Impact	9652	9652	8478	8478	8478	8478	8478	8478	8478
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.28×10^{-7}	4.68×10^{-8}	0.00	3.28×10^{-7}	4.74×10^{-8}	0.00	3.28×10^{-7}	5.04×10^{-8}	0.00
Chromium	2.08×10^{-4}	1.98×10^{-3}	0.00	2.08×10^{-4}	1.98×10^{-3}	2.96×10^{-12}	2.08×10^{-4}	2.89×10^{-3}	1.36×10^{-7}
Fluoride	2.45×10^{-5}	1.17×10^{-5}	0.00	2.45×10^{-5}	1.20×10^{-5}	0.00	2.45×10^{-5}	1.29×10^{-5}	0.00
Nitrate	4.07	7.26×10^{-2}	0.00	4.07	9.56×10^{-2}	0.00	4.07	1.88×10^{-1}	0.00
Total	4.07	7.46×10^{-2}	0.00	4.07	9.76×10^{-2}	2.96×10^{-12}	4.07	1.91×10^{-1}	1.36×10^{-7}
Year of Peak Impact	8055	8055	N/A	8055	8055	8354	8055	8055	8354

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–268. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	9.27×10^{-12}	4.17×10^{-5}	1.83×10^{-9}	7.99×10^{-12}	8.31×10^{-5}	3.94×10^{-9}	1.87×10^{-7}	2.07×10^{-3}	4.03×10^{-7}
Iodine-129	6.61×10^{-14}	2.19×10^{-5}	2.90×10^{-10}	7.52×10^{-14}	4.06×10^{-4}	9.78×10^{-9}	5.61×10^{-9}	8.83×10^{-3}	6.83×10^{-8}
Total	9.33×10^{-12}	6.36×10^{-5}	2.12×10^{-9}	8.07×10^{-12}	4.89×10^{-4}	1.37×10^{-8}	1.92×10^{-7}	1.09×10^{-2}	4.71×10^{-7}
Year of Peak Impact	9014	9014	9014	8774	8774	8774	9652	9652	8478

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.07×10^{-11}	1.55×10^{-12}	0.00	1.07×10^{-11}	1.70×10^{-12}	0.00	6.56×10^{-7}	6.54×10^{-9}	0.00
Chromium	5.56×10^{-9}	5.30×10^{-8}	4.07×10^{-17}	5.56×10^{-9}	8.48×10^{-8}	1.87×10^{-12}	3.32×10^{-5}	7.35×10^{-5}	6.79×10^{-8}
Fluoride	6.46×10^{-10}	3.17×10^{-10}	0.00	6.46×10^{-10}	4.48×10^{-10}	0.00	2.45×10^{-5}	3.59×10^{-6}	0.00
Nitrate	4.58×10^{-5}	1.58×10^{-6}	0.00	4.58×10^{-5}	4.31×10^{-3}	0.00	4.07	1.52×10^{-1}	0.00
Total	4.58×10^{-5}	1.64×10^{-6}	4.07×10^{-17}	4.58×10^{-5}	4.31×10^{-3}	1.87×10^{-12}	4.07	1.52×10^{-1}	6.79×10^{-8}
Year of Peak Impact	8326	8326	8489	8326	8326	8489	8056	8056	8354

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–28 and Q–29 depict the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary, respectively, for the drinking-water well user over time. The peak radiological risk occurs around the year 8500 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

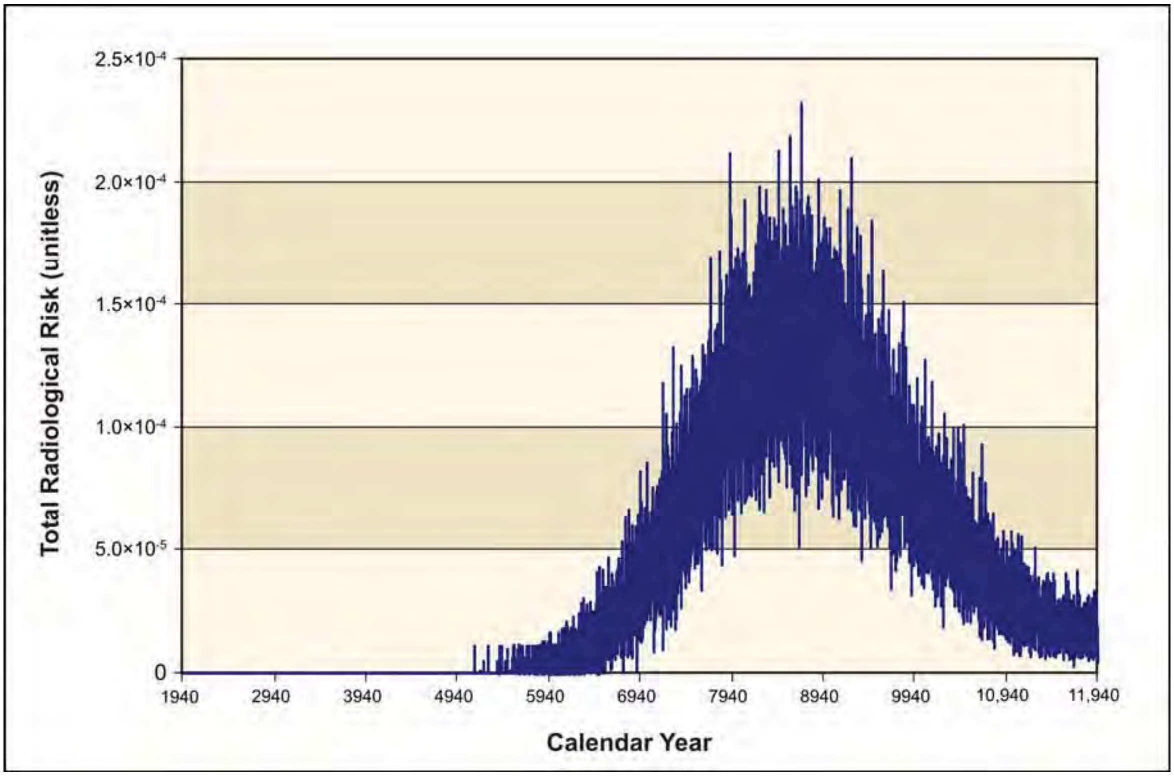

Figure Q–28. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

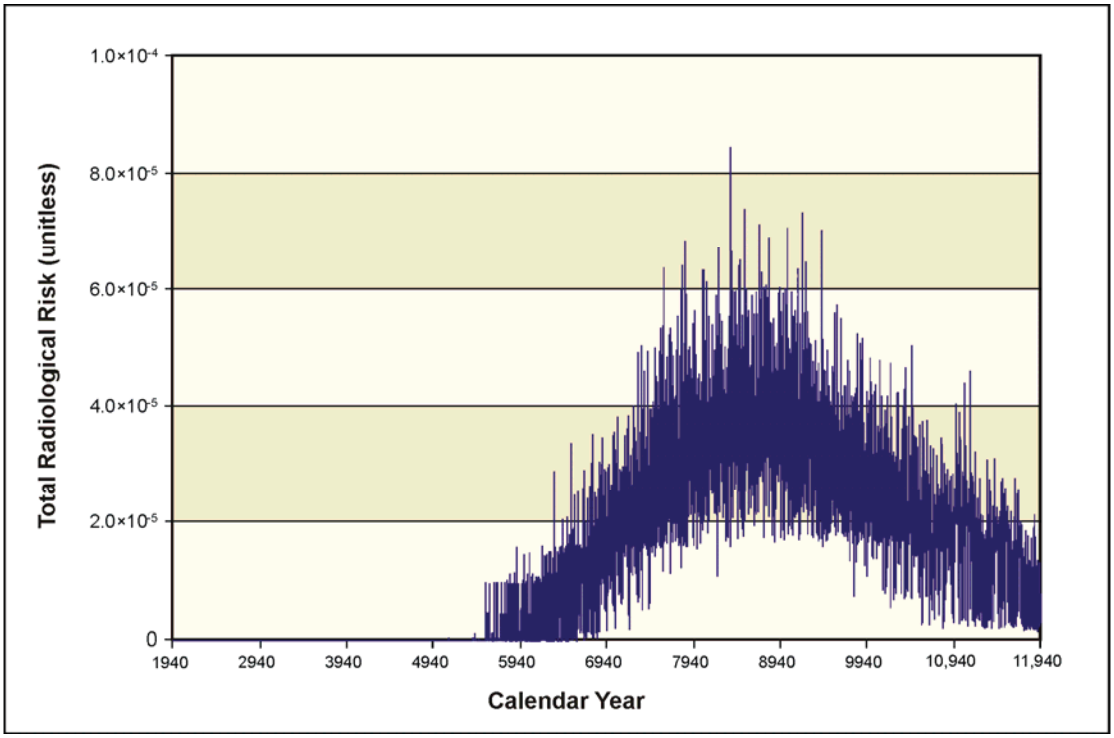

Figure Q–29. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.9 Waste Management Alternative 2; Disposal Group 2, Subgroup 2-B

Disposal Group 2, Subgroup 2-B, addresses the waste resulting from Tank Closure Alternative 6B (Base and Option Cases), onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- Preprocessing Facility (PPF) glass
- PPF melters
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 6B (Base and Option Cases).

Potential human health impacts at the IDF-East barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–269 through Q–278, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides; and acetonitrile, boron and boron compounds, chromium, fluoride, nitrate, and total uranium for chemicals. For radionuclides, the dose standard would not be exceeded at any location. In addition, the Hazard Index guideline would not be exceeded at any location for the Base Case. For the Option Case, the Hazard Index guideline would be exceeded primarily due to chromium at the Core Zone Boundary for the drinking-water well user, the resident farmer, and the American Indian resident farmer. Population dose was estimated for Subgroup 2-B, Base

Case, as 3.22×10^{-1} person-rem per year for the year of maximum impact and for Subgroup 2-B, Option Case, as 3.23×10^{-1} person-rem per year for the year of maximum impact.

Table Q–269. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.61×10^{-6}	4.57	1.57×10^{-4}	2.61×10^{-6}	1.17×10^{1}	5.72×10^{-4}	2.61×10^{-6}	2.39×10^{1}	1.25×10^{-3}
Iodine-129	2.38×10^{-8}	6.78	7.72×10^{-5}	2.38×10^{-8}	7.87	6.63×10^{-5}	2.38×10^{-8}	9.72	9.54×10^{-5}
Total	2.63×10^{-6}	1.14×10^{1}	2.34×10^{-4}	2.63×10^{-6}	1.96×10^{1}	6.38×10^{-4}	2.63×10^{-6}	3.36×10^{1}	1.34×10^{-3}
Year of Peak Impact	8706	8706	8706	8706	8706	8580	8706	8706	8580

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.69×10^{-6}	2.41×10^{-7}	0.00	1.69×10^{-6}	2.44×10^{-7}	0.00	1.69×10^{-6}	2.60×10^{-7}	0.00
Chromium	2.45×10^{-3}	2.34×10^{-2}	0.00	2.45×10^{-3}	2.34×10^{-2}	1.27×10^{-11}	2.45×10^{3}	3.42×10^{-2}	5.81×10^{-7}
Fluoride	1.46×10^{-4}	6.96×10^{-5}	0.00	1.46×10^{-4}	7.17×10^{-5}	0.00	1.46×10^{-4}	7.71×10^{-5}	0.00
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.68×10^{-1}	0.00
Total	1.66×10^{1}	3.21×10^{-1}	0.00	1.66×10^{1}	4.15×10^{-1}	1.27×10^{-11}	1.66×10^{1}	8.02×10^{-1}	5.81×10^{-7}
Year of Peak Impact	8414	8414	N/A	8414	8414	8281	8414	8414	8281

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–270. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.83×10^{-7}	4.97×10^{-1}	1.71×10^{-5}	2.83×10^{-7}	1.28	5.60×10^{-5}	2.83×10^{-7}	2.60	1.22×10^{-4}
Iodine-129	3.34×10^{-10}	9.51×10^{-2}	1.08×10^{-6}	3.34×10^{-10}	1.10×10^{-1}	1.46×10^{-6}	3.34×10^{-10}	1.36×10^{-1}	2.10×10^{-6}
Total	2.84×10^{-7}	5.92×10^{-1}	1.82×10^{-5}	2.84×10^{-7}	1.39	5.75×10^{-5}	2.84×10^{-7}	2.73	1.24×10^{-4}
Year of Peak Impact	3889	3889	3889	3889	3889	3889	3889	3889	3889

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	6.80×10^{-7}	3.24×10^{-6}	0.00	6.80×10^{-7}	4.04×10^{-6}	0.00	6.80×10^{-7}	7.30×10^{-6}	0.00
Chromium	5.77×10^{-3}	5.49×10^{-2}	0.00	5.77×10^{-3}	5.50×10^{-2}	2.27×10^{-11}	5.77×10^{-3}	8.03×10^{-2}	1.04×10^{-6}
Nitrate	2.62×10^{-1}	4.67×10^{-3}	0.00	2.62×10^{-1}	6.16×10^{-3}	0.00	2.62×10^{-1}	1.21×10^{-2}	0.00
Total	2.68×10^{-1}	5.96×10^{-2}	0.00	2.68×10^{-1}	6.11×10^{-2}	2.27×10^{-11}	2.68×10^{-1}	9.24×10^{-2}	1.04×10^{-6}
Year of Peak Impact	3868	3868	N/A	3868	3868	3868	3868	3868	3868

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–271. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.92×10^{-7}	1.21	6.85×10^{-5}	1.14×10^{-6}	5.12	2.25×10^{-4}	1.14×10^{-6}	1.04×10^{1}	4.90×10^{-4}
Iodine-129	9.64×10^{-9}	2.75	1.38×10^{-5}	4.25×10^{-9}	1.40	1.86×10^{-5}	4.25×10^{-9}	1.73	2.67×10^{-5}
Total	7.02×10^{-7}	3.96	8.23×10^{-5}	1.14×10^{-6}	6.52	2.43×10^{-4}	1.14×10^{-6}	1.22×10^{1}	5.17×10^{-4}
Year of Peak Impact	9188	9188	8365	8365	8365	8365	8365	8365	8365
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.37×10^{-6}	6.51×10^{-6}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Boron and Compounds	0.00	0.00	0.00	9.83×10^{-7}	1.42×10^{-7}	0.00	9.83×10^{-7}	1.51×10^{-7}	0.00
Chromium	1.12×10^{-2}	1.06×10^{-1}	0.00	4.63×10^{-4}	4.41×10^{-3}	4.41×10^{-11}	4.63×10^{-4}	6.45×10^{-3}	2.02×10^{-6}
Fluoride	0.00	0.00	0.00	7.36×10^{-5}	3.61×10^{-5}	0.00	7.36×10^{-5}	3.88×10^{-5}	0.00
Nitrate	5.46×10^{-1}	9.75×10^{-3}	0.00	5.75	1.35×10^{-1}	0.00	5.75	2.65×10^{-1}	0.00
Total	5.57×10^{-1}	1.16×10^{-1}	0.00	5.75	1.40×10^{-1}	4.41×10^{-11}	5.75	2.72×10^{-1}	2.02×10^{-6}
Year of Peak Impact	3995	3995	N/A	8245	8245	11,232	8245	8245	11,232

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–272. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.87×10^{-7}	3.28×10^{-1}	4.24×10^{-5}	7.03×10^{-7}	3.16	1.39×10^{-4}	7.03×10^{-7}	6.45	3.03×10^{-4}
Iodine-129	5.61×10^{-9}	1.60	4.90×10^{-6}	1.51×10^{-9}	5.00×10^{-1}	6.62×10^{-6}	1.51×10^{-9}	6.17×10^{-1}	9.53×10^{-6}
Total	1.93×10^{-7}	1.92	4.73×10^{-5}	7.05×10^{-7}	3.66	1.46×10^{-4}	7.05×10^{-7}	7.06	3.13×10^{-4}
Year of Peak Impact	9652	9652	8477	8477	8477	8477	8477	8477	8477

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	1.36×10^{-7}	6.49×10^{-7}	0.00	1.36×10^{-7}	8.10×10^{-7}	0.00	1.36×10^{-7}	1.46×10^{-6}	0.00
Boron and Compounds	3.28×10^{-7}	4.68×10^{-8}	0.00	3.28×10^{-7}	4.74×10^{-8}	0.00	3.28×10^{-7}	5.04×10^{-8}	0.00
Chromium	5.94×10^{-4}	5.66×10^{-3}	0.00	5.94×10^{-4}	5.66×10^{-3}	9.08×10^{-12}	5.94×10^{-4}	8.27×10^{-3}	4.17×10^{-7}
Fluoride	4.91×10^{-5}	2.34×10^{-5}	0.00	4.91×10^{-5}	2.41×10^{-5}	0.00	4.91×10^{-5}	2.59×10^{-5}	0.00
Nitrate	3.31	5.92×10^{-2}	0.00	3.31	7.79×10^{-2}	0.00	3.31	1.53×10^{-1}	0.00
Total	3.31	6.48×10^{-2}	0.00	3.31	8.36×10^{-2}	9.08×10^{-12}	3.31	1.61×10^{-1}	4.17×10^{-7}
Year of Peak Impact	7829	7829	N/A	7829	7829	5035	7829	7829	5035

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–273. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	9.36×10^{-12}	4.21×10^{-5}	1.85×10^{-9}	8.06×10^{-12}	8.37×10^{-5}	3.97×10^{-9}	1.87×10^{-7}	2.07×10^{-3}	4.22×10^{-7}
Iodine-129	6.69×10^{-14}	2.22×10^{-5}	2.94×10^{-10}	7.53×10^{-14}	4.07×10^{-4}	9.79×10^{-9}	5.61×10^{-9}	8.83×10^{-3}	7.02×10^{-8}
Total	9.43×10^{-12}	6.43×10^{-5}	2.14×10^{-9}	8.13×10^{-12}	4.90×10^{-4}	1.38×10^{-8}	1.93×10^{-7}	1.09×10^{-2}	4.93×10^{-7}
Year of Peak Impact	9014	9014	9014	8774	8774	8774	9652	9652	8477
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	2.88×10^{-13}	1.72×10^{-12}	0.00	2.88×10^{-13}	3.10×10^{-12}	0.00	1.36×10^{-7}	8.10×10^{-7}	0.00
Chromium	7.87×10^{-9}	7.50×10^{-8}	1.23×10^{-16}	7.87×10^{-9}	1.20×10^{-7}	5.63×10^{-12}	5.85×10^{-4}	1.29×10^{-3}	2.08×10^{-7}
Fluoride	7.01×10^{-10}	3.43×10^{-10}	0.00	7.01×10^{-10}	4.86×10^{-10}	0.00	7.36×10^{-5}	1.08×10^{-5}	0.00
Nitrate	4.79×10^{-5}	1.65×10^{-6}	0.00	4.79×10^{-5}	4.50×10^{-3}	0.00	3.31	1.24×10^{-1}	0.00
Total	4.79×10^{-5}	1.73×10^{-6}	1.23×10^{-16}	4.79×10^{-5}	4.50×10^{-3}	5.63×10^{-12}	3.31	1.26×10^{-1}	2.08×10^{-7}
Year of Peak Impact	8304	8304	4172	8304	8304	4172	7837	7837	5035

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–274. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.61×10^{-6}	4.57	1.57×10^{-4}	2.61×10^{-6}	1.17×10^{1}	5.72×10^{-4}	2.61×10^{-6}	2.39×10^{1}	1.25×10^{-3}
Iodine-129	2.38×10^{-8}	6.78	7.72×10^{-5}	2.38×10^{-8}	7.87	6.63×10^{-5}	2.38×10^{-8}	9.72	9.54×10^{-5}
Total	2.63×10^{-6}	1.14×10^{1}	2.34×10^{-4}	2.63×10^{-6}	1.96×10^{1}	6.38×10^{-4}	2.63×10^{-6}	3.36×10^{1}	1.34×10^{-3}
Year of Peak Impact	8706	8706	8706	8706	8706	8580	8706	8706	8580

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.69×10^{-6}	2.41×10^{-7}	0.00	1.69×10^{-6}	2.44×10^{-7}	0.00	1.69×10^{-6}	2.60×10^{-7}	0.00
Chromium	2.46×10^{-3}	2.34×10^{-2}	0.00	2.46×10^{-3}	2.34×10^{-2}	1.27×10^{-11}	2.46×10^{-3}	3.42×10^{-2}	5.82×10^{-7}
Fluoride	1.46×10^{-4}	6.96×10^{-5}	0.00	1.46×10^{-4}	7.17×10^{-5}	0.00	1.46×10^{-4}	7.71×10^{-5}	0.00
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.68×10^{-1}	0.00
Total	1.66×10^{1}	3.21×10^{-1}	0.00	1.66×10^{1}	4.15×10^{-1}	1.27×10^{-11}	1.66×10^{1}	8.02×10^{-1}	5.82×10^{-7}
Year of Peak Impact	8414	8414	N/A	8414	8414	8281	8414	8414	8281

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–275. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.40×10^{-7}	5.95×10^{-1}	2.05×10^{-5}	3.40×10^{-7}	1.53	6.71×10^{-5}	3.40×10^{-7}	3.11	1.46×10^{-4}
Iodine-129	3.54×10^{-10}	1.01×10^{-1}	1.15×10^{-6}	3.54×10^{-10}	1.17×10^{-1}	1.55×10^{-6}	3.54×10^{-10}	1.45×10^{-1}	2.23×10^{-6}
Total	3.40×10^{-7}	6.96×10^{-1}	2.16×10^{-5}	3.40×10^{-7}	1.65	6.87×10^{-5}	3.40×10^{-7}	3.26	1.49×10^{-4}
Year of Peak Impact	4213	4213	4213	4213	4213	4213	4213	4213	4213
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	4.34×10^{-7}	2.06×10^{-6}	0.00	4.34×10^{-7}	2.58×10^{-6}	0.00	4.34×10^{-7}	4.66×10^{-6}	0.00
Chromium	2.55×10^{-2}	2.43×10^{-1}	0.00	2.55×10^{-2}	2.43×10^{-1}	1.28×10^{-10}	2.55×10^{-2}	3.55×10^{-1}	5.87×10^{-6}
Nitrate	8.28	1.48×10^{-1}	0.00	8.28	1.95×10^{-1}	0.00	8.28	3.82×10^{-1}	0.00
Total	8.31	3.91×10^{-1}	0.00	8.31	4.38×10^{-1}	1.28×10^{-10}	8.31	7.37×10^{-1}	5.87×10^{-6}
Year of Peak Impact	4260	4260	N/A	4260	4260	4118	4260	4260	4118

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–276. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.92×10^{-7}	1.21	8.13×10^{-5}	1.14×10^{-6}	5.12	2.67×10^{-4}	1.35×10^{-6}	1.24×10^{1}	5.82×10^{-4}
Iodine-129	9.64×10^{-9}	2.75	2.00×10^{-6}	4.25×10^{-9}	1.40	2.70×10^{-6}	6.18×10^{-10}	2.52×10^{-1}	3.89×10^{-6}
Total	7.02×10^{-7}	3.96	8.33×10^{-5}	1.14×10^{-6}	6.52	2.70×10^{-4}	1.35×10^{-6}	1.26×10^{1}	5.86×10^{-4}
Year of Peak Impact	9188	9188	4466	8365	8365	4466	4466	4466	4466
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	6.08×10^{-7}	2.89×10^{-6}	0.00	6.08×10^{-7}	3.61×10^{-6}	0.00	6.08×10^{-7}	6.53×10^{-6}	0.00
Chromium	9.51×10^{-2}	9.06×10^{-1}	0.00	9.51×10^{-2}	9.07×10^{-1}	3.82×10^{-10}	9.51×10^{-2}	1.32	1.75×10^{-5}
Nitrate	2.68×10^{1}	4.78×10^{-1}	0.00	2.68×10^{1}	6.29×10^{-1}	0.00	2.68×10^{1}	1.23	0.00
Total	2.69×10^{1}	1.38	0.00	2.69×10^{1}	1.54	3.82×10^{-10}	2.69×10^{1}	2.56	1.75×10^{-5}
Year of Peak Impact	4564	4564	N/A	4564	4564	10,533	4564	4564	10,533

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–277. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.87×10^{-7}	3.28×10^{-1}	4.32×10^{-5}	7.17×10^{-7}	3.22	1.42×10^{-4}	7.17×10^{-7}	6.57	3.09×10^{-4}
Iodine-129	5.67×10^{-9}	1.61	4.97×10^{-6}	1.53×10^{-9}	5.07×10^{-1}	6.71×10^{-6}	1.53×10^{-9}	6.26×10^{-1}	9.66×10^{-6}
Total	1.93×10^{-7}	1.94	4.81×10^{-5}	7.18×10^{-7}	3.73	1.48×10^{-4}	7.18×10^{-7}	7.19	3.18×10^{-4}
Year of Peak Impact	9652	9652	8477	8477	8477	8477	8477	8477	8477

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	2.69×10^{-7}	1.28×10^{-6}	0.00	2.69×10^{-7}	1.60×10^{-6}	0.00	2.69×10^{-7}	2.89×10^{-6}	0.00
Chromium	1.69×10^{-2}	1.61×10^{-1}	0.00	1.69×10^{-2}	1.61×10^{-1}	6.67×10^{-11}	1.69×10^{-2}	2.36×10^{-1}	3.06×10^{-6}
Nitrate	3.81	6.81×10^{-2}	0.00	3.81	8.97×10^{-2}	0.00	3.81	1.76×10^{-1}	0.00
Total	3.83	2.29×10^{-1}	0.00	3.83	2.51×10^{-1}	6.67×10^{-11}	3.83	4.12×10^{-1}	3.06×10^{-6}
Year of Peak Impact	5180	5180	N/A	5180	5180	5522	5180	5180	5522

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–278. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	9.45×10^{-12}	4.25×10^{-5}	1.87×10^{-9}	8.19×10^{-12}	8.51×10^{-5}	4.03×10^{-9}	1.87×10^{-7}	2.07×10^{-3}	4.30×10^{-7}
Iodine-129	6.69×10^{-14}	2.22×10^{-5}	2.94×10^{-10}	7.56×10^{-14}	4.08×10^{-4}	9.82×10^{-9}	5.67×10^{-9}	8.92×10^{-3}	7.10×10^{-8}
Total	9.51×10^{-12}	6.46×10^{-5}	2.16×10^{-9}	8.27×10^{-12}	4.93×10^{-4}	1.39×10^{-8}	1.93×10^{-7}	1.10×10^{-2}	5.01×10^{-7}
Year of Peak Impact	9014	9014	9014	8774	8774	8774	9652	9652	8477

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	5.64×10^{-12}	3.35×10^{-11}	0.00	5.69×10^{-12}	6.11×10^{-11}	0.00	1.34×10^{-7}	7.97×10^{-7}	0.00
Chromium	1.75×10^{-7}	1.67×10^{-6}	8.31×10^{-16}	8.77×10^{-8}	1.34×10^{-6}	3.81×10^{-11}	6.75×10^{-3}	1.49×10^{-2}	1.53×10^{-6}
Nitrate	5.13×10^{-5}	1.77×10^{-6}	0.00	5.40×10^{-5}	5.08×10^{-3}	0.00	5.70	2.06×10^{-1}	0.00
Total	5.15×10^{-5}	3.44×10^{-6}	8.31×10^{-16}	5.41×10^{-5}	5.08×10^{-3}	3.81×10^{-11}	5.70	2.21×10^{-1}	1.53×10^{-6}
Year of Peak Impact	4576	4576	4805	4839	4839	4805	4618	4618	5522

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–30 through Q–33 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary for the drinking-water well user over time. For the Base Case, the peak radiological risk occurs around the year 8300 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. For the Option Case, the peak radiological risk occurs around the year 4500 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater.

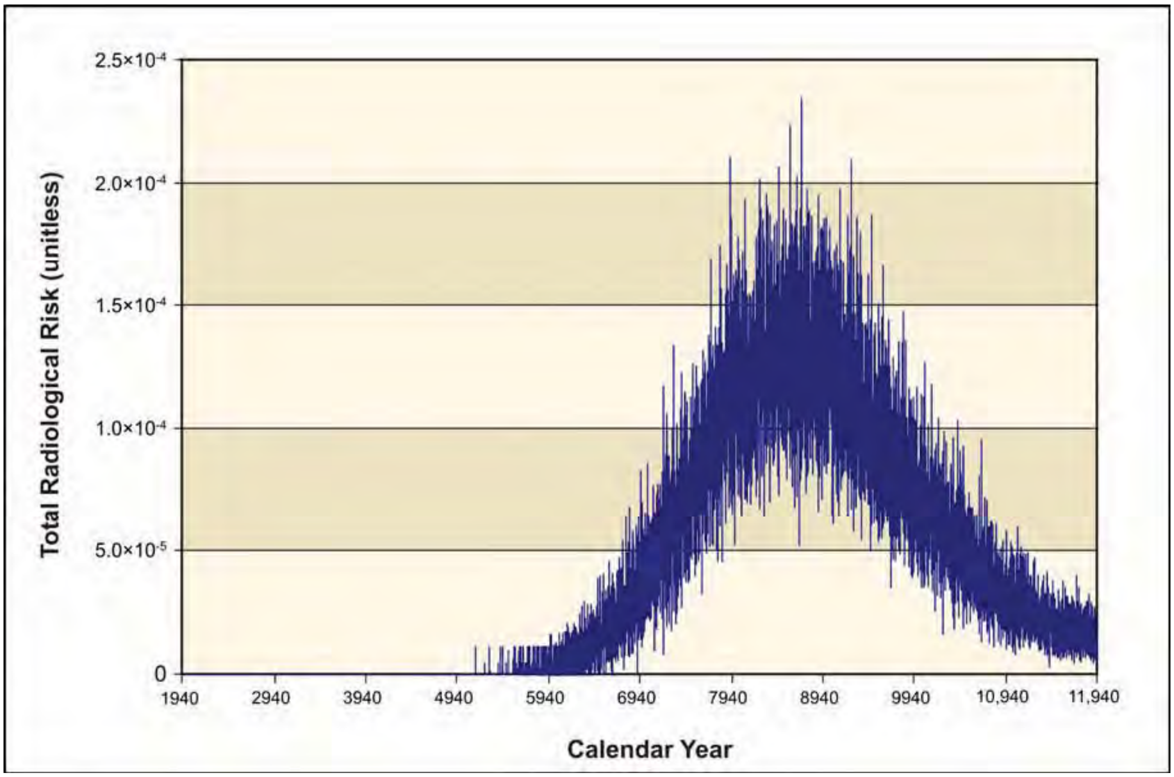

Figure Q–30. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

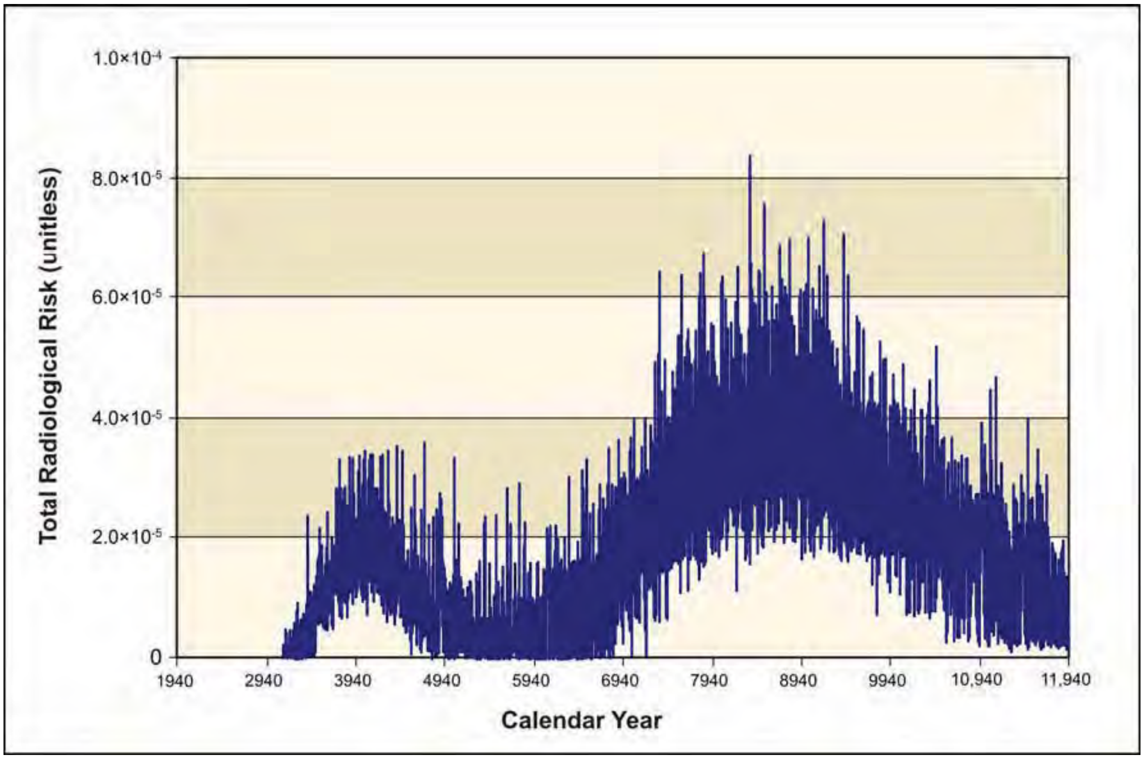

Figure Q–31. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

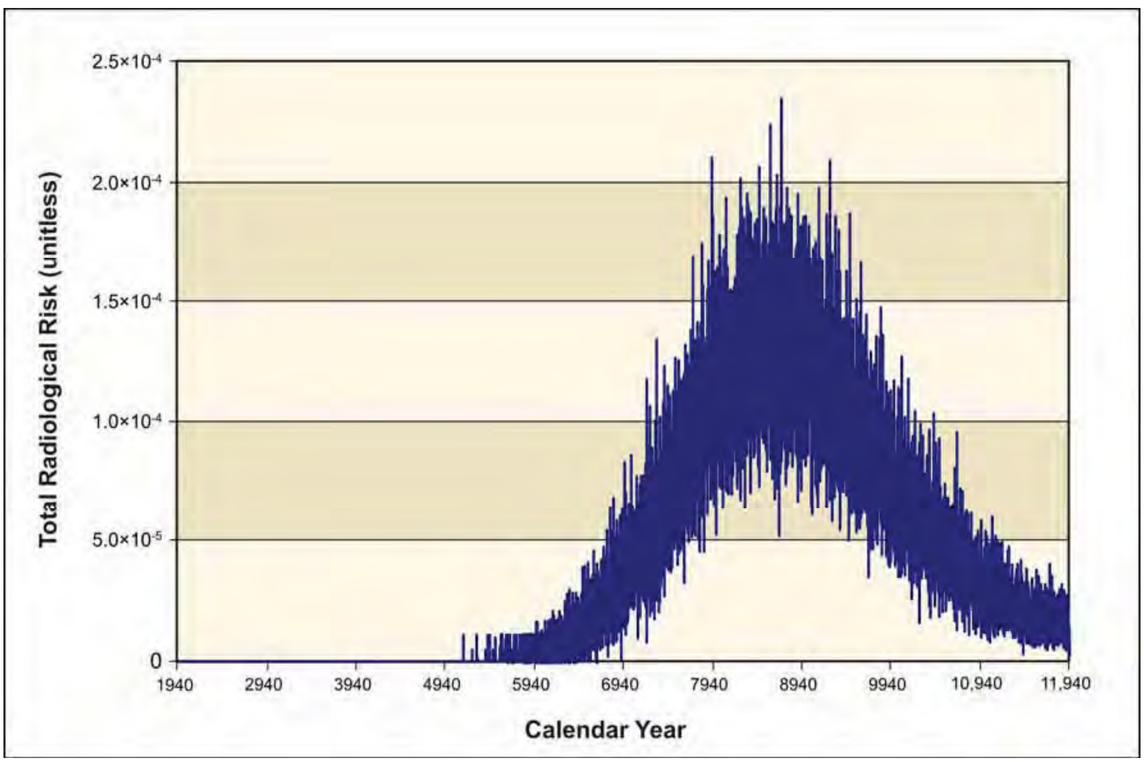

Figure Q–32. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

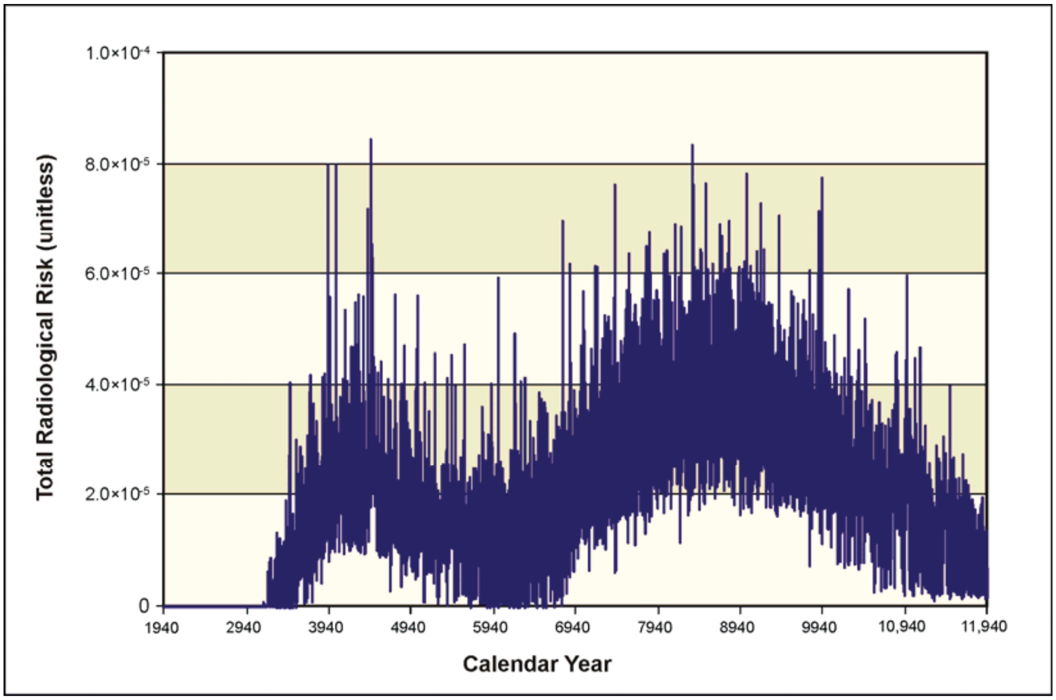

Figure Q–33. Waste Management Alternative 2, Disposal Group 2, Subgroup 2-B, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.2.10 Waste Management Alternative 2; Disposal Group 3

Disposal Group 3 addresses the waste resulting from Tank Closure Alternative 6A (Base and Option Cases), onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- PPF glass
- PPF melters
- Tank closure secondary waste
- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 6A (Base and Option Cases).

Potential human health impacts at the IDF-East barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–279 through Q–288, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides; and acetonitrile, boron and boron compounds, chromium, fluoride, nitrate, and total uranium for chemicals. For radionuclides, the dose standard would not be exceeded at any location for both the Base and Option Cases. In addition, the Hazard Index guideline would not be exceeded at any location for the Base Case. However, the Hazard Index guideline would be exceeded primarily due to chromium and nitrate at the Core Zone Boundary for the Option Case for the drinking-water well user, the resident farmer, and the American Indian resident farmer. Population dose was estimated for Disposal Group 3, Base Case, as 3.12×10^{-1} person-rem per year for the year of maximum impact and for Disposal Group 3, Option Case, as 3.13×10^{-1} person-rem per year for the year of maximum impact.

Table Q–279. Waste Management Alternative 2, Disposal Group 3, Base Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.64×10^{-6}	4.62	1.59×10^{-4}	2.64×10^{-6}	1.19×10^{1}	6.00×10^{-4}	2.64×10^{-6}	2.42×10^{1}	1.31×10^{-3}
Iodine-129	2.17×10^{-8}	6.17	7.02×10^{-5}	2.17×10^{-8}	7.16	4.77×10^{-5}	2.17×10^{-8}	8.84	6.86×10^{-5}
Total	2.66×10^{-6}	1.08×10^{1}	2.29×10^{-4}	2.66×10^{-6}	1.90×10^{1}	6.48×10^{-4}	2.66×10^{-6}	3.30×10^{1}	1.38×10^{-3}
Year of Peak Impact	8290	8290	8290	8290	8290	8646	8290	8290	8646

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.35×10^{-6}	1.93×10^{-7}	0.00	1.35×10^{-6}	1.95×10^{-7}	0.00	1.35×10^{-6}	2.07×10^{-7}	0.00
Chromium	1.04×10^{-3}	9.95×10^{-3}	0.00	1.04×10^{-3}	9.96×10^{-3}	1.20×10^{-11}	1.04×10^{-3}	1.46×10^{-2}	5.52×10^{-7}
Fluoride	1.77×10^{-4}	8.42×10^{-5}	0.00	1.77×10^{-4}	8.66×10^{-5}	0.00	1.77×10^{-4}	9.32×10^{-5}	0.00
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.68×10^{-1}	0.00
Total	1.66×10^{1}	3.07×10^{-1}	0.00	1.66×10^{1}	4.01×10^{-1}	1.20×10^{-11}	1.66×10^{1}	7.82×10^{-1}	5.52×10^{-7}
Year of Peak Impact	8236	8236	N/A	8236	8236	8561	8236	8236	8561

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–280. Waste Management Alternative 2, Disposal Group 3, Base Case, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.03×10^{-7}	5.31×10^{-1}	1.82×10^{-5}	3.03×10^{-7}	1.36	5.99×10^{-5}	3.03×10^{-7}	2.78	1.31×10^{-4}
Iodine-129	3.64×10^{-10}	1.04×10^{-1}	1.18×10^{-6}	3.64×10^{-10}	1.20×10^{-1}	1.59×10^{-6}	3.64×10^{-10}	1.49×10^{-1}	2.29×10^{-6}
Total	3.03×10^{-7}	6.35×10^{-1}	1.94×10^{-5}	3.03×10^{-7}	1.48	6.15×10^{-5}	3.03×10^{-7}	2.93	1.33×10^{-4}
Year of Peak Impact	3987	3987	3987	3987	3987	3987	3987	3987	3987
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.07×10^{-6}	5.10×10^{-6}	0.00	1.07×10^{-6}	6.37×10^{-6}	0.00	1.07×10^{-6}	1.15×10^{-5}	0.00
Chromium	5.77×10^{-3}	5.50×10^{-2}	0.00	5.77×10^{-3}	5.50×10^{-2}	2.27×10^{-11}	5.77×10^{-3}	8.04×10^{-2}	1.04×10^{-6}
Nitrate	2.18×10^{-1}	3.89×10^{-3}	0.00	2.18×10^{-1}	5.12×10^{-3}	0.00	2.18×10^{-1}	1.01×10^{-2}	0.00
Total	2.24×10^{-1}	5.89×10^{-2}	0.00	2.24×10^{-1}	6.01×10^{-2}	2.27×10^{-11}	2.24×10^{-1}	9.04×10^{-2}	1.04×10^{-6}
Year of Peak Impact	4109	4109	N/A	4109	4109	4109	4109	4109	4109

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–281. Waste Management Alternative 2, Disposal Group 3, Base Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.75×10^{-7}	1.18	7.10×10^{-5}	1.18×10^{-6}	5.31	2.33×10^{-4}	1.18×10^{-6}	1.08×10^{1}	5.08×10^{-4}
Iodine-129	8.47×10^{-9}	2.41	6.70×10^{-6}	2.07×10^{-9}	6.83×10^{-1}	9.04×10^{-6}	2.07×10^{-9}	8.43×10^{-1}	1.30×10^{-5}
Total	6.83×10^{-7}	3.59	7.77×10^{-5}	1.18×10^{-6}	5.99	2.42×10^{-4}	1.18×10^{-6}	1.17×10^{1}	5.21×10^{-4}
Year of Peak Impact	8393	8393	8173	8173	8173	8173	8173	8173	8173

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	9.82×10^{-7}	1.40×10^{-7}	0.00	3.28×10^{-7}	4.74×10^{-8}	0.00	3.28×10^{-7}	5.03×10^{-8}	0.00
Chromium	9.62×10^{-3}	9.16×10^{-2}	0.00	2.14×10^{-4}	2.04×10^{-3}	4.31×10^{-11}	2.14×10^{-4}	2.98×10^{-3}	1.98×10^{-6}
Fluoride	4.84×10^{-5}	2.30×10^{-5}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrate	1.64	2.93×10^{-2}	0.00	6.55	1.54×10^{-1}	0.00	6.55	3.02×10^{-1}	0.00
Total	1.65	1.21×10^{-1}	0.00	6.55	1.56×10^{-1}	4.31×10^{-11}	6.55	3.05×10^{-1}	1.98×10^{-6}
Year of Peak Impact	9877	9877	N/A	6859	6859	6384	6859	6859	6384

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–282. Waste Management Alternative 2, Disposal Group 3, Base Case, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.41×10^{-7}	1.47	5.11×10^{-5}	8.48×10^{-7}	3.82	1.68×10^{-4}	8.48×10^{-7}	7.77	3.66×10^{-4}
Iodine-129	2.95×10^{-9}	8.40×10^{-1}	9.25×10^{-6}	2.85×10^{-9}	9.43×10^{-1}	1.25×10^{-5}	2.85×10^{-9}	1.16	1.80×10^{-5}
Total	8.44×10^{-7}	2.31	6.03×10^{-5}	8.51×10^{-7}	4.76	1.80×10^{-4}	8.51×10^{-7}	8.94	3.83×10^{-4}
Year of Peak Impact	9282	9282	9284	9284	9284	9284	9284	9284	9284
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.36×10^{-7}	6.48×10^{-7}	0.00	1.36×10^{-7}	8.09×10^{-7}	0.00	1.36×10^{-7}	1.46×10^{-6}	0.00
Boron and Compounds	3.27×10^{-7}	4.68×10^{-8}	0.00	3.27×10^{-7}	4.74×10^{-8}	0.00	3.27×10^{-7}	5.03×10^{-8}	0.00
Chromium	9.82×10^{-4}	9.35×10^{-3}	0.00	9.82×10^{-4}	9.36×10^{-3}	1.21×10^{-11}	9.82×10^{-4}	1.37×10^{-2}	5.54×10^{-7}
Fluoride	7.35×10^{-5}	3.50×10^{-5}	0.00	7.35×10^{-5}	3.60×10^{-5}	0.00	7.35×10^{-5}	3.88×10^{-5}	0.00
Nitrate	3.29	5.87×10^{-2}	0.00	3.29	7.73×10^{-2}	0.00	3.29	1.52×10^{-1}	0.00
Total	3.29	6.81×10^{-2}	0.00	3.29	8.67×10^{-2}	1.21×10^{-11}	3.29	1.65×10^{-1}	5.54×10^{-7}
Year of Peak Impact	7710	7710	N/A	7710	7710	4877	7710	7710	4877

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–283. Waste Management Alternative 2, Disposal Group 3, Base Case, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	9.40×10^{-12}	4.23×10^{-5}	1.86×10^{-9}	6.00×10^{-12}	6.23×10^{-5}	2.95×10^{-9}	8.48×10^{-7}	9.28×10^{-3}	5.09×10^{-7}
Iodine-129	6.08×10^{-14}	2.01×10^{-5}	2.67×10^{-10}	8.58×10^{-14}	4.63×10^{-4}	1.11×10^{-8}	2.85×10^{-9}	4.83×10^{-3}	1.18×10^{-7}
Total	9.46×10^{-12}	6.24×10^{-5}	2.12×10^{-9}	6.08×10^{-12}	5.26×10^{-4}	1.41×10^{-8}	8.51×10^{-7}	1.41×10^{-2}	6.28×10^{-7}
Year of Peak Impact	8962	8962	8962	9354	9354	9354	9284	9284	9284

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	7.21×10^{-13}	4.29×10^{-12}	0.00	7.21×10^{-13}	7.75×10^{-12}	0.00	1.36×10^{-7}	8.09×10^{-7}	0.00
Boron and Compounds	5.47×10^{-12}	7.92×10^{-13}	0.00	5.47×10^{-12}	8.69×10^{-13}	0.00	3.27×10^{-7}	3.27×10^{-9}	0.00
Chromium	6.45×10^{-9}	6.15×10^{-8}	1.23×10^{-16}	6.45×10^{-9}	9.85×10^{-8}	5.64×10^{-12}	5.93×10^{-4}	1.31×10^{-3}	2.77×10^{-7}
Fluoride	5.65×10^{-10}	2.77×10^{-10}	0.00	5.65×10^{-10}	3.92×10^{-10}	0.00	4.90×10^{-5}	7.17×10^{-6}	0.00
Nitrate	5.01×10^{-5}	1.73×10^{-6}	0.00	5.01×10^{-5}	4.71×10^{-3}	0.00	3.31	1.25×10^{-1}	0.00
Total	5.01×10^{-5}	1.79×10^{-6}	1.23×10^{-16}	5.01×10^{-5}	4.71×10^{-3}	5.64×10^{-12}	3.31	1.26×10^{-1}	2.77×10^{-7}
Year of Peak Impact	7991	7991	4468	7991	7991	4468	7714	7714	4877

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–284. Waste Management Alternative 2, Disposal Group 3, Option Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.64×10^{-6}	4.62	1.59×10^{-4}	2.64×10^{-6}	1.19×10^{1}	6.00×10^{-4}	2.64×10^{-6}	2.42×10^{1}	1.31×10^{-3}
Iodine-129	2.17×10^{-8}	6.17	7.02×10^{-5}	2.17×10^{-8}	7.16	4.77×10^{-5}	2.17×10^{-8}	8.84	6.86×10^{-5}
Total	2.66×10^{-6}	1.08×10^{1}	2.29×10^{-4}	2.66×10^{-6}	1.90×10^{1}	6.48×10^{-4}	2.66×10^{-6}	3.30×10^{1}	1.38×10^{-3}
Year of Peak Impact	8290	8290	8290	8290	8290	8646	8290	8290	8646
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.35×10^{-6}	1.93×10^{-7}	0.00	1.35×10^{-6}	1.95×10^{-7}	0.00	1.35×10^{-6}	2.07×10^{-7}	0.00
Chromium	1.05×10^{-3}	9.97×10^{-3}	0.00	1.05×10^{-3}	9.98×10^{-3}	1.21×10^{-11}	1.05×10^{-3}	1.46×10^{-2}	5.53×10^{-7}
Fluoride	1.77×10^{-4}	8.42×10^{-5}	0.00	1.77×10^{-4}	8.66×10^{-5}	0.00	1.77×10^{-4}	9.32×10^{-5}	0.00
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.68×10^{-1}	0.00
Total	1.66×10^{1}	3.07×10^{-1}	0.00	1.66×10^{1}	4.01×10^{-1}	1.21×10^{-11}	1.66×10^{1}	7.82×10^{-1}	5.53×10^{-7}
Year of Peak Impact	8236	8236	N/A	8236	8236	8561	8236	8236	8561

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–285. Waste Management Alternative 2, Disposal Group 3, Option Case, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.86×10^{-7}	6.76×10^{-1}	2.32×10^{-5}	3.86×10^{-7}	1.74	7.62×10^{-5}	3.86×10^{-7}	3.54	1.66×10^{-4}
Iodine-129	3.91×10^{-10}	1.11×10^{-1}	1.27×10^{-6}	3.91×10^{-10}	1.29×10^{-1}	1.71×10^{-6}	3.91×10^{-10}	1.59×10^{-1}	2.46×10^{-6}
Total	3.86×10^{-7}	7.87×10^{-1}	2.45×10^{-5}	3.86×10^{-7}	1.86	7.79×10^{-5}	3.86×10^{-7}	3.70	1.69×10^{-4}
Year of Peak Impact	4013	4013	4013	4013	4013	4013	4013	4013	4013

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	8.36×10^{-7}	3.98×10^{-6}	0.00	5.45×10^{-7}	3.24×10^{-6}	0.00	5.45×10^{-7}	5.85×10^{-6}	0.00
Chromium	3.37×10^{-2}	3.21×10^{-1}	0.00	2.94×10^{-2}	2.81×10^{-1}	1.43×10^{-10}	2.94×10^{-2}	4.10×10^{-1}	6.54×10^{-6}
Nitrate	6.07	1.08×10^{-1}	0.00	8.02	1.89×10^{-1}	0.00	8.02	3.70×10^{-1}	0.00
Total	6.10	4.29×10^{-1}	0.00	8.05	4.69×10^{-1}	1.43×10^{-10}	8.05	7.80×10^{-1}	6.54×10^{-6}
Year of Peak Impact	4387	4387	N/A	4196	4196	3878	4196	4196	3878

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–286. Waste Management Alternative 2, Disposal Group 3, Option Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	9.63×10^{-7}	1.69	5.80×10^{-5}	9.63×10^{-7}	4.33	2.33×10^{-4}	9.63×10^{-7}	8.83	5.08×10^{-4}
Iodine-129	8.47×10^{-9}	2.41	2.74×10^{-5}	8.47×10^{-9}	2.80	9.04×10^{-6}	8.47×10^{-9}	3.46	1.30×10^{-5}
Total	9.71×10^{-7}	4.10	8.54×10^{-5}	9.71×10^{-7}	7.13	2.42×10^{-4}	9.71×10^{-7}	1.23×10^{1}	5.21×10^{-4}
Year of Peak Impact	8393	8393	8393	8393	8393	8173	8393	8393	8173
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	6.63×10^{-7}	3.16×10^{-6}	0.00	6.63×10^{-7}	3.94×10^{-6}	0.00	6.63×10^{-7}	7.12×10^{-6}	0.00
Chromium	8.55×10^{-2}	8.15×10^{-1}	0.00	8.55×10^{-2}	8.15×10^{-1}	4.89×10^{-10}	8.55×10^{-2}	1.19	2.24×10^{-5}
Nitrate	3.02×10^{1}	5.40×10^{-1}	0.00	3.02×10^{1}	7.11×10^{-1}	0.00	3.02×10^{1}	1.39	0.00
Total	3.03×10^{1}	1.35	0.00	3.03×10^{1}	1.53	4.89×10^{-10}	3.03×10^{1}	2.59	2.24×10^{-5}
Year of Peak Impact	4628	4628	N/A	4628	4628	6610	4628	4628	6610

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–287. Waste Management Alternative 2, Disposal Group 3, Option Case, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.61×10^{-7}	1.51	5.19×10^{-5}	8.61×10^{-7}	3.87	1.70×10^{-4}	8.61×10^{-7}	7.89	3.71×10^{-4}
Iodine-129	2.91×10^{-9}	8.29×10^{-1}	9.44×10^{-6}	2.91×10^{-9}	9.63×10^{-1}	1.27×10^{-5}	2.91×10^{-9}	1.19	1.83×10^{-5}
Total	8.64×10^{-7}	2.34	6.13×10^{-5}	8.64×10^{-7}	4.84	1.83×10^{-4}	8.64×10^{-7}	9.08	3.89×10^{-4}
Year of Peak Impact	9284	9284	9284	9284	9284	9284	9284	9284	9284

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	2.69×10^{-7}	1.28×10^{-6}	0.00	2.69×10^{-7}	1.60×10^{-6}	0.00	2.69×10^{-7}	2.89×10^{-6}	0.00
Chromium	1.69×10^{-2}	1.61×10^{-1}	0.00	1.69×10^{-2}	1.61×10^{-1}	8.04×10^{-11}	1.69×10^{-2}	2.35×10^{-1}	3.69×10^{-6}
Nitrate	3.80	6.79×10^{-2}	0.00	3.80	8.94×10^{-2}	0.00	3.80	1.75×10^{-1}	0.00
Total	3.82	2.29×10^{-1}	0.00	3.82	2.51×10^{-1}	8.04×10^{-11}	3.82	4.11×10^{-1}	3.69×10^{-6}
Year of Peak Impact	4954	4954	N/A	4954	4954	6701	4954	4954	6701

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–288. Waste Management Alternative 2, Disposal Group 3, Option Case, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	9.41×10^{-12}	4.23×10^{-5}	1.86×10^{-9}	6.10×10^{-12}	6.34×10^{-5}	3.01×10^{-9}	8.61×10^{-7}	9.42×10^{-3}	5.17×10^{-7}
Iodine-129	6.10×10^{-14}	2.02×10^{-5}	2.68×10^{-10}	8.59×10^{-14}	4.64×10^{-4}	1.12×10^{-8}	2.91×10^{-9}	4.92×10^{-3}	1.21×10^{-7}
Total	9.47×10^{-12}	6.25×10^{-5}	2.13×10^{-9}	6.19×10^{-12}	5.28×10^{-4}	1.42×10^{-8}	8.64×10^{-7}	1.43×10^{-2}	6.38×10^{-7}
Year of Peak Impact	8962	8962	8962	9354	9354	9354	9284	9284	9284
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	6.41×10^{-12}	3.81×10^{-11}	0.00	4.49×10^{-12}	4.83×10^{-11}	0.00	4.07×10^{-7}	2.42×10^{-6}	0.00
Chromium	1.72×10^{-7}	1.64×10^{-6}	7.90×10^{-16}	1.15×10^{-7}	1.75×10^{-6}	3.62×10^{-11}	6.85×10^{-3}	1.51×10^{-2}	1.84×10^{-6}
Nitrate	4.49×10^{-5}	1.55×10^{-6}	0.00	5.65×10^{-5}	5.31×10^{-3}	0.00	5.62	2.02×10^{-1}	0.00
Total	4.50×10^{-5}	3.19×10^{-6}	7.90×10^{-16}	5.66×10^{-5}	5.31×10^{-3}	3.62×10^{-11}	5.62	2.17×10^{-1}	1.84×10^{-6}
Year of Peak Impact	4640	4640	4927	4843	4843	4927	6522	6522	6701

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–34 through Q–37 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier and the Core Zone Boundary for the drinking-water well user over time. For the Base Case, the peak radiological risk occurs around the year 8200 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. For the Option Case, the peak radiological risk occurs around the year 8400 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater.

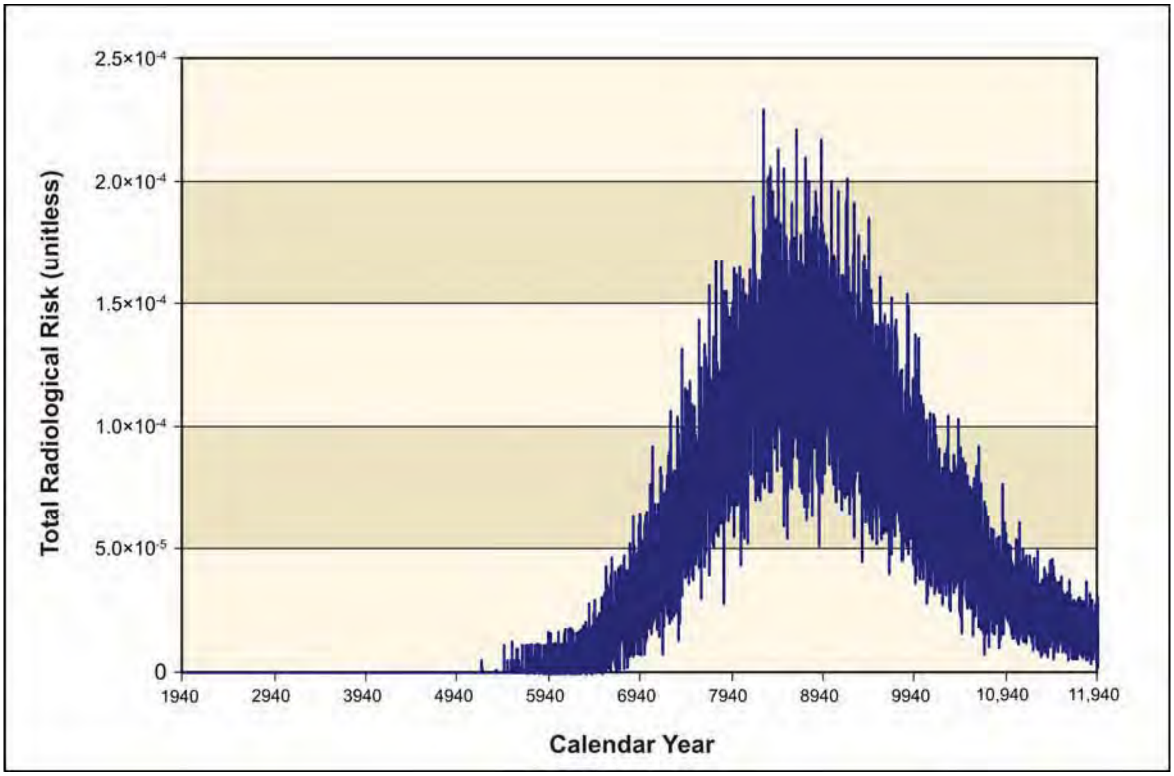

Figure Q–34. Waste Management Alternative 2, Disposal Group 3, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

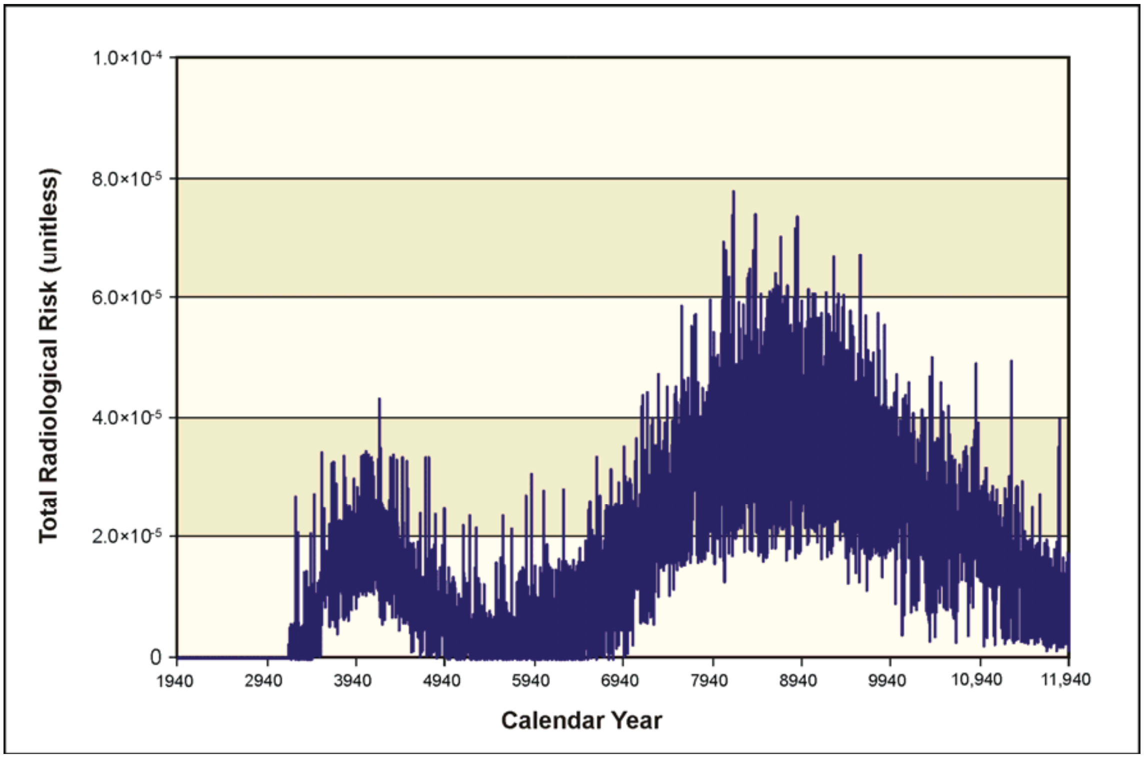

Figure Q–35. Waste Management Alternative 2, Disposal Group 3, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

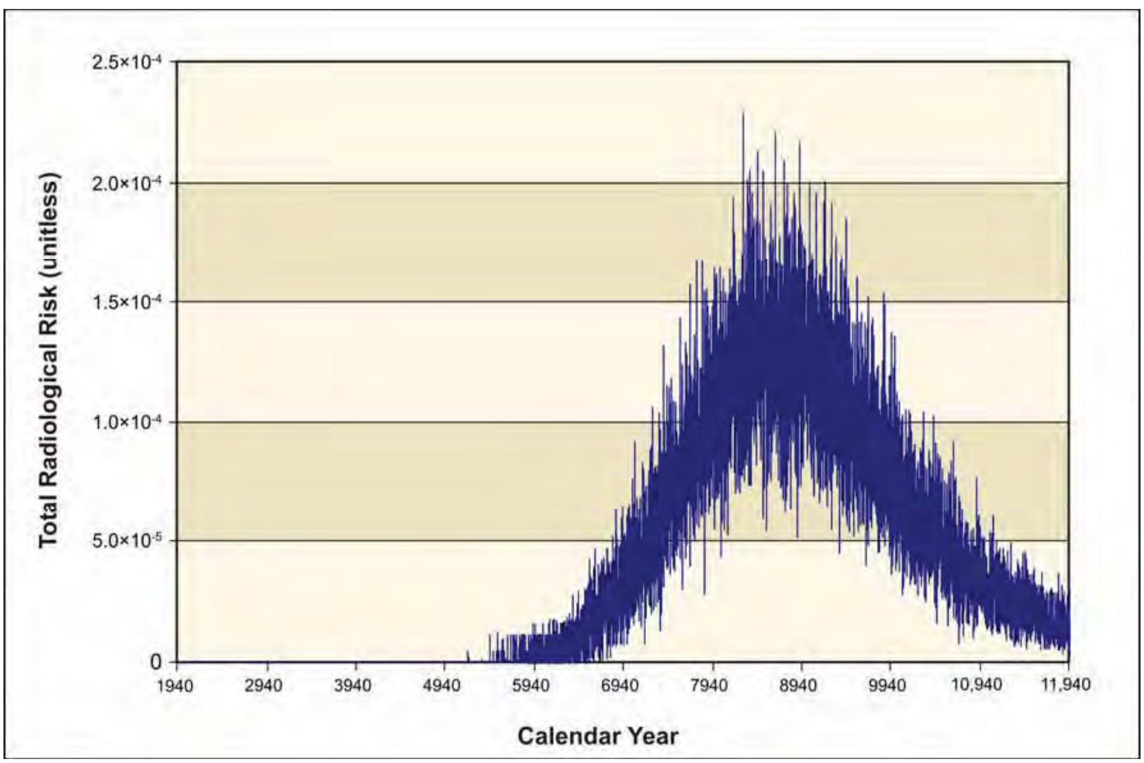

Figure Q–36. Waste Management Alternative 2, Disposal Group 3, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

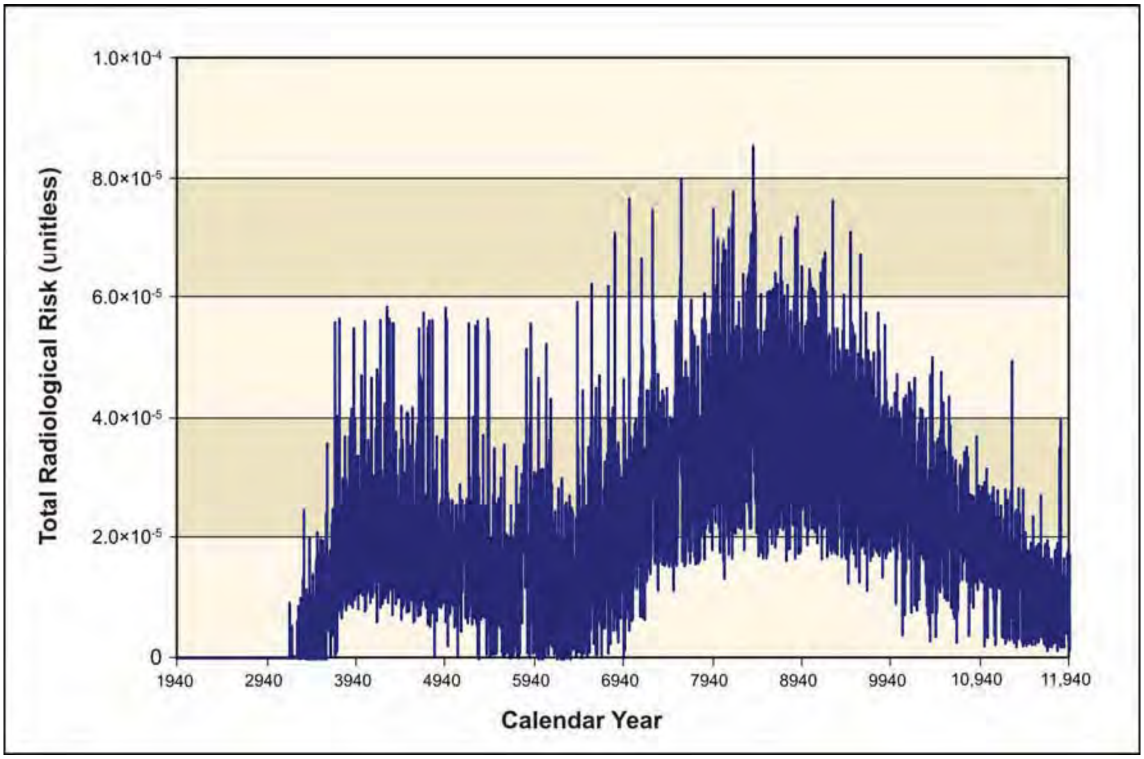

Figure Q–37. Waste Management Alternative 2, Disposal Group 3, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3 Waste Management Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Under Waste Management Alternative 3, the waste from tank treatment operations would be disposed of in IDF-East, and onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites would be disposed of in IDF-West. Waste from tank farm cleanup operations would be disposed of in the RPPDF. As a result, the waste disposed of in these three facilities would become available for release to the environment. Because of the different waste types that result from the Tank Closure action alternatives, three disposal groups were considered to account for the different IDF-East sizes and operational time periods. In addition, within these three disposal groups, subgroups were identified to allow consideration of the different waste types resulting from the Tank Closure alternatives. Potential human health impacts of these subgroups under this alternative are discussed in the following sections.

Q.3.3.1.3.1 Waste Management Alternative 3; Disposal Group 1, Subgroup 1-A

Disposal Group 1, Subgroup 1-A, addresses the waste resulting from Tank Closure Alternative 2B, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 2B.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–289 through Q–294, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are boron and boron compounds, chromium, fluoride, and nitrate, however, the peak chemical hazard is negligible. For radionuclides, the dose standard would be exceeded at IDF-West boundary for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 5.75×10^{-1} person-rem per year for the year of maximum impact.

Table Q–289. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	4.61×10^{-7}	8.08×10^{-1}	2.84×10^{-5}	4.61×10^{-7}	2.08	9.30×10^{-5}	4.71×10^{-7}	4.32	2.03×10^{-4}
Iodine-129	8.24×10^{-10}	2.35×10^{-1}	2.12×10^{-6}	8.24×10^{-10}	2.72×10^{-1}	2.86×10^{-6}	6.53×10^{-10}	2.67×10^{-1}	4.12×10^{-6}
Total	4.62×10^{-7}	1.04	3.05×10^{-5}	4.62×10^{-7}	2.35	9.59×10^{-5}	4.72×10^{-7}	4.58	2.07×10^{-4}
Year of Peak Impact	11,257	11,257	8991	11,257	11,257	8991	8991	8991	8991
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.76×10^{-3}	1.68×10^{-2}	0.00	1.76×10^{-3}	1.68×10^{-2}	1.62×10^{-11}	1.76×10^{-3}	2.46×10^{-2}	7.41×10^{-7}
Nitrate	1.42×10^{1}	2.54×10^{-1}	0.00	1.42×10^{1}	3.35×10^{-1}	0.00	1.42×10^{1}	6.57×10^{-1}	0.00
Total	1.42×10^{1}	2.71×10^{-1}	0.00	1.42×10^{1}	3.52×10^{-1}	1.62×10^{-11}	1.42×10^{1}	6.82×10^{-1}	7.41×10^{-7}
Year of Peak Impact	8522	8522	N/A	8522	8522	8511	8522	8522	8511

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–290. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the 200-West Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–291. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–292. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.43×10^{-6}	1.13×10^{1}	4.55×10^{-4}	6.43×10^{-6}	2.89×10^{1}	1.49×10^{-3}	7.55×10^{-6}	6.92×10^{1}	3.26×10^{-3}
Iodine-129	5.62×10^{-8}	1.60×10^{1}	1.24×10^{-4}	5.62×10^{-8}	1.86×10^{1}	1.68×10^{-4}	3.84×10^{-8}	1.57×10^{1}	2.42×10^{-4}
Total	6.49×10^{-6}	2.73×10^{1}	5.79×10^{-4}	6.49×10^{-6}	4.75×10^{1}	1.66×10^{-3}	7.59×10^{-6}	8.49×10^{1}	3.50×10^{-3}
Year of Peak Impact	3709	3709	3690	3709	3709	3690	3690	3690	3690

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	3.70×10^{-4}	3.52×10^{-3}	0.00	3.70×10^{-4}	3.53×10^{-3}	1.22×10^{-11}	3.70×10^{-4}	5.15×10^{-3}	5.58×10^{-7}
Nitrate	5.63	1.01×10^{-1}	0.00	5.63	1.32×10^{-1}	0.00	5.63	2.60×10^{-1}	0.00
Total	5.63	1.04×10^{-1}	0.00	5.63	1.36×10^{-1}	1.22×10^{-11}	5.63	2.65×10^{-1}	5.58×10^{-7}
Year of Peak Impact	9653	9653	N/A	9653	9653	3628	9653	9653	3628

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–293. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.06×10^{-7}	1.41	6.79×10^{-5}	1.13×10^{-6}	5.07	2.23×10^{-4}	1.13×10^{-6}	1.03×10^{1}	4.86×10^{-4}
Iodine-129	6.88×10^{-9}	1.96	1.34×10^{-5}	4.12×10^{-9}	1.36	1.80×10^{-5}	4.12×10^{-9}	1.68	2.60×10^{-5}
Total	8.12×10^{-7}	3.37	8.13×10^{-5}	1.13×10^{-6}	6.44	2.41×10^{-4}	1.13×10^{-6}	1.20×10^{1}	5.12×10^{-4}
Year of Peak Impact	4388	4388	4191	4191	4191	4191	4191	4191	4191
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.35×10^{-7}	4.79×10^{-8}	0.00	3.35×10^{-7}	4.85×10^{-8}	0.00	3.35×10^{-7}	5.15×10^{-8}	0.00
Chromium	4.11×10^{-4}	3.91×10^{-3}	0.00	4.11×10^{-4}	3.92×10^{-3}	2.88×10^{-12}	4.11×10^{-4}	5.73×10^{-3}	1.32×10^{-7}
Fluoride	2.51×10^{-5}	1.20×10^{-5}	0.00	2.51×10^{-5}	1.23×10^{-5}	0.00	2.51×10^{-5}	1.32×10^{-5}	0.00
Nitrate	2.44	4.36×10^{-2}	0.00	2.44	5.74×10^{-2}	0.00	2.44	1.13×10^{-1}	0.00
Total	2.44	4.76×10^{-2}	0.00	2.44	6.14×10^{-2}	2.88×10^{-12}	2.44	1.18×10^{-1}	1.32×10^{-7}
Year of Peak Impact	8044	8044	N/A	8044	8044	8879	8044	8044	8879

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–294. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.58×10^{-11}	7.09×10^{-5}	3.29×10^{-9}	1.18×10^{-11}	1.23×10^{-4}	7.76×10^{-9}	8.05×10^{-7}	8.81×10^{-3}	6.77×10^{-7}
Iodine-129	1.34×10^{-13}	4.43×10^{-5}	4.72×10^{-10}	1.47×10^{-13}	7.92×10^{-4}	1.74×10^{-8}	6.87×10^{-9}	1.12×10^{-2}	1.82×10^{-7}
Total	1.59×10^{-11}	1.15×10^{-4}	3.77×10^{-9}	1.20×10^{-11}	9.15×10^{-4}	2.51×10^{-8}	8.12×10^{-7}	2.00×10^{-2}	8.58×10^{-7}
Year of Peak Impact	4005	4005	4042	4076	4076	4005	4389	4389	3882

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	7.12×10^{-13}	1.03×10^{-13}	0.00	7.12×10^{-13}	1.13×10^{-13}	0.00	3.35×10^{-7}	3.34×10^{-9}	0.00
Chromium	6.50×10^{-9}	6.19×10^{-8}	3.91×10^{-17}	6.50×10^{-9}	9.92×10^{-8}	1.79×10^{-12}	2.54×10^{-4}	5.61×10^{-4}	6.61×10^{-8}
Nitrate	4.48×10^{-5}	1.55×10^{-6}	0.00	4.48×10^{-5}	4.21×10^{-3}	0.00	2.44	9.51×10^{-2}	0.00
Total	4.48×10^{-5}	1.61×10^{-6}	3.91×10^{-17}	4.48×10^{-5}	4.21×10^{-3}	1.79×10^{-12}	2.44	9.57×10^{-2}	6.61×10^{-8}
Year of Peak Impact	8016	8016	8736	8016	8016	8736	8085	8085	8879

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–38 through Q–40 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-East, the radiological lifetime risk of incidence of cancer does not occur until around the year 11,300 as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East.

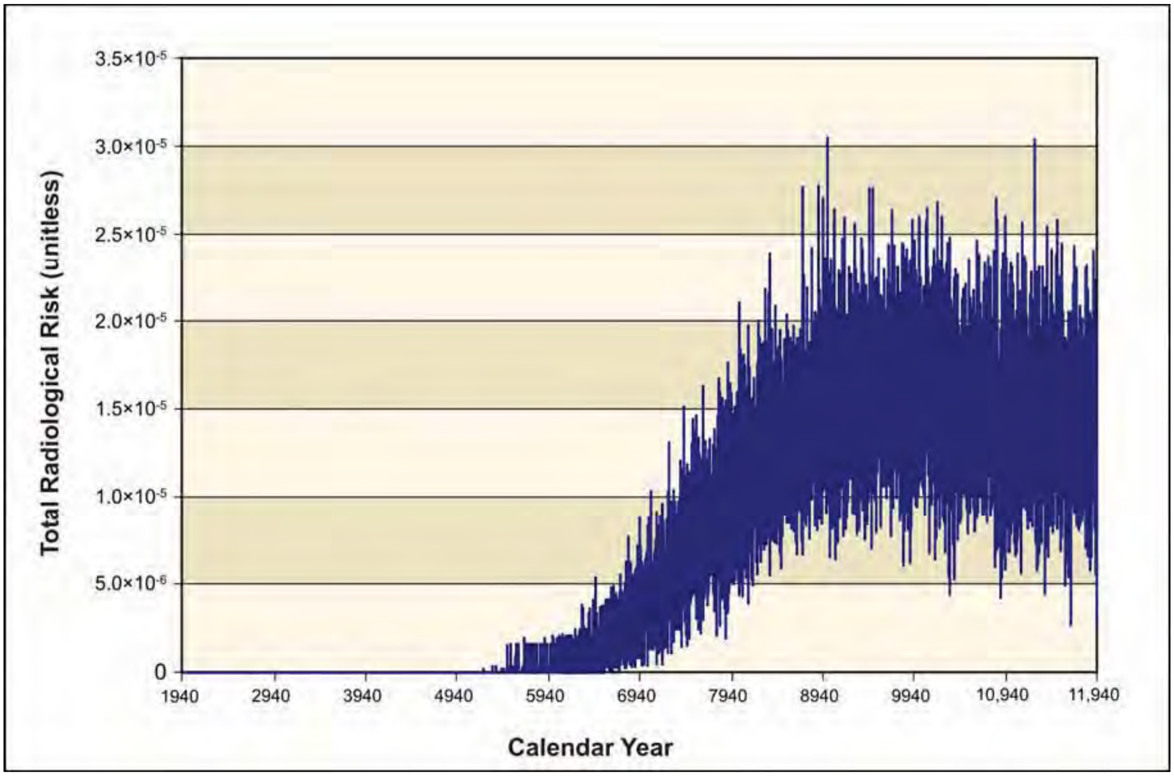

Figure Q–38. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

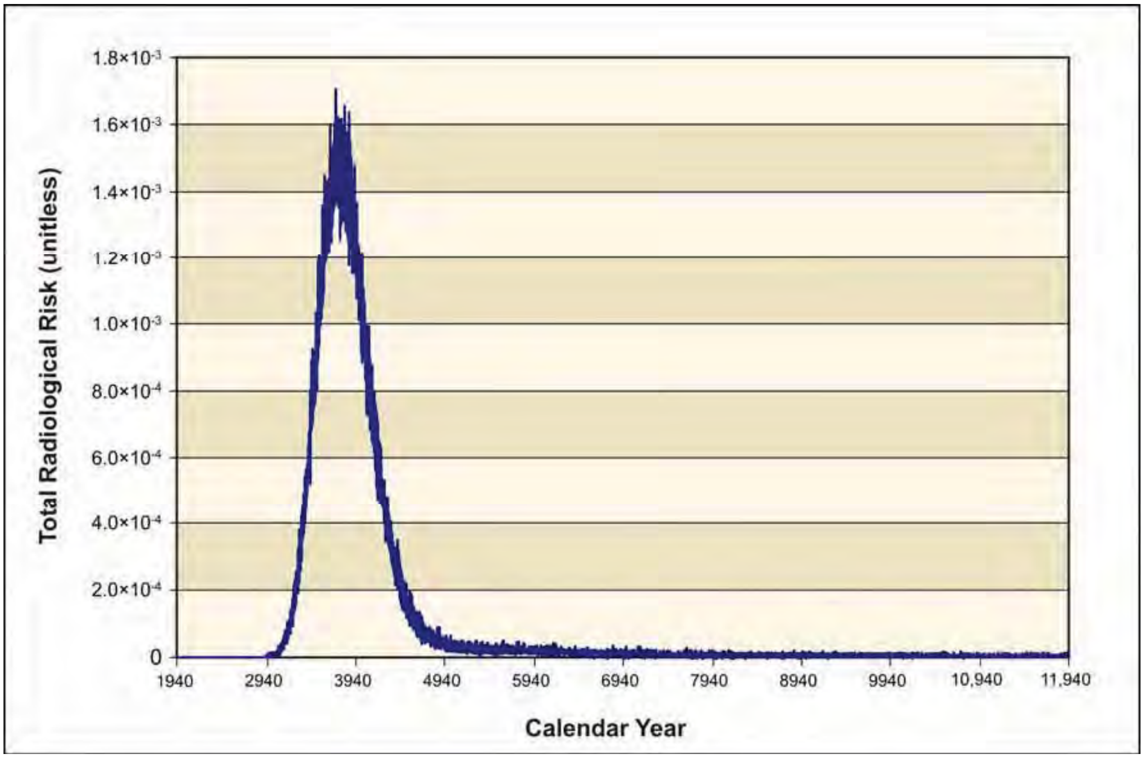

Figure Q–39. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

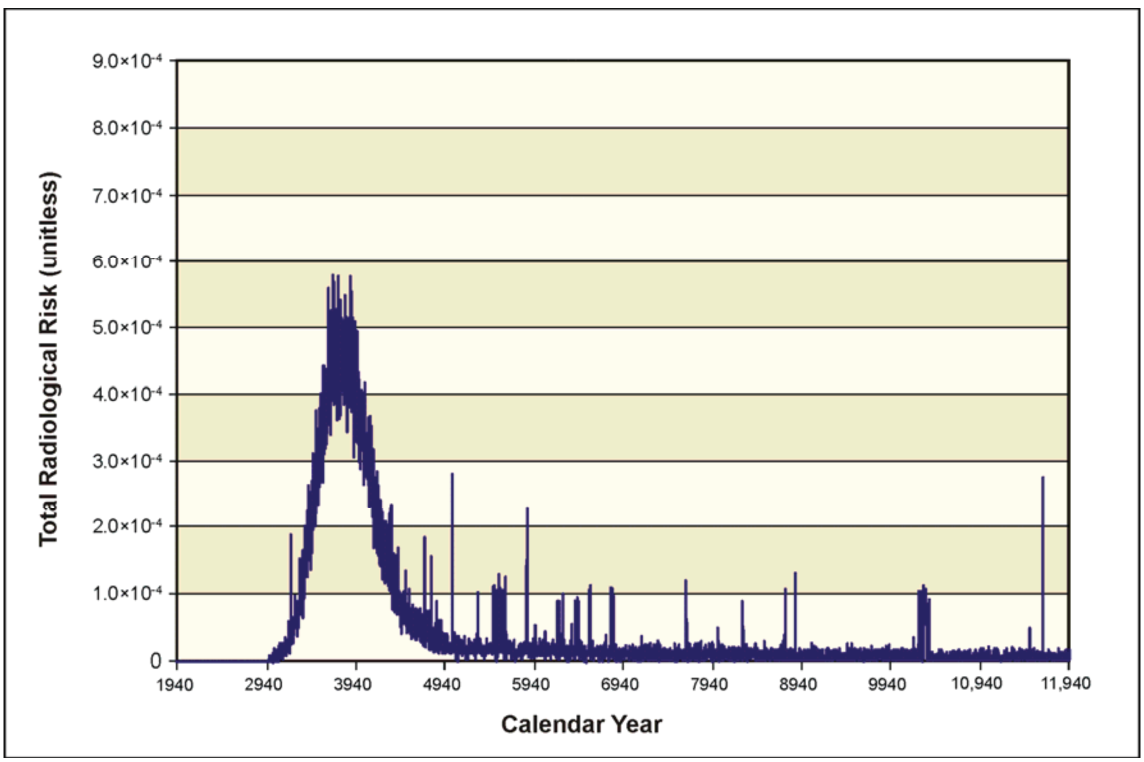

Figure Q–40. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.2 Waste Management Alternative 3; Disposal Group 1, Subgroup 1-B

Disposal Group 1, Subgroup 1-B, addresses the waste resulting from Tank Closure Alternative 3A, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Bulk vitrification glass
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 3A.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–295 through Q–300, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are boron and boron compounds, chromium, fluoride, and nitrate, however, the peak chemical hazard is negligible. For radionuclides, the dose standard would be exceeded at the IDF-West barrier for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 5.75×10^{-1} person-rem per year for the year of maximum impact.

Table Q–295. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.60×10^{-6}	2.81	9.66×10^{-5}	1.60×10^{-6}	7.22	3.17×10^{-4}	1.60×10^{-6}	1.47×10^{1}	6.91×10^{-4}
Iodine-129	6.64×10^{-10}	1.89×10^{-1}	2.15×10^{-6}	6.64×10^{-10}	2.19×10^{-1}	2.90×10^{-6}	6.64×10^{-10}	2.71×10^{-1}	4.18×10^{-6}
Total	1.60×10^{-6}	3.00	9.88×10^{-5}	1.60×10^{-6}	7.44	3.20×10^{-4}	1.60×10^{-6}	1.50×10^{1}	6.96×10^{-4}
Year of Peak Impact	8486	8486	8486	8486	8486	8486	8486	8486	8486
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	7.32×10^{-4}	6.97×10^{-3}	0.00	7.32×10^{-4}	6.98×10^{-3}	6.22×10^{-12}	7.32×10^{-4}	1.02×10^{-2}	2.85×10^{-7}
Nitrate	1.44×10^{1}	2.57×10^{-1}	0.00	1.44×10^{1}	3.38×10^{-1}	0.00	1.44×10^{1}	6.63×10^{-1}	0.00
Total	1.44×10^{1}	2.64×10^{-1}	0.00	1.44×10^{1}	3.45×10^{-1}	6.22×10^{-12}	1.44×10^{1}	6.74×10^{-1}	2.85×10^{-7}
Year of Peak Impact	7821	7821	N/A	7821	7821	8278	7821	7821	8278

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–296. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the 200-West Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–297. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–298. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	6.43×10^{-6}	1.13×10^{1}	4.55×10^{-4}	6.43×10^{-6}	2.89×10^{1}	1.49×10^{-3}	7.55×10^{-6}	6.92×10^{1}	3.26×10^{-3}
Iodine-129	5.62×10^{-8}	1.60×10^{1}	1.24×10^{-4}	5.62×10^{-8}	1.86×10^{1}	1.68×10^{-4}	3.84×10^{-8}	1.57×10^{1}	2.42×10^{-4}
Total	6.49×10^{-6}	2.73×10^{1}	5.79×10^{-4}	6.49×10^{-6}	4.75×10^{1}	1.66×10^{-3}	7.59×10^{-6}	8.49×10^{1}	3.50×10^{-3}
Year of Peak Impact	3709	3709	3690	3709	3709	3690	3690	3690	3690
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.59×10^{-4}	1.52×10^{-3}	0.00	1.59×10^{-4}	1.52×10^{-3}	1.22×10^{-11}	1.59×10^{-4}	2.22×10^{-3}	5.58×10^{-7}
Nitrate	5.86	1.05×10^{-1}	0.00	5.86	1.38×10^{-1}	0.00	5.86	2.70×10^{-1}	0.00
Total	5.86	1.06×10^{-1}	0.00	5.86	1.39×10^{-1}	1.22×10^{-11}	5.86	2.72×10^{-1}	5.58×10^{-7}
Year of Peak Impact	8905	8905	N/A	8905	8905	3628	8905	8905	3628

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–299. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.06×10^{-7}	1.41	6.79×10^{-5}	1.13×10^{-6}	5.07	2.23×10^{-4}	1.13×10^{-6}	1.03×10^{1}	4.86×10^{-4}
Iodine-129	6.88×10^{-9}	1.96	1.34×10^{-5}	4.12×10^{-9}	1.36	1.80×10^{-5}	4.12×10^{-9}	1.68	2.60×10^{-5}
Total	8.12×10^{-7}	3.37	8.13×10^{-5}	1.13×10^{-6}	6.44	2.41×10^{-4}	1.13×10^{-6}	1.20×10^{1}	5.12×10^{-4}
Year of Peak Impact	4388	4388	4191	4191	4191	4191	4191	4191	4191
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.35×10^{-7}	4.79×10^{-8}	0.00	3.35×10^{-7}	4.85×10^{-8}	0.00	3.35×10^{-7}	5.15×10^{-8}	0.00
Chromium	1.40×10^{-4}	1.33×10^{-3}	0.00	1.40×10^{-4}	1.33×10^{-3}	1.80×10^{-12}	1.40×10^{-4}	1.95×10^{-3}	8.28×10^{-8}
Fluoride	2.51×10^{-5}	1.20×10^{-5}	0.00	2.51×10^{-5}	1.23×10^{-5}	0.00	2.51×10^{-5}	1.32×10^{-5}	0.00
Nitrate	3.68	6.57×10^{-2}	0.00	3.68	8.65×10^{-2}	0.00	3.68	1.70×10^{-1}	0.00
Total	3.68	6.71×10^{-2}	0.00	3.68	8.79×10^{-2}	1.80×10^{-12}	3.68	1.72×10^{-1}	8.28×10^{-8}
Year of Peak Impact	8144	8144	N/A	8144	8144	4812	8144	8144	4812

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–300. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.58×10^{-11}	7.09×10^{-5}	3.29×10^{-9}	1.18×10^{-11}	1.23×10^{-4}	7.76×10^{-9}	8.05×10^{-7}	8.81×10^{-3}	6.77×10^{-7}
Iodine-129	1.34×10^{-13}	4.43×10^{-5}	4.72×10^{-10}	1.47×10^{-13}	7.92×10^{-4}	1.74×10^{-8}	6.87×10^{-9}	1.12×10^{-2}	1.82×10^{-7}
Total	1.59×10^{-11}	1.15×10^{-4}	3.77×10^{-9}	1.20×10^{-11}	9.15×10^{-4}	2.51×10^{-8}	8.12×10^{-7}	2.00×10^{-2}	8.58×10^{-7}
Year of Peak Impact	4005	4005	4042	4076	4076	4005	4389	4389	3882

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	7.12×10^{-13}	1.03×10^{-13}	0.00	7.12×10^{-13}	1.13×10^{-13}	0.00	3.35×10^{-7}	3.34×10^{-9}	0.00
Chromium	2.91×10^{-9}	2.77×10^{-8}	3.00×10^{-17}	2.91×10^{-9}	4.44×10^{-8}	1.37×10^{-12}	1.40×10^{-4}	3.09×10^{-4}	4.14×10^{-8}
Fluoride	5.38×10^{-11}	2.64×10^{-11}	0.00	5.38×10^{-11}	3.74×10^{-11}	0.00	2.51×10^{-5}	3.67×10^{-6}	0.00
Nitrate	4.29×10^{-5}	1.48×10^{-6}	0.00	4.29×10^{-5}	4.03×10^{-3}	0.00	3.68	1.35×10^{-1}	0.00
Total	4.29×10^{-5}	1.51×10^{-6}	3.00×10^{-17}	4.29×10^{-5}	4.03×10^{-3}	1.37×10^{-12}	3.68	1.36×10^{-1}	4.14×10^{-8}
Year of Peak Impact	8558	8558	3934	8558	8558	3934	8144	8144	4812

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–41 through Q–43 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For IDF-East, the radiological lifetime risk of incidence of cancer does not occur until around the year 8500 as a result of slower movement through the vadose zone for waste forms disposed of in the IDF-East.

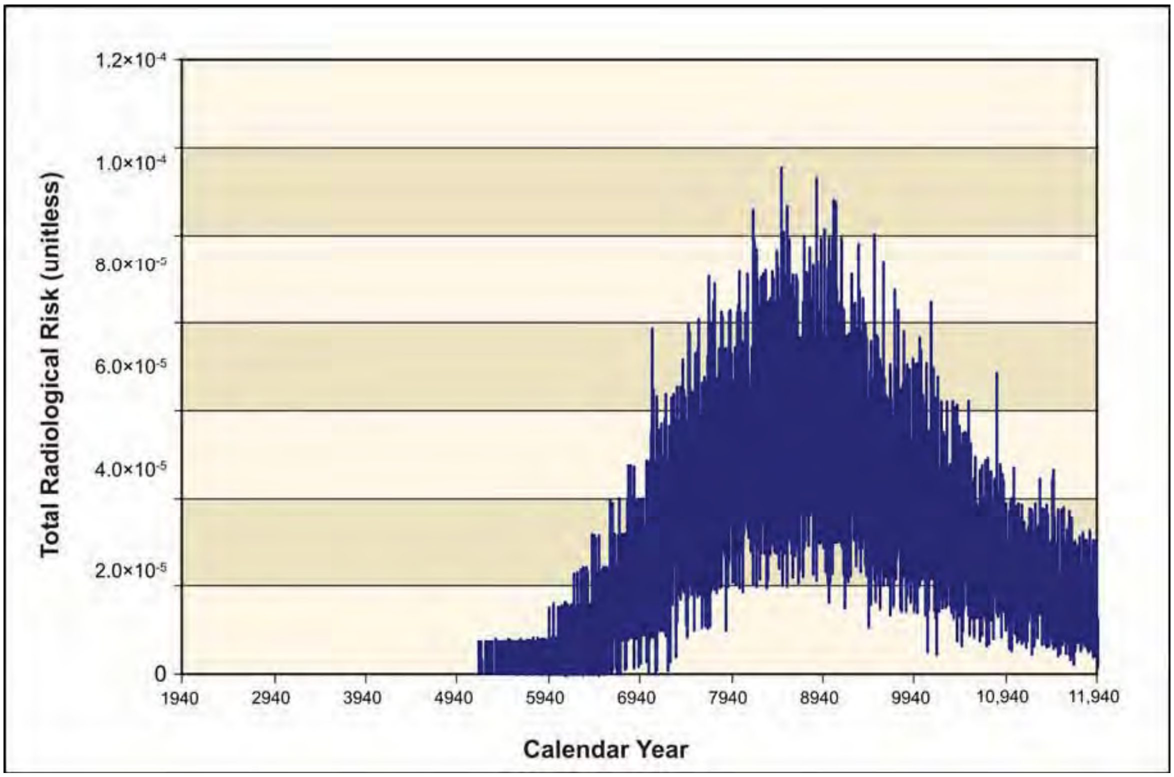

Figure Q–41. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

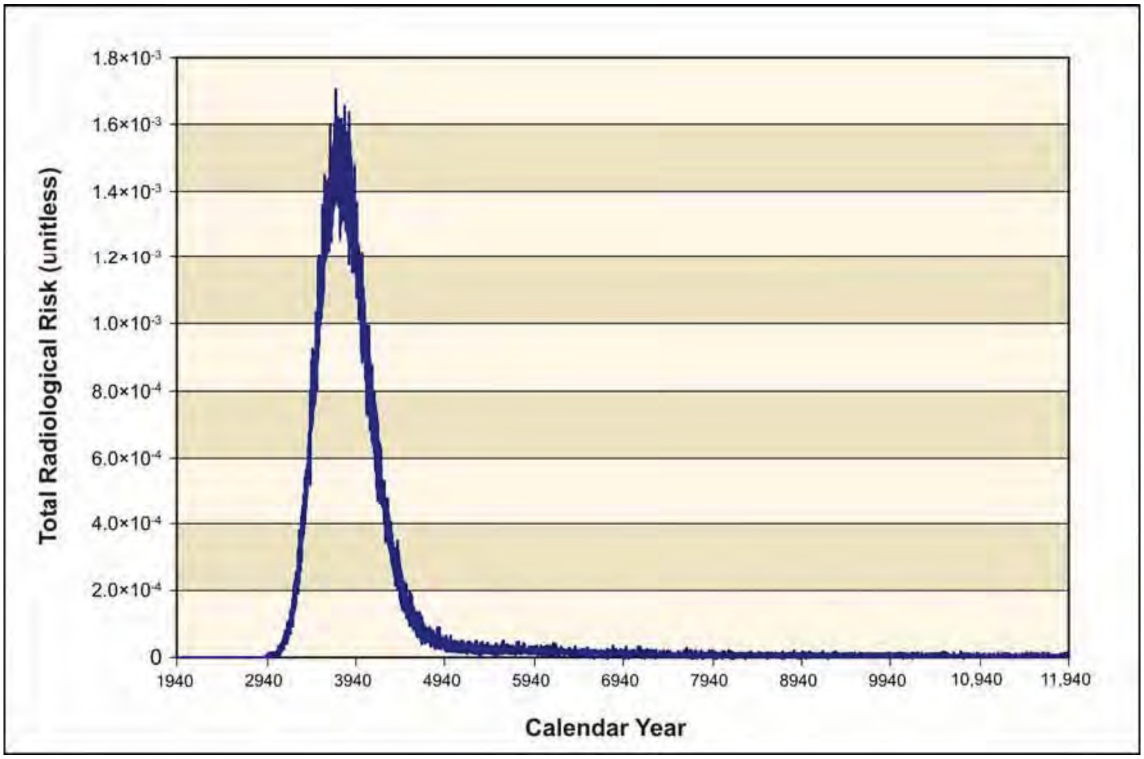

Figure Q–42. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

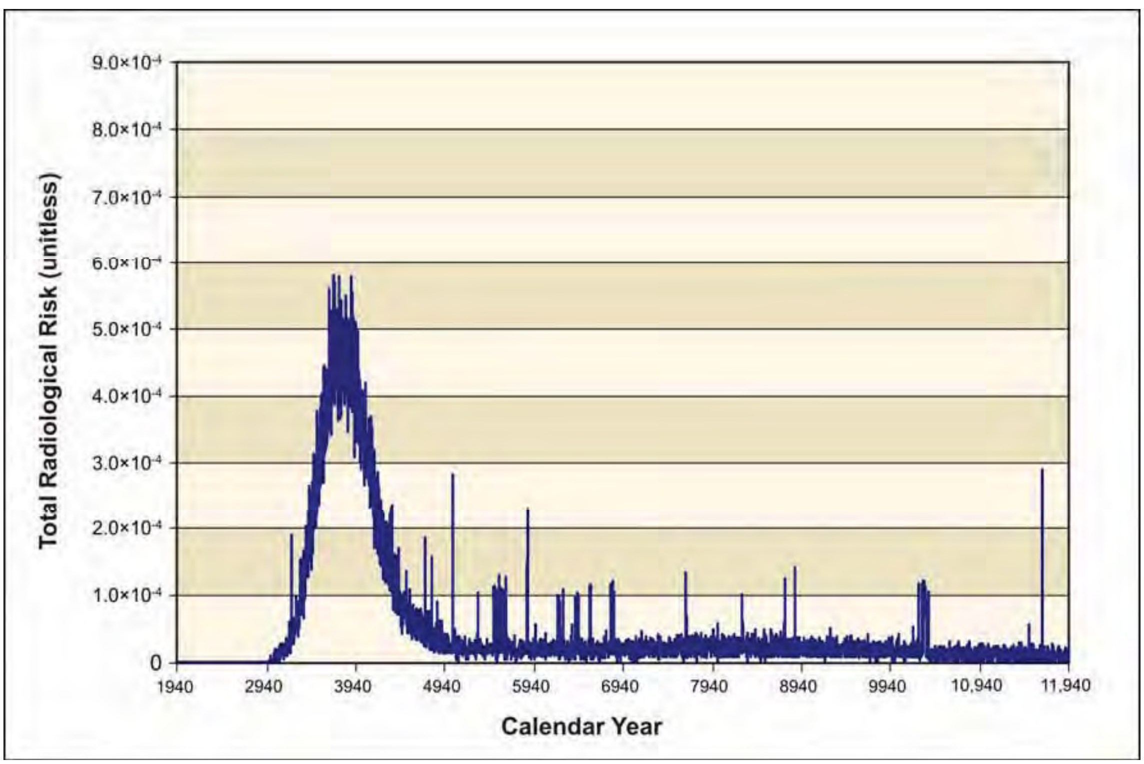

Figure Q–43. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-B, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.3 Waste Management Alternative 3; Disposal Group 1, Subgroup 1-C

Disposal Group 1, Subgroup 1-C, addresses the waste resulting from Tank Closure Alternative 3B, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Cast stone
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 3B.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–301 through Q–306, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate. For radionuclides, the dose standard would be exceeded at the IDF-West barrier for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would be exceeded primarily due to chromium and nitrate at the IDF-East barrier, the Core Zone Boundary, and the Columbia River nearshore for the drinking-water well user, resident farmer, and American Indian resident farmer. Population dose was estimated as 5.75×10^{-1} person-rem per year for the year of maximum impact.

Table Q–301. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	5.02×10^{-6}	8.80	3.02×10^{-4}	5.02×10^{-6}	2.26×10^{1}	9.92×10^{-4}	5.02×10^{-6}	4.60×10^{1}	2.16×10^{-3}
Iodine-129	2.97×10^{-10}	8.45×10^{-2}	9.62×10^{-7}	2.97×10^{-10}	9.81×10^{-2}	1.30×10^{-6}	2.97×10^{-10}	1.21×10^{-1}	1.87×10^{-6}
Total	5.02×10^{-6}	8.88	3.03×10^{-4}	5.02×10^{-6}	2.27×10^{1}	9.93×10^{-4}	5.02×10^{-6}	4.61×10^{1}	2.17×10^{-3}
Year of Peak Impact	9048	9048	9048	9048	9048	9048	9048	9048	9048

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	1.26×10^{-2}	6.02×10^{-2}	0.00	1.26×10^{-2}	7.51×10^{-2}	0.00	1.26×10^{-2}	1.36×10^{-1}	0.00
Chromium	4.36×10^{-1}	4.16	0.00	4.36×10^{-1}	4.16	1.71×10^{-9}	4.36×10^{-1}	6.08	7.86×10^{-5}
Nitrate	3.58×10^{1}	6.40×10^{-1}	0.00	3.58×10^{1}	8.43×10^{-1}	0.00	3.58×10^{1}	1.65	0.00
Total	3.63×10^{1}	4.86	0.00	3.63×10^{1}	5.08	1.71×10^{-9}	3.63×10^{1}	7.87	7.86×10^{-5}
Year of Peak Impact	8940	8940	N/A	8940	8940	8940	8940	8940	8940

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–302. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the 200-West Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–303. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–304. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.43×10^{-6}	1.13×10^{1}	4.55×10^{-4}	6.43×10^{-6}	2.89×10^{1}	1.49×10^{-3}	7.55×10^{-6}	6.92×10^{1}	3.26×10^{-3}
Iodine-129	5.62×10^{-8}	1.60×10^{1}	1.24×10^{-4}	5.62×10^{-8}	1.86×10^{1}	1.68×10^{-4}	3.84×10^{-8}	1.57×10^{1}	2.42×10^{-4}
Total	6.49×10^{-6}	2.73×10^{1}	5.79×10^{-4}	6.49×10^{-6}	4.75×10^{1}	1.66×10^{-3}	7.59×10^{-6}	8.49×10^{1}	3.50×10^{-3}
Year of Peak Impact	3709	3709	3690	3709	3709	3690	3690	3690	3690

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	5.42×10^{-3}	2.58×10^{-2}	0.00	5.42×10^{-3}	3.22×10^{-2}	0.00	5.42×10^{-3}	5.82×10^{-2}	0.00
Chromium	2.65×10^{-1}	2.52	0.00	2.65×10^{-1}	2.52	1.04×10^{-9}	2.65×10^{-1}	3.69	4.77×10^{-5}
Nitrate	1.05×10^{1}	1.87×10^{-1}	0.00	1.05×10^{1}	2.47×10^{-1}	0.00	1.05×10^{1}	4.84×10^{-1}	0.00
Total	1.08×10^{1}	2.73	0.00	1.08×10^{1}	2.80	1.04×10^{-9}	1.08×10^{1}	4.23	4.77×10^{-5}
Year of Peak Impact	8760	8760	N/A	8760	8760	8760	8760	8760	8760

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–305. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.69×10^{-6}	2.96	1.02×10^{-4}	1.69×10^{-6}	7.60	3.34×10^{-4}	1.69×10^{-6}	1.55×10^{1}	7.28×10^{-4}
Iodine-129	1.45×10^{-9}	4.12×10^{-1}	4.69×10^{-6}	1.45×10^{-9}	4.79×10^{-1}	6.34×10^{-6}	1.45×10^{-9}	5.91×10^{-1}	9.12×10^{-6}
Total	1.69×10^{-6}	3.37	1.06×10^{-4}	1.69×10^{-6}	8.08	3.40×10^{-4}	1.69×10^{-6}	1.61×10^{1}	7.37×10^{-4}
Year of Peak Impact	8939	8939	8939	8939	8939	8939	8939	8939	8939
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.81×10^{-3}	8.60×10^{-3}	0.00	1.81×10^{-3}	1.07×10^{-2}	0.00	1.81×10^{-3}	1.94×10^{-2}	0.00
Boron and Compounds	3.35×10^{-7}	4.79×10^{-8}	0.00	3.35×10^{-7}	4.85×10^{-8}	0.00	3.35×10^{-7}	5.16×10^{-8}	0.00
Chromium	1.16×10^{-1}	1.11	0.00	1.16×10^{-1}	1.11	4.57×10^{-10}	1.16×10^{-1}	1.62	2.10×10^{-5}
Fluoride	2.51×10^{-5}	1.20×10^{-5}	0.00	2.51×10^{-5}	1.23×10^{-5}	0.00	2.51×10^{-5}	1.33×10^{-5}	0.00
Nitrate	7.07	1.26×10^{-1}	0.00	7.07	1.66×10^{-1}	0.00	7.07	3.26×10^{-1}	0.00
Total	7.19	1.24	0.00	7.19	1.29	4.57×10^{-10}	7.19	1.97	2.10×10^{-5}
Year of Peak Impact	9310	9310	N/A	9310	9310	9311	9310	9310	9311

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–306. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.58×10^{-11}	7.09×10^{-5}	3.29×10^{-9}	1.18×10^{-11}	1.23×10^{-4}	7.76×10^{-9}	1.69×10^{-6}	1.84×10^{-2}	1.01×10^{-6}
Iodine-129	1.34×10^{-13}	4.43×10^{-5}	4.72×10^{-10}	1.47×10^{-13}	7.92×10^{-4}	1.74×10^{-8}	1.45×10^{-9}	2.16×10^{-3}	5.30×10^{-8}
Total	1.59×10^{-11}	1.15×10^{-4}	3.77×10^{-9}	1.20×10^{-11}	9.15×10^{-4}	2.51×10^{-8}	1.69×10^{-6}	2.06×10^{-2}	1.07×10^{-6}
Year of Peak Impact	4005	4005	4042	4076	4076	4005	8939	8939	8939
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	6.80×10^{-8}	4.04×10^{-7}	0.00	7.98×10^{-8}	8.57×10^{-7}	0.00	1.81×10^{-3}	1.07×10^{-2}	0.00
Chromium	1.41×10^{-6}	1.34×10^{-5}	5.84×10^{-15}	1.01×10^{-6}	1.54×10^{-5}	2.68×10^{-10}	5.82×10^{-2}	1.28×10^{-1}	1.05×10^{-5}
Nitrate	1.53×10^{-4}	5.27×10^{-6}	0.00	1.91×10^{-4}	1.80×10^{-2}	0.00	1.39×10^{1}	5.20×10^{-1}	0.00
Total	1.54×10^{-4}	1.91×10^{-5}	5.84×10^{-15}	1.92×10^{-4}	1.80×10^{-2}	2.68×10^{-10}	1.40×10^{1}	6.59×10^{-1}	1.05×10^{-5}
Year of Peak Impact	9141	9141	9446	9138	9138	9446	9451	9451	9311

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–44 through Q–46 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For IDF-East, the radiological lifetime risk of incidence of cancer does not occur until around the year 9000 as a result of slower movement in the vadose zone for waste forms disposed of in IDF-East.

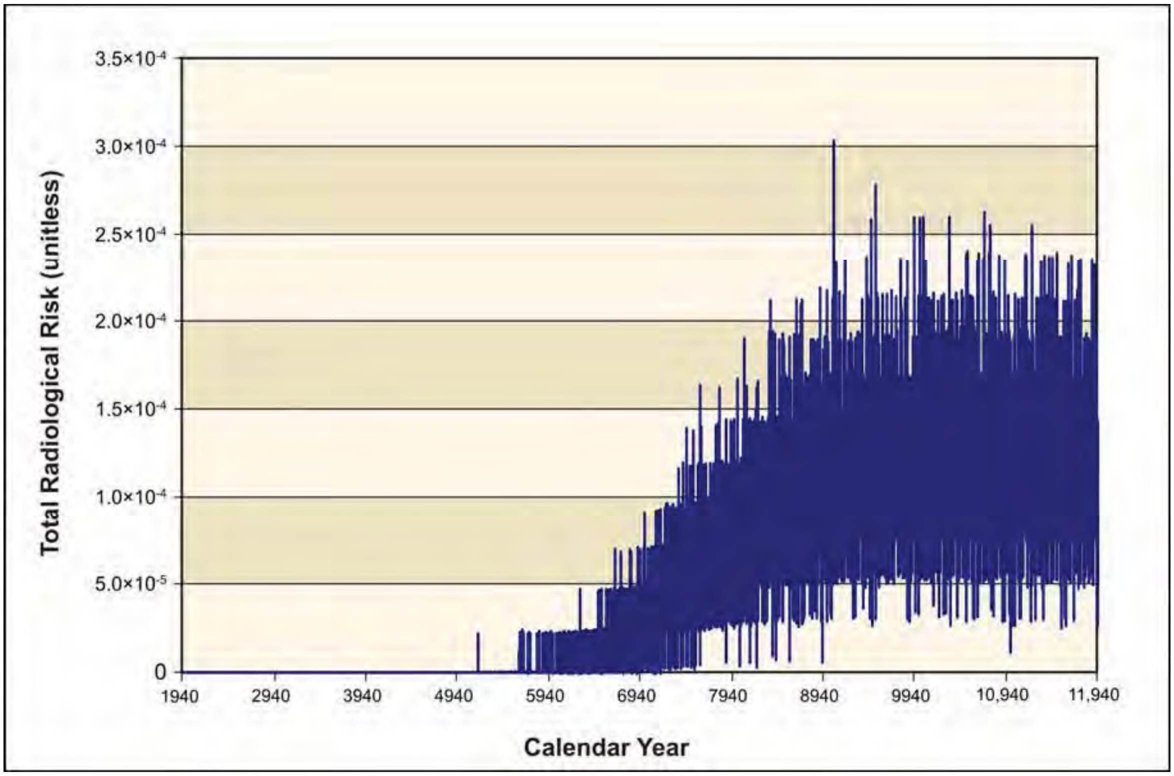

Figure Q–44. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

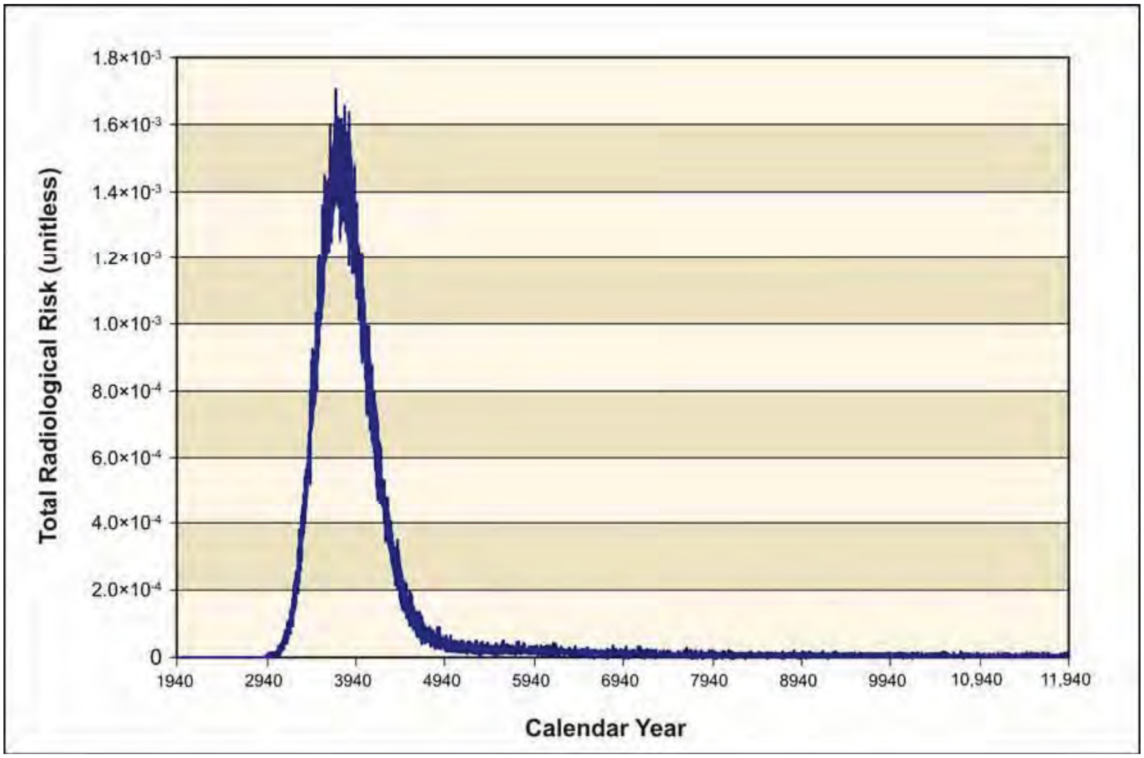

Figure Q–45. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

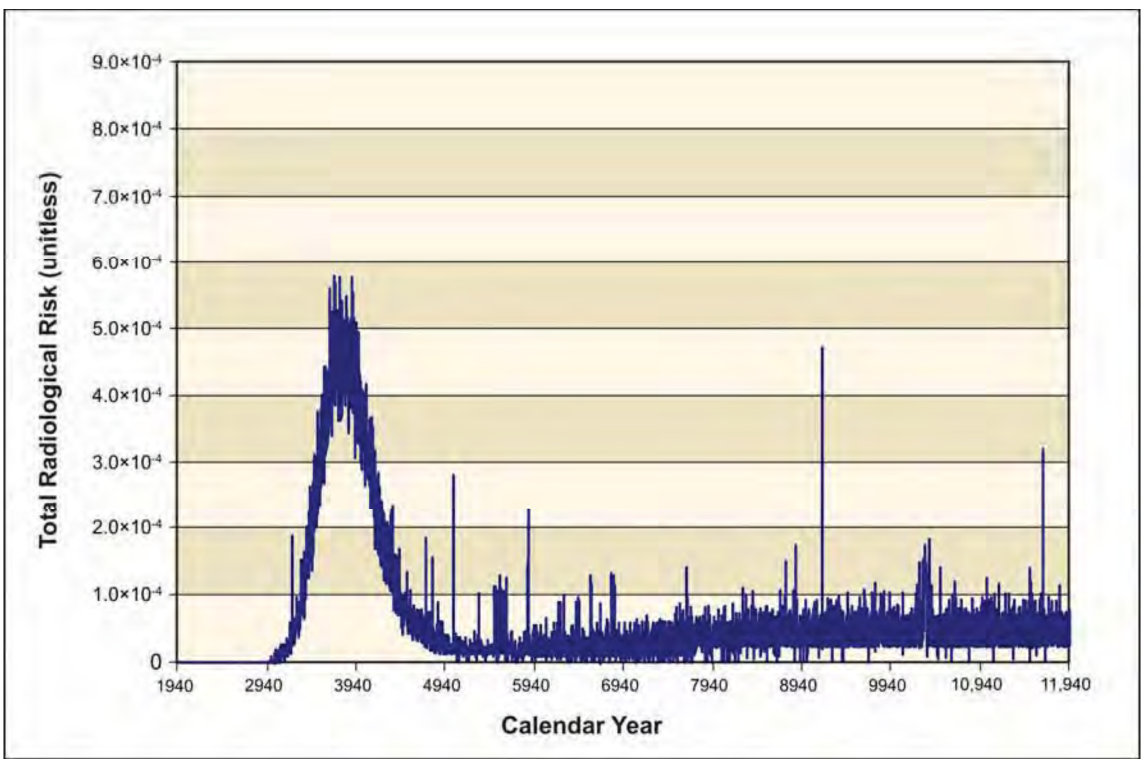

Figure Q–46. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-C, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.4 Waste Management Alternative 3; Disposal Group 1, Subgroup 1-D

Disposal Group 1, Subgroup 1-D, addresses the waste resulting from Tank Closure Alternative 3C, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Steam reforming waste
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 3C.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–307 through Q–312, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are boron and boron compounds, chromium, fluoride, and nitrate. For radionuclides, the dose standard would be exceeded at the IDF-East barrier, the IDF-West barrier and the Core Zone Boundary for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would be exceeded primarily due to chromium at the IDF-East barrier, Core Zone Boundary, and Columbia River nearshore for the drinking-water well user, resident farmer, and American Indian resident farmer. Population dose was estimated as 2.24 person-rem per year for the year of maximum impact.

Table Q–307. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.92×10^{-5}	5.11×10^{1}	1.76×10^{-3}	2.92×10^{-5}	1.31×10^{2}	5.76×10^{-3}	2.92×10^{-5}	2.67×10^{2}	1.26×10^{-2}
Iodine-129	6.01×10^{-9}	1.71	1.95×10^{-5}	6.01×10^{-9}	1.99	2.63×10^{-5}	6.01×10^{-9}	2.45	3.79×10^{-5}
Total	2.92×10^{-5}	5.28×10^{1}	1.78×10^{-3}	2.92×10^{-5}	1.33×10^{2}	5.79×10^{-3}	2.92×10^{-5}	2.70×10^{2}	1.26×10^{-2}
Year of Peak Impact	9032	9032	9032	9032	9032	9032	9032	9032	9032
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	4.35×10^{-1}	4.14	0.00	4.35×10^{-1}	4.15	1.71×10^{-9}	4.35×10^{-1}	6.06	7.85×10^{-5}
Nitrate	8.54	1.52×10^{-1}	0.00	8.54	2.01×10^{-1}	0.00	8.54	3.94×10^{-1}	0.00
Total	8.97	4.30	0.00	8.97	4.35	1.71×10^{-9}	8.97	6.46	7.85×10^{-5}
Year of Peak Impact	8442	8442	N/A	8442	8442	9071	8442	8442	9071

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–308. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the 200-West Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–309. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–310. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.46×10^{-5}	4.31×10^{1}	1.48×10^{-3}	2.46×10^{-5}	1.11×10^{2}	4.87×10^{-3}	2.46×10^{-5}	2.26×10^{2}	1.06×10^{-2}
Iodine-129	2.71×10^{-9}	7.72×10^{-1}	8.79×10^{-6}	2.71×10^{-9}	8.97×10^{-1}	1.19×10^{-5}	2.71×10^{-9}	1.11	1.71×10^{-5}
Total	2.46×10^{-5}	4.39×10^{1}	1.49×10^{-3}	2.46×10^{-5}	1.12×10^{2}	4.88×10^{-3}	2.46×10^{-5}	2.27×10^{2}	1.06×10^{-2}
Year of Peak Impact	9067	9067	9067	9067	9067	9067	9067	9067	9067
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.74×10^{-1}	1.66	0.00	1.74×10^{-1}	1.66	6.84×10^{-10}	1.74×10^{-1}	2.43	3.14×10^{-5}
Nitrate	1.66	2.96×10^{-2}	0.00	1.66	3.90×10^{-2}	0.00	1.66	7.64×10^{-2}	0.00
Total	1.83	1.69	0.00	1.83	1.70	6.84×10^{-10}	1.83	2.50	3.14×10^{-5}
Year of Peak Impact	8397	8397	N/A	8397	8397	8397	8397	8397	8397

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–311. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	7.44×10^{-6}	1.30×10^{1}	4.48×10^{-4}	7.44×10^{-6}	3.35×10^{1}	1.47×10^{-3}	7.44×10^{-6}	6.82×10^{1}	3.21×10^{-3}
Iodine-129	3.49×10^{-9}	9.93×10^{-1}	1.13×10^{-5}	3.49×10^{-9}	1.15	1.53×10^{-5}	3.49×10^{-9}	1.42	2.20×10^{-5}
Total	7.45×10^{-6}	1.40×10^{1}	4.60×10^{-4}	7.45×10^{-6}	3.46×10^{1}	1.49×10^{-3}	7.45×10^{-6}	6.96×10^{1}	3.23×10^{-3}
Year of Peak Impact	7821	7821	7821	7821	7821	7821	7821	7821	7821
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.16×10^{-1}	1.11	0.00	1.16×10^{-1}	1.11	4.56×10^{-10}	1.16×10^{-1}	1.62	2.09×10^{-5}
Nitrate	8.28×10^{-1}	1.48×10^{-2}	0.00	8.28×10^{-1}	1.95×10^{-2}	0.00	8.28×10^{-1}	3.82×10^{-2}	0.00
Total	9.44×10^{-1}	1.12	0.00	9.44×10^{-1}	1.13	4.56×10^{-10}	9.44×10^{-1}	1.65	2.09×10^{-5}
Year of Peak Impact	9878	9878	N/A	9878	9878	9878	9878	9878	9878

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–312. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	9.78×10^{-11}	4.40×10^{-4}	1.93×10^{-8}	9.53×10^{-11}	9.91×10^{-4}	4.82×10^{-8}	7.44×10^{-6}	8.13×10^{-2}	4.46×10^{-6}
Iodine-129	2.28×10^{-14}	7.54×10^{-6}	9.99×10^{-11}	2.77×10^{-14}	1.49×10^{-4}	2.96×10^{-9}	3.49×10^{-9}	5.24×10^{-3}	1.29×10^{-7}
Total	9.78×10^{-11}	4.47×10^{-4}	1.94×10^{-8}	9.54×10^{-11}	1.14×10^{-3}	5.11×10^{-8}	7.45×10^{-6}	8.66×10^{-2}	4.59×10^{-6}
Year of Peak Impact	9193	9193	9193	9247	9247	9193	7821	7821	7821
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	1.66×10^{-6}	1.58×10^{-5}	6.52×10^{-15}	7.11×10^{-7}	1.08×10^{-5}	2.99×10^{-10}	1.16×10^{-1}	2.56×10^{-1}	1.05×10^{-5}
Nitrate	3.01×10^{-5}	1.04×10^{-6}	0.00	5.04×10^{-5}	4.73×10^{-3}	0.00	8.28×10^{-1}	3.16×10^{-2}	0.00
Total	3.18×10^{-5}	1.69×10^{-5}	6.52×10^{-15}	5.11×10^{-5}	4.74×10^{-3}	2.99×10^{-10}	9.44×10^{-1}	2.88×10^{-1}	1.05×10^{-5}
Year of Peak Impact	8877	8877	8877	8446	8446	8877	9878	9878	9878

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–47 through Q–49 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 9000 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-East. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-West barrier, the radiological lifetime risk of incidence of cancer occurs around the year 3700, and for the IDF-East barrier, the radiological lifetime risk of incidence of cancer occurs around the year 9000 as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East. While the peak of the series of time average of lifetime radiological risk appears on the curve of Figure Q–49, the peak of the series of instantaneous lifetime radiological risk does not appear in the figure as the upper limit of the risk scale was reduced to facilitate comparison of the peaks attributed to RPPDF and IDF-East.

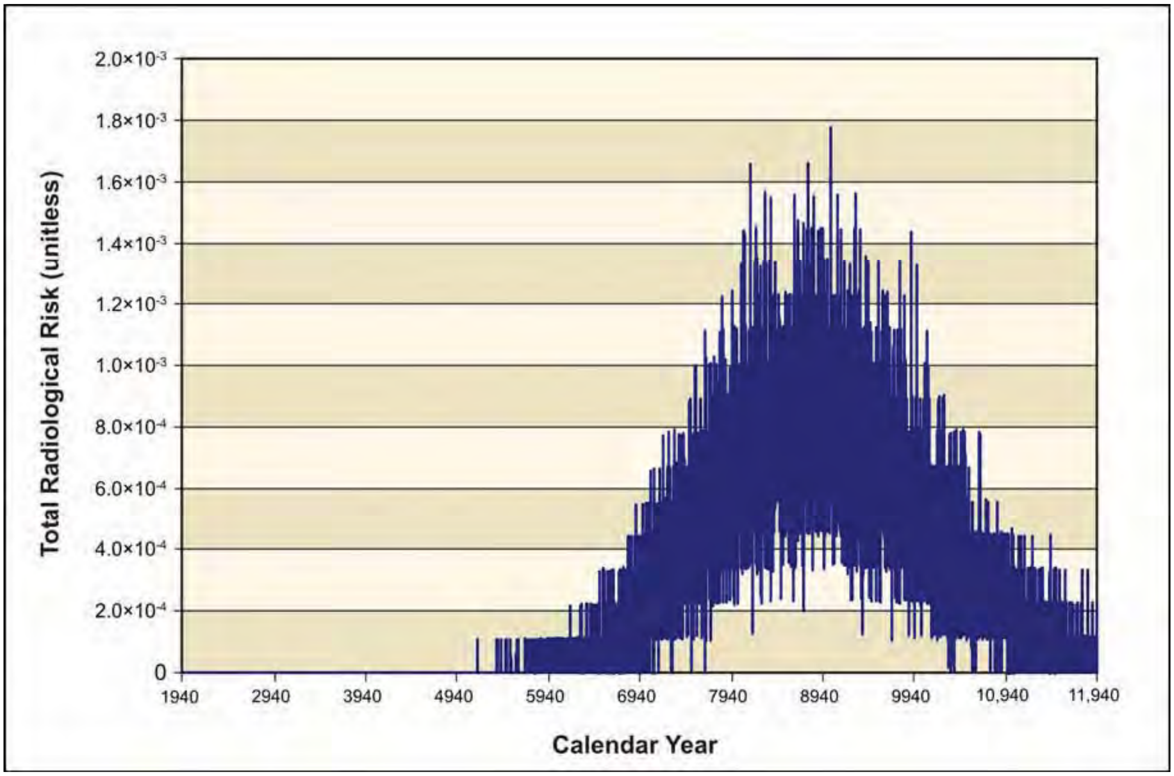

Figure Q–47. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

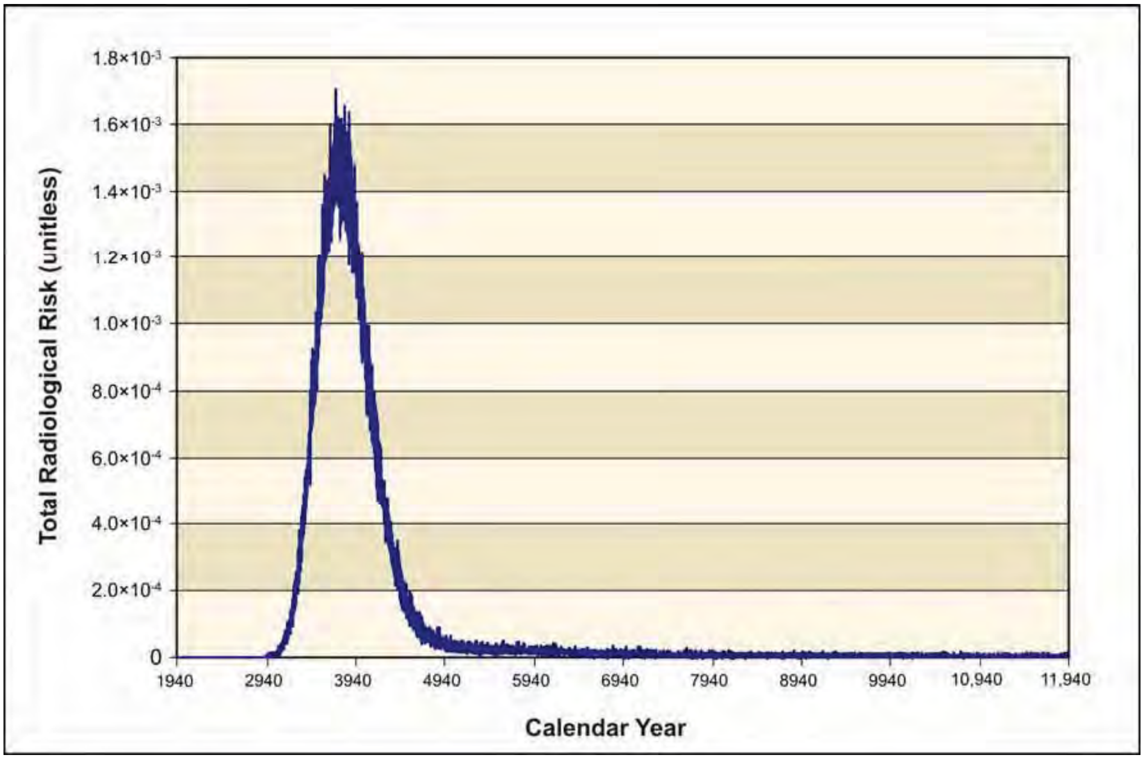

Figure Q–48. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

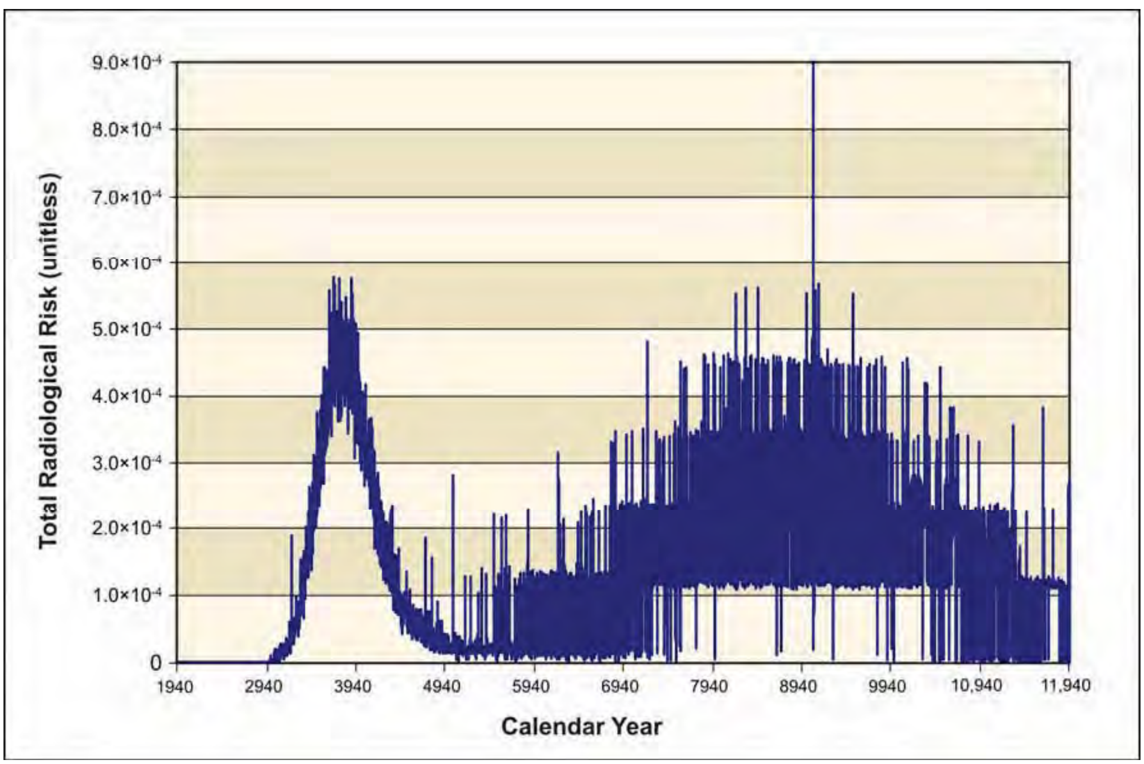

Figure Q–49. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-D, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.5 Waste Management Alternative 3; Disposal Group 1, Subgroup 1-E

Disposal Group 1, Subgroup 1-E, addresses the waste resulting from Tank Closure Alternative 4, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Bulk vitrification glass
- Cast stone
- Sulfate grout
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 4.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–313 through Q–318, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate. For radionuclides, the dose standard would be exceeded at the IDF-West barrier for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would be exceeded primarily due to chromium at the IDF-East barrier and the Core Zone Boundary for the drinking-water well user, resident farmer, and American Indian resident farmer, and at the Columbia River nearshore for the American Indian resident farmer. Population dose was estimated as 5.80×10^{-1} person-rem per year for the year of maximum impact.

Table Q–313. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	5.64×10^{-6}	9.88	3.40×10^{-4}	5.64×10^{-6}	2.54×10^{1}	1.11×10^{-3}	5.64×10^{-6}	5.17×10^{1}	2.43×10^{-3}
Iodine-129	7.34×10^{-10}	2.09×10^{-1}	2.38×10^{-6}	7.34×10^{-10}	2.42×10^{-1}	3.21×10^{-6}	7.34×10^{-10}	2.99×10^{-1}	4.62×10^{-6}
Total	5.64×10^{-6}	1.01×10^{1}	3.42×10^{-4}	5.64×10^{-6}	2.56×10^{1}	1.12×10^{-3}	5.64×10^{-6}	5.20×10^{1}	2.43×10^{-3}
Year of Peak Impact	9826	9826	9826	9826	9826	9826	9826	9826	9826
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	7.01×10^{-3}	3.34×10^{-2}	0.00	7.01×10^{-3}	4.17×10^{-2}	0.00	7.01×10^{-3}	7.53×10^{-2}	0.00
Chromium	2.23×10^{-1}	2.13	0.00	2.23×10^{-1}	2.13	8.78×10^{-10}	2.23×10^{-1}	3.11	4.03×10^{-5}
Nitrate	1.77×10^{1}	3.16×10^{-1}	0.00	1.77×10^{1}	4.16×10^{-1}	0.00	1.77×10^{1}	8.16×10^{-1}	0.00
Total	1.79×10^{1}	2.48	0.00	1.79×10^{1}	2.59	8.78×10^{-10}	1.79×10^{1}	4.00	4.03×10^{-5}
Year of Peak Impact	9318	9318	N/A	9318	9318	9069	9318	9318	9069

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–314. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the 200-West Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–315. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	$1.03{\times}10^{-7}$	$1.80{\times}10^{-1}$	$6.19{\times}10^{-6}$	$1.03{\times}10^{-7}$	$4.63{\times}10^{-1}$	$2.03{\times}10^{-5}$	$1.03{\times}10^{-7}$	$9.42{\times}10^{-1}$	$4.43{\times}10^{-5}$
Iodine-129	$1.22{\times}10^{-10}$	$3.47{\times}10^{-2}$	$3.95{\times}10^{-7}$	$1.22{\times}10^{-10}$	$4.02{\times}10^{-2}$	$5.33{\times}10^{-7}$	$1.22{\times}10^{-10}$	$4.97{\times}10^{-2}$	$7.67{\times}10^{-7}$
Total	$1.03{\times}10^{-7}$	$2.15{\times}10^{-1}$	$6.59{\times}10^{-6}$	$1.03{\times}10^{-7}$	$5.03{\times}10^{-1}$	$2.08{\times}10^{-5}$	$1.03{\times}10^{-7}$	$9.92{\times}10^{-1}$	$4.51{\times}10^{-5}$
Year of Peak Impact	3822	3822	3822	3822	3822	3822	3822	3822	3822
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	$5.86{\times}10^{-3}$	$5.59{\times}10^{-2}$	0.00	$5.86{\times}10^{-3}$	$5.59{\times}10^{-2}$	$2.30{\times}10^{-11}$	$5.86{\times}10^{-3}$	$8.17{\times}10^{-2}$	$1.06{\times}10^{-6}$
Nitrate	$1.53{\times}10^{-1}$	$2.73{\times}10^{-3}$	0.00	$1.53{\times}10^{-1}$	$3.59{\times}10^{-3}$	0.00	$1.53{\times}10^{-1}$	$7.04{\times}10^{-3}$	0.00
Total	$1.59{\times}10^{-1}$	$5.86{\times}10^{-2}$	0.00	$1.59{\times}10^{-1}$	$5.95{\times}10^{-2}$	$2.30{\times}10^{-11}$	$1.59{\times}10^{-1}$	$8.87{\times}10^{-2}$	$1.06{\times}10^{-6}$
Year of Peak Impact	3804	3804	N/A	3804	3804	3804	3804	3804	3804

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–316. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	6.44×10^{-6}	1.13×10^{1}	4.57×10^{-4}	6.44×10^{-6}	2.90×10^{1}	1.50×10^{-3}	7.60×10^{-6}	6.96×10^{1}	3.27×10^{-3}
Iodine-129	5.62×10^{-8}	1.60×10^{1}	1.25×10^{-4}	5.62×10^{-8}	1.86×10^{1}	1.68×10^{-4}	3.84×10^{-8}	1.57×10^{1}	2.42×10^{-4}
Total	6.49×10^{-6}	2.73×10^{1}	5.82×10^{-4}	6.49×10^{-6}	4.75×10^{1}	1.67×10^{-3}	7.63×10^{-6}	8.53×10^{1}	3.52×10^{-3}
Year of Peak Impact	3709	3709	3690	3709	3709	3690	3690	3690	3690
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.00×10^{-3}	4.77×10^{-3}	0.00	1.00×10^{-3}	5.95×10^{-3}	0.00	1.00×10^{-3}	1.08×10^{-2}	0.00
Chromium	9.56×10^{-2}	9.11×10^{-1}	0.00	9.56×10^{-2}	9.12×10^{-1}	3.76×10^{-10}	9.56×10^{-2}	1.33	1.72×10^{-5}
Nitrate	6.02	1.07×10^{-1}	0.00	6.02	1.41×10^{-1}	0.00	6.02	2.78×10^{-1}	0.00
Total Uranium	6.77×10^{-11}	6.45×10^{-10}	0.00	6.77×10^{-11}	6.52×10^{-10}	0.00	6.77×10^{-11}	6.75×10^{-10}	0.00
Total	6.11	1.02	0.00	6.11	1.06	3.76×10^{-10}	6.11	1.62	1.72×10^{-5}
Year of Peak Impact	9599	9599	N/A	9599	9599	8643	9599	9599	8643

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–317. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.03×10^{-6}	3.56	1.22×10^{-4}	2.03×10^{-6}	9.14	4.01×10^{-4}	2.03×10^{-6}	1.86×10^{1}	8.75×10^{-4}
Iodine-129	1.47×10^{-9}	4.18×10^{-1}	4.76×10^{-6}	1.47×10^{-9}	4.86×10^{-1}	6.43×10^{-6}	1.47×10^{-9}	6.00×10^{-1}	9.26×10^{-6}
Total	2.03×10^{-6}	3.98	1.27×10^{-4}	2.03×10^{-6}	9.62	4.08×10^{-4}	2.03×10^{-6}	1.92×10^{1}	8.85×10^{-4}
Year of Peak Impact	8117	8117	8117	8117	8117	8117	8117	8117	8117
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.00×10^{-3}	4.77×10^{-3}	0.00	1.00×10^{-3}	5.95×10^{-3}	0.00	1.00×10^{-3}	1.08×10^{-2}	0.00
Chromium	6.37×10^{-2}	6.07×10^{-1}	0.00	6.37×10^{-2}	6.08×10^{-1}	2.50×10^{-10}	6.37×10^{-2}	8.88×10^{-1}	1.15×10^{-5}
Nitrate	2.61	4.67×10^{-2}	0.00	2.61	6.14×10^{-2}	0.00	2.61	1.21×10^{-1}	0.00
Total	2.68	6.59×10^{-1}	0.00	2.68	6.75×10^{-1}	2.50×10^{-10}	2.68	1.02	1.15×10^{-5}
Year of Peak Impact	8069	8069	N/A	8069	8069	8079	8069	8069	8079

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–318. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.59×10^{-11}	7.14×10^{-5}	4.43×10^{-9}	1.15×10^{-11}	1.19×10^{-4}	7.81×10^{-9}	2.03×10^{-6}	2.21×10^{-2}	1.22×10^{-6}
Iodine-129	1.34×10^{-13}	4.43×10^{-5}	1.53×10^{-11}	1.48×10^{-13}	7.99×10^{-4}	1.74×10^{-8}	1.47×10^{-9}	2.20×10^{-3}	5.41×10^{-8}
Total	1.60×10^{-11}	1.16×10^{-4}	4.44×10^{-9}	1.16×10^{-11}	9.18×10^{-4}	2.52×10^{-8}	2.03×10^{-6}	2.44×10^{-2}	1.27×10^{-6}
Year of Peak Impact	4005	4005	9835	4075	4075	4005	8117	8117	8117

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	3.43×10^{-8}	2.04×10^{-7}	0.00	3.30×10^{-8}	3.54×10^{-7}	0.00	1.00×10^{-3}	5.96×10^{-3}	0.00
Chromium	9.28×10^{-7}	8.85×10^{-6}	3.65×10^{-15}	5.37×10^{-7}	8.19×10^{-6}	1.67×10^{-10}	4.80×10^{-2}	1.06×10^{-1}	5.74×10^{-6}
Fluoride	0.00	0.00	0.00	5.38×10^{-11}	3.74×10^{-11}	0.00	2.51×10^{-5}	3.68×10^{-6}	0.00
Nitrate	7.09×10^{-5}	2.45×10^{-6}	0.00	1.11×10^{-4}	1.05×10^{-2}	0.00	6.02	2.28×10^{-1}	0.00
Total	7.18×10^{-5}	1.15×10^{-5}	3.65×10^{-15}	1.12×10^{-4}	1.05×10^{-2}	1.67×10^{-10}	6.07	3.40×10^{-1}	5.74×10^{-6}
Year of Peak Impact	8553	8553	8553	8888	8888	8553	8691	8691	8079

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–50 through Q–52 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-East barrier, the radiological lifetime risk of incidence of cancer occurs around the year 9800 as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East.

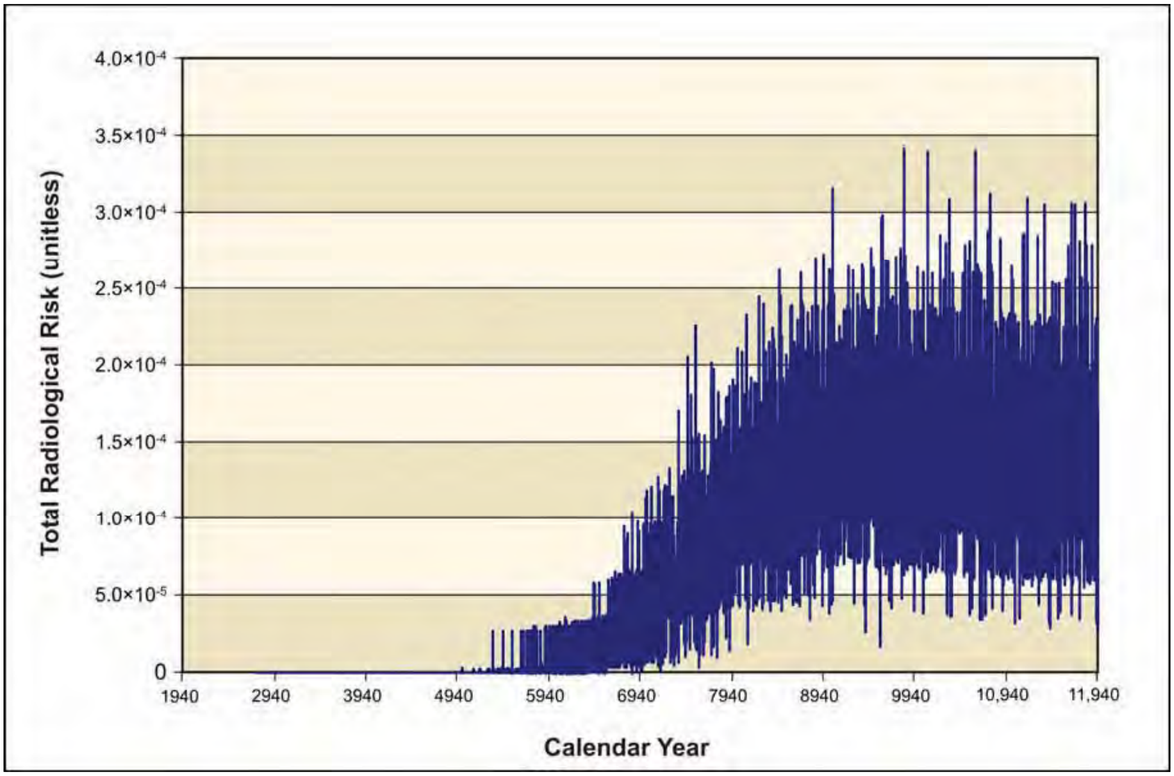

Figure Q–50. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

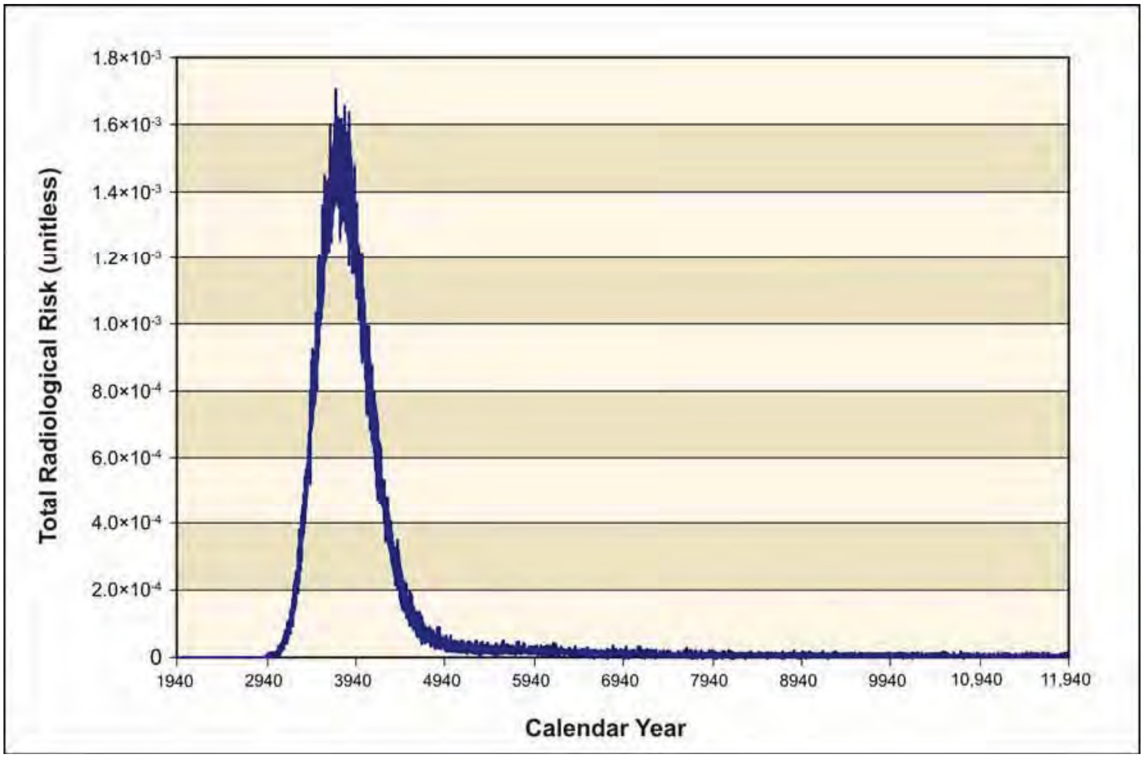

Figure Q–51. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

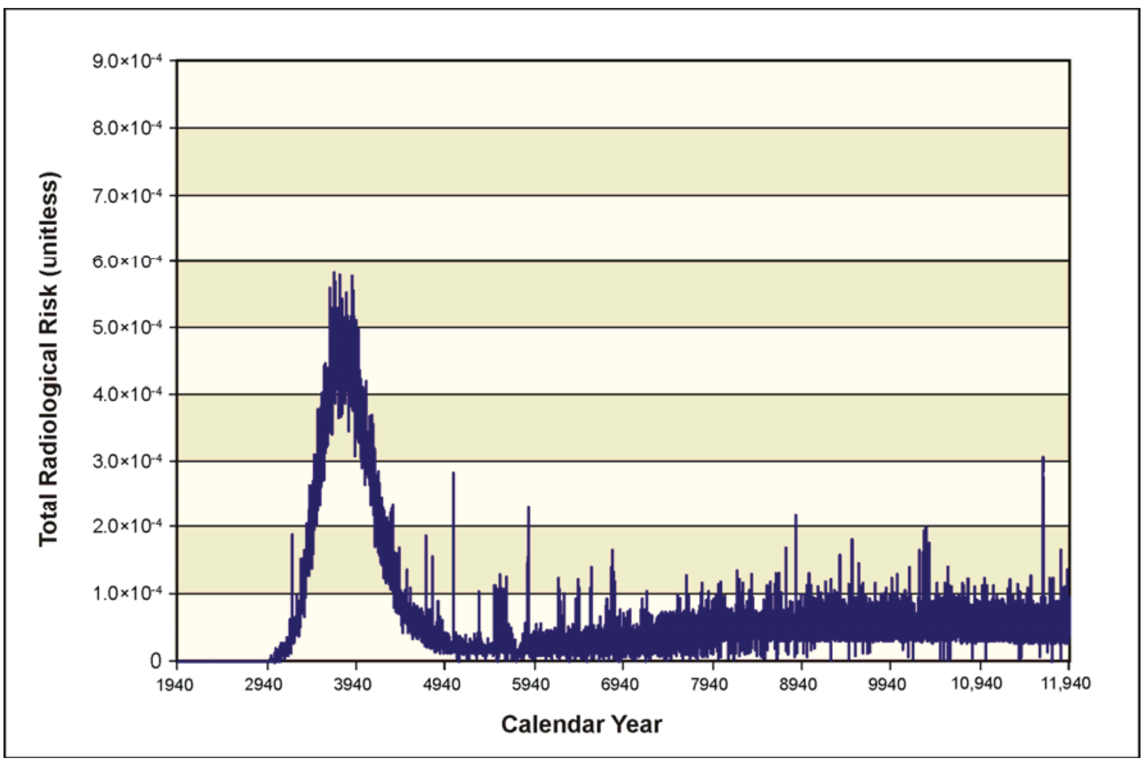

Figure Q–52. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-E, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.6 Waste Management Alternative 3; Disposal Group 1, Subgroup 1-F

Disposal Group 1, Subgroup 1-F addresses the waste resulting from Tank Closure Alternative 5, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Bulk vitrification glass
- Cast stone
- Sulfate grout
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

The RPPDF would not be constructed or operated for Tank Closure Alternative 5 because tank closure cleanup activities would not be conducted.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–319 through Q–323, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate. For radionuclides, the dose standard would be exceeded at the IDF-West barrier for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would be exceeded primarily due to chromium at the IDF-East barrier, the Core Zone Boundary, and the Columbia River nearshore for the drinking-water well user, resident farmer, and American Indian resident farmer. Population dose was estimated as 5.75×10^{-1} person-rem per year for the year of maximum impact.

Table Q–319. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.39×10^{-6}	4.18	1.44×10^{-4}	2.39×10^{-6}	1.07×10^{1}	4.72×10^{-4}	2.39×10^{-6}	2.19×10^{1}	1.03×10^{-3}
Iodine-129	5.52×10^{-10}	1.57×10^{-1}	1.79×10^{-6}	5.52×10^{-10}	1.82×10^{-1}	2.42×10^{-6}	5.52×10^{-10}	2.25×10^{-1}	3.48×10^{-6}
Total	2.39×10^{-6}	4.34	1.46×10^{-4}	2.39×10^{-6}	1.09×10^{1}	4.74×10^{-4}	2.39×10^{-6}	2.21×10^{1}	1.03×10^{-3}
Year of Peak Impact	9701	9701	9701	9701	9701	9701	9701	9701	9701
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	2.65×10^{-3}	1.26×10^{-2}	0.00	2.65×10^{-3}	1.58×10^{-2}	0.00	2.65×10^{-3}	2.85×10^{-2}	0.00
Chromium	3.35×10^{-1}	3.19	0.00	3.35×10^{-1}	3.20	1.32×10^{-9}	3.35×10^{-1}	4.67	6.04×10^{-5}
Nitrate	1.73×10^{1}	3.08×10^{-1}	0.00	1.73×10^{1}	4.06×10^{-1}	0.00	1.73×10^{1}	7.96×10^{-1}	0.00
Total	1.76×10^{1}	3.51	0.00	1.76×10^{1}	3.62	1.32×10^{-9}	1.76×10^{1}	5.49	6.04×10^{-5}
Year of Peak Impact	8735	8735	N/A	8735	8735	8735	8735	8735	8735

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–320. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the 200-West Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–321. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	6.42×10^{-6}	1.12×10^{1}	4.54×10^{-4}	6.42×10^{-6}	2.89×10^{1}	1.49×10^{-3}	7.54×10^{-6}	6.91×10^{1}	3.25×10^{-3}
Iodine-129	5.61×10^{-8}	1.60×10^{1}	1.24×10^{-4}	5.61×10^{-8}	1.86×10^{1}	1.68×10^{-4}	3.83×10^{-8}	1.57×10^{1}	2.42×10^{-4}
Total	6.47×10^{-6}	2.72×10^{1}	5.78×10^{-4}	6.47×10^{-6}	4.74×10^{1}	1.66×10^{-3}	7.58×10^{-6}	8.47×10^{1}	3.49×10^{-3}
Year of Peak Impact	3709	3709	3690	3709	3709	3690	3690	3690	3690
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.33×10^{-3}	6.32×10^{-3}	0.00	1.33×10^{-3}	7.89×10^{-3}	0.00	1.33×10^{-3}	1.42×10^{-2}	0.00
Chromium	1.48×10^{-1}	1.41	0.00	1.48×10^{-1}	1.41	5.81×10^{-10}	1.48×10^{-1}	2.06	2.67×10^{-5}
Nitrate	3.27	5.84×10^{-2}	0.00	3.27	7.69×10^{-2}	0.00	3.27	1.51×10^{-1}	0.00
Total	3.42	1.47	0.00	3.42	1.50	5.81×10^{-10}	3.42	2.23	2.67×10^{-5}
Year of Peak Impact	8764	8764	N/A	8764	8764	8764	8764	8764	8764

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–322. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.04×10^{-7}	1.41	6.77×10^{-5}	1.12×10^{-6}	5.06	2.22×10^{-4}	1.12×10^{-6}	1.03×10^{1}	4.85×10^{-4}
Iodine-129	6.87×10^{-9}	1.96	1.33×10^{-5}	4.12×10^{-9}	1.36	1.80×10^{-5}	4.12×10^{-9}	1.68	2.59×10^{-5}
Total	8.11×10^{-7}	3.36	8.11×10^{-5}	1.13×10^{-6}	6.42	2.40×10^{-4}	1.13×10^{-6}	1.20×10^{1}	5.11×10^{-4}
Year of Peak Impact	4388	4388	4191	4191	4191	4191	4191	4191	4191
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	3.32×10^{-4}	1.58×10^{-3}	0.00	3.32×10^{-4}	1.97×10^{-3}	0.00	3.32×10^{-4}	3.56×10^{-3}	0.00
Chromium	1.10×10^{-1}	1.05	0.00	1.10×10^{-1}	1.05	4.32×10^{-10}	1.10×10^{-1}	1.53	1.98×10^{-5}
Fluoride	2.51×10^{-5}	1.20×10^{-5}	0.00	2.51×10^{-5}	1.23×10^{-5}	0.00	2.51×10^{-5}	1.33×10^{-5}	0.00
Nitrate	2.16	3.86×10^{-2}	0.00	2.16	5.09×10^{-2}	0.00	2.16	9.98×10^{-2}	0.00
Total	2.27	1.09	0.00	2.27	1.10	4.32×10^{-10}	2.27	1.63	1.98×10^{-5}
Year of Peak Impact	8819	8819	N/A	8819	8819	8819	8819	8819	8819

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–323. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.57×10^{-11}	7.06×10^{-5}	3.28×10^{-9}	1.18×10^{-11}	1.22×10^{-4}	7.73×10^{-9}	8.04×10^{-7}	8.79×10^{-3}	6.75×10^{-7}
Iodine-129	1.34×10^{-13}	4.42×10^{-5}	4.72×10^{-10}	1.47×10^{-13}	7.91×10^{-4}	1.74×10^{-8}	6.87×10^{-9}	1.12×10^{-2}	1.82×10^{-7}
Total	1.58×10^{-11}	1.15×10^{-4}	3.75×10^{-9}	1.19×10^{-11}	9.13×10^{-4}	2.51×10^{-8}	8.11×10^{-7}	2.00×10^{-2}	8.57×10^{-7}
Year of Peak Impact	4005	4005	4042	4076	4076	4005	4389	4389	3882
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.04×10^{-8}	6.16×10^{-8}	0.00	8.56×10^{-9}	9.20×10^{-8}	0.00	3.32×10^{-4}	1.97×10^{-3}	0.00
Chromium	1.17×10^{-6}	1.11×10^{-5}	4.79×10^{-15}	9.44×10^{-7}	1.44×10^{-5}	2.20×10^{-10}	7.03×10^{-2}	1.55×10^{-1}	9.90×10^{-6}
Nitrate	5.79×10^{-5}	2.00×10^{-6}	0.00	7.39×10^{-5}	6.94×10^{-3}	0.00	4.56	1.74×10^{-1}	0.00
Total	5.90×10^{-5}	1.32×10^{-5}	4.79×10^{-15}	7.48×10^{-5}	6.96×10^{-3}	2.20×10^{-10}	4.63	3.31×10^{-1}	9.90×10^{-6}
Year of Peak Impact	9128	9128	8667	8316	8316	8667	8787	8787	8819

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–53 through Q–55 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-East barrier, the radiological lifetime risk of incidence of cancer occurs around the year 9700 as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East.

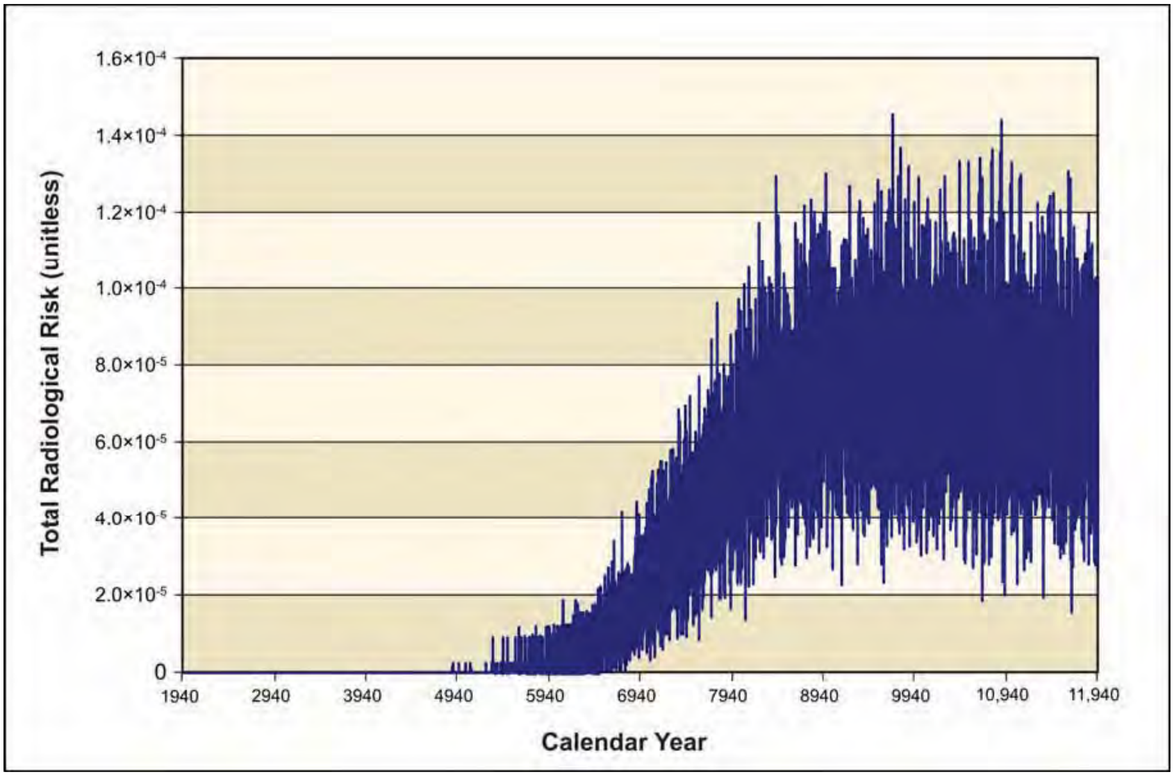

Figure Q–53. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

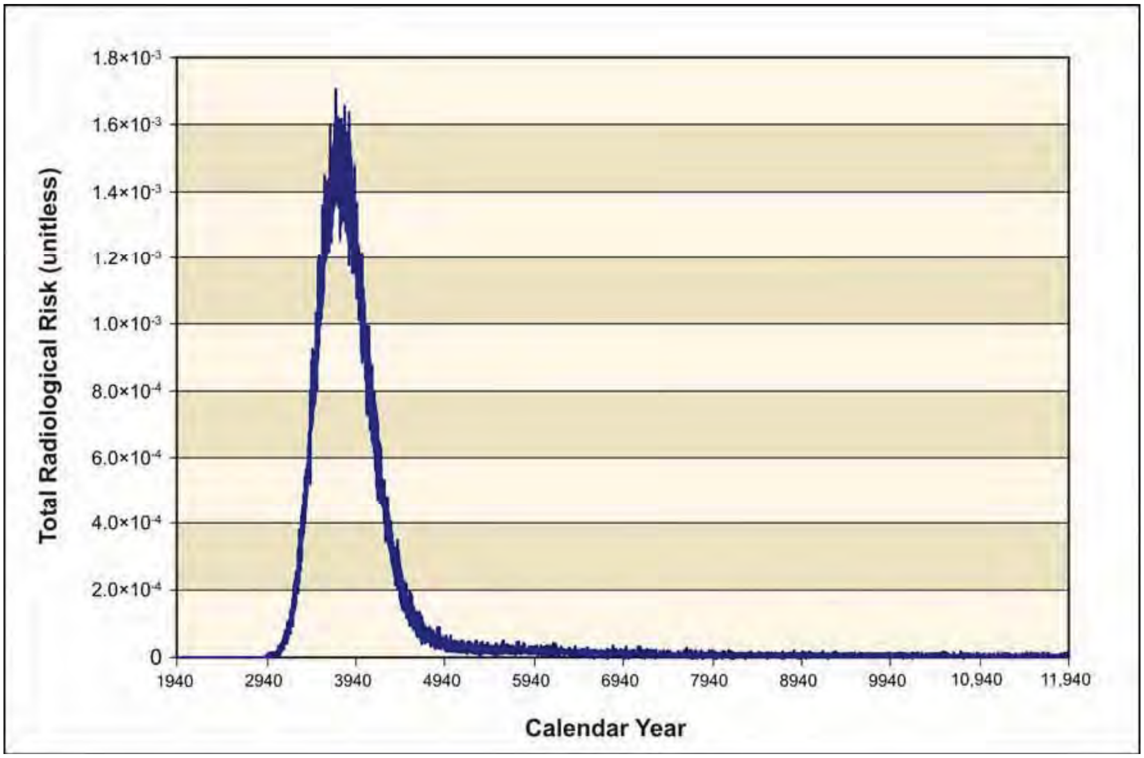

Figure Q–54. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

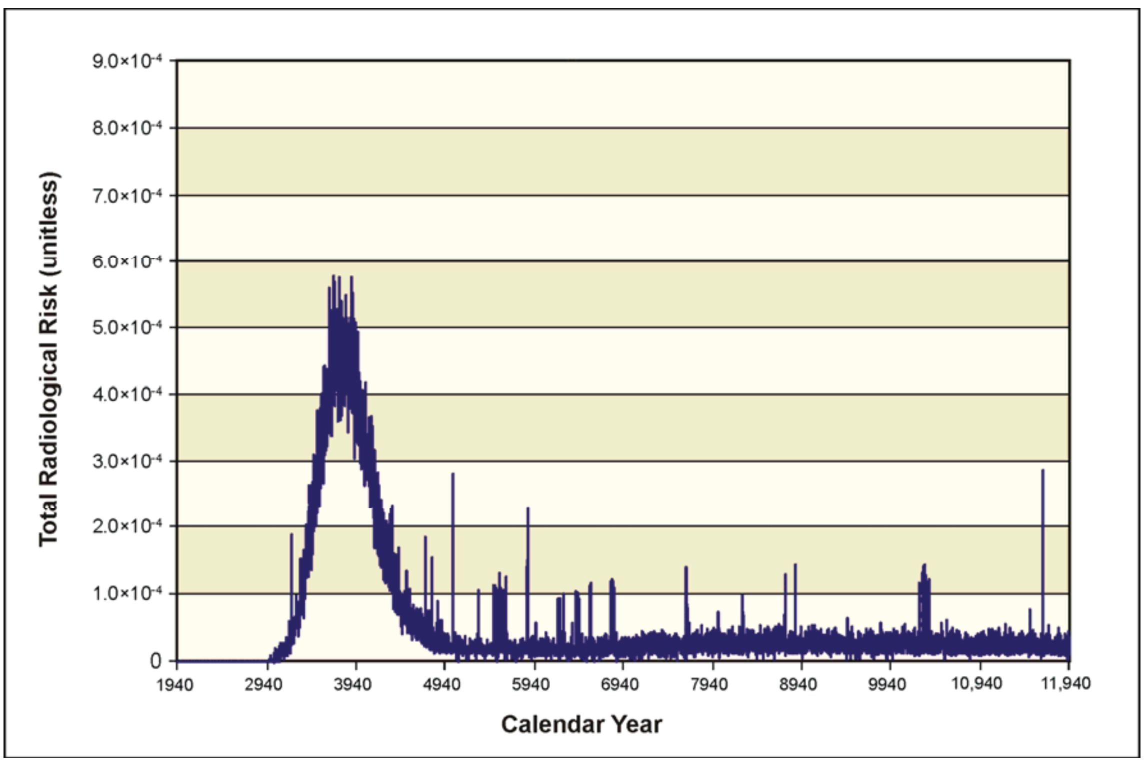

Figure Q–55. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-F, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.7 Waste Management Alternative 3; Disposal Group 1, Subgroup 1-G

Disposal Group 1, Subgroup 1-G, addresses the waste resulting from Tank Closure Alternative 6C, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 6C.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–324 through Q–329, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are boron and boron compounds, chromium, fluoride, and nitrate. For radionuclides, the dose standard would be exceeded at the IDF-West barrier for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 5.75×10^{-1} person-rem per year for the year of maximum impact.

Table Q–324. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	4.14×10^{-7}	7.25×10^{-1}	2.49×10^{-5}	4.14×10^{-7}	1.86	8.17×10^{-5}	4.14×10^{-7}	3.79	1.78×10^{-4}
Iodine-129	6.40×10^{-10}	1.82×10^{-1}	2.07×10^{-6}	6.40×10^{-10}	2.11×10^{-1}	2.80×10^{-6}	6.40×10^{-10}	2.61×10^{-1}	4.03×10^{-6}
Total	4.14×10^{-7}	9.07×10^{-1}	2.70×10^{-5}	4.14×10^{-7}	2.07	8.45×10^{-5}	4.14×10^{-7}	4.05	1.82×10^{-4}
Year of Peak Impact	10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,032	10,032

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.82×10^{-3}	2.69×10^{-2}	0.00	8.63×10^{-4}	8.23×10^{-3}	1.44×10^{-11}	8.63×10^{-4}	1.20×10^{-2}	6.61×10^{-7}
Nitrate	1.34×10^{1}	2.39×10^{-1}	0.00	1.42×10^{1}	3.35×10^{-1}	0.00	1.42×10^{1}	6.57×10^{-1}	0.00
Total	1.34×10^{1}	2.66×10^{-1}	0.00	1.42×10^{1}	3.43×10^{-1}	1.44×10^{-11}	1.42×10^{1}	6.69×10^{-1}	6.61×10^{-7}
Year of Peak Impact	8168	8168	N/A	8522	8522	8618	8522	8522	8618

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–325. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the 200-West Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–326. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.18×10^{-8}	5.58×10^{-2}	1.98×10^{-6}	3.30×10^{-8}	1.48×10^{-1}	6.51×10^{-6}	3.30×10^{-8}	3.02×10^{-1}	1.42×10^{-5}
Iodine-129	4.71×10^{-11}	1.34×10^{-2}	1.26×10^{-7}	3.89×10^{-11}	1.29×10^{-2}	1.70×10^{-7}	3.89×10^{-11}	1.59×10^{-2}	2.45×10^{-7}
Total	3.19×10^{-8}	6.92×10^{-2}	2.11×10^{-6}	3.30×10^{-8}	1.61×10^{-1}	6.68×10^{-6}	3.30×10^{-8}	3.18×10^{-1}	1.44×10^{-5}
Year of Peak Impact	3804	3804	3825	3825	3825	3825	3825	3825	3825

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	2.13×10^{-3}	2.03×10^{-2}	0.00	2.13×10^{-3}	2.03×10^{-2}	8.36×10^{-12}	2.13×10^{-3}	2.96×10^{-2}	3.83×10^{-7}
Nitrate	9.37×10^{-2}	1.67×10^{-3}	0.00	9.37×10^{-2}	2.20×10^{-3}	0.00	9.37×10^{-2}	4.32×10^{-3}	0.00
Total	9.58×10^{-2}	2.19×10^{-2}	0.00	9.58×10^{-2}	2.25×10^{-2}	8.36×10^{-12}	9.58×10^{-2}	3.40×10^{-2}	3.83×10^{-7}
Year of Peak Impact	3856	3856	N/A	3856	3856	3856	3856	3856	3856

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–327. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.43×10^{-6}	1.13×10^{1}	4.55×10^{-4}	6.43×10^{-6}	2.89×10^{1}	1.49×10^{-3}	7.55×10^{-6}	6.92×10^{1}	3.26×10^{-3}
Iodine-129	5.62×10^{-8}	1.60×10^{1}	1.24×10^{-4}	5.62×10^{-8}	1.86×10^{1}	1.68×10^{-4}	3.84×10^{-8}	1.57×10^{1}	2.42×10^{-4}
Total	6.49×10^{-6}	2.73×10^{1}	5.79×10^{-4}	6.49×10^{-6}	4.75×10^{1}	1.66×10^{-3}	7.59×10^{-6}	8.49×10^{1}	3.50×10^{-3}
Year of Peak Impact	3709	3709	3690	3709	3709	3690	3690	3690	3690
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.60×10^{-4}	3.43×10^{-3}	0.00	3.60×10^{-4}	3.44×10^{-3}	1.22×10^{-11}	3.60×10^{-4}	5.02×10^{-3}	5.58×10^{-7}
Nitrate	5.63	1.01×10^{-1}	0.00	5.63	1.32×10^{-1}	0.00	5.63	2.60×10^{-1}	0.00
Total	5.63	1.04×10^{-1}	0.00	5.63	1.36×10^{-1}	1.22×10^{-11}	5.63	2.65×10^{-1}	5.58×10^{-7}
Year of Peak Impact	9653	9653	N/A	9653	9653	3628	9653	9653	3628

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–328. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.06×10^{-7}	1.41	6.79×10^{-5}	1.13×10^{-6}	5.07	2.23×10^{-4}	1.13×10^{-6}	1.03×10^{1}	4.86×10^{-4}
Iodine-129	6.88×10^{-9}	1.96	1.34×10^{-5}	4.12×10^{-9}	1.36	1.80×10^{-5}	4.12×10^{-9}	1.68	2.60×10^{-5}
Total	8.12×10^{-7}	3.37	8.13×10^{-5}	1.13×10^{-6}	6.44	2.41×10^{-4}	1.13×10^{-6}	1.20×10^{1}	5.12×10^{-4}
Year of Peak Impact	4388	4388	4191	4191	4191	4191	4191	4191	4191
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.35×10^{-7}	4.79×10^{-8}	0.00	3.35×10^{-7}	4.85×10^{-8}	0.00	3.35×10^{-7}	5.15×10^{-8}	0.00
Chromium	4.32×10^{-4}	4.11×10^{-3}	0.00	4.32×10^{-4}	4.12×10^{-3}	3.08×10^{-12}	4.32×10^{-4}	6.02×10^{-3}	1.41×10^{-7}
Fluoride	2.51×10^{-5}	1.20×10^{-5}	0.00	2.51×10^{-5}	1.23×10^{-5}	0.00	2.51×10^{-5}	1.33×10^{-5}	0.00
Nitrate	2.44	4.36×10^{-2}	0.00	2.44	5.74×10^{-2}	0.00	2.44	1.13×10^{-1}	0.00
Total	2.44	4.78×10^{-2}	0.00	2.44	6.16×10^{-2}	3.08×10^{-12}	2.44	1.19×10^{-1}	1.41×10^{-7}
Year of Peak Impact	8821	8821	N/A	8821	8821	8204	8821	8821	8204

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–329. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.58×10^{-11}	7.09×10^{-5}	3.29×10^{-9}	1.18×10^{-11}	1.23×10^{-4}	7.76×10^{-9}	8.05×10^{-7}	8.81×10^{-3}	6.77×10^{-7}
Iodine-129	1.34×10^{-13}	4.43×10^{-5}	4.72×10^{-10}	1.47×10^{-13}	7.92×10^{-4}	1.74×10^{-8}	6.87×10^{-9}	1.12×10^{-2}	1.82×10^{-7}
Total	1.59×10^{-11}	1.15×10^{-4}	3.77×10^{-9}	1.20×10^{-11}	9.15×10^{-4}	2.51×10^{-8}	8.12×10^{-7}	2.00×10^{-2}	8.58×10^{-7}
Year of Peak Impact	4005	4005	4042	4076	4076	4005	4389	4389	3882
Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	6.39×10^{-9}	6.09×10^{-8}	3.70×10^{-17}	6.39×10^{-9}	9.75×10^{-8}	1.70×10^{-12}	4.23×10^{-4}	9.34×10^{-4}	7.06×10^{-8}
Nitrate	4.48×10^{-5}	1.55×10^{-6}	0.00	4.48×10^{-5}	4.21×10^{-3}	0.00	2.44	9.51×10^{-2}	0.00
Total	4.48×10^{-5}	1.61×10^{-6}	3.70×10^{-17}	4.48×10^{-5}	4.21×10^{-3}	1.70×10^{-12}	2.44	9.61×10^{-2}	7.06×10^{-8}
Year of Peak Impact	8016	8016	8400	8016	8016	8400	8085	8085	8204

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–56 through Q–58 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-East barrier, the radiological lifetime risk of incidence of cancer occurs around the year 10,000 as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East.

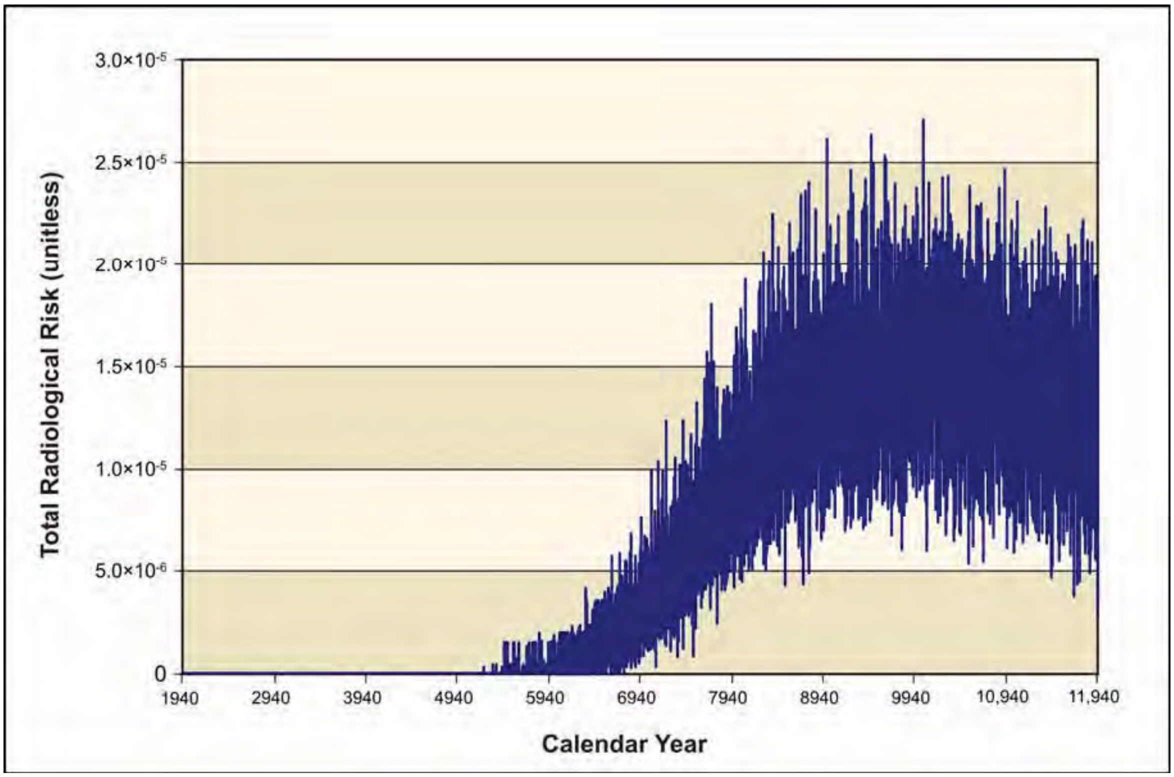

Figure Q–56. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

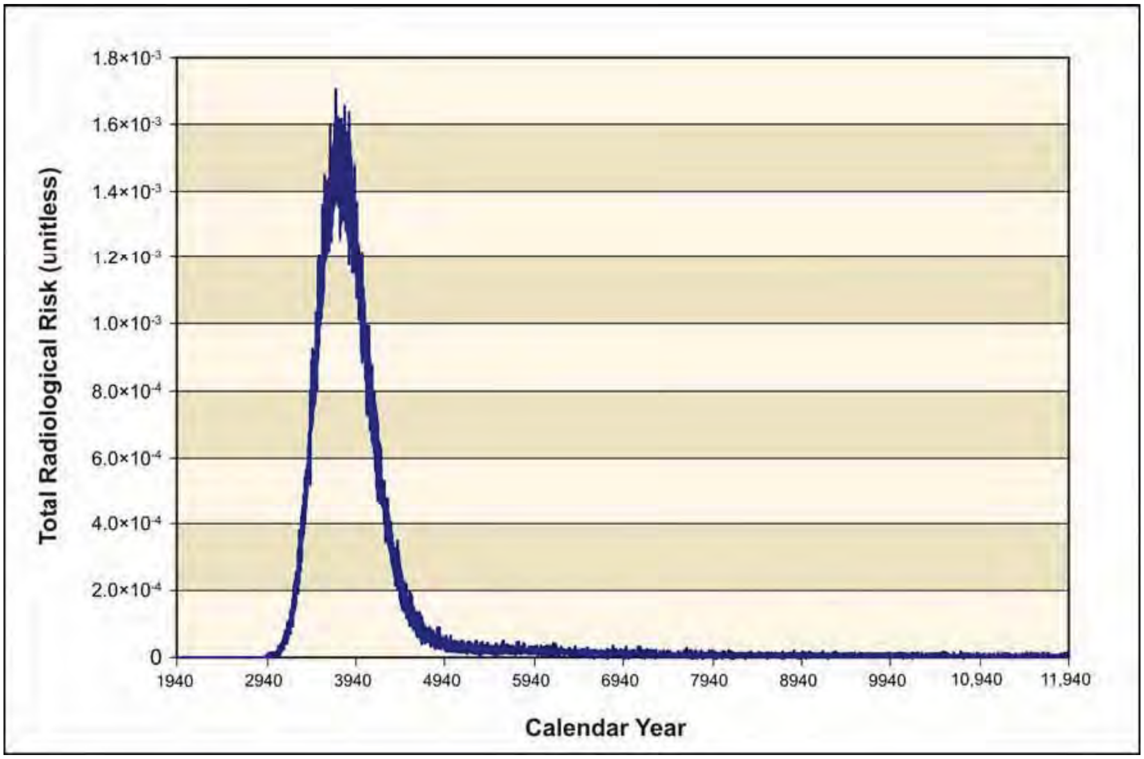

Figure Q–57. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

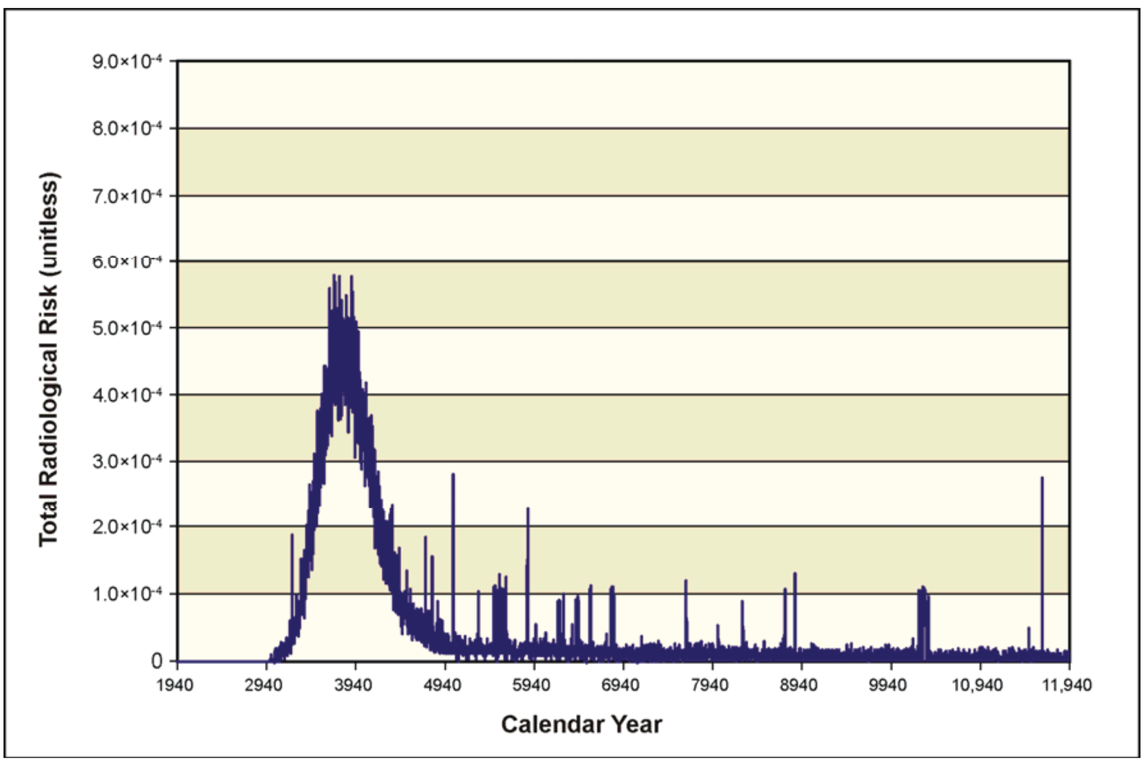

Figure Q–58. Waste Management Alternative 3, Disposal Group 1, Subgroup 1-G, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.8 Waste Management Alternative 3; Disposal Group 2, Subgroup 2-A

Disposal Group 2, Subgroup 2-A, addresses the waste resulting from Tank Closure Alternative 2A, onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- ILAW glass
- LAW melters
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

The RPPDF would not be constructed or operated for Tank Closure Alternative 2A because tank closure cleanup activities would not be conducted.

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–330 through Q–334, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides. For chemicals, the key constituents are boron and boron compounds, chromium, fluoride, and nitrate. For radionuclides, the dose standard would be exceeded at the IDF-West barrier for the resident farmer and the American Indian resident farmer. The Hazard Index guideline would not be exceeded at any location. Population dose was estimated as 5.75×10^{-1} person-rem per year for the year of maximum impact.

Table Q–330. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.45×10^{-7}	4.29×10^{-1}	2.01×10^{-5}	3.34×10^{-7}	1.50	6.59×10^{-5}	3.34×10^{-7}	3.06	1.44×10^{-4}
Iodine-129	1.53×10^{-9}	4.35×10^{-1}	2.38×10^{-6}	7.34×10^{-10}	2.42×10^{-1}	3.21×10^{-6}	7.34×10^{-10}	2.99×10^{-1}	4.62×10^{-6}
Total	2.46×10^{-7}	8.64×10^{-1}	2.25×10^{-5}	3.34×10^{-7}	1.74	6.91×10^{-5}	3.34×10^{-7}	3.36	1.48×10^{-4}
Year of Peak Impact	9988	9988	9823	9823	9823	9823	9823	9823	9823
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.00×10^{-3}	1.90×10^{-2}	0.00	2.00×10^{-3}	1.90×10^{-2}	1.20×10^{-11}	2.00×10^{-3}	2.78×10^{-2}	5.49×10^{-7}
Nitrate	1.55×10^{1}	2.77×10^{-1}	0.00	1.55×10^{1}	3.65×10^{-1}	0.00	1.55×10^{1}	7.15×10^{-1}	0.00
Total	1.55×10^{1}	2.96×10^{-1}	0.00	1.55×10^{1}	3.84×10^{-1}	1.20×10^{-11}	1.55×10^{1}	7.43×10^{-1}	5.49×10^{-7}
Year of Peak Impact	8216	8216	N/A	8216	8216	9308	8216	8216	9308

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–331. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the 200-West Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–332. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	6.42×10^{-6}	1.12×10^{1}	4.54×10^{-4}	6.42×10^{-6}	2.89×10^{1}	1.49×10^{-3}	7.54×10^{-6}	6.91×10^{1}	3.25×10^{-3}
Iodine-129	5.61×10^{-8}	1.60×10^{1}	1.24×10^{-4}	5.61×10^{-8}	1.86×10^{1}	1.68×10^{-4}	3.83×10^{-8}	1.57×10^{1}	2.42×10^{-4}
Total	6.47×10^{-6}	2.72×10^{1}	5.78×10^{-4}	6.47×10^{-6}	4.74×10^{1}	1.66×10^{-3}	7.58×10^{-6}	8.47×10^{1}	3.49×10^{-3}
Year of Peak Impact	3709	3709	3690	3709	3709	3690	3690	3690	3690
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	3.65×10^{-4}	3.48×10^{-3}	0.00	3.65×10^{-4}	3.48×10^{-3}	6.29×10^{-12}	3.65×10^{-4}	5.08×10^{-3}	2.88×10^{-7}
Nitrate	5.69	1.02×10^{-1}	0.00	5.69	1.34×10^{-1}	0.00	5.69	2.63×10^{-1}	0.00
Total	5.69	1.05×10^{-1}	0.00	5.69	1.37×10^{-1}	6.29×10^{-12}	5.69	2.68×10^{-1}	2.88×10^{-7}
Year of Peak Impact	7905	7905	N/A	7905	7905	8982	7905	7905	8982

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–333. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	8.04×10^{-7}	1.41	6.77×10^{-5}	1.12×10^{-6}	5.06	2.22×10^{-4}	1.12×10^{-6}	1.03×10^{1}	4.85×10^{-4}
Iodine-129	6.87×10^{-9}	1.96	1.33×10^{-5}	4.12×10^{-9}	1.36	1.80×10^{-5}	4.12×10^{-9}	1.68	2.59×10^{-5}
Total	8.11×10^{-7}	3.36	8.11×10^{-5}	1.13×10^{-6}	6.42	2.40×10^{-4}	1.13×10^{-6}	1.20×10^{1}	5.11×10^{-4}
Year of Peak Impact	4388	4388	4191	4191	4191	4191	4191	4191	4191
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	3.35×10^{-7}	4.79×10^{-8}	0.00	3.35×10^{-7}	4.85×10^{-8}	0.00	3.35×10^{-7}	5.15×10^{-8}	0.00
Chromium	1.91×10^{-4}	1.82×10^{-3}	0.00	1.91×10^{-4}	1.82×10^{-3}	2.81×10^{-12}	1.91×10^{-4}	2.66×10^{-3}	1.29×10^{-7}
Nitrate	4.07	7.26×10^{-2}	0.00	4.07	9.56×10^{-2}	0.00	4.07	1.88×10^{-1}	0.00
Total	4.07	7.45×10^{-2}	0.00	4.07	9.75×10^{-2}	2.81×10^{-12}	4.07	1.90×10^{-1}	1.29×10^{-7}
Year of Peak Impact	8055	8055	N/A	8055	8055	8353	8055	8055	8353

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–334. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.57×10^{-11}	7.06×10^{-5}	3.28×10^{-9}	1.18×10^{-11}	1.22×10^{-4}	7.73×10^{-9}	8.04×10^{-7}	8.79×10^{-3}	6.75×10^{-7}
Iodine-129	1.34×10^{-13}	4.42×10^{-5}	4.72×10^{-10}	1.47×10^{-13}	7.91×10^{-4}	1.74×10^{-8}	6.87×10^{-9}	1.12×10^{-2}	1.82×10^{-7}
Total	1.58×10^{-11}	1.15×10^{-4}	3.75×10^{-9}	1.19×10^{-11}	9.13×10^{-4}	2.51×10^{-8}	8.11×10^{-7}	2.00×10^{-2}	8.57×10^{-7}
Year of Peak Impact	4005	4005	4042	4076	4076	4005	4389	4389	3882

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	5.12×10^{-9}	4.88×10^{-8}	3.77×10^{-17}	5.12×10^{-9}	7.82×10^{-8}	1.73×10^{-12}	8.49×10^{-6}	1.89×10^{-5}	6.46×10^{-8}
Fluoride	2.69×10^{-11}	1.32×10^{-11}	0.00	2.69×10^{-11}	1.87×10^{-11}	0.00	2.51×10^{-5}	3.67×10^{-6}	0.00
Nitrate	4.58×10^{-5}	1.58×10^{-6}	0.00	4.58×10^{-5}	4.31×10^{-3}	0.00	4.07	1.52×10^{-1}	0.00
Total	4.58×10^{-5}	1.63×10^{-6}	3.77×10^{-17}	4.58×10^{-5}	4.31×10^{-3}	1.73×10^{-12}	4.07	1.52×10^{-1}	6.46×10^{-8}
Year of Peak Impact	8326	8326	8489	8326	8326	8489	8056	8056	8353

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–59 through Q–61 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-East barrier, the radiological lifetime risk of incidence of cancer occurs around the year 10,000 as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East.

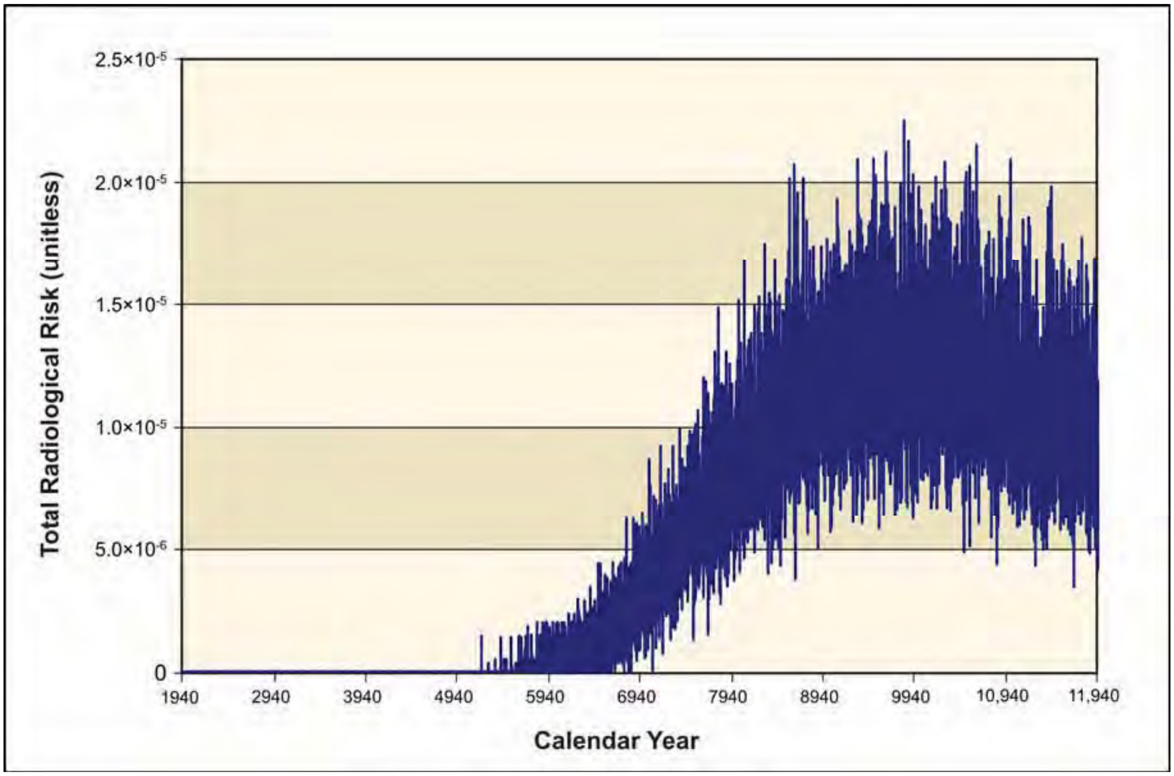

Figure Q–59. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

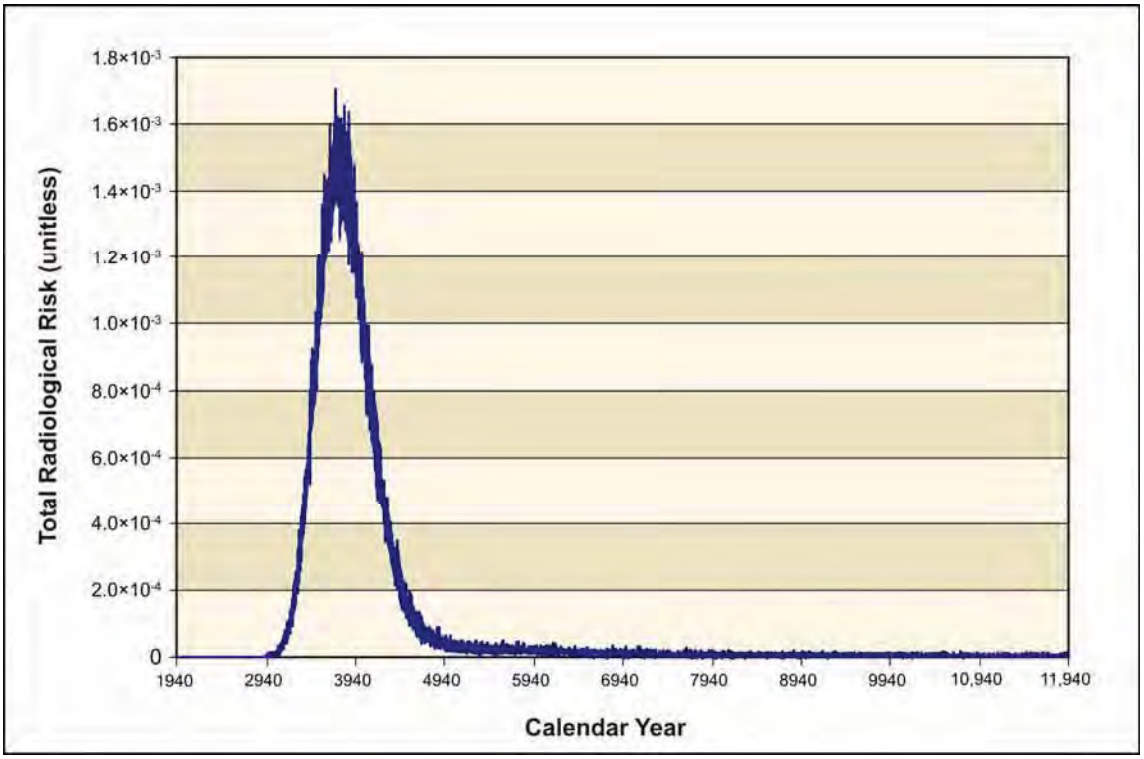

Figure Q–60. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

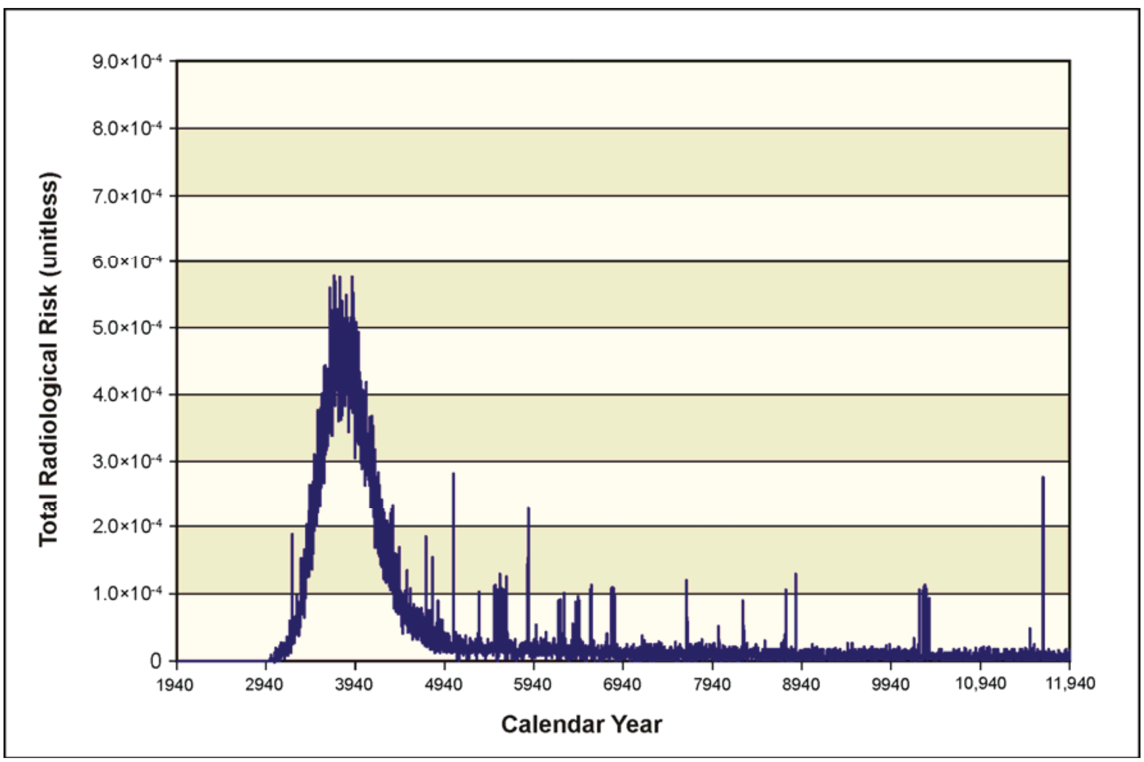

Figure Q–61. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-A, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.9 Waste Management Alternative 3; Disposal Group 2, Subgroup 2-B

Disposal Group 2, Subgroup 2-B addresses the waste resulting from Tank Closure Alternative 6B (Base and Option Cases), onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- PPF glass
- PPF melters
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 6B (Base and Option Cases).

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary, the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–335 through Q–346. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides; and acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would be exceeded at IDF-West for the resident farmer and the American Indian resident farmer for both the Base and Option Cases. The Hazard Index guideline would be exceeded for the Option Case only at the Core Zone Boundary for the drinking-water well user, the resident farmer, and the American Indian resident farmer. Population dose for the Base Case was estimated as 6.00×10^{-1} person-rem per year for the year of maximum impact and for the Option Case was estimated as 5.90×10^{-1} person-rem per year for the year of maximum impact.

Table Q–335. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.37×10^{-7}	5.90×10^{-1}	2.03×10^{-5}	3.37×10^{-7}	1.51	6.85×10^{-5}	3.37×10^{-7}	3.09	1.50×10^{-4}
Iodine-129	1.08×10^{-9}	3.08×10^{-1}	3.50×10^{-6}	1.08×10^{-9}	3.57×10^{-1}	3.70×10^{-6}	1.08×10^{-9}	4.41×10^{-1}	5.32×10^{-6}
Total	3.38×10^{-7}	8.97×10^{-1}	2.38×10^{-5}	3.38×10^{-7}	1.87	7.22×10^{-5}	3.38×10^{-7}	3.53	1.55×10^{-4}
Year of Peak Impact	11,141	11,141	11,141	11,141	11,141	10,643	11,141	11,141	10,643
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.20×10^{-3}	2.10×10^{-2}	0.00	2.20×10^{-3}	2.10×10^{-2}	1.20×10^{-11}	2.20×10^{-3}	3.07×10^{-2}	5.49×10^{-7}
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.68×10^{-1}	0.00
Total	1.66×10^{1}	3.18×10^{-1}	0.00	1.66×10^{1}	4.12×10^{-1}	1.20×10^{-11}	1.66×10^{1}	7.98×10^{-1}	5.49×10^{-7}
Year of Peak Impact	8414	8414	N/A	8414	8414	8281	8414	8414	8281

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–336. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the 200-West Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–337. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.83×10^{-7}	4.97×10^{-1}	1.71×10^{-5}	2.83×10^{-7}	1.28	5.60×10^{-5}	2.83×10^{-7}	2.60	1.22×10^{-4}
Iodine-129	3.34×10^{-10}	9.51×10^{-2}	1.08×10^{-6}	3.34×10^{-10}	1.10×10^{-1}	1.46×10^{-6}	3.34×10^{-10}	1.36×10^{-1}	2.10×10^{-6}
Total	2.84×10^{-7}	5.92×10^{-1}	1.82×10^{-5}	2.84×10^{-7}	1.39	5.75×10^{-5}	2.84×10^{-7}	2.73	1.24×10^{-4}
Year of Peak Impact	3889	3889	3889	3889	3889	3889	3889	3889	3889
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	6.80×10^{-7}	3.24×10^{-6}	0.00	6.80×10^{-7}	4.04×10^{-6}	0.00	6.80×10^{-7}	7.30×10^{-6}	0.00
Chromium	5.77×10^{-3}	5.49×10^{-2}	0.00	5.77×10^{-3}	5.50×10^{-2}	2.27×10^{-11}	5.77×10^{-3}	8.03×10^{-2}	1.04×10^{-6}
Nitrate	2.62×10^{-1}	4.67×10^{-3}	0.00	2.62×10^{-1}	6.16×10^{-3}	0.00	2.62×10^{-1}	1.21×10^{-2}	0.00
Total	2.68×10^{-1}	5.96×10^{-2}	0.00	2.68×10^{-1}	6.11×10^{-2}	2.27×10^{-11}	2.68×10^{-1}	9.24×10^{-2}	1.04×10^{-6}
Year of Peak Impact	3868	3868	N/A	3868	3868	3868	3868	3868	3868

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–338. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	6.62×10^{-6}	1.16×10^{1}	4.49×10^{-4}	6.62×10^{-6}	2.98×10^{1}	1.53×10^{-3}	7.75×10^{-6}	7.10×10^{1}	3.34×10^{-3}
Iodine-129	5.63×10^{-8}	1.60×10^{1}	1.43×10^{-4}	5.63×10^{-8}	1.86×10^{1}	1.69×10^{-4}	3.87×10^{-8}	1.58×10^{1}	2.44×10^{-4}
Total	6.67×10^{-6}	2.76×10^{1}	5.92×10^{-4}	6.67×10^{-6}	4.84×10^{1}	1.70×10^{-3}	7.79×10^{-6}	8.68×10^{1}	3.58×10^{-3}
Year of Peak Impact	3709	3709	3751	3709	3709	3690	3690	3690	3690
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.84×10^{-6}	8.77×10^{-6}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Boron and Compounds	9.63×10^{-6}	1.38×10^{-6}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium	1.20×10^{-2}	1.15×10^{-1}	0.00	4.30×10^{-4}	4.10×10^{-3}	4.72×10^{-11}	4.30×10^{-4}	5.98×10^{-3}	2.17×10^{-6}
Fluoride	7.21×10^{-4}	3.43×10^{-4}	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrate	5.52×10^{-1}	9.86×10^{-3}	0.00	5.75	1.35×10^{-1}	0.00	5.75	2.65×10^{-1}	0.00
Total	5.65×10^{-1}	1.25×10^{-1}	0.00	5.75	1.39×10^{-1}	4.72×10^{-11}	5.75	2.71×10^{-1}	2.17×10^{-6}
Year of Peak Impact	4042	4042	N/A	8245	8245	4042	8245	8245	4042

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–339. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	8.79×10^{-7}	1.54	7.00×10^{-5}	1.16×10^{-6}	5.22	2.30×10^{-4}	1.16×10^{-6}	1.07×10^{1}	5.01×10^{-4}
Iodine-129	6.98×10^{-9}	1.99	1.35×10^{-5}	4.18×10^{-9}	1.38	1.82×10^{-5}	4.15×10^{-9}	1.70	2.62×10^{-5}
Total	8.86×10^{-7}	3.53	8.35×10^{-5}	1.16×10^{-6}	6.60	2.48×10^{-4}	1.17×10^{-6}	1.23×10^{1}	5.27×10^{-4}
Year of Peak Impact	4389	4389	4191	3882	3882	4191	4191	4191	4191
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.36×10^{-7}	6.49×10^{-7}	0.00	1.36×10^{-7}	8.10×10^{-7}	0.00	1.36×10^{-7}	1.46×10^{-6}	0.00
Boron and Compounds	3.35×10^{-7}	4.79×10^{-8}	0.00	3.35×10^{-7}	4.85×10^{-8}	0.00	3.35×10^{-7}	5.15×10^{-8}	0.00
Chromium	5.86×10^{-4}	5.58×10^{-3}	0.00	5.86×10^{-4}	5.59×10^{-3}	9.42×10^{-12}	5.86×10^{-4}	8.16×10^{-3}	4.32×10^{-7}
Fluoride	2.51×10^{-5}	1.20×10^{-5}	0.00	2.51×10^{-5}	1.23×10^{-5}	0.00	2.51×10^{-5}	1.32×10^{-5}	0.00
Nitrate	3.31	5.92×10^{-2}	0.00	3.31	7.79×10^{-2}	0.00	3.31	1.53×10^{-1}	0.00
Total	3.31	6.48×10^{-2}	0.00	3.31	8.35×10^{-2}	9.42×10^{-12}	3.31	1.61×10^{-1}	4.32×10^{-7}
Year of Peak Impact	7831	7831	N/A	7831	7831	4714	7831	7831	4714

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–340. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.68×10^{-11}	7.55×10^{-5}	3.49×10^{-9}	1.32×10^{-11}	1.37×10^{-4}	8.26×10^{-9}	8.79×10^{-7}	9.62×10^{-3}	6.98×10^{-7}
Iodine-129	1.36×10^{-13}	4.49×10^{-5}	4.84×10^{-10}	1.49×10^{-13}	8.05×10^{-4}	1.76×10^{-8}	6.98×10^{-9}	1.14×10^{-2}	1.85×10^{-7}
Total	1.69×10^{-11}	1.20×10^{-4}	3.97×10^{-9}	1.33×10^{-11}	9.42×10^{-4}	2.59×10^{-8}	8.86×10^{-7}	2.10×10^{-2}	8.82×10^{-7}
Year of Peak Impact	4005	4005	4042	4076	4076	4005	4389	4389	3882

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	2.88×10^{-13}	1.72×10^{-12}	0.00	2.88×10^{-13}	3.10×10^{-12}	0.00	1.36×10^{-7}	8.10×10^{-7}	0.00
Boron and Compounds	1.07×10^{-12}	1.54×10^{-13}	0.00	1.07×10^{-12}	1.69×10^{-13}	0.00	3.35×10^{-7}	3.34×10^{-9}	0.00
Chromium	7.12×10^{-9}	6.79×10^{-8}	1.30×10^{-16}	7.12×10^{-9}	1.09×10^{-7}	5.94×10^{-12}	5.86×10^{-4}	1.29×10^{-3}	2.16×10^{-7}
Fluoride	0.00	0.00	0.00	0.00	0.00	0.00	2.51×10^{-5}	3.67×10^{-6}	0.00
Nitrate	4.78×10^{-5}	1.65×10^{-6}	0.00	4.78×10^{-5}	4.50×10^{-3}	0.00	3.31	1.24×10^{-1}	0.00
Total	4.79×10^{-5}	1.72×10^{-6}	1.30×10^{-16}	4.79×10^{-5}	4.50×10^{-3}	5.94×10^{-12}	3.31	1.26×10^{-1}	2.16×10^{-7}
Year of Peak Impact	8304	8304	4172	8304	8304	4172	7837	7837	4714

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–341. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.37×10^{-7}	5.90×10^{-1}	2.03×10^{-5}	3.37×10^{-7}	1.51	6.85×10^{-5}	3.37×10^{-7}	3.09	1.50×10^{-4}
Iodine-129	1.08×10^{-9}	3.08×10^{-1}	3.50×10^{-6}	1.08×10^{-9}	3.57×10^{-1}	3.70×10^{-6}	1.08×10^{-9}	4.41×10^{-1}	5.32×10^{-6}
Total	3.38×10^{-7}	8.97×10^{-1}	2.38×10^{-5}	3.38×10^{-7}	1.87	7.22×10^{-5}	3.38×10^{-7}	3.53	1.55×10^{-4}
Year of Peak Impact	11,141	11,141	11,141	11,141	11,141	10,643	11,141	11,141	10,643
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	2.21×10^{-3}	2.10×10^{-2}	0.00	2.21×10^{-3}	2.11×10^{-2}	1.20×10^{-11}	2.21×10^{-3}	3.08×10^{-2}	5.50×10^{-7}
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.68×10^{-1}	0.00
Total	1.66×10^{1}	3.18×10^{-1}	0.00	1.66×10^{1}	4.12×10^{-1}	1.20×10^{-11}	1.66×10^{1}	7.98×10^{-1}	5.50×10^{-7}
Year of Peak Impact	8414	8414	N/A	8414	8414	8281	8414	8414	8281

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–342. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the 200-West Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–343. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.40×10^{-7}	5.95×10^{-1}	2.05×10^{-5}	3.40×10^{-7}	1.53	6.71×10^{-5}	3.40×10^{-7}	3.11	1.46×10^{-4}
Iodine-129	3.54×10^{-10}	1.01×10^{-1}	1.15×10^{-6}	3.54×10^{-10}	1.17×10^{-1}	1.55×10^{-6}	3.54×10^{-10}	1.45×10^{-1}	2.23×10^{-6}
Total	3.40×10^{-7}	6.96×10^{-1}	2.16×10^{-5}	3.40×10^{-7}	1.65	6.87×10^{-5}	3.40×10^{-7}	3.26	1.49×10^{-4}
Year of Peak Impact	4213	4213	4213	4213	4213	4213	4213	4213	4213
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	4.34×10^{-7}	2.06×10^{-6}	0.00	4.34×10^{-7}	2.58×10^{-6}	0.00	4.34×10^{-7}	4.66×10^{-6}	0.00
Chromium	2.55×10^{-2}	2.43×10^{-1}	0.00	2.55×10^{-2}	2.43×10^{-1}	1.28×10^{-10}	2.55×10^{-2}	3.55×10^{-1}	5.87×10^{-6}
Nitrate	8.28	1.48×10^{-1}	0.00	8.28	1.95×10^{-1}	0.00	8.28	3.82×10^{-1}	0.00
Total	8.31	3.91×10^{-1}	0.00	8.31	4.38×10^{-1}	1.28×10^{-10}	8.31	7.37×10^{-1}	5.87×10^{-6}
Year of Peak Impact	4260	4260	N/A	4260	4260	4118	4260	4260	4118

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–344. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.63×10^{-6}	1.16×10^{1}	4.44×10^{-4}	6.63×10^{-6}	2.98×10^{1}	1.50×10^{-3}	7.38×10^{-6}	6.76×10^{1}	3.27×10^{-3}
Iodine-129	5.64×10^{-8}	1.61×10^{1}	1.44×10^{-4}	5.64×10^{-8}	1.86×10^{1}	1.70×10^{-4}	4.43×10^{-8}	1.81×10^{1}	2.44×10^{-4}
Total	6.69×10^{-6}	2.77×10^{1}	5.88×10^{-4}	6.69×10^{-6}	4.85×10^{1}	1.67×10^{-3}	7.42×10^{-6}	8.57×10^{1}	3.51×10^{-3}
Year of Peak Impact	3709	3709	3895	3709	3709	3690	3895	3895	3690

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	6.08×10^{-7}	2.89×10^{-6}	0.00	6.08×10^{-7}	3.61×10^{-6}	0.00	6.08×10^{-7}	6.53×10^{-6}	0.00
Boron and Compounds	9.99×10^{-7}	1.43×10^{-7}	0.00	9.99×10^{-7}	1.45×10^{-7}	0.00	9.99×10^{-7}	1.53×10^{-7}	0.00
Chromium	9.52×10^{-2}	9.07×10^{-1}	0.00	9.52×10^{-2}	9.08×10^{-1}	3.81×10^{-10}	9.52×10^{-2}	1.33	1.75×10^{-5}
Fluoride	1.50×10^{-4}	7.12×10^{-5}	0.00	1.50×10^{-4}	7.33×10^{-5}	0.00	1.50×10^{-4}	7.89×10^{-5}	0.00
Nitrate	2.68×10^{1}	4.78×10^{-1}	0.00	2.68×10^{1}	6.29×10^{-1}	0.00	2.68×10^{1}	1.23	0.00
Total	2.69×10^{1}	1.38	0.00	2.69×10^{1}	1.54	3.81×10^{-10}	2.69×10^{1}	2.56	1.75×10^{-5}
Year of Peak Impact	4564	4564	N/A	4564	4564	10,533	4564	4564	10,533

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–345. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.67×10^{-7}	1.52	7.15×10^{-5}	1.19×10^{-6}	5.34	2.35×10^{-4}	1.19×10^{-6}	1.09×10^{1}	5.12×10^{-4}
Iodine-129	6.93×10^{-9}	1.97	1.37×10^{-5}	4.23×10^{-9}	1.40	1.85×10^{-5}	4.23×10^{-9}	1.73	2.67×10^{-5}
Total	8.74×10^{-7}	3.49	8.53×10^{-5}	1.19×10^{-6}	6.74	2.53×10^{-4}	1.19×10^{-6}	1.26×10^{1}	5.39×10^{-4}
Year of Peak Impact	4388	4388	4189	4189	4189	4189	4189	4189	4189
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	2.69×10^{-7}	1.28×10^{-6}	0.00	2.69×10^{-7}	1.60×10^{-6}	0.00	2.69×10^{-7}	2.89×10^{-6}	0.00
Boron and Compounds	6.68×10^{-7}	9.54×10^{-8}	0.00	6.68×10^{-7}	9.66×10^{-8}	0.00	6.68×10^{-7}	1.03×10^{-7}	0.00
Chromium	1.70×10^{-2}	1.62×10^{-1}	0.00	1.70×10^{-2}	1.62×10^{-1}	6.69×10^{-11}	1.70×10^{-2}	2.37×10^{-1}	3.07×10^{-6}
Fluoride	5.00×10^{-5}	2.38×10^{-5}	0.00	5.00×10^{-5}	2.45×10^{-5}	0.00	5.00×10^{-5}	2.64×10^{-5}	0.00
Nitrate	3.81	6.81×10^{-2}	0.00	3.81	8.97×10^{-2}	0.00	3.81	1.76×10^{-1}	0.00
Total	3.83	2.30×10^{-1}	0.00	3.83	2.52×10^{-1}	6.69×10^{-11}	3.83	4.13×10^{-1}	3.07×10^{-6}
Year of Peak Impact	5180	5180	N/A	5180	5180	5522	5180	5180	5522

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–346. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.63×10^{-11}	7.35×10^{-5}	3.45×10^{-9}	1.22×10^{-11}	1.27×10^{-4}	6.96×10^{-9}	1.03×10^{-6}	1.13×10^{-2}	7.13×10^{-7}
Iodine-129	1.35×10^{-13}	4.47×10^{-5}	5.13×10^{-10}	1.49×10^{-13}	8.05×10^{-4}	1.87×10^{-8}	5.54×10^{-9}	9.49×10^{-3}	1.79×10^{-7}
Total	1.65×10^{-11}	1.18×10^{-4}	3.96×10^{-9}	1.23×10^{-11}	9.32×10^{-4}	2.57×10^{-8}	1.03×10^{-6}	2.08×10^{-2}	8.93×10^{-7}
Year of Peak Impact	4005	4005	4036	4075	4075	4006	4059	4059	4189

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	5.64×10^{-12}	3.35×10^{-11}	0.00	5.69×10^{-12}	6.11×10^{-11}	0.00	1.34×10^{-7}	7.97×10^{-7}	0.00
Boron and Compounds	1.14×10^{-11}	1.64×10^{-12}	0.00	4.40×10^{-12}	6.99×10^{-13}	0.00	9.99×10^{-7}	9.97×10^{-9}	0.00
Chromium	1.76×10^{-7}	1.68×10^{-6}	8.34×10^{-16}	8.83×10^{-8}	1.35×10^{-6}	3.82×10^{-11}	6.83×10^{-3}	1.51×10^{-2}	1.53×10^{-6}
Fluoride	1.01×10^{-9}	4.95×10^{-10}	0.00	3.97×10^{-10}	2.76×10^{-10}	0.00	7.48×10^{-5}	1.09×10^{-5}	0.00
Nitrate	5.13×10^{-5}	1.77×10^{-6}	0.00	5.40×10^{-5}	5.08×10^{-3}	0.00	5.70	2.06×10^{-1}	0.00
Total	5.15×10^{-5}	3.45×10^{-6}	8.34×10^{-16}	5.41×10^{-5}	5.08×10^{-3}	3.82×10^{-11}	5.70	2.22×10^{-1}	1.53×10^{-6}
Year of Peak Impact	4576	4576	4805	4839	4839	4805	4618	4618	5522

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q–62 through Q–67 depicts the cumulative radiological lifetime risk of incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary for the Base and Option Cases and is dominated by technetium-99 and iodine-129 from the naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-East barrier, the radiological lifetime risk of incidence of cancer occurs around the year 11,000 for the Base and Option Cases as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East.

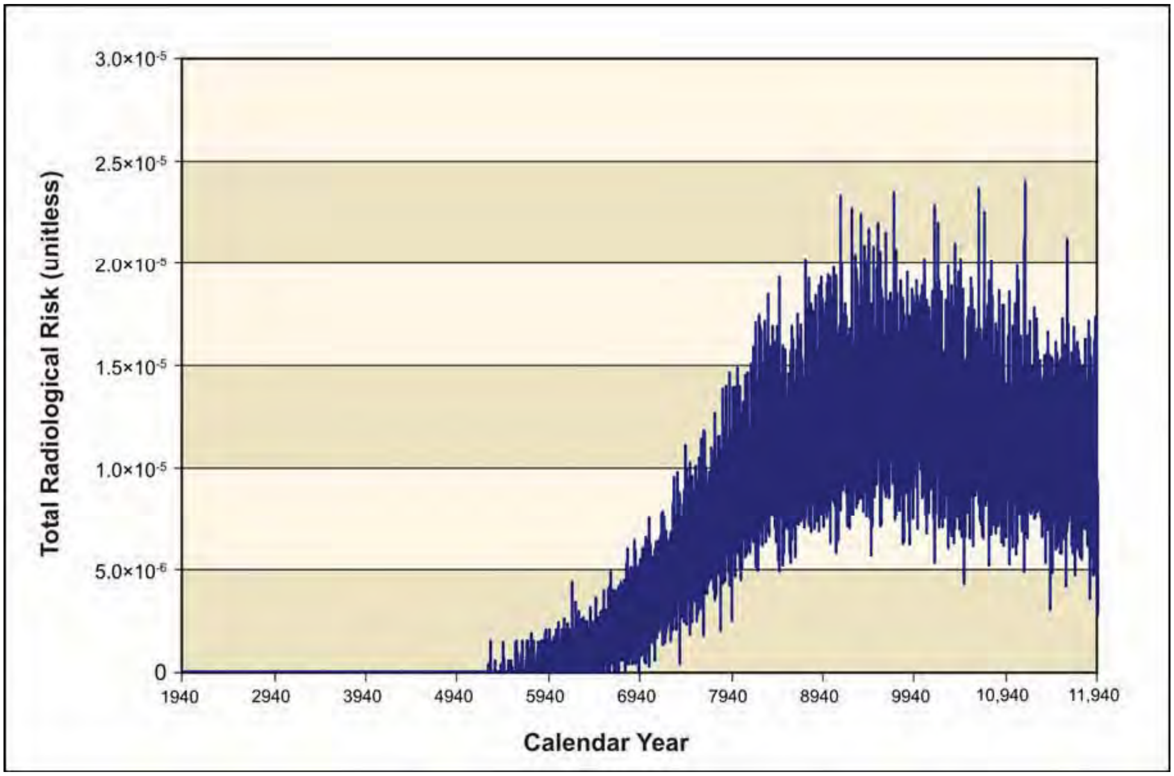

Figure Q–62. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

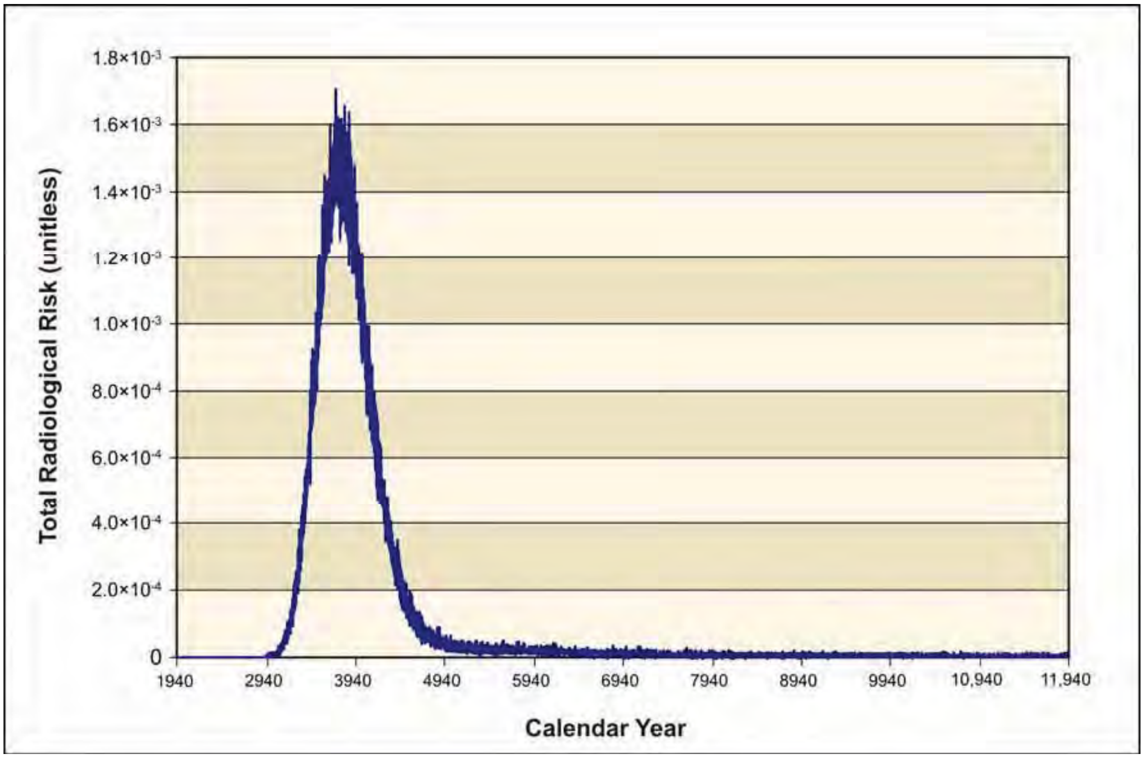

Figure Q–63. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

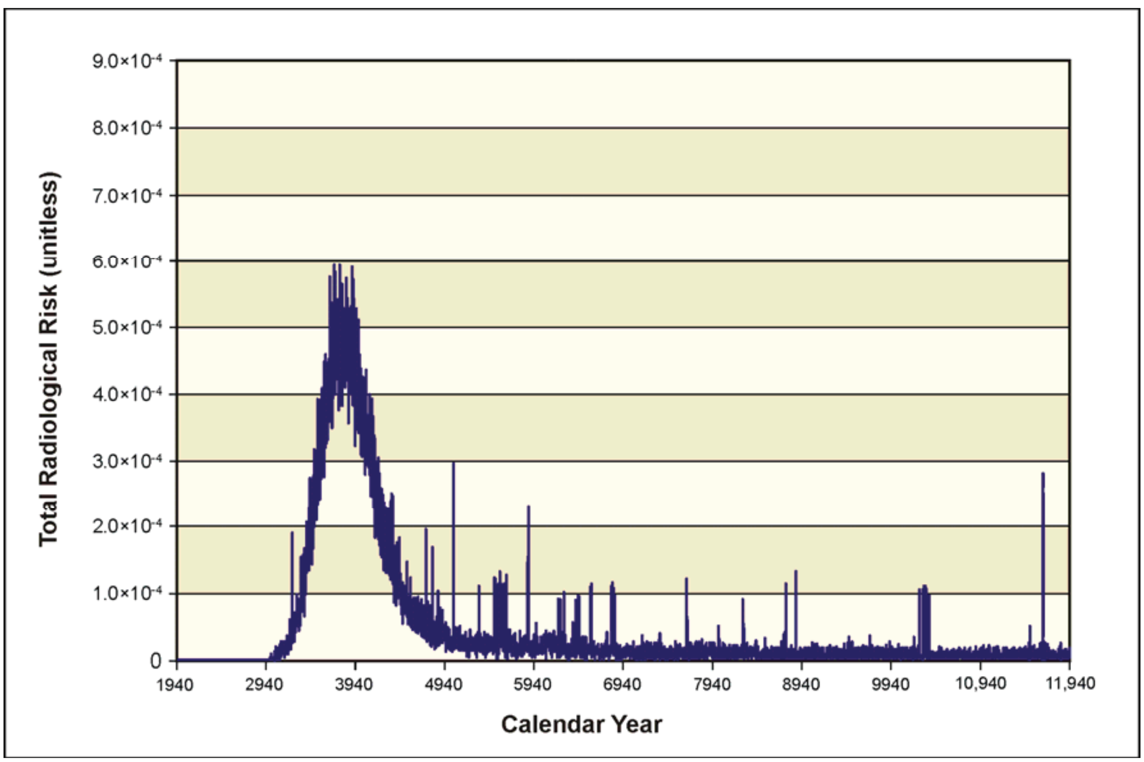

Figure Q–64. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

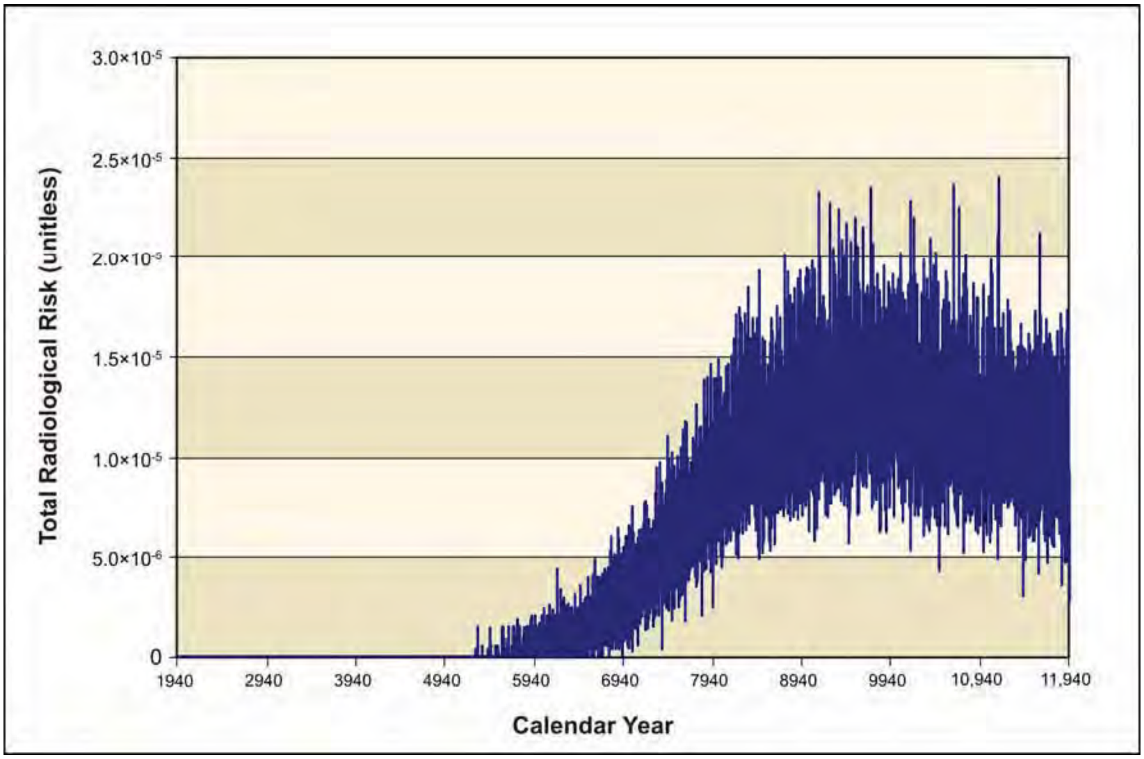

Figure Q–65. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

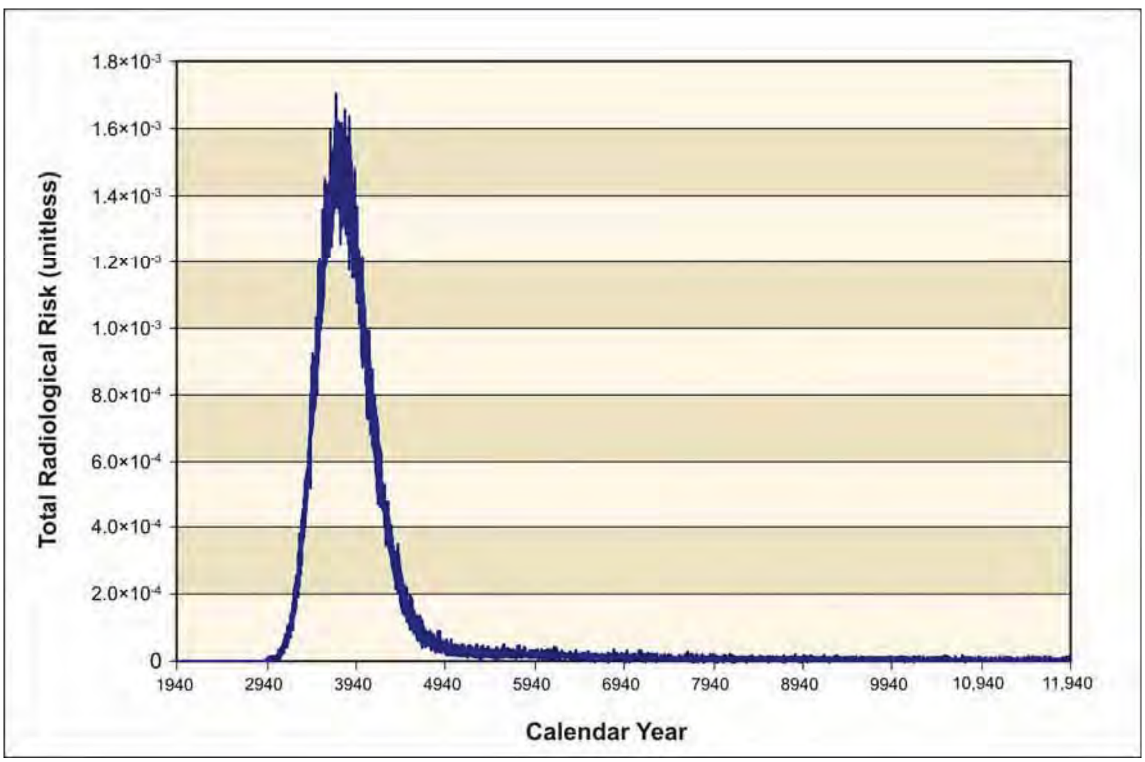

Figure Q–66. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

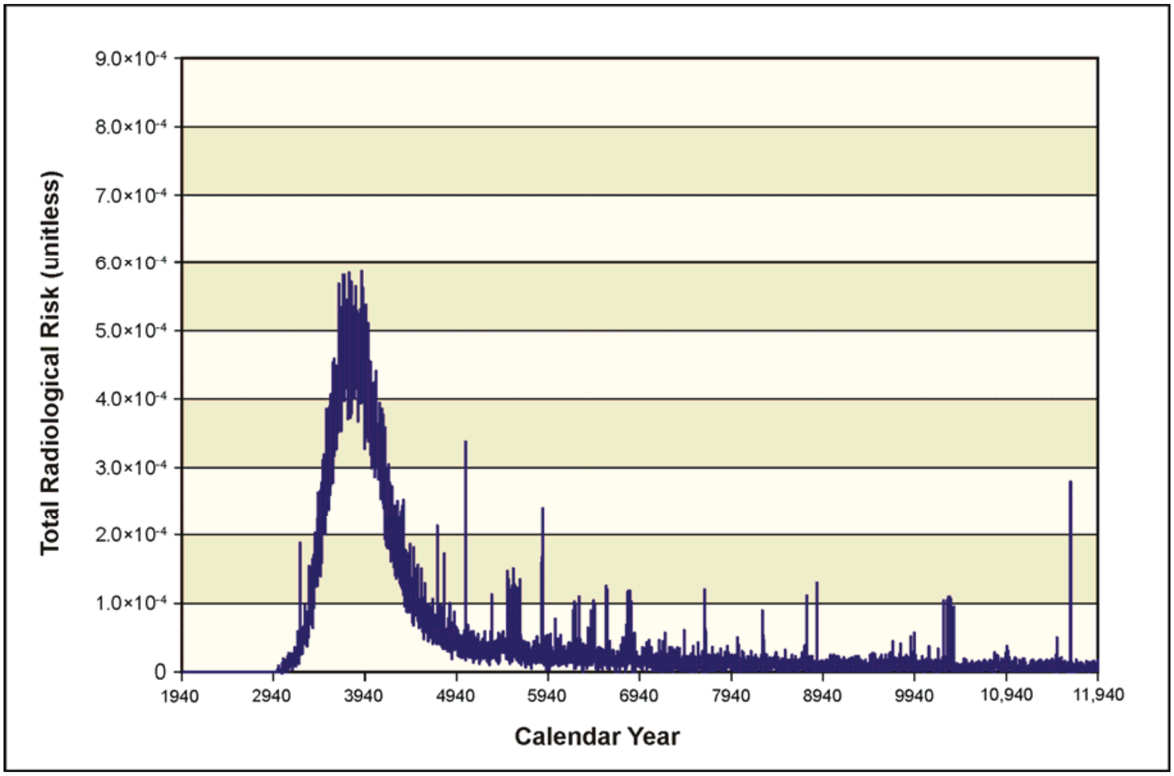

Figure Q–67. Waste Management Alternative 3, Disposal Group 2, Subgroup 2-B, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.3.10 Waste Management Alternative 3; Disposal Group 3

Disposal Group 3 addresses the waste resulting from Tank Closure Alternative 6A (Base and Option Cases), onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites. Waste forms for IDF-East include the following:

- PPF glass
- PPF melters
- Tank closure secondary waste

Waste forms for IDF-West include the following:

- FFTF decommissioning secondary waste
- Waste management secondary waste
- Offsite waste
- Onsite non-CERCLA waste

Waste forms for the RPPDF include those resulting from tank closure cleanup activities for Tank Closure Alternative 6A (Base and Option Cases).

Potential human health impacts at the IDF-East barrier, the IDF-West barrier, the RPPDF barrier, the Core Zone Boundary and the Columbia River nearshore, and the Columbia River surface-water locations are summarized in Tables Q–347 through Q–358, respectively. The key constituent contributors to human health risk are technetium-99 and iodine-129 for radionuclides; and acetonitrile, boron and boron compounds, chromium, fluoride, and nitrate for chemicals. For radionuclides, the dose standard would be exceeded at IDF-West for the resident farmer and the American Indian resident farmer under the Base and Option Cases. The Hazard Index guideline would be exceeded only for the Option Case at the Core Zone Boundary for the drinking-water well user, the resident farmer, and the American Indian resident farmer. Population dose for the Base Case was estimated as 5.95×10^{-1} person-rem per year for the year of maximum impact and for the Option Case as 5.95×10^{-1} person-rem per year for the year of maximum impact.

Table Q–347. Waste Management Alternative 3, Disposal Group 3, Base Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	2.61×10^{-7}	4.57×10^{-1}	2.34×10^{-5}	3.89×10^{-7}	1.75	7.68×10^{-5}	3.89×10^{-7}	3.56	1.68×10^{-4}
Iodine-129	1.42×10^{-9}	4.06×10^{-1}	1.59×10^{-6}	4.91×10^{-10}	1.62×10^{-1}	2.15×10^{-6}	4.91×10^{-10}	2.00×10^{-1}	3.09×10^{-6}
Total	2.62×10^{-7}	8.62×10^{-1}	2.50×10^{-5}	3.89×10^{-7}	1.91	7.89×10^{-5}	3.89×10^{-7}	3.76	1.71×10^{-4}
Year of Peak Impact	11,896	11,896	9324	9324	9324	9324	9324	9324	9324

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Chromium	9.10×10^{-4}	8.67×10^{-3}	0.00	9.10×10^{-4}	8.68×10^{-3}	1.13×10^{-11}	9.10×10^{-4}	1.27×10^{-2}	5.16×10^{-7}
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.67×10^{-1}	0.00
Total	1.66×10^{1}	3.06×10^{-1}	0.00	1.66×10^{1}	4.00×10^{-1}	1.13×10^{-11}	1.66×10^{1}	7.80×10^{-1}	5.16×10^{-7}
Year of Peak Impact	8236	8236	N/A	8236	8236	8037	8236	8236	8037

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–348. Waste Management Alternative 3, Disposal Group 3, Base Case, Human Health Impacts at the 200-West Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–349. Waste Management Alternative 3, Disposal Group 3, Base Case, Human Health Impacts at the River Protection Project Disposal Facility

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	3.03×10^{-7}	5.31×10^{-1}	1.82×10^{-5}	3.03×10^{-7}	1.36	5.99×10^{-5}	3.03×10^{-7}	2.78	1.31×10^{-4}
Iodine-129	3.64×10^{-10}	1.04×10^{-1}	1.18×10^{-6}	3.64×10^{-10}	1.20×10^{-1}	1.59×10^{-6}	3.64×10^{-10}	1.49×10^{-1}	2.29×10^{-6}
Total	3.03×10^{-7}	6.35×10^{-1}	1.94×10^{-5}	3.03×10^{-7}	1.48	6.15×10^{-5}	3.03×10^{-7}	2.93	1.33×10^{-4}
Year of Peak Impact	3987	3987	3987	3987	3987	3987	3987	3987	3987
Chemical Constituent	**Drinking-Water Well User**			**Resident Farmer**			**American Indian Resident Farmer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	1.07×10^{-6}	5.10×10^{-6}	0.00	1.07×10^{-6}	6.37×10^{-6}	0.00	1.07×10^{-6}	1.15×10^{-5}	0.00
Chromium	5.77×10^{-3}	5.50×10^{-2}	0.00	5.77×10^{-3}	5.50×10^{-2}	2.27×10^{-11}	5.77×10^{-3}	8.04×10^{-2}	1.04×10^{-6}
Nitrate	2.18×10^{-1}	3.89×10^{-3}	0.00	2.18×10^{-1}	5.12×10^{-3}	0.00	2.18×10^{-1}	1.01×10^{-2}	0.00
Total	2.24×10^{-1}	5.89×10^{-2}	0.00	2.24×10^{-1}	6.01×10^{-2}	2.27×10^{-11}	2.24×10^{-1}	9.04×10^{-2}	1.04×10^{-6}
Year of Peak Impact	4109	4109	N/A	4109	4109	4109	4109	4109	4109

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–350. Waste Management Alternative 3, Disposal Group 3, Base Case, Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	6.51×10^{-6}	1.14×10^{1}	4.58×10^{-4}	7.60×10^{-6}	3.42×10^{1}	1.53×10^{-3}	7.60×10^{-6}	6.97×10^{1}	3.35×10^{-3}
Iodine-129	5.67×10^{-8}	1.61×10^{1}	1.43×10^{-4}	4.42×10^{-8}	1.46×10^{1}	1.69×10^{-4}	4.42×10^{-8}	1.80×10^{1}	2.43×10^{-4}
Total	6.57×10^{-6}	2.75×10^{1}	6.01×10^{-4}	7.65×10^{-6}	4.88×10^{1}	1.70×10^{-3}	7.65×10^{-6}	8.77×10^{1}	3.59×10^{-3}
Year of Peak Impact	3709	3709	3895	3895	3895	3690	3895	3895	3690
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.55×10^{-3}	9.09×10^{-2}	0.00	1.80×10^{-4}	1.71×10^{-3}	4.57×10^{-11}	1.80×10^{-4}	2.50×10^{-3}	2.10×10^{-6}
Nitrate	1.64	2.93×10^{-2}	0.00	6.55	1.54×10^{-1}	0.00	6.55	3.02×10^{-1}	0.00
Total	1.65	1.20×10^{-1}	0.00	6.55	1.56×10^{-1}	4.57×10^{-11}	6.55	3.05×10^{-1}	2.10×10^{-6}
Year of Peak Impact	9877	9877	N/A	6859	6859	4035	6859	6859	4035

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–351. Waste Management Alternative 3, Disposal Group 3, Base Case, Human Health Impacts at the Columbia River Nearshore

Radiological Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	8.42×10^{-7}	1.47	7.00×10^{-5}	1.16×10^{-6}	5.23	2.30×10^{-4}	1.16×10^{-6}	1.07×10^{1}	5.01×10^{-4}
Iodine-129	6.94×10^{-9}	1.98	1.36×10^{-5}	4.19×10^{-9}	1.38	1.83×10^{-5}	4.19×10^{-9}	1.71	2.64×10^{-5}
Total	8.48×10^{-7}	3.45	8.36×10^{-5}	1.17×10^{-6}	6.61	2.48×10^{-4}	1.17×10^{-6}	1.24×10^{1}	5.27×10^{-4}
Year of Peak Impact	4389	4389	4191	4191	4191	4191	4191	4191	4191

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	1.36×10^{-7}	6.48×10^{-7}	0.00	1.36×10^{-7}	8.09×10^{-7}	0.00	1.36×10^{-7}	1.46×10^{-6}	0.00
Chromium	9.83×10^{-4}	9.36×10^{-3}	0.00	9.83×10^{-4}	9.37×10^{-3}	1.25×10^{-11}	9.83×10^{-4}	1.37×10^{-2}	5.72×10^{-7}
Nitrate	3.29	5.87×10^{-2}	0.00	3.29	7.73×10^{-2}	0.00	3.29	1.52×10^{-1}	0.00
Total	3.29	6.80×10^{-2}	0.00	3.29	8.66×10^{-2}	1.25×10^{-11}	3.29	1.65×10^{-1}	5.72×10^{-7}
Year of Peak Impact	7710	7710	N/A	7710	7710	4877	7710	7710	4877

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–352. Waste Management Alternative 3, Disposal Group 3, Base Case, Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.70×10^{-11}	7.65×10^{-5}	3.49×10^{-9}	1.28×10^{-11}	1.33×10^{-4}	6.28×10^{-9}	8.42×10^{-7}	9.20×10^{-3}	6.98×10^{-7}
Iodine-129	1.29×10^{-13}	4.28×10^{-5}	4.82×10^{-10}	1.49×10^{-13}	8.05×10^{-4}	1.94×10^{-8}	6.94×10^{-9}	1.13×10^{-2}	1.83×10^{-7}
Total	1.71×10^{-11}	1.19×10^{-4}	3.98×10^{-9}	1.29×10^{-11}	9.37×10^{-4}	2.56×10^{-8}	8.48×10^{-7}	2.05×10^{-2}	8.81×10^{-7}
Year of Peak Impact	4019	4019	4042	4076	4076	4076	4389	4389	3882
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	7.21×10^{-13}	4.29×10^{-12}	0.00	7.21×10^{-13}	7.75×10^{-12}	0.00	1.36×10^{-7}	8.09×10^{-7}	0.00
Boron and Compounds	0.00	0.00	0.00	0.00	0.00	0.00	3.35×10^{-7}	3.34×10^{-9}	0.00
Chromium	5.90×10^{-9}	5.62×10^{-8}	1.27×10^{-16}	5.90×10^{-9}	9.00×10^{-8}	5.84×10^{-12}	5.94×10^{-4}	1.31×10^{-3}	2.86×10^{-7}
Nitrate	5.01×10^{-5}	1.73×10^{-6}	0.00	5.01×10^{-5}	4.71×10^{-3}	0.00	3.31	1.25×10^{-1}	0.00
Total	5.01×10^{-5}	1.79×10^{-6}	1.27×10^{-16}	5.01×10^{-5}	4.71×10^{-3}	5.84×10^{-12}	3.31	1.26×10^{-1}	2.86×10^{-7}
Year of Peak Impact	7991	7991	4468	7991	7991	4468	7714	7714	4877

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table Q–353. Waste Management Alternative 3, Disposal Group 3, Option Case, Human Health Impacts at the 200-East Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	2.61×10^{-7}	4.57×10^{-1}	2.34×10^{-5}	3.89×10^{-7}	1.75	7.68×10^{-5}	3.89×10^{-7}	3.56	1.68×10^{-4}
Iodine-129	1.42×10^{-9}	4.06×10^{-1}	1.59×10^{-6}	4.91×10^{-10}	1.62×10^{-1}	2.15×10^{-6}	4.91×10^{-10}	2.00×10^{-1}	3.09×10^{-6}
Total	2.62×10^{-7}	8.62×10^{-1}	2.50×10^{-5}	3.89×10^{-7}	1.91	7.90×10^{-5}	3.89×10^{-7}	3.76	1.71×10^{-4}
Year of Peak Impact	11896	11896	9324	9324	9324	9324	9324	9324	9324
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Chromium	9.13×10^{-4}	8.69×10^{-3}	0.00	9.13×10^{-4}	8.70×10^{-3}	1.13×10^{-11}	9.13×10^{-4}	1.27×10^{-2}	5.17×10^{-7}
Nitrate	1.66×10^{1}	2.97×10^{-1}	0.00	1.66×10^{1}	3.91×10^{-1}	0.00	1.66×10^{1}	7.67×10^{-1}	0.00
Total	1.66×10^{1}	3.06×10^{-1}	0.00	1.66×10^{1}	4.00×10^{-1}	1.13×10^{-11}	1.66×10^{1}	7.80×10^{-1}	5.17×10^{-7}
Year of Peak Impact	8236	8236	N/A	8236	8236	8037	8236	8236	8037

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–354. Waste Management Alternative 3, Disposal Group 3, Option Case, Human Health Impacts at the 200-West Area Integrated Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	1.83×10^{-5}	3.20×10^{1}	1.22×10^{-3}	2.02×10^{-5}	9.09×10^{1}	3.99×10^{-3}	2.02×10^{-5}	1.85×10^{2}	8.71×10^{-3}
Iodine-129	1.71×10^{-7}	4.87×10^{1}	4.84×10^{-4}	1.49×10^{-7}	4.93×10^{1}	6.53×10^{-4}	1.49×10^{-7}	6.09×10^{1}	9.40×10^{-4}
Total	1.85×10^{-5}	8.08×10^{1}	1.70×10^{-3}	2.04×10^{-5}	1.40×10^{2}	4.65×10^{-3}	2.04×10^{-5}	2.46×10^{2}	9.65×10^{-3}
Year of Peak Impact	3723	3723	3713	3713	3713	3713	3713	3713	3713
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Boron and Compounds	1.59×10^{-5}	2.27×10^{-6}	0.00	1.59×10^{-5}	2.30×10^{-6}	0.00	1.59×10^{-5}	2.45×10^{-6}	0.00
Chromium	1.95×10^{-3}	1.86×10^{-2}	0.00	1.95×10^{-3}	1.86×10^{-2}	7.67×10^{-12}	1.95×10^{-3}	2.72×10^{-2}	3.52×10^{-7}
Fluoride	1.37×10^{-3}	6.50×10^{-4}	0.00	1.37×10^{-3}	6.69×10^{-4}	0.00	1.37×10^{-3}	7.20×10^{-4}	0.00
Nitrate	1.37×10^{-2}	2.45×10^{-4}	0.00	1.37×10^{-2}	3.23×10^{-4}	0.00	1.37×10^{-2}	6.33×10^{-4}	0.00
Total	1.71×10^{-2}	1.95×10^{-2}	0.00	1.71×10^{-2}	1.96×10^{-2}	7.67×10^{-12}	1.71×10^{-2}	2.85×10^{-2}	3.52×10^{-7}
Year of Peak Impact	3756	3756	N/A	3756	3756	3696	3756	3756	3696

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–355. Waste Management Alternative 3, Disposal Group 3, Option Case, Human Health Impacts at the River Protection Project Disposal Facility

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	3.86×10^{-7}	6.76×10^{-1}	2.32×10^{-5}	3.86×10^{-7}	1.74	7.62×10^{-5}	3.86×10^{-7}	3.54	1.66×10^{-4}
Iodine-129	3.91×10^{-10}	1.11×10^{-1}	1.27×10^{-6}	3.91×10^{-10}	1.29×10^{-1}	1.71×10^{-6}	3.91×10^{-10}	1.59×10^{-1}	2.46×10^{-6}
Total	3.86×10^{-7}	7.87×10^{-1}	2.45×10^{-5}	3.86×10^{-7}	1.86	7.79×10^{-5}	3.86×10^{-7}	3.70	1.69×10^{-4}
Year of Peak Impact	4013	4013	4013	4013	4013	4013	4013	4013	4013
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	8.36×10^{-7}	3.98×10^{-6}	0.00	5.45×10^{-7}	3.24×10^{-6}	0.00	5.45×10^{-7}	5.85×10^{-6}	0.00
Chromium	3.37×10^{-2}	3.21×10^{-1}	0.00	2.94×10^{-2}	2.81×10^{-1}	1.43×10^{-10}	2.94×10^{-2}	4.10×10^{-1}	6.54×10^{-6}
Nitrate	6.07	1.08×10^{-1}	0.00	8.02	1.89×10^{-1}	0.00	8.02	3.70×10^{-1}	0.00
Total	6.10	4.29×10^{-1}	0.00	8.05	4.69×10^{-1}	1.43×10^{-10}	8.05	7.80×10^{-1}	6.54×10^{-6}
Year of Peak Impact	4387	4387	N/A	4196	4196	3878	4196	4196	3878

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–356. Waste Management Alternative 3, Disposal Group 3, Option Case, Human Health Impacts at the Core Zone Boundary

Radiological Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	6.60×10^{-6}	1.16×10^{1}	4.78×10^{-4}	7.94×10^{-6}	3.57×10^{1}	1.57×10^{-3}	7.94×10^{-6}	7.27×10^{1}	3.42×10^{-3}
Iodine-129	5.64×10^{-8}	1.61×10^{1}	1.25×10^{-4}	3.86×10^{-8}	1.28×10^{1}	1.69×10^{-4}	3.86×10^{-8}	1.58×10^{1}	2.43×10^{-4}
Total	6.66×10^{-6}	2.76×10^{1}	6.03×10^{-4}	7.97×10^{-6}	4.85×10^{1}	1.74×10^{-3}	7.97×10^{-6}	8.85×10^{1}	3.66×10^{-3}
Year of Peak Impact	3709	3709	3690	3690	3690	3690	3690	3690	3690

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	6.63×10^{-7}	3.16×10^{-6}	0.00	6.63×10^{-7}	3.94×10^{-6}	0.00	6.63×10^{-7}	7.12×10^{-6}	0.00
Boron and Compounds	7.00×10^{-7}	9.99×10^{-8}	0.00	7.00×10^{-7}	1.01×10^{-7}	0.00	7.00×10^{-7}	1.08×10^{-7}	0.00
Chromium	8.56×10^{-2}	8.16×10^{-1}	0.00	8.56×10^{-2}	8.16×10^{-1}	4.89×10^{-10}	8.56×10^{-2}	1.19	2.24×10^{-5}
Fluoride	9.98×10^{-5}	4.75×10^{-5}	0.00	9.98×10^{-5}	4.89×10^{-5}	0.00	9.98×10^{-5}	5.26×10^{-5}	0.00
Nitrate	3.02×10^{1}	5.40×10^{-1}	0.00	3.02×10^{1}	7.11×10^{-1}	0.00	3.02×10^{1}	1.39	0.00
Total	3.03×10^{1}	1.36	0.00	3.03×10^{1}	1.53	4.89×10^{-10}	3.03×10^{1}	2.59	2.24×10^{-5}
Year of Peak Impact	4628	4628	N/A	4628	4628	6610	4628	4628	6610

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–357. Waste Management Alternative 3, Disposal Group 3, Option Case, Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radiological Constituent	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**	**Concentration at Year of Peak Dose (curies per cubic meter)**	**Dose at Year of Peak Dose (millirem per year)**	**Radiological Risk at Year of Peak Radiological Risk (unitless)**
Technetium-99	8.99×10^{-7}	1.58	7.34×10^{-5}	1.22×10^{-6}	5.48	2.41×10^{-4}	1.22×10^{-6}	1.12×10^{1}	5.25×10^{-4}
Iodine-129	7.04×10^{-9}	2.01	1.35×10^{-5}	4.17×10^{-9}	1.38	1.83×10^{-5}	4.17×10^{-9}	1.70	2.63×10^{-5}
Total	9.06×10^{-7}	3.58	8.69×10^{-5}	1.22×10^{-6}	6.86	2.59×10^{-4}	1.22×10^{-6}	1.29×10^{1}	5.52×10^{-4}
Year of Peak Impact	4388	4388	4066	4066	4066	4066	4066	4066	4066
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**	**Concentration at Year of Peak Hazard Index (grams per cubic meter)**	**Hazard Index at Year of Peak Hazard Index (unitless)**	**Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)**
Acetonitrile	2.69×10^{-7}	1.28×10^{-6}	0.00	2.69×10^{-7}	1.60×10^{-6}	0.00	2.69×10^{-7}	2.89×10^{-6}	0.00
Boron and Compounds	3.34×10^{-7}	4.77×10^{-8}	0.00	3.34×10^{-7}	4.83×10^{-8}	0.00	3.34×10^{-7}	5.13×10^{-8}	0.00
Chromium	1.70×10^{-2}	1.62×10^{-1}	0.00	1.70×10^{-2}	1.62×10^{-1}	8.05×10^{-11}	1.70×10^{-2}	2.36×10^{-1}	3.69×10^{-6}
Fluoride	1.00×10^{-4}	4.76×10^{-5}	0.00	1.00×10^{-4}	4.90×10^{-5}	0.00	1.00×10^{-4}	5.27×10^{-5}	0.00
Nitrate	3.80	6.79×10^{-2}	0.00	3.80	8.95×10^{-2}	0.00	3.80	1.75×10^{-1}	0.00
Total	3.82	2.30×10^{-1}	0.00	3.82	2.51×10^{-1}	8.05×10^{-11}	3.82	4.12×10^{-1}	3.69×10^{-6}
Year of Peak Impact	4954	4954	N/A	4954	4954	6701	4954	4954	6701

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: N/A=not applicable.

Table Q–358. Waste Management Alternative 3, Disposal Group 3, Option Case, Human Health Impacts at the Columbia River Surface Water

Radiological Constituent	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Hunter-Gatherer: Dose at Year of Peak Dose (millirem per year)	American Indian Hunter-Gatherer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Technetium-99	1.65×10^{-11}	7.42×10^{-5}	3.42×10^{-9}	1.24×10^{-11}	1.29×10^{-4}	8.13×10^{-9}	8.99×10^{-7}	9.84×10^{-3}	7.33×10^{-7}
Iodine-129	1.35×10^{-13}	4.48×10^{-5}	4.82×10^{-10}	1.48×10^{-13}	8.01×10^{-4}	1.76×10^{-8}	7.04×10^{-9}	1.12×10^{-2}	1.83×10^{-7}
Total	1.66×10^{-11}	1.19×10^{-4}	3.90×10^{-9}	1.26×10^{-11}	9.30×10^{-4}	2.57×10^{-8}	9.06×10^{-7}	2.10×10^{-2}	9.16×10^{-7}
Year of Peak Impact	4005	4005	3986	4076	4076	4005	4388	4388	4066

Chemical Constituent	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Hunter-Gatherer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Hunter-Gatherer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Hunter-Gatherer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Acetonitrile	6.41×10^{-12}	3.81×10^{-11}	0.00	4.49×10^{-12}	4.83×10^{-11}	0.00	4.07×10^{-7}	2.42×10^{-6}	0.00
Boron and Compounds	1.15×10^{-11}	1.66×10^{-12}	0.00	6.26×10^{-12}	9.93×10^{-13}	0.00	3.35×10^{-7}	3.34×10^{-9}	0.00
Chromium	1.73×10^{-7}	1.65×10^{-6}	7.92×10^{-16}	1.15×10^{-7}	1.76×10^{-6}	3.63×10^{-11}	6.85×10^{-3}	1.51×10^{-2}	1.85×10^{-6}
Fluoride	7.28×10^{-10}	3.57×10^{-10}	0.00	5.42×10^{-10}	3.76×10^{-10}	0.00	2.51×10^{-5}	3.67×10^{-6}	0.00
Nitrate	4.49×10^{-5}	1.55×10^{-6}	0.00	5.65×10^{-5}	5.31×10^{-3}	0.00	5.62	2.02×10^{-1}	0.00
Total	4.50×10^{-5}	3.20×10^{-6}	7.92×10^{-16}	5.66×10^{-5}	5.31×10^{-3}	3.63×10^{-11}	5.62	2.17×10^{-1}	1.85×10^{-6}
Year of Peak Impact	4640	4640	4927	4843	4843	4927	6522	6522	6701

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Figures Q-68 through Q–73 depicts the cumulative radiological lifetime risk of the incidence of cancer at the IDF-East barrier, the IDF-West barrier, and the Core Zone Boundary for the drinking-water well user over time. The peak radiological risk occurs around the year 3700 for the Core Zone Boundary for the Base and Option Cases and is dominated by technetium-99 and iodine-129 from naturally occurring release mechanisms and degradation of waste forms disposed of in IDF-West and the RPPDF. These are relatively mobile radionuclides that move at the same velocity as groundwater. For the IDF-East barrier, the radiological lifetime risk of incidence of cancer occurs around the year 11,900 as a result of slower movement through the vadose zone for waste forms disposed of in IDF-East.

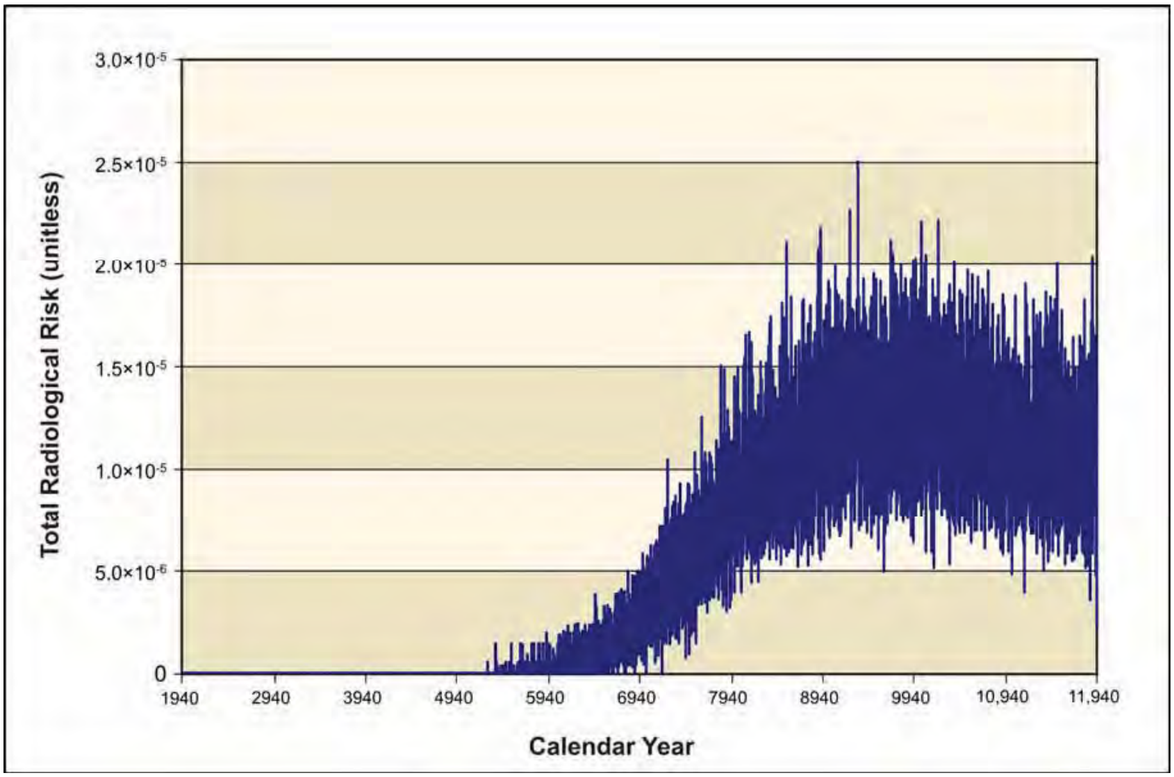

Figure Q–68. Waste Management Alternative 3, Disposal Group 3, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

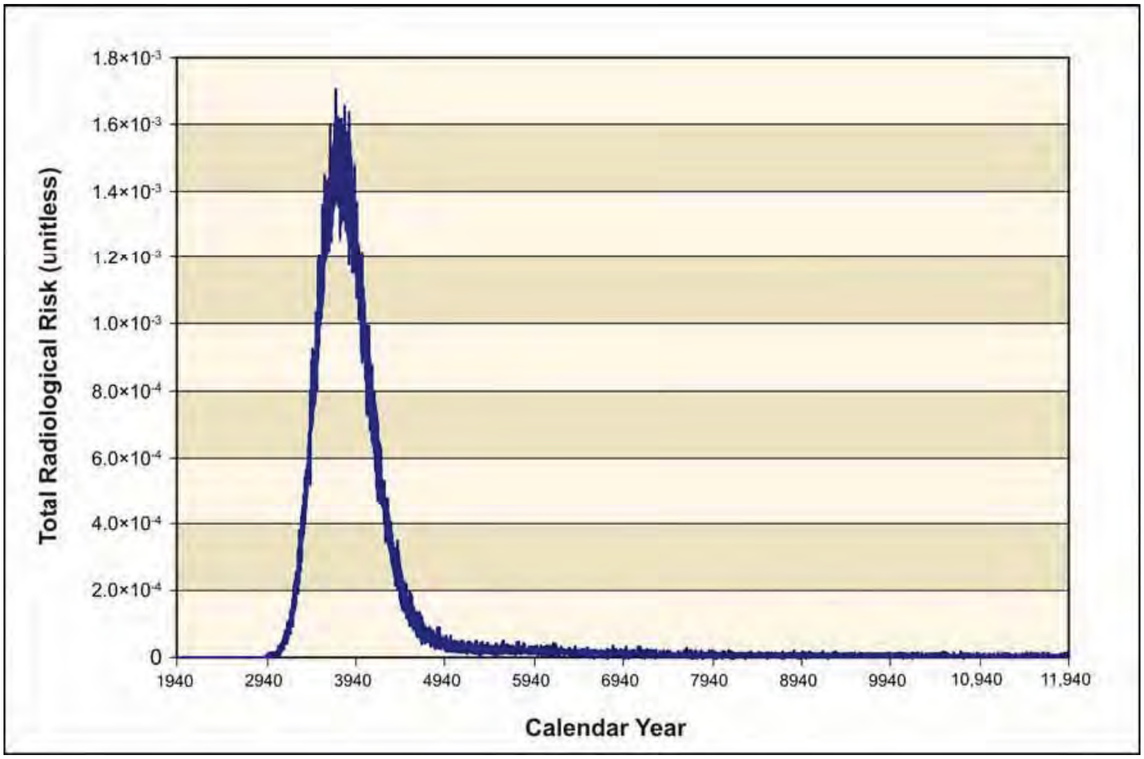

Figure Q–69. Waste Management Alternative 3, Disposal Group 3, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

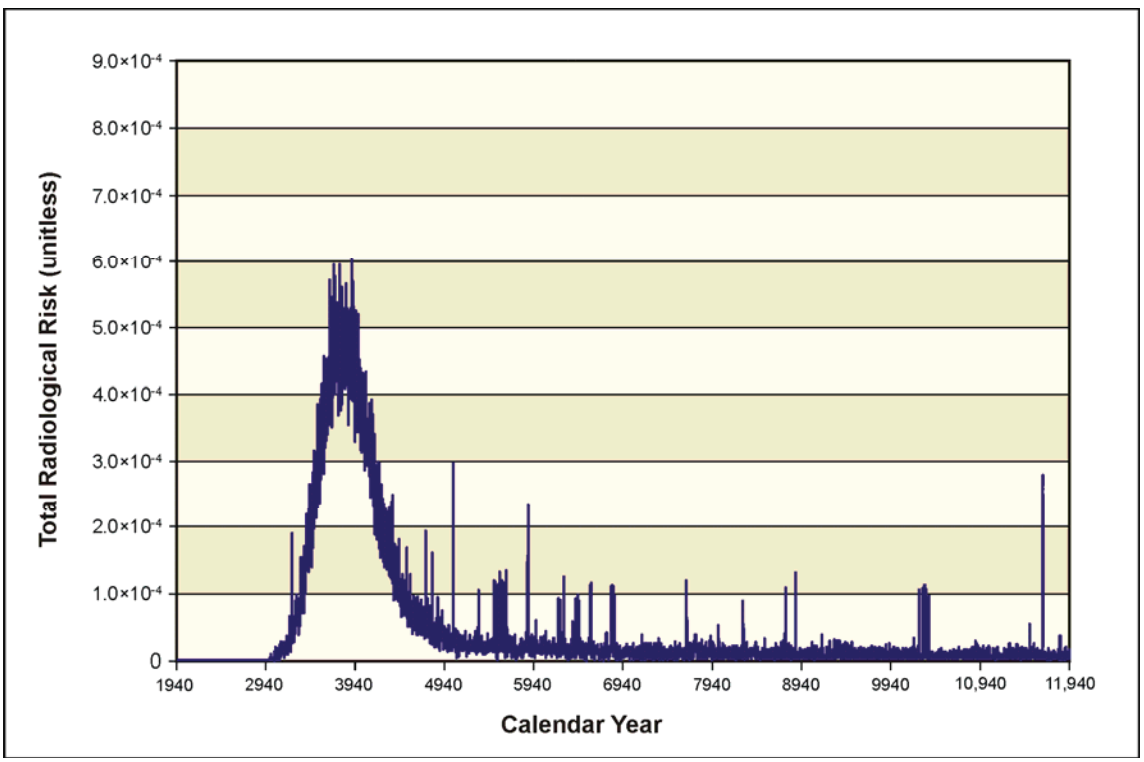

Figure Q–70. Waste Management Alternative 3, Disposal Group 3, Base Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

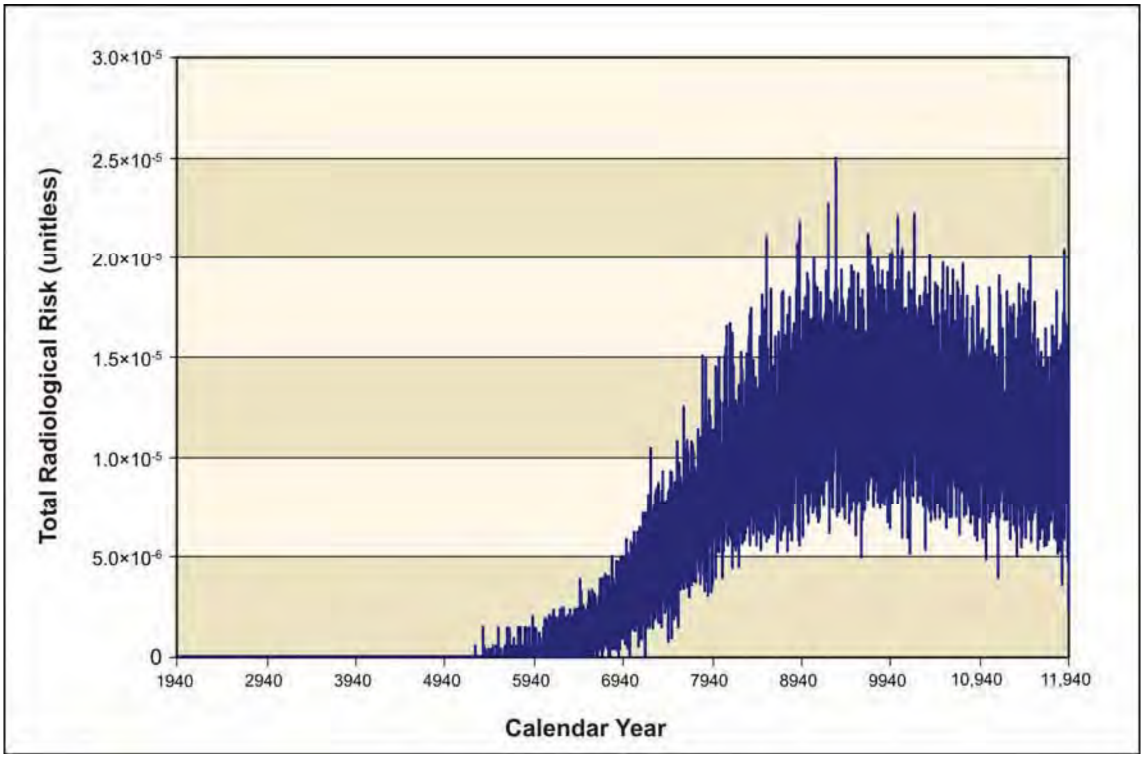

Figure Q–71. Waste Management Alternative 3, Disposal Group 3, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-East Area Integrated Disposal Facility

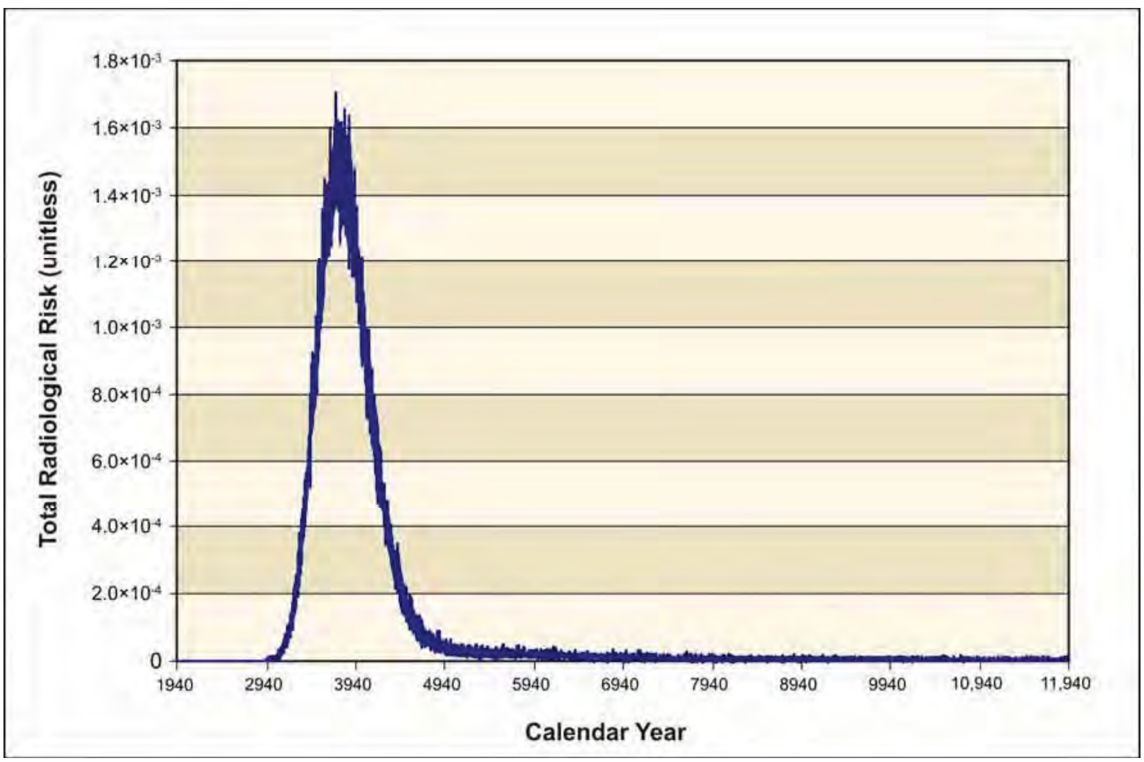

Figure Q–72. Waste Management Alternative 3, Disposal Group 3, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the 200-West Area Integrated Disposal Facility

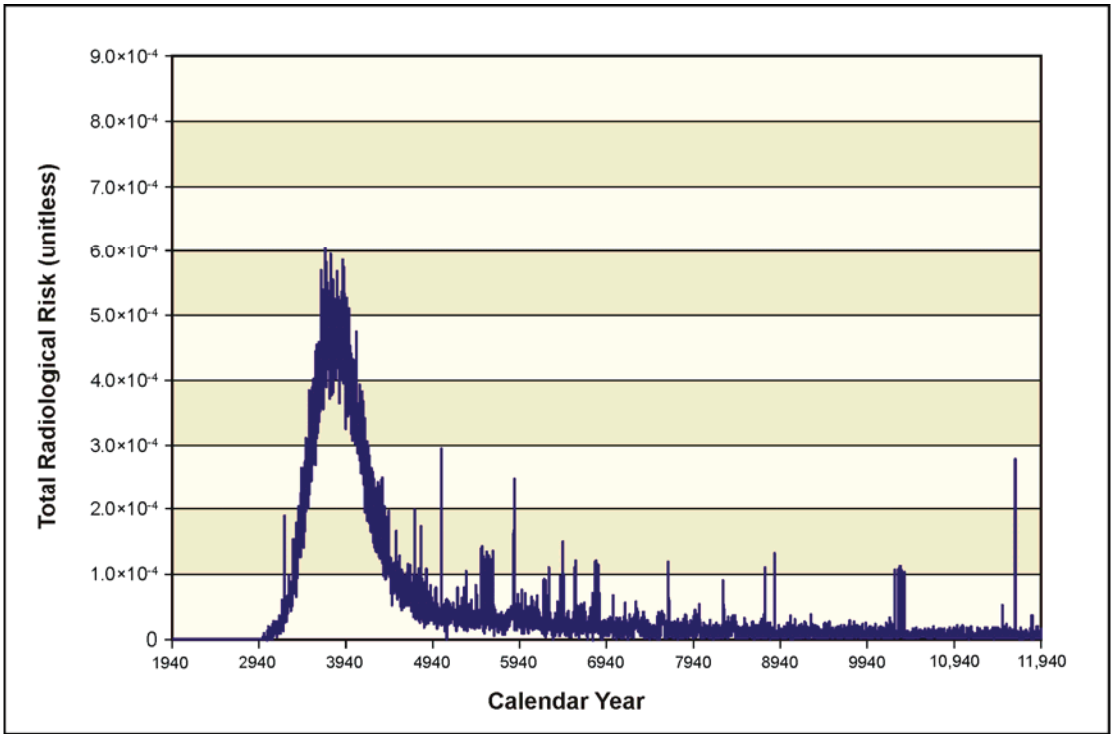

Figure Q–73. Waste Management Alternative 3, Disposal Group 3, Option Case, Summary of Long-Term Human Health Impacts on Drinking-Water Well User at the Core Zone Boundary

Q.3.3.1.4 Waste Management Intruder Scenario

Intruders are individuals who enter IDF-East, IDF-West, or the RPPDF and engage in activity that could cause direct contact with residual contamination in the stabilized, below-grade waste. Waste types that would be disposed of in IDF-East and IDF-West include waste generated in activities related to tank closure and activities not related to tank closure. Waste types related to tank closure that would be disposed of in IDF-East include:

- ILAW glass
- Bulk vitrification glass
- Cast stone
- Steam reforming solids
- PPF glass
- Effluent Treatment Facility (ETF) Secondary
- Sulfate grout
- Tank closure secondary
- Discarded melters

In addition, rubble, soil and equipment generated during tank closure activities would be disposed of in the RPPDF under some Tank Closure alternatives. Waste types not related to tank closure that would be disposed of in either the IDF-East or IDF-West include:

- Onsite non-CERCLA waste
- Waste management secondary waste
- Offsite waste
- FFTF decommissioning secondary waste

As in the case of Tank Closure alternatives, two types of receptors and two types of scenarios were considered. The receptor types were the resident farmer and American Indian resident farmer, and the scenario types were home construction and well drilling. Because the waste at the disposal areas is at a depth greater than that of the foundation for a home, the home construction scenario was screened from the analysis. Also, sensitivity analysis determined that in all cases for residential agriculture, impacts on the American Indian resident farmer exceeded impacts on the resident farmer. Because inhalation and external exposure are the only exposure modes for the well-drilling worker, impacts on the worker involved in well drilling would be the same for the resident farmer and American Indian resident farmer. Screening analysis also determined that impacts of intrusion were dominated by contact with short-lived radionuclides, strontium-90 and cesium-137 for all waste types except ETF Secondary waste. Consequently, impacts of intrusion at the disposal areas are represented by the well-drilling scenario in which a worker inhales dust and receives external radiation while drilling the well, and an American Indian resident farmer contacting residual contamination brought to the surface during development of the well. For both the resident farmer and drilling worker, impacts are presented as dose for the year of peak dose and the year of peak dose occurs immediately after loss of institutional control.

The impacts under this intrusion scenario at IDF-East or IDF-West for waste types related to tank closure are summarized in Tables Q–359 and Q–360 for the American Indian resident farmer and worker intruders, respectively. For all waste types and alternatives except ETF Secondary waste, resident farmer impacts are dominated by exposure to strontium-90 and cesium-137. Estimates of impact on the drilling worker are dominated by external exposure due to cesium-137. For both the American Indian resident farmer and drilling worker, impacts related to ETF Secondary waste are dominated by exposure to iodine-129. Due to high waste loadings of cesium-137, the DOE intruder dose guideline of 500 millirem is exceeded for both primary and secondary waste forms. The estimated impacts of intrusion into the rubble, soil and equipment related to tank closure that is disposed of in the RPPDF are presented in Table Q–361. As for other tank closure waste types, doses are dominated by exposure to cesium-137. The DOE intruder dose guideline is exceeded only for Tank Closure Alternatives 6A and 6B that involve complete removal of below grade tanks and soil. The estimated impacts of intrusion into waste types not related to tank closure that are disposed of in either IDF-East or IDF-West are presented in Table Q–362 for an American Indian resident farmer and a drilling worker. The DOE intruder dose guideline of 500 millirem is exceeded for the Offsite waste type due to high loading of cesium-137.

Table Q–359. Doses by Tank Closure Waste Type to an American Indian Engaged in Residential Agriculture Following Well Drilling at an Integrated Disposal Facility

Alternative	Dose (rem per year)								
	Waste Type								
	ILAW Glass	Bulk Vitrification Glass	Cast Stone	Steam Reforming Solids	PPF Glass	ETF Secondary	Sulfate Grout	Tank Closure Secondary	Discarded Melters
2A	0.74	N/A[a]	N/A	N/A	N/A	0.29	N/A	1.22	0.026
2B	0.74	N/A	N/A	N/A	N/A	0.29	N/A	1.29	0.025
3A	0.93	7.7	N/A	N/A	N/A	0.51	N/A	1.63	0.034
3B	0.93	N/A	5.9	N/A	N/A	0.22	N/A	2.19	0.034
3C	0.93	N/A	N/A	7.6	N/A	0.51	N/A	2.19	0.034
4	1.36	18.6	0.47	N/A	N/A	0.58	N/A	1.84	0.044
5	1.24	20.5	0.46	N/A	N/A	0.49	0.47	1.50	0.049
6A, Base Case	N/A	N/A	N/A	N/A	64.2	0.29	N/A	1.38	0.969
6A, Option Case	N/A	N/A	N/A	N/A	2.37	0.29	N/A	1.38	0.033
6B, Base Case	N/A	N/A	N/A	N/A	62.8	0.29	N/A	1.36	1.48
6B, Option Case	N/A	N/A	N/A	N/A	2.36	0.29	N/A	1.36	0.05
6C	N/A	N/A	N/A	N/A	N/A	0.29	N/A	1.29	N/A

[a] N/A=not applicable, this waste type is not generated for this alternative.
Key: ETF=Effluent Treatment Facility; ILAW=immobilized low-activity waste; PPF=Preprocessing Facility.

Table Q–360. Doses by Tank Closure Waste Type to a Well-Drilling Worker at an Integrated Disposal Facility

Alternative	Dose (rem)								
	Waste Type								
	ILAW Glass	Bulk Vitrification Glass	Cast Stone	Steam Reforming Solids	PPF Glass	ETF Secondary	Sulfate Grout	Tank Closure Secondary	Discarded Melters
2A	1.6×10^{-3}	N/A[a]	N/A	N/A	N/A	3.3×10^{-4}	N/A	2.1×10^{-3}	5.4×10^{-5}
2B	1.6×10^{-3}	N/A	N/A	N/A	N/A	3.3×10^{-4}	N/A	2.2×10^{-3}	5.2×10^{-5}
3A	2.0×10^{-3}	1.7×10^{-2}	N/A	N/A	N/A	6.7×10^{-4}	N/A	2.7×10^{-3}	7.2×10^{-5}
3B	2.0×10^{-3}	N/A	1.3×10^{-2}	N/A	N/A	3.1×10^{-4}	N/A	3.6×10^{-3}	7.2×10^{-5}
3C	2.0×10^{-3}	N/A	N/A	1.7×10^{-2}	N/A	6.7×10^{-4}	N/A	3.6×10^{-3}	7.2×10^{-5}
4	2.9×10^{-3}	4.0×10^{-2}	9.9×10^{-4}	N/A	N/A	8.0×10^{-4}	N/A	3.1×10^{-3}	9.1×10^{-5}
5	2.6×10^{-3}	4.5×10^{-2}	9.6×10^{-4}	N/A	N/A	6.7×10^{-4}	9.9×10^{-4}	2.5×10^{-3}	9.5×10^{-5}
6A, Base Case	N/A	N/A	N/A	N/A	1.4×10^{-1}	3.3×10^{-4}	N/A	2.4×10^{-3}	2.0×10^{-3}
6A, Option Case	N/A	N/A	N/A	N/A	7.2×10^{-3}	3.3×10^{-4}	N/A	2.4×10^{-3}	1.0×10^{-4}
6B, Base Case	N/A	N/A	N/A	N/A	1.32×10^{-1}	3.3×10^{-4}	N/A	2.3×10^{-3}	3.1×10^{-3}
6B, Option Case	N/A	N/A	N/A	N/A	7.1×10^{-3}	3.3×10^{-4}	N/A	2.3×10^{-3}	1.6×10^{-4}
6C	N/A	N/A	N/A	N/A	N/A	3.3×10^{-4}	N/A	2.2×10^{-3}	N/A

[a] N/A=not applicable, this waste type is not generated for this alternative.
Key: ETF=Effluent Treatment Facility; ILAW=immobilized low-activity waste; PPF=Preprocessing Facility.

Table Q–361. Doses by Waste Management Waste Type to an American Indian Engaged in Residential Agriculture and a Well-Drilling Worker at an Integrated Disposal Facility

Waste Type	Dose for American Indian Resident Farmer (rem per year)	Dose for Drilling Worker (rem)
Onsite non-CERCLA waste	1.78×10^{-1}	5.20×10^{-4}
Waste management secondary waste	3.66×10^{-4}	1.5×10^{-4}
Offsite waste	2.67	5.77×10^{-3}
FFTF decommissioning secondary waste	3.4×10^{-3}	2.37×10^{-8}

Key: CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; FFTF=Fast Flux Test Facility.

Table Q–362. Doses by Tank Closure Waste Type to an American Indian Engaged in Residential Agriculture and a Well-Drilling Worker at the RPPDF

Alternative	Dose for American Indian Resident Farmer (rem per year)	Dose for Drilling Worker (rem)
2A	Not applicable[a]	Not applicable
2B	0.096	2.6×10^{-4}
3A	0.096	2.6×10^{-4}
3B	0.096	2.6×10^{-4}
3C	0.096	2.6×10^{-4}
4	0.544	1.2×10^{-3}
5	Not applicable	Not applicable
6A, Base Case	2.19	4.6×10^{-3}
6A, Option Case	2.28	6.3×10^{-3}
6B, Base Case	2.19	4.6×10^{-3}
6B, Option Case	2.28	6.3×10^{-3}
6C	0.096	

[a] N/A=not applicable, this waste type is not generated in this alternative.
Key: RPPDF=River Protection Project Disposal Facility.

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APPENDIX R
CUMULATIVE IMPACTS: ASSESSMENT METHODOLOGY

This appendix describes the cumulative impacts methodology for the U.S. Department of Energy *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*. The appendix is organized into sections on (1) regulations and guidance, (2) previous studies, (3) history of land use at the Hanford Site and in surrounding regions, (4) future land use at the Hanford Site, (5) future land use in surrounding regions, (6) approach to cumulative impacts analysis, (7) uncertainties, (8) selection of resource areas for analysis, (9) resource area methodologies, (10) spatial and temporal considerations, (11) past and present actions, and (12) selection of reasonably foreseeable future actions. The results of the cumulative impacts analysis are presented in Chapter 6. Supporting information for the short-term cumulative impacts analysis is presented in Appendix T; long-term, in Appendix U. The details of inventory development and end states for the cumulative groundwater modeling are described in Appendix S.

The Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) (40 CFR 1500–1508) define cumulative impacts as impacts on the environment that result from the proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7). Thus, the cumulative impacts of an action on a resource (e.g., land, air, water, soil) ecosystem or human community comprise the effects of that action and all other activities affecting that resource no matter what entity (Federal, non-Federal, or private) is taking the action (EPA 1999:2).

Cumulative impacts are analyzed for activities occurring at the Hanford Site (Hanford). Under the Fast Flux Test Facility (FFTF) Decommissioning Entombment and Removal Alternatives, Idaho options were evaluated for management and disposition of the FFTF remote-handled special components and bulk sodium. These options involve shipping the remote-handled special components to the proposed Idaho National Laboratory (INL) Remote Treatment Facility for treatment and the bulk sodium to the existing INL Sodium Processing Facility for processing to produce a caustic sodium hydroxide solution, which would be returned to Hanford for reuse in the Waste Treatment Plant (WTP) pretreatment processes. Construction of these facilities was, or would be, largely unrelated to the processing of materials from Hanford. The additional materials processing would not contribute substantially to the cumulative impacts of activities at INL because (1) there would be no marked increase in daily effluent emissions from, or waste generation by, the facilities; (2) sodium hydroxide, produced at INL's Sodium Processing Facility, would be returned to Hanford for use in processing tank waste; (3) hazardous and radioactive wastes would not be disposed of at INL; and (4) impacts of the activities would be small. Accordingly, only the cumulative impacts of transporting materials and waste to and from INL are evaluated in this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)*. Cumulative impacts of activities at INL have been evaluated in the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995a:C-4.6.7-1) and *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems* (DOE 2005a:4-65).

R.1 REGULATIONS AND GUIDANCE

Cumulative impacts analysis in U.S. Department of Energy (DOE) NEPA documents is governed by the CEQ regulations (40 CFR 1500–1508) and the DOE NEPA implementing procedures (10 CFR 1021). Additional guidance on how to conduct such analyses was obtained from *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997) and *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* (EPA 1999).

As noted, cumulative impacts on the environment result from proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over an extended period of time. They can also result from the spatial or temporal crowding of environmental perturbations. That is, increased environmental impact can be expected when a second perturbation occurs at a site before that site can fully rebound from the effects of the first.

While there is no universally accepted framework for cumulative impacts analysis, eight general principles (CEQ 1997:8) have gained acceptance and thus inform the methodology adopted for this *TC & WM EIS*. These principles are based on the premise that any resource, ecosystem, or human community can experience stress, and that for each there are thresholds, or levels of stress, beyond which conditions degrade. The following is a summary of the CEQ's eight principles of cumulative effects analysis:

1. Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions. This includes all actions that affect the same resources.

2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, or human community of all actions taken, no matter who (Federal, non-Federal, or private entity) has taken the actions. Effects from individual activities may interact to cause additional effects not apparent when looking at individual effects one at a time.

3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, or human community being affected, rather than from the perspective of the proposed actions. Analyzing cumulative effects involves developing an understanding of how the resources are susceptible to effects.

4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those effects that are truly meaningful. The boundaries for evaluating cumulative effects should be expanded to the point at which the resource is no longer affected significantly.

5. Cumulative effects on a given resource, ecosystem, or human community are rarely aligned with political or administrative boundaries. Cumulative effects analysis of natural systems must use natural boundaries, and analysis of human communities must use actual sociocultural boundaries to ensure that all effects are included.

6. Cumulative effects may result from accumulation of similar effects or from the synergistic interaction of different effects. Accordingly, the cumulative effect can in some cases be greater than the sum of the individual effects.

7. Cumulative effects may last for many years beyond the life of the action(s) that caused the effects. Radioactive contamination is an example. Cumulative effects analysis must involve application of the best science and forecasting techniques.

8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters. The most effective cumulative effects analysis focuses on what is needed to ensure long-term productivity or sustainability of the resource.

In *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (known as *The Green Book*) (DOE 2004a:1, 2, 19, 20), DOE expands on the CEQ instruction (40 CFR 1502.2(b)) by stating that impacts should be discussed in proportion to their significance and that this sliding-scale approach applies to all *Green Book* recommendations. *The Green Book* stipulates use of the sliding scale for impact identification and quantification and provides the following basic recommendations:

- Quantify impacts consistent with the sliding-scale approach and available information.
- Provide sufficient information so the validity of analytical methods and results can be reviewed.
- Acknowledge uncertainty and incompleteness in data and how they may affect significance in the analysis.
- Do not quantify impacts when they are virtually absent.
- Define and compare impacts in their appropriate context using both relative and absolute information.
- Define, where possible, the actual impact on health or the environment, not just contaminant concentrations or release rates.

Included in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997:49–57) is discussion of various techniques for analyzing cumulative effects. Implicit in that discussion is the idea that there is no one appropriate method for such an analysis.

R.2 PREVIOUS STUDIES

Cumulative impacts at Hanford were evaluated in the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (*TWRS EIS*) (DOE and Ecology 1996) and the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement (Hanford Comprehensive Land-Use Plan EIS)* (DOE 1999a). Presented in Table R–1 is a breakdown of the resource areas addressed in those evaluations. While the entries attest to evaluation of certain areas in both documents, they do not necessarily reflect evaluations at the same level of detail.

Table R–1. Resource Areas Evaluated in Recent Major Hanford Cumulative Impacts Analyses

Resource Area	*TWRS EIS*[a]	*Hanford Comprehensive Land-Use Plan EIS*[b]
Land resources	X	X
Noise and vibration	–	X
Air quality	X	X
Geology and soils	–	X
Water resources	–	X
Ecological resources	X	X
Cultural resources	–	X
Socioeconomics	X	X
Public health and safety—normal operations	X	X
Occupational health and safety	–	X
Long-term groundwater quality	X	–

[a] DOE and Ecology 1996:5-237–5-251.

[b] DOE 1999a:5-65–5-72.

Key: *Hanford Comprehensive Land-Use Plan EIS=Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement; TWRS EIS=Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement.*

R.3 HISTORY OF LAND USE AT THE HANFORD SITE AND IN SURROUNDING REGIONS

This section provides information on past land use in the region to illustrate how the land and its resources have changed since European-American colonization. Such information helps determine the impacts of past actions.

The 151,775-hectare (375,040-acre) Hanford Site is in the Columbia Basin Ecoregion, an area historically including over 6 million hectares (14.8 million acres) of steppe and shrub-steppe vegetation extending across most of central and southeastern Washington and portions of north-central Oregon. In the early 1800s, the dominant plant in the Hanford area was big sagebrush underlain by perennial Sandberg's bluegrass and bluebunch wheatgrass. Many places on Hanford are fairly free of nonnative species and extensive enough to retain characteristic populations of shrub-steppe plants and animals absent or scarce in developed areas of the ecoregion. Hanford's location provides important connectivity with other undeveloped portions of the ecoregion (Neitzel 2005:4.73). Washington State considers pristine shrub-steppe habitat as a priority habitat because it is scarce in the state and important to several state-listed wildlife species (WDFW 2007). Sagebrush communities are also considered a Level III resource under the *Hanford Site Biological Resources Management Plan* (DOE 2001a). Impacts on such resources should be avoided or minimized; however, when avoidance and minimization are not possible, rectification or compensatory mitigation is recommended (DOE 2002a:4.7).

In prehistoric and early historic times, American Indians of various tribal affiliations heavily populated the area along the Columbia River in eastern Washington, including the area occupied by Hanford, and some of their descendants still live in the region (DOE 2000a:3-125). When Euro-American explorers arrived in the early 1800s, people presently referred to as "the Wanapum" (the River People) were observed inhabiting numerous villages and fishing camps scattered throughout this segment of the mid-Columbia River. Neighboring groups known today as the Yakama, Umatilla, Cayuse, Walla Walla, Palus, Nez Perce, and Middle Columbia Salish frequented the area to trade, gather resources, and conduct other activities. Many descendants of these tribes and bands are affiliated with the Wanapum, Confederated Tribes and Bands of the Yakama Nation, Confederated Tribes of the Umatilla Reservation, Nez Perce Tribe of Idaho, or the Confederated Tribes of the Colville Reservation (Neitzel 2005:4.102, 4.103). Present-day tribal members retain traditional secular and religious ties to the region, and many have knowledge of their cultural ceremonies and lifeways (DOE 2000a:3-125).

Under separate treaties signed in 1855, the land area of much of what is now eastern Washington, Oregon, and Idaho was ceded to the United States by a number of regional American Indian tribes. The land area includes land occupied by Hanford. Under these treaties, the tribes retained the right to fish in usual and accustomed places. Tribal fishing rights are recognized on rivers within the ceded lands, including the Columbia River, which flows through Hanford. In addition to fishing rights, the tribes retained under the treaties the privilege to hunt, gather roots and berries, and pasture horses and cattle on open and unclaimed lands. It is the position of DOE that Hanford, like other ceded lands that were settled or used for specific purposes, is not open and unclaimed land. While reserving all rights to assert their respective positions regarding treaty rights, the tribes are participants in DOE's land use planning process, and DOE considers tribal concerns in that process.

American Indian traditional cultural places within Hanford include, but are not limited to, a wide variety of places and landscapes: archaeological sites, cemeteries, trails and pathways, campsites and villages, fisheries, hunting grounds, plant-gathering areas, holy lands, landmarks, important places in American Indian history and culture, places of persistence and resistance, and landscapes of the heart (Neitzel 2005:4.104). Culturally important localities and geographic features include Rattlesnake Mountain, Gable Mountain, Gable Butte, Goose Egg Hill, Coyote Rapids, and the White Bluffs portion of the Columbia River. The Wanapum resided on land that is now part of Hanford until 1942, when the site was established, then moved to Priest Rapids (DOE 1987).

Lewis and Clark were among the first European Americans to visit the Hanford region during their 1804–1806 expedition. They were followed by fur trappers, military units, and miners. It was not until the 1860s that merchants set up stores, a freight depot, and the White Bluffs Ferry on the Hanford Reach, and gold miners began to work the gravel bars. Cattle ranches opened in the 1880s, and farmers soon followed. Land use began to change as settlers populated the area (Neitzel 2005:4.104). By the beginning of the twentieth century, much of the area was used for farming and grazing (DOE 1999a:4-1, 4-3). The Grand Coulee Dam was built on the Columbia River in the 1940s, and the Columbia Irrigation Project brought more water for farming. The population then increased in Franklin County, across the Columbia River from Hanford (DOE 2004a:21).

Several small, thriving towns, including Hanford, White Bluffs, and Ringold, grew up along the riverbanks in the early twentieth century. The accessibility of these communities to outside markets expanded with the arrival of the Chicago, Milwaukee, St. Paul, and Pacific Railroad branch line in 1913. These towns, and nearly all other structures, were razed after the U.S. Government acquired the land for the original Hanford Engineer Works in 1943 (part of the Manhattan Project). Although agriculture and livestock production were the primary activities within the region and in Hanford at the beginning of the twentieth century, these activities ceased at the site when it was acquired by the Government (Neitzel 2005:4.73, 4.104). Today, remnants of homesteads, farm fields, ranches, abandoned military installations, and other buildings can be found throughout Hanford. Nearly 5,200 hectares (13,000 acres) of abandoned agricultural lands remain on the site (DOE and Ecology 1996:4-37).

During the Manhattan Project and Cold War era, numerous nuclear reactors and associated reprocessing facilities were constructed at Hanford. The reactor sites cover over 900 hectares (2,300 acres) of land. All reactor buildings still stand, although many ancillary support structures have been removed (DOE and Ecology 1996:4-37; Neitzel 2005:4.107).

Hanford is owned and used primarily by DOE, but portions are owned, leased, or administered by other Government agencies. Only about 6 percent of the land area has been disturbed and is actively used, leaving mostly vacant land with widely scattered facilities (Neitzel 2005:4.144).

Currently, land use within the Hanford vicinity includes wildlife protection areas and areas used for urban and industrial development, recreation, military training, irrigated and dryland farming, and grazing. At the time of the 2002 Census of Agriculture, Benton, Franklin, and Grant Counties had a total of 949,772 hectares (2,346,912 acres) of land in farms. Of that farmland, 72 to 77 percent was used as cropland, 18 to 24 percent was pastureland, and 4 to 5 percent had other uses (USDA 2002). In 2006 land committed for the Conservation Reserve Program of the U.S. Department of Agriculture included 49,067 hectares (121,246 acres) in Benton County, 47,819 hectares (118,163 acres) in Franklin County, and 34,756 hectares (85,882 acres) in Grant County (USDA 2006:275).

Residential, commercial, and industrial land uses are predominant in the Tri-Cities area (Richland, Kennewick, and Pasco) southeast of Hanford and around other cities near the southern boundary of Hanford, including Benton City, Prosser, and West Richland (USDA 2003).

R.4 FUTURE LAND USE AT THE HANFORD SITE

This section contains a description of the land use planning at Hanford. An understanding of expected future land use at Hanford sets the stage for reasonably foreseeable actions that may occur.

On May 15, 1989, DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) signed a comprehensive agreement for cleaning up Hanford. The Hanford Federal Facility Agreement and Consent Order (Ecology, EPA, and DOE 1989), or Tri-Party Agreement, is an agreement for achieving compliance with the remedial action provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the treatment, storage, and disposal unit regulations and corrective action provisions of the Resource Conservation and Recovery Act (RCRA). The Tri-Party Agreement (1) defines and ranks CERCLA and RCRA cleanup commitments, (2) establishes responsibilities, (3) provides a basis for budgeting, and (4) establishes aggressive goals for site remediation, with enforceable milestones to ensure compliance. Compliance with the Tri-Party Agreement necessitates that DOE consider future land use at Hanford.

Recognizing the need for a comprehensive land use plan, DOE issued the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) in September 1999; this document provides the framework within which future use of lands and resources at Hanford would occur. The overall *Hanford Comprehensive Land-Use Plan* as adopted by the Record of Decision (ROD) (64 FR 61615) is to accomplish the following for Hanford:

- Protect the Columbia River and associated natural and cultural resources and water quality.
- Wherever possible, locate new development, including cleanup- and remediation-related projects, in previously disturbed areas.
- Protect and preserve the natural and cultural resources for the enjoyment, education, study, and use of future generations.
- Honor treaties with American Indian tribes as they relate to land uses and resource uses.
- Reduce exclusive-use zone areas to maximize the amount of land available for alternative uses while still protecting the public from inherently hazardous operations.

- Allow access for other uses (e.g., recreation) outside of active waste management areas, consistent with the land use designation.
- Ensure that a public involvement process is used for amending the *Hanford Comprehensive Land-Use Plan EIS* and land use designations to respond to changing conditions.
- As feasible and practical, remove pre-existing, nonconforming uses.
- Facilitate cleanup and waste management.

These *Hanford Comprehensive Land-Use Plan EIS* policies are intended to provide for the protection of environmental and cultural resources; the siting of new development, utility, and transportation corridors; and economic development (DOE 2008a:2-6).

Figure R–1 shows the generalized land use at Hanford as developed in the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) and modified by establishment of the Hanford Reach National Monument (65 FR 37253). DOE anticipates multiple uses of Hanford, including consolidation of waste management activities in the Central Plateau; industrial development in the eastern and southern portions, including the 400 Area; increased recreational access to the Columbia River; expansion of the Saddle Mountain National Wildlife Refuge to include all of the Wahluke Slope; and management of the Fitzner-Eberhardt Arid Lands Ecology Reserve by the U.S. Fish and Wildlife Service (USFWS) (64 FR 61615).

Important areas within the Preservation land use designation include the 78,900-hectare (195,000-acre) Hanford Reach National Monument, which incorporates a portion of the Columbia River corridor (65 FR 37253). The area known as the Hanford Reach includes the quarter-mile strip of public land on either side of the last free-flowing, nontidal segment of the Columbia River in the United States (DOE 2000a:3-91). The USFWS (with DOE as a cooperating agency) prepared the *Hanford Reach National Monument Comprehensive Conservation Plan and Environmental Impact Statement, Adams Benton, Grant and Franklin Counties, Washington* (USFWS 2008) for all lands within the monument. Alternative E, selected as the preferred alternative in that environmental impact statement (EIS), attempts to strike a balance between resource protection and the level of public use and access the USFWS believes the public will expect.

Since the issuance of the *Hanford Comprehensive Land-Use Plan EIS* and ROD, numerous actions have been taken and decision documents issued pertaining to Hanford that potentially could impact the land use plan. A supplement analysis to the *Hanford Comprehensive Land-Use Plan EIS* was recently prepared to help inform DOE's determination of whether that EIS remains adequate, or whether a new EIS or supplement to the existing EIS should be prepared (DOE 2008a:Summary-1, Summary-2). The supplement analysis concludes that the information on land use developed since issuance of the *Hanford Comprehensive Land-Use Plan EIS* continues to support the land use designations and stated policies of the land use plan (DOE 2008a:Summary-3). DOE has not identified significant changes in circumstances or substantial new information since 1999 that would affect the basis for its decisions as documented in the *Hanford Comprehensive Land-Use Plan EIS* ROD (64 FR 61615).

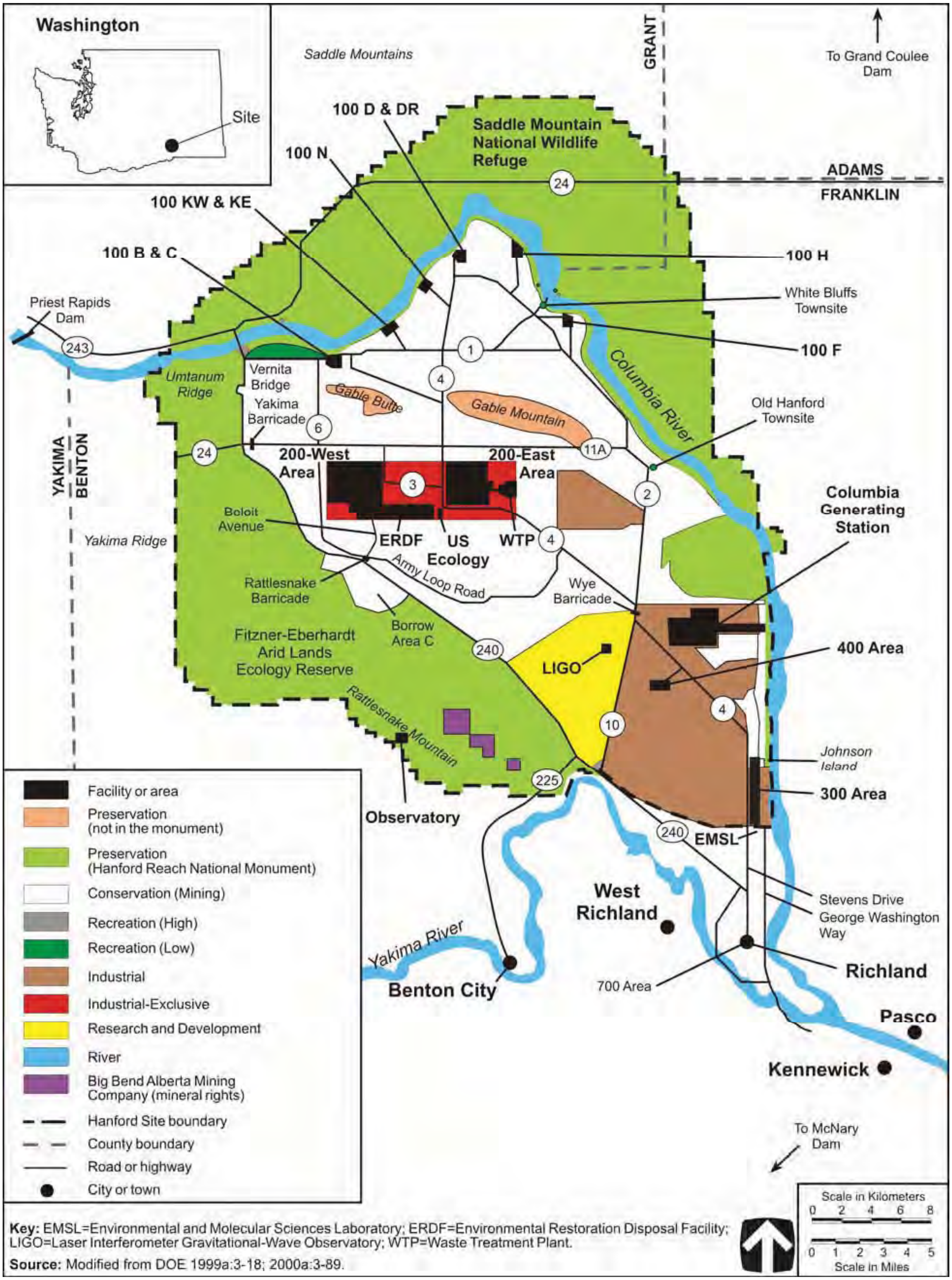

Figure R–1. Generalized Land Use at the Hanford Site

The *Hanford Site End State Vision* (DOE 2005b) describes a postcleanup condition for Hanford. That end state is based on the land use plan contained in the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a). The following paragraphs describe the end-state vision for the 100, 200, and 300 Areas:

100 Areas. Contamination in the 100 Areas will be remediated according to 50-year conservation and preservation land use exposure scenarios for recreational, resident park ranger, and tribal activities, including fishing. Unlimited use is anticipated after 50 years. Remediation of waste sites consistent with the current CERCLA Interim Action RODs will continue. There will be no further degradation of the quality of groundwater that is currently above drinking water standards, and groundwater quality will be restored when practicable (DOE 2005c:iv).

Eight of nine reactors will be cocooned and left in place to decay for up to 75 years. B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*. DOE will make a final decision on whether to cut up and move the eight reactor cores to the Central Plateau after sufficient decay has occurred. Reactor pipelines will be left in place in the Columbia River if risk levels are protective and removal would result in additional impacts. The pipelines will be stabilized if required (DOE 2005b:vi).

200 Areas. A Central Plateau Core Zone will be designated as a permanent waste management area to remain under Federal control for the next 150 years or longer. A buffer area will be maintained between the Core Zone and the remainder of the Central Plateau during cleanup operations. After Core Zone cleanup is complete, the buffer area will be reduced, and land use between the Core Zone and the Columbia River will be similar to that in the 100 Areas (DOE 2005b:v).

Waste sites in the Core Zone will be addressed through the CERCLA process consistent with Industrial-Exclusive, Conservation, or Preservation land use scenarios identified in the land use plan and within the timeframe identified in the *Hanford Comprehensive Land-Use Plan EIS* ROD (at least 50 years). Waste sites will be remediated and monitored to achieve human health and environmental protection goals under CERCLA. Small waste sites will be removed and consolidated to optimize placement and minimize the number of surface barriers. Disposition of buried pipelines in the Central Plateau will be achieved through the RCRA and CERCLA remove-treat-dispose of or stabilize-in-place processes. Canyon buildings that are robust will be used as engineered waste disposal facilities. Equipment, debris, and plutonium holdup material will be removed from the Plutonium Finishing Plant (PFP) and disposed of at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, or on site in accordance with waste acceptance criteria and CERCLA decision documents. The PFP will be demolished to slab-on-grade (DOE 2005b:v, vi).

Retrievably stored suspect transuranic (TRU) waste will be retrieved and treated, and the TRU waste portion will be shipped to WIPP. The low-level radioactive waste (LLW) portion of the retrieved waste will be treated and disposed of on site. Radioactive waste buried before 1970 containing TRU materials will be managed per CERCLA decisions (DOE 2005b:v).

Groundwater contamination across the Central Plateau Core Zone will be managed in accordance with the *Hanford Site Groundwater Strategy: Protection, Monitoring, and Remediation* (DOE 2004b; 2005b:v).

300 Area. Waste sites in the 300 Area will be remediated to achieve remedial action objectives based on Industrial land use exposure scenarios. Remediation of waste sites to industrial standards will continue as required under the current CERCLA Interim Action RODs. Remediated sites will be backfilled to support unlimited surface use where practicable, and, depending on the success of future groundwater cleanup activities, irrigation and groundwater use may be restricted. DOE will work to meet the goals of no further degradation of the groundwater that is currently above drinking water standards and restoration of groundwater quality when practicable (DOE 2005b:iv).

The *Plan for Central Plateau Closure* (Fluor Hanford 2004) presents a strategic approach to closing the Central Plateau area of Hanford. That approach addresses nearly 4,000 items requiring closure action consistent with Hanford's environmental restoration mission. It divides the Central Plateau into 22 geographic zones organized around significant processing and waste management facilities, then organizes the major constituents of those zones into five logically grouped closure elements: canyons, underground tanks, waste sites, structures, and wells. The *Plan for Central Plateau Closure* provides the framework for integrating ongoing operations with the closure of facilities no longer used, all with a view to closing the Central Plateau by 2035. Primary objectives are to demolish structures; remove or stabilize contaminants; and establish institutional controls, such as postclosure groundwater care, consistent with long-term stewardship. The ultimate goals are to minimize risks to groundwater and return the Central Plateau to a state that supports the ecosystem (Fluor Hanford 2004:ES-2). The plan is based on the following assumptions (Fluor Hanford 2004:ES-3, ES-4):

- The Central Plateau will remain under institutional control for the foreseeable future.
- Ninety-five percent of the plutonium currently present on Hanford will be removed and shipped off site.
- Contaminated materials and soils will be left in place, unless removal and disposal are more cost-effective.
- Barriers over contaminated structures and waste sites will effectively minimize biointrusion and reduce the transport rate of contaminants to the groundwater.

This approach represents the first planning effort to identify the full range of actions that must be accomplished to close the Central Plateau and position DOE to complete its environmental management mission (Fluor Hanford 2004:ES-9).

The waste site closure element of the *Plan for Central Plateau Closure* focuses on 884 sites, including cribs, ponds, ditches, retention basins, burial grounds, pipelines, and areas of unplanned releases (i.e., areas in which liquid or solid waste contaminated with radioactive materials or hazardous chemicals were disposed of or released). In compliance with CERCLA, remedial actions are being taken at waste sites in groups of operable units as established by the Tri-Party Agreement. The closure approach for these waste sites involves a combination of the following actions:

- Removing, treating, and disposing of contaminated materials, especially soil
- Taking no action for sites that represent minimal hazard
- Maintaining the existing soil cover
- Capping with protective barriers where required to protect groundwater or mitigate intrusion (Fluor Hanford 2004:ES-5, ES-6)

The structures closure element of the *Plan for Central Plateau Closure* consists of 955 varied structures, including offices, shops, trailers, and water tanks, as well as large processing, storage, or handling facilities such as the PFP. The closure approach for structures is as follows:

- Demolish aboveground structures.
- Fill voids in belowground structures.
- Stabilize the surface.
- Cap with protective barriers where required to protect groundwater or mitigate intrusion (Fluor Hanford 2004:ES-6).

The wells closure element for the *Plan for Central Plateau Closure* includes 1,968 groundwater or vadose zone wells that have been used for monitoring and characterization and are noncompliant with applicable regulations or will not be needed following closure. These wells will be closed to eliminate a pathway for migration of contamination to the groundwater. The closure approach for wells is to decommission through filling or demolition (Fluor Hanford 2004:ES-6).

The canyon closure element for the *Plan for Central Plateau Closure* includes the five major defense production facilities originally designed for fuel-reprocessing operations. Four of the five—U Plant, B Plant, the Plutonium-Uranium Extraction (PUREX) Plant, and the Reduction-Oxidation Facility (S Plant)—are currently under surveillance and maintenance. The fifth—T Plant—is being used for waste management. The remedial action for each canyon will be evaluated using the CERCLA process (Fluor Hanford 2004:ES-4).

The Canyon Disposition Initiative is the result of the 1996 Agreement-in-Principle among the signatories of the Tri-Party Agreement to define the path forward for determining the final disposition for Hanford's five canyon buildings (i.e., B Plant, S Plant, T Plant, U Plant, and the PUREX Plant). The purpose of the initiative is to investigate the potential for using the canyon buildings as disposal sites for Hanford remediation waste, rather than demolishing the structures and transferring the resulting waste to the Environmental Restoration Disposal Facility (DOE 2004c:4).

The 221-U Facility is the first canyon building to be addressed under the Canyon Disposition Initiative. The selected remedy is to partially demolish 221-U, dispose of contaminated equipment and demolition debris inside and adjacent to the remaining structure, fill void spaces with grout, and cover the remnants with an engineered barrier (DOE 2005d). Disposition of 221-U is considered to be a pilot project for disposition of the remaining four canyon buildings. However, the complexity and costs for implementation could vary significantly for each building because of varying amounts, types, and locations of radiological contamination within the five canyon buildings (DOE 2004c:1, 4).

The PUREX tunnels in the 200-East Area contain equipment contaminated with approximately 2.8 million curies of various radionuclides and with other hazardous materials (DOE 2003a:552, 553). These tunnels will be managed as an RCRA storage unit until closure can be coordinated with the final closure plan for the PUREX Plant. The current DOE vision calls for the PUREX tunnels to be filled with grout and covered with a surface barrier (DOE 2005b:vi; Fluor Hanford 2004:A3-2). Final closure of the tunnels will require an evaluation of alternatives (Bergeron, Freeman, and Wurstner 2001:3.26).

Because most of the 300 Area is within the City of Richland's Urban Growth Boundary, Richland funded a *Preliminary Assessment of Redevelopment Potential for the Hanford 300 Area* (Richland 2005a). The recently issued *Supplement Analysis, Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 2008a) considered the City of Richland's *Preliminary Assessment of Redevelopment*

Potential for the Hanford 300 Area in its review of new information on land use considerations developed since the *Hanford Comprehensive Land-Use Plan EIS* was issued in 1999 (DOE 1999a). The supplement analysis concluded that no significant new information or changes in circumstances had developed since 1999 that would affect the basis for DOE's land use decisions as documented in the ROD for the *Hanford Comprehensive Land-Use Plan EIS* (64 FR 61615).

R.5 FUTURE LAND USE IN SURROUNDING REGIONS

This section contains a description of the land use planning in the counties surrounding Hanford. An understanding of expected future land use and development provides the underpinnings for reasonably foreseeable actions that may occur in the region.

The 1990 Washington State Growth Management Act (RCW 36.70A.020) requires counties in the region around Hanford to have comprehensive plans. Cities and other government jurisdictions adopt comprehensive plans to serve as guides for future activities within their jurisdictions. These plans attempt to project 20 years into the future for land development, housing, infrastructure, and community services needs. Table R–2 describes the 13 broad goals described in the Washington State Growth Management Act that local governments must consider when developing their comprehensive plans.

The following plans exist for counties in the region around Hanford and for the Cities of Richland and Kennewick:

- *Adams County Comprehensive Plan* (ACPC 2005)
- *Benton County Comprehensive Land Use Plan* (BCPC 2003)
- *City of Richland Comprehensive Land Use Plan* (Richland 2002, 2005b)
- *City of Kennewick Comprehensive Plan 2006, Executive Document* (Kennewick 2006)
- *Franklin County Growth Management Comprehensive Plan* (Franklin County 2005)
- *Grant County Comprehensive Plan* (GCDCD 1999)
- *Kittitas County Comprehensive Plan* (Kittitas County 2001)
- *Klickitat County, Washington, Comprehensive Plan* (Dreyer 2007)
- *Plan 2015: A Blueprint for Yakima County Progress* (Yakima County 1998)
- *Walla Walla County Integrated Comprehensive Plan and EIS* (Walla Walla County 2007)

These plans are updated periodically. Generally, the plans encourage growth in urban growth areas (UGAs) and discourage growth outside these areas. A comprehensive plan is not a legally enforceable document; zoning is the enforceable means for controlling growth.

Under the Growth Management Act (RCW 36.70A), the Washington State Office of Financial Management has the responsibility to project population growth rates for local planning purposes. Population projections are used by cities and counties to identify the amounts and locations of rural land needed for conversion to urban use as urban growth occurs (BCPC 2003).

To set aside or designate lands necessary for future population growth (beyond those undeveloped lands already within city boundaries), the Growth Management Act requires counties to designate UGAs outside of, but adjacent to, the corporate boundary of each city. UGAs are the land areas that, though not currently within a city's corporate limits, are designated for conversion to urban use in the normal process of urban growth. UGAs must be large enough to accommodate 20 years of urban growth. The identification of amounts of land to be converted to urban use has important economic implications for both cities and counties (BCPC 2003).

Table R–2. Washington State Growth Management Act Planning Goals

Goal	Description
Urban growth	Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
Reduce sprawl	Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
Transportation	Encourage efficient multimodal transportation systems that are based on regional priorities and coordinated with county and city comprehensive plans.
Housing	Encourage the availability of affordable housing to all economic segments of the population of this state, promote a variety of residential densities and housing types, and encourage preservation of existing housing stock.
Economic development	Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
Property rights	Private property shall not be taken for public use without just compensation having been made. The property rights of landowners shall be protected from arbitrary and discriminatory actions.
Permits	Applications for both state and local government permits should be processed in a timely and fair manner to ensure predictability.
Natural resources industries	Maintain and enhance natural-resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forest lands and productive agricultural lands, and discourage incompatible uses.
Open space and recreation	Encourage the retention of open space and development of recreational opportunities, conserve fish and wildlife habitat, increase access to natural resource lands and water, and develop parks.
Environment	Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.
Citizen participation and coordination	Encourage the involvement of citizens in the planning process and ensure coordination between communities and jurisdictions to reconcile conflicts.
Public facilities and services	Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.
Historic preservation	Identify and encourage the preservation of lands, sites, and structures that have historical or archaeological significance.

Source: RCW 36.70A.020; Yakima County 1998:I-4.

The size of UGAs is not determined solely by the projected rate of population growth. Other possible considerations include a city's need for commercial- and industrial-zoned lands to meet the economic goals and objectives identified in its comprehensive plan. Land may also be deemed unsuitable as a UGA because of its value as natural resource land (i.e., agricultural, mineral, and forestland) or its value to local residents as a unique low-density rural community (BCPC 2003).

Of primary importance to the initial establishment and future expansion of UGAs into unincorporated areas is the projected need for additional lands in relation to the existing available supply of undeveloped land already inside a city's UGA. Equally important, however, is the maintenance of low-enough densities outside the UGA to enable its logical and cost-effective expansion in the distant future (30 to 70 years) (BCPC 2003).

The phenomenon of city boundary enlargement and expansion into rural county lands will continue with population growth. Designation of UGAs endeavors to set standards and mechanisms whereby legitimate needs for new urban lands are met while rural communities and natural resource lands are protected.

Cities can neither annex lands nor generally extend municipal services to lands outside of UGAs (BCPC 2003).

Because the majority of Hanford lies within Benton County and the majority of Hanford workers live in Benton County and the city of Richland, the following discussion concentrates on future land use in these regions.

Benton County. As described in *Benton County Sustainable Development Overall Economic Development Plan* (Benton County 2006), 263,049 hectares (650,000 acres) of the county are planned for agriculture and agribusiness, 2,045 hectares (5,053 acres) for commercial and industrial use, and 5,541 hectares (13,693 acres) for tourism and recreation. This does not include the 30,352 hectares (75,000 acres) and 4,346 hectares (10,740 acres) within Hanford designated for commercial/industrial and recreational use, respectively, in the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a).

Historically, the Cities of West Richland, Richland, and Kennewick have aggressively pursued annexation of unincorporated lands, largely in response to the boom-and-bust cycles of Hanford. Between 1985 and 2003, 7,328 hectares (18,107 acres) were annexed even though each city still had over half its incorporated acreage undeveloped. Kennewick has 2,428 hectares (6,000 acres) of vacant or undeveloped land designated for low-density residential use; Richland, 8,789 hectares (21,719 acres); and West Richland has 5,520 hectares (13,641 acres), some actually designated for rural densities and lower (BCPC 2003).

City of Richland. The City of Richland recently released an updated *City of Richland Comprehensive Land Use Plan* (Richland 2005b). Although this plan is for the period ending in 2035, it contains few quantitative estimates of future changes. Therefore, the 1997 *City of Richland Comprehensive Land Use Plan,* as amended through December 10, 2002 (Richland 2002), was used to obtain the pertinent information. The 1995–2015 planning horizon of that plan (Richland 2002:ES 1-1–ES 1-5) reflects the following projected changes:

- Gain of 11,041 jobs
- Demand for 3,134 residential units requiring 170 hectares (420 acres) of the 1,281 hectares (3,165 acres) of currently vacant land
- Demand for an additional 490 hectares (1,212 acres) of vacant developable land
- Demand for an additional 42 hectares (104 acres) of parkland
- Growth in the student population of 1,504
- Falling level-of-service ratings on 19 roadway segments
- Increasing demand for irrigation water for landscaping as unused open space and agricultural land are converted to public facility and residential uses

Also indicated (Richland 2002:3-6) are the following changes in land use patterns expected between 1995 and 2015:

- Land designated for residential uses will increase from 31 to 33 percent of the total land area.
- Land designated for industrial uses will increase from 19 to 26 percent of the total land area. Most of this increase will be attributable to the addition of Hanford land.

- Land designated for agricultural uses will decrease from 21 to 3 percent of the total land area. Most of this decrease will result from the redesignation of lands in the Horn Rapids area from agricultural to Urban Reserve and public facility uses.

- Land designated for commercial uses will increase slightly to 6 percent of the total land area.

- Land designated for public facilities and open space will increase from 12 to 23 percent of the total land area.

- Land designated for Urban Reserve use will be approximately 8 percent of the total land area.

The UGA in the *City of Richland Comprehensive Land Use Plan, Final* (Richland 2002:3-4) covers an area of 8,954 hectares (22,125 acres). Of that area, 4,563 hectares (11,275 acres) are currently developed, and 4,391 hectares (10,850 acres) are vacant and available for future development.

Although changes will inevitably occur due to the pressures of continued population growth, land use in the region surrounding Hanford is not expected to change drastically during the upcoming decades. It is assumed that the largest land use in the region will continue to be agricultural, and that populations will increase mainly around the current urban areas (DOE 2004a:22).

R.6 APPROACH TO CUMULATIVE IMPACTS ANALYSIS

A flowchart of the methodology used to estimate cumulative impacts is presented as Figure R–2. This flowchart, which incorporates the CEQ's eight principles of cumulative effects analysis (CEQ 1997:8), is divided into four phases: (1) selection of resource areas and appropriate regions of influence (ROIs), (2) selection of reasonably foreseeable future actions, (3) estimation of cumulative impacts, and (4) identification of monitoring and mitigation.

Phase 1—Selection of Resource Areas and Appropriate ROIs. This phase concentrates on selecting resource areas most likely to incur meaningful cumulative impacts. Steps in this process include the following:

1a. Examine resource areas evaluated in recent Hanford NEPA documents, areas evaluated in this *TC & WM EIS* (see Chapter 4), and areas subjected to historically significant impacts to develop a list of resource areas likely to exhibit cumulative effects.

> **Region of Influence:**
> A site-specific geographic area in which the principal direct and indirect effects of actions are likely to occur.

1b. Identify the ROI—i.e., the spatial limits—for each resource area to be evaluated for cumulative impacts. ROIs are described in the introduction to Chapter 3 of this *TC & WM EIS* and are summarized in Section R.9.

Phase 2—Selection of Reasonably Foreseeable Future Actions. In this phase, reasonably foreseeable future actions are examined and screened to determine which must be included in the cumulative impacts analysis. Steps in this process include the following:

2a. Identify future actions—Federal, non-Federal, or private—occurring in the ROI. Typical information sources include RODs, RCRA, CERCLA, NEPA, and Washington State Environmental Policy Act documents; the Tri-Party Agreement; permits and permit applications; and land use and development plans.

> **Reasonably foreseeable actions** are ongoing and will continue into the future, are funded for future implementation, or are included in firm near-term plans.

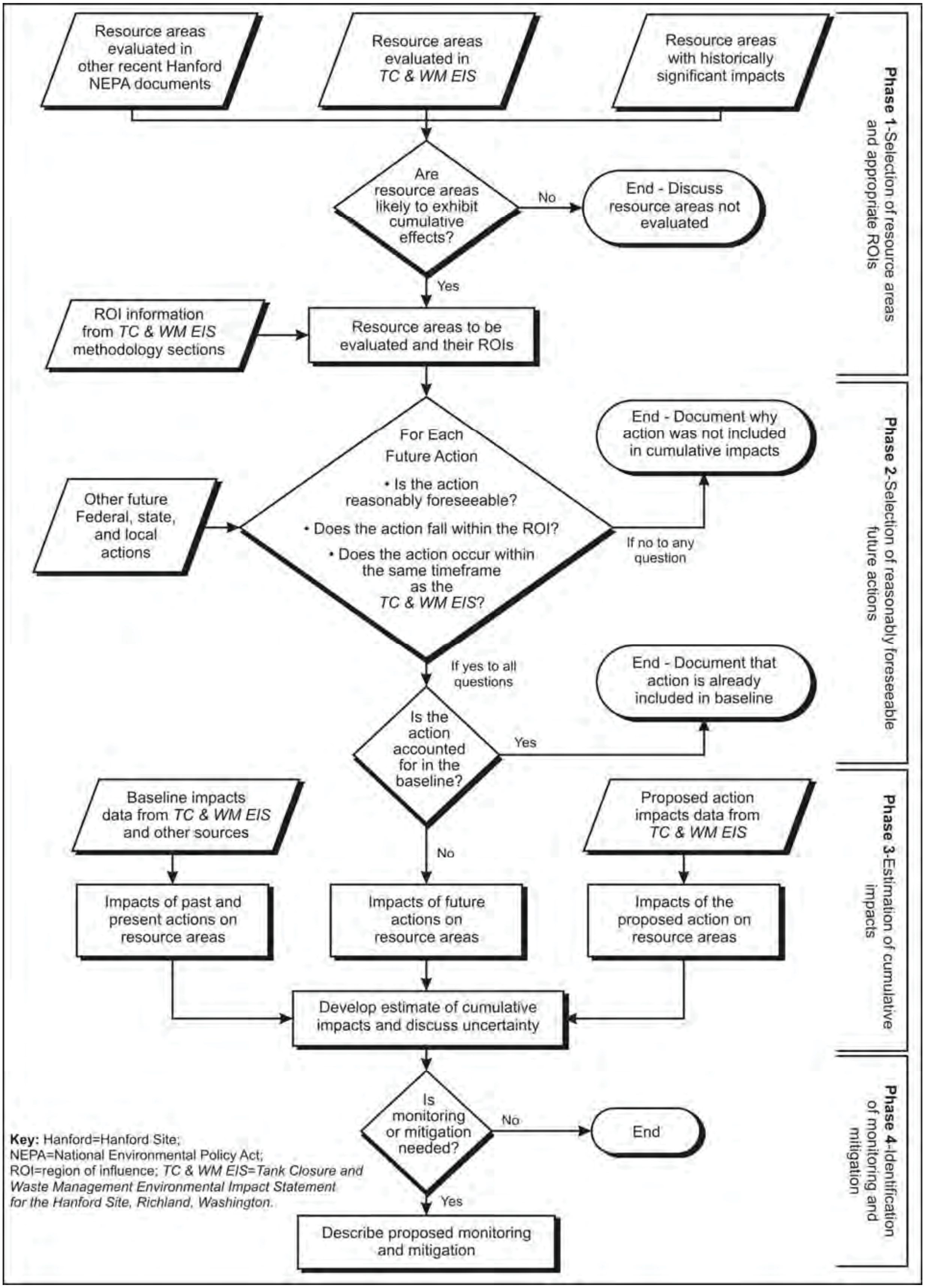

Figure R–2. Flow Diagram for Identifying and Evaluating Cumulative Impacts

2b. Examine each future action to determine whether the action is reasonably foreseeable, occurs within the ROI, occurs within the same timeframe as the *TC & WM EIS* action, and is not already accounted for in the baseline impacts.

2c. Retain for analysis future actions meeting the criteria listed in item 2b, and eliminate from further consideration future actions not meeting all those criteria.

Phase 3—Estimation of Cumulative Impacts. In this phase, impact indicators for the proposed actions are added to baseline values and to values for reasonably foreseeable future actions to estimate cumulative impacts. Steps in this process include the following:

3a. Identify, and, to the extent possible, quantify baseline impacts. Baseline impacts (i.e., the level of degradation that a resource is currently experiencing) include effects of past and present actions. These impacts are generally those described in Chapter 3 of this *TC & WM EIS*. Present actions include cleanup activities that could reduce impacts of a past action, as well as actions that could add to the degradation of a resource. The importance of past actions to cumulative impacts is resource-specific. For example, past air pollutant releases would not affect the baseline (current) site air quality, whereas liquid releases to the ground could have a lasting effect and could impact the baseline. Therefore, only past actions continuing to have impacts on the resource are considered in the cumulative impacts analysis.

3b. Identify impacts of the *TC & WM EIS* Preferred Alternative and the combined *TC & WM EIS* alternative combinations from Chapter 4.

3c. Identify impacts of the reasonably foreseeable future actions identified in Phase 2. If quantitative data are available, incorporate the values into a quantitative or semiquantitative cumulative impacts analysis. If quantitative data are not available, use qualitative data.

3d. Aggregate the effects on each resource of past, present, and reasonably foreseeable future actions, including the proposed actions. Use aggregate effects to estimate cumulative impacts for each resource area. Determine the degree of impact using largely the same impact measures that were used for Chapter 4 of this *TC & WM EIS*.

The results of the cumulative impacts analysis are presented in Chapter 6. Supporting information for the short-term cumulative impacts analysis is presented in Appendix T; long-term, in Appendix U.

Phase 4—Identification of Monitoring and Mitigation. In this phase, resultant estimates of cumulative impacts are examined to determine whether monitoring and/or mitigation activities are needed. Steps in this process include the following:

4a. Determine those resource areas where appreciable cumulative impacts are predicted.

4b. Describe measures that may be used to monitor or mitigate these potentially appreciable cumulative impacts.

R.7 UNCERTAINTIES

Many uncertainties are inherent to the estimation of cumulative impacts. The uncertainties in the cumulative impacts described in this *TC & WM EIS* are largely the result of the following assumptions and conditions:

- Small changes in current activities are generally not documented and therefore not considered.

- Individual activities disturbing less than 40 hectares (100 acres) are generally not considered.
- Detailed information for many of the future activities considered in this cumulative impacts analysis is limited.
- Information on projects to be implemented 10 or more years in the future is limited.
- Future changes to laws and regulations cannot be considered.
- Future fluctuations and changes to the environment, including climate change and the effects of climate change on water resources, ecological resources, and man, are not considered.

The contribution of most of these assumptions and conditions to the determination of Hanford's cumulative impacts, is believed to be small, at least for the short term. Although not quantified, the chance that these assumptions and conditions would change the conclusions of the *TC & WM EIS* cumulative impacts analysis is unlikely. Given the extended duration of the analysis, resulting projections of long-term cumulative impacts are subject to a high degree of uncertainty.

As described in the previous sections, cumulative impacts were assessed by combining the potential effects of *TC & WM EIS* activities with the effects of other past, present, and reasonably foreseeable actions in the ROI. It must be noted, of course, that many actions occur at different times and locations across the ROI—e.g., the set of actions impacting air quality—and thus their impacts are not entirely cumulative. Therefore, this approach should yield a conservative estimate of cumulative impacts for the activities considered.

R.8 SELECTION OF RESOURCE AREAS FOR ANALYSIS

Because of the comprehensive nature of this *TC & WM EIS*, cumulative impacts were evaluated for all resource areas except for the impacts of accidents on public and occupational health and safety. Except under an extremely unlikely catastrophic earthquake scenario, it is highly unlikely that accidents in separate facilities would occur at the same time and be close enough to each other to have appreciable additive effects.

R.9 RESOURCE AREA METHODOLOGIES

This *TC & WM EIS* incorporates a range of methods for cumulative impacts because of differences in the anticipated significance of the impact on a given resource area, the availability of adequate data, and the specific needs of decisionmakers and the public.

In general, long-term impacts, including impacts on groundwater quality, were evaluated quantitatively (i.e., they were modeled). Analyses of short-term impacts were generally semiquantitative (i.e., simple addition of impact indicators) or qualitative (i.e., descriptions were based on non-numerical data). Where data were not uniformly available or comparable for a particular resource across its ROI, however, analysis entailed a combination of semiquantitative and qualitative methods. And with regard to those resource areas for which a detailed analysis was preferable but data were simply insufficient to support that level of analysis, the analysis was performed qualitatively. Table R–3 identifies, for each resource area, the method of analysis and the rationale for its application.

Table R–3. Methods of Cumulative Impacts Analysis for Different Resource Areas

Resource Area	Region of Influence	Method of Analysis	Indicator	Note
Short-Term Impacts				
Land use	Hanford and nearby offsite areas	Semiquantitative	Land area disturbed or occupied	Amount of land disturbed or occupied for other actions[a] is added to present a total.
Visual resources	Hanford and nearby offsite areas in the viewshed	Qualitative	Visual resource alteration in the viewshed	Resource area does not lend itself to a quantitative analysis.
Infrastructure	Hanford utility infrastructure	Semiquantitative	Utility use (electricity, fuel, and water)	Utility resources used for other actions[a] are added to present a site total.
Noise	Hanford, nearby offsite areas, and access routes to the site	Qualitative	Noise levels	Noise data are not likely to be available to perform a quantitative analysis.
Air quality	Hanford and nearby offsite areas within the airshed	Semiquantitative	Concentrations of criteria and toxic air pollutants	Air quality indicators for other actions[a] are added to present a conservative total, given that the values likely occur at different locations and at different times.
Geology and soils	Hanford and nearby offsite areas where geologic and soil resources may be affected	Semiquantitative	Volumes of geologic and soil resources used	Geologic and soil resources used for other actions[a] are added to present a total.
Water resources	Hanford and nearby offsite areas in the Columbia River and Yakima River watersheds	Semiquantitative Qualitative	Amount of surface water and groundwater used Surface-water and groundwater quality	Water use for other actions[a] is added to present a total.
Ecological resources	Hanford and nearby offsite areas with similar habitat	Semiquantitative Qualitative	Sensitive habitat (e.g., shrub steppe) disturbed or occupied Disturbance of threatened and endangered species	Amount of habitat disturbed for other actions[a] is added to present a total.
Cultural and paleontological resources	Hanford and nearby offsite areas that may contain significant cultural resources	Qualitative	Disturbance of National Register of Historic Places—listed or eligible—historic properties or archaeologic, American Indian, or paleontologic resources	Potential for cumulative impacts on cultural resources is discussed qualitatively.
Socioeconomics	Hanford and nearby counties where at least 90 percent of Hanford employees reside	Semiquantitative	Direct and indirect employment Traffic from employee and truck trips	Employment and vehicle trips for other actions[a] are added to present a total.

Table R–3. Methods of Cumulative Impacts Analysis for Different Resource Areas *(continued)*

Resource Area	Region of Influence	Method of Analysis	Indicator	Note
Short-Term Impacts *(continued)*				
Public and occupational health and safety—normal operations	Hanford and offsite areas within 80 kilometers (50 miles) of the site	Semiquantitative	Population and MEI doses and LCFs from radiological air emissions and Hazard Indices for chemical air emissions	Public health indicators for other actions[a] are added to present a total.
	Occupational impacts limited to Hanford workers		Worker doses and LCFs from radiological exposure and Hazard Indices for chemical exposure	Worker health indicators for other actions[a] are added to present a total, as resource is suitable for addition of impact indicators.
Public and occupational health and safety—transportation	Hanford roads and railroads and selected offsite transportation corridors to waste disposal facilities	Semiquantitative	Population and MEI doses, LCFs, and accident fatalities for transport crew and public along transportation routes	Transportation indicators for other actions[a] are added to present a total.
Waste management	Hanford waste management facilities and offsite facilities where Hanford waste is managed	Semiquantitative	Waste generation for TRU, low-level radioactive, mixed low-level radioactive, hazardous, dangerous, and nonhazardous wastes	Waste volumes/weights generated for other actions[a] are added to present a total.
Long-Term Impacts				
Groundwater	Portions of the groundwater basin that may be adversely affected by *TC & WM EIS* activities; bounded by groundwater discharge locations along the Columbia River	Quantitative	Radionuclide and chemical contaminant concentrations	Analysis required by Settlement Agreement re: *State of Washington v. Bodman* (Civil No. 2:03-cv-05018-AAM). Analysis is per the Technical Guidance Document for *Tank Closure Environmental Impact Statement, Vadose Zone and Groundwater Revised Analyses*, Final Rev. 0, dated March 25, 2005 (DOE 2005d), due to "significance" of the resource area (groundwater) at Hanford.
Human health	Potential future onsite groundwater users and users of the Columbia River downstream from the site	Quantitative	MEI dose, LCFs, and Hazard Indices for drinking-water well user, resident farmer, American Indian resident farmer, and American Indian hunter-gatherer, and population dose, LCFs, and Hazard Indices for downstream surface-water users	Direct inputs are obtained from long-term groundwater modeling results.

Table R–3. Methods of Cumulative Impacts Analysis for Different Resource Areas *(continued)*

Resource Area	Region of Influence	Method of Analysis	Indicator	Note
Long-Term Impacts *(continued)*				
Environmental justice	Potential future onsite subsistence farmers and American Indian users, and users of the Columbia River downstream from the site	Quantitative	MEI dose, LCFs, and Hazard Indices for future onsite subsistence farmers and American Indians	Direct inputs are obtained from long-term groundwater modeling results.
Ecological risk	Plants and animals using Hanford and the Columbia River adjacent to and downstream from the site	Quantitative	Risk to indicator species at the shore of the Columbia River (terrestrial) and in the river (aquatic)	Direct inputs are obtained from long-term groundwater modeling results.

[a] Other past, present, and future actions in the region of influence that may contribute to cumulative impacts. The proposed approaches for cumulative impacts described in this table are dependent on the availability of information for the other past, present, and reasonably foreseeable future actions. If numerical data are not available, qualitative cumulative impacts analyses will be performed.

Key: Hanford=Hanford Site; LCF=latent cancer fatality; MEI=maximally exposed individual; *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*; TRU=transuranic.

Source: Based on Chapter 3, Table 3–1.

R.10 SPATIAL AND TEMPORAL CONSIDERATIONS

Cumulative environmental impacts—i.e., the impacts of all past, present, and reasonably foreseeable actions—have limits in space and time. For cumulative impact analysis, those recognized spatial limits help determine the specific geographic expanse (ROI) to be evaluated for each resource area. The ROIs used in the cumulative impacts analysis—many are the same as those described in the introduction to Chapter 3—are summarized in Table R–3.

To conclusively address the temporal limits of environmental impact, short- and long-term cumulative impact analyses were performed for each resource area. Short-term cumulative impacts are associated with the active project phase, extending through the applicable administrative control, institutional control, or postclosure care period. For this *TC & WM EIS*, short-term cumulative impacts are deemed to extend up to 188 years (2006 through 2193 under Tank Closure Alternative 2A). Long-term cumulative impacts extend beyond the active project phase, thus beyond the appropriate period of administrative control, institutional control, or postclosure care. For this EIS, long-term cumulative impacts are assessed for approximately 10,000 years into the future.

R.11 PAST AND PRESENT ACTIONS

To determine the baseline impacts on a resource, the impacts of past and present actions must be identified. For most resource areas, baseline impacts were culled from information on the affected environment provided in Chapter 3 of this *TC & WM EIS*. For example, the current air quality in the ROI as described in Chapter 3 adequately reflects both past and present activities. In contrast, current resource use alone may not adequately account for past resource loss, and thus, may not be a good indicator of baseline impacts.

Past and present actions that may contribute to cumulative impacts include those conducted by government agencies, businesses, or individuals within the ROIs considered. Examples of past Hanford activities include operation of the fuel fabrication plants, production reactors, the PUREX Plant and other fuel reprocessing facilities, the PFP, and research facilities, as well as the treatment and disposal of waste. Current Hanford activities include site cleanup, waste disposal, and tank waste stabilization.

Examples of past and present offsite activities that may contribute to cumulative impacts include the clearing of land for agriculture and urban development, water diversion and irrigation projects, waste management, industrial and commercial development, mining, power generation, and the development of transportation and utility networks.

R.12 SELECTION OF REASONABLY FORESEEABLE FUTURE ACTIONS

As described in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997), Principle 1 of cumulative effects analysis reads, "Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions." Principle 2 reads, in part, "Cumulative effects are the total effect… of all actions taken, no matter who (Federal, non-Federal, or private) has taken the actions." Therefore, it is important to identify future actions that may appreciably degrade the resources or add to the impacts of the proposed actions, regardless of the agency or individual undertaking the actions.

The *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) lays out the future vision for land use at Hanford. Both DOE and non-DOE actions may occur within the current Hanford boundaries. The major DOE activities will include continuation of site cleanup, waste consolidation and disposal, facility closure and decontamination and decommissioning, and the various high-level radioactive waste treatment and tank closure activities. Non-DOE actions are expected within the areas at Hanford set aside for industrial use, research and development, preservation, mining, and recreation (see Figure R–1).

DOE Actions at Hanford

The *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) describes the major DOE activities that are occurring or would occur at Hanford to achieve the vision set forth in the *Hanford Comprehensive Land-Use Plan EIS*. The list of activities reflected in that plan was modified by eliminating those activities within the scope of this *TC & WM EIS* and those that have already been completed, and adding new activities planned for Hanford (72 FR 40135; DOE 2006a; DOE, EPA, and Ecology 2006, 2007; PHMC 2006a, 2006b; Poston et al. 2007). Present and future DOE activities at Hanford include the following:

- Cleanup and restoration activities across all areas of Hanford
- Decommissioning of surplus production reactors and their support facilities in the 100 Areas along the Columbia River[1]
- Deactivation of the PFP in the 200-West Area
- Actions to remove the sludge and decommission the K Basins in the 100-K Area
- U Plant regional closure
- Final disposition of the canyon buildings (i.e., B Plant, S Plant, T Plant, U Plant, and the PUREX Plant), PUREX tunnels, and other facilities in the 200 Areas, and cleanup of the Central Plateau to Industrial-Exclusive land use standards

[1] B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*.

- Transport of sodium-bonded spent nuclear fuel from the Fast Flux Test Facility in the 400 Area to INL for treatment

- Excavation and use of geologic materials

- Continued disposal of waste in the Environmental Restoration Disposal Facility near the 200-West Area

- Implementation of the programmatic waste management decisions described in the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a)

- Retrieval of suspect TRU waste buried after 1970

- Cleanup and protection of groundwater

- Potential disposal of greater-than-Class C LLW

- Transport of TRU waste to WIPP

Non-DOE Actions at Hanford

The aforementioned review of documentation for data bearing on cumulative impacts also entailed consideration of non-DOE activities inside the Hanford boundary. These included Federal, state, or local initiatives; industrial or commercial ventures; utility or infrastructure construction and operation; and waste treatment and disposal. Specific non-DOE activities at Hanford include the following:

- Continued transport of U.S. Navy reactor plants via the Columbia River and disposal thereof in trench 218-E-12B in the 200-East Area

- Continued operation of the Columbia Generating Station (previously Washington Public Power Supply System, Nuclear Project No. 2)

- Continued operation of the US Ecology commercial LLW disposal site

- Management of the Hanford Reach of the Columbia River as a national monument and a national wildlife refuge

Other Actions in the Region

It was also necessary to consider activities outside Hanford but within the ROI. These included Federal actions, state and local development initiatives, industrial and commercial ventures, residential development, and infrastructure projects. Activities in the region surrounding Hanford include the following:

- Future land use in the region as described in city and county comprehensive land use plans

- Base realignment and closure and other U.S. Department of Defense activities

- Cleanup of toxic, hazardous, and dangerous waste disposal sites

- Columbia River and Yakima River water management, including the Black Rock Reservoir proposal

- Power generation and transmission line projects
- Wind energy projects
- Pipeline projects
- Transportation projects

For more information on anticipated future activities that could contribute to cumulative impacts, data were also collected from the Cities of Kennewick, Pasco, Richland, West Richland, and Yakima in Washington; the Counties of Adams, Benton, Franklin, Grant, Kittitas, Klickitat, Walla Walla, and Yakima in Washington; the Counties of Morrow and Umatilla in Oregon; and the Yakama Nation, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation. No additional major future actions were identified by the Cities of Richland or Pasco in Washington; Adams, Benton, Franklin, Grant, Kittitas, Klickitat, Walla Walla, or Yakima Counties in Washington; Umatilla County in Oregon; or the Confederated Tribes of the Umatilla Indian Reservation or Nez Perce Tribe (Adams 2007; Bailor 2007; D'Hondt 2007; Jennings 2007; Lamb 2007; Lilligren 2007a, 2007b; Patterson 2007; Prentice 2007; Rolph 2007; Shuttleworth 2007; Smith 2007; Torres 2007; Wendt 2007). Future activities that were identified for the region surrounding Hanford include the following:

- The 1,012-hectare (2,500-acre) South Ridge Development Zone in Kennewick, Washington, designated for mixed-use development over the next 5 to 10 years (Romine 2007).
- The 130-hectare (320-acre) Red Mountain Center mixed-use development area in West Richland, Washington, that broke ground in 2007 and is expected to be completed in 2010 (Gouk 2007).
- The annexation of approximately 648 hectares (1,600 acres) of land near the Apple Tree Golf Course by the City of Yakima for residential development over the next 5 to 10 years (Benson 2007).
- The 567-hectare (1,400-acre) Multi-Purpose Motor Speedway Project 4.8 kilometers (3 miles) west of Boardman, Oregon, that began construction in 2007. Future expansions could total 2,833 hectares (7,000 acres) over the next 10 years (McClane 2007; PNMP 2007).
- The 162-hectare (400-acre) multitenant industrial park for the Port of Morrow in Boardman, Oregon, that was expected to begin construction in 2007 (McClane 2007).
- The 648-hectare (1,600-acre) Destination Resort Complex mixed vacation-style residential development with golf course and marina along the Columbia River 4.8 kilometers (3 miles) west of Boardman, Oregon, that is expected to begin construction within 5 years (McClane 2007).
- The development of biofuels (including ethanol) facilities in Finley, Moses Lake, and Plymouth, Washington, and biodiesel facilities in Burbank, Ellensburg, Sunnyside, Toppenish, and Warden, Washington (Riggsbee 2007; WSU 2007).

Because of the distance from Hanford; the routine nature of most actions; and various zoning, permitting, environmental review, and construction requirements, most other actions are not expected to interact with Hanford activities to produce cumulative impacts.

Benton, Franklin, and Grant Counties had a total of 949,772 hectares (2,346,912 acres) of farmland in 2002 (USDA 2002). This farmland area is 65 percent of the 1,457,298 hectares (3,601,024 acres) of the total land area of these counties (WOFM 2007). Little growth in agriculture is expected through 2025 (WSTC 2006:B-8).

Many areas of the Columbia River Basin have the potential for natural gas accumulations in underground sediments. Although significant production has not occurred, small amounts of gas were produced from the Rattlesnake Hills Gas Field north of Richland. No oil or gas production wells have been completed in the state of Washington since 1962 (Lingley 2005), although state and Federal lands in the region around Hanford continue to be leased for natural gas exploration (WDNR 2007a).

As described in Chapter 3, sand, gravel, and basalt are the primary geologic resources extracted from the earth in the region around Hanford. There are many commercial surface mines in the region (WDNR 2006), and it is expected that mines will be expanded and new mines developed to satisfy the future need for these construction materials. Long-term cumulative impacts of these activities are not expected because the Washington State Surface Mine Reclamation Act (RCW 78.44) ensures that surface mines more than 1.2 hectares (3 acres) in size or with a highwall that is higher than 9.1 meters (30 feet) and steeper than 45 degrees are reclaimed (WDNR 2007b).

The Yakima Training Center is in central Washington in Yakima and Kittitas Counties, approximately 11 kilometers (7 miles) northeast of the city of Yakima (Army 2007:365). Land use at the center is separated into two major areas: the cantonment area (approximately 400 hectares [1,000 acres]) and the training areas (approximately 132,000 hectares [326,000 acres]) (Army 2007:367). The cantonment area, which includes residential, administrative, commercial, light industrial, and open spaces, is in the southwest corner of the installation (Army 2007:365). The training areas include a large maneuver area and a variety of large- and small-caliber live-fire ranges (Army 2007:355). Units from Fort Lewis and elsewhere use the Yakima Training Center to conduct maneuver and live-fire training, and then return home to their respective installations (Army 2007:355).

Construction activities planned for the foreseeable future at the Yakima Training Center include the following:

- Construction of a digital multipurpose range complex for fiscal year 2008
- Construction of an Armed Forces Reserve Center for fiscal year 2008
- Construction of a sniper field fire range for fiscal year 2010
- Construction of a multipurpose machine gun range for fiscal year 2011
- Construction of an aviation gunnery range for fiscal year 2011
- Construction of a fire station for fiscal year 2013
- Natural gas exploration and drilling (Army 2007:369)

In May 2005 the U.S. Department of Defense announced its latest round of base realignment and closure activities (AFIS 2005; BRAC 2005). These activities can impact areas around military facilities by reducing or increasing direct and indirect employment and activities that have environmental impacts. The Umatilla Army Depot is the only major military facility in the Hanford ROI to be closed. Closure of the depot and the associated loss of 884 regional jobs (512 direct and 372 indirect) (BRAC 2005:Ind-14, C-20) and reduction in activities will have inevitable environmental impacts. While the precise impacts of closure and reuse of the depot have not been evaluated, they will be the subject of future NEPA documentation. Because the depot is over 48 kilometers (30 miles) from the Hanford boundary, little in the way of cumulative impacts are expected.

The sites on EPA's National Priorities List (NPL) (also known as Superfund [Superfund Amendments and Reauthorization Act] sites) were reviewed to determine whether any could contribute to cumulative impacts at Hanford. Seven active NPL sites are in Hanford or within 80 kilometers (50 miles) of the site boundary. Three of these sites are the Hanford 100, 200, and 300 Areas. The closest of the remaining four NPL sites is the Pasco Sanitary Landfill near Pasco, Washington, approximately 19 kilometers (12 miles) southeast of the site boundary (EPA 2006a, 2006b). The State of Washington also actively pursues the cleanup of contaminated sites through the State Toxics Cleanup Program. Approximately

145 State of Washington sites are within 80 kilometers (50 miles) of Hanford, including 4 in Adams County, 19 in Benton County (6 in the city of Richland), 8 in Franklin County, 19 in Grant County, 7 in Kittitas County, 6 in Walla Walla County, and 82 in Yakima County (Ecology 2006a). In addition to being some distance from Hanford, most of the NPL and Washington State Toxics Cleanup Program sites are well into the control and cleanup process, and thus would not substantially contribute to cumulative impacts.

The Columbia River Water Management Act (RCW 90.90) requires Ecology to "aggressively pursue the development of water supplies to benefit both in-stream and out-of-stream uses." Ecology is in the process of developing a Columbia River Water Management Program to facilitate compliance with the legislation. No specific storage or conservation projects have been identified for implementation under the management program (Ecology 2007a:1).

The proposed Black Rock Reservoir, a water storage and electrical power generation project currently being evaluated for the Yakima River Basin, could have substantial environmental and economic effects on the region. This project could include the construction of a 160-meter-high (525-foot-high), central core rockfill dam, creating a reservoir with a active storage volume of 1,300,000 acre-feet. A pipeline would take water from the Columbia River upstream of Priest Rapids Dam, store it in the reservoir, and then discharge it to the Yakima River Valley. The total project construction cost is estimated at $4.5 billion, with an annual operating cost of 60.2 million. This reservoir would be approximately 8 kilometers (5 miles) west of Hanford's nearest boundary. Other alternatives to the Black Rock Reservoir that are being considered are the Wymer Dam and Reservoir Alternative, Wymer Dam Plus Yakima River Pump Exchange Alternative, Enhanced Water Conservation Alternative, Market-Based Reallocation of Water Resources Alternative, and Groundwater Storage Alternative. None of the alternatives has been identified as a preferred alternative (BOR and Ecology 2008:xvi, xxi, xviii, 2-37).

In December of 2008 Ecology issued the *Supplemental Draft Environmental Impact Statement, Yakima River Basin Water Storage Feasibility Study* (Ecology 2008). This document is a supplement to the January 2008 *Draft Planning Report/Environmental Impact Statement, Yakima River Basin Water Storage Feasibility Study, Yakima Project, Washington* (BOR and Ecology 2008), which evaluated alternatives for Yakima River Basin water storage, including construction and operation of a Black Rock Reservoir. Ecology prepared the supplemental draft EIS to evaluate an additional water supply alternative. The Integrated Water Resource Management Alternative included in the supplemental draft EIS includes four general elements to improve water resources in the Yakima River Basin—fish passage improvements, modification of existing operations and facilities, new storage, and fish habitat enhancement on mainstem rivers and tributaries. The analysis in the supplemental draft EIS is programmatic in nature. If the decision is made to implement this alternative, any individual projects that are carried forward will require additional environmental review when they are proposed (Ecology 2008:FS-1, FS-3).

The Priest Rapids Hydroelectric Project, consisting of the Priest Rapids and Wanapum Dams, is directly upstream of Hanford. The project occupies an estimated 1,256 hectares (3,104 acres) of Federal land managed by the U.S. Bureau of Reclamation, U.S. Bureau of Land Management, U.S. Department of the Army, USFWS, DOE, and Bonneville Power Administration. It also occupies an estimated 1,135 hectares (2,804 acres) of Washington State land (FERC 2006a:xvi). The project has operated since 1955 under a 50-year license with the Federal Energy Regulatory Commission. In anticipation of license expiration in 2005, the Grant County Public Utility District filed a relicensing application with the commission in October 2003 and an EIS was completed in 2006 (FERC 2006a; Grant County PUD 2003). In the future, the Grant County Public Utility District proposes to improve the project by installing advanced-design turbines, improving downstream fish bypass facilities, creating new programs to protect and enhance anadromous and resident fish and wildlife, and implementing additional cultural resources protections (Grant County PUD 2003:1, 2). It is expected that these improvements will reduce the impacts of operation of the Priest Rapids Hydroelectric Project to levels below those currently experienced. A 44-year license extension was granted for the project in April of 2008 (FERC 2008:58).

Information on power generation and transmission line projects was collected to determine whether major projects are planned for the region around Hanford (BPA 2005a, 2007a, 2007b, 2008; EFSEC 2007; RNP 2006). Long-term planning by the Bonneville Power Administration and the Pacific Northwest Electric Power Planning and Conservation Council suggests a need for up to 8,000 megawatts of electricity in the region over the next 10 years. To that end, a number of power generation projects have been proposed for the ROI (BPA 2003:2). Utility projects either proposed or recently completed include the following:

- Plymouth Generation Facility, a 306-megawatt natural-gas-fired turbine electricity-generating facility (Benton and BPA 2003; BPA 2007c, 2008)
- Wanapa Energy Center, a 1,200-megawatt gas and steam turbine electricity-generating facility (BIA 2004; BPA 2008)
- Wind projects, including Big Horn, Combine Hills II, Desert Claim, and Wild Horse (BPA 2007a, 2007c; EFSEC 2007, 2009)
- New transmission lines, including the 127-kilometer (79-mile), 500-kilovolt line between McNary and John Day Substations (BPA 2008)
- Transmission line upgrades, including the Tucannon River-to-North Lewiston Rebuild (BPA 2007b)

The Plymouth Generation Facility would be approximately 40 kilometers (25 miles) south of the Hanford boundary (Benton and BPA 2003); the Wanapa Energy Center, approximately 48 kilometers (30 miles) south (BIA 2004:3.6-4). These facilities would be approximately 64 kilometers (40 miles) from the 200 Areas. As of September 2008, both projects were on hold (BPA 2008).

Four wind projects would be within 80 kilometers (50 miles) of Hanford's boundary. The recently completed Big Horn Wind Project is approximately 72 kilometers (45 miles) southwest of Hanford's boundary. The proposed Combine Hills II Wind Project would be alongside the Combine Hills I Wind Project southeast of Hanford's boundary approximately 56 kilometers (35 miles) away. The recently completed Wild Horse Wind Project is approximately 56 kilometers (35 miles) northwest of Hanford's boundary (BPA 2007a; EFSEC 2007). The proposed Desert Claim Wind Project is approximately 72 kilometers (45 miles) northwest of Hanford's boundary (EFSEC 2009). In total, these wind projects involve the construction of 418 wind turbines that would generate 682 megawatts of electricity (EFSEC 2009; NPCC 2006).

Most transmission line projects are some distance from Hanford's boundary. The McNary–John Day transmission line would be approximately 40 kilometers (25 miles) from Hanford (BPA 2005a). As of September 2008, this project was on hold (BPA 2008).

In addition, information on water and gas pipeline projects was reviewed. No major water or gas pipeline projects are planned for the region around Hanford (FERC 2007a, 2007b).

Information on road and rail transportation projects was collected to determine whether major projects could impact the region around Hanford (WSDOT 2006, 2007, 2009a, 2009b; WFLHD 2006, 2007). Some of the more-substantial transportation projects in the region include the following:

- Adding 4.8 kilometers (3 miles) of additional lanes to State Route 240 between Kennewick and Richland (completed in 2007) (WSDOT 2007, 2009a)
- Widening 4.8 kilometers (3 miles) of State Route 17 in Moses Lake (completed in 2007) (WSDOT 2006, 2009a)
- Constructing a new 16-kilometer (10-mile) road between Interstate 82 and State Route 397 in the Finley area (completed in 2008) (WSDOT 2006, 2009b)
- Realigning approximately 823 meters (2,700 feet) of the Naches River channel away from U.S. Route 12 in Yakima (completed in 2008) (WSDOT 2006, 2009a)
- Adding 4 kilometers (2.5 miles) of passing lanes to State Route 240 in Hanford (to be completed in 2009) (WSDOT 2007)
- Widening 13 kilometers (8 miles) of U.S. Route 12 between McDonald Road and the city of Walla Walla, Washington (to be completed in 2009) (WSDOT 2006, 2009b)

Some of the major development activities planned in Richland over the next several years are described below. Future development beyond the next several years is, for the most part, speculative.

Pacific Northwest National Laboratory (PNNL) has selected a parcel of land just north of Horn Rapids Road to construct a new Physical Sciences Facility to replace that which will be lost in the 300 Areas. The parcel, referred to as the "Horn Rapids Triangle," is adjacent to PNNL's existing campus and the Tri-Cities Science and Technology Park (DOE 2004d). Construction of the Physical Sciences Facility began in 2007 and is expected to be completed in 2010 (PNNL 2007). In addition, ground was broken for the new PNNL Biological Sciences Facility and Computational Sciences Facility in 2008. These facilities are expected to be completed in 2009 (PNNL 2008).

Plans have been approved for Richland's Washington State University Tri-Cities (WSU-TC) campus to more than double in size over the next 10 years. The campus, which borders the Columbia River in North Richland, serves about 1,200 students (Richland 2004). WSU-TC partnered with PNNL to open a new Bioproducts, Sciences, and Engineering Laboratory at its North Richland campus in 2008 (WSU 2008).

The Kadlec Medical Center and Columbia Basin Community College opened a new health science building near the Kadlec Medical Center campus in 2006 (Trumbo 2006). The Kadlec Medical Center broke ground in 2006 on a $70 million expansion of its Richland campus, including a six-story tower (Kadlec 2008; Richland 2006:4). The new tower was completed in 2008 (Kadlec 2008). The hospital's workforce has been increasing rapidly, with 500 new employees added in the past few years (Richland 2004).

Ground was broken on the Hanford Reach National Monument Heritage and Visitors Center on December 5, 2003. The $40 million center will include interpretive galleries, office space, classrooms, and a 220-seat auditorium, and will focus on increasing understanding and appreciation of the history and resources of the Hanford Reach and the Columbia River (Richland 2004). Construction is scheduled to begin in 2009, with dedication expected in 2010 (The Reach 2008).

The Red Mountain American Viticultural Area (AVA), established in 2001, is a 1,781-hectare (4,400-acre) federally designated grape- and wine-producing region on the south-facing slope of Red Mountain. There are 10 wineries in the AVA, with about 283 hectares (700 acres) currently planted in wine grapes; 10 more wineries are likely to be constructed in the next 5 years. Visitor projections show that, by the year 2025, the Red Mountain AVA will attract approximately 175,000 wine-oriented visitors—a nearly ninefold increase over the current level. Elements of the Red Mountain AVA Conceptual Plan include the expansion of existing vineyard and winery operations; a number of new wineries; new visitor-oriented facilities, including recreation and interpretive experiences; and additional development of adjacent areas. When fully developed, it is estimated that approximately 20 to 30 additional wineries will be located in the AVA (Benton County 2006:B-14, G-3, G-4).

Table R–4 shows the activities examined as potential contributors to cumulative impacts at Hanford, the sources used, and why activities were or were not carried forward for cumulative impacts analysis. This determination follows the methodology documented in Figure R–2. Future activities that are speculative or not well defined were not carried forward for analysis. The activities and their end states considered in the cumulative groundwater modeling are described in Appendix S.

A number of actions are considered in the cumulative transportation risk analysis that are not listed in Table R–4. These other actions are listed in Appendix T, Table T–4, and include transportation of radioactive materials and wastes in the United States from DOE and non-DOE activities. The transportation risk analysis considers information from recently released DOE NEPA documents, including the *Final Complex Transformation Supplemental Programmatic Environmental Impact Statement* (DOE 2008b), *Revised Draft Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center* (DOE and NYSERDA 2008), and *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2008c). These actions are not considered elsewhere in the cumulative impacts analysis because (1) they do not include activities at Hanford, (2) the activities that would occur at Hanford are already considered in the *TC & WM EIS* alternatives, or (3) insufficient information is available to analyze their contribution to cumulative impacts at Hanford.

Table R–4. Activities Considered for the Cumulative Impacts Analysis

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]?
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities							
Cleanup and restoration activities across all areas of the Hanford Site	• *Draft Hanford Remedial Action EIS and Comprehensive Land Use Plan* (DOE 1996a)[e] • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) • *Hanford Site End State Vision* (DOE 2005b) • *Plan for Central Plateau Closure* (Fluor Hanford 2004) • *River Corridor Closure Project, TPA Quarterly Review for Period: December 2006–February 2007* (DOE, EPA, and Ecology 2007) • *CERCLA Five-Year Review Report for the Hanford Site* (DOE 2006a) • *River Corridor Closure Project, March 2007 Monthly Performance Report* (WCH 2007) • *Cumulative Impact Data for "Tank Closure and Waste Management EIS"* (CEES 2006)	2146 (DOE 1996a:S-12, S-20) 2035 (DOE 2002a:8) 2035 (Fluor Hanford 2004:ES-8)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Changes in land use at Hanford	• *Final Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) • "ROD: *Hanford Comprehensive Land-Use Plan EIS*" (64 FR 61615) • *Supplement Analysis, Hanford Comprehensive Land-Use Plan EIS* (DOE 2008a) • "Amended ROD for the *Hanford Comprehensive Land-Use Plan EIS*" (73 FR 55824) • *Hanford Site End State Vision* (DOE 2005b)	2050 (64 FR 61615)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Decommissioning of the eight surplus production reactors and their support facilities in the 100 Areas along the Columbia River[f]	• *Draft EIS, Decommissioning of Eight Surplus Production Reactors at the Hanford Site* (DOE 1989) • *Addendum (Final EIS), Decommissioning of Eight Surplus Production Reactors at the Hanford Site* (DOE 1992) • "ROD: *Decommissioning of Eight Surplus Production Reactors at the Hanford Site*" (58 FR 48509) • *Surplus Reactor Final Disposition Engineering Evaluation* (DOE 2005c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) • "DOI Designates B Reactor as a National Historic Landmark" (DOE and DOI 2008)	2080 (DOE 1989:3.52)	Yes	Yes (on site)	Yes	No (five of the eight reactors have already been cocooned)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Decommissioning of the N Reactor and support facilities	• *Surplus Reactor Final Disposition Engineering Evaluation* (DOE 2005c)	2068 (DOE 2005c:19)	Yes	Yes (on site)	Yes	No	Yes
Safe storage of surplus plutonium at the Plutonium Finishing Plant in the 200-West Area until it can be shipped to the Savannah River Site for disposition	• *Storage and Disposition of Weapons-Usable Fissile Materials Final PEIS* (DOE 1996b) • "ROD: *Storage and Disposition of Weapons-Usable Fissile Materials Final PEIS*" (62 FR 3014) • *Surplus Plutonium Disposition Final EIS* (DOE 1999b) • "ROD: *Surplus Plutonium Disposition Final EIS*" (65 FR 1608) • "Amended ROD: Storage of Surplus Plutonium Materials at the Savannah River Site" (72 FR 51807)	2010 (72 FR 51807)	Yes	Yes (on site)	Yes	Yes (ongoing activity)	No
Deactivation of the Plutonium Finishing Plant in the 200-West Area	• *EA, Deactivation of the Plutonium Finishing Plant, Hanford Site* (DOE 2003b) • *FONSI, "EA, Deactivation of the Plutonium Finishing Plant"* (DOE 2003c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2009 (DOE 2002a:A-20) 2009 (DOE 2003c:5-7)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]: Reasonably Foreseeable?	Evaluation Criteria[b]: Within the Regions of Influence?[c]	Evaluation Criteria[b]: Within the Timeframe of *TC & WM EIS*?	Evaluation Criteria[b]: Accounted for in Baseline?	Considered in *TC & WM EIS* Cumulative Impacts[d]
Actions to empty the K Basins in the 100-K Area and implement dry storage of the fuel rods in the Canister Storage Building in the 200-East Area	• *Draft EIS, Management of Spent Nuclear Fuel from the K Basins at the Hanford Site* (DOE 1995b) • *Addendum (Final EIS), Management of Spent Nuclear Fuel from the K Basins at the Hanford Site* (DOE 1996c) • "ROD: *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site*" (61 FR 10736) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2036 (61 FR 10736)	Yes	Yes (on site)	Yes (note: the movement of K Basin spent nuclear fuel to the 200 Areas was completed in 2005)	No (ongoing activity)	Yes
Complete U Plant regional closure	• *Final Feasibility Study for the Canyon Disposition Initiative (221-U Facility)* (DOE 2004e) • *Proposed Plan for Remediation of the 221-U Facility (Canyon Disposition Initiative)* (DOE 2004b) • *ROD, "221-U Facility (Canyon Disposition Initiative)," Hanford Site* (DOE 2005d) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2014 (DOE 2004e:K-14)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Final disposition of the canyons, PUREX Plant, PUREX tunnels, and other facilities in the 200 Areas and cleanup to Industrial-Exclusive land use standards	• *Plan for Central Plateau Closure* (Fluor Hanford 2004) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2035 (DOE 2002a:8)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Transport of sodium-bonded spent nuclear fuel to INL for treatment	• *Final EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel* (DOE 2000b) • "ROD for the *Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*" (65 FR 56565)	2012 (DOE 2000b:4-21)	Yes	Yes (transportation corridors)	Yes	No	Yes
Deactivation of FFTF in the 400 Area	• *EA, Shutdown of the FFTF, Hanford Site* (DOE 1995c) • *"Shutdown of the FFTF, Hanford Site," DOE, FONSI* (DOE 1995d) • *EA, "Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, FFTF Project," Hanford Site* (DOE 2006b) • *FONSI, "EA, Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, FFTF Project, Hanford Site"* (DOE 2006c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2016 (SAIC 2007a)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]: Reasonably Foreseeable?	Evaluation Criteria[b]: Within the Regions of Influence?[c]	Evaluation Criteria[b]: Within the Timeframe of *TC & WM EIS*?	Evaluation Criteria[b]: Accounted for in Baseline?	Considered in *TC & WM EIS* Cumulative Impacts[d]
Construction and operation of a PNNL Physical Sciences Facility	• *EA, Construction and Operation of a Physical Sciences Facility at PNNL* (DOE 2007a) • *FONSI for "Construction and Operation of a Physical Sciences Facility at the PNNL"* (DOE 2007b)	Construction completed in 2010 (PNNL 2007)	Yes	Yes (on site)	Yes	No (relocation of activities from 300 Area)	Yes
Excavation and use of geologic materials from existing borrow pits	• *Final Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) • "*ROD: Hanford Comprehensive Land-Use Plan EIS*" (64 FR 61615) • *EA, Use of Existing Borrow Areas, Hanford Site* (DOE 2001b) • *FONSI, "Use of Existing Borrow Areas, Hanford Site"* (DOE 2001c) • *EA, Reactivation and Use of Three Former Borrow Sites in the 100-F, 100-H, and 100-N Areas* (DOE 2003d) • *FONSI, "Reactivation and Use of Three Former Borrow Sites in the 100-F, 100-H, and 100-N Areas"* (DOE 2003e) • *Supplement Analysis, Hanford Comprehensive Land-Use Plan EIS* (DOE 2008a) • "Amended ROD for the *Hanford Comprehensive Land-Use Plan EIS*" (73 FR 55824)	2050 (64 FR 61615) 2011 (DOE 2001c) 2013 (DOE 2003e)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Construction and operation of the Environmental Restoration Disposal Facility near the 200-West Area	• *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility* (DOE 1994) • *Proposed Plan for an Amendment to the Environmental Restoration Disposal Facility ROD, Hanford Site* (DOE 2001d)	2024 (DOE 1994:9-23)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Implementation of the programmatic waste management decisions described in the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*	• *Final Waste Management PEIS for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a) • "ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (63 FR 3629) • "ROD for the DOE's Waste Management Program: Treatment of Non-wastewater Hazardous Waste" (63 FR 41810) • "ROD for the DOE's Waste Management Program: Storage of High-Level Radioactive Waste" (64 FR 46661) • "ROD for the DOE's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste" (65 FR 10061)	2017 (DOE 1997a)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Implementation of the programmatic waste management decisions described in the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (continued)*	• "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (65 FR 82985) • "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (66 FR 38646) • "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (67 FR 56989) • "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (69 FR 39446) • "Revision to the ROD for the DOE's Waste Management Program" (70 FR 60508) • "Amendment to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (73 FR 12401)	2017 (DOE 1997a)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Retrieval of suspect TRU waste buried after 1970	• *EA, Transuranic Waste Retrieval from the 218-W-4B and 218-W-4C Low-Level Burial Grounds, Hanford Site* (DOE 2002b) • *FONSI, "Transuranic Waste Retrieval from the 218-W-4B and 218-W-4C Low-Level Burial Grounds, Hanford Site"* (DOE 2002c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) • "Retrieval of Retrievably Stored TRU Waste from the Alpha Caissons" (SAIC 2007b)	2007 (DOE 2002b) 2010 (DOE 2002a:47) 2018 (SAIC 2007b)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Construction and operation of facilities for disposal of greater-than-Class C low-level radioactive waste	• "Notice of Intent to Prepare an *EIS for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste*" (72 FR 40135)	Not available	Yes	Yes (if a disposal facility is located at Hanford)	Yes	No	Yes
Cleanup and protection of groundwater	• *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) • *CERCLA Five-Year Review Report for the Hanford Site* (DOE 2006a)	2018 (DOE 2002a:A-33)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Transport of TRU waste to WIPP near Carlsbad, New Mexico	• *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997b) • "ROD for the DOE's *WIPP Disposal Phase*" (63 FR 3624)	2033 (63 FR 3624)	Yes	Yes (transportation corridors)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]: Reasonably Foreseeable?	Evaluation Criteria[b]: Within the Regions of Influence?[c]	Evaluation Criteria[b]: Within the Timeframe of *TC & WM EIS*?	Evaluation Criteria[b]: Accounted for in Baseline?	Considered in *TC & WM EIS* Cumulative Impacts[d]
Non-DOE Activities on Hanford Site							
Transport of Navy reactor plants from the Columbia River and their disposal in trench 218-E-12B in the 200-East Area	• *Final EIS on the Disposal of Decommissioned, Defueled Cruiser, OHIO Class, and LOS ANGELES Class Naval Reactor Plants* (Navy 1996) • "NEPA ROD for the *Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants*" (61 FR 41596)	2029 (Navy 1996:S-11)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Continued operation of the Columbia Generating Station (previously Washington Public Power Supply System, Nuclear Project No. 2)	• *Hanford Site Environmental Report for Calendar Year 2006* (Poston et al. 2007) • *2004 Annual Report* (Energy Northwest 2004) • *Columbia Generating Station 2005 Annual Radiological Environmental Operating Report* (Energy Northwest 2006)	2026 (Energy Northwest 2004)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Operation of the US Ecology commercial low-level radioactive waste disposal site near the 200-East Area	• *Final EIS for the Commercial Low-Level Radioactive Waste Disposal Site, Richland, Washington* (Ecology and WSDOH 2004) • *Hanford Site Environmental Report for Calendar Year 2006* (Poston et al. 2007) • *Annual Environmental Monitoring Report for Calendar Year 2006* (US Ecology 2007)	2056 (Ecology and WSDOH 2004:i)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

			Evaluation Criteria[b]				
Activity	**Source Document**	**Completion Date[a]**	**Reasonably Foreseeable?**	**Within the Regions of Influence?[c]**	**Within the Timeframe of *TC & WM EIS*?**	**Accounted for in Baseline?**	**Considered in *TC & WM EIS* Cumulative Impacts[d]**
Management of the Hanford Reach National Monument and Saddle Mountain National Wildlife Refuge	• *Hanford Reach of the Columbia River: Final River Conservation Study and EIS* (NPS 1994) • ROD, *"Hanford Reach of the Columbia River Final EIS for Comprehensive River Conservation Study"* (DOI 1996) • ROD, "Extension of the Saddle Mountain National Wildlife Refuge Acquisition Boundary" (64 FR 66928) • *Hanford Reach Protection and Management Program Interim Action Plan* (CAP 1998) • *"Establishment of the Hanford Reach National Monument"* (65 FR 37253) • *Hanford Reach National Monument Final Comprehensive Conservation Plan and EIS* (USFWS 2008)	2022 (USFWS 2008:i)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Operation of the Laser Interferometer Gravitational-Wave Observatory	• *Hanford Site Environmental Report for Calendar Year 2006* (Poston et al. 2007)	Not available	Yes	Yes (on site)	Yes	Yes (ongoing activity)	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region							
Changes in land use in the region	• *Adams County Comprehensive Plan* (ACPC 2005) • *Benton County Comprehensive Land Use Plan* (BCPC 2003) • *Benton County Sustainable Development Overall Economic Development Plan* (BCPC 2006) • *City of Richland Comprehensive Land Use Plan* (Richland 2002) • *Preliminary Assessment of Redevelopment Potential for the Hanford 300 Area* (Richland 2005a) • *City of Kennewick Comprehensive Plan 2006* (Kennewick 2006) • *Franklin County Growth Management Comprehensive Plan* (Franklin County 2005) • *Grant County Comprehensive Plan* (GCDCD 1999) • *Kittitas County Comprehensive Plan* (Kittitas County 2001) • *Klickitat County, Washington, Comprehensive Plan* (Dreyer 2007)	2024 (Richland 2005b:1-1) 2025 (Kennewick 2006:23) 2018 (BCPC 2003) 2015 (Yakima County 1998) 2018 (GCDCD 1999) 2021 (Kittitas County 2001) 2026 (Benton County 2006:1) 2023 (Franklin County 2005) 2025 (Walla Walla County 2007:1-14)	Yes	Yes (various)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Changes in land use in the region (*continued*)	*Plan 2015: A Blueprint for Yakima County Progress* (Yakima County 1998) *Walla Walla County Integrated Comprehensive Plan and EIS* (Walla Walla County 2007)						
Operation of the Perma-Fix Northwest (formerly Pacific Ecosolutions) waste treatment facility in Richland, Washington	*EA, Non-thermal Treatment of Hanford Site Low-Level Mixed Waste* (DOE 1998a) *FONSI, "Non-thermal Treatment of Hanford Site Low-Level Mixed Waste"* (DOE 1998b) *Final EIS for Treatment of Low-Level Mixed Waste* (Richland 1998) *EA, Offsite Thermal Treatment of Low-Level Mixed Waste* (DOE 1999c) *EA, "Offsite Thermal Treatment of Low-Level Mixed Waste," FONSI* (DOE 1999d) *Hanford Site Environmental Report for Calendar Year 2006* (Poston et al. 2007) *Annual Environmental Monitoring Report for 2006* (Pacific Ecosolutions 2007)	2019 (Richland 1998:1, 25)	Yes	Yes (0.8 km south)	Yes	No (ongoing activity)	Yes
Operation of the AREVA NP nuclear fuel fabrication facility in Richland, Washington	*NRC Inspection Report No. 70-1257/2004-001* (NRC 2004)	Not available	Yes	Yes (directly south)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Operation of the AREVA NP nuclear fuel fabrication facility in Richland, Washington (*continued)*	*NRC Inspection Report No. 70-1257/2005-002* (NRC 2005) *Hanford Site Environmental Report for Calendar Year 2006* (Poston et al. 2007) *Supplement to Applicant's Environmental Report* (AREVA 2006)	Not available	Yes	Yes (directly south)	Yes	No (ongoing activity)	Yes
Operation of the Westinghouse Service Center decontamination facility in Richland, Washington	*Hanford Site Environmental Report for Calendar Year 2006* (Poston et al. 2007)	Not available	Yes	Yes (1.5 km south)	Yes	No (ongoing activity)	Yes
Operation of the IsoRay medical facility in Richland, Washington	"Results of 2006 Air Emissions Monitoring" (Boyce 2007)	Not available	Yes	Yes (1 km south)	Yes	No (ongoing activity)	Yes
Operation of the Moravek Biochemicals facility in Richland, Washington	*Report on Compliance with the Clean Air Act Limits for Radionuclide Emissions* (Moravek 2005)	Not available	Yes	Yes (2 km south)	Yes	No (ongoing activity)	Yes
Cleanup of EPA NPL sites and state toxic waste sites	*National Priorities List Sites in Oregon* (EPA 2006a) *National Priorities List Sites in Washington* (EPA 2006b) *Hazardous Sites List* (Ecology 2006a)	Various	Yes	Yes (various)	Yes	No (ongoing activity)	Yes
Oil and gas leasing and exploration	*Leasing Washington State-Owned Lands for Oil and Gas Exploration* (WDNR 2007a)	Not applicable (ongoing)	Yes	Yes (various)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Oil and gas leasing and exploration (*continued*)	*Final Supplemental EIS on the Oil and Gas Leasing Program for State Lands* (WDNR 2005)	Not applicable (ongoing)	Yes	Yes (various)	Yes	No (ongoing activity)	Yes
Surface mining	*Surface Mining Reclamation Program* (WDNR 2007b) *Directory of Washington State Surface Mining Reclamation Sites–2006* (WDNR 2006)	Not applicable (ongoing)	Yes	Yes (various)	Yes	No (ongoing activity)	Yes
Operation of the U.S. Army Yakima Training Center	*Final Programmatic Environmental Impact Statement for Army Growth and Force Structure Realignment* (Army 2007)	Realignment complete in 2013 (Army 2007:iii)	Yes	Yes (10 km northwest)	Yes	No (ongoing activity)	Yes
DoD base realignment and closure—Umatilla Army Depot	*2005 Defense Base Closure and Realignment Commission Report* (BRAC 2005) *Commission Makes More BRAC Decisions* (AFIS 2005)	2011 (BRAC 2005:Ind-14)	Yes	Yes (55 km south)	Yes	No	Yes
Construction and operation of the Wanapa Energy Center	*Wanapa Energy Center Final EIS* (BIA 2004) "Wanapa Energy Center: Notice of Availability of ROD" (70 FR 10612) *Generation and Interconnection Projects on Hold* (BPA 2008)	2055 (BIA 2004:ES-14)	No; project on hold (BPA 2008)	Yes (48 km south)	Yes	No	No
Construction and operation of the Plymouth generating facility	*Final EIS, Plymouth Generating Facility* (Benton and BPA 2003) ROD, *"Plymouth Generating Facility"* (68 FR 60342) *Generation and Interconnection Projects on Hold* (BPA 2008)	Not available	No; project on hold (BPA 2008)	Yes (40 km south)	Yes	No	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Big Horn Wind Project	*Supporting the Development of Wind Resources in the Pacific Northwest* (BPA 2005b) *Completed Wind Projects* (BPA 2007c) *ROD for the Electrical Interconnection of the Big Horn Wind Energy Project* (BPA 2005c) "PPM Announces 200 MW Big Horn Wind Project" (PPM Energy, Inc. 2005) *Renewable Energy Projects Serving Northwest Load* (RNP 2006)	Not available	Yes	Yes (72 km southwest)	Yes	No (ongoing activity)	Yes
Combine Hills II Wind Project	*Supporting the Development of Wind Resources in the Pacific Northwest* (BPA 2005b) *Current Wind Projects* (BPA 2007a)	Not available	Yes	Yes (56 km southeast)	Yes	No	Yes
Desert Claim Wind Project	*Desert Claim Wind Power Project, Final EIS* (Kittitas County 2004) *Desert Claim Wind Power Project - Revised* (EFSEC 2009)	Not available	Yes	Yes (72 km northwest)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Wild Horse Wind Project	*Supporting the Development of Wind Resources in the Pacific Northwest* (BPA 2005b) *Renewable Energy Projects Serving Northwest Load* (RNP 2006)	Not available	Yes	Yes (56 km northwest)	Yes	No (ongoing activity)	Yes
Designation of west-wide energy corridors	*PEIS, Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE and BLM 2008)	Not applicable	Yes	No	Yes	No	No
McNary–John Day transmission line project	*McNary–John Day Transmission Line Project, Draft EIS* (BPA and DOE 2002a) *McNary–John Day Transmission Line Project, Abbreviated Final EIS* (BPA and DOE 2002b) *"McNary–John Day Transmission Line Project" ROD* (BPA and DOE 2002c) *Generation and Interconnection Projects on Hold* (BPA 2008)	2003–2007 (BPA and DOE 2002c:1, 2)	No; project on hold (BPA 2008)	Yes (40 km south)	Yes	No	No
Columbia River Basin water management	*Final PEIS for the Columbia River Water Management Program* (Ecology 2007a) *Upper Columbia Alternative Flood Control and Fish Operations, Columbia River Basin, Final EIS* (USACE 2006) *Potholes Reservoir Supplemental Feed Route Draft EA* (BOR 2007a) *Initial Alternative Development and Evaluation: Odessa Subarea Special Study* (BOR 2006a)	Ongoing management activities	Yes	Yes (various)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Priest Rapids Hydroelectric Project relicensing	*Priest Rapids Project License Application, FERC No. 2114, Executive Summary* (Grant County PUD 2003) *Final EIS, Priest Rapids Hydroelectric Project, Washington* (FERC 2006a) *Order Issuing New License* (FERC 2008)	2052 (FERC 2008)	Yes	Yes (6 km northwest)	Yes	No (upgrades not included in baseline)	Yes
Yakima River Basin water management (also see the next row on Black Rock Reservoir)	*Sunnyside Division Board of Control, Water Conservation Program, Yakima Project, Washington: FONSI and Final EA* (BOR 2004a) *Phase I Assessment Report, Storage Dam Fish Passage Study, Yakima Project, Washington* (BOR 2005) *Supplemental Draft EIS, Yakima River Basin Water Storage Feasibility Study* (Ecology 2008)	Ongoing management activities	Yes	Yes (various)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Construction and operation of the Black Rock Reservoir or Wymer Reservoir	*Yakima River Storage Enhancement Initiative, Black Rock Reservoir Study* (WIS 2002) *Summary Report Appraisal Assessment of the Black Rock Alternative*, Executive Summary (BOR 2004b) *Yakima River Basin Storage Alternatives Appraisal Assessment* (BOR 2006b) *Recreation Demand and User Preference Analysis: A Component of Yakima River Basin Water Storage Feasibility Study* (BOR 2007b) *Potential Impacts of Leakage from Black Rock Reservoir on the Hanford Site Unconfined Aquifer* (Freedman 2008) *Modeling Groundwater Hydrologic Impacts of the Potential Black Rock Reservoir* (BOR 2007c) *One-Dimensional Hydraulic Modeling of the Yakima Basin* (Hilldale and Mooney 2007) *Yakima River Basin Storage Study, Wymer Dam and Reservoir Appraisal Report* (BOR 2007d) *Draft Planning Report/EIS, Yakima River Basin Water Storage Feasibility Study* (DOI and Ecology 2008)	10-year construction period, 100-year operations period (McCartney 2007)	Yes	Yes Black Rock Reservoir (8 km west); Wymer Reservoir (45 km northwest)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Construction and operation of water pipelines	*Projects Near You* (FERC 2007a)	Not applicable	Yes	No	Yes	No	No
Construction and operation of biofuels facilities	*Biofuel Development in Washington* (WSU 2007) *NorthWest Biofuels, Inc., SEPA Checklist* (CCH 2006) *SEPA Checklist for the Central Washington Biodiesel Ellensburg Plant* (Central Washington Biodiesel, LLC 2006) *Walla Walla County Mitigated Determination, of Non-significance,* Gen-X Energy Group Biodiesel Production Facility (WWCCDD 2006) *Determination of Non-significance,* Central Washington Biodiesel Ellensburg Plant (Ecology 2006b) *SEPA Environmental Checklist, Washington Ethanol Plant, Moses Lake, Washington* (Washington Ethanol, LLC 2006) "Biofuel or Ethanol Production" (Plummer 2007)	Various	Yes	Yes (various)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Construction and operation of biofuels facilities (*continued*)	*Mitigated Determination of Non-significance, Moses Lake Ethanol Plant* (GCPD 2007) *SEPA Checklist for the Moses Lake Ethanol Plant* (Liquafaction Corporation 2007) *Mitigated Determination of Nonsignificance*, Washington Ethanol LLC Plant (Ecology 2007b) *SEPA Environmental Checklist for the Columbia Ethanol Plant* (Columbia Ethanol Plant Holdings, LLC 2006) *Revised SEPA Mitigated Determination of Nonsignificance for the Proposed Columbia Ethanol Facility* (Ecology 2006c) *Notice of Construction, Final Order of Approval No. 2006-0009*, Columbia Ethanol Plant Holdings, LLC (Benton Clean Air Authority 2007)						
Construction and operation of natural gas terminals, pipelines, and storage projects	*Projects Near You* (FERC 2007a) *Major Storage Projects on the Horizon* (FERC 2006b) *Major Pipeline Projects on the Horizon* (FERC 2007b) *Existing and Proposed North American LNG Terminals* (FERC 2007c)	Not applicable	Yes	No	Yes	No	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Regional road projects	*Washington Projects* (WFLHD 2007) *Oregon Projects* (WFLHD 2006) *Making Every Dollar Count for Benton County* (WSDOT 2007) *Agency Projects: Highway, Ferry and Rail Construction and Improvement Projects* (WSDOT 2006, 2009b) *Agency Projects: Completed Projects* (WSDOT 2009a)	2009 (WSDOT 2006, 2009a, 2009b)	Yes	Yes (various)	Yes	No	Yes
Regional rail projects	*WSDOT Projects: Highway, Ferry and Rail Construction and Improvement Projects* (WSDOT 2006)	Not applicable	Yes	No	Yes	No	No

[a] The "completion date" is the date the activity is expected to be completed. This information determines if the activity is within the same time period as the *TC & WM EIS* alternatives.

[b] These evaluation criteria are used to help determine if the activity should be considered in the *TC & WM EIS* cumulative impacts analysis. See Figure R–2 (Phase 2) for a description of how the criteria are used.

[c] Because regions of influence vary by resource, the action may lie outside the region of influence for one resource and within it for another. Distances measured using Google Earth Version 4.2.0198.2451.

[d] This column presents the results of the assessment performed in Phase 2 of Figure R–2 for each activity evaluated.

[e] Appendix A of the *Draft Hanford Remedial Action EIS and Comprehensive Land Use Plan* (DOE 1996a) describes the activities analyzed in that EIS. Page A-3 notes that decommissioning of major canyon facilities in the 200 Areas (i.e., T Plant, B Plant, and the PUREX Plant) are not included.

[f] B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*.

Note: B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS.* To convert kilometers to miles, multiply by 0.6214.

Key: BRAC=Base Realignment and Closure; CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; DOE=U.S. Department of Energy; DoD=U.S. Department of Defense; DOI=U.S. Department of the Interior; EA=environmental assessment; EIS=environmental impact statement; EPA=U.S. Environmental Protection Agency; FERC=Federal Energy Regulatory Commission; FFTF=Fast Flux Test Facility; FONSI=Finding of No Significant Impact; INL=Idaho National Laboratory; km=kilometers; MW=megawatt; NEPA=National Environmental Policy Act; NPL=National Priorities List; NRC=Nuclear Regulatory Commission; *PEIS=Programmatic Environmental Impact Statement;* PNNL=Pacific Northwest National Laboratory; PPM=Pacific Core Power Marketing, Inc.; PUREX=Plutonium-Uranium Extraction; ROD=Record of Decision; SEPA=State Environmental Policy Act; *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*; TPA=Tri-Party Agreement; TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WSDOT=Washington State Department of Transportation.

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APPENDIX S
WASTE INVENTORIES FOR CUMULATIVE IMPACT ANALYSES

Integral to development of the inventory data set for the cumulative impact analyses presented in this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* was identification of those waste sites potentially contributing to cumulative impacts on groundwater. Their identification involved two semi-independent, convergent processes: a Waste Information Data System Screen and a Technical Baseline Review.

S.1 WASTE INFORMATION DATA SYSTEM SCREEN

The Waste Information Data System (WIDS) Screen began with the universe of sites reflected in the *Hanford Site Waste Management Units Report* (Shearer 2005a), also referred to as the "WIDS database," and focused on the assignment of each site to one of two classes: (1) those sites that potentially contribute significantly to cumulative impacts and (2) those sites that are not expected to contribute significantly to cumulative impacts. The WIDS database is an environmental database specific to the Hanford Site (Hanford) and includes information on the waste sites identified at Hanford. The objectives of the WIDS screening process are presented in Table S–1.

Table S–1. Objectives of Waste Information Data System Screening

Objective 1	Identify all potential groundwater sources (radiological and chemical)
Objective 2	Confirm and screen out *de minimis* sources
Objective 3	Identify inventories and associated information (e.g., end states) for screened groundwater sources
Objective 4	Further screen sites remaining after completion of Objective 3 with risk/hazard analysis
Objective 5	Record the source by name, location, source type, and reference
Objective 6	Seek additional documentation from site owners

Overall strategy for the screening involved four steps:

1. Reviewing approximately 2,800 WIDS sites included in the *Hanford Site Waste Management Units Report* (Shearer 2005a)
2. Applying the screening rules as described below
3. Confirming the site locations using the Hanford Site Atlas (BHI 2001)
4. Performing quality assurance verifications of the sites that failed each round of screening and were therefore not included in the cumulative impact inventory data set

In preparation for the screening (step 2 above), various rules were specified for retaining sites as potentially significant contributors or for eliminating sites from consideration in cumulative impacts. Those rules and the assignment of site screen codes are described in the following sections.

S.1.2 Screen 1 Rules

Screen 1 involved reviewing all WIDS sites and asking the question: Is the site a potential source to include in the *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)* cumulative impacts analysis?

If the answer to the question was "Yes," the site passed the Screen 1 test and was assigned a Screen 1 reason code as follows:

1. Known inventory + potential for release
2. Reported cleanup + possible residual contamination
3. Unknown inventory

If the answer to the question was "No," the site failed the Screen 1 test and was assigned a Screen 1 reason code as follows:

1. WIDS status for the site is rejected as a potential waste site and not reclassified as accepted for continued consideration in WIDS, plus the site is inactive and has a description consistent with the designated WIDS status.
2. Site is a duplicate site.
3. Site has been consolidated with another WIDS site; sources for the consolidated site become a part of the "parent" site.
4. Site is included in the *TC & WM EIS* alternatives. Facilities and equipment of the single-shell tank system are described in RPP-15043, *Single-Shell Tank System Description* (Field 2003).
5. Site is a satellite storage/accumulation site.

S.1.3 Screen 2 Rules

Screen 2 involved a review of all WIDS sites that passed the Screen 1 test, and further screening based on the WIDS classification system for sites as potential waste sites.

The WIDS site was assigned a "No" (fail) for Screen 2 for any of the following WIDS classifications. (There was an additional evaluation of all of these "No" sites to determine if the *TC & WM EIS* team was in agreement with the classification, and some "No" sites were changed to "Yes" sites regardless of the WIDS classification if the *TC & WM EIS* team believed the site required further consideration or the information was not clear for its classification.)

Rejected
Accepted, then reclassified as rejected
Accepted, then reclassified as "No Action" or "Closed Out"

The WIDS site was assigned a "Yes" (pass) for Screen 2 for all "Accepted" classifications.

S.1.4 Screen 3 Rules

Screen 3 involved a review of all WIDS sites that passed the Screen 2 test and focused on the waste types. If the site met the criteria below under the Screen 3 rules it was rejected.

General Screen 3 rules for all waste types were as follows:

Non-liquid-effluent areas previously identified as contaminated areas that are not currently posted as such are assumed to contain no active contamination and do not pass through Screen 3.

If constituent K_d > 10, there was complete retention of the constituent in the vadose zone and the contamination was removed, consequently there was no release to the groundwater and the site does not pass through Screen 3.

If the site is not a groundwater source, then the site does not pass through Screen 3. For example, if the site is an outfall to the river, within 100 meters (328 feet) of the river shoreline or within the river floodplain, then the site is not considered to be a source of groundwater contamination.

If the release consists primarily of a petroleum product or polychlorinated biphenyls, then the site does not pass through Screen 3. Releases that contained polychlorinated biphenyls may continue for consideration if they are part of a large liquid release or solid disposal.

Screen 3 rules for each specific waste type are listed in Table S–2.

Table S–2. Screen 3 Rules of the Waste Information Data System for Specific Waste Types

Waste Type	Rule
Abandoned chemicals	No, if the quantities are laboratory or bench scale.
Abandoned pipe trench	No, if remediation is expected.
Animal waste	Yes, if the animals or animal byproducts were associated with radiological experiments or unknown.
Asbestos	No, if the only constituent of concern is asbestos; the site may contain demolition/building debris and miscellaneous trash.
Ash	No, if EP Toxicity Testing indicates it is nontoxic.
Barrels/drums/buckets/cans	No, if their content is clearly not associated with nuclear materials production/processing.
Batteries	No, if the site contains only batteries.
Building floor drains	No, if the building is clearly not associated with nuclear materials production/processing.
Bunker pipeline	No, if it is a petroleum carrying pipeline.
Burial ground	Yes, but only if it is the site of a process- or production-related release or unknown.
Chemicals	Yes, but only if their release was production-related or unknown.
Chemical release	Yes, but only if it was production-related or unknown.
Construction debris	Yes, if it contains radiological contaminants or unknown.
Contaminated ramp	Yes, if the contaminants are radiological or unknown.
Contaminated soil	Yes, if it contains radiological or chemical contaminants for which there is no remediation or unknown.
Contamination area	Yes, if it contains radiological or chemical contaminants for which there is no remediation; no, if it is clearly only surface contamination or unknown.
Control structure	Yes, if the contamination is radiological or unknown.
Demolition and inert waste	No, unless there is evidence of chemical or radiological production waste.
Drywell	No, unless there is evidence of chemical or radiological production waste.
Dumping area	No, unless there is evidence of chemical or radiological production waste.
Electric substation	No, if the content is only petroleum-based waste or PCBs.
Equipment	Yes, but only if it was used in a process- or production-related release or unknown.
Floodplain	No, if it is a large, diffused area within 100 meters (328 feet) of the river.
French drain	Yes, but only if it was used in a process- or production-related release or unknown.
Fuel tank	No, if the content is only petroleum-based waste or PCBs.
Honey dump station	Yes, but only if it is the site of a process- or production-related release or unknown.
Injection/reverse well	Yes, but only if it is the site of a process- or production-related release or unknown.
Maintenance garage	No, if it is only a petroleum-based waste site.
Military compound	Yes, but only if the site was used for a process- or production-related release or unknown.
Miscellaneous pipelines	Yes, but only if they were used for a process- or production-related release or unknown.
Miscellaneous trash and debris	Yes, but only if it is the result of a process- or production-related release or unknown.
Neutralization tank	Yes, but only if it is the site of a process- or production-related release or unknown.

Table S–2. Screen 3 Rules of the Waste Information Data System for SpecificWaste Types *(continued)*

Waste Type	Rule
Oil	No, if it is only petroleum-based waste or PCBs.
Ordnance	Yes, but only if it is the site of a process- or production-related release or unknown.
Process effluent	Yes, but only if it is the result of an untreated process- or production-related release or unknown; no, if the effluent was contained or treated.
Process sewer	Yes, but only if it is the site of an untreated process- or production-related release or unknown.
Product piping	Yes, but only if it is the site of an untreated process- or production-related release or unknown.
Rad site	Yes, but only if it is the site of an untreated process- or production-related release or unknown.
Reactor exhaust stack	Yes, but only if it is the site of an untreated process- or production-related release or unknown.
Sanitary sewer	Yes, if it is the site of an untreated process- or production-related release; yes, if it was used for the disposal of animals or animal byproducts associated with radiological experiments or unknown.
Septic tank	Yes, if it is the site of an untreated process- or production-related release; yes, if it was used for the disposal of animals or animal byproducts associated with radiological experiments or unknown.
Sludge	Yes, but only if it is the result of an untreated process- or production-related release or unknown.
Sodium storage facility	No, if it is an active regulated facility.
Soil	Yes, if it is the site of an untreated process- or production-related release; no, if only airborne contamination was involved or unknown.
Steam condensate	Yes, if it is the result of an untreated process- or production-related release or unknown.
Storage	Yes, if the site was used to store untreated process- or production-related waste or unknown.
Storage tank	Yes, if it was used to store untreated process- or production-related waste or unknown.
Stormwater runoff	No, unless it is chemically or radiologically contaminated or associated with a process- or production-related release.
Surface debris	Yes, if there is evidence of process- or production-related contamination or unknown.
Underground radioactive area	Yes, if it was the site of an untreated process- or production-related release or unknown.
Unplanned release	Yes, if it was an untreated process- or production-related release or unknown.
Vegetation	Yes, if it is the site of an untreated process- or production-related liquid release or unknown.
Waste storage	Yes, if the site was used to store untreated process- or production-related waste or unknown.
Water	Yes, if it is associated with an untreated process- or production-related liquid release or unknown.
Water treatment facility	Yes, if it is the site of an untreated process- or production-related liquid release or unknown.
Wood and coal debris	Yes, if there is evidence of process- or production-related contamination or unknown.

Key: EP=Extraction Procedure; PCB=polychlorinated biphenyls.

S.1.5 Screen 4 Rules

In addition to a review of the Waste Management Units Area document used for Screens 1 through 3, Screen 4 included review of an updated, more-detailed WIDS site description document (Shearer 2005b). Published Comprehensive Environmental Response, Compensation and Liability Act Records of Decision were also reviewed to determine the status of WIDS sites reviewed in Screen 4. Furthermore, the Composite Analyses Revision 0 inventory was reviewed to validate independent screening decisions.

Screen 4 involved an additional review of all WIDS sites that passed the Screen 3 test according to the following screening criteria. If the site met the criteria listed below under Screen 4 rules it was rejected.

Facility-Specific Screen: The WIDS site is assigned a "No" (fail) if the facility associated with the release is not a process- or production-related facility. "Yes" (pass) is assigned to the WIDS site if the facility or original source is unknown.

Minimum-Inventory Screen: The WIDS site is assigned a "No" (fail) if the inventory is identified and will be coded as noted below.

For WIDS sites assigned a "No," one of the following Screen 4 codes is assigned. The *de minimis* criteria were selected by a team of subject matter experts using engineering judgment and groundwater modeling experience, the objective being to limit the WIDS sites to those that are likely to contribute significantly to the cumulative impact. Given the waste information available, each criterion is believed to be the limit at which the WIDS site would have a significant impact.

- Updated information provided in new WIDS site description document (regulatory status does not drive the decision)
- More specificity of process information (location/building/room)
- *De minimis* contaminant quantity < 0.45 kilograms (1 pound) of chemicals
- *De minimis* contaminant quantity < 1 curie of radionuclides
- *De minimis* contaminant quantity < 379 liters (100 gallons)
- *De minimis* contaminant quantity (dry, residual) < 50,000 disintegrations per minute of alpha, beta, gamma per gram

For WIDS sites assigned a "Yes," one of the following Screen 4 codes is assigned.

- Inventory information available in new WIDS description document
- No inventory information available but may be available in other documentation
- Reference to inventory available in new WIDS description document
- No inventory information available and no inventory data are expected to be found
- Permitted facility inventory to be provided by applicable documentation, e.g., facility waste acceptance criteria

The WIDS does not suffice for the analysis of cumulative impacts at Hanford. It is not a complete set of sites potentially contributing to cumulative impacts. Some Hanford facilities and some facilities not located on Hanford are not included in the WIDS. Equally important, the WIDS has little inventory data. Therefore, other sources of information about waste sites, such as Hanford technical baseline documents, were used to supplement the identification of sites potentially contributing significantly to cumulative impacts and to locate the waste inventory data for those sites. This process is described in Section S.2.

S.2 TECHNICAL BASELINE REVIEW

The Technical Baseline Review (TBR) was a systematic search of documents and databases to identify waste sites and inventory data. Documents describing facilities and waste sites in the Hanford operable units were collected. In addition to the technical baseline documents for the 100, 200, 300, 400, and 600 Areas at Hanford, offsite sources such as those described in the Environmental Data Resources, Inc., online database were reviewed. References to additional documents potentially containing inventory data for these waste sites were recorded, and the referenced documents were reviewed (SAIC 2006).

All sites in a technical baseline or similar source document were assigned to one of four categories (see Table S–3) based on the information in the TBR source documents. (Note: Waste sites included in the *TC & WM EIS* alternatives analysis were excluded from this review.)

Table S–3. Technical Baseline Review Categories

Category 1	Sites containing radiological or chemical COPCs above *de minimis* contamination levels
Category 2	Sites expected to contain a radiological or chemical COPC inventory above *de minimis* contamination levels, but without inventory information
Category 3	Sites for which process knowledge indicates a lack of contamination, or sites containing radiological or chemical COPCs below *de minimis* contamination levels
Category 4	Nonliquid waste sites where the contamination would be removed and therefore would not contribute to groundwater contamination

Key: COPC=constituent of potential concern.

This accounting of waste sites potentially contributing to cumulative impacts is independent of the WIDS Screen and serves as a check on the results of that screen for common sites. Combined, these two sets of sites (WIDS and TBR) are expected to include all known sites, with most sites common to the two sets. In addition to identifying waste sites not in the WIDS, the TBR identified reference documents for waste inventory data. It was also determined that the 1987 version of the WIDS (specifically, the *Hanford Site Waste Management Units Report*, known as the Cramer Report [DOE 1987]) could be used as a waste inventory reference in lieu of the more-recent WIDS because the more-recent version of WIDS did not include the detailed inventory data.

S.3 "MARRIAGE" OF WASTE INFORMATION DATA SYSTEM SCREEN AND TECHNICAL BASELINE REVIEW

To develop the inventory for the cumulative impacts analysis, the WIDS sites had to be combined with the TBR waste sites. This was accomplished by the development of Excel spreadsheets that document Site and Inventory information by site areas. This included a significant "data mining" effort.

Excel Workbooks includes two individual worksheets: Sites and Inventory. The elements of each are described in Tables S–4 and S–5. The columns in the "Sites" worksheet are explained in Table S–4.

The columns in the "Inventory" worksheet are described in Table S–5. It should be noted that there are uncertainties related to the contamination volumes and concentrations found in the available documents. Some of these uncertainties relate to the limited available data for many waste sites. More-detailed discussions on inventory uncertainties can be found in the documents used to develop the inventory worksheets described in Table S–5.

Table S–4. Content of Sites Worksheet of Excel Workbooks

Table Entry	Comment/Assumption[a]
Site Number	Sequential numbering system to provide an efficient index between the site list on the spreadsheets for each area and the site locations on the maps developed to graphically represent the waste sites.
Common Site Name	Taken from (1) the technical baseline documents (SAIC 2006), (2) the latest version of WIDS (Shearer 2005b), (3) the *Hanford Site Waste Management Units Report* (DOE 1987), known as the Cramer Report, or (4) some other source.
WIDS ID	Taken from the latest version of WIDS (Shearer 2005b).
Operable Unit	Taken from the latest version of WIDS (Shearer 2005b).
Site Type	Based on available descriptive information, site was assigned a site type (e.g., pond, crib, trench, ditch, burial ground, tank, septic tank, building, equipment, contaminated soil). Conflicting information was resolved through reliance on the latest version of WIDS (Shearer 2005b).
Source Type	Based on available descriptive information, source was assigned a type (i.e., liquid, solid, liquid/solid, N/A [not applicable], or UNK [unknown]).
Centroids (coordinates)	Taken from (1) the Hanford Site Atlas (BHI 2001) index, (2) the latest version of WIDS (Shearer 2005b), or (3) estimated from maps in the Hanford Site Atlas (BHI 2001).
Effective Area (bottom area [L×W] of feature) square feet	Taken from (1) the latest version of WIDS (Shearer 2005b), (2) the technical baseline documents (SAIC 2006), or (3) the Cramer Report (DOE 1987). If the Cramer Report was used for inventory data, it was also used for effective area.
Liquid Volume (volume of liquid released) liters	If inventory is found, then it is taken from that reference. Otherwise, liquid volume is taken from (1) the *Hanford Soil Inventory Model, Rev. 1* (Corbin et al. 2005), (2) *Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site* (Diediker 1999), (3) the Cramer Report (DOE 1987), (4) the latest version of WIDS (Shearer 2005b), or (5) the technical baseline documents (SAIC 2006).
Solid Volume, Solid Mass (volume or mass of waste) cubic meters or kilograms	Generally, these entries were only used for burial grounds. If inventory is found, then it is taken from that reference. Otherwise, it is taken from (1) the latest version of WIDS (Shearer 2005b), (2) the Cramer Report (DOE 1987), or (3) the technical baseline documents (SAIC 2006).
Decay Date	If radionuclide inventory is found, then it is taken from that reference.
Start/Stop Dates (year unit started and stopped operation or started and stopped receiving waste)	If inventory is found, then it is taken from that reference. Otherwise, it is taken from (1) the latest version of WIDS (Shearer 2005b), (2) the technical baseline documents (SAIC 2006), or (3) the Cramer Report (DOE 1987).
Status (current status including important cleanup and closure milestones)	Taken from (1) the latest version of WIDS (Shearer 2005b), (2) the technical baseline documents (SAIC 2006), or (3) the Cramer Report (DOE 1987).
End State, Barrier Type, Completion Date	For the 200 Areas, it is taken from the *Plan for Central Plateau Closure* (Fluor Hanford 2004). For other areas, it is taken from applicable cleanup (1) RODs, (2) closure plans, and (3) other documents.
Comments to Analysts	References and page numbers are provided. Important comments are also noted.
Comparison to WIDS	If differences were found between the results of the WIDS screening and the results of the TBR, they were resolved and noted.
References	References for each area are included at the bottom of the Sites worksheet.

[a] Numerical listings of source documents are in order of priority.

Key: ROD=Record of Decision; TBR=Technical Baseline Review; WIDS=Waste Information Data System.

Table S–5. Content of Inventory Worksheet of Excel Workbooks

Table Entry	Comment/Assumption[a]
Site Number	Sequential numbering system to provide an efficient index between the site list on the spreadsheets for each area and the site locations on the maps developed to graphically represent the waste sites.
Common Site Name	Taken from (1) the technical baseline documents (SAIC 2006), (2) the latest version of WIDS (Shearer 2005b), (3) the *Hanford Site Waste Management Units Report*, known as the Cramer Report (DOE 1987), or (4) some other source.
WIDS ID	Taken from the latest version of WIDS.
Radionuclides[b]	Liquid release inventories taken from (1) *Hanford Soil Inventory Model, Rev. 1* (Corbin et al. 2005), (2) *Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site* (Diediker 1999), (3) the Cramer Report (DOE 1987), (4) the technical baseline documents (SAIC 2006), (5) the latest version of WIDS (Shearer 2005b), or (6) other sources. Solid waste inventories taken from (1) *Summary of Radioactive Solid Waste Received in the 200 Areas During Calendar Year 1995* (Anderson and Hagel 1996) or other site-specific solid waste references, (2) the Cramer Report (DOE 1987), (3) technical baseline documents (SAIC 2006), (4) the latest version of WIDS (Shearer 2005b), or (5) other sources.
Chemicals[c]	Liquid release inventories taken from (1) *Hanford Soil Inventory Model, Rev.1*, (2) the Cramer Report (DOE 1987), (3) technical baseline documents (SAIC 2006), (4) the latest version of WIDS (Shearer 2005b), or (5) other sources. Solid waste inventories taken from (1) site-specific solid waste references, (2) the Cramer Report (DOE 1987), (3) the technical baseline documents (SAIC 2006), (4) the latest version of WIDS (Shearer 2005b), or (5) other sources.
Comments	Important comments regarding the inventories are noted.

[a] Numerical listings of source documents are in order of priority.
[b] Curies of radionuclides (half-life > 10 years and inventory greater than 1 curie [cumulative or individual]).
[c] Kilograms of chemicals (inventory greater than 0.45 kilograms (1 pound) of chemicals that have MCLs or a health-based ingestion standard in IRIS, and compounds that have constituents with MCLs or a health-based ingestion standard in IRIS).

Key: IRIS=Integrated Risk Information System maintained by the U.S. Environmental Protection Agency; MCL=maximum contaminant level; WIDS=Waste Information Data System.

Combining the WIDS Screening results and the TBR results requires resolving any conflicts between the two independent screening processes. The WIDS screening sites were compared to the TBR sites and the differences were reviewed and reconciled. For example, during the “marriage” of the two processes, TBR sites were reclassified from sites having inventories with a potential to contribute significantly to cumulative impacts to sites that are not expected to contribute significantly to cumulative impacts if the only contamination present or released from the site was radionuclides with half-lives less than 10 years, such as cobalt-60 (half-life 5.27 years).

S.3.1 End-State Approach

End-state analysis included the review of applicable documents and consultation with the U.S. Department of Energy's (DOE's) Office of River Protection (ORP) and Richland Operations Office (RL). The end states for all waste sites were reviewed and concurred upon by each responsible ORP and DOE-RL manager to ensure accuracy and completeness. The approach for determining which end state to use for each waste site followed specific guidelines. The guidelines for selecting an end state were based on the following broad criteria:

> The end state should represent a reasonably foreseeable outcome for a particular facility or group of facilities. The implementing approach should not assume excessive research and development or relying on undeveloped technology.
>
> The end state should comply with current regulations and agreements where applicable, based on the following hierarchy:
>
> - Environmental documents submitted to or approved by regulatory agencies (e.g., remedial investigations/feasibility studies, interim records of decision, Resource Conservation and Recovery Act closure plans) (SAIC 2006)
> - Milestones stipulated in the Hanford Federal Facility Agreement and Consent Order (also known as the Tri-Party Agreement) (Ecology, EPA, and DOE 1989)
> - Outcomes defined by Requests for Proposal or Contracts (e.g., river corridor)
> - Planning documents (e.g., *Plan for Central Plateau Closure* [Fluor Hanford 2004])
>
> End states should represent a consistent application of DOE policies and procedures. Exceptions have to be documented to support a reason for a policy change.
>
> If a different end state is proposed than those identified above, the end states must be in a publicly available, referenced document.

The end states identified using the approach described above are current through October 2006 when the cumulative impact groundwater inventory was completed. Since that time, additional or different decisions on end states may have been made and it is quite possible that other decisions may be made as DOE progresses through the closure and cleanup process at Hanford. However, to complete the groundwater analysis for cumulative impacts in the *Draft TC & WM EIS*, a cutoff date had to be determined.

S.3.2 Independent Review and Verification (Quality Assurance) Process

Following each step of the cumulative impact inventory development process (i.e., screening steps 1, 2, 3, and 4, and the "marriage" of the WIDS Screen and the TBR), an independent quality assurance review was conducted. These independent quality assurance reviews were conducted to ensure data accuracy and integrity. This included verification that the data are traceable to the source document, and verification of radionuclide and chemical inventory values. These reviews also verified that the inventory development process was consistently applied in the preparation of the Excel Sites and Inventory worksheets for each Hanford area.

S.3.3 Emerging Data

As new and emerging data were identified, the Excel Workbooks' Sites and Inventory worksheets were revised and updated as necessary. For example, the latest version of SIM [the Hanford Soil Inventory Model] (Corbin et al. 2005) was obtained and reviewed to determine applicability. The updated data from this document were incorporated into the Sites and Inventory worksheets. This included adding individual worksheets for each waste site provided by Revision 1 of SIM. The cutoff date for revisions or updates to the inventory database was October 2006.

S.3.4 Results of Initial Screening

Based on the screening approach discussed above, over 2,300 sites and sources were documented. These sites were identified for 18 geographical areas. Of this total, 383 sites were identified as sites with referenceable inventories containing radiological or chemical constituents of potential concern (COPCs) above *de minimis* contamination levels. Approximately 403 sites were identified as sites expected to contain a radiological or chemical COPC inventory above *de minimis*, but no referenceable inventory information was available. A total of 1,429 sites were identified as sites for which process knowledge indicates a lack of contamination, or sites containing radiological or chemical COPCs below *de minimis* contamination levels as defined in the Screen 4 Rule; and approximately 106 nonliquid waste sites where the contamination would be removed and thus would not contribute to groundwater contamination.

S.3.5 Analysis of Sites with Missing Inventory

As previously discussed, the cumulative impacts analysis inventory looked at a total of 2,321 sites. The 403 sites identified as having unknown inventory expected to contain radiological or chemical COPCs represent about 17 percent of the total. The remainder, 1,918 sites, or 83 percent of the total, have known inventory. The percentage of sites with unknown inventory varies by area as shown in Table S–6.

Table S–6. Unknown-Inventory Sites per Area at the Hanford Site

Area	Total Sites	Unknown-Inventory Sites	Percent Unknown-Inventory Sites
100 Areas	808	132	16
200 Areas	957	194	20
300 Area	440	66	15
400 Area	76	1	1
Permitted facilities	2	0	0
Other sites	38	10	26
Total	**2,321**	**403**	**17**

In the core of the production area at Hanford (100, 200, and 300 Areas), characterization is most advanced for the 100 and 300 Areas. Therefore, the 100 and 300 Areas have corresponding lower percentages of unknown-inventory sites.

The simplest inference that can be drawn from these initial observations is that the cumulative impacts analysis inventory might be about 17 percent low because data are missing for about 17 percent of the sites. This inference is based on the assumption that each of the sites with unknown inventory actually has inventory equal to the average of the sites with known inventory.

The cumulative impacts analysis inventory additionally categorized the sites with known inventory into three groups:

1. Sites with inventories that would be released into the environment at their original disposal locations

2. Sites with inventories that would be removed, treated, and disposed of in permitted facilities
3. Sites with inventories that are essentially zero (*de minimis*)

Another assumption is that the sites with unknown inventory behave similarly (statistically) to the sites with known inventory (this assumption is examined in more detail below). The COPCs at 293 sites with known inventories are not negligible and based on the end-state information would not be removed, treated, and disposed of in permitted facilities. These sites represent about 15 percent of the 1,918 sites with known inventory. If the sites with unknown inventory have a similar COPC population to the sites with known inventory, then we might expect that about 15 percent of the 403 sites with unknown inventory, or about 65 sites, actually contain non-negligible amounts of inventory that will be released to the environment outside of permitted facilities. The missing inventory (estimated to be about 17 percent of the total inventory) might be contained in only 15 percent of the sites with unknown inventory. This observation suggests that it might be useful to examine the sites with unknown inventory individually to try to identify the 15 percent of the unknown-inventory sites that are significant to the total inventory.

To follow this thought, a third analysis of the sites with unknown inventory was performed to evaluate their significance. A weight-of-evidence approach was used by reviewing the WIDS description (and technical baseline documents where necessary) to categorize the unknown-inventory sites into three groups:

1. Sites that most likely have significant inventory
2. Sites that most likely have insignificant inventory
3. Sites where no judgment of significance could be made

As shown in Figures S–1 through S–3, the 200-B Area has a rather high percentage of unknown-inventory sites and was selected as an area in which to evaluate the utility of the weight-of-evidence approach. Three independent teams performed this evaluation. The independent teams each reviewed the 37 sites with unknown inventory in the 200-B Area.

All three teams concluded that the missing inventory is probably not spread evenly over the 37 sites with unknown inventory in the 200-B Area. The teams concluded that the unknown-inventory sites likely had a higher proportion of significant sites than the 15 percent observed in the known inventory population. A conservative estimate is that the percentage of unknown-inventory sites that are most likely to be significant in the 200-B Area is about 50 percent. This suggests that about half of the 403 unknown-inventory sites in the total population, about 202, are most likely to be insignificant to the analysis if the other areas are similar to the 200-B Area. The missing inventory is currently estimated to be 17 percent of the known inventory.

The significance of the missing inventory should be considered in the context of the inventory for the alternatives impacts analysis. If the inventory for the cumulative impacts analysis is smaller than that for the alternatives impacts analysis, then we would expect that uncertainties in the sum of both inventories would be dominated by uncertainties in the alternatives impacts analysis. Similarly, if the inventory for the cumulative impacts analysis is larger than that for the alternatives impacts analysis, then we would expect that uncertainties in the sum of both inventories would be dominated by uncertainties in the cumulative impacts analysis. If the uncertainties in the two inventories are of the same order of magnitude, then uncertainties in both inventories contribute to the overall uncertainty.

Reflected in Table S–7 is the relative uncertainty of the two inventories. For example, technetium-99 has an alternatives inventory of 29,700 curies in tanks (DOE 2003), 312 curies in past leaks (CH2M HILL 2002; Jones et al. 2000, 2001; Myers 2005; Wood and Jones 2003; Wood et al. 2003), and 142 curies disposed of in cribs and trenches (ditches) (Corbin et al. 2005), for a total of 30,154 curies. The spreadsheets of the October 2006, Revision 4, Cumulative Impact Analysis reflect a cumulative inventory of 762 curies for technetium-99 (SAIC 2006). Thus, we expect missing inventory because data incompleteness in the cumulative inventory of about 17 percent would be dominated by uncertainty in the alternatives inventory. It can be concluded that the effects of potentially missing inventory in the cumulative impacts inventory would not be an important factor in evaluating the sum of the alternatives and cumulative inventories.

Table S–7. Uncertainty of Alternatives and Cumulative Radionuclide and Chemical Inventories at the Hanford Site

Constituent	Alternatives Inventory[a]	Known Cumulative Inventory[b]	Uncertainties Dominating Overall Uncertainty
Technetium-99	30,200	762	Alternatives inventory
Iodine-129	49	25	Alternatives inventory
Uranium-238	964	3,220	Cumulative inventory
Strontium-90	50,900,000	2,100,000	Alternatives inventory
Cesium-137	47,100,000	2,430,000	Alternatives inventory
Hydrogen-3 (tritium)	19,700	1,500,000	Cumulative inventory
Carbon-14	3,180	43,500	Cumulative inventory

[a] CH2M HILL 2002; Corbin et al. 2005; DOE 2003; Field 2003; Jones et al. 2000, 2001; Myers 2005; Wood and Jones 2003; Wood et al. 2003.

[b] SAIC 2006.

Similarly, these data suggest that missing inventory in the cumulative impacts analysis because of data incompleteness for strontium-90 and cesium-137 is not a driver of the uncertainty in the total inventory for the same reasons given above for technetium-99.

For iodine-129, missing cumulative impacts analysis inventory is probably a minor issue. The Inventory Data Package suggested that the uncertainty in the iodine-129 inventory (49 curies) for the alternatives impacts analysis is ± 21 curies. This suggests that the inventory for the alternatives impacts analysis will be between 28 curies and 70 curies. The October 2, 2006, spreadsheets show an inventory for the cumulative impacts analysis of 25 curies for iodine-129, and our inference is that 17 percent of that inventory (about 4 curies) may be missing because of data incompleteness. The expected value for the total inventory is about 74 curies, with an uncertainty of ± 21 curies in the portion of the inventory reflected in the alternatives impacts analysis, and an estimated 4 curies missing because of data incompleteness. The uncertainty of the iodine-129 inventory in the alternatives impacts analysis is thus five times greater than that in the cumulative impacts analysis.

For uranium-238, hydrogen-3 (tritium), and carbon-14, missing inventory plays a potentially important role in the uncertainty of the total inventory.

Presented as Figures S–1, S–2, and S–3 are the proportions of known and unknown inventory for the various areas, sites, and facilities at Hanford. The figures suggest rather even proportions of unknown inventory for the subareas of the 100 Areas (see Figure S–1). Those proportions are more variable, however, within the 200 Areas (see Figure S–2); unknown inventory is proportionally high for the B, PUREX, S, T, and U Areas relative to that for B Pond, Gable North, 2 Area, and the Nonradioactive Dangerous Waste Landfill (NRDWL). Substantial disparity in the proportion of unknown inventory is evident for the other Hanford areas, sites, and facilities (see Figure S–3).

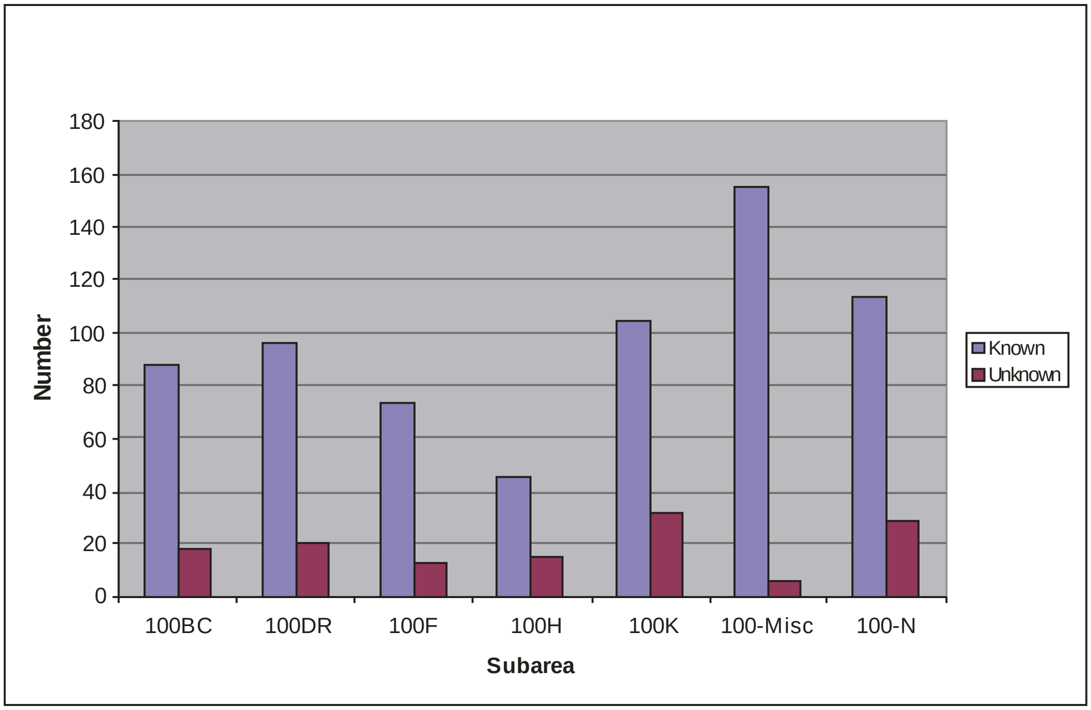


Figure S–1. Known and Unknown Inventory in 100 Area Sites at Hanford

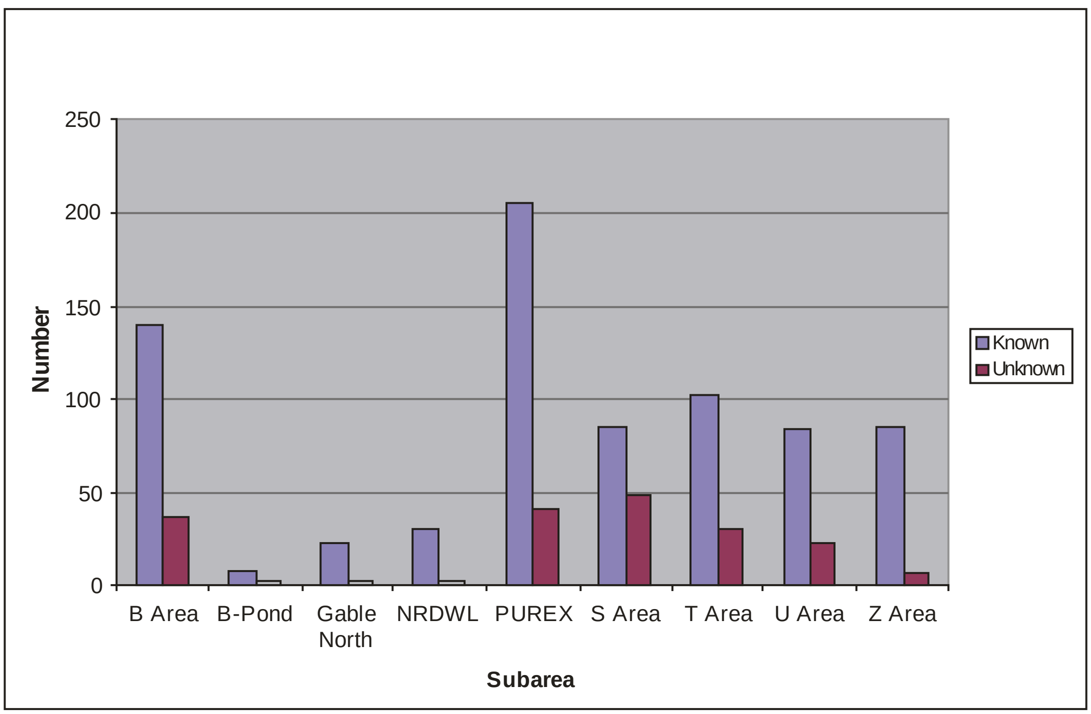


Figure S–2. Known and Unknown Inventory in 200 Area Sites at Hanford

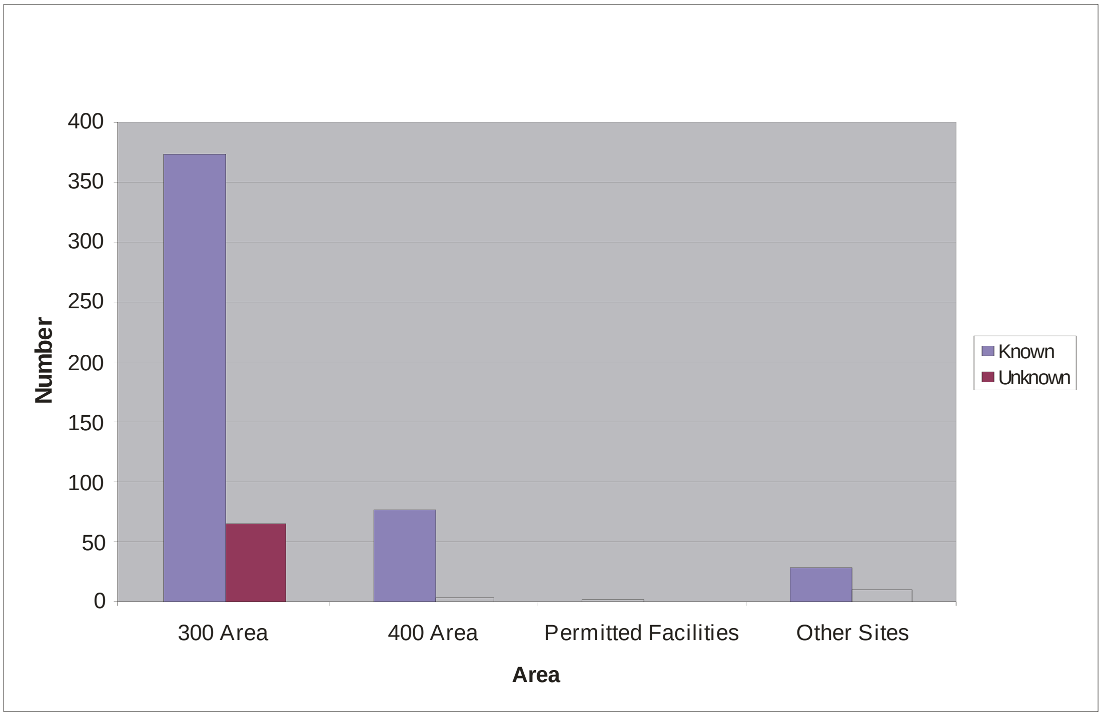


Figure S–3. Known and Unknown Inventory in 300 Area, 400 Area, Permitted Facilities, and Other Sites at Hanford

S.3.6 Determination of Final Inventory Used for Cumulative Analysis

The initial list of radionuclides included those with half-lives greater than 10 years, and the initial list of chemicals included those with a health risk from ingestion—that is, they have maximum contaminant levels or are listed in the Integrated Risk Information System as having health-based ingestion standards. Not all the radionuclides and chemical constituents on the initial list are important in exposure scenarios used to assess cumulative impacts in this *TC & WM EIS*. Therefore, to focus attention on constituents that control impacts, an additional screening analysis was performed. The primary focus of that analysis was to consider groundwater release scenarios for cumulative impact analysis sources and to ensure consistency with the screening done for the alternative analysis, allowing for cumulative impacts to be added to the alternative impacts. For radionuclides, only groundwater consumption was considered, release was assumed to be partition-limited, and decay during transport was considered. For purposes of the analysis, estimation of relative impacts was based on the distribution of radionuclides in the cumulative impacts inventory. Radionuclides contributing less than 1 percent of impacts under well scenarios were eliminated from the detailed analysis. To screen for hazardous chemicals, reported chemical inventories for the cumulative impact sites were compared with health-based limits. Chemicals present in the inventories at levels above health-based limits were selected for detailed analysis. As indicated in Table S–8, the screening resulted in reduction of the original set of radionuclides and chemical constituents to a final set of 14 radionuclides and 26 chemical constituents, which include those constituents also identified for the alternative impact analysis. The final list of cumulative impact waste inventories, waste sites, and end states was provided to DOE-RL and ORP responsible managers for review and concurrence to ensure accuracy and completeness.

Table S–8. Radionuclide and Chemical Constituents

Radionuclides	Chemicals	
Hydrogen-3 (tritium)	1,2-Dichloroethane	Lead
Carbon-14	1,4-Dioxane	Manganese
Potassium-40	1-Butanol	Mercury
Strontium-90	2,4,6-Trichlorophenol	Molybdenum
Zirconium-93	Acetonitrile	Nickel (soluble salts)
Technetium-99	Arsenic, inorganic	Nitrate
Iodine-129	Benzene	Polychlorinated biphenyls
Cesium-137	Boron and compounds	Silver
Gadolinium-152	Cadmium	Strontium (stable)
Thorium-232	Carbon tetrachloride	Total uranium
Uranium isotopes (includes uranium-233, -234, -235, -238)	Chromium[a]	Trichloroethylene
Neptunium-237	Dichloromethane	Vinyl chloride
Plutonium isotopes (includes plutonium-239, -240)	Fluoride	
Americium-241	Hydrazine/hydrazine sulfate	

[a] For purposes of long-term impacts, it was assumed that this is hexavalent chromium.

Locations of the sites of the WIDS screening and TBR are depicted in the maps provided as Figures S–4 through S–30. The final results of the WIDS screening, the TBR, the marriage of these two approaches, and the additional screening process are provided in Tables S–9 through S–34. The radionuclide inventories for the sites listed in these tables are provided in Tables S–35 through S–60 and the chemical inventories, in Tables S–61 through S–86.

As discussed in Chapter 1, DOE is preparing the *Environmental Impact Statement for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste (GTCC EIS)*, DOE/EIS-0375 (72 FR 40135), addressing the disposal of low-level radioactive waste (LLW) generated by activities licensed by the U.S. Nuclear Regulatory Commission or an Agreement State and containing radionuclides in concentrations exceeding 10 CFR 61 Class C limits. The *GTCC EIS* would also consider DOE LLW and transuranic waste having characteristics similar to greater-than-Class C (GTCC) LLW and possibly no identified path to disposal.

Hanford is being considered as a candidate location for a new GTCC waste disposal facility in the *GTCC EIS*. Such a facility is not expected to be operational until after 2013. In addition, DOE estimates there is about 11,000 cubic meters (388,000 cubic feet) of GTCC LLW and similar DOE waste (Joyce 2009) already in storage or projected to be generated from facilities in operation or that could result from proposals being analyzed in other National Environmental Policy Act (NEPA) reviews, including the *Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center*, DOE/EIS-0226-D (Revised) (DOE and NYSERDA 2008), and the *Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems*, DOE/EIS-0373 (69 FR 67139).

If Hanford were selected to host a GTCC disposal facility pursuant to the *GTCC EIS*, DOE would conduct an appropriate project-specific NEPA review, including a cumulative impacts analysis. These offsite inventories were not included in the groundwater analysis for this *TC & WM EIS* because the *Draft GTCC EIS* is still under development.

Figure S–4. Alternative and Cumulative Sites Index Map

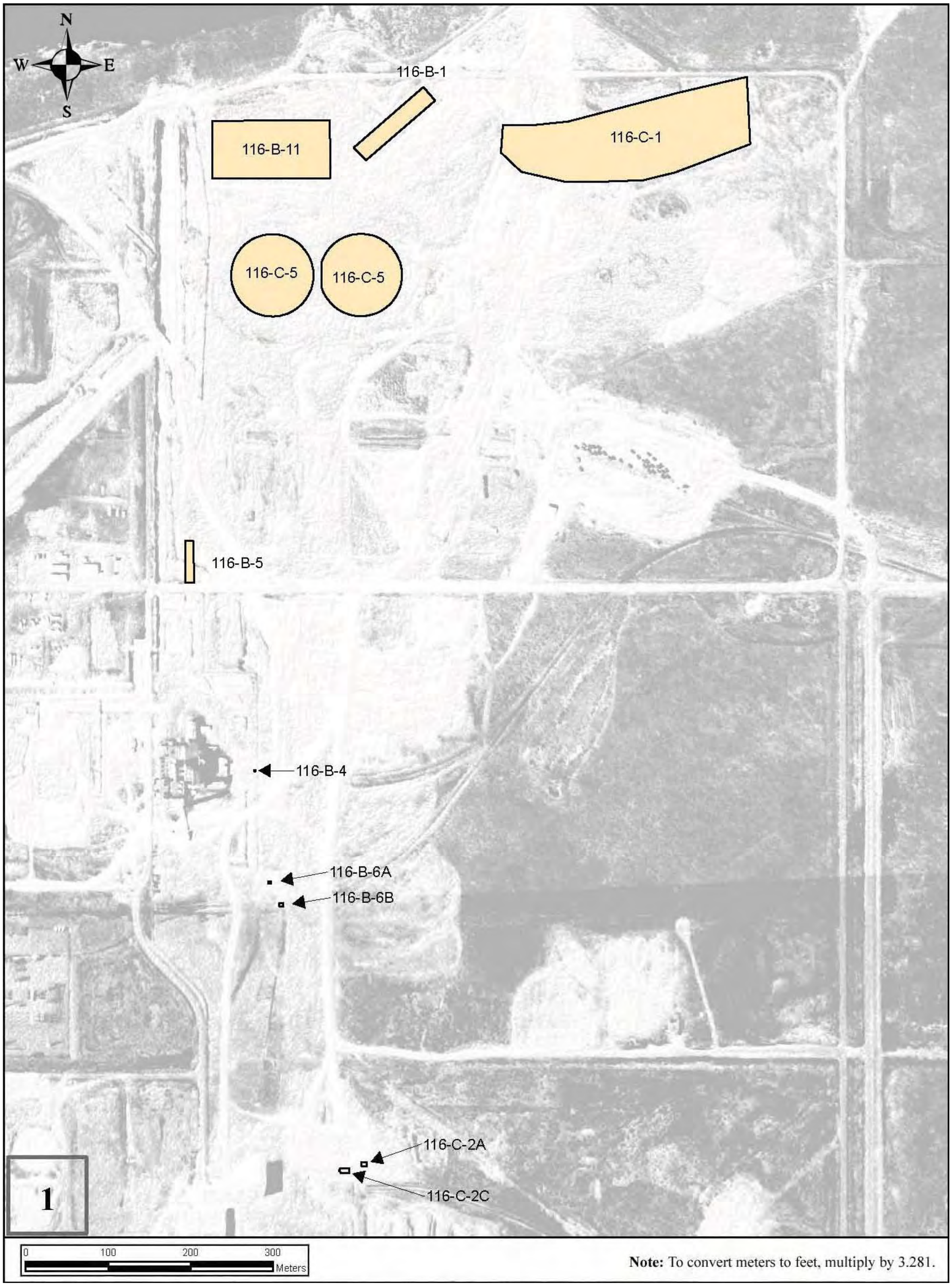


Figure S–5. Map 1: Cumulative Sites in the 100-BC Area

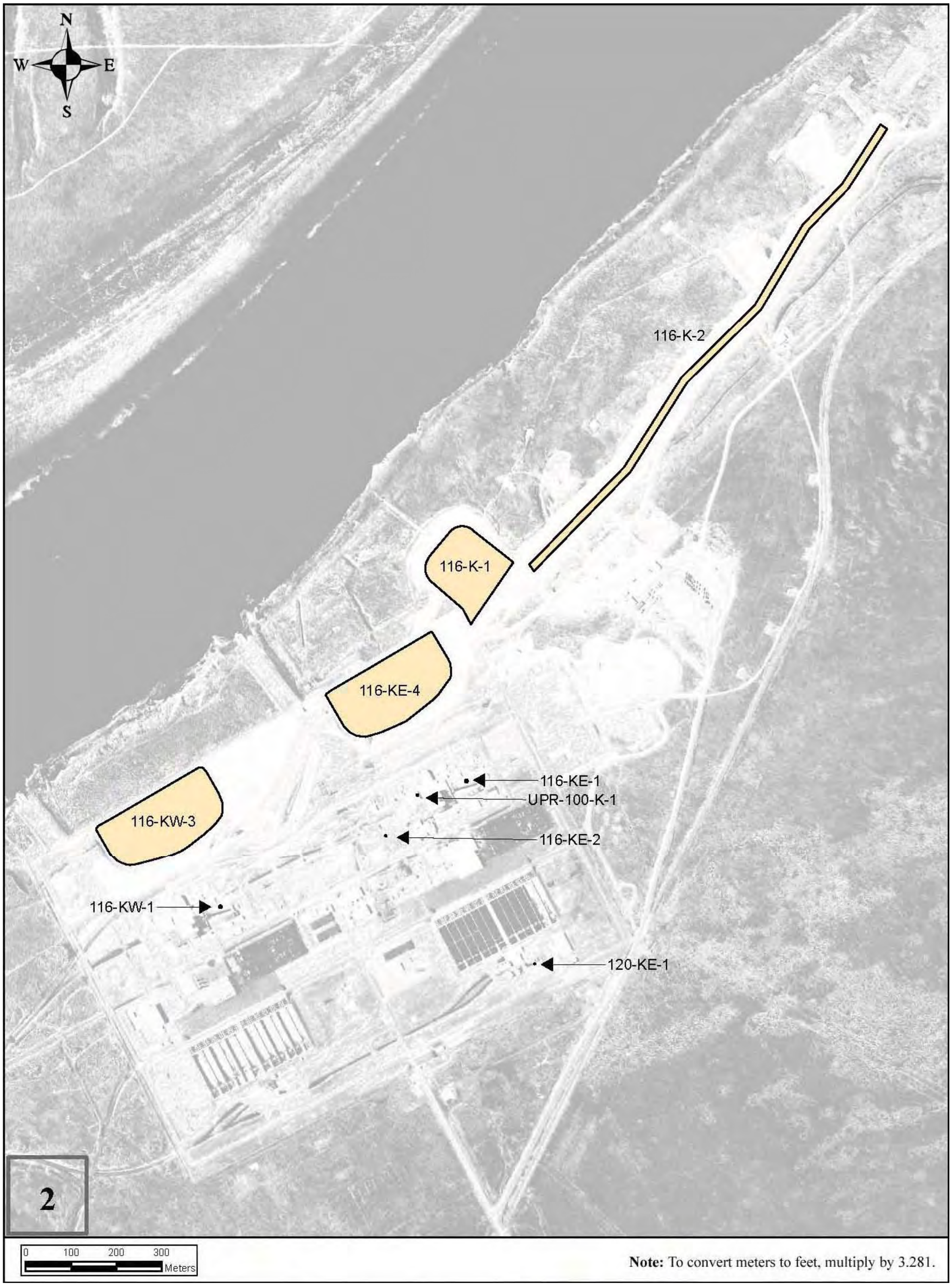


Figure S–6. Map 2: Cumulative Sites in the 100-K Area

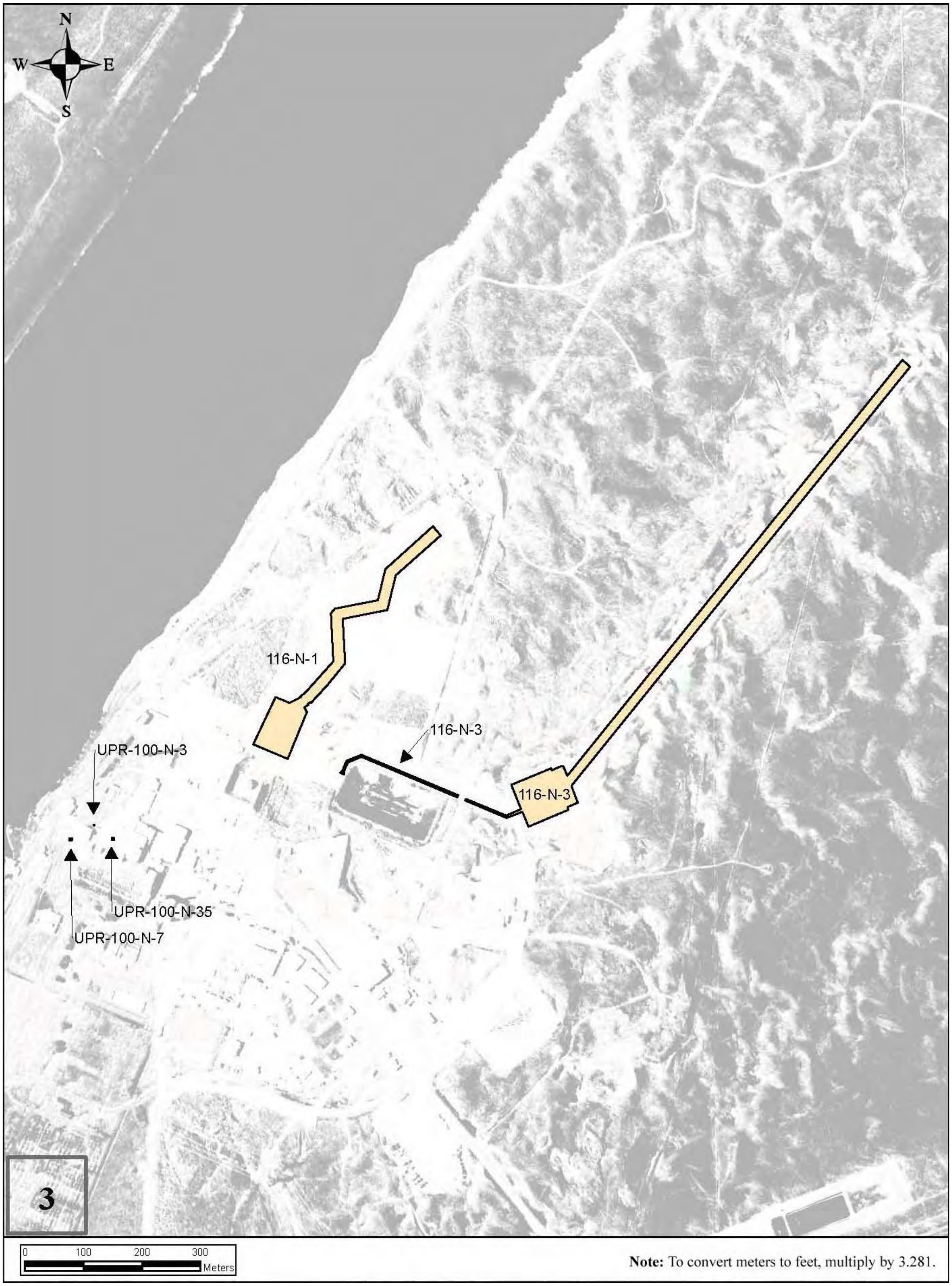


Figure S–7. Map 3: Cumulative Sites in the 100-N Area

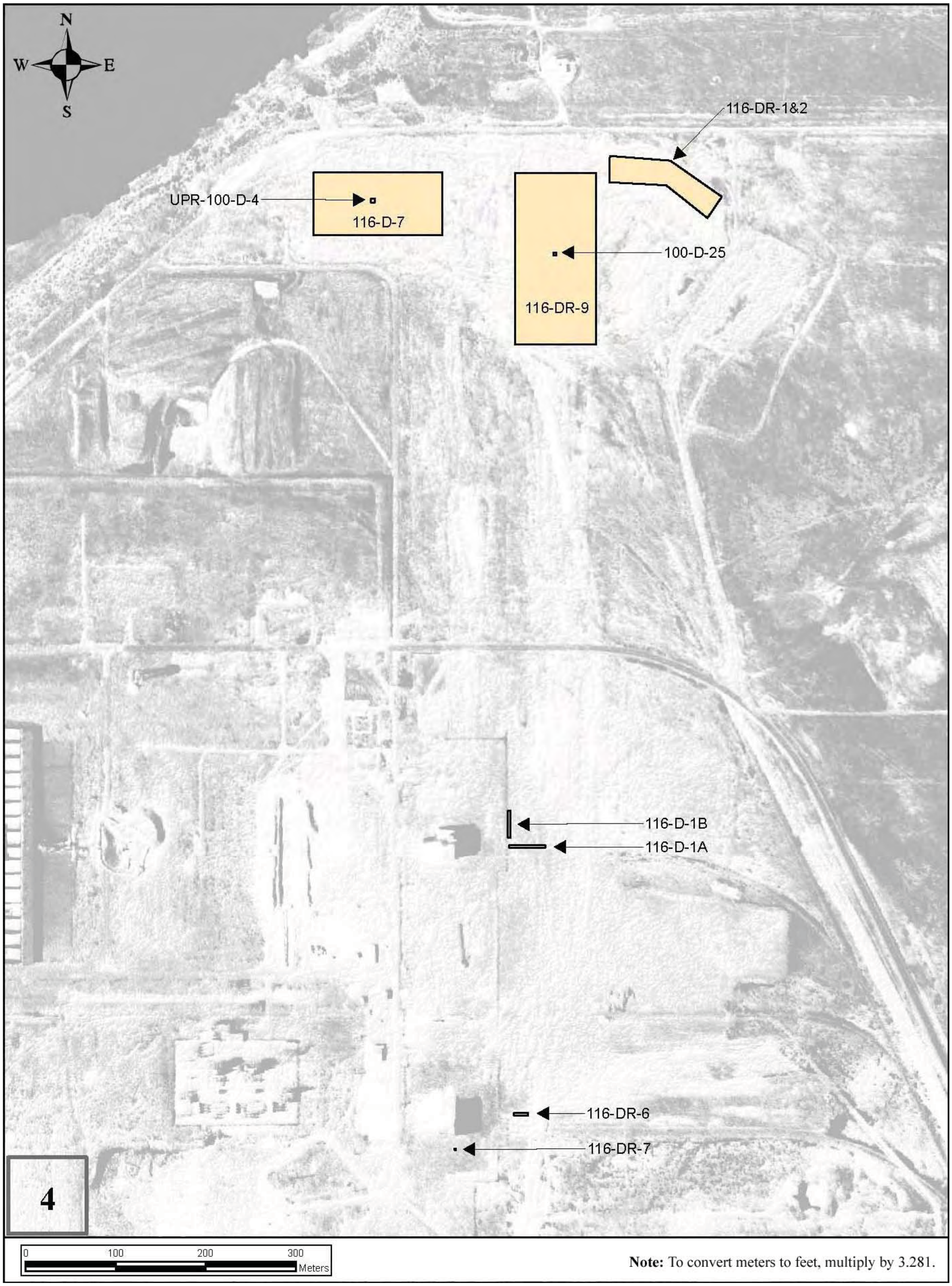


Figure S–8. Map 4: Cumulative Sites in the 100-D Area

Figure S–9. Map 5: Cumulative Sites in the 100-H Area

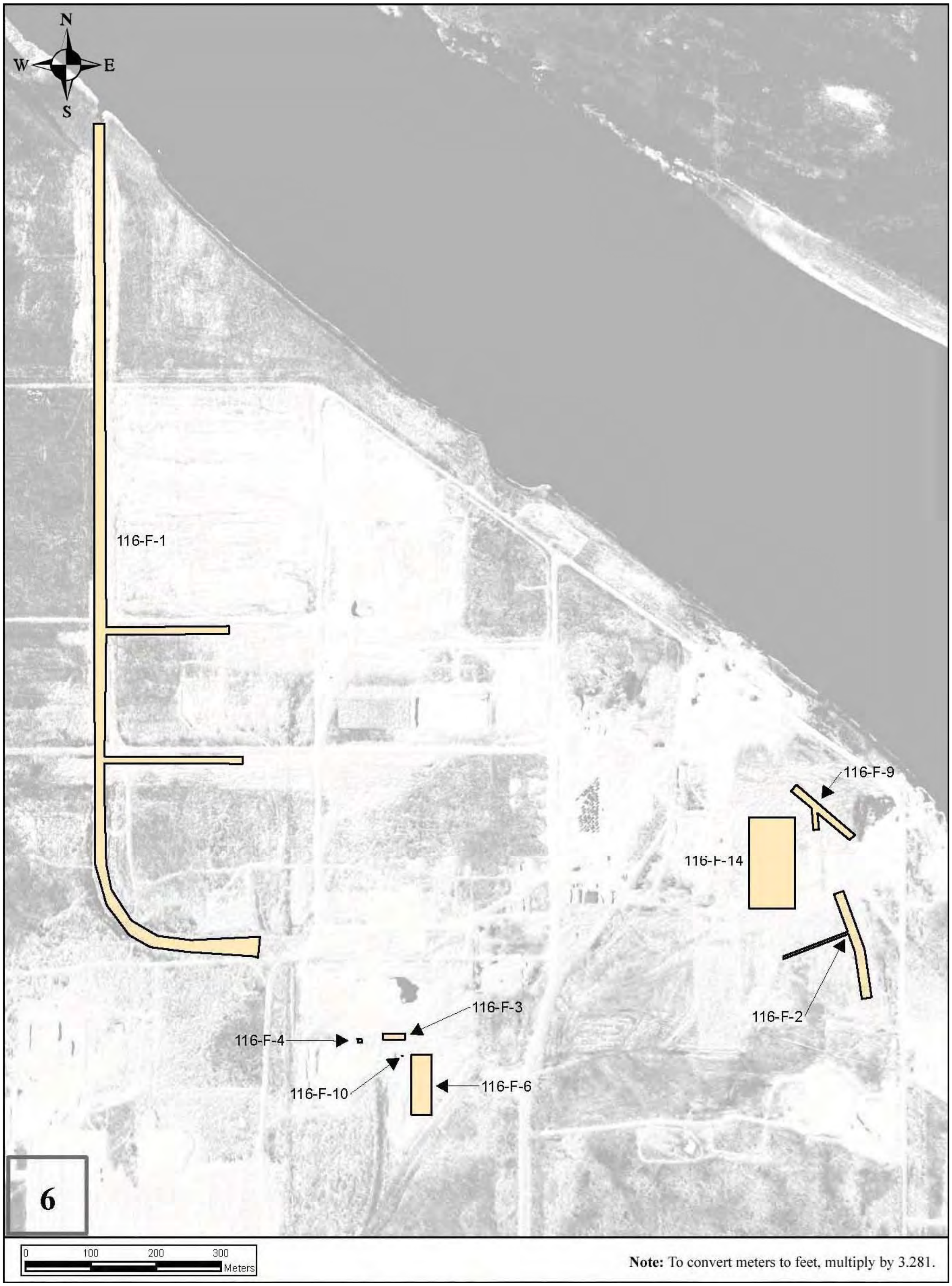


Figure S–10. Map 6: Cumulative Sites in the 100-F Area

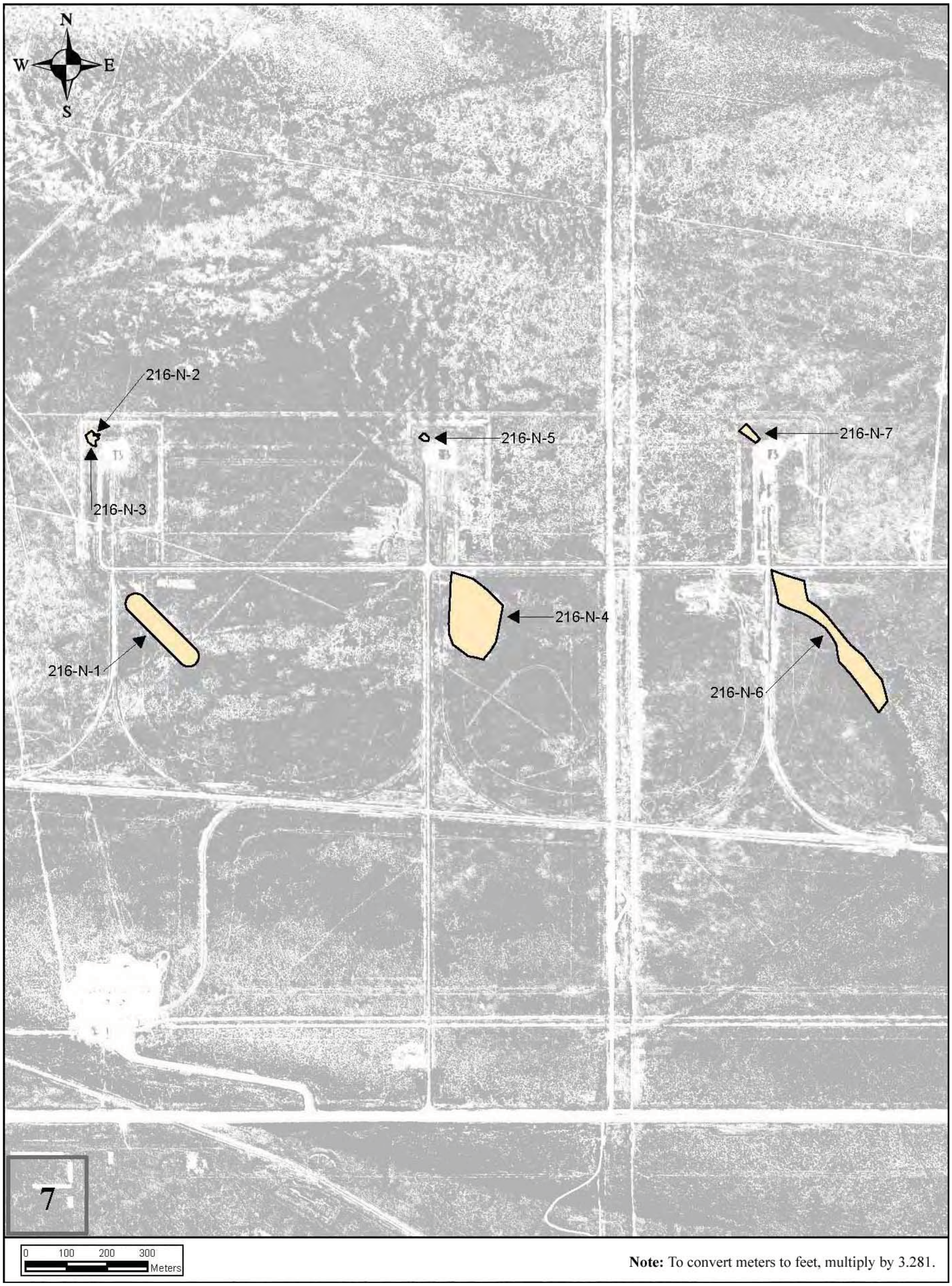


Figure S–11. Map 7: Cumulative Sites in the 216-N Area

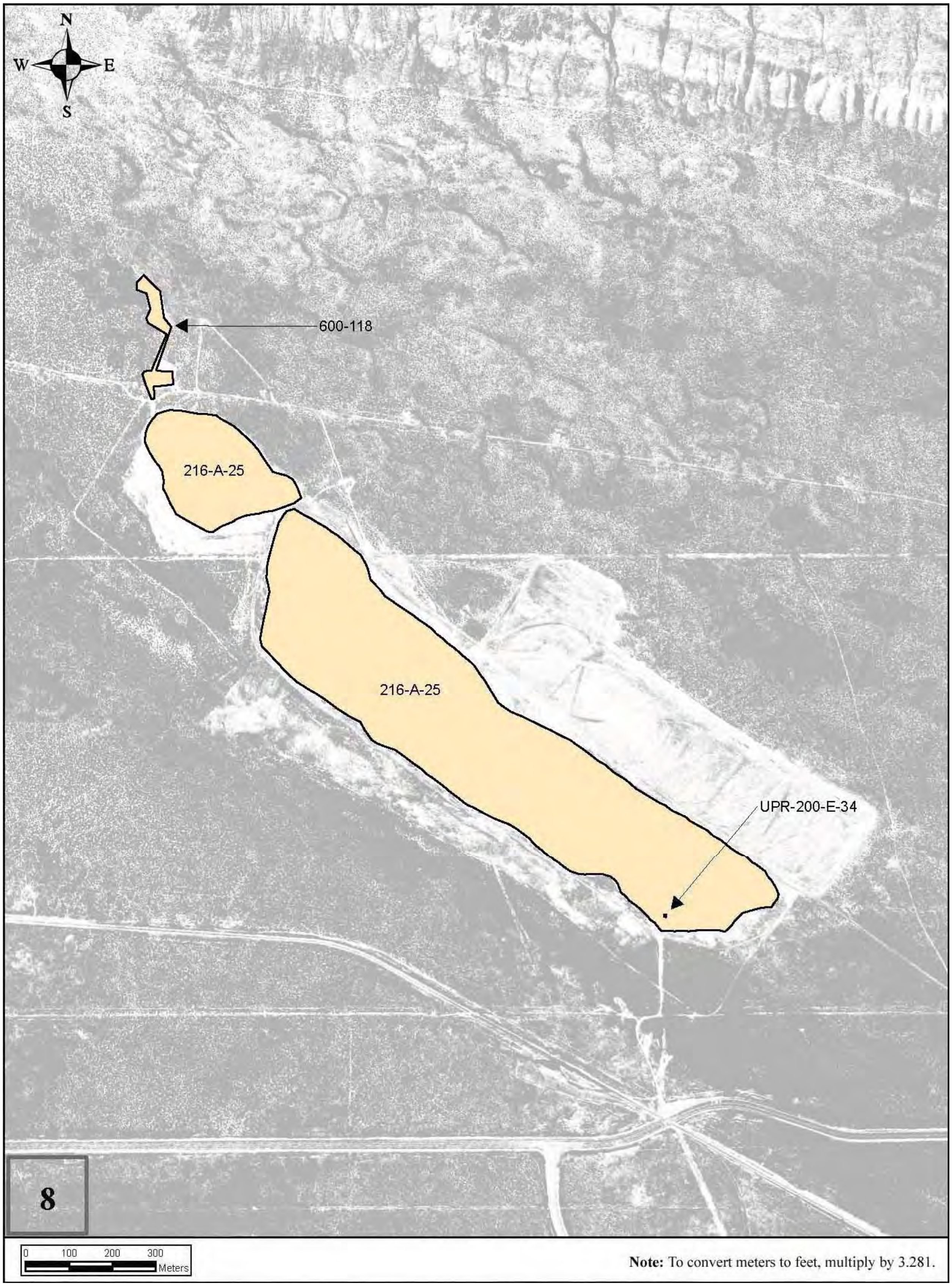


Figure S–12. Map 8: Cumulative Sites in the Gable Mountain Pond Area

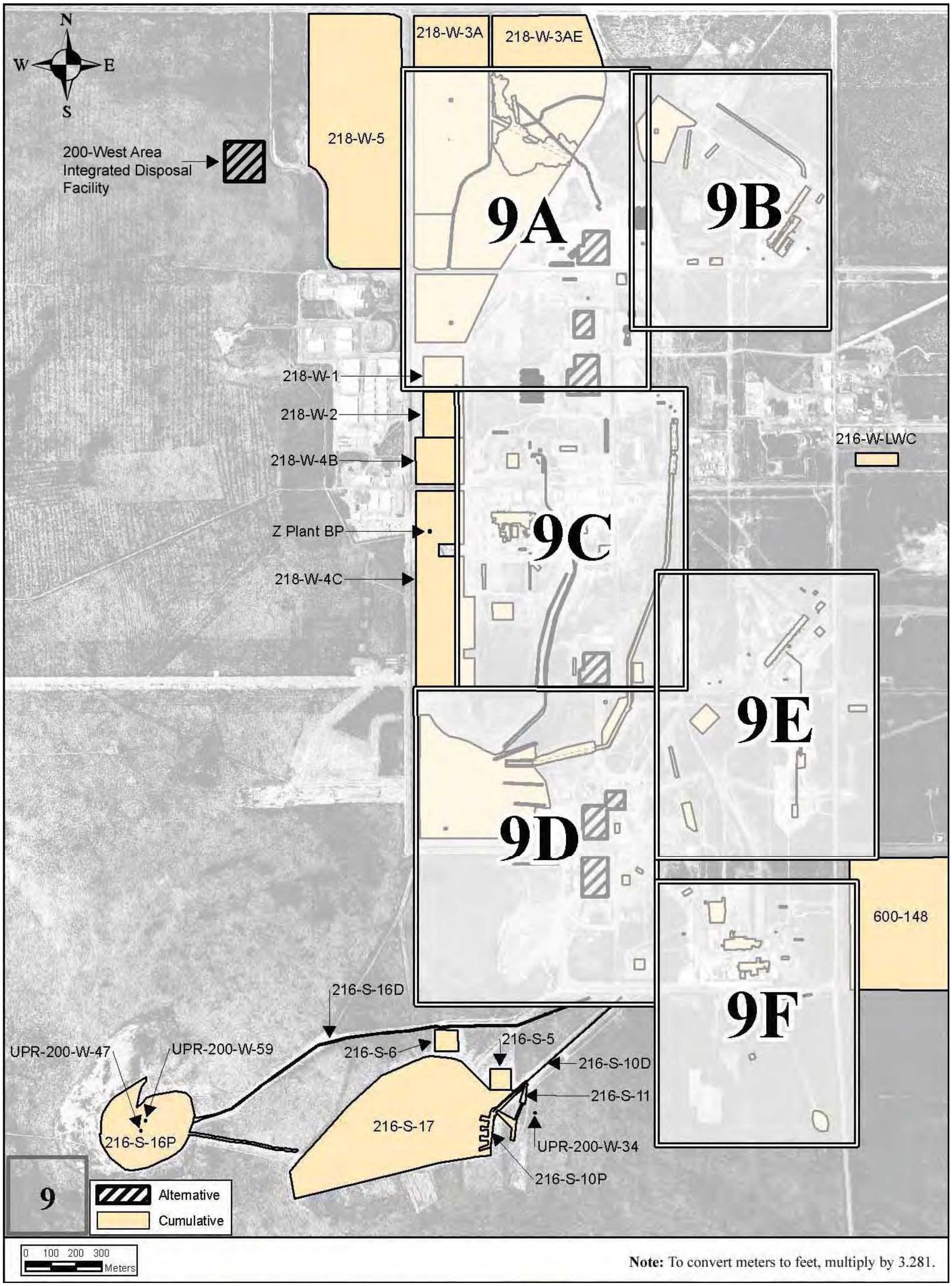


Figure S–13. Map 9: Alternative and Cumulative Sites in the 200-West Area

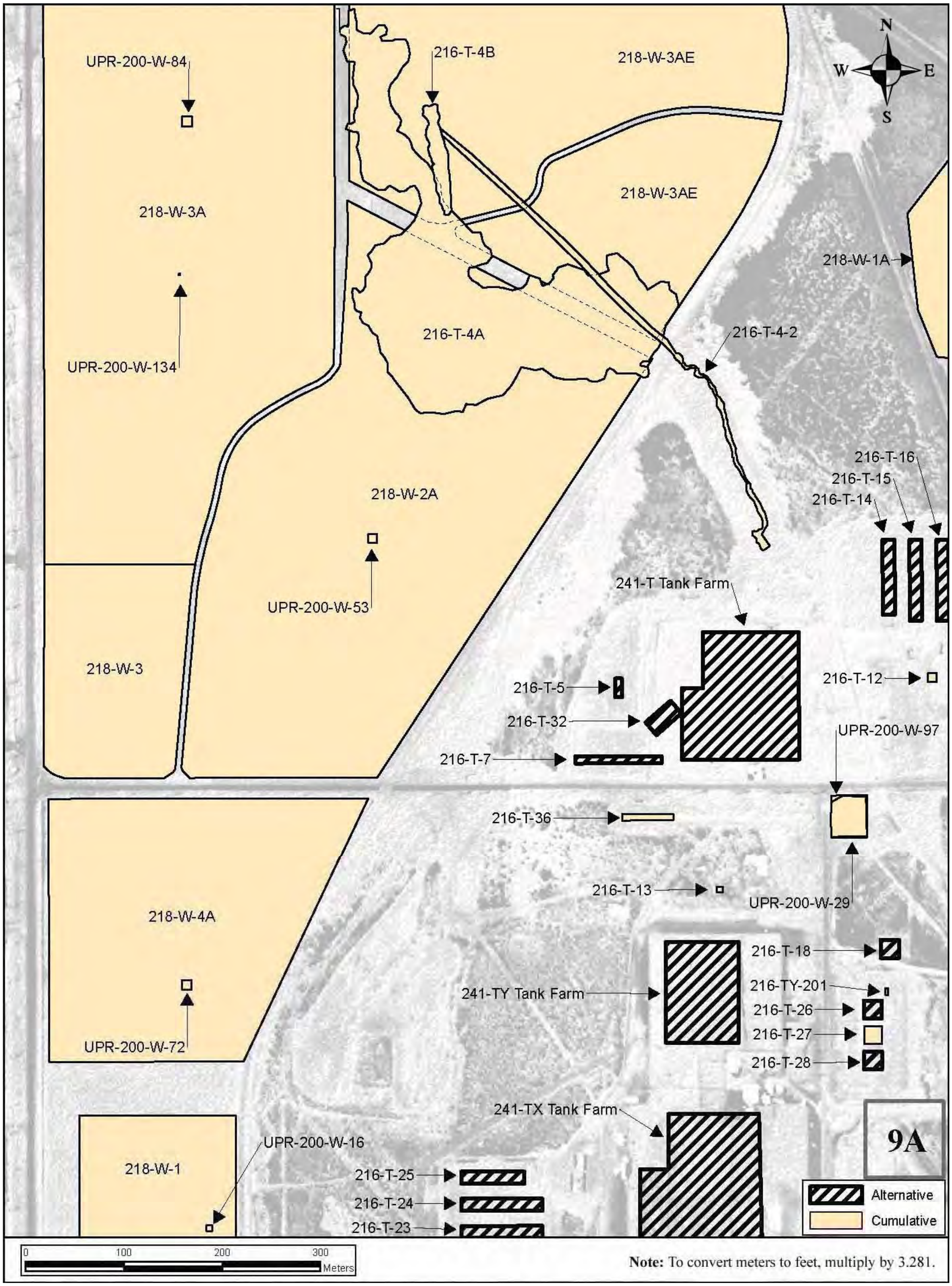


Figure S–14. Map 9A: Alternative and Cumulative Sites in the 200-West Area

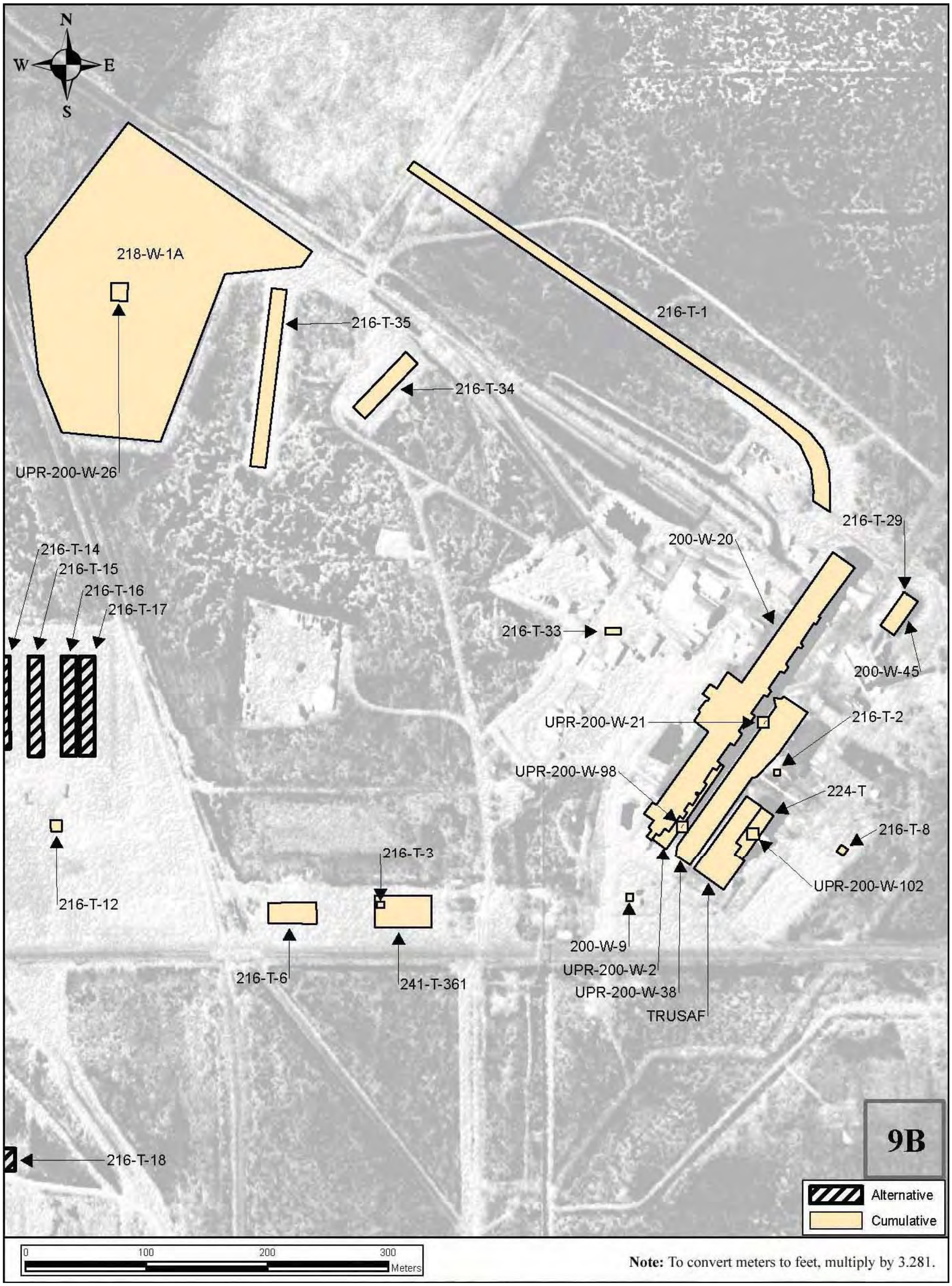


Figure S–15. Map 9B: Alternative and Cumulative Sites in the 200-West Area

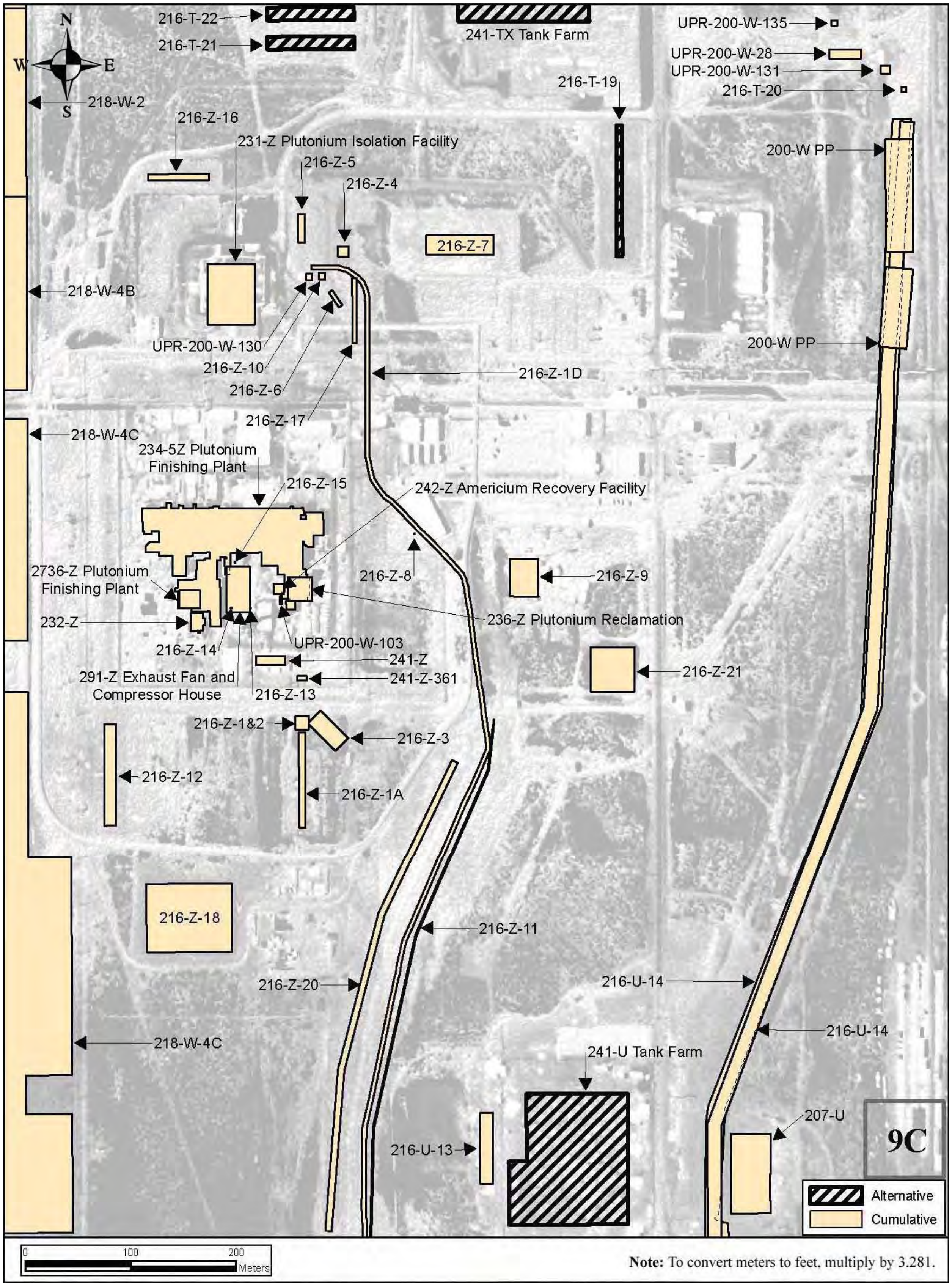


Figure S–16. Map 9C: Alternative and Cumulative Sites in the 200-West Area

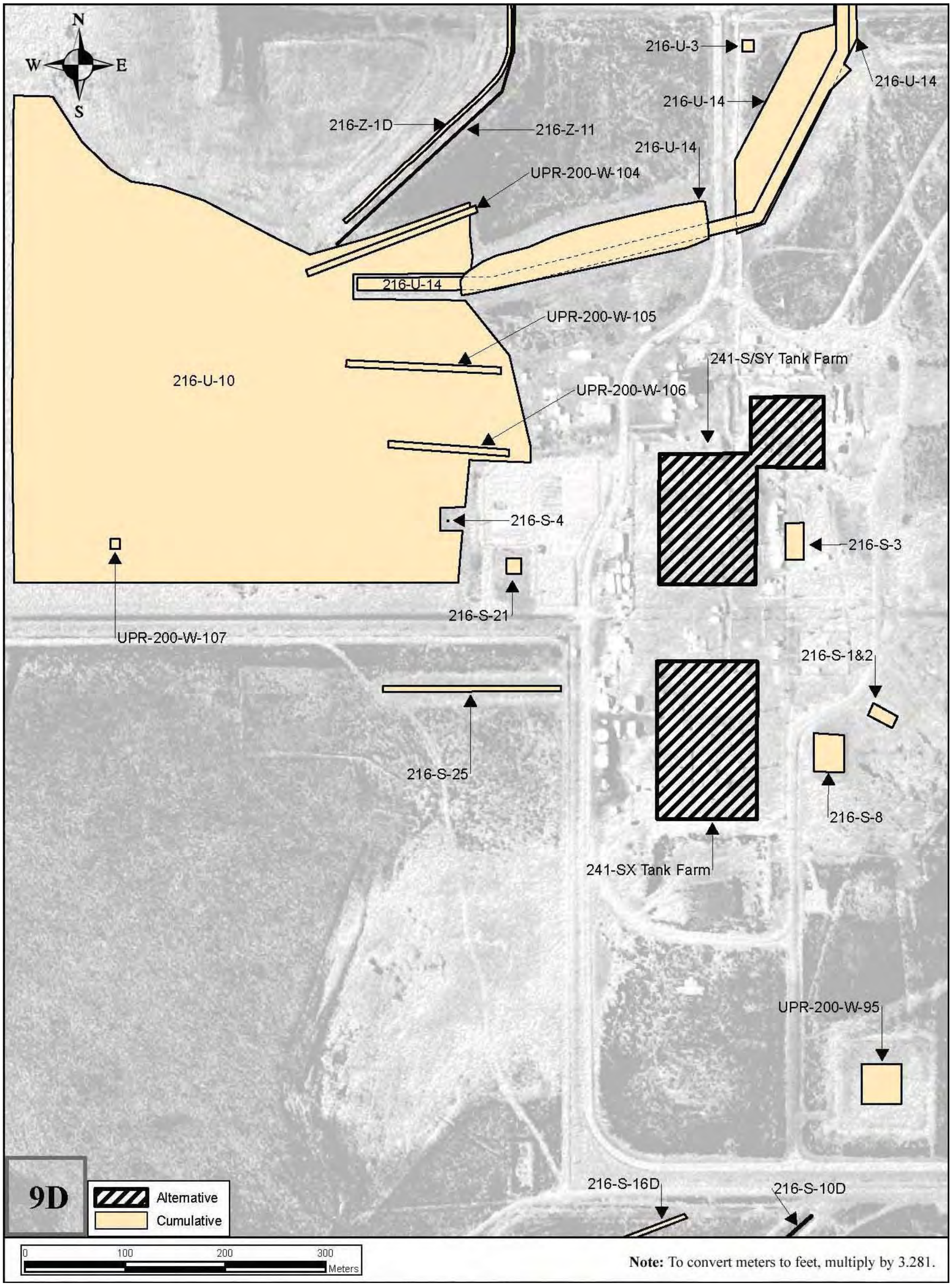


Figure S–17. Map 9D: Alternative and Cumulative Sites in the 200-West Area

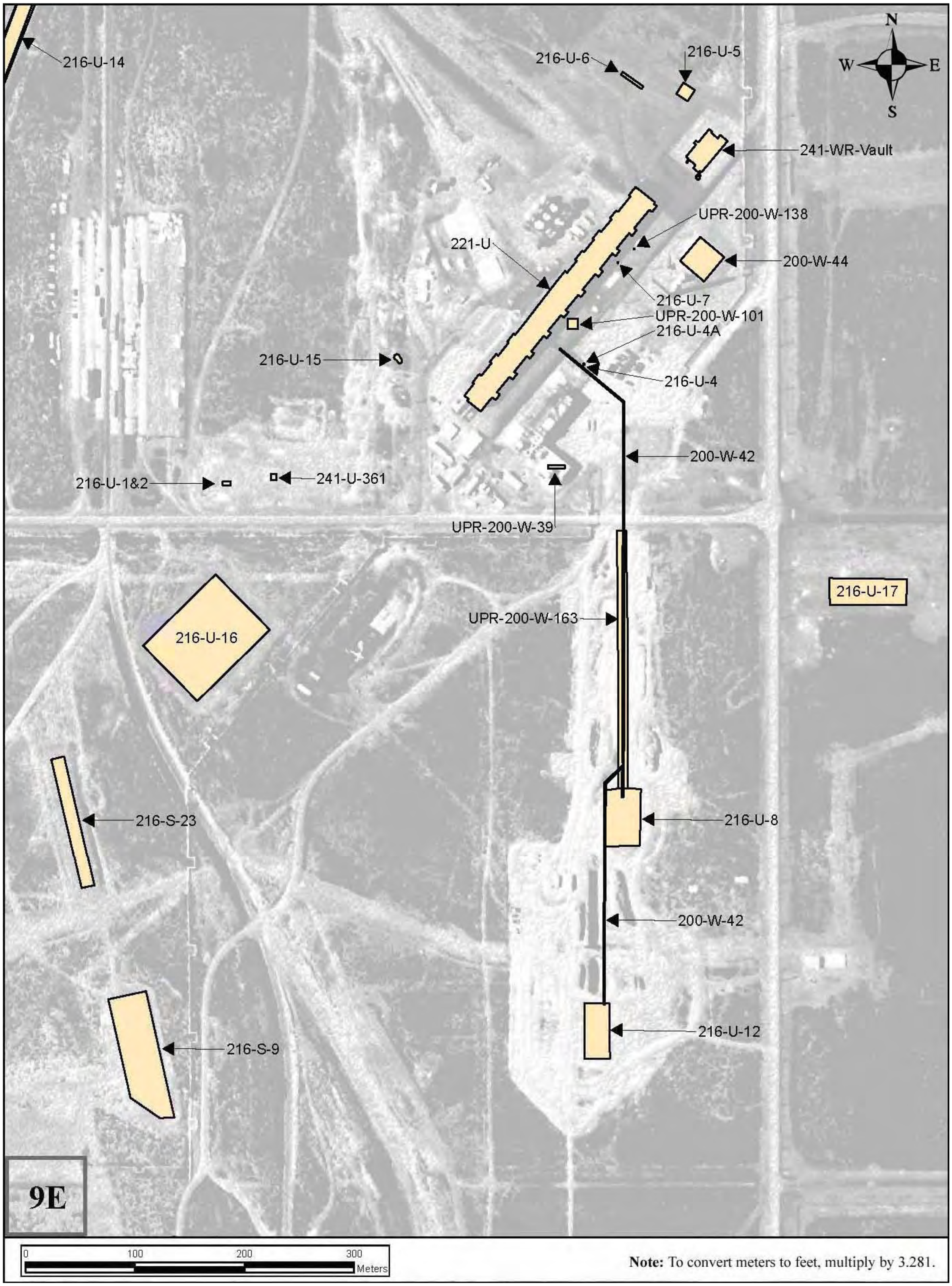


Figure S–18. Map 9E: Cumulative Sites in the 200-West Area

Figure S–19. Map 9F: Cumulative Sites in the 200-West Area

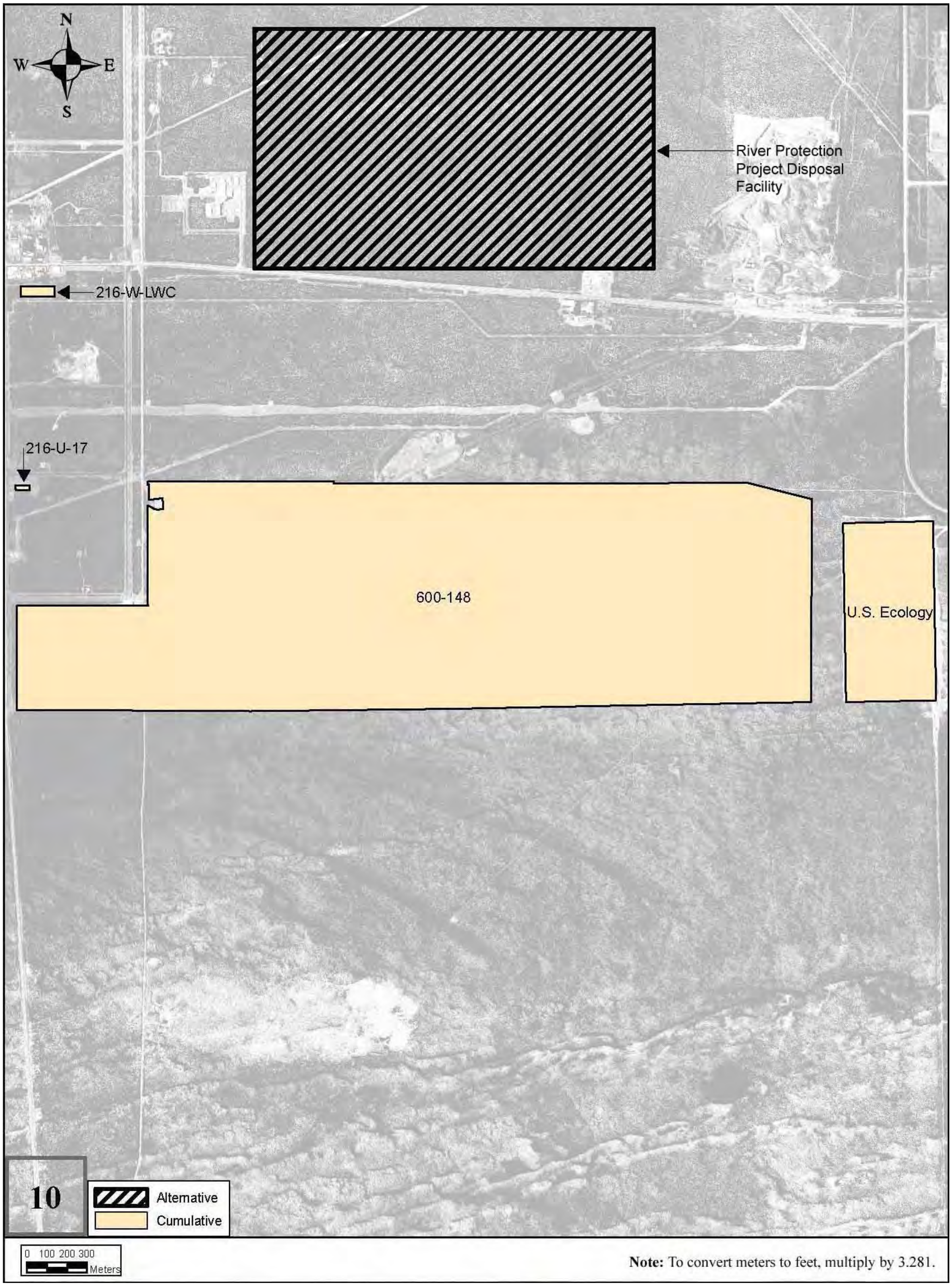


Figure S–20. Map 10: Alternative and Cumulative Sites in the Environmental Restoration Disposal Facility Area

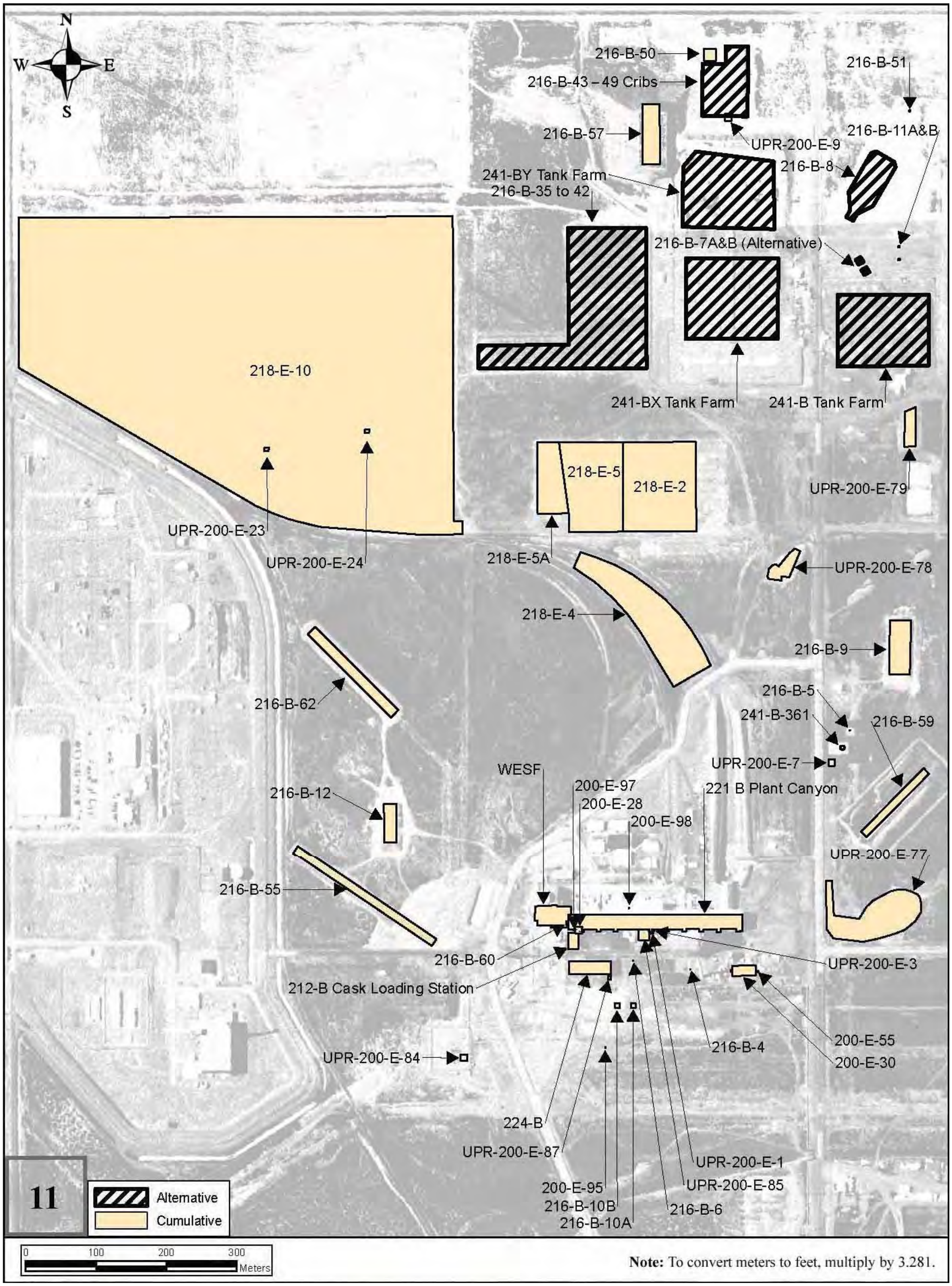


Figure S–21. Map 11: Alternative and Cumulative Sites in the 200-East Area

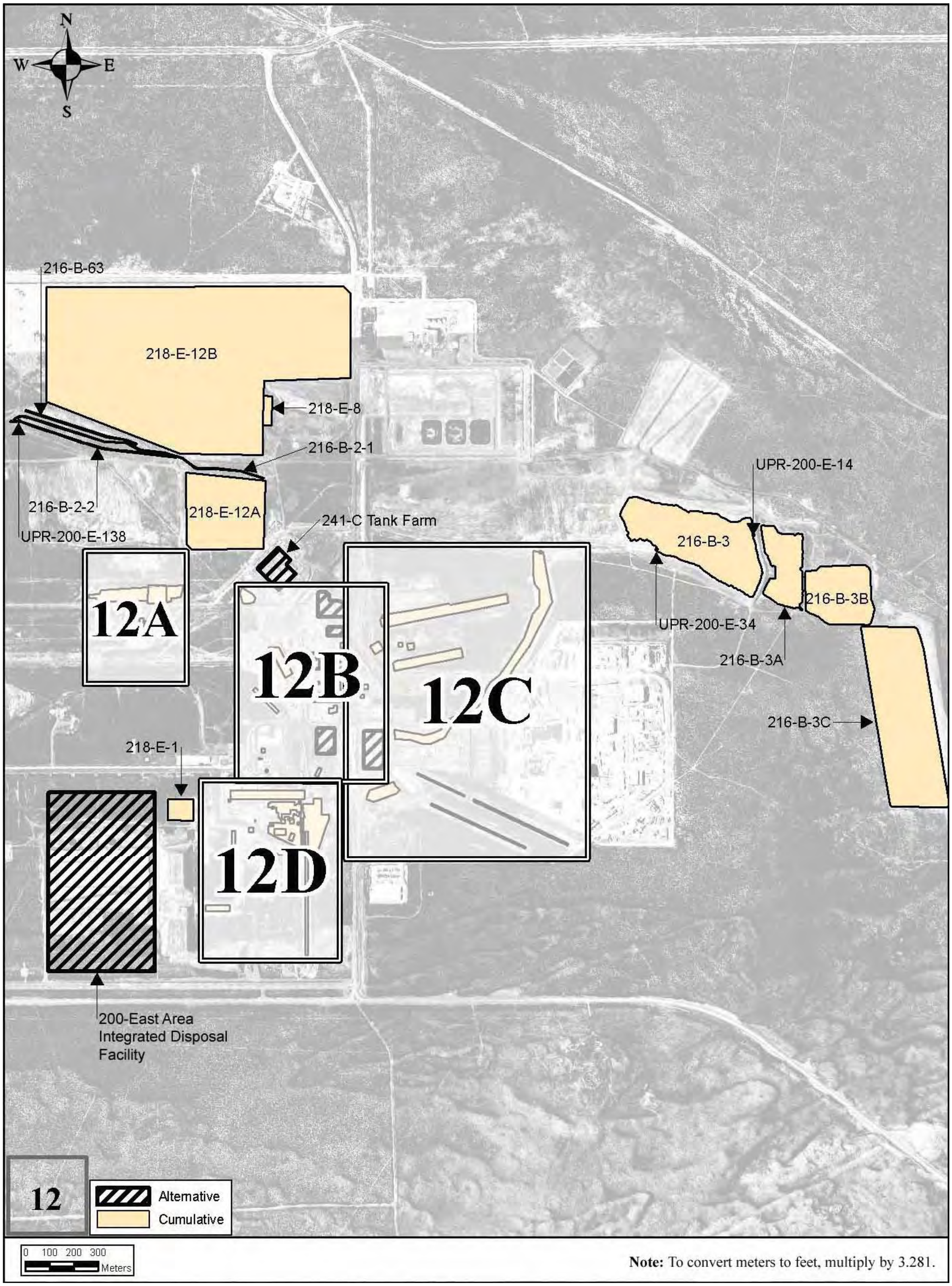


Figure S–22. Map 12: Alternative and Cumulative Sites in the 200-East Area

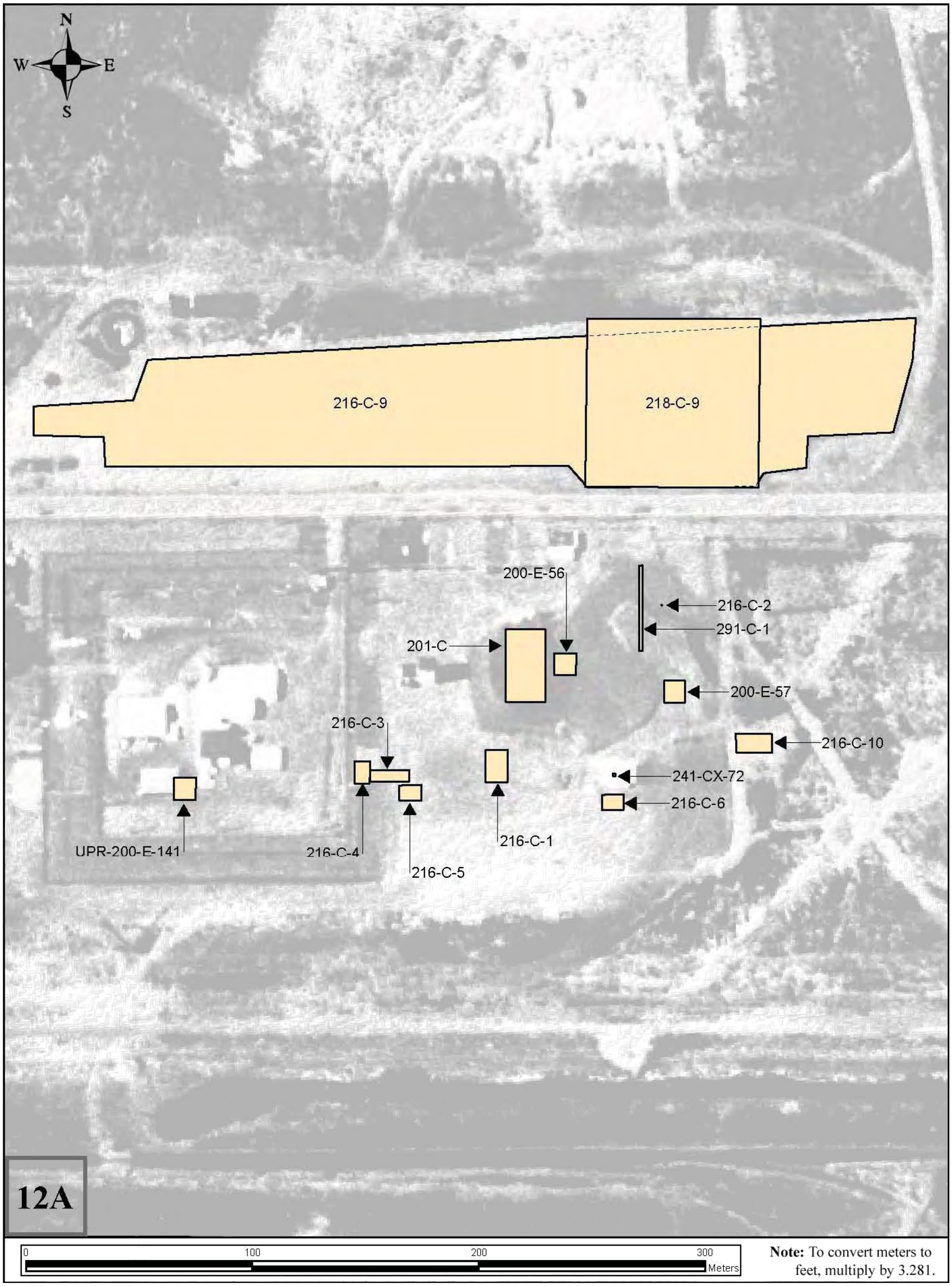
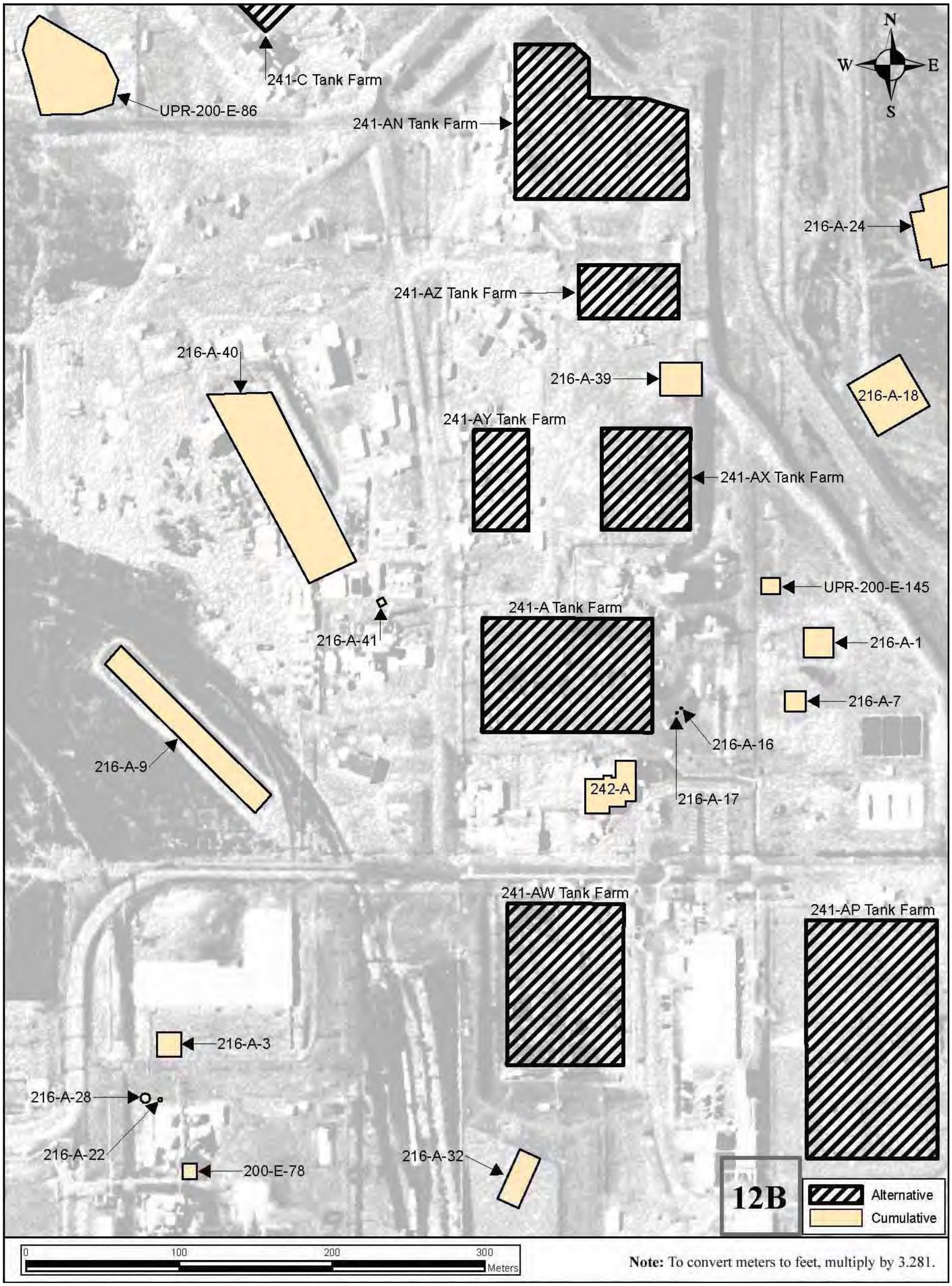


Figure S–23. Map 12A: Cumulative Sites in the 200-East Area



Note: To convert meters to feet, multiply by 3.281.

Figure S–24. Map 12B: Alternative and Cumulative Sites in the 200-East Area

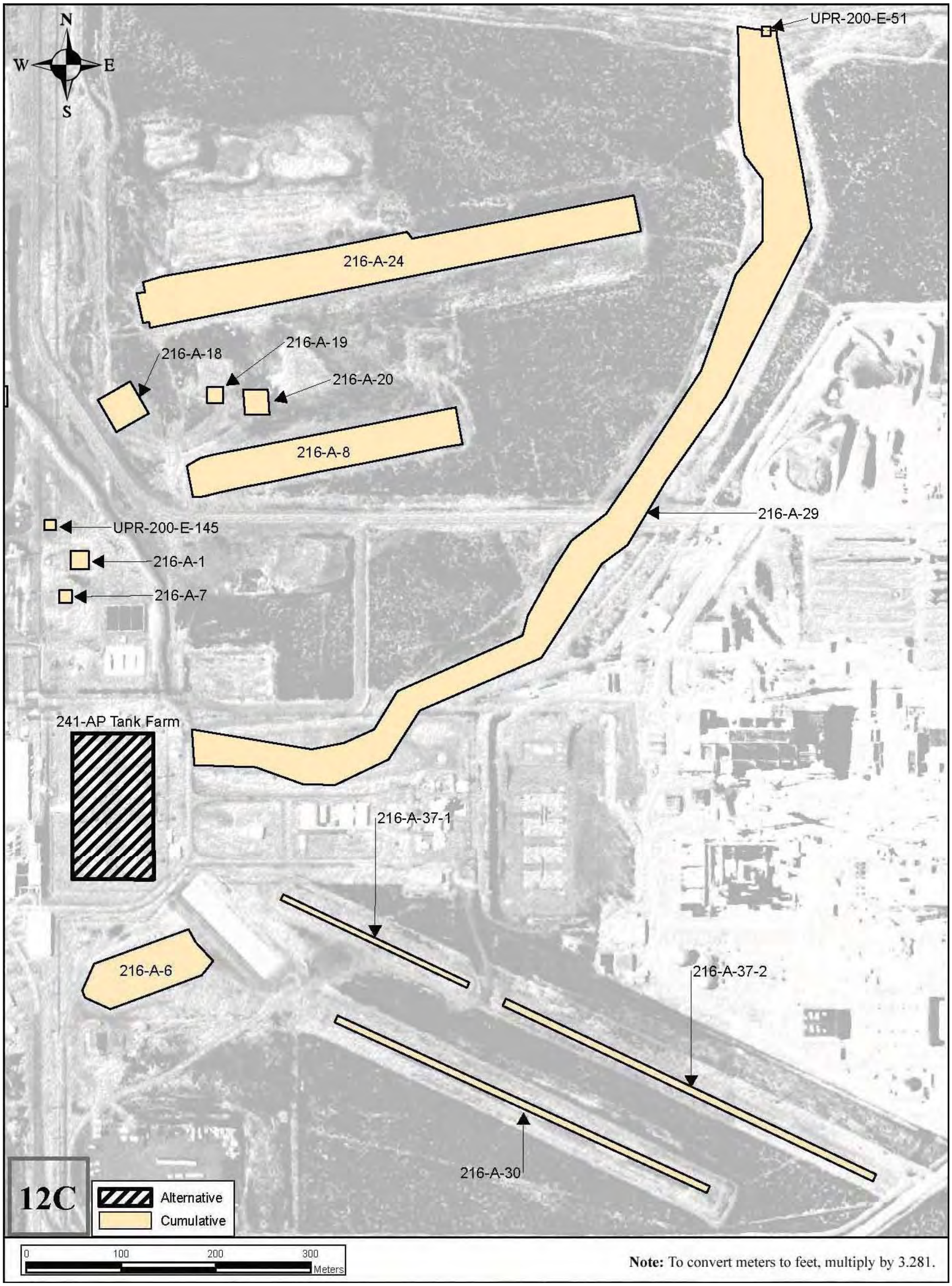


Figure S–25. Map 12C: Alternative and Cumulative Sites in the 200-East Area

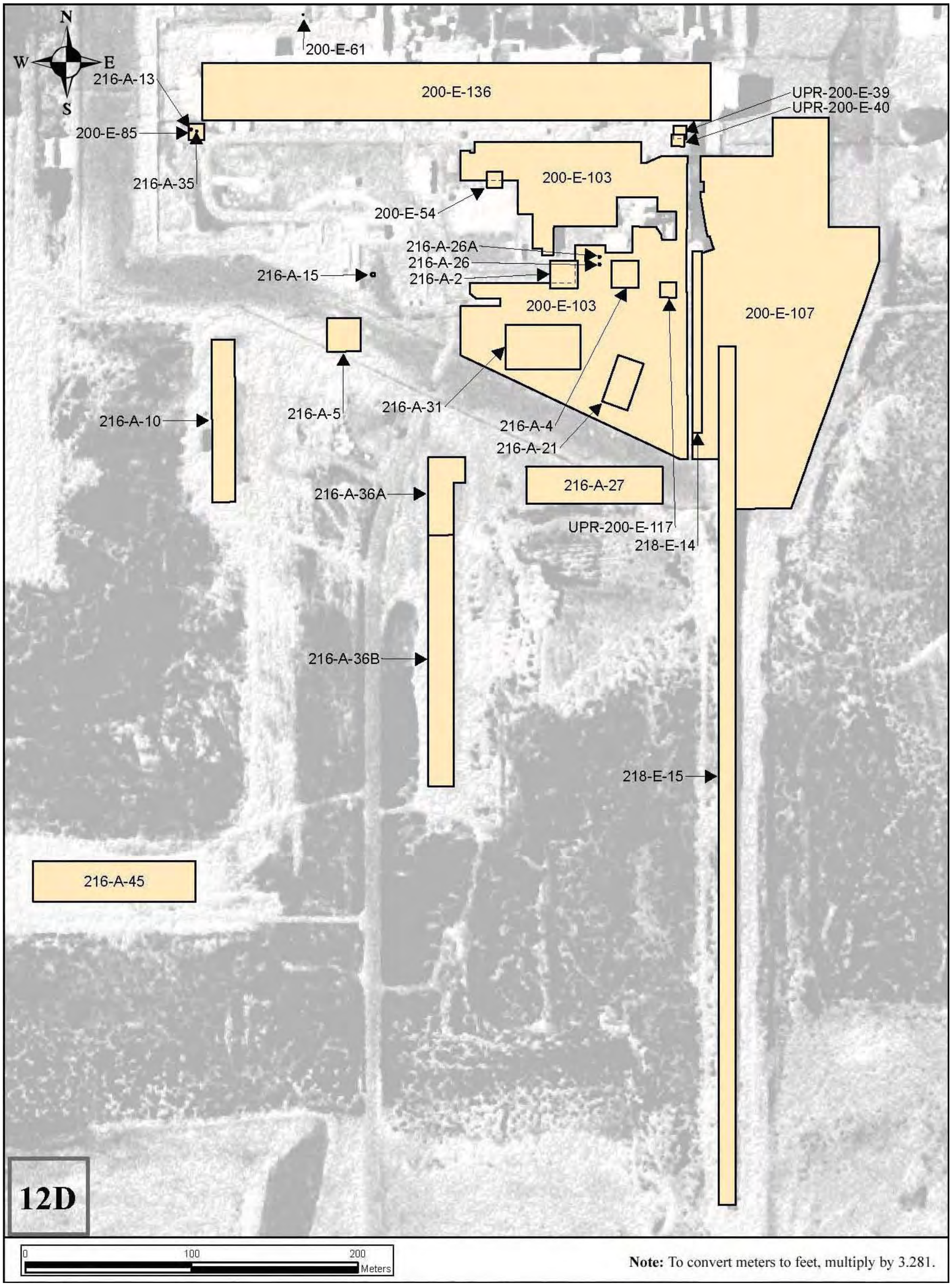
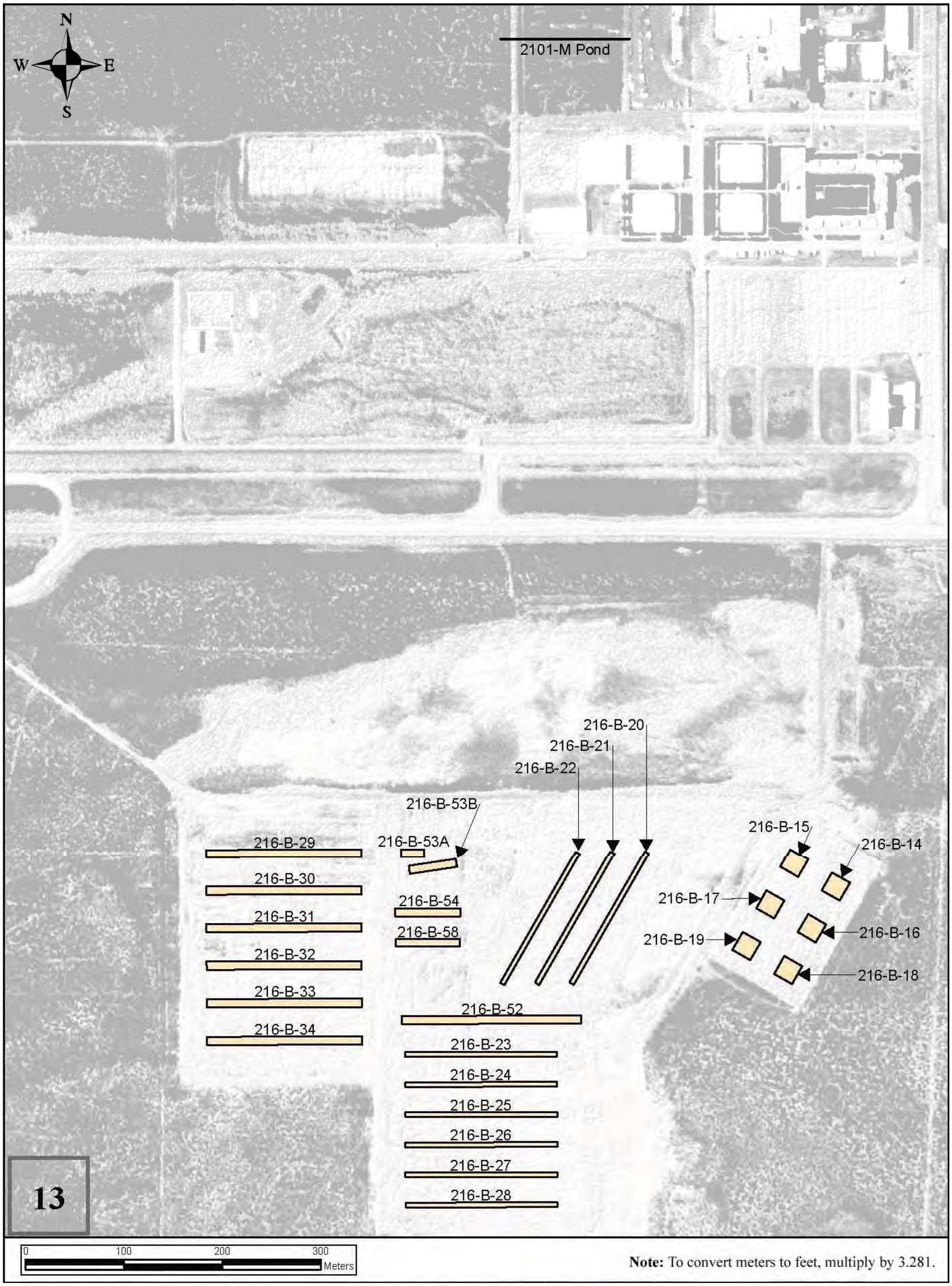


Figure S–26. Map 12D: Cumulative Sites in the 200-East Area



Note: To convert meters to feet, multiply by 3.281.

Figure S–27. Map 13: Cumulative Sites in the 200-East Area

Figure S–28. Map 14: Cumulative Sites in the 600 Area

Figure S–29. Map 15: Alternative and Cumulative Sites in Vicinity of the 300 and 400 Areas

Figure S–30. Map 16: Cumulative Sites in the 300 Area

Table S–9. Cumulative Impact Sites for Map 1

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
116-B-1	107-B Liquid Waste Disposal Trench	Trench	Liquid	6.0×10^7	–	1950	1968	Remediated and closed out in 1999
116-B-4	105-B Dummy Decontamination French Drain	French Drain	Liquid	3.0×10^5	–	1957	1968	Remediated and closed out in 2000
116-B-5	108-B Crib (116-B-5 Crib)	Crib	Liquid	1.0×10^7	–	1950	1968	Site excavated in 1995 and contaminated soil disposed of in ERDF
116-B-6A	116-B-6-1 Crib	Crib	Liquid	5.0×10^3	–	1951	1968	Excavated and remediated in 1999
116-B-6B	116-B-6-2 Crib	Crib	Liquid	1.0×10^4	–	1950	1953	Excavated and remediated in 1999
116-B-11	107-B Retention Basins	Retention Basin	Liquid	Unknown	–	1944	1968	Excavated and remediated in 1999
116-C-5	107-C Retention Basins	Retention Basin	Liquid	Unknown	–	1952	1969	Tanks excavated, remediated, and closed out in 1999
116-C-1	107-C Liquid Waste Disposal Trench	Trench	Liquid	1.0×10^8	–	1952	1968	Tanks excavated, remediated, and closed out in 1999
116-C-2A	105-C Pluto Crib	Crib	Liquid	3.50×10^6	–	1952	1968	Backfilled with 15 feet of soil in 1968; area excavated and contaminated soil removed to ERDF in 1999
116-C-2C	105-C Pluto Crib Sand Filter	Crib/ Sand filter	Liquid	3.50×10^6	–	1952	1969	Site excavated and removed to ERDF in 1999

Key: Dash (–)=not applicable; ERDF=Environmental Restoration Disposal Facility; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–10. Cumulative Impact Sites for Map 2

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
116-K-1	100-K Crib	Crib	Liquid	4.00×10^{7}	–	1955	1971	Contaminated soil removed and disposed of at ERDF in 2003
116-K-2	100-K Mile Long Trench	Trench	Liquid	3.00×10^{11}	–	1955	1971	Contaminated soil removed in 1996; site backfilled and stabilized
116-KE-4	107-KE Retention Basins	Retention Basin	Liquid	Unknown	–	1955	1971	Steel walls of tanks removed, site interim-stabilized, and bottoms of tanks left in place and backfilled in 1995; large pieces of contaminated effluent piping and scrap metal removed and taken to ERDF in 1999
116-KW-3	107-KW Retention Basin	Retention Basin	Liquid	Unknown	–	1955	1970	Steel walls of tanks removed, site interim-stabilized, bottoms of tanks left in place, and site backfilled in 1995; large pieces of contaminated effluent piping and scrap metal removed and taken to ERDF in 1999
116-KE-1	115-KE Condensate Crib	Crib	Liquid	8.00×10^{5}	–	1955	1971	Crib and pipeline removed to ERDF and site covered with clean backfill
116-KE-2	1706-KER Waste Crib	Crib	Liquid	3.00×10^{6}	–	1955	1971	Inactive; site retired in 1971
116-KW-1	115-KW Condensate Crib	Crib	Liquid	8.00×10^{5}	–	1955	1971	Crib and pipeline removed to ERDF and site covered with clean backfill in 2004
UPR-100-K-1	100-KE Fuel Storage Basin Leak	Unplanned Release	Liquid	Unknown	–	1974	1979	Inactive
120-KE-1	183-KE Filter Waste Facility Drywell	Sump	Liquid/ Solid	Unknown	–	1955	1971	Drain backfilled and surface stabilized in August 2000

Key: Dash (–)=not applicable; ERDF=Environmental Restoration Disposal Facility; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–11. Cumulative Impact Sites for Map 3

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
116-N-1	1301-N Liquid Waste Disposal Facility	Crib	Liquid	8.37×10^{10}	–	1964	1985	Inactive; crib stabilized and trench backfilled
116-N-3	1325-N Liquid Waste Disposal Facility	Crib	Liquid	7.61×10^{9}	–	1983	1991	Remediated and closed out
UPR-100-N-3	Spacer Disposal System Transport Line Leak	Unplanned Release	Liquid	1.36×10^{6}	–	1978	1978	Line repaired, contaminated soil removed, and sinkhole backfilled
UPR-100-N-7	Rad Line Leak	Unplanned Release	Liquid	1.91×10^{6}	–	1985	1985	Inactive; no remediation action reported
UPR-100-N-35	100-N Fuel Storage Basin Drainage System Leak	Unplanned Release	Liquid	Unknown	–	1986	1986	Inactive; no remediation action reported

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–12. Cumulative Impact Sites for Map 4

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
116-D-1A	105-D Storage Basin Trenches 1	Trench	Liquid	2.00×10^{5}	–	1947	1952	Site excavated and contaminated soil disposed of in ERDF; backfilled with clean soil in 2000
116-D-1B	105-D Storage Basin Trenches 2	Trench	Liquid	8.00×10^{6}	–	1953	1967	Site excavated and contaminated soil disposed of in ERDF; backfilled with clean soil in 2000
116-D-7	107-D Retention Basin	Retention Basin	Liquid	Unknown	–	1944	1967	Site excavated and contaminated soil disposed of in ERDF in 1997; closed out in 2000
116-DR-9	107-DR Retention Basin	Retention Basin	Liquid	Unknown	–	1950	1967	Site excavated and contaminated soil disposed of in ERDF; closed out in 1999
100-D-25	107-DR Basin Leaks	Unplanned Release	Liquid	Unknown	–	1951	Unknown	Site excavated and contaminated soil disposed of in ERDF; closed out in 1999
UPR-100-D-4	107-D Basin Leaks	Unplanned Release	Liquid	Unknown	–	1950	Unknown	Site excavated and contaminated soil disposed of in ERDF in 1997; closed out in 2000
116-DR-1&2	107-DR Liquid Waste Disposal Trenches	Trench	Liquid	8.00×10^{7}	–	1951	1967	Site excavated and contaminated soil disposed of in ERDF in 1997; closed out in 2000
116-DR-6	1608-DR Liquid Disposal Trench	Trench	Liquid	7.00×10^{6}	–	1953	1965	Site excavated and contaminated soil disposed of in ERDF; closed out in 2000
116-DR-7	105-DR Inkwell Crib	Crib	Liquid	4.00×10^{3}	–	1953	1953	Site excavated and contaminated soil disposed of in ERDF in 1999

Key: Dash (–)=not applicable; ERDF=Environmental Restoration Disposal Facility; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–13. Cumulative Impact Sites for Map 5

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
100-H-33	183-H Solar Evaporation Basins Radionuclide Components	Retention Basin	Liquid	9.63×10^6	–	1949	1985	Remediated in 1985 and 1996 and closed out in 1997
116-H-6	183-H Solar Evaporation Basins	Retention Basin	Liquid	See 100-H-33	–	1949	1985	Remediated in 1985 and 1996 and closed out in 1997
116-H-1	107-H Liquid Disposal Trench	Trench	Liquid	9.00×10^7	–	1952	1965	Contaminated soil removed and disposed of at ERDF in 2000
116-H-2	1608-H Liquid Waste Disposal Trench	Trench	Liquid	6.00×10^9	–	1953	1965	Contaminated soil removed and disposed of at ERDF in 2001
116-H-4	105-H Pluto Crib	Crib	Liquid	1.00×10^3	–	1950	1952	Contaminated material moved in 1960 and placed in 118-H-5 burial ground
116-H-7	107-H Retention Basin	Retention Basin	Liquid	Unknown	–	1949	1965	Contaminated soil removed and disposed of at ERDF in 2001
116-H-3	105-H Dummy Decontamination French Drain	French Drain	Liquid	4.00×10^5	–	1950	1965	Contaminated soil removed and disposed of at ERDF in 2000

Key: Dash (–)=not applicable; ERDF=Environmental Restoration Disposal Facility; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–14. Cumulative Impact Sites for Map 6

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
116-F-1	Lewis Canal	Trench	Liquid	1.00×10^{8}	–	1953	1965	Soil and debris removed and disposed of at ERDF in 2002; backfilled to grade with clean soil
116-F-2	107-F Liquid Waste Disposal Trench	Trench	Liquid	6.00×10^{7}	–	1950	1965	Soil and debris removed and disposed of at ERDF in 2002; backfilled to grade with clean soil
116-F-9	Animal Waste Leaching Trench	Trench	Liquid	3.00×10^{8}	–	1963	1976	Soil and debris removed and disposed of at ERDF in 2002; backfilled to grade with clean soil
116-F-3	105-F Storage Basin Trench	Trench	Liquid	4.00×10^{6}	–	1949	1951	Contaminated soil removed and disposed of at ERDF in 2003
116-F-6	105-F Cooling Water Trench	Trench	Liquid	1.00×10^{5}	–	1952	1965	Contaminated soil removed and disposed of at ERDF in 2002
116-F-4	105-F Pluto Crib	Crib	Liquid	4.00×10^{3}	–	1950	1956	Contaminated soil removed and disposed of at ERDF in 1993
116-F-10	105-F Dummy Decontamination French Drain	French Drain	Liquid	4.00×10^{5}	–	1953	1965	Contaminated soil removed and disposed of at ERDF in 2003
116-F-14	107-F Retention Basin	Retention Basin	Liquid	–	–	1945	1965	Decommissioned in stages from 1965 to 1999; excavation and disposal at ERDF completed in 2002

Key: Dash (–)=not applicable; ERDF=Environmental Restoration Disposal Facility; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–15. Cumulative Impact Sites for Map 7

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-N-1	216-N-1 Pond	Pond	Liquid	9.47×10^{8}	–	1944	1952	Deactivated and backfilled; removal, treatment, and disposal planned
216-N-2	216-N-2 Trench	Trench	Liquid	7.57×10^{6}	–	1947	1947	Deactivated and backfilled; removal, treatment, and disposal planned
216-N-3	216-N-3 Trench	Trench	Liquid	7.57×10^{6}	–	1952	1952	Deactivated and backfilled; removal, treatment, and disposal planned
216-N-4	216-N-4 Pond	Pond	Liquid	9.47×10^{8}	–	1944	1952	Deactivated and backfilled; removal, treatment, and disposal planned
216-N-5	216-N-5 Trench	Trench	Liquid	7.57×10^{6}	–	1952	1952	Deactivated and backfilled; removal, treatment, and disposal planned
216-N-6	216-N-6 Pond	Pond	Liquid	9.47×10^{8}	–	1944	1952	Deactivated in 1952; removal, treatment, and disposal planned
216-N-7	216-N-7 Trench	Trench	Liquid	7.57×10^{6}	–	1952	1952	Deactivated and backfilled; removal, treatment, and disposal planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–16. Cumulative Impact Sites for Map 8

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-A-25	216-A-25 Gable Mountain Pond	Pond	Liquid	2.94×10^{11}	–	1957	1985	Backfilled in 1988, surface stabilized in 1997
UPR-200-E-34	UPR-200-E-34	Contaminated Soil	Liquid	Unknown	–	1964	1964	Surface stabilized
600-118	600-118 Ditch	Soil	Liquid	Unknown	–	Unknown	Unknown	Backfilled with clean soil

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–17. Cumulative Impact Sites for Map 9

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-S-5	216-S-5 Crib	Crib	Liquid	4.08×10^{9}	–	1954	1957	Surface stabilized in 1990; landfill closure planned
216-S-6	216-S-6 Crib	Crib	Liquid	4.44×10^{9}	–	1954	1972	Surface stabilized in 1990; landfill closure planned
216-S-10D	216-S-10D Ditch	Ditch	Liquid	4.66×10^{9}	–	1954	1991	Portion backfilled and stabilized in 1984
216-S-10P	216-S-10P Pond	Pond	Liquid	6.73×10^{9}	–	1951	1991	Backfilled and stabilized in 1984; landfill closure planned
216-S-11	216-S-11 Pond	Pond	Liquid	2.23×10^{9}	–	1954	1965	Interim-stabilized in 1983; landfill closure planned
216-S-16D	216-S-16D Ditch	Ditch	Liquid	4.00×10^{8}	–	1957	1975	Backfilled and surface stabilized
216-S-16P	216-S-16P Pond	Pond	Liquid	4.07×10^{10}	–	1957	1972	Surface stabilized with additional backfill in 1984; landfill closure planned
216-S-17	216-S-17 Pond	Pond	Liquid	6.44×10^{9}	–	1951	1954	Backfilled in 1954; surface stabilized with additional backfill in 1984; landfill closure planned
UPR-200-W-47	UPR-200-W-47	Contaminated Soil	Liquid	Unknown	–	1958	1959	Surface stabilized in 1984; landfill closure planned
UPR-200-W-59	UPR-200-W-59	Pond	Liquid	Unknown	–	1965	1965	Landfill closure planned
UPR-200-W-34	UPR-200-W-34	Contaminated Soil	Liquid	Unknown	–	1955	1955	Stabilized in 1984
218-W-1	218-W-1 Burial Ground	Burial Ground	Solid	–	7.0×10^{3}	1944	1953	Surface stabilized in 1983; landfill closure planned
218-W-2	218-W-2 Burial Ground	Burial Ground	Solid	–	8.2×10^{3}	1953	1956	Surface stabilized in 1983; landfill closure planned
218-W-4B	218-W-4B Burial Ground	Burial Ground	Solid	–	1.0×10^{4}	1967	1990	Trenches 1–7 stabilized in 1983; remaining trenches stabilized in 1995; landfill closure planned
218-W-4C	218-W-4C Burial Ground	Burial Ground	Solid	–	1.6×10^{4}	1978	active	Landfill closure planned
218-W-5	218-W-5 Burial Ground	Burial Ground	Solid	–	3.6×10^{4}	1986	active	Landfill closure planned
218-W-3AE	218-W-3AE Burial Ground	Burial Ground	Solid	–	2.2×10^{4}	1981	active	Landfill closure planned
218-W-3A	218-W-3A Burial Ground	Burial Ground	Solid	–	1.0×10^{5}	1970	active	Landfill closure planned
Z Plant BP	Z Plant Burning Pit	Burning Pit	Solid	–	Unknown	1950	1960	Landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–18. Cumulative Impact Sites for Map 9A

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
218-W-3	218-W-3 Burial Ground	Burial Ground	Solid	–	1.1×10^4	1957	1961	Surface stabilized in 1983; landfill closure planned
218-W-4A	218-W-4A Burial Ground	Burial Ground	Solid	–	1.8×10^4	1959	1968	Surface stabilized in 1983; landfill closure planned
218-W-2A	218-W-2A Burial Ground	Burial Ground	Solid	–	2.5×10^4	1954	1985	Backfilled and stabilized in 1980; landfill closure planned
UPR-200-W-84	UPR-200-W-84	Contaminated Soil	Liquid	Unknown	–	1980	1980	Landfill closure planned
UPR-200-W-134	UPR-200-W-134	Contaminated Soil	Solid	–	Unknown	1975	1975	Landfill closure planned
UPR-200-W-53	UPR-200-W-53	Contaminated Soil	Liquid	Unknown	–	1959	1959	Backfilled and stabilized
UPR-200-W-72	UPR-200-W-72	Contaminated Soil	Solid	–	Unknown	1975	1975	Stabilized in 1975; landfill closure planned
UPR-200-W-16	UPR-200-W-16	Contaminated Soil	Solid	–	Unknown	1952	1952	Landfill closure planned
216-T-4A	216-T-4A Pond	Pond	Liquid	4.28×10^{10}	–	1944	1995	Interim-stabilized in 1995; landfill closure planned
216-T-4B	216-T-4B Pond	Pond	Liquid	Included in 216-T-4A	–	1972	1995	Landfill closure planned
216-T-36	216-T-36 Crib	Crib	Liquid	5.09×10^5	–	1967	1969	Surface stabilized in 2000; removal, treatment, and disposal planned
216-T-4-2	216-T-4-2 Ditch	Ditch	Liquid	Unknown	–	1972	1995	Backfilled and stabilized in 1995; removal, treatment, and disposal planned
UPR-200-W-97	UPR-200-W-97 Unplanned Release	Contaminated Soil	Liquid	2.00×10^3	–	1966	1966	Partial soil removal in 1966; surface stabilized in 1978; landfill closure planned
UPR-200-W-29	UPR-200-W-29 Unplanned Release	Contaminated Soil	Liquid	3.79×10^3	–	1954	1954	Backfilled and covered with gravel; landfill closure planned
216-T-13	216-T-13 Trench	Trench	Liquid	9.84×10^4	–	1954	1964	Soil excavated and removed in 1972; landfill closure planned
216-T-27	216-T-27 Crib	Crib	Liquid	7.19×10^6	–	1965	1965	Surface stabilized in 1990; landfill closure planned
216-TY-201	216-TY-201 Settling Tank	Tank	Liquid	2.40×10^4	–	1953	1966	Isolated in 1981; surface stabilized in 1990; landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–19. Cumulative Impact Sites for Map 9B

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-T-12	216-T-12 Trench	Trench	Liquid	5.01×10^{6}	–	1954	1954	Site backfilled and surface stabilized; landfill closure planned
218-W-1A	218-W-1A Burial Ground	Burial Ground	Solid	–	1.4×10^{4}	1944	1960	Site backfilled and surface stabilized in 1983; landfill closure planned
UPR-200-W-26	UPR-200-W-26	Contaminated Soil	Solid	–	Unknown	1953	1953	Landfill closure planned
216-T-29	216-T-29 Crib	Crib	Liquid	7.40×10^{4}	–	1949	1964	Deactivated; landfill closure planned
216-T-33	216-T-33 Crib	Crib	Liquid	1.90×10^{6}	–	1963	1963	Surface stabilized in 1991; landfill closure planned
216-T-34	216-T-34 Crib	Crib	Liquid	1.73×10^{7}	–	1966	1967	Interim-stabilized in 1990; landfill closure planned
216-T-35	216-T-35 Crib	Crib	Liquid	5.73×10^{6}	–	1967	1968	Surface stabilized in 1990; landfill closure planned
216-T-1	216-T-1 Ditch (221-T Ditch)	Ditch	Liquid	2.75×10^{8}	–	1945 1964	1956 1995	Backfilled and stabilized in 1995; landfill closure planned
216-T-2	216-T-2 Reverse Well	French Drain	Liquid	6.01×10^{6}	–	1945	1950	Surface stabilized
216-T-3	216-T-3 Reverse Well	French Drain	Liquid	1.13×10^{7}	–	1945	1946	Surface stabilized in 1993
216-T-6	216-T-6 Cribs	Crib	Liquid	4.50×10^{7}	–	1946	1947	Surface stabilized in 1993; landfill closure planned
216-T-8	216-T-8 Crib	Crib	Liquid	5.00×10^{5}	–	1950	1951	Stabilized in 1981; landfill closure planned
200-W-45	200-W-45 Sand Filter	Sand Filter	Solid	–	Unknown	1949	1979	Inactive
200-W-20	2706-T Equipment Decontamination Building	Building	Solid	–	Unknown	1944	Unknown	Landfill closure planned
200-W-20	T Plant Complex (including 221-T)	Building	Solid	–	Unknown	1944	Unknown	Landfill closure planned
224-T	224-T Canyon	Building	Liquid/ Solid	Unknown	–	1944	1956	Landfill closure planned
200-W-9	200-W-9 Unplanned Release	Contaminated Soil	Liquid	1.36×10^{5}	–	1994	1994	Landfill closure planned
UPR-200-W-2	UPR-200-W-2 Unplanned Release	Contaminated Soil	Liquid	1.23×10^{4}	–	1947	1947	Landfill closure planned
UPR-200-W-21	UPR-200-W-21	Contaminated Soil	Liquid	1.11×10^{4}	–	1953	1953	Covered with blacktop; entire area covered with shotcrete in 1991; landfill closure planned
UPR-200-W-38	UPR-200-W-38 Unplanned Release	Contaminated Soil	Liquid	7.70×10^{3}	–	1955	1955	Backfilled with soil in 1955; surface stabilized in 1991; landfill closure planned
UPR-200-W-98	UPR-200-W-98 Unplanned Release	Contaminated Soil	Liquid	3.30×10^{2}	–	1945	1945	Covered with 4 feet of soil in 1945; currently located under blacktop road; landfill closure planned
UPR-200-W-102	UPR-200-W-102 Unplanned Release	Contaminated Soil	Liquid	2.88×10^{4}	–	1972	1972	Landfill closure planned
TRUSAF	TRUSAF (in 224-T Canyon)	Building	Liquid/ Solid	Unknown	Unknown	1944	Standby	Landfill closure planned
241-T-361	241-T-361 Settling Tank	Tank	Liquid/ Solid	1.06×10^{5}	–	1944	1951	Liquids pumped out and isolated in 1985; surface stabilized in 1993; landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–20. Cumulative Impact Sites for Map 9C

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-Z-16	216-Z-16 Crib	Crib	Liquid	1.02×10^{8}	–	1968	1977	Landfill closure planned
231-Z	231-Z Plutonium Isolation Facility	Building	Solid		Unknown	1945	1975	Partially cleaned out and decontaminated after 1975; landfill closure planned
216-Z-4	216-Z-4 Trench	Trench	Liquid	1.10×10^{4}	–	1945	1945	Deactivated and backfilled in 1945; interim-stabilized in 1990; landfill closure planned
216-Z-5	216-Z-5 Crib	Crib	Liquid	3.10×10^{7}	–	1945	1947	Deactivated in 1947; surface stabilized in 1990; landfill closure planned
216-Z-6	216-Z-6 Crib	Crib	Liquid	9.80×10^{4}	–	1945	1945	Surface stabilized in 1990; landfill closure planned
216-Z-7	216-Z-7 Crib	Crib	Liquid	7.99×10^{7}	–	1947 1965	1957 1966	Backfilled in 1967; interim-stabilized in 1990; landfill closure planned
216-Z-8	216-Z-8 Trench	French Drain	Liquid	1.04×10^{4}	–	1957	1961	Landfill closure planned
216-Z-9	216-Z-9 Trench	Trench	Liquid	4.09×10^{6}	–	1955	1962	Gravel biobarrier placed in 1999; landfill closure planned
216-Z-10	216-Z-10 Reverse Well	Reverse Well	Liquid	1.00×10^{6}	–	1945	1945	Interim-stabilized 1990; landfill closure planned
UPR-200-W-130	UPR-200-W-130	Contaminated Soil	Liquid	3.30×10^{2}	–	1967	1967	Covered with clean soil; landfill closure planned
216-Z-17	216-Z-17 Trench	Trench	Liquid	3.68×10^{7}	–	1967	1968	Backfilled in 1975; surface stabilized in 1990; landfill closure planned
216-Z-15	216-Z-15 French Drain	French Drain	Liquid	4.81×10^{7}	–	1949	1997	Landfill closure planned
234-5Z	234-5Z Plutonium Finishing Plant	Building	Solid	–	Unknown	1949	1988	Landfill closure planned
2736-Z	2736-Z Plutonium Finishing Plant	Building	Liquid/ Solid	Unknown	Unknown	1971	Active	Landfill closure planned
242-Z	242-Z Americium Recovery Facility	Building	Solid	–	Unknown	1964	1976	Landfill closure planned
216-Z-1D	216-Z-1(D) Ditch	Ditch	Liquid	1.00×10^{6}	–	1944	1959	Backfilled in 1959; landfill closure planned
236-Z	236-Z Plutonium Reclamation Facility	Building	Solid	–	Unknown	1964	1991	Landfill closure planned
216-Z-14	216-Z-14 French Drain	French Drain	Liquid	5.18×10^{7}	–	1949	2001	Landfill closure planned
291-Z	291-Z Exhaust Fan and Compressor House	Building	Solid	–	Unknown	1949	Active	Landfill closure planned
UPR-200-W-103	UPR-200-W-103	Contaminated Soil	Liquid	2.97×10^{2}	–	1971	1971	Part of soil removed; landfill closure planned
241-Z	241-Z Treatment Tank	Tank	Liquid	Unknown	–	1948	Active	Landfill closure planned
241-Z-361	241-Z-361 Settling Tank	Tank	Liquid	7.50×10^{2}	76	1949	1976	Landfill closure planned
216-Z-13	216-Z-13 French Drain	French Drain	Liquid	4.98×10^{7}	–	1949	1999	Active
216-Z-1&2	216-Z-1 & 2 Cribs	Crib	Liquid	3.37×10^{7}	–	1949 1966	1952 1969	Landfill closure planned
216-Z-3	216-Z-3 Crib	Crib	Liquid	1.78×10^{8}	–	1952	1959	Landfill closure planned
216-Z-12	216-Z-12 Crib	Crib	Liquid	2.72×10^{8}	–	1959	1973	Landfill closure planned

Table S–20. Cumulative Impact Sites for Map 9C *(continued)*

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-Z-1A	216-Z-1A Tile Field	Tile Field	Liquid	6.21×10^6	–	1949 1964	1959 1969	Deactivated in 1969; landfill closure planned
216-Z-18	216-Z-18 Crib	Crib	Liquid	3.86×10^6	–	1969	1973	Landfill closure planned
216-Z-20	216-Z-20 Crib	Crib	Liquid	4.19×10^9	–	1981	1995	Backfilled and isolated; landfill closure planned
216-Z-21	216-Z-21 Seepage Basin	Pond	Liquid	1.57×10^9	–	1980	1995	Landfill closure planned
216-Z-11	216-Z-11 Ditch	Ditch	Liquid	Unknown	–	1959	1971	Backfilled in 1981; landfill closure planned
216-U-13	216-U-13 Trench	Trench	Liquid	1.14×10^4	–	1952	1956	Contaminated soil removed in 1956; landfill closure planned
216-U-14	216-U-14 Ditch	Ditch	Liquid	4.88×10^9	–	1944	1994	Stabilized in 1995
207-U	207-U Retention Basin	Basin	Liquid	1.30×10^4	–	1952	Unknown	Converted into active stormwater basin; stabilization planned
UPR-200-W-135	UPR-200-W-135 Unplanned Release	Contaminated Soil	Liquid	3.79×10^3	–	1954	1954	Stabilized with soil in 1990; landfill closure planned
UPR-200-W-28	UPR-200-W-28	Contaminated Soil	Liquid	2.31×10^3	–	1954	1954	Covered with clean soil; landfill closure planned
UPR-200-W-131	UPR-200-W-131	Contaminated Soil	Liquid	15.1	–	1953	1953	Covered with clean gravel in 2002; landfill closure planned
200-W PP	200-W PP Powerhouse Pond	Pond	Liquid	3.41×10^9	–	1984	1995	Stabilized in 1995
216-T-20	216-T-20 Trench	Trench	Liquid	1.89×10^4	–	1952	1952	Deactivated and backfilled; landfill closure planned
232-Z	232-Z Waste Incinerator	Building	Solid	–	Unknown	1959	1976	Isolated and stabilized; landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–21. Cumulative Impact Sites for Map 9D

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-U-10	216-U-10 Pond	Pond	Liquid	1.60×10^{11}	–	1944	1994	Backfilled and stabilized; landfill closure planned
216-U-3	216-U-3 French Drain	Crib	Liquid	7.91×10^{5}	–	1954	1955	Landfill closure planned
UPR-200-W-104	UPR-200-W-104	Contaminated Soil	Liquid	Unknown	–	Unknown	Unknown	Stabilized in 1985; landfill closure planned
UPR-200-W-105	UPR-200-W-105	Contaminated Soil	Liquid	Unknown	–	Unknown	Unknown	Stabilized in 1985; landfill closure planned
UPR-200-W-106	UPR-200-W-106	Contaminated Soil	Liquid	Unknown	–	Unknown	Unknown	Stabilized in 1985; landfill closure planned
216-S-4	216-S-4 French Drain	French Drain	Liquid	9.99×10^{5}	–	1953	1956	Stabilized; landfill closure planned
216-S-3	216-S-3 Crib	Crib	Liquid	4.20×10^{6}	–	1953	1956	Landfill closure planned
216-S-21	216-S-21 Crib	Crib	Liquid	8.71×10^{7}	–	1954	1969	Interim-stabilized in 1990; landfill closure planned
UPR-200-W-107	UPR-200-W-107	Contaminated Soil	Liquid	Unknown	–	1952	1957	Stabilized in 1985; landfill closure planned
216-S-25	216-S-25 Crib	Crib	Liquid	2.88×10^{8}	–	1973 1985	1980 1985	Landfill closure planned
216-S-1&2	216-S-1 and 216-S-2 Cribs	Cribs	Liquid	1.60×10^{8}	–	1952	1956	Surface stabilized in 1994; landfill closure planned
216-S-8	216-S-8 Trench	Trench	Liquid	1.00×10^{7}	–	1951	1952	Backfilled and surface stabilized in 1994; landfill closure planned
UPR-200-W-95	UPR-200-W-95	Contaminated Soil	Liquid	39.7	–	1951	1954	Lined basin covered with clean soil in 1984

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–22. Cumulative Impact Sites for Map 9E

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-U-5	216-U-5 Trench	Trench	Liquid	2.25×10^{6}	–	1952	1952	Backfilled in 1952; surface stabilized in 1994; removal, treatment, and disposal planned
216-U-6	216-U-6 Trench	Trench	Liquid	2.25×10^{6}	–	1952	1952	Backfilled in 1952; surface stabilized in 1994; removal, treatment, and disposal planned
221-U	221-U Process Canyon	Building	Liquid/ Solid	Unknown	Unknown	1945	1961	Landfill closure planned
241-WR-Vault	241-WR Vault	Building	Liquid	Unknown	–	1952	1976	Covered with plastic; landfill closure planned
216-U-15	216-U-15 Trench	Trench	Liquid	6.81×10^{4}	–	1957	1957	Backfilled in 1957; removal, treatment, and disposal planned
UPR-200-W-138	UPR-200-W-138	Contaminated Soil	Liquid	1.49×10^{4}	–	1953	1953	Covered with clean soil 1998; landfill closure planned
200-W-44	200-W-44 Sand Filter	Sand Filter	Solid	–	Unknown	1948	active	Active
216-U-7	216-U-7 French Drain	French Drain	Liquid	7.00×10^{3}	–	1952	1957	Surface stabilized in 1998; landfill closure planned
UPR-200-W-101	UPR-200-W-101 Unplanned Release	Contaminated Soil	Liquid	4.50×10^{3}	–	1957	1957	Covered with clean backfill in 1998; landfill closure planned
216-U-4	216-U-4 Reverse Well	Reverse Well	Liquid	3.00×10^{5}	–	1947	1955	Landfill closure planned
216-U-4A	216-U-4A French Drain	French Drain	Liquid	5.45×10^{5}	–	1955 1965	1961 1970	Landfill closure planned
216-U-1&2	216-U-1 and 2 Cribs	Crib	Liquid	1.59×10^{7}	–	1951 1958 1966	1956 1960 1967	Landfill closure planned
241-U-361	241-U-361 Settling Tank	Tank	Liquid	1.04×10^{5}	–	1951	1967	Interim-stabilized in 1985; surface stabilized in 1992; landfill closure planned
UPR-200-W-39	UPR-200-W-39 Unplanned Release	Contaminated Soil	Liquid	3.85×10^{2}	–	1954	1954	Covered with clean soil and building; landfill closure planned
200-W-42	200-W-42 Process Sewer	Process Sewer	Liquid	1.11×10^{4}	–	1952	1988	Portions stabilized with gravel in 1995 and 2001; removal, treatment, and disposal planned
UPR-200-W-163	UPR-200-W-163 Unplanned Release	Contaminated Vegetation	Liquid	3.35×10^{4}	–	1952	1988	Partially stabilized
216-U-16	216-U-16 Crib	Crib	Liquid	4.09×10^{8}	–	1984	1985	Backfilled in 2000
216-S-9	216-S-9 Crib	Crib	Liquid	4.96×10^{7}	–	1965	1969	Surface stabilized in 1995; landfill closure planned
216-S-23	216-S-23 Crib	Crib	Liquid	3.41×10^{7}	–	1969	1972	Interim-stabilized in 1985; landfill closure planned
216-U-8	216-U-8 Crib	Crib	Liquid	3.75×10^{8}	–	1952	1960	Interim-stabilized in 1995; landfill closure planned
216-U-12	216-U-12 Crib	Crib	Liquid	1.49×10^{8}	–	1960 1981	1972 1988	Landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–23. Cumulative Impact Sites for Map 9F

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-S-19	216-S-19 Pond	Pond	Liquid	1.30×10^{9}	–	1952	1984	Stabilized in 1984; removal, treatment, and disposal planned
216-S-14	216-S-14 Trench	Trench	Liquid	7.60×10^{4}	–	1952	1952	Backfilled; removal, treatment, and disposal planned
216-S-7	216-S-7 Crib	Crib	Liquid	3.90×10^{8}	–	1956	1965	Surface stabilized in 1992; landfill closure planned
UPR-200-W-32	UPR-200-W-32	Contaminated Soil	Liquid	3.30×10^{2}	–	1954	1954	Contaminated soil covered with clean soil in 1954; removal, treatment, and disposal planned
216-S-13	216-S-13 Crib	Crib	Liquid	5.00×10^{6}	–	1951	1966	Interim-stabilized in 1991; landfill closure planned
216-S-12	216-S-12 Trench	Trench	Liquid	7.48×10^{4}	–	1954	1954	Landfill closure planned
200-W-22	200-W-22 Unplanned Release	Contaminated Soil	Liquid	32	–	1952	1983	Aboveground contamination removed; removal, treatment, and disposal planned
233-S	233-S Plutonium Concentration Facility	Building	Solid	Unknown	–	1952	1967	Demolished in 2004; concrete cap placed over foundation
200-W-69	200-W-69 Lab Complex (includes 222-S Lab, 222-S DMWSA, 219-S, 222-SA, 296-S-21, 296-S-16, 296-S-23, 296-S-13)	Chemicals	Liquid/ Solid	Unknown	–	1951	active	Landfill closure planned
UPR-200-W-61	UPR-200-W-61	Contaminated Soil	Liquid	9.24×10^{2}	–	1966	1966	Landfill closure planned
202-S	202-S (REDOX)	Building	Solid	Unknown	–	1952	1967	Landfill closure planned
291-S	291-S Sand Filter	Sand Filter/ Equipment	Solid	Unknown	–	1952	Active	Active
216-S-20	216-S-20 Crib	Crib	Liquid	1.35×10^{8}	–	1952 1972	1969 1973	Deactivated in 1974; sinkholes backfilled; removal, treatment, and disposal planned
216-S-22	216-S-22 Crib	Crib	Liquid	9.83×10^{4}	–	1957	1959	Landfill closure planned
216-S-26	216-S-26 Crib	Crib	Liquid	2.19×10^{8}	–	1984	1995	Isolated; manhole filled with concrete; removal, treatment, and disposal planned
218-W-7	218-W-7 Burial Ground (222-S Vault)	Burial Ground	Solid	–	1.59×10^{2}	1952	1960	Landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; REDOX=Reduction-Oxidation (Facility); WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–24. Cumulative Impact Sites for Map 10

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
600-148	Environmental Restoration Disposal Facility	Disposal Facility	Solid	–	2.1×10^{7}	1996	2031	Disposal operations to be completed in 2031, barrier construction to be completed in 2033
N/A	US Ecology	Disposal Facility	Solid	–	7.1×10^{5}	1965	2056	Operations assumed to end in 2056; barrier placed in stages
216-W-LWC	216-W-LWC Crib	Crib	Liquid	9.99×10^{8}	–	1981	1993	Isolated in 1994; landfill closure planned
216-U-17	216-U-17 Crib	Crib	Liquid	5.93×10^{6}	–	1988 1992	1989 1994	Stabilized

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; N/A=not applicable; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–25. Cumulative Impact Sites for Map 11

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
218-E-10	218-E-10 Trench	Burial Ground	Solid	–	2.18×10^4	1960	Unknown	Active; partially stabilized 1980; landfill closure planned
UPR-200-E-23	UPR-200-E-23	Contaminated Soil	Solid	Unknown	–	Unknown	Unknown	Addressed in 218-E-10
UPR-200-E-24	UPR-200-E-24	Contaminated Soil	Solid	Unknown	–	Unknown	Unknown	Addressed in 218-E-10
216-B-50	216-B-50 Crib	Crib	Liquid	5.47×10^7	–	1965	1974	Interim-stabilized in 1991; landfill closure planned
216-B-57	216-B-57 Crib	Crib	Liquid	8.43×10^7	–	1968	1973	Surface stabilized in 1991; covered with Hanford prototype barrier in 1994; landfill closure planned
UPR-200-E-9	UPR-200-E-9	Contaminated Soil	Liquid	4.16×10^4	–	1955	1955	Most contaminated soil removed; remainder stabilized in 1955; landfill closure planned
216-B-11A & B	216-B-11A & B	Reverse Well	Liquid	2.96×10^7	–	1952	1954	Backfilled in 1992; landfill closure planned
216-B-51	216-B-51 French Drain	French Drain	Liquid	1.00×10^3	–	1956	1958	Stabilized in 1992
218-E-5	218-E-5 Burial Ground	Burial Ground	Solid	–	3.17×10^3	1954	1956	Surface stabilized in 1980; landfill closure planned
218-E-5A	218-E-5A Burial Ground	Burial Ground	Solid	–	6.17×10^3	1956	1959	Surface stabilized in 1980; landfill closure planned
218-E-2	218-E-2 Burial Ground	Burial Ground	Solid	–	9.03×10^3	1945	1953	Backfilled and stabilized in 1979; landfill closure planned
UPR-200-E-79	UPR-200-E-79 Unplanned Release	Contaminated Soil	Liquid	3.85×10^3	–	1953	1953	Contaminated soil covered with soil
UPR-200-E-78	UPR-200-E-78 Unplanned Release	Contaminated Soil	Liquid	1.54×10^2	–	1955	1955	Covered with clean soil; landfill closure planned
218-E-4	218-E-4 Burial Ground	Burial Ground	Solid	–	1.59×10^3	1955	1956	Surface stabilized in 1980; landfill closure planned
216-B-5	216-B-5 Reverse Well	Reverse Well	Liquid	3.21×10^7	–	1945	1947	Interim-stabilized in 1994
216-B-9	216-B-9 Crib	Crib	Liquid	3.60×10^7	–	1948	1951	Inactive; surface stabilized; landfill closure planned
216-B-59	216-B-59 Trench	Trench	Liquid	4.77×10^5	–	1968	1968	Inactive; removal, treatment, and disposal planned
241-B-361	241-B-361 Settling Tank	Tank	Liquid	–	83	1945	1947	Interim-stabilized in 1985; landfill closure planned
UPR-200-E-7	UPR-200-E-7 Unplanned Release	Contaminated Soil	Liquid	1.89×10^4	–	1954	1954	Stabilized; removal, treatment, and disposal planned
221-B	221-B B Plant/Canyon	Building	Solid	–	Unknown	1945	1984	Deactivated; landfill closure planned
200-E-28	200-E-28 UPR	Steam Condensate	Liquid	5.86×10^5	–	1990	1990	Closed out as part of completion of 221-B
200-E-97	200-E-97 French Drain	French Drain	Liquid	2.32×10^5	–	1945	1997	Inactive
200-E-98	200-E-98 French Drain	French Drain	Liquid	1.92×10^5	–	1945	1997	Inactive
WESF	WESF (Building 225-B)	Waste Storage	Solid	unknown	–	1974	active	Cesium/strontium capsules to be removed; landfill closure planned
216-B-62	216-B-62 Crib	Crib	Liquid	2.80×10^8	–	1973	1986	Inactive; isolated; landfill closure planned
216-B-12	216-B-12 Crib	Crib	Liquid	5.20×10^8	–	1952 1967	1957 1973	Inactive; stabilized in 1993; landfill closure planned

Table S–25. Cumulative Impact Sites for Map 11 *(continued)*

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-B-55	216-B-55 Crib	Crib	Liquid	1.20×10^9	–	1967 1988	1986 1990	Inactive; isolated; landfill closure planned
212-B	212-B Cask Loading Station	Building	Solid	–	Unknown	Unknown	Unknown	Deactivated in 1998; landfill closure planned
216-B-60	216-B-60 Crib	Crib	Liquid	1.89×10^4	–	1968	1968	Inactive; landfill closure planned
UPR-200-E-84	UPR-200-E-84 Unplanned Release	Contaminated Soil	Liquid	6.43×10^3	–	1953	1953	Landfill closure planned
224-B	224-B Plutonium Concentration Facility	Equipment	Solid	–	Unknown	1945	1976	Landfill closure planned
UPR-200-E-87	UPR-200-E-87 Unplanned Release	Contaminated Soil	Liquid	2.88×10^4	–	1949	1949	Landfill closure planned
UPR-200-E-1	UPR-200-E-1 Unplanned Release	Contaminated Soil	Liquid	2.04×10^4	–	1946	1946	Area covered; landfill closure planned
UPR-200-E-3	UPR-200-E-3 Unplanned Release	Contaminated Soil	Liquid	3.30×10^2	–	1951	1951	Cleanup of highly radioactive areas prohibited; landfill closure planned
UPR-200-E-85	UPR-200-E-85 Unplanned Release	Contaminated Soil	Liquid	2.48×10^3	–	1972	1972	Stabilized in 1984; landfill closure planned
216-B-4	216-B-4 Reverse Well	Reverse Well	Liquid	1.00×10^4	–	1945	1949	Inactive; landfill closure planned
216-B-6	216-B-6 Reverse Well	Reverse Well	Liquid	6.00×10^6	–	1945	1949	Inactive; landfill closure planned
200-E-30	200-E-30 Sand Filter (291-B Sand Filter)	Soil	Solid	unknown	–	1948	1997	Inactive; deactivated
200-E-55	200-E-55 French Drain	French Drain	Liquid	2.31×10^5	–	1945	1997	Landfill closure planned
200-E-95	200-E-95 French Drain	French Drain	Liquid	2.19×10^5	–	1945	1994	Inactive
216-B-10A	216-B-10A Crib	Crib	Liquid	9.98×10^6	–	1949	1952	Stabilized in 1983; removal, treatment, and disposal planned
216-B-10B	216-B-10B Crib	Crib	Liquid	2.80×10^4	–	1969	1973	Stabilized in 1983; removal, treatment, and disposal planned
UPR-200-E-77	UPR-200-E-77 Unplanned Release	Contaminated Soil	Liquid	34.7	–	1946	1946	Stabilized in 1946; landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–26. Cumulative Impact Sites for Map 12

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
218-E-12B	218-E-12B Burial Ground	Burial Ground	Solid	–	7.3×10^4	1967	Unknown	Seventeen trenches stabilized in 1981; landfill closure planned
218-E-12A	218-E-12A Burial Ground	Burial Ground	Solid	–	1.5×10^4	1953	1967	Surface stabilized in 1980 and 1994; landfill closure planned
216-B-63	216-B-63 Ditch	Ditch	Liquid	7.98×10^9	–	1970	1992	Inactive; backfilled and stabilized; remove, treat and disposal planned
216-B-2-2	216-B-2-2 Ditch	Ditch	Liquid	1.49×10^{11}	–	1963	1970	Inactive; backfilled in 1970; surface stabilized in 1987; removal, treatment, and disposal planned
216-B-2-1	216-B-2-1 Ditch	Ditch	Liquid	1.49×10^{11}	–	1945	1963	Backfilled and stabilized; removal, treatment, and disposal planned
UPR-200-E-138	UPR-200-E-138 Unplanned Release	Contaminated Soil	Liquid	Unknown	–	1970	1970	Surface stabilized in 1987
218-E-8	218-E-8 Burial Ground	Burial Ground	Solid	–	2.3×10^3	1958	1959	Surface stabilized in 1980; landfill closure planned
218-E-1	218-E-1 Burial Ground	Burial Ground	Solid	–	3.0×10^3	1945	1953	Surface stabilized in 1981; landfill closure planned
216-B-3	216-B-3 Pond	Pond	Liquid	2.8×10^{11}	–	1945	1997	Pond backfilled and surface stabilized in 1994
216-B-3A Pond / 216-B-3A RAD	216-B-3A Pond / 216-B-3A RAD	Pond	Liquid	Unknown	–	1983	1984	Closed as RCRA TSD site in 1995; interim-stabilized with B Pond
216-B-3B Pond / 216-B-3B-RAD	216-B-3B Pond / 216-B-3B-RAD	Pond	Liquid	Unknown	–	1984	1985	Closed as RCRA TSD site in 1995; interim-stabilized with B Pond
216-B-3C Pond / 216-B-3C RAD	216-B-3C Pond / 216-B-3C RAD	Pond	Liquid	Unknown	–	1985	1997	Backfilled in 1997; clean-closed under RCRA in 1995
UPR-200-E-14	Unplanned Release-UPR-200-E-14	Contaminated Soil	Liquid	Unknown	–	1958	1958	Released from radiation zone status in 1970; covered by 216-B-3A Pond Lobe in 1983; contaminated zone covered with clean soil
UPR-200-E-34	UPR-200-E-34	Contaminated Soil	Liquid	Unknown	–	1964	1964	Surface stabilized

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; RCRA=Resource Conservation and Recovery Act; TSD=treatment, storage, and disposal; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–27. Cumulative Impact Sites for Map 12A

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-C-9	216-C-9 Swamp	Pond	Liquid	1.04×10^{9}	–	1953	1985	Backfilled and interim-stabilized in 1989
218-C-9	218-C-9 Burial Ground	Burial Ground	Solid		2.3×10^{3}	1985	1989	Backfilled and stabilized in 1989; landfill closure planned
UPR-200-E-141	UPR-200-E-141	Contaminated Soil	Liquid	2.08×10^{2}	–	1984	1984	Contamination cleaned up
200-E-56	200-E-56 Unplanned release	Contaminated Soil	Liquid	7.55×10^{4}	–	1957	1957	Landfill closure planned
201-C	201-C Process Building	Buildings	Liquid/ Solid	Unknown	Unknown	1949	1967	Core entombed in 1986; area covered with 10 feet of ash in 1992; landfill closure planned
216-C-1	216-C-1 Hot Semi Work Crib	Crib	Liquid	2.34×10^{7}	–	1952	1957	Stabilized in 1979; entombed in concrete in 1986; landfill closure planned
216-C-3	216-C-3 Hot Semi Work Crib	Crib	Liquid	5.00×10^{6}	–	1953	1954	Stabilized in 1979; landfill closure planned
216-C-4	216-C-4 Hot Semi Work Crib	Crib	Liquid	1.70×10^{5}	–	1955 1962	1957 1964	Stabilized and backfilled in 2000; landfill closure planned
216-C-5	216-C-5 Hot Semi Work Crib	Crib	Liquid	3.89×10^{4}	–	1955	1955	Stabilized in 1979; landfill closure planned
216-C-6	216-C-6 Hot Semi Work Crib	Crib	Liquid	5.31×10^{5}	–	1955 1962	1957 1964	Deactivated in 1964; landfill closure planned
216-C-10	216-C-10 Hot Semi Work Crib	Crib	Liquid	8.97×10^{5}	–	1964	1967	Surface stabilized in 1989; landfill closure planned
216-C-2	216-C-2 Semi Works Reverse Well	Reverse Well	Liquid	3.15×10^{6}	–	1953	1988	Sealed with concrete in 1988; landfill closure planned
200-E-57	200-E-57 Unplanned release	Contaminated Soil	Liquid	1.13×10^{5}	–	1957	1957	Some soil removed; removal, treatment, and disposal planned
241-CX-72	241-CX-72 Storage Tank and Vault	Equipment	Liquid/ Solid	Unknown	1.32×10^{2}	1957	1976	Filled with grout in 1986; landfill closure planned
291-C-1	291-C-1 Burial Ground	Burial Ground	Solid	–	Unknown	1949	1987	Landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–28. Cumulative Impact Sites for Map 12B

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
UPR-200-E-86	UPR-200-E-86	Contaminated Soil	Liquid	7.00×10^{4}	–	1971	1971	Surface covered with shotcrete in 1995; landfill closure planned
216-A-40	216-A-40 Trench	Trench	Liquid	9.46×10^{5}	–	1968	1979	Backfilled with soil in 1994; removal, treatment, and disposal planned
216-A-41	216-A-41 Crib	Crib	Liquid	1.00×10^{4}	–	1968	1974	Removal, treatment, and disposal planned
216-A-9	216-A-9 Crib	Crib	Liquid	9.81×10^{8}	–	1956 1966	1958 1967	Surface stabilized; removal, treatment, and disposal planned
216-A-3	216-A-3 Crib	Crib	Liquid	3.05×10^{6}	–	1956 1976	1966 1981	Backfilled with gravel; removal, treatment, and disposal planned
216-A-39	216-A-39 Crib	Trench	Liquid	20.0	–	1966	1966	Landfill closure planned
216-A-18	216-A-18 Trench	Trench	Liquid	4.88×10^{5}	–	1955	1955	Surface stabilized in 1990; landfill closure planned
216-A-1	216-A-1 Crib	Crib	Liquid	9.84×10^{4}	–	1955	1955	Backfilled in 1992; landfill closure planned
216-A-7	216-A-7 Crib	Crib	Liquid	3.27×10^{5}	–	1955 1966	1956 1966	Backfilled in 1992; landfill closure planned
UPR-200-E-145	UPR-200-E-145	Contaminated Soil	Liquid	6.25×10^{3}	–	1993	1993	Covered with clean soil in 2003
216-A-16	216-A-16 French Drain	French Drain	Liquid	1.22×10^{5}	–	1956	1969	Landfill closure planned
216-A-17	216-A-17 French Drain	French Drain	Liquid	6.00×10^{4}	–	1956	1969	Landfill closure planned
242-A	242-A Evaporator	Equipment	Liquid	Unknown	–	1977	Active	Landfill closure planned
216-A-22	216-A-22 Crib (French Drain)	Crib	Liquid	9.99×10^{3}	–	1956	1959	Removal, treatment, and disposal planned
216-A-28	216-A-28 French Drain	French Drain	Liquid	3.00×10^{4}	–	1960	1960	Excavated in 1981; removal, treatment, and disposal planned
216-A-32	216-A-32 Crib	Crib	Liquid	4.00×10^{3}	–	1959	1972	Surface stabilized in 2001
200-E-78	200-E-78 Reverse Well	Reverse Well	Liquid	1.84×10^{5}	–	1955	1996	Inactive

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–29. Cumulative Impact Sites for Map 12C

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
UPR-200-E-51	UPR-200-E-51	Chemicals	Liquid	Unknown	–	1977	1977	Backfilled
216-A-24	216-A-24 Crib	Crib	Liquid	8.21×10^{8}	–	1958 1971 1978	1967 1976 1978	Surface stabilized in 1988; landfill closure planned
216-A-6	216-A-6 Crib	Crib	Liquid	3.36×10^{9}	–	1955 1966	1961 1970	Surface stabilized with sand and plastic sheeting in 1972 and 1993; landfill closure planned
216-A-19	216-A-19 Trench	Trench	Liquid	1.10×10^{6}	–	1955	1955	Surface stabilized in 1990; landfill closure planned
216-A-20	216-A-20 Trench	Trench	Liquid	9.61×10^{5}	–	1955	1955	Surface stabilized in 1990; landfill closure planned
216-A-8	216-A-8 Crib	Crib	Liquid	1.15×10^{9}	–	1955 1966 1978 1983	1958 1976 1978 1985	Surfaced stabilized in 1990; landfill closure planned
216-A-29	216-A-29 Ditch	Ditch	Liquid	Unknown	–	1955	1991	Surface stabilized in 1991
216-A-30	216-A-30 Crib	Crib	Liquid	7.64×10^{9}	–	1961 1976	1973 1991	Backfilled with gravel in 2001; landfill closure planned
216-A-37-1	216-A-37-1 Crib	Crib	Liquid	3.68×10^{8}	–	1977	1989	Landfill closure planned
216-A-37-2	216-A-37-2 Crib	Crib	Liquid	1.10×10^{9}	–	1984 1988	1986 1991	Landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–30. Cumulative Impact Sites for Map 12D

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
216-A-13	216-A-13 French Drain	French Drain	Liquid	1.00×10^{4}	–	1956	1962	Landfill closure planned
200-E-61	200-E-61 Reverse Well	Reverse Well	Liquid	1.80×10^{6}	–	1955	2001	Landfill closure planned
200-E-136	200-E-136 PUREX Plant (202-A and Others)	Building	Solid	–	Unknown	1956	1990	Landfill closure planned
UPR-200-E-39	UPR-200-E-39 (@ 216-A-36B)	Contaminated Soil	Liquid	1.52×10^{3}	–	1968	1968	Inactive
UPR-200-E-40	UPR-200-E-40	Contaminated Soil	Liquid	1.17×10^{2}	–	1968	1968	Contaminated blacktop removed in 1968; covered with clean gravel in 1999
200-E-85	200-E-85 Reverse Well	Reverse Well	Liquid	1.43×10^{6}	–	1955	1997	Landfill closure planned
216-A-35	216-A-35 French Drain	French Drain	Liquid	1.00×10^{4}	–	1963	1966	Landfill closure planned
200-E-54	200-E-54 Unplanned Release	Contaminated Soil	Liquid	2.01×10^{5}	–	1991	1991	Inactive
200-E-103	200-E-103 PUREX Stabilized Area	Contaminated Soil	Liquid	4.00×10^{3}	–	1960	1960	Interim-stabilized in 1999; landfill closure planned
UPR-200-E-117	UPR-200-E-117	Contaminated Soil	Liquid	3.30×10^{2}	–	1972	1972	Covered with clean backfill in 1999; landfill closure planned
216-A-2	216-A-2 Crib	Crib	Liquid	2.30×10^{5}	–	1956	1960	Landfill closure planned
216-A-26	216-A-26 French Drain	French Drain	Liquid	3.86×10^{3}	–	1965	1991	Inactive
216-A-26A	216-A-26A French Drain	French Drain	Liquid	1.00×10^{3}	–	1959	1965	Landfill closure planned
216-A-15	216-A-15 French Drain	French Drain	Liquid	1.00×10^{7}	–	1955	1972	Landfill closure planned
200-E-107	200-E-107 Unplanned Release	Contaminated Soil	Liquid	4.00×10^{3}	–	2000	2000	Surface stabilized with clean soil in 2001; landfill closure planned
218-E-14	218-E-14 PUREX Tunnel 1	Equipment	Solid	–	5.7×10^{2}	1960	1965	Landfill closure planned
218-E-15	218-E-15 PUREX Tunnel 2	Equipment	Solid	–	Unknown	1967	1996	Landfill closure planned
216-A-4	216-A-4 Crib	Crib	Liquid	6.21×10^{6}	–	1955	1958	Surface stabilized in 1999; landfill closure planned
216-A-5	216-A-5 Crib	Crib	Liquid	1.63×10^{9}	–	1955 1966	1961 1966	Surface stabilized in 1983; landfill closure planned
216-A-10	216-A-10 Crib	Crib	Liquid	3.16×10^{9}	–	1956 1961 1977 1981	1956 1973 1978 1987	Deactivated in 1987; landfill closure planned
216-A-21	216-A-21 Crib	Crib	Liquid	7.79×10^{7}	–	1957	1965	Landfill closure planned
216-A-27	216-A-27 Crib	Crib	Liquid	2.32×10^{7}	–	1965	1970	Landfill closure planned
216-A-31	216-A-31 Crib	Crib	Liquid	3.05×10^{4}	–	1964 1966	1964 1966	Landfill closure planned
216-A-36-A	216-A-36A Crib	Crib	Liquid	1.07×10^{6}	–	1965	1966	Landfill closure planned
216-A-36-B	216-A-36B Crib	Crib	Liquid	3.15×10^{8}	–	1966 1982	1972 1987	Landfill closure planned
216-A-45	216-A-45 Crib	Crib	Liquid	1.03×10^{8}	–	1987	1989	Landfill closure planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; PUREX=Plutonium-Uranium Extraction; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–31. Cumulative Impact Sites for Map 13

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
2101-M Pond	2101-M Pond	Pond	Liquid	1.11×10^{9}	–	1953	1995	Inactive
216-B-54	216-B-54 Trench	Trench	Liquid	9.99×10^{5}	–	1963	1965	Surface of backfilled trenches stabilized in 1982; removal, treatment, and disposal planned
216-B-14	216-B-14 Crib	Crib	Liquid	8.67×10^{6}	–	1956	1956	Stabilized in 1981; landfill closure planned
216-B-15	216-B-15 Crib	Crib	Liquid	6.32×10^{6}	–	1956	1957	Stabilized in 1981; landfill closure planned
216-B-16	216-B-16 Crib	Crib	Liquid	5.60×10^{6}	–	1956	1956	Stabilized in 1981; landfill closure planned
216-B-17	216-B-17 Crib	Crib	Liquid	3.41×10^{6}	–	1956	1956	Stabilized in 1981; landfill closure planned
216-B-18	216-B-18 Crib	Crib	Liquid	8.52×10^{6}	–	1956	1956	Stabilized in 1981; landfill closure planned
216-B-19	216-B-19 Crib	Crib	Liquid	6.35×10^{6}	–	1957	1957	Stabilized in 1981; landfill closure planned
216-B-20	216-B-20 Trench	Trench	Liquid	4.68×10^{6}	–	1956	1956	Stabilized in 1982; landfill closure planned
216-B-21	216-B-21 Trench	Trench	Liquid	4.67×10^{6}	–	1956	1956	Stabilized in 1982; landfill closure planned
216-B-22	216-B-22 Trench	Trench	Liquid	4.74×10^{6}	–	1956	1956	Stabilized in 1982; landfill closure planned
216-B-23	216-B-23 Trench	Trench	Liquid	4.52×10^{6}	–	1956	1956	Stabilized in 1982; landfill closure planned
216-B-24	216-B-24 Trench	Trench	Liquid	4.87×10^{6}	–	1956	1956	Stabilized in 1982; landfill closure planned
216-B-25	216-B-25 Trench	Trench	Liquid	4.91×10^{6}	–	1956	1956	Stabilized in 1982; landfill closure planned
216-B-26	216-B-26 Trench	Trench	Liquid	4.75×10^{6}	–	1956	1957	Stabilized in 1982; landfill closure planned
216-B-27	216-B-27 Trench	Trench	Liquid	4.42×10^{6}	–	1957	1957	Stabilized in 1982; landfill closure planned
216-B-28	216-B-28 Trench	Trench	Liquid	5.05×10^{6}	–	1957	1957	Stabilized in 1982; landfill closure planned
216-B-29	216-B-29 Trench	Trench	Liquid	4.83×10^{6}	–	1957	1957	Stabilized in 1982; landfill closure planned
216-B-30	216-B-30 Trench	Trench	Liquid	4.78×10^{6}	–	1957	1957	Stabilized in 1982; landfill closure planned
216-B-31	216-B-31 Trench	Trench	Liquid	4.85×10^{6}	–	1957	1957	Stabilized in 1982; landfill closure planned
216-B-32	216-B-32 Trench	Trench	Liquid	4.75×10^{6}	–	1956	1957	Stabilized in 1982; landfill closure planned
216-B-33	216-B-33 Trench	Trench	Liquid	4.75×10^{6}	–	1956	1957	Stabilized in 1982; landfill closure planned
216-B-34	216-B-34 Trench	Trench	Liquid	4.88×10^{6}	–	1956	1957	Stabilized in 1982; landfill closure planned
216-B-52	216-B-52 Trench	Trench	Liquid	8.53×10^{6}	–	1957	1958	Stabilized in 1982; landfill closure planned
216-B-53A	216-B-53A Trench	Trench	Liquid	5.49×10^{5}	–	1965	1965	Stabilized in 1982; removal, treatment, and disposal planned
216-B-53B	216-B-53B Trench	Trench	Liquid	2.01×10^{4}	–	1962	1963	Stabilized in 1982; removal, treatment, and disposal planned
216-B-58	216-B-58 Trench	Trench	Liquid	4.17×10^{5}	–	1965	1967	Stabilized in 1982; removal, treatment, and disposal planned

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–32. Cumulative Impact Sites for Map 14

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
600 NRDWL	600 Nonrad Dangerous Waste Landfill	Landfill	Solid	Unknown	1.41×10^5	1975	1985	Backfilled and covered; landfill closure planned

Key: Dash (-)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–33. Cumulative Impact Sites for Map 15

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
618-11	300 Wye Burial Ground	Burial Ground	Solid	–	Unknown	1962	1967	Surface stabilized in 1987
400 RFD	400 Area Retired French Drains	French Drain	Liquid	Unknown	–	Unknown	Unknown	Inactive
316-4	300 North Cribs, 321 Cribs	Crib	Liquid	2.00×10^5	–	1948	1955	Remedial excavation work begun in 2004

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–34. Cumulative Impact Sites for Map 16

WIDS ID/ Building Number	Common Site Name	Site Type	Source Type	Volume Liquid (L)	Solid Volume (m^3)/ Mass (kg)	Time Start	Time Stop	Status/Future End State
618-9	300 West Burial Ground	Burial Ground	Solid	–	Unknown	1950	1956	Remediated in 1991; site exhumed and all waste removed
316-1	300 Area South Process Ponds	Pond	Liquid	5.11×10^{10}	–	1944	1975	Remediated and closed out; removal, treatment, and disposal planned
316-2	300 Area North Process Ponds	Pond	Liquid	3.73×10^{10}	–	1949	1975	Remediated and closed out; removal, treatment, and disposal planned
316-5	300 Area Process Trenches	Trench	Liquid	3.63×10^{10}	–	1975	1985	Remediated and closed out; removal, treatment, and disposal planned
UPR-300-1	307-340 Waste Line Leak	Unplanned Release	Liquid	Unknown	–	1969	1969	Top 2 feet of contaminated soil removed and disposed of in 200 Areas
300-19	324 Sodium Removal Pilot Plant	Process Unit/Plant	Liquid	Unknown	–	1979	1987	Reaction vessel decommissioned and removed in 1991
UPR-300-13	Acid Neutralization Tank Leak East of 333 Building	Unplanned Release	Liquid	4.93×10^{3}	–	1973	1973	Tank and contaminated soil removed
300-264	327 Building, Postirradiation Testing Laboratory	Laboratory	Liquid	Unknown	–	1953	1996	Currently in stabilization and deactivation stage
309-WS-1	309 Plutonium Recycle Test Reactor Ion Exchange Vault	Process Unit/Plant	Liquid	Unknown	–	1961	1969	Deactivated in 1995; vault decontaminated and residual contamination stabilized
316-3	307 Disposal Trenches	Trench	Liquid	1.00×10^{9}	–	1953	1963	Contaminated sediments excavated and removed in 1963; trench backfilled in 1965

Key: Dash (–)=not applicable; ID=identifier; kg=kilograms; L=liters; m^3=cubic meters; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–35a. Map 1: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
116-B-1	107-B Liquid Waste Disposal Trench	Liquid	1998	2.51×10^{-2}	–	–	4.98×10^{-2}	–	–	–
116-B-4	105-B Dummy Decontamination French Drain	Liquid	1998	–	–	–	–	–	–	–
116-B-5	108-B Crib	Liquid	1998	8.29×10^{1}	–	–	8.10×10^{-4}	–	–	–
116-B-6A	116-B-6-1 Crib	Liquid	1998	–	–	–	6.37×10^{-1}	–	–	–
116-B-6B	116-B-6-2 Crib	Liquid	1998	3.31×10^{-3}	–	–	1.33×10^{-4}	–	–	–
116-B-11	107-B Retention Basins	Liquid	1998	1.82	–	–	6.58×10^{-1}	–	–	–
116-C-5	107-C Retention Basins	Liquid	1998	3.68×10^{-1}	–	–	1.7	–	–	–
116-C-1	107-C Liquid Waste Disposal Trench	Liquid	1998	3.87×10^{-1}	–	–	1.16	–	–	–
116-C-2A	105-C Pluto Crib	Liquid	1998	1.38×10^{-1}	–	–	6.94×10^{-1}	–	–	–
116-C-2C	105-C Pluto Crib Sand Filter	Liquid	1998	1.24×10^{-1}	–	–	1.27	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–35b. Map 1: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
116-B-1	107-B Liquid Waste Disposal Trench	Liquid	1998	2.17×10^{-1}	–	–	6.15×10^{-9}	–	8.18×10^{-3}	–
116-B-4	105-B Dummy Decontamination French Drain	Liquid	1998	–	–	–	–	–	–	–
116-B-5	108-B Crib	Liquid	1998	1.46×10^{-3}	–	–	–	–	–	–
116-B-6A	116-B-6-1 Crib	Liquid	1998	1.05×10^{-1}	–	–	4.53×10^{-11}	–	2.00×10^{-3}	–
116-B-6B	116-B-6-2 Crib	Liquid	1998	1.46×10^{-4}	–	–	–	–	–	–
116-B-11	107-B Retention Basins	Liquid	1998	5.24	–	–	1.09×10^{-6}	–	9.13×10^{-1}	–
116-C-5	107-C Retention Basins	Liquid	1998	8.78×10^{-1}	–	–	6.06×10^{-7}	–	2.94×10^{-1}	–
116-C-1	107-C Liquid Waste Disposal Trench	Liquid	1998	4.10	–	–	2.94×10^{-9}	–	1.30×10^{-1}	–
116-C-2A	105-C Pluto Crib	Liquid	1998	5.86×10^{-4}	–	–	–	–	–	–
116-C-2C	105-C Pluto Crib Sand Filter	Liquid	1998	5.86	–	–	7.15×10^{-6}	–	1.20×10^{-1}	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–36a. Map 2: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
116-K-1	100-K Crib	Liquid	1998	–	–	–	4.39×10^{-1}	–	–	–
116-K-2	100-K Mile Long Trench	Liquid	1998	1.44×10^{1}	–	–	1.08×10^{1}	–	–	–
116-KE-4	107-KE Retention Basins	Liquid	1998	3.61×10^{-2}	–	–	9.40×10^{-2}	–	–	–
116-KW-3	107-KW Retention Basin	Liquid	1998	1.38×10^{-1}	–	–	4.65×10^{-2}	–	–	–
116-KE-1	115-KE Condensate Crib	Liquid	1998	5.65×10^{1}	1.10×10^{2}	–	–	–	–	–
116-KE-2	1706-KER Waste Crib	Liquid	1986	–	1.46×10^{1}	–	–	–	–	–
116-KW-1	115-KW Condensate Crib	Liquid	1998	3.59×10^{1}	–	–	4.40×10^{-3}	–	–	–
UPR-100-K-1[b]	100-KE Fuel Storage Basin Leak	Liquid	Unknown	–	–	–	–	–	–	–
120-KE-1	183-KE Filter Waste Facility Drywell	Liquid/ Solid	N/A	–	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System ; Zr=zirconium.

Source: SAIC 2006.

Table S–36b. Map 2: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
116-K-1	100-K Crib	Liquid	1998	1.29×10^{1}	–	–	8.38×10^{-7}	–	1.41×10^{-1}	–
116-K-2	100-K Mile Long Trench	Liquid	1998	1.06×10^{2}	–	–	1.14×10^{-5}	–	4.99	–
116-KE-4	107-KE Retention Basins	Liquid	1998	9.97×10^{-1}	–	–	1.26×10^{-9}	–	5.38×10^{-4}	–
116-KW-3	107-KW Retention Basin	Liquid	1998	3.02×10^{-1}	–	–	8.19×10^{-11}	–	3.61×10^{-3}	–
116-KE-1	115-KE Condensate Crib	Liquid	1998	–	–	–	–	–	–	–
116-KE-2	1706-KER Waste Crib	Liquid	–	–	–	–	–	–	–	–
116-KW-1	115-KW Condensate Crib	Liquid	1998	2.58×10^{-3}	–	–	–	–	–	–
UPR-100-K-1[b]	100-KE Fuel Storage Basin Leak	Liquid	Unknown	–	–	–	–	–	1.30	–
120-KE-1	183-KE Filter Waste Facility Drywell	Liquid/ Solid	N/A	–	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–37a. Map 3: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
116-N-1	1301-N Liquid Waste Disposal Facility	Liquid	1998	5.29×10^{3}	–	–	1.61×10^{3}	–	–	–
116-N-3	1325-N Liquid Waste Disposal Facility	Liquid	1998	3.23×10^{2}	–	–	1.61×10^{2}	–	–	–
UPR-100-N-3	Spacer Disposal System Transport Line Leak	Liquid	1978	1.00	–	–	8.00×10^{-1}	–	–	–
UPR-100-N-7	Rad Line Leak	Liquid	1985	–	–	–	–	–	8.00×10^{-1}	–
UPR-100-N-35[b]	100-N Fuel Storage Basin Drainage System Leak	Liquid	1986	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–37b. Map 3: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
116-N-1	1301-N Liquid Waste Disposal Facility	Liquid	1998	2.11×10^{3}	–	–	2.72×10^{-7}	–	2.30×10^{1}	–
116-N-3	1325-N Liquid Waste Disposal Facility	Liquid	1998	2.92×10^{2}	–	–	5.49×10^{-2}	–	2.80	–
UPR-100-N-3	Spacer Disposal System Transport Line Leak	Liquid	1978	2.50×10^{-1}	–	–	–	–	4.00×10^{-4}	–
UPR-100-N-7	Rad Line Leak	Liquid	1985	–	–	–	–	–	–	–
UPR-100-N-35[b]	100-N Fuel Storage Basin Drainage System Leak	Liquid	1986	4.00×10^{-1}	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–38a. Map 4: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
116-D-1A	105-D Storage Basin Trenches 1	Liquid	1998	3.87×10^{-1}	–	–	8.68×10^{-2}	–	–	–
116-D-1B	105-D Storage Basin Trenches 2	Liquid	1998	5.52×10^{-2}	–	–	1.16×10^{-1}	–	–	–
116-D-7	107-D Retention Basin	Liquid	1998	2.49×10^{-1}	–	–	1.62×10^{-1}	–	–	–
116-DR-9	107-DR Retention Basin	Liquid	1998	9.39×10^{-3}	–	–	1.43×10^{-1}	–	–	–
100-D-25[b]	107-DR Basin Leaks	Liquid	1998	1.52×10^{-1}	–	–	2.20×10^{-1}	–	–	–
UPR-100-D-4[b]	107-D Basin Leaks	Liquid	1998	4.06×10^{-1}	–	–	1.12×10^{-1}	–	–	–
116-DR-1&2	107-DR Liquid Waste Disposal Trenches	Liquid	1998	1.96×10^{-1}	–	–	2.14×10^{-1}	–	–	–
116-DR-6	1608-DR Liquid Disposal Trench	Liquid	N/A	–	–	–	–	–	–	–
116-DR-7	105-DR Inkwell Crib	Liquid	1986	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–38b. Map 4: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
116-D-1A	105-D Storage Basin Trenches 1	Liquid	1998	7.61×10^{-1}	–	–	4.53×10^{-10}	–	2.00×10^{-2}	–
116-D-1B	105-D Storage Basin Trenches 2	Liquid	1998	3.63×10^{-1}	–	–	1.52×10^{-10}	–	–	–
116-D-7	107-D Retention Basin	Liquid	1998	1.68	–	–	6.17×10^{-7}	–	1.40×10^{-1}	–
116-DR-9	107-DR Retention Basin	Liquid	1998	2.68	–	–	9.32×10^{-8}	–	6.86×10^{-2}	–
100-D-25[b]	107-DR Basin Leaks	Liquid	1998	3.29	–	–	9.85×10^{-10}	–	4.34×10^{-2}	–
UPR-100-D-4[b]	107-D Basin Leaks	Liquid	1998	2.17	–	–	6.72×10^{-8}	–	6.99×10^{-2}	–
116-DR-1&2	107-DR Liquid Waste Disposal Trenches	Liquid	1998	9.37	–	–	7.92×10^{-10}	–	3.49×10^{-2}	–
116-DR-6	1608-DR Liquid Disposal Trench	Liquid	N/A	–	–	–	–	–	–	–
116-DR-7	105-DR Inkwell Crib	Liquid	1986	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–39a. Map 5: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
100-H-33	183-H Solar Evaporation Basins Radionuclide Components	Liquid	N/A	–	–	–	–	–	–	–
116-H-6	183-H Solar Evaporation Basins	Liquid	N/A	Site consolidated with Site WIDS ID 100-H-33						
116-H-1	107-H Liquid Disposal Trench	Liquid	1998	1.35×10^{-2}	–	–	5.32×10^{-1}	–	–	–
116-H-2	1608-H Liquid Waste Disposal Trench	Liquid	1998	–	–	–	–	–	–	–
116-H-4	105-H Pluto Crib	Liquid	N/A	–	–	–	–	–	–	–
116-H-7	107-H Retention Basin	Liquid	1998	4.27×10^{-1}	–	–	5.76×10^{-1}	–	–	–
116-H-3	105-H Dummy Decontamination French Drain	Liquid	1998	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–39b. Map 5: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
100-H-33	183-H Solar Evaporation Basins Radionuclide Components	Liquid	N/A	–	–	–	–	–	–	–
116-H-6	183-H Solar Evaporation Basins	Liquid	N/A	Site consolidated with Site WIDS ID 100-H-33						
116-H-1	107-H Liquid Disposal Trench	Liquid	1998	2.69	–	–	1.99×10^{-7}	–	6.68×10^{-2}	–
116-H-2	1608-H Liquid Waste Disposal Trench	Liquid	1998	–	–	–	–	–	–	–
116-H-4	105-H Pluto Crib	Liquid	N/A	–	–	–	–	–	–	–
116-H-7	107-H Retention Basin	Liquid	1998	6.43	–	–	3.46×10^{-7}	–	2.36×10^{-1}	–
116-H-3	105-H Dummy Decontamination French Drain	Liquid	1998	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–40a. Map 6: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
116-F-1[b]	Lewis Canal	Liquid	1998	8.84×10^{-2}	–	–	3.65×10^{-2}	–	–	–
116-F-2	107-F Liquid Waste Disposal Trench	Liquid	1998	1.64×10^{-1}	–	–	4.92×10^{-2}	–	–	–
116-F-9	Animal Waste Leaching Trench	Liquid	1986	–	–	–	1.96	–	–	–
116-F-3	105-F Storage Basin Trench	Liquid	1998	–	–	–	–	–	–	–
116-F-6	105-F Cooling Water Trench	Liquid	1998	6.35×10^{-1}	–	–	1.22×10^{-1}	–	–	–
116-F-4	105-F Pluto Crib	Liquid	1998	4.70×10^{-3}	–	–	7.52×10^{-1}	–	–	–
116-F-10	105-F Dummy Decontamination French Drain	Liquid	N/A	–	–	–	–	–	–	–
116-F-14	107-F Retention Basin	Liquid	1998	1.96×10^{-1}	–	–	1.19×10^{-1}	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because it emptied directly into the Columbia River.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–40b. Map 6: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
116-F-1[b]	Lewis Canal	Liquid	1998	6.44×10^{-1}	–	–	1.49×10^{-10}	–	6.58×10^{-3}	–
116-F-2	107-F Liquid Waste Disposal Trench	Liquid	1998	5.39×10^{-1}	–	–	1.85×10^{-10}	–	8.18×10^{-3}	–
116-F-9	Animal Waste Leaching Trench	Liquid	1986	9.10×10^{-2}	–	–	–	–	7.00×10^{-3}	–
116-F-3	105-F Storage Basin Trench	Liquid	1998	–	–	–	–	–	–	–
116-F-6	105-F Cooling Water Trench	Liquid	1998	3.86×10^{-1}	–	–	2.22×10^{-10}	–	9.78×10^{-3}	–
116-F-4	105-F Pluto Crib	Liquid	1998	1.11	–	–	3.44×10^{-8}	–	4.19×10^{-2}	–
116-F-10	105-F Dummy Decontamination French Drain	Liquid	N/A	–	–	–	–	–	–	–
116-F-14	107-F Retention Basin	Liquid	1998	1.48	–	–	1.79×10^{-9}	–	7.91×10^{-2}	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because it emptied directly into the Columbia River.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–41a. Map 7: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-N-1	216-N-1 Pond	Liquid	2001	–	–	–	–	–	–	–
216-N-2	216-N-2 Trench	Liquid	2001	4.27×10^{-4}	8.26×10^{-6}	–	4.74×10^{-2}	1.94×10^{-5}	1.76×10^{-4}	1.76×10^{-7}
216-N-3	216-N-3 Trench	Liquid	2001	4.27×10^{-4}	8.26×10^{-6}	–	4.74×10^{-2}	1.94×10^{-5}	1.76×10^{-4}	1.76×10^{-7}
216-N-4	216-N-4 Pond	Liquid	2001	4.28×10^{-4}	8.27×10^{-6}	–	4.75×10^{-2}	1.94×10^{-5}	1.76×10^{-4}	1.76×10^{-7}
216-N-5	216-N-5 Trench	Liquid	2001	4.27×10^{-4}	8.25×10^{-6}	–	4.74×10^{-2}	1.94×10^{-5}	1.76×10^{-4}	1.76×10^{-7}
216-N-6	216-N-6 Pond	Liquid	2001	4.28×10^{-4}	8.27×10^{-6}	–	4.75×10^{-2}	1.94×10^{-5}	1.76×10^{-4}	1.76×10^{-7}
216-N-7	216-N-7 Trench	Liquid	2001	4.27×10^{-4}	8.25×10^{-6}	–	4.74×10^{-2}	1.94×10^{-5}	1.76×10^{-4}	1.76×10^{-7}

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–41b. Map 7: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-N-1	216-N-1 Pond	Liquid	2001	–	–	5.02×10^{-15}	3.90×10^{-4}	4.78×10^{-8}	3.17×10^{-5}	–
216-N-2	216-N-2 Trench	Liquid	2001	3.89×10^{-1}	–	1.05×10^{-14}	1.51×10^{-5}	1.09×10^{-6}	2.22×10^{-4}	6.18×10^{-5}
216-N-3	216-N-3 Trench	Liquid	2001	3.89×10^{-1}	–	1.05×10^{-14}	1.51×10^{-5}	1.09×10^{-6}	2.22×10^{-4}	6.18×10^{-5}
216-N-4	216-N-4 Pond	Liquid	2001	3.90×10^{-1}	–	1.57×10^{-14}	4.02×10^{-4}	1.14×10^{-6}	2.54×10^{-4}	6.18×10^{-5}
216-N-5	216-N-5 Trench	Liquid	2001	3.90×10^{-1}	–	1.05×10^{-14}	1.50×10^{-5}	1.09×10^{-6}	2.22×10^{-4}	6.18×10^{-5}
216-N-6	216-N-6 Pond	Liquid	2001	3.90×10^{-1}	–	1.55×10^{-14}	4.02×10^{-4}	1.14×10^{-6}	2.53×10^{-4}	6.18×10^{-5}
216-N-7	216-N-7 Trench	Liquid	2001	3.90×10^{-1}	–	1.05×10^{-14}	1.51×10^{-5}	1.09×10^{-6}	2.22×10^{-4}	6.18×10^{-5}

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–42a. Map 8: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-A-25	216-A-25 Gable Mountain Pond	Liquid	2001	8.75×10^{2}	3.49×10^{1}	–	1.83×10^{2}	3.26×10^{-1}	1.71	1.40×10^{-2}
UPR-200-E-34	UPR-200-E-34	Liquid	N/A	Site consolidated with Site WIDS ID 216-A-25						
600-118	600-118 Ditch	Liquid	N/A	Site consolidated with Site WIDS ID 216-A-25						

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–42b. Map 8: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-A-25	216-A-25 Gable Mountain Pond	Liquid	2001	7.26×10^{3}	–	4.91×10^{-9}	9.23	1.17×10^{-1}	3.76×10^{1}	2.84
UPR-200-E-34	UPR-200-E-34	Liquid	N/A	Site consolidated with Site WIDS ID 216-A-25						
600-118	600-118 Ditch	Liquid	N/A	Site consolidated with Site WIDS ID 216-A-25						

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–43a. Map 9: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-S-5	216-S-5 Crib	Liquid	2001	3.30	1.08×10^{-3}	–	3.14×10^{1}	3.11×10^{-3}	2.59×10^{-2}	3.15×10^{-5}
216-S-6	216-S-6 Crib	Liquid	2001	3.55	9.23×10^{-5}	–	5.83	2.37×10^{-3}	1.60×10^{-2}	2.80×10^{-3}
216-S-10D[b]	216-S-10D Ditch	Liquid	1998	–	–	–	8.67×10^{-1}	–	–	–
216-S-10P	216-S-10P Pond	Liquid	2001	1.05	2.55	–	8.28×10^{-1}	1.83×10^{-3}	1.15×10^{-2}	1.81×10^{-5}
216-S-11	216-S-11P Pond	Liquid	1998	–	–	–	6.57×10^{-1}	2.24×10^{-5}	9.95×10^{-5}	–
216-S-16D[b]	216-S-16D Ditch	Liquid	N/A	–	–	–	–	–	–	–
216-S-16P	216-S-16P Pond	Liquid	2001	2.60	8.47×10^{-4}	–	1.37	3.75×10^{-3}	2.88×10^{-2}	3.50×10^{-5}
216-S-17	216-S-17 Pond	Liquid	2001	7.31×10^{-1}	1.62×10^{-3}	–	7.13	4.65×10^{-3}	2.95×10^{-2}	4.71×10^{-5}
UPR-200-W-47	UPR-200-W-47	Liquid	N/A	Site consolidated with Site WIDS ID 216-S-16P						
UPR-200-W-59	UPR-200-W-59	Liquid	N/A	Site consolidated with Site WIDS ID 216-S-16P						
UPR-200-W-34	UPR-200-W-34	Liquid	N/A	Site consolidated with Site WIDS ID 216-S-10D						
218-W-1	218-W-1 Burial Ground	Solid	1986	–	–	–	3.88	–	–	–
218-W-2	218-W-2 Burial Ground	Solid	1986	–	–	–	9.70	–	–	–
218-W-4B	218-W-4B Burial Ground	Solid	1995	5.23×10^{4}	1.14×10^{1}	–	1.48×10^{4}	–	–	5.00×10^{-1}
218-W-4C	218-W-4C Burial Ground	Solid	1995	3.29×10^{4}	2.63	2.00×10^{-4}	7.33×10^{3}	5.70×10^{-4}	1.64×10^{1}	1.46×10^{-3}
218-W-5	218-W-5 Burial Ground	Solid	1995	5.82×10^{4}	5.33	5.42×10^{-2}	1.05×10^{5}	1.03×10^{-3}	1.42×10^{2}	3.66×10^{-2}
218-W-3AE	218-W-3AE Burial Ground	Solid	1995	7.03×10^{4}	1.46×10^{1}	6.24×10^{-2}	8.65×10^{4}	7.84	3.50×10^{1}	4.46×10^{-4}
218-W-3A	218-W-3A Burial Ground	Solid	1995	1.35×10^{5}	2.91×10^{2}	1.25×10^{-4}	9.85×10^{4}	1.83×10^{-5}	2.54×10^{-1}	1.44×10^{-2}
Z Plant BP	Z Plant Burning Pit	Solid	N/A	Site consolidated with Site WIDS ID 218-W-4C						

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–43b. Map 9: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-S-5	216-S-5 Crib	Liquid	2001	5.63×10^{1}	–	1.89×10^{-14}	7.42×10^{-1}	1.37×10^{-4}	1.73×10^{-2}	1.02×10^{-2}
216-S-6	216-S-6 Crib	Liquid	2001	1.13×10^{1}	–	3.26×10^{-12}	5.77×10^{-1}	1.74×10^{-3}	2.98×10^{-1}	5.49×10^{-2}
216-S-10D[b]	216-S-10D Ditch	Liquid	1998	1.02	–	2.52×10^{-14}	6.91×10^{-11}	–	8.17×10^{-3}	1.87×10^{-2}
216-S-10P	216-S-10P Pond	Liquid	2001	3.76×10^{1}	–	2.56×10^{-10}	4.15×10^{-1}	4.60×10^{-2}	1.97×10^{1}	5.31×10^{1}
216-S-11	216-S-11 Pond	Liquid	1998	6.65×10^{-1}	–	2.57×10^{-15}	–	–	–	–
216-S-16D[b]	216-S-16D Ditch	Liquid	N/A	–	–	–	–	–	–	–
216-S-16P	216-S-16P Pond	Liquid	2001	7.07×10^{1}	–	2.96×10^{-14}	4.44×10^{-1}	1.37×10^{-4}	6.14×10^{-3}	6.68×10^{-3}
216-S-17	216-S-17 Pond	Liquid	2001	8.41×10^{-1}	–	2.81×10^{-14}	2.39×10^{-3}	2.07×10^{-4}	8.55×10^{-3}	8.08×10^{-3}
UPR-200-W-47	UPR-200-W-47	Liquid	N/A	Site consolidated with Site WIDS ID 216-S-16P						
UPR-200-W-59	UPR-200-W-59	Liquid	N/A	Site consolidated with Site WIDS ID 216-S-16P						
UPR-200-W-34	UPR-200-W-34	Liquid	N/A	Site consolidated with Site WIDS ID 216-S-10D						
218-W-1	218-W-1 Burial Ground	Solid	1986	4.15	–	–	2.35×10^{-2}	–	6.82×10^{3}	–
218-W-2	218-W-2 Burial Ground	Solid	1986	1.04×10^{1}	–	–	4.69×10^{-1}	–	9.13×10^{3}	–
218-W-4B	218-W-4B Burial Ground	Solid	1995	1.63×10^{4}	–	–	–	–	–	–
218-W-4C	218-W-4C Burial Ground	Solid	1995	5.75×10^{4}	–	–	7.28×10^{1}	8.26×10^{-3}	1.73×10^{4}	1.61×10^{4}
218-W-5	218-W-5 Burial Ground	Solid	1995	3.25×10^{3}	–	–	6.54×10^{2}	3.47×10^{-2}	1.46×10^{2}	3.86
218-W-3AE	218-W-3AE Burial Ground	Solid	1995	1.29×10^{5}	–	–	1.85×10^{2}	6.79×10^{-2}	3.69×10^{1}	1.11×10^{2}
218-W-3A	218-W-3A Burial Ground	Solid	1995	2.70×10^{5}	3.39×10^{-3}	–	–	–	–	–
Z Plant BP	Z Plant Burning Pit	Solid	N/A	Site consolidated with Site WIDS ID 218-W-4C						

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–44a. Map 9A: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
218-W-3	218-W-3 Burial Ground	Solid	Varies based on time of disposal	–	–	–	1.75×10^{1}	–	–	–
218-W-4A	218-W-4A Burial Ground	Solid	1986	–	–	–	5.84×10^{1}	–	–	–
218-W-2A	218-W-2A Burial Ground	Solid	Varies based on time of disposal	–	–	–	2.98×10^{3}	–	–	–
UPR-200-W-84	UPR-200-W-84	Liquid	UPR-200-W-84	Site consolidated with Site WIDS ID 218-W-3A						
UPR-200-W-134	UPR-200-W-134	Solid	UPR-200-W-134	Site consolidated with Site WIDS ID 218-W-3A						
UPR-200-W-53	UPR-200-W-53	Liquid	UPR-200-W-53	Site consolidated with Site WIDS ID 218-W-2A						
UPR-200-W-72	UPR-200-W-72	Solid	UPR-200-W-72	Site consolidated with Site WIDS ID 218-W-4A						
UPR-200-W-16	UPR-200-W-16	Solid	UPR-200-W-16	Site consolidated with Site WIDS ID 218-W-1						
216-T-4A	216-T-4A Pond	Liquid	2001	1.25×10^{3}	1.11×10^{-4}	–	2.87	2.60×10^{-4}	6.68×10^{-2}	4.36×10^{-4}
216-T-4B	216-T-4B Pond	Liquid	1998	Site consolidated with Site WIDS ID 216-T-4A						
216-T-36	216-T-36 Crib	Liquid	2001	1.24×10^{-3}	1.19×10^{-5}	–	6.16×10^{-1}	2.96×10^{-5}	2.15×10^{-4}	2.98×10^{-4}
216-T-4-2	216-T-4-2 Ditch	Liquid	N/A	Site consolidated with Site WIDS ID 216-T-4A						
UPR-200-W-97	UPR-200-W-97 Unplanned Release	Liquid	2001	5.57×10^{-6}	1.76×10^{-5}	–	1.87×10^{-2}	4.78×10^{-4}	9.49×10^{-6}	–
UPR-200-W-29	UPR-200-W-29 Unplanned Release	Liquid	2001	2.31×10^{-2}	3.06×10^{-4}	–	2.54×10^{-1}	4.67×10^{-3}	7.66×10^{-4}	6.68×10^{-6}
216-T-13	216-T-13 Trench	Liquid	1972	–	–	–	1.00×10^{-1}	–	–	–
216-T-27	216-T-27 Crib	Liquid	2001	8.35×10^{-3}	1.10×10^{-1}	–	4.15	2.00×10^{-4}	1.43×10^{-3}	–
216-TY-201	216-TY-201 Settling Tank	Liquid	N/A	–	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–44b. Map 9A: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
218-W-3	218-W-3 Burial Ground	Solid	Varies based on time of disposal	1.87×10^{1}	–	–	2.35×10^{1}	–	4.93×10^{3}	–
218-W-4A	218-W-4A Burial Ground	Solid	1986	6.25×10^{1}	–	–	1.32×10^{2}	–	2.57×10^{3}	–
218-W-2A	218-W-2A Burial Ground	Solid	Varies based on time of disposal	3.18×10^{3}	–	–	–	–	–	–
UPR-200-W-84	UPR-200-W-84	Liquid	UPR-200-W-84	Site consolidated with Site WIDS ID 218-W-3A						
UPR-200-W-134	UPR-200-W-134	Solid	UPR-200-W-134	Site consolidated with Site WIDS ID 218-W-3A						
UPR-200-W-53	UPR-200-W-53	Liquid	UPR-200-W-53	Site consolidated with Site WIDS ID 218-W-2A						
UPR-200-W-72	UPR-200-W-72	Solid	UPR-200-W-72	Site consolidated with Site WIDS ID 218-W-4A						
UPR-200-W-16	UPR-200-W-16	Solid	UPR-200-W-16	Site consolidated with Site WIDS ID 218-W-1						
216-T-4A	216-T-4A Pond	Liquid	2001	5.50	–	5.15×10^{-11}	4.12×10^{-1}	1.63×10^{-4}	6.26×10^{-2}	8.30×10^{-4}
216-T-4B	216-T-4B Pond	Liquid	1998	Site consolidated with Site WIDS ID 216-T-4A						
216-T-36	216-T-36 Crib	Liquid	2001	7.26×10^{-1}	–	3.46×10^{-8}	1.32	4.52×10^{-7}	2.28×10^{1}	7.96×10^{-4}
216-T-4-2	216-T-4-2 Ditch	Liquid	N/A	Site consolidated with Site WIDS ID 216-T-4A						
UPR-200-W-97	UPR-200-W-97 Unplanned Release	Liquid	2001	2.18×10^{-2}	–	2.87×10^{-3}	1.04×10^{-5}	3.93×10^{-6}	1.13×10^{-2}	2.76×10^{-4}
UPR-200-W-29	UPR-200-W-29 Unplanned Release	Liquid	2001	1.73	–	1.26×10^{-12}	7.92×10^{-5}	1.76×10^{-5}	2.13×10^{-4}	1.97×10^{-3}
216-T-13	216-T-13 Trench	Liquid	1972	1.00×10^{-1}	–	–	–	–	–	–
216-T-27	216-T-27 Crib	Liquid	2001	4.94	–	2.33×10^{-7}	8.17×10^{-2}	3.33×10^{-3}	1.98	2.30
216-TY-201	216-TY-201 Settling Tank	Liquid	N/A		–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–45a. Map 9B: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-T-12	216-T-12 Trench	Liquid	2001	7.92×10^{1}	4.04×10^{-4}	–	3.60×10^{-1}	6.18×10^{-3}	8.43×10^{-3}	8.82×10^{-6}
218-W-1A	218-W-1A Burial Ground	Solid	Varies based on time of disposal	–	–	–	9.32×10^{2}	–	–	–
UPR-200-W-26	UPR-200-W-26	Solid		Site consolidated with Site WIDS ID 218-W-1A						
216-T-29	216-T-29 Crib	Liquid	2001	4.57×10^{-5}	8.83×10^{-7}	–	5.07×10^{-3}	2.07×10^{-6}	1.88×10^{-5}	1.88×10^{-8}
216-T-33	216-T-33 Crib	Liquid	2001	7.66×10^{-1}	1.21×10^{-6}	–	6.03×10^{-2}	3.01×10^{-6}	4.13×10^{-3}	2.93×10^{-5}
216-T-34	216-T-34 Crib	Liquid	2001	3.68×10^{-4}	8.66×10^{-2}	–	1.74×10^{-1}	1.11×10^{-5}	7.37×10^{-5}	8.21×10^{-3}
216-T-35	216-T-35 Crib	Liquid	2001	–	1.50×10^{-1}	–	7.13×10^{-3}	–	–	–
216-T-1	216-T-1 Ditch (221-T Ditch)	Liquid	2001	4.23×10^{-2}	6.27×10^{-4}	–	2.70	1.06×10^{-4}	9.66×10^{-4}	9.63×10^{-7}
216-T-2	216-T-2 Reverse Well	Liquid	2001	7.14×10^{-3}	1.38×10^{-4}	–	7.92×10^{-1}	3.24×10^{-4}	2.94×10^{-3}	2.94×10^{-6}
216-T-3	216-T-3 Reverse Well	Liquid	2001	2.02×10^{-5}	4.14×10^{-3}	–	1.70	3.57×10^{-2}	9.57×10^{-4}	4.24×10^{-7}
216-T-6	216-T-6 Cribs	Liquid	2001	2.13×10^{-4}	1.48×10^{-2}	–	1.40×10^{1}	4.01×10^{-1}	7.87×10^{-3}	3.49×10^{-6}
216-T-8	216-T-8 Crib	Liquid	2001	4.38×10^{-4}	7.87×10^{-5}	–	1.52×10^{1}	2.80×10^{-6}	1.94×10^{-4}	2.17×10^{-7}
200-W-45	200-W-45 Sand Filter	Solid	1994	–	–	–	2.90×10^{1}	–	–	–
200-W-20	2706-T Equipment Decontamination Building	Solid	1994	–	–	–	1.50×10^{1}	–	–	–
200-W-20	T Plant Complex (including 221-T)	Solid	1994	–	6.66×10^{1}	–	1.66×10^{4}	–	4.03×10^{1}	1.40×10^{1}
224-T	224-T Canyon	Liquid/ Solid	2003	–	–	–		–	–	–
200-W-9	200-W-9 Unplanned Release	Liquid	2001	1.61×10^{-4}	3.12×10^{-6}	–	1.79×10^{-2}	7.33×10^{-6}	6.66×10^{-5}	6.64×10^{-8}
UPR-200-W-2[b]	UPR-200-W-2 Unplanned Release	Liquid	2001	1.43×10^{-1}	3.80×10^{-3}	–	3.04×10^{1}	4.73×10^{-5}	8.43×10^{-2}	3.72×10^{-5}
UPR-200-W-21	UPR-200-W-21	Liquid	2001	2.87×10^{-1}	4.77×10^{-3}	–	2.75×10^{1}	7.08×10^{-5}	1.28×10^{-1}	1.46×10^{-4}
UPR-200-W-38	UPR-200-W-38 Unplanned Release	Liquid	2001	1.99×10^{-1}	3.31×10^{-3}	–	1.91×10^{1}	4.89×10^{-5}	8.87×10^{-2}	1.01×10^{-4}
UPR-200-W-98[b]	UPR-200-W-98 Unplanned Release	Liquid	2001	3.84×10^{-3}	1.03×10^{-4}	–	8.14×10^{-1}	1.26×10^{-6}	2.27×10^{-3}	1.01×10^{-6}
UPR-200-W-102	UPR-200-W-102 Unplanned Release	Liquid	2001	3.98×10^{-7}	1.65×10^{-5}	–	2.96×10^{-3}	–	1.51×10^{-6}	–
TRUSAF	TRUSAF (in 224-T Canyon)	Liquid/ Solid	1985	–	–	–	2.20×10^{1}	–	–	–
241-T-361	241-T-361 Settling Tank	Liquid/ Solid	Unknown	–	–	–	8.72×10^{2}	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–45b. Map 9B: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-T-12	216-T-12 Trench	Liquid	2001	2.29	–	1.67×10^{-12}	1.46×10^{-1}	2.42×10^{-5}	2.47×10^{-3}	2.60×10^{-3}
218-W-1A	218-W-1A Burial Ground	Solid	Varies based on time of disposal	9.97×10^{2}	–	–	3.02×10^{-1}	–	1.45×10^{2}	–
UPR-200-W-26	UPR-200-W-26	Solid		Site consolidated with Site WIDS ID 218-W-1A						
216-T-29	216-T-29 Crib	Liquid	2001	4.17×10^{-2}	–	1.12×10^{-15}	1.29×10^{-6}	1.16×10^{-7}	2.37×10^{-5}	6.60×10^{-6}
216-T-33	216-T-33 Crib	Liquid	2001	7.34×10^{-2}	–	3.37×10^{-9}	1.57×10^{-1}	4.95×10^{-8}	2.24	7.86×10^{-5}
216-T-34	216-T-34 Crib	Liquid	2001	3.08×10^{-1}	–	9.51×10^{-9}	3.73×10^{-1}	1.21×10^{-3}	6.99	1.81
216-T-35	216-T-35 Crib	Liquid	2001	7.71×10^{-2}	–	9.44×10^{-12}	2.39×10^{-2}	2.10×10^{-3}	1.19	3.14
216-T-1	216-T-1 Ditch (221-T Ditch)	Liquid	2001	2.42	–	9.30×10^{-14}	1.53×10^{-4}	2.04×10^{-5}	7.17×10^{-3}	3.56×10^{-4}
216-T-2	216-T-2 Reverse Well	Liquid	2001	6.51	–	1.74×10^{-13}	2.02×10^{-4}	1.82×10^{-5}	3.70×10^{-3}	1.03×10^{-3}
216-T-3	216-T-3 Reverse Well	Liquid	2001	1.95	–	2.82×10^{-10}	1.36×10^{-3}	3.35×10^{-3}	1.77×10^{1}	7.26×10^{-2}
216-T-6	216-T-6 Cribs	Liquid	2001	1.60×10^{1}	–	2.78×10^{-10}	1.41×10^{-2}	3.31×10^{-3}	1.61×10^{1}	7.17×10^{-2}
216-T-8	216-T-8 Crib	Liquid	2001	4.41×10^{-1}	–	4.47×10^{-15}	3.21×10^{-2}	1.12×10^{-6}	1.22×10^{-3}	7.64×10^{-5}
200-W-45	200-W-45 Sand Filter	Solid	1994	3.30×10^{1}	–	–	–	–	4.10	–
200-W-20	2706-T Equipment Decontamination Building	Solid	1994	1.50×10^{1}	–	–	–	–	2.50	1.50×10^{-1}
200-W-20	T Plant Complex (including 221-T)	Solid	1994	5.24×10^{4}	–	–	1.26×10^{1}	–	7.49×10^{1}	5.49×10^{1}
224-T	224-T Canyon	Liquid/ Solid	2003	–	–	–	–	–	1.70	1.86×10^{1}
200-W-9	200-W-9 Unplanned Release	Liquid	2001	1.47×10^{-1}	–	3.95×10^{-15}	4.57×10^{-6}	4.11×10^{-7}	8.38×10^{-5}	2.34×10^{-5}
UPR-200-W-2[b]	UPR-200-W-2 Unplanned Release	Liquid	2001	1.72×10^{2}	–	1.72×10^{-12}	7.91×10^{-3}	4.77×10^{-4}	5.30×10^{-2}	1.03×10^{-2}
UPR-200-W-21	UPR-200-W-21	Liquid	2001	2.92×10^{2}	–	2.28×10^{-12}	7.12×10^{-3}	7.35×10^{-4}	6.49×10^{-2}	5.14×10^{-2}
UPR-200-W-38	UPR-200-W-38 Unplanned Release	Liquid	2001	2.03×10^{2}	–	1.59×10^{-12}	4.94×10^{-3}	5.09×10^{-4}	4.50×10^{-2}	3.58×10^{-2}
UPR-200-W-98[b]	UPR-200-W-98 Unplanned Release	Liquid	2001	4.59	–	4.61×10^{-14}	2.12×10^{-4}	1.28×10^{-5}	1.41×10^{-3}	2.76×10^{-4}
UPR-200-W-102	UPR-200-W-102 Unplanned Release	Liquid	2001	3.46×10^{-3}	–	1.34×10^{-12}	3.60×10^{-7}	1.84×10^{-5}	4.01	1.29×10^{-3}
TRUSAF	TRUSAF (in 224-T Canyon)	Liquid/ Solid	1985	1.10	–	–	–	–	3.10×10^{1}	5.00
241-T-361	241-T-361 Settling Tank	Liquid/ Solid	Unknown	4.91×10^{3}	–	–	–	–	1.39×10^{4}	1.60×10^{3}

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–46a. Map 9C: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-Z-16	216-Z-16 Crib	Liquid	2001	–	–	–	4.39×10^{-5}	1.23×10^{-6}	5.45×10^{-6}	–
231-Z	231-Z Plutonium Isolation Facility	Solid	2003	–	–	–	–	–	–	–
216-Z-4	216-Z-4 Trench	Liquid	2001	–	–	–	2.28×10^{-1}	1.00×10^{-6}	4.47×10^{-6}	–
216-Z-5	216-Z-5 Crib	Liquid	2001	–	–	–	3.69	1.62×10^{-5}	7.21×10^{-5}	–
216-Z-6	216-Z-6 Crib	Liquid	2001	–	–	–	4.86×10^{-1}	2.13×10^{-6}	9.50×10^{-6}	–
216-Z-7	216-Z-7 Crib	Liquid	2001	1.55×10^{-3}	1.50×10^{-5}	–	1.54×10^{2}	7.10×10^{-4}	3.26×10^{-3}	3.71×10^{-3}
216-Z-8	216-Z-8 Trench	Liquid	2001	–	–	–	2.95×10^{-12}	–	–	–
216-Z-9	216-Z-9 Trench	Liquid	2001	–	–	–	5.96×10^{-2}	7.87×10^{-6}	3.50×10^{-5}	–
216-Z-10	216-Z-10 Reverse Well	Liquid	2001	–	–	–	4.78	2.10×10^{-5}	9.33×10^{-5}	–
UPR-200-W-130[b]	UPR-200-W-130	Liquid	2001	–	–	–	1.43×10^{-10}	3.91×10^{-12}	1.76×10^{-11}	–
216-Z-17	216-Z-17 Trench	Liquid	2001	–	–	–	1.58×10^{-5}	4.42×10^{-7}	1.97×10^{-6}	–
216-Z-15	216-Z-15 French Drain	Liquid	2001	–	–	–	1.63×10^{-8}	–	–	–
234-5Z[c]	234-5Z Plutonium Finishing Plant	Solid	N/A	–	–	–	–	–	–	–
2736-Z	2736-Z Plutonium Finishing Plant	Liquid/ Solid	Unknown	–	–	–	–	–	–	–
242-Z	242-Z Americium Recovery Facility	Solid	Unknown	–	–	–	–	–	–	–
216-Z-1D[d]	216-Z-1(D) Ditch	Liquid	1986	–	–	–	–	–	–	–
236-Z	236-Z Plutonium Reclamation Facility	Solid	Unknown	–	–	–	–	–	–	–
216-Z-14	216-Z-14 French Drain	Liquid	2001	–	–	–	1.57×10^{-8}	–	–	–
291-Z	291-Z Exhaust Fan and Compressor House	Solid	N/A	–	–	–	–	–	–	–
UPR-200-W-103	UPR-200-W-103	Liquid	2001	–	–	–	–	–	–	–
241-Z[c]	241-Z Treatment Tank	Liquid	N/A	–	–	–	–	–	–	–
241-Z-361	241-Z-361 Settling Tank	Liquid	N/A	–	–	–	–	–	–	–
216-Z-13	216-Z-13 French Drain	Liquid	2001	–	–	–	1.51×10^{-8}	–	–	–
216-Z-1&2	216-Z-1 & 2 Cribs	Liquid	2001	–	–	–	1.68×10^{-2}	1.07×10^{-6}	4.77×10^{-6}	–
216-Z-3	216-Z-3 Crib	Liquid	2001	–	–	–	3.20×10^{-1}	1.89×10^{-6}	8.39×10^{-6}	–
216-Z-12	216-Z-12 Crib	Liquid	2001	–	–	–	7.05×10^{-1}	4.75×10^{-5}	2.11×10^{-4}	–
216-Z-1A	216-Z-1A Tile Field	Liquid	2001	–	–	–	9.82×10^{-1}	1.60×10^{-5}	7.10×10^{-5}	–
216-Z-18	216-Z-18 Crib	Liquid	2001	–	–	–	5.68×10^{-2}	7.51×10^{-6}	3.33×10^{-5}	–
216-Z-20	216-Z-20 Crib	Liquid	2001	–	–	–	1.94×10^{-7}	–	–	–
216-Z-21	216-Z-21 Seepage Basin	Liquid	2001	–	–	–	4.82×10^{-7}	–	–	–
216-Z-11	216-Z-11 Ditch	Liquid	1986	–	–	–	–	–	–	–
216-U-13	216-U-13 Trench	Liquid	1956	1.78×10^{-5}	1.14×10^{-6}	–	1.74×10^{-1}	6.13×10^{-7}	7.48×10^{-6}	7.73×10^{-9}
216-U-14[d]	216-U-14 Ditch	Liquid	1994	9.52	7.77×10^{-3}	–	7.52×10^{-2}	1.37×10^{-4}	8.21×10^{-4}	8.23×10^{-3}
207-U	207-U Retention Basin	Liquid	2006	–	–	–	–	–	–	–
UPR-200-W-135	UPR-200-W-135 Unplanned Release	Liquid	2001	9.80×10^{-2}	1.63×10^{-3}	–	9.38	2.41×10^{-5}	4.36×10^{-2}	4.97×10^{-5}
UPR-200-W-28	UPR-200-W-28	Liquid	2001	1.42×10^{-2}	5.46×10^{-4}	–	5.72	6.65×10^{-6}	8.62×10^{-3}	1.11×10^{-5}
UPR-200-W-131[b]	UPR-200-W-131	Liquid	2001	9.26×10^{-5}	3.59×10^{-6}	–	3.75×10^{-2}	4.36×10^{-8}	5.64×10^{-5}	7.23×10^{-8}

Table S–46a. Map 9C: Radionuclide Inventories (curies) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
200-W PP	200-W PP Powerhouse Pond	Liquid	2001	–	–	–	–	–	–	–
216-T-20	216-T-20 Trench	Liquid	2001	3.03×10^{-1}	9.23×10^{-6}	–	7.64×10^{-2}	3.33×10^{-5}	1.08×10^{-4}	1.52×10^{-7}
232-Z	232-Z Waste Incinerator	Solid	2002	–	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

c This site had inventories that were in the initial list of constituents, but was screened out during final screening described in Section S.3.6.

d This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–46b. Map 9C: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-Z-16	216-Z-16 Crib	Liquid	2001	4.84×10^{-5}	–	9.50×10^{-14}	3.09×10^{-4}	1.06×10^{-2}	3.57	2.75
231-Z	231-Z Plutonium Isolation Facility	Solid	2003	–	–	–	–	–	6.85	–
216-Z-4	216-Z-4 Trench	Liquid	2001	2.35×10^{-1}	–	1.05×10^{-16}	9.53×10^{-6}	1.06×10^{-3}	7.06×10^{-1}	7.60
216-Z-5	216-Z-5 Crib	Liquid	2001	3.79	–	1.67×10^{-15}	1.52×10^{-4}	4.76×10^{-2}	3.16×10^{1}	1.18×10^{3}
216-Z-6	216-Z-6 Crib	Liquid	2001	4.99×10^{-1}	–	2.23×10^{-16}	2.03×10^{-5}	2.34×10^{-3}	1.55	1.87×10^{1}
216-Z-7	216-Z-7 Crib	Liquid	2001	1.58×10^{2}	–	4.27×10^{-8}	1.64	7.78×10^{-1}	5.45×10^{2}	7.35×10^{3}
216-Z-8	216-Z-8 Trench	Liquid	2001	6.81×10^{-12}	–	5.83×10^{-20}	3.21×10^{-9}	1.66×10^{-2}	3.28	6.73×10^{-1}
216-Z-9	216-Z-9 Trench	Liquid	2001	6.22×10^{-2}	–	2.87×10^{-16}	1.70×10^{-5}	9.89	2.18×10^{3}	5.65×10^{2}
216-Z-10	216-Z-10 Reverse Well	Liquid	2001	4.90	–	2.19×10^{-15}	1.99×10^{-4}	2.30×10^{-2}	1.53×10^{1}	1.85×10^{2}
UPR-200-W-130[b]	UPR-200-W-130	Liquid	2001	1.57×10^{-10}	–	3.05×10^{-19}	9.96×10^{-10}	3.44×10^{-8}	1.14×10^{-5}	9.15×10^{-6}
216-Z-17	216-Z-17 Trench	Liquid	2001	1.75×10^{-5}	–	3.43×10^{-14}	1.12×10^{-4}	3.84×10^{-3}	1.29	9.91×10^{-1}
216-Z-15	216-Z-15 French Drain	Liquid	2001	3.75×10^{-8}	–	3.52×10^{-15}	1.53×10^{-5}	1.51×10^{-9}	4.88×10^{-7}	6.26×10^{-8}
234-5Z[c]	234-5Z Plutonium Finishing Plant	Solid	N/A	–	–	–	–	–	–	–
2736-Z	2736-Z Plutonium Finishing Plant	Liquid/ Solid	Unknown	–	–	–	–	–	1.98×10^{2}	1.92×10^{2}
242-Z	242-Z Americium Recovery Facility	Solid	Unknown	–	–	–	–	–	8.57×10^{1}	3.51×10^{3}
216-Z-1D[d]	216-Z-1(D) Ditch	Liquid	1986	–	–	–	–	–	1.74×10^{2}	–
236-Z	236-Z Plutonium Reclamation Facility	Solid	Unknown	–	–	–	–	–	4.72×10^{3}	4.56×10^{3}
216-Z-14	216-Z-14 French Drain	Liquid	2001	3.62×10^{-8}	–	3.53×10^{-15}	1.48×10^{-5}	1.44×10^{-9}	4.72×10^{-7}	6.05×10^{-8}
291-Z	291-Z Exhaust Fan and Compressor House	Solid	N/A	–	–	–	–	–	1.07×10^{1}	1.03×10^{1}
UPR-200-W-103	UPR-200-W-103	Liquid	2001	–	–	7.54×10^{-20}	2.46×10^{-10}	3.87×10^{-3}	1.30	2.42×10^{-1}

Table S–46b. Map 9C: Radionuclide Inventories (curies) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
241-Z[c]	241-Z Treatment Tank	Liquid	N/A	–	–	–	–	–	–	–
241-Z-361	241-Z-361 Settling Tank	Liquid	N/A	–	–	–	–	–	4.67×10^{3}	–
216-Z-13	216-Z-13 French Drain	Liquid	2001	3.48×10^{-8}	–	3.35×10^{-15}	1.42×10^{-5}	1.38×10^{-9}	4.53×10^{-7}	5.81×10^{-8}
216-Z-1&2	216-Z-1 & 2 Cribs	Liquid	2001	1.07×10^{-2}	–	3.98×10^{-16}	7.13×10^{-6}	4.98×10^{-1}	1.85×10^{2}	1.88×10^{2}
216-Z-3	216-Z-3 Crib	Liquid	2001	3.20×10^{-1}	–	1.56×10^{-16}	1.11×10^{-5}	4.26×10^{-1}	1.35×10^{2}	5.23×10^{3}
216-Z-12	216-Z-12 Crib	Liquid	2001	7.10×10^{-1}	–	4.04×10^{-14}	1.43×10^{-4}	1.08×10^{1}	3.15×10^{3}	8.51×10^{3}
216-Z-1A	216-Z-1A Tile Field	Liquid	2001	1.01	–	9.21×10^{-15}	6.58×10^{-5}	1.23×10^{1}	4.14×10^{3}	3.88×10^{3}
216-Z-18	216-Z-18 Crib	Liquid	2001	5.94×10^{-2}	–	5.48×10^{-15}	1.78×10^{-5}	6.86	2.30×10^{3}	7.55×10^{2}
216-Z-20	216-Z-20 Crib	Liquid	2001	4.47×10^{-7}	–	5.76×10^{-14}	1.88×10^{-4}	8.62×10^{-3}	2.90	5.39×10^{-1}
216-Z-21	216-Z-21 Seepage Basin	Liquid	2001	1.11×10^{-6}	–	1.43×10^{-13}	4.66×10^{-4}	4.48×10^{-8}	1.50×10^{-5}	1.86×10^{-6}
216-Z-11	216-Z-11 Ditch	Liquid	1986	–	–	–	–	–	1.74×10^{2}	–
216-U-13	216-U-13 Trench	Liquid	1956	1.67×10^{-2}	–	3.64×10^{-16}	3.64×10^{-4}	4.53×10^{-8}	2.05×10^{-5}	2.72×10^{-6}
216-U-14[d]	216-U-14 Ditch	Liquid	1994	2.85	–	3.09×10^{-10}	5.71×10^{-2}	1.36×10^{-3}	2.65×10^{-1}	2.32×10^{-3}
207-U	207-U Retention Basin	Liquid	2006	–	–	–	–	–	–	–
UPR-200-W-135	UPR-200-W-135 Unplanned Release	Liquid	2001	9.98×10^{1}	–	7.80×10^{-13}	2.43×10^{-3}	2.51×10^{-4}	2.22×10^{-2}	1.76×10^{-2}
UPR-200-W-28	UPR-200-W-28	Liquid	2001	2.63×10^{1}	–	2.23×10^{-13}	4.84×10^{-5}	6.84×10^{-5}	7.57×10^{-3}	3.79×10^{-3}
UPR-200-W-131[b]	UPR-200-W-131	Liquid	2001	1.73×10^{-1}	–	1.46×10^{-15}	3.16×10^{-7}	4.49×10^{-7}	4.96×10^{-5}	2.47×10^{-5}
200-W PP	200-W PP Powerhouse Pond	Liquid	2001	–	–	–	–	–	–	–
216-T-20	216-T-20 Trench	Liquid	2001	3.19×10^{-1}	–	1.18×10^{-14}	7.24×10^{-7}	9.37×10^{-7}	1.95×10^{-4}	5.27×10^{-5}
232-Z	232-Z Waste Incinerator	Solid	2002	–	–	–	–	–	4.84×10^{1}	3.46

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

[c] This site had inventories that were in the initial list of constituents, but was screened out during final screening described in Section S.3.6.

[d] This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–47a. Map 9D: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-U-10	216-U-10 Pond	Liquid	1994	2.47×10^{2}	2.02×10^{-1}	–	1.96	3.56×10^{-3}	2.13×10^{-2}	2.14×10^{-1}
216-U-3	216-U-3 French Drain	Liquid	1955	2.28×10^{1}	–	–	1.39×10^{-7}	–	5.94×10^{-4}	–
UPR-200-W-104	UPR-200-W-104	Liquid	Unknown	Site consolidated with Site WIDS ID 216-U-10						
UPR-200-W-105	UPR-200-W-105	Liquid	Unknown	Site consolidated with Site WIDS ID 216-U-10						
UPR-200-W-106	UPR-200-W-106	Liquid	Unknown	Site consolidated with Site WIDS ID 216-U-10						
216-S-4	216-S-4 French Drain	Liquid	1956	2.91×10^{1}	–	–	1.81×10^{-7}	–	–	–
216-S-3	216-S-3 Crib	Liquid	2001	1.22×10^{2}	4.06×10^{-4}	–	3.31×10^{-1}	2.28×10^{-3}	1.42×10^{-2}	2.18×10^{-5}
216-S-21	216-S-21 Crib	Liquid	1969	2.54×10^{3}	8.95×10^{-3}	–	6.63	3.38×10^{-2}	2.11×10^{-1}	3.23×10^{-4}
UPR-200-W-107	UPR-200-W-107	Liquid	1957	Site consolidated with Site WIDS ID 216-U-10						
216-S-25	216-S-25 Crib	Liquid	1998	3.62×10^{3}	4.48×10^{-5}	–	4.85×10^{-5}	–	–	–
216-S-1&2	216-S-1 & 216-S-2 Cribs	Liquid	2001	2.54×10^{3}	–	–	9.59×10^{2}	5.87×10^{-1}	2.60	1.36×10^{-1}
216-S-8	216-S-8 Trench	Liquid	2001	–	–	–	–	–	–	–
UPR-200-W-95	UPR-200-W-95	Liquid	2001	1.10×10^{-3}	5.97×10^{-5}	–	9.82×10^{-2}	1.65×10^{-4}	1.05×10^{-3}	1.68×10^{-6}

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–47b. Map 9D: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-U-10	216-U-10 Pond	Liquid	1994	7.41×10^{1}	–	8.03×10^{-9}	1.49	1.21	4.00×10^{2}	1.60×10^{2}
216-U-3	216-U-3 French Drain	Liquid	1955	3.42×10^{-7}	–	9.63×10^{-18}	1.17×10^{-2}	2.93×10^{-6}	4.96×10^{-4}	–
UPR-200-W-104	UPR-200-W-104	Liquid	Unknown	Site consolidated with Site WIDS ID 216-U-10						
UPR-200-W-105	UPR-200-W-105	Liquid	Unknown	Site consolidated with Site WIDS ID 216-U-10						
UPR-200-W-106	UPR-200-W-106	Liquid	Unknown	Site consolidated with Site WIDS ID 216-U-10						
216-S-4	216-S-4 French Drain	Liquid	1956	4.43×10^{-7}	–	1.25×10^{-17}	2.03×10^{-7}	3.80×10^{-6}	6.42×10^{-4}	–
216-S-3	216-S-3 Crib	Liquid	2001	4.21×10^{1}	–	9.21×10^{-10}	1.41×10^{-3}	7.21×10^{-5}	3.53×10^{-3}	8.96×10^{-4}
216-S-21	216-S-21 Crib	Liquid	1969	6.28×10^{2}	–	1.36×10^{-8}	9.49×10^{-5}	1.16×10^{-3}	7.33×10^{-2}	1.79×10^{-2}
UPR-200-W-107	UPR-200-W-107	Liquid	1957	Site consolidated with Site WIDS ID 216-U-10						
216-S-25	216-S-25 Crib	Liquid	1998	2.30×10^{-5}	–	1.19×10^{-13}	4.87×10^{-4}	9.59×10^{-4}	1.71×10^{-1}	1.35×10^{-5}
216-S-1&2	216-S-1 & 216-S-2 Cribs	Liquid	2001	8.27×10^{2}	–	9.19×10^{-11}	1.50	5.14×10^{-1}	8.70×10^{1}	2.45×10^{1}
216-S-8	216-S-8 Trench	Liquid	2001	–	–	–	2.09×10^{-1}	–	–	–
UPR-200-W-95	UPR-200-W-95	Liquid	2001	2.97	–	9.57×10^{-16}	8.25×10^{-7}	7.66×10^{-6}	2.41×10^{-4}	2.69×10^{-4}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–48a. Map 9E: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-U-5	216-U-5 Trench	Liquid	1952	–	–	–	–	–	–	–
216-U-6	216-U-6 Trench	Liquid	1952	–	–	–	–	–	–	–
221-U	221-U Process Canyon	Liquid/ Solid	1961	–	–	–	1.00×10^{5}	–	–	–
241-WR-Vault	241-WR Vault	Liquid	1976	–	–	–	6.00×10^{1}	–	–	–
216-U-15	216-U-15 Trench	Liquid	1957	6.38×10^{-5}	1.51×10^{-6}	–	1.13×10^{2}	2.25×10^{-6}	3.52×10^{-2}	3.16×10^{-8}
UPR-200-W-138	UPR-200-W-138	Liquid	1953	2.33×10^{-1}	–	–	–	–	4.43×10^{-4}	–
200-W-44	200-W-44 Sand filter	Solid	Active	–	–	–	7.90×10^{2}	–	–	–
216-U-7	216-U-7 French Drain	Liquid	1957	1.90×10^{-8}	4.36×10^{-10}	–	3.87×10^{-7}	2.20×10^{-9}	1.17×10^{-8}	2.24×10^{-11}
UPR-200-W-101	UPR-200-W-101 Unplanned release	Liquid	1957	7.09×10^{-2}	–	–	–	–	1.34×10^{-4}	–
216-U-4	216-U-4 Reverse Well	Liquid	1955	3.56×10^{-4}	6.99×10^{-6}	–	3.95×10^{-2}	1.61×10^{-5}	1.47×10^{-4}	1.46×10^{-7}
216-U-4A	216-U-4A French Drain	Liquid	1961	5.69×10^{-7}	1.43×10^{-2}	–	7.42×10^{-4}	2.58×10^{-8}	2.35×10^{-7}	2.34×10^{-10}
216-U-1&2	216-U-1&2 Cribs	Liquid	1956	1.13×10^{2}	1.12×10^{-4}	–	1.17	1.36×10^{-6}	7.27	2.27×10^{-6}
241-U-361	241-U-361 Settling Tank	Liquid	1967	–	–	–	7.60×10^{2}	–	–	–
UPR-200-W-39	UPR-200-W-39 Unplanned release	Liquid	1954	6.06×10^{-3}	–	–	–	–	1.14×10^{-5}	–
200-W-42[b]	200-W-42 Process Sewer	Liquid	1988	3.20×10^{-1}	–	–	–	–	–	–
UPR-200-W-163	UPR-200-W-163 Unplanned release	Liquid	1988	9.35×10^{-1}	3.05×10^{-10}	–	1.42×10^{-6}	8.62×10^{-10}	2.27×10^{-3}	2.49×10^{-7}
216-U-16	216-U-16 Crib	Liquid	1985	4.18×10^{3}	9.28×10^{-4}	–	6.71×10^{-8}	–	–	7.53×10^{-8}
216-S-9	216-S-9 Crib	Liquid	2001	1.17×10^{3}	–	–	1.19×10^{2}	2.33×10^{-2}	1.04×10^{-1}	2.95×10^{-2}
216-S-23	216-S-23 Crib	Liquid	2001	4.24×10^{-5}	7.08×10^{-7}	–	1.15×10^{-3}	2.96×10^{-6}	1.86×10^{-5}	2.93×10^{-8}
216-U-8	216-U-8 Crib	Liquid	1960	4.62×10^{3}	6.80×10^{-6}	–	3.25×10^{-2}	1.88×10^{-5}	2.71	4.93×10^{-3}
216-U-12	216-U-12 Crib	Liquid	1972	3.16×10^{3}	7.64×10^{-7}	–	3.00×10^{1}	3.45×10^{-3}	6.78×10^{-1}	1.38×10^{-6}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–48b. Map 9E: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-U-5	216-U-5 Trench	Liquid	1952	–	–	–	4.27×10^{-1}	–	–	–
216-U-6	216-U-6 Trench	Liquid	1952	–	–	–	4.27×10^{-1}	–	–	–
221-U	221-U Process Canyon	Liquid/ Solid	1961	2.42×10^{2}	–	–	–	–	7.20×10^{1}	2.60×10^{1}
241-WR-Vault	241-WR Vault	Liquid	1976	–	–	–	–	–	–	–
216-U-15	216-U-15 Trench	Liquid	1957	5.41×10^{-2}	–	1.03×10^{-11}	6.71×10^{-3}	2.24×10^{-6}	2.59×10^{-4}	1.24×10^{-4}
UPR-200-W-138	UPR-200-W-138	Liquid	1953	–	–	–	8.75×10^{-3}	–	–	–
200-W-44	200-W-44 Sand Filter	Solid	Active	6.80×10^{3}	–	–	–	–	4.10×10^{1}	–
216-U-7	216-U-7 French Drain	Liquid	1957	4.84×10^{-5}	–	1.52×10^{-14}	3.71×10^{-11}	4.72×10^{-11}	1.98×10^{-9}	1.37×10^{-9}
UPR-200-W-101	UPR-200-W-101 Unplanned Release	Liquid	1957	–	–	–	2.63×10^{-3}	–	–	–
216-U-4	216-U-4 Reverse Well	Liquid	1955	3.25×10^{-1}	–	1.93×10^{-14}	1.01×10^{-5}	1.03×10^{-6}	1.87×10^{-4}	5.42×10^{-5}
216-U-4A	216-U-4A French Drain	Liquid	1961	7.85×10^{-3}	–	6.96×10^{-13}	2.16×10^{-3}	2.95×10^{-4}	1.10×10^{-1}	2.99×10^{-1}
216-U-1&2	216-U-1&2 Cribs	Liquid	1956	1.81	–	2.07×10^{-9}	2.67	4.26×10^{-4}	4.74×10^{-2}	2.34×10^{-2}
241-U-361	241-U-361 Settling Tank	Liquid	1967	1.37×10^{3}	–	–	–	–	–	–
UPR-200-W-39	UPR-200-W-39 Unplanned Release	Liquid	1954	–	–	–	2.25×10^{-4}	–	–	–
200-W-42[b]	200-W-42 Process Sewer	Liquid	1988	–	–	1.63×10^{-16}	3.63×10^{-7}	1.11×10^{-9}	3.73×10^{-7}	–
UPR-200-W-163	UPR-200-W-163 Unplanned Release	Liquid	1988	3.03×10^{-6}	–	2.06×10^{-17}	1.50×10^{-2}	8.57×10^{-10}	1.31×10^{-7}	2.07×10^{-9}
216-U-16	216-U-16 Crib	Liquid	1985	8.55×10^{-5}	–	9.83×10^{-14}	1.05×10^{-4}	3.65×10^{-7}	1.13×10^{-4}	2.96×10^{-5}
216-S-9	216-S-9 Crib	Liquid	2001	6.04×10^{1}	–	1.01×10^{-10}	2.28×10^{-1}	2.01×10^{-2}	3.57	3.29×10^{-2}
216-S-23	216-S-23 Crib	Liquid	2001	5.88×10^{-2}	–	2.37×10^{-17}	1.13×10^{-8}	8.53×10^{-8}	3.10×10^{-6}	3.39×10^{-6}
216-U-8	216-U-8 Crib	Liquid	1960	5.12×10^{-2}	–	1.38×10^{-12}	1.72×10^{1}	5.63×10^{-5}	8.57×10^{-3}	4.66×10^{-5}
216-U-12	216-U-12 Crib	Liquid	1972	6.96×10^{1}	–	3.54×10^{-4}	4.48	1.68×10^{-5}	4.75×10^{-3}	1.37×10^{-8}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–49a. Map 9F: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-S-19	216-S-19 Pond	Liquid	2001	2.30×10^{-1}	3.42×10^{-3}	–	1.63×10^{-4}	–	–	–
216-S-14	216-S-14 Trench	Liquid	2001	–	–	–	–	–	–	–
216-S-7	216-S-7 Crib	Liquid	2001	8.38×10^{3}	–	–	1.47×10^{3}	5.59×10^{-1}	2.48	3.51×10^{-1}
UPR-200-W-32[b]	UPR-200-W-32	Liquid	2001	7.69×10^{-3}	–	–	–	–	1.56×10^{-5}	–
216-S-13	216-S-13 Crib	Liquid	2001	4.31×10^{1}	1.86×10^{-4}	–	4.20×10^{-1}	6.47×10^{-2}	4.40×10^{-1}	–
216-S-12	216-S-12 Trench	Liquid	2001	1.06×10^{-1}	1.62×10^{-7}	–	1.39	8.53×10^{-4}	3.77×10^{-3}	4.03×10^{-4}
200-W-22	200-W-22 Unplanned Release	Liquid	2001	9.02×10^{-4}	–	–	–	–	2.13×10^{-6}	–
233-S	233-S Plutonium Concentration Facility	Solid	2003	–	–	–	–	–	–	–
200-W-69	200-W-69 Lab Complex (includes 222-S Lab, 222-S DMWSA, 219-S, 222-SA, 296-S-21, 296-S-16, 296-S-23, 296-S-13)	Liquid/ Solid	2002	–	–	–	1.80×10^{3}	–	–	–
UPR-200-W-61	UPR-200-W-61	Liquid	2001	2.29×10^{-2}	1.25×10^{-3}	–	2.06	3.48×10^{-3}	2.20×10^{-2}	3.53×10^{-5}
202-S	202-S (REDOX)	Solid	1997	–	–	–	9.84×10^{3}	–	–	–
291-S	291-S Sand Filter	Solid	1998	–	–	–	8.00×10^{3}	–	–	–
216-S-20	216-S-20 Crib	Liquid	2001	1.53×10^{-1}	2.69	–	7.46×10^{1}	3.60×10^{-3}	2.57×10^{-2}	8.15×10^{-3}
216-S-22	216-S-22 Crib	Liquid	2001	2.23	2.04×10^{-9}	–	3.31×10^{-6}	8.54×10^{-9}	5.38×10^{-8}	6.39×10^{-6}
216-S-26	216-S-26 Crib	Liquid	2001	3.87×10^{-2}	5.77×10^{-4}	–	2.74×10^{-5}	–	–	–
218-W-7	218-W-7 Burial Ground (222-S Vault)	Solid	1986	–	–	–	7.82×10^{-1}	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; REDOX=Reduction-Oxidation (Facility); Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–49b. Map 9F: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-S-19	216-S-19 Pond	Liquid	2001	1.76×10^{-3}	–	2.19×10^{-13}	5.38×10^{-4}	1.26×10^{-6}	3.74×10^{-4}	1.03×10^{-3}
216-S-14	216-S-14 Trench	Liquid	2001	–	–	–	4.96×10^{-5}	–	–	–
216-S-7	216-S-7 Crib	Liquid	2001	9.79×10^{2}	–	7.63×10^{-10}	2.59	4.87×10^{-1}	8.36×10^{1}	1.68×10^{1}
UPR-200-W-32[b]	UPR-200-W-32	Liquid	2001	–	–	–	1.93×10^{-4}	–	–	–
216-S-13	216-S-13 Crib	Liquid	2001	1.45×10^{2}	–	3.80×10^{-13}	2.08×10^{-3}	1.24×10^{-2}	8.63×10^{-1}	9.36×10^{-1}
216-S-12	216-S-12 Trench	Liquid	2001	1.22	–	1.35×10^{-13}	2.16×10^{-3}	7.47×10^{-4}	1.27×10^{-1}	3.54×10^{-2}
200-W-22	200-W-22 Unplanned Release	Liquid	2001	–	–	–	1.87×10^{-5}	–	–	–
233-S	233-S Plutonium Concentration Facility	Solid	2003	–	–	–	–	2.10×10^{-3}	7.58	3.70
200-W-69	200-W-69 Lab Complex (includes 222-S Lab, 222-S DMWSA, 219-S, 222-SA, 296-S-21, 296-S-16, 296-S-23, 296-S-13)	Liquid/ Solid	2002	6.33×10^{2}	–	–	–	–	1.83×10^{1}	1.35×10^{1}
UPR-200-W-61	UPR-200-W-61	Liquid	2001	6.25×10^{1}	–	2.02×10^{-14}	1.74×10^{-5}	1.61×10^{-4}	5.08×10^{-3}	5.58×10^{-3}
202-S	202-S (REDOX)	Solid	1997	–	–	–	–	–	1.64×10^{3}	–
291-S	291-S Sand Filter	Solid	1998	–	–	–	–	–	3.40×10^{2}	–
216-S-20	216-S-20 Crib	Liquid	2001	8.90×10^{1}	–	4.18×10^{-6}	5.59×10^{-1}	1.20×10^{-1}	2.26×10^{1}	5.62×10^{1}
216-S-22	216-S-22 Crib	Liquid	2001	1.70×10^{-6}	–	6.85×10^{-20}	3.27×10^{-11}	2.46×10^{-10}	8.93×10^{-9}	9.77×10^{-9}
216-S-26	216-S-26 Crib	Liquid	2001	2.96×10^{-4}	–	9.07×10^{-14}	9.67×10^{-5}	2.05×10^{-7}	6.33×10^{-5}	1.76×10^{-4}
218-W-7	218-W-7 Burial Ground (222-S Vault)	Solid	1986	8.36×10^{1}	–	–	2.30×10^{-4}	–	5.08×10^{-2}	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; REDOX=Reduction-Oxidation (Facility); Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–50a. Map 10: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
600-148	Environmental Restoration Disposal Facility	Solid	–	1.50×10^{4}	1.20×10^{2}	6.01	3.70	–	2.01×10^{-1}	–
N/A	US Ecology	Solid	–	8.60×10^{5}	5.09×10^{3}	4.76	4.98×10^{4}	–	5.51×10^{1}	5.98
216-W-LWC	216-W-LWC Crib	Liquid	2001	4.40×10^{5}	–	–	1.92×10^{-1}	–	–	5.08×10^{-2}
216-U-17	216-U-17 Crib	Liquid	1989	1.86×10^{2}	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–50b. Map 10: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
600-148	Environmental Restoration Disposal Facility	Solid	–	3.70	–	1.40×10^{-1}	5.40×10^{1}	–	9.16	2.71
N/A	US Ecology	Solid	–	1.21×10^{5}	–	1.22×10^{1}	1.82×10^{3}	–	6.46×10^{3}	4.67×10^{2}
216-W-LWC	216-W-LWC Crib	Liquid	2001	2.59×10^{-1}	–	1.95×10^{-12}	2.37×10^{-3}	9.23×10^{-4}	3.19×10^{-1}	1.34×10^{-2}
216-U-17	216-U-17 Crib	Liquid	1989	–	–	1.92×10^{-13}	2.05×10^{-4}	6.52×10^{-7}	2.01×10^{-4}	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–51a. Map 11: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
218-E-10	218-E-10 Trench	Solid	Varies based on time of disposal	8.00×10^{-8}	–	3.96×10^{-4}	8.53×10^{5}	–	5.07×10^{-3}	–
UPR-200-E-23	UPR-200-E-23	Solid	–	Site consolidated with Site WIDS ID 218-E-10						
UPR-200-E-24	UPR-200-E-24	Solid	–	Site consolidated with Site WIDS ID 218-E-10						
216-B-50	216-B-50 Crib	Liquid	2001	1.26×10^{2}	3.04×10^{-3}	–	1.52	1.23×10^{-2}	6.60×10^{-2}	9.34×10^{-5}
216-B-57	216-B-57 Crib	Liquid	2001	1.95×10^{2}	9.10×10^{-3}	–	3.55	3.69×10^{-2}	1.97×10^{-1}	2.80×10^{-4}
UPR-200-E-9	UPR-200-E-9	Liquid	2001	2.55×10^{-1}	9.89×10^{-3}	–	1.03×10^{2}	1.20×10^{-4}	1.55×10^{-1}	1.99×10^{-4}
216-B-11A & B	216-B-11A & B	Liquid	2001	1.59×10^{1}	2.77×10^{-4}	–	3.04	9.97×10^{-4}	3.25×10^{-3}	4.54×10^{-6}
216-B-51	216-B-51 French Drain	Liquid	2001	6.24×10^{-3}	2.42×10^{-4}	–	2.66×10^{-2}	2.93×10^{-6}	3.80×10^{-3}	4.87×10^{-6}
218-E-5	218-E-5 Burial Ground	Solid	1986	–	–	–	1.46×10^{2}	–	–	–
218-E-5A	218-E-5A Burial Ground	Solid	1986	–	–	–	3.20×10^{2}	–	–	–
218-E-2	218-E-2 Burial Ground	Solid	1986	–	–	–	4.85×10^{2}	–	–	–
UPR-200-E-79	UPR-200-E-79 Unplanned Release	Liquid	2001	1.82×10^{-2}	1.07×10^{-3}	–	8.82	3.84×10^{-3}	1.25×10^{-2}	1.75×10^{-5}
UPR-200-E-78	UPR-200-E-78 Unplanned Release	Liquid	2001	5.03×10^{-5}	2.18×10^{-5}	–	1.50×10^{1}	1.60×10^{-4}	8.42×10^{-4}	5.05×10^{-8}
218-E-4	218-E-4 Burial Ground	Solid	1986	–	–	–	1.94×10^{-1}	–	–	–
216-B-5	216-B-5 Reverse Well	Liquid	2001	1.07×10^{-4}	1.11×10^{-2}	–	7.55	1.99×10^{-1}	4.25×10^{-3}	1.88×10^{-6}
216-B-9	216-B-9 Crib	Liquid	2001	1.68×10^{-3}	1.10×10^{-2}	–	1.07×10^{1}	2.89×10^{-1}	5.74×10^{-3}	1.32×10^{-6}
216-B-59	216-B-59 Trench	Liquid	2001	7.06×10^{-8}	1.35×10^{-8}	–	8.76×10^{-8}	9.61×10^{-8}	5.15×10^{-7}	3.04×10^{-10}
241-B-361	241-B-361 Settling Tank	Liquid	Unknown	–	–	–	3.06×10^{3}	–	–	–
UPR-200-E-7	UPR-200-E-7 Unplanned Release	Liquid	2001	1.60×10^{-6}	5.36×10^{-6}	–	5.39×10^{-3}	1.37×10^{-4}	2.75×10^{-6}	–
221-B	221-B B Plant/Canyon	Solid	1997	–	–	–	1.15×10^{5}	–	–	–
200-E-28	200-E-28 UPR	Liquid	2001	–	–	–	1.49×10^{-2}	–	–	–
200-E-97	200-E-97 French Drain	Liquid	2001	4.16×10^{-5}	8.05×10^{-7}	–	9.62×10^{-3}	1.89×10^{-6}	1.72×10^{-5}	1.71×10^{-8}
200-E-98[b]	200-E-98 French Drain	Liquid	2001	3.47×10^{-5}	6.71×10^{-7}	–	7.98×10^{-3}	1.57×10^{-6}	1.43×10^{-5}	1.43×10^{-8}
WESF	WESF (Building 225-B)	Solid	2005	–	–	–	4.97×10^{5}	–	–	–
216-B-62	216-B-62 Crib	Liquid	2001	3.57×10^{-1}	6.47×10^{-2}	–	8.25×10^{1}	4.59×10^{-1}	2.39	1.29×10^{-3}
216-B-12	216-B-12 Crib	Liquid	2001	2.34×10^{3}	9.54×10^{-3}	–	1.20×10^{2}	3.37×10^{-2}	1.65	1.55×10^{-4}
216-B-55	216-B-55 Crib	Liquid	2001	1.77×10^{-4}	3.40×10^{-5}	–	2.20×10^{-4}	2.41×10^{-4}	1.29×10^{-3}	7.63×10^{-7}
212-B	212-B Cask Loading Station	Solid	1997	–	–	–	1.00×10^{3}	–	–	–
216-B-60	216-B-60 Crib	Liquid	2001	4.60×10^{-6}	4.51×10^{-8}	–	2.28×10^{-3}	1.14×10^{-7}	8.14×10^{-7}	1.11×10^{-5}
UPR-200-E-84	UPR-200-E-84 Unplanned Release	Liquid	2001	6.72×10^{-2}	3.94×10^{-8}	–	1.20×10^{-4}	2.30×10^{-7}	1.21×10^{-6}	3.80×10^{-6}
224-B	224-B Plutonium Concentration Facility	Solid	1985	–	–	–	–	–	–	–
UPR-200-E-87	UPR-200-E-87 Unplanned Release	Liquid	2001	4.59×10^{-9}	1.03×10^{-5}	–	1.65×10^{-3}	–	9.29×10^{-7}	4.11×10^{-10}
UPR-200-E-1[b]	UPR-200-E-1 Unplanned Release	Liquid	2001	5.90×10^{-2}	1.95×10^{-3}	–	5.54	1.96×10^{-2}	3.13×10^{-3}	1.54×10^{-6}
UPR-200-E-3[b]	UPR-200-E-3 Unplanned Release	Liquid	2001	2.02×10^{-3}	2.68×10^{-5}	–	2.21×10^{-2}	4.08×10^{-4}	6.68×10^{-5}	5.82×10^{-7}
UPR-200-E-85	UPR-200-E-85 Unplanned Release	Liquid	2001	4.92×10^{-2}	9.40×10^{-3}	–	6.24	6.68×10^{-2}	3.57×10^{-1}	2.09×10^{-4}
216-B-4	216-B-4 Reverse Well	Liquid	2001	1.19×10^{-5}	2.30×10^{-7}	–	1.32×10^{-3}	5.39×10^{-7}	4.90×10^{-6}	4.89×10^{-9}

Table S–51a. Map 11: Radionuclide Inventories (curies) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-B-6	216-B-6 Reverse Well	Liquid	2001	7.12×10^{-3}	1.38×10^{-4}	–	7.91×10^{-1}	3.23×10^{-4}	2.94×10^{-3}	2.93×10^{-6}
200-E-30	200-E-30 Sand Filter (291-B Sand Filter)	Solid	1994	–	–	–	3.00×10^{3}	–	–	–
200-E-55	200-E-55 French Drain	Liquid	2001	4.08×10^{-5}	7.88×10^{-7}	–	9.51×10^{-3}	1.85×10^{-6}	1.68×10^{-5}	1.68×10^{-8}
200-E-95	200-E-95 French Drain	Liquid	2001	4.16×10^{-5}	8.05×10^{-7}	–	9.28×10^{-3}	1.89×10^{-6}	1.72×10^{-5}	1.71×10^{-8}
216-B-10A	216-B-10A Crib	Liquid	2001	6.37×10^{-2}	2.29×10^{-4}	–	1.32	5.38×10^{-4}	5.35×10^{-3}	4.87×10^{-6}
216-B-10B	216-B-10B Crib	Liquid	2001	5.11×10^{-8}	1.17×10^{-9}	–	1.04×10^{-6}	5.90×10^{-9}	3.13×10^{-8}	1.64×10^{-5}
UPR-200-E-77	UPR-200-E-77 Unplanned Release	Liquid	2001	4.03×10^{-4}	1.08×10^{-5}	–	8.62×10^{-2}	1.33×10^{-7}	2.38×10^{-4}	1.05×10^{-7}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–51b. Map 11: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
218-E-10	218-E-10 Trench	Solid	Varies based on time of disposal	1.02×10^{6}	–	–	1.10×10^{-1}	1.05×10^{-3}	3.94×10^{-3}	1.45×10^{-3}
UPR-200-E-23	UPR-200-E-23	Solid	–	Site consolidated with Site WIDS ID 218-E-10						
UPR-200-E-24	UPR-200-E-24	Solid	–	Site consolidated with Site WIDS ID 218-E-10						
216-B-50	216-B-50 Crib	Liquid	2001	5.49×10^{1}	–	7.43×10^{-8}	8.59×10^{-5}	2.61×10^{-4}	2.17×10^{-2}	2.24×10^{-3}
216-B-57	216-B-57 Crib	Liquid	2001	1.64×10^{2}	–	2.23×10^{-7}	2.38×10^{-4}	6.30×10^{-4}	3.65×10^{-2}	6.73×10^{-3}
UPR-200-E-9	UPR-200-E-9	Liquid	2001	4.77×10^{2}	–	4.03×10^{-12}	8.72×10^{-4}	1.23×10^{-3}	1.37×10^{-1}	6.81×10^{-2}
216-B-11A & B	216-B-11A & B	Liquid	2001	9.66	–	3.54×10^{-13}	2.85×10^{-5}	3.04×10^{-5}	7.39×10^{-3}	1.58×10^{-3}
216-B-51	216-B-51 French Drain	Liquid	2001	3.51×10^{-2}	–	9.84×10^{-14}	2.10×10^{-5}	3.01×10^{-5}	8.81×10^{-4}	1.67×10^{-3}
218-E-5	218-E-5 Burial Ground	Solid	1986	1.56×10^{2}	–	–	4.02×10^{-2}	–	4.50×10^{1}	–
218-E-5A	218-E-5A Burial Ground	Solid	1986	3.43×10^{2}	–	–	4.02×10^{-2}	–	1.00×10^{2}	–
218-E-2	218-E-2 Burial Ground	Solid	1986	5.19×10^{2}	–	–	–	–	5.80×10^{1}	–
UPR-200-E-79	UPR-200-E-79 Unplanned Release	Liquid	2001	3.68×10^{1}	–	1.36×10^{-12}	8.07×10^{-5}	1.08×10^{-4}	2.25×10^{-2}	6.07×10^{-3}
UPR-200-E-78	UPR-200-E-78 Unplanned Release	Liquid	2001	3.39	–	8.26×10^{-16}	3.25×10^{-6}	3.58×10^{-6}	1.12×10^{-3}	4.38×10^{-2}
218-E-4	218-E-4 Burial Ground	Solid	1986	2.08×10^{-1}	–	–	3.40×10^{-4}	–	7.25×10^{-1}	–
216-B-5	216-B-5 Reverse Well	Liquid	2001	8.67	–	4.81×10^{-10}	7.13×10^{-3}	5.71×10^{-3}	3.97×10^{1}	1.24×10^{-1}
216-B-9	216-B-9 Crib	Liquid	2001	1.24×10^{1}	–	2.12×10^{-10}	8.34×10^{-3}	2.73×10^{-3}	8.80	1.33×10^{-1}

Table S–51b. Map 11: Radionuclide Inventories (curies) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-B-59	216-B-59 Trench	Liquid	2001	5.71×10^{-5}	–	5.39×10^{-14}	1.36×10^{-10}	1.68×10^{-9}	2.25×10^{-8}	2.56×10^{-8}
241-B-361	241-B-361 Settling Tank	Liquid	unknown	1.87×10^{2}	–	–	–	–	1.53×10^{2}	–
UPR-200-E-7	UPR-200-E-7 Unplanned Release	Liquid	2001	6.28×10^{-3}	–	1.10×10^{-13}	2.97×10^{-6}	1.51×10^{-6}	3.22×10^{-3}	1.06×10^{-4}
221-B	221-B B Plant/Canyon	Solid	1997	2.37×10^{5}	–	–	–	–	2.10	–
200-E-28	200-E-28 UPR	Liquid	2001	1.75×10^{-3}	–	1.71×10^{-16}	1.83×10^{-7}	1.13×10^{-7}	3.48×10^{-5}	–
200-E-97	200-E-97 French Drain	Liquid	2001	3.86×10^{-2}	–	1.05×10^{-15}	1.23×10^{-6}	1.47×10^{-7}	3.33×10^{-5}	6.02×10^{-6}
200-E-98[b]	200-E-98 French Drain	Liquid	2001	3.21×10^{-2}	–	8.72×10^{-16}	1.03×10^{-6}	1.22×10^{-7}	2.77×10^{-5}	5.01×10^{-6}
WESF	WESF (Building 225-B)	Solid	2005	1.72×10^{5}	–	–	–	–	–	–
216-B-62	216-B-62 Crib	Liquid	2001	9.67×10^{3}	–	3.30×10^{-7}	8.43×10^{-4}	9.95×10^{-3}	2.06×10^{-1}	2.24×10^{-1}
216-B-12	216-B-12 Crib	Liquid	2001	3.26×10^{2}	–	2.93×10^{-11}	1.02×10^{1}	9.93×10^{-4}	2.15×10^{-1}	5.36×10^{-2}
216-B-55	216-B-55 Crib	Liquid	2001	1.43×10^{-1}	–	1.35×10^{-10}	3.41×10^{-7}	4.21×10^{-6}	5.64×10^{-5}	6.43×10^{-5}
212-B	212-B Cask Loading Station	Solid	1997	1.00×10^{2}	–	–	–	–	–	–
216-B-60	216-B-60 Crib	Liquid	2001	2.79×10^{-3}	–	1.27×10^{-10}	4.87×10^{-3}	1.74×10^{-9}	8.44×10^{-2}	2.93×10^{-6}
UPR-200-E-84	UPR-200-E-84 Unplanned Release	Liquid	2001	4.58×10^{-5}	–	1.51×10^{-15}	5.26×10^{-7}	5.17×10^{-6}	1.54×10^{-4}	1.69×10^{-4}
224-B	224-B Plutonium Concentration Facility	Solid	1985	–	–	–	–	–	8.85×10^{1}	1.14×10^{1}
UPR-200-E-87	UPR-200-E-87 Unplanned Release	Liquid	2001	1.89×10^{-3}	–	9.40×10^{-13}	3.65×10^{-7}	1.12×10^{-5}	2.75	2.41×10^{-4}
UPR-200-E-1[b]	UPR-200-E-1 Unplanned Release	Liquid	2001	6.36	–	5.86×10^{-12}	4.28×10^{-4}	7.09×10^{-5}	1.15×10^{-1}	2.12×10^{-3}
UPR-200-E-3[b]	UPR-200-E-3 Unplanned Release	Liquid	2001	1.51×10^{-1}	–	1.09×10^{-13}	6.91×10^{-6}	1.54×10^{-6}	1.86×10^{-5}	1.71×10^{-4}
UPR-200-E-85	UPR-200-E-85 Unplanned Release	Liquid	2001	3.73×10^{1}	–	3.81×10^{-8}	9.39×10^{-5}	1.15×10^{-3}	1.55×10^{-2}	1.70×10^{-2}
216-B-4	216-B-4 Reverse Well	Liquid	2001	1.08×10^{-2}	–	2.90×10^{-16}	3.36×10^{-7}	3.02×10^{-8}	6.16×10^{-6}	1.72×10^{-6}
216-B-6	216-B-6 Reverse Well	Liquid	2001	6.50	–	1.74×10^{-13}	2.02×10^{-4}	1.81×10^{-5}	3.69×10^{-3}	1.03×10^{-3}
200-E-30	200-E-30 Sand Filter (291-B Sand Filter)	Solid	1994	2.00×10^{3}	–	–	–	–	1.93	
200-E-55	200-E-55 French Drain	Liquid	2001	3.78×10^{-2}	–	1.03×10^{-15}	1.21×10^{-6}	1.45×10^{-7}	3.28×10^{-5}	5.89×10^{-6}
200-E-95	200-E-95 French Drain	Liquid	2001	3.85×10^{-2}	–	1.04×10^{-15}	1.23×10^{-6}	1.44×10^{-7}	3.25×10^{-5}	6.01×10^{-6}
216-B-10A	216-B-10A Crib	Liquid	2001	1.08×10^{1}	–	2.89×10^{-13}	3.26×10^{-3}	3.02×10^{-5}	6.15×10^{-3}	1.71×10^{-3}
216-B-10B	216-B-10B Crib	Liquid	2001	1.30×10^{-4}	–	4.09×10^{-14}	9.95×10^{-11}	1.27×10^{-10}	5.32×10^{-9}	3.69×10^{-9}
UPR-200-E-77	UPR-200-E-77 Unplanned Release	Liquid	2001	4.84×10^{-1}	–	4.85×10^{-15}	2.24×10^{-5}	1.34×10^{-6}	1.49×10^{-4}	2.91×10^{-5}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–52a. Map 12: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
218-E-12B	218-E-12B Burial Ground	Solid	Varies based on time of disposal	1.12×10^{3}	1.31×10^{2}	9.70×10^{-3}	2.69×10^{4}	5.61×10^{-1}	8.08×10^{-1}	2.94×10^{-3}
218-E-12A	218-E-12A Burial Ground	Solid	1986	–	–	–	1.72×10^{1}	–	–	–
216-B-63	216-B-63 Ditch	Liquid	2001	1.30×10^{2}	3.36×10^{-2}	–	6.91×10^{-1}	1.86×10^{-5}	1.66×10^{-2}	5.89×10^{-8}
216-B-2-2	216-B-2-2 Ditch	Liquid	1986	Site consolidated with Site WIDS ID 216-B-3						
216-B-2-1	216-B-2-1 Ditch	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
UPR-200-E-138	UPR-200-E-138 Unplanned Release	Liquid	–	Site consolidated with Site WIDS ID 216-B-3						
218-E-8	218-E-8 Burial Ground	Solid	1986	–	–	–	1.94×10^{-1}	–	–	–
218-E-1	218-E-1 Burial Ground	Solid	1986	–	–	–	1.94	–	–	–
216-B-3	216-B-3 Pond	Liquid	2001	2.01×10^{4}	9.90×10^{1}	–	1.34×10^{2}	4.42×10^{-2}	3.20×10^{-1}	3.20×10^{-3}
216-B-3A Pond / 216-B-3A RAD	216-B-3A Pond / 216-B-3A RAD	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
216-B-3B Pond / 216-B-3B-RAD	216-B-3B Pond / 216-B-3B-RAD	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
216-B-3C Pond / 216-B-3C RAD	216-B-3C Pond / 216-B-3C RAD	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
UPR-200-E-14	UPR-200-E-14 Unplanned Release	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
UPR-200-E-34	UPR-200-E-34	Liquid	1994	Site consolidated with Site WIDS ID 216-A-25						

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–52b. Map 12: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
218-E-12B	218-E-12B Burial Ground	Solid	Varies based on time of disposal	2.69×10^{4}	–	–	4.59×10^{-2}	3.99×10^{-6}	3.13×10^{-1}	1.91
218-E-12A	218-E-12A Burial Ground	Solid	1986	1.84×10^{1}	–	–	3.32×10^{-1}	–	6.48×10^{2}	–
216-B-63	216-B-63 Ditch	Liquid	2001	9.33×10^{-2}	–	1.24×10^{-11}	1.20×10^{-1}	1.04×10^{-4}	1.95×10^{-2}	4.38×10^{2}
216-B-2-2	216-B-2-2 Ditch	Liquid	1986	Site consolidated with Site WIDS ID 216-B-3						
216-B-2-1	216-B-2-1 Ditch	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
UPR-200-E-138	UPR-200-E-138 Unplanned Release	Liquid	–	Site consolidated with Site WIDS ID 216-B-3						
218-E-8	218-E-8 Burial Ground	Solid	1986	2.08×10^{-1}	–	–	6.70×10^{-4}	–	1.45	–
218-E-1	218-E-1 Burial Ground	Solid	1986	2.08	–	–	1.34×10^{-1}	–	6.53×10^{1}	–
216-B-3	216-B-3 Pond	Liquid	2001	4.26×10^{2}	–	1.63×10^{-8}	2.22	8.66×10^{-2}	2.43×10^{1}	1.19×10^{1}
216-B-3A Pond / 216-B-3A RAD	216-B-3A Pond / 216-B-3A RAD	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
216-B-3B Pond / 216-B-3B-RAD	216-B-3B Pond / 216-B-3B-RAD	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
216-B-3C Pond / 216-B-3C RAD	216-B-3C Pond / 216-B-3C RAD	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
UPR-200-E-14	UPR-200-E-14 Unplanned Release	Liquid	1994	Site consolidated with Site WIDS ID 216-B-3						
UPR-200-E-34	UPR-200-E-34	Liquid	1994	Site consolidated with Site WIDS ID 216-A-25						

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–53a. Map 12A: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-C-9	216-C-9 Swamp	Liquid	2001	8.28×10^{-3}	2.44×10^{-4}	–	1.31	1.89×10^{-4}	1.01×10^{-3}	5.97×10^{-7}
218-C-9	218-C-9 Burial Ground	Solid	Varies based on time of disposal	–	–	–	1.27×10^{1}	–	–	–
UPR-200-E-141[b]	UPR-200-E-141	Liquid	2001	6.50×10^{-3}	–	–	–	–	2.77×10^{-5}	–
200-E-56[b]	200-E-56 Unplanned Release	Liquid	2001	2.47×10^{-2}	1.07×10^{-2}	–	7.38×10^{3}	7.87×10^{-2}	4.13×10^{-1}	2.47×10^{-5}
201-C	201-C Process Building	Liquid/ Solid	1988	–	–	–	9.00×10^{3}	–	–	–
216-C-1	216-C-1 Hot Semi Work Crib	Liquid	2001	1.95×10^{-4}	7.11×10^{-5}	–	4.88×10^{1}	5.22×10^{-4}	2.74×10^{-3}	7.70×10^{-6}
216-C-3	216-C-3 Hot Semi Work Crib	Liquid	2001	7.92×10^{1}	1.42×10^{-5}	–	9.78	1.04×10^{-4}	6.96×10^{-4}	3.27×10^{-8}
216-C-4	216-C-4 Hot Semi Work Crib	Liquid	2001	1.68×10^{-4}	1.22×10^{-5}	–	7.40	1.56×10^{-4}	8.05×10^{-4}	4.95×10^{-8}
216-C-5	216-C-5 Hot Semi Work Crib	Liquid	2001	–	–	–	–	–	–	–
216-C-6	216-C-6 Hot Semi Work Crib	Liquid	2001	1.25×10^{1}	3.29×10^{-5}	–	2.07×10^{1}	5.70×10^{-4}	2.84×10^{-3}	1.33×10^{-7}
216-C-10	216-C-10 Hot Semi Work Crib	Liquid	2001	6.54×10^{-5}	2.83×10^{-5}	–	1.96×10^{1}	2.08×10^{-4}	1.09×10^{-3}	6.55×10^{-8}
216-C-2	216-C-2 Semi Works Reverse Well	Liquid	2001	–	–	–	8.00×10^{-2}	–	–	–
200-E-57[b]	200-E-57 Unplanned Release	Liquid	2001	3.71×10^{-2}	1.60×10^{-2}	–	1.11×10^{4}	1.18×10^{-1}	6.21×10^{-1}	3.71×10^{-5}
241-CX-72	241-CX-72 Storage Tank and Vault	Liquid/ Solid	1986	–	–	–	–	–	–	–
291-C-1	291-C-1 Burial Ground	Solid	Varies based on time of disposal	–	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–53b. Map 12A: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-C-9	216-C-9 Swamp	Liquid	2001	2.67×10^{-1}	–	1.06×10^{-10}	3.30×10^{-5}	1.93×10^{-5}	2.97×10^{-3}	2.99×10^{-4}
218-C-9	218-C-9 Burial Ground	Solid	Varies based on time of disposal	7.50	–	–	–	–	–	–
UPR-200-E-141[b]	UPR-200-E-141	Liquid	2001	–	–	–	1.22×10^{-4}	–	–	–
200-E-56[b]	200-E-56 Unplanned Release	Liquid	2001	1.66×10^{3}	–	4.04×10^{-13}	1.59×10^{-3}	1.75×10^{-3}	5.48×10^{-1}	2.14×10^{1}
201-C	201-C Process Building	Liquid/ Solid	1988	–	–	–	–	–	4.90	2.00×10^{-1}
216-C-1	216-C-1 Hot Semi Work Crib	Liquid	2001	1.10×10^{1}	–	8.76×10^{-10}	6.42×10^{-1}	1.16×10^{-5}	5.99×10^{-1}	1.42×10^{-1}
216-C-3	216-C-3 Hot Semi Work Crib	Liquid	2001	2.20	–	9.09×10^{-15}	3.06×10^{-3}	3.25×10^{-6}	8.83×10^{-4}	2.84×10^{-2}
216-C-4	216-C-4 Hot Semi Work Crib	Liquid	2001	5.08×10^{-4}	–	2.08×10^{-15}	2.24×10^{-6}	2.51×10^{-6}	7.50×10^{-4}	7.68×10^{-3}
216-C-5	216-C-5 Hot Semi Work Crib	Liquid	2001	–	–	–	1.40×10^{-2}	–	–	–
216-C-6	216-C-6 Hot Semi Work Crib	Liquid	2001	3.88×10^{-1}	–	6.56×10^{-13}	1.47×10^{-3}	1.36×10^{-4}	2.49×10^{-2}	2.10×10^{-2}
216-C-10	216-C-10 Hot Semi Work Crib	Liquid	2001	4.40	–	1.12×10^{-15}	4.45×10^{-6}	4.84×10^{-6}	1.50×10^{-3}	5.67×10^{-2}
216-C-2	216-C-2 Semi Works Reverse Well	Liquid	2001	9.43×10^{-3}	–	3.70×10^{-16}	8.85×10^{-7}	6.72×10^{-7}	1.87×10^{-4}	–
200-E-57[b]	200-E-57 Unplanned Release	Liquid	2001	2.49×10^{3}	–	6.07×10^{-13}	2.39×10^{-3}	2.62×10^{-3}	8.22×10^{-1}	3.22×10^{1}
241-CX-72	241-CX-72 Storage Tank and Vault	Liquid/ Solid	1986	–	–	–	–	–	3.00	–
291-C-1	291-C-1 Burial Ground	Solid	Varies based on time of disposal	–	–	–	–	–	1.00×10^{2}	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–54a. Map 12B: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
UPR-200-E-86	UPR-200-E-86	Liquid	2001	7.21×10^{-1}	1.31×10^{-1}	–	1.69×10^{2}	9.34×10^{-1}	4.92	2.61×10^{-3}
216-A-40	216-A-40 Trench	Liquid	2001	1.40×10^{-7}	2.69×10^{-8}	–	1.73×10^{-7}	1.91×10^{-7}	1.02×10^{-6}	6.04×10^{-10}
216-A-41	216-A-41 Crib	Liquid	2001	1.04×10^{-1}	8.93×10^{-9}	–	7.44×10^{-6}	9.43×10^{-8}	4.93×10^{-7}	1.68×10^{-6}
216-A-9	216-A-9 Crib	Liquid	2001	8.07×10^{2}	1.17	–	6.81	3.21×10^{-4}	2.30×10^{-3}	1.22×10^{-3}
216-A-3	216-A-3 Crib	Liquid	2001	4.13×10^{1}	4.04×10^{-7}	–	2.08×10^{-2}	1.01×10^{-6}	2.73×10^{-1}	–
216-A-39	216-A-39 Crib	Liquid	2001	2.36×10^{-4}	5.96×10^{-5}	–	4.96×10^{-2}	6.46×10^{-4}	3.39×10^{-3}	2.04×10^{-7}
216-A-18	216-A-18 Trench	Liquid	2001	–	–	–	–	–	–	–
216-A-1	216-A-1 Crib	Liquid	2001	–	–	–	–	–	–	–
216-A-7	216-A-7 Crib	Liquid	2001	2.33×10^{-1}	3.15×10^{-3}	–	1.02×10^{1}	3.54×10^{-1}	6.39×10^{-2}	4.19×10^{-5}
UPR-200-E-145	UPR-200-E-145	Liquid	2001	1.95×10^{-1}	–	–	–	–	8.31×10^{-4}	–
216-A-16	216-A-16 French Drain	Liquid	2001	3.32×10^{-7}	7.60×10^{-9}	–	6.75×10^{-6}	3.83×10^{-8}	2.03×10^{-7}	3.90×10^{-10}
216-A-17	216-A-17 French Drain	Liquid	2001	1.63×10^{-7}	3.73×10^{-9}	–	3.32×10^{-6}	1.89×10^{-8}	1.00×10^{-7}	1.92×10^{-10}
242-A	242-A Evaporator	Liquid	1998	–	–	–	2.18×10^{4}	–	–	–
216-A-22	216-A-22 Crib (French Drain)	Liquid	2001	7.97×10^{-2}	9.13×10^{-9}	–	5.63×10^{-10}	–	4.89×10^{-4}	1.29×10^{-10}
216-A-28	216-A-28 French Drain	Liquid	2001	3.66×10^{-1}	–	–	–	–	2.48×10^{-3}	–
216-A-32	216-A-32 Crib	Liquid	2001	1.09×10^{-8}	2.49×10^{-10}	–	2.22×10^{-7}	1.26×10^{-9}	6.67×10^{-9}	1.28×10^{-11}
200-E-78	200-E-78 Reverse Well	Liquid	2001	–	7.17×10^{-7}	–	4.42×10^{-8}	–	–	1.01×10^{-8}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–54b. Map 12B: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
UPR-200-E-86	UPR-200-E-86	Liquid	2001	1.98×10^{4}	–	6.75×10^{-7}	1.71×10^{-3}	2.02×10^{-2}	4.20×10^{-1}	4.58×10^{-1}
216-A-40	216-A-40 Trench	Liquid	2001	1.13×10^{-4}	–	1.07×10^{-13}	2.70×10^{-10}	3.32×10^{-9}	4.45×10^{-8}	5.08×10^{-8}
216-A-41	216-A-41 Crib	Liquid	2001	7.01×10^{-5}	–	1.78×10^{-14}	2.34×10^{-7}	2.51×10^{-6}	6.88×10^{-5}	7.40×10^{-5}
216-A-9	216-A-9 Crib	Liquid	2001	7.84	–	3.74×10^{-7}	1.42×10^{1}	1.30×10^{-3}	2.48×10^{2}	1.02×10^{-1}
216-A-3	216-A-3 Crib	Liquid	2001	2.45×10^{-2}	–	1.17×10^{-9}	1.78	1.52×10^{-8}	1.32×10^{-4}	2.69×10^{-5}
216-A-39	216-A-39 Crib	Liquid	2001	1.45×10^{1}	–	4.08×10^{-15}	4.27×10^{-7}	9.14×10^{-6}	1.25×10^{-4}	1.35×10^{-4}
216-A-18	216-A-18 Trench	Liquid	2001	–	–	–	4.59×10^{-1}	–	–	–
216-A-1	216-A-1 Crib	Liquid	2001	–	–	–	9.28×10^{-2}	–	–	–
216-A-7	216-A-7 Crib	Liquid	2001	2.99×10^{3}	–	6.66×10^{-11}	3.32×10^{-1}	3.14×10^{-3}	7.59×10^{-1}	1.85×10^{-1}
UPR-200-E-145	UPR-200-E-145	Liquid	2001	–	–	–	3.66×10^{-3}	–	–	–
216-A-16	216-A-16 French Drain	Liquid	2001	8.43×10^{-4}	–	2.65×10^{-13}	6.46×10^{-10}	8.23×10^{-10}	3.45×10^{-8}	2.39×10^{-8}
216-A-17	216-A-17 French Drain	Liquid	2001	4.15×10^{-4}	–	1.31×10^{-13}	3.18×10^{-10}	4.04×10^{-10}	1.70×10^{-8}	1.18×10^{-8}
242-A	242-A Evaporator	Liquid	1998	1.49×10^{5}	–	–	–	–	1.58×10^{1}	9.90×10^{1}
216-A-22	216-A-22 Crib (French Drain)	Liquid	2001	–	–	2.63×10^{-17}	3.11×10^{-3}	2.42×10^{-9}	3.67×10^{-7}	4.68×10^{-12}
216-A-28	216-A-28 French Drain	Liquid	2001	–	–	–	4.42×10^{-1}	–	–	–
216-A-32	216-A-32 Crib	Liquid	2001	2.77×10^{-5}	–	8.71×10^{-15}	2.12×10^{-11}	2.70×10^{-11}	1.13×10^{-9}	7.86×10^{-10}
200-E-78	200-E-78 Reverse Well	Liquid	2001	–	–	3.67×10^{-15}	6.85×10^{-6}	8.34×10^{-8}	2.46×10^{-5}	3.68×10^{-10}

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–55a. Map 12C: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
UPR-200-E-51	UPR-200-E-51	Liquid		Site consolidated with Site WIDS ID 216-A-29						
216-A-24	216-A-24 Crib	Liquid	2001	8.80×10^{3}	3.03	–	1.75	4.75×10^{-2}	8.57×10^{-3}	5.64×10^{-6}
216-A-6	216-A-6 Crib	Liquid	2001	1.16×10^{3}	1.32×10^{-2}	–	2.09	3.99×10^{-3}	2.10×10^{-2}	7.30×10^{-2}
216-A-19	216-A-19 Trench	Liquid	2001	–	–	–	–	–	–	–
216-A-20	216-A-20 Trench	Liquid	2001	2.33	3.37×10^{-3}	–	4.15×10^{-4}	–	–	–
216-A-8	216-A-8 Crib	Liquid	2001	2.46×10^{4}	3.53	–	8.65	2.85×10^{-1}	5.15×10^{-2}	3.74×10^{-5}
216-A-29[b]	216-A-29 Ditch	Liquid	Unknown	–	–	–	–	–	–	–
216-A-30	216-A-30 Crib	Liquid	2001	1.81×10^{-2}	2.89×10^{-2}	–	1.10	1.21×10^{-4}	7.39×10^{-4}	8.91×10^{-3}
216-A-37-1	216-A-37-1 Crib	Liquid	2001	5.92×10^{2}	1.50	–	1.85×10^{-1}	–	–	–
216-A-37-2	216-A-37-2 Crib	Liquid	2001	9.51	4.53×10^{-1}	–	5.56×10^{-2}	–	–	5.44×10^{-5}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–55b. Map 12C: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
UPR-200-E-51	UPR-200-E-51	Liquid		Site consolidated with Site WIDS ID 216-A-29						
216-A-24	216-A-24 Crib	Liquid	2001	4.01×10^{2}	–	2.03×10^{-11}	5.14×10^{-2}	2.27×10^{-3}	4.40×10^{-1}	2.98×10^{-1}
216-A-6	216-A-6 Crib	Liquid	2001	1.10	–	9.53×10^{-10}	1.45×10^{-1}	9.19×10^{-2}	3.61	2.94
216-A-19	216-A-19 Trench	Liquid	2001	–	–	–	2.93×10^{1}	–	–	–
216-A-20	216-A-20 Trench	Liquid	2001	–	–	5.44×10^{-17}	4.18×10^{-1}	2.13×10^{-6}	3.23×10^{-4}	2.70×10^{-4}
216-A-8	216-A-8 Crib	Liquid	2001	2.41×10^{3}	–	1.22×10^{-10}	3.10×10^{-1}	3.77×10^{-3}	1.13	5.18×10^{-1}
216-A-29[b]	216-A-29 Ditch	Liquid	Unknown	–	–	–	–	–	–	–
216-A-30	216-A-30 Crib	Liquid	2001	2.80	–	6.18×10^{-8}	2.58	3.31×10^{-3}	4.14×10^{1}	1.47×10^{-3}
216-A-37-1	216-A-37-1 Crib	Liquid	2001	–	–	1.23×10^{-13}	1.59×10^{-4}	4.31×10^{-4}	1.57×10^{-1}	1.20×10^{-1}
216-A-37-2	216-A-37-2 Crib	Liquid	2001	–	–	3.73×10^{-11}	3.97×10^{-2}	5.76×10^{-4}	1.78×10^{-1}	3.60×10^{-2}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–56a. Map 12D: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
216-A-13	216-A-13 French Drain	Liquid	2001	2.72×10^{-8}	6.23×10^{-10}	–	5.54×10^{-7}	3.14×10^{-9}	1.67×10^{-8}	3.20×10^{-11}
200-E-61	200-E-61 Reverse Well	Liquid	2001	4.90×10^{-6}	1.12×10^{-7}	–	9.96×10^{-5}	5.65×10^{-7}	3.00×10^{-6}	5.75×10^{-9}
200-E-136	200-E-136 PUREX Plant (202-A and Others)	Solid	2003	–	–	–	8.92×10^{3}	–	–	6.21×10^{-3}
UPR-200-E-39	UPR-200-E-39 (@ 216-A-36B)	Liquid	2001	1.43×10^{-1}	–	–	1.12	1.55×10^{-4}	6.90×10^{-4}	–
UPR-200-E-40	UPR-200-E-40	Liquid	2001	1.10×10^{-2}	–	–	8.64×10^{-2}	1.20×10^{-5}	5.33×10^{-5}	–
200-E-85	200-E-85 Reverse Well	Liquid	2001	3.87×10^{-6}	8.88×10^{-8}	–	7.88×10^{-5}	4.48×10^{-7}	2.37×10^{-6}	4.56×10^{-9}
216-A-35	216-A-35 French Drain	Liquid	2001	2.72×10^{-8}	6.22×10^{-10}	–	5.53×10^{-7}	3.14×10^{-9}	1.67×10^{-8}	3.20×10^{-11}
200-E-54	200-E-54 Unplanned Release	Liquid	2001	5.45×10^{-7}	1.25×10^{-8}	–	1.11×10^{-5}	6.29×10^{-8}	3.34×10^{-7}	6.42×10^{-10}
200-E-103	200-E-103 PUREX Stabilized Area	Liquid	2001	1.09×10^{-8}	2.49×10^{-10}	–	2.21×10^{-7}	1.26×10^{-9}	6.66×10^{-9}	1.28×10^{-11}
UPR-200-E-117[b]	UPR-200-E-117	Liquid	2001	3.54×10^{-3}	6.36×10^{-4}	–	8.21×10^{-1}	4.51×10^{-3}	2.39×10^{-2}	1.27×10^{-5}
216-A-2	216-A-2 Crib	Liquid	2001	1.40×10^{-3}	2.21×10^{-3}	–	8.92×10^{-1}	1.49×10^{-1}	2.70×10^{-2}	1.76×10^{-5}
216-A-26	216-A-26 French Drain	Liquid	2001	1.05×10^{-8}	2.40×10^{-10}	–	2.14×10^{-7}	1.21×10^{-9}	6.43×10^{-9}	1.23×10^{-11}
216-A-26A	216-A-26A French Drain	Liquid	2001	2.72×10^{-9}	6.23×10^{-11}	–	5.54×10^{-8}	3.14×10^{-10}	1.67×10^{-9}	3.20×10^{-12}
216-A-15	216-A-15 French Drain	Liquid	2001	–	3.90×10^{-5}	–	2.40×10^{-6}	–	–	5.51×10^{-7}
200-E-107	200-E-107 Unplanned Release	Liquid	2001	7.28×10^{-9}	1.67×10^{-10}	–	1.49×10^{-7}	8.41×10^{-10}	4.47×10^{-9}	2.34×10^{-6}
218-E-14	218-E-14 PUREX Tunnel 1	Solid	1990	–	–	–	8.45×10^{2}	–	–	–
218-E-15	218-E-15 PUREX Tunnel 2	Solid	1990	–	–	–	–	–	–	–
216-A-4	216-A-4 Crib	Liquid	2001	6.45×10^{1}	8.02×10^{-5}	–	4.14	1.99×10^{-4}	5.72×10^{-1}	–
216-A-5	216-A-5 Crib	Liquid	2001	1.71×10^{4}	9.98×10^{-3}	–	3.03×10^{1}	5.82×10^{-2}	3.07×10^{-1}	9.63×10^{-1}
216-A-10	216-A-10 Crib	Liquid	2001	5.78×10^{4}	1.11×10^{-2}	–	1.84×10^{1}	9.36×10^{-2}	4.89×10^{-1}	1.73
216-A-21	216-A-21 Crib	Liquid	2001	4.95×10^{1}	–	–	6.06	1.69×10^{-3}	7.53×10^{-3}	–
216-A-27	216-A-27 Crib	Liquid	2001	5.01×10^{-2}	4.82×10^{-4}	–	2.48×10^{1}	1.21×10^{-3}	8.61×10^{-3}	7.40×10^{-8}
216-A-31	216-A-31 Crib	Liquid	2001	5.52×10^{-4}	3.51×10^{-4}	–	1.27	4.40×10^{-2}	7.93×10^{-3}	5.20×10^{-6}
216-A-36-A	216-A-36A Crib	Liquid	2001	1.00×10^{2}	–	–	7.89×10^{2}	1.10×10^{-1}	4.89×10^{-1}	–
216-A-36-B	216-A-36B Crib	Liquid	2001	2.00×10^{2}	–	–	2.75×10^{2}	1.43×10^{-2}	6.33×10^{-2}	8.64×10^{-3}
216-A-45	216-A-45 Crib	Liquid	2001	3.22×10^{3}	3.96×10^{-5}	–	6.99×10^{-2}	1.20×10^{-3}	5.84×10^{-3}	3.26×10^{-2}

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; PUREX=Plutonium-Uranium Extraction; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–56b. Map 12D: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
216-A-13	216-A-13 French Drain	Liquid	2001	6.92×10^{-5}	–	2.18×10^{-14}	5.30×10^{-11}	6.75×10^{-11}	2.83×10^{-9}	1.96×10^{-9}
200-E-61	200-E-61 Reverse Well	Liquid	2001	1.24×10^{-2}	–	3.92×10^{-12}	9.53×10^{-9}	1.21×10^{-8}	5.09×10^{-7}	3.53×10^{-7}
200-E-136	200-E-136 PUREX Plant (202-A and Others)	Solid	2003	1.10×10^{4}	–	–	–	–	4.78×10^{2}	4.91×10^{2}
UPR-200-E-39	UPR-200-E-39 (@ 216-A-36B)	Liquid	2001	9.73×10^{-1}	–	6.45×10^{-14}	1.63×10^{-4}	8.47×10^{-6}	4.75×10^{-3}	3.43×10^{-3}
UPR-200-E-40	UPR-200-E-40	Liquid	2001	7.54×10^{-2}	–	4.99×10^{-15}	1.26×10^{-5}	6.56×10^{-7}	3.71×10^{-4}	2.60×10^{-4}
200-E-85	200-E-85 Reverse Well	Liquid	2001	9.85×10^{-3}	–	3.10×10^{-12}	7.55×10^{-9}	9.61×10^{-9}	4.03×10^{-7}	2.80×10^{-7}
216-A-35	216-A-35 French Drain	Liquid	2001	6.91×10^{-5}	–	2.18×10^{-14}	5.29×10^{-11}	6.74×10^{-11}	2.83×10^{-9}	1.96×10^{-9}
200-E-54	200-E-54 Unplanned Release	Liquid	2001	1.39×10^{-3}	–	4.36×10^{-13}	1.06×10^{-9}	1.35×10^{-9}	5.67×10^{-8}	3.93×10^{-8}
200-E-103	200-E-103 PUREX Stabilized Area	Liquid	2001	2.76×10^{-5}	–	8.70×10^{-15}	2.12×10^{-11}	2.70×10^{-11}	1.13×10^{-9}	7.85×10^{-10}
UPR-200-E-117[b]	UPR-200-E-117	Liquid	2001	9.64×10^{1}	–	3.23×10^{-9}	8.35×10^{-6}	9.85×10^{-5}	2.03×10^{-3}	2.24×10^{-3}
216-A-2	216-A-2 Crib	Liquid	2001	1.86	–	2.86×10^{-11}	1.54×10^{-1}	6.23×10^{-2}	9.47	1.76×10^{-1}
216-A-26	216-A-26 French Drain	Liquid	2001	2.67×10^{-5}	–	8.40×10^{-15}	2.04×10^{-11}	2.60×10^{-11}	1.09×10^{-9}	7.57×10^{-10}
216-A-26A	216-A-26A French Drain	Liquid	2001	6.92×10^{-6}	–	2.18×10^{-15}	5.30×10^{-12}	6.75×10^{-12}	2.83×10^{-10}	1.96×10^{-10}
216-A-15	216-A-15 French Drain	Liquid	2001	–	–	8.73×10^{-14}	3.43×10^{-4}	5.84×10^{-6}	1.31×10^{-3}	2.00×10^{-8}
200-E-107	200-E-107 Unplanned Release	Liquid	2001	1.85×10^{-5}	–	5.85×10^{-15}	1.42×10^{-11}	1.81×10^{-11}	7.60×10^{-10}	5.26×10^{-10}
218-E-14	218-E-14 PUREX Tunnel 1	Solid	1990	9.45×10^{2}	–	–	–	–	–	–
218-E-15	218-E-15 PUREX Tunnel 2	Solid	1990	–	–	–	–	–	4.74×10^{1}	–
216-A-4	216-A-4 Crib	Liquid	2001	4.86	–	2.32×10^{-7}	3.71	3.02×10^{-6}	1.47	5.35×10^{-3}
216-A-5	216-A-5 Crib	Liquid	2001	1.16×10^{1}	–	3.84×10^{-10}	1.33×10^{-1}	1.31	3.91×10^{1}	4.30×10^{1}
216-A-10	216-A-10 Crib	Liquid	2001	2.84×10^{1}	–	6.37×10^{-9}	2.50×10^{-1}	2.50	6.99×10^{1}	7.53×10^{1}
216-A-21	216-A-21 Crib	Liquid	2001	6.37×10^{1}	–	2.69×10^{-11}	1.34×10^{-1}	2.37×10^{-2}	5.74	4.61
216-A-27	216-A-27 Crib	Liquid	2001	2.94×10^{1}	–	1.39×10^{-6}	4.99×10^{-1}	1.83×10^{-5}	8.76	3.21×10^{-2}
216-A-31	216-A-31 Crib	Liquid	2001	3.71×10^{2}	–	8.27×10^{-12}	4.12×10^{-2}	3.89×10^{-4}	9.43×10^{-2}	2.29×10^{-2}
216-A-36-A	216-A-36A Crib	Liquid	2001	6.87×10^{2}	–	4.55×10^{-11}	1.15×10^{-1}	5.96×10^{-3}	3.39	2.40
216-A-36-B	216-A-36B Crib	Liquid	2001	2.92×10^{2}	–	9.58×10^{-11}	1.02×10^{-1}	2.43×10^{-4}	7.49×10^{-2}	2.26×10^{-1}
216-A-45	216-A-45 Crib	Liquid	2001	1.59	–	7.82×10^{-10}	6.52×10^{-3}	4.35×10^{-2}	1.18	1.25

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; PUREX=Plutonium-Uranium Extraction; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–57a. Map 13: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
2101-M Pond	2101-M Pond	Liquid	2001	1.50×10^{-1}	3.25×10^{-3}	–	1.69×10^{-4}	–	–	1.43×10^{-5}
216-B-54	216-B-54 Trench	Liquid	2001	1.04×10^{-2}	2.62×10^{-2}	–	5.19	2.50×10^{-4}	1.79×10^{-3}	–
216-B-14	216-B-14 Crib	Liquid	2001	5.41×10^{1}	2.10	–	5.95×10^{2}	2.54×10^{-2}	3.29×10^{1}	4.23×10^{-2}
216-B-15	216-B-15 Crib	Liquid	2001	3.94×10^{1}	1.53	–	1.68×10^{2}	1.85×10^{-2}	2.40×10^{1}	3.08×10^{-2}
216-B-16	216-B-16 Crib	Liquid	2001	3.50×10^{1}	1.31	–	1.45×10^{2}	5.02×10^{-1}	1.97×10^{1}	2.98×10^{-2}
216-B-17	216-B-17 Crib	Liquid	2001	2.13×10^{1}	7.41×10^{-1}	–	8.29×10^{1}	9.90×10^{-1}	9.84	2.17×10^{-2}
216-B-18	216-B-18 Crib	Liquid	2001	5.31×10^{1}	2.06	–	2.27×10^{2}	2.50×10^{-2}	3.24×10^{1}	4.15×10^{-2}
216-B-19	216-B-19 Crib	Liquid	2001	3.97×10^{1}	1.43	–	1.59×10^{2}	1.29	2.01×10^{1}	3.75×10^{-2}
216-B-20	216-B-20 Trench	Liquid	2001	2.92×10^{1}	1.06	–	3.07×10^{2}	8.33×10^{-1}	1.52×10^{1}	2.70×10^{-2}
216-B-21	216-B-21 Trench	Liquid	2001	2.91×10^{1}	1.11	–	1.23×10^{2}	2.06×10^{-1}	1.71×10^{1}	2.38×10^{-2}
216-B-22	216-B-22 Trench	Liquid	2001	2.96×10^{1}	1.10	–	1.22×10^{2}	5.43×10^{-1}	1.63×10^{1}	2.58×10^{-2}
216-B-23	216-B-23 Trench	Liquid	2001	2.82×10^{1}	1.05	–	1.16×10^{2}	5.31×10^{-1}	1.55×10^{1}	2.47×10^{-2}
216-B-24	216-B-24 Trench	Liquid	2001	3.04×10^{1}	1.18	–	1.30×10^{2}	1.43×10^{-2}	1.85×10^{1}	2.37×10^{-2}
216-B-25	216-B-25 Trench	Liquid	2001	3.06×10^{1}	1.19	–	1.31×10^{2}	1.44×10^{-2}	1.87×10^{1}	2.39×10^{-2}
216-B-26	216-B-26 Trench	Liquid	2001	2.96×10^{1}	1.15	–	4.88×10^{2}	1.39×10^{-2}	1.80×10^{1}	2.31×10^{-2}
216-B-27	216-B-27 Trench	Liquid	2001	2.76×10^{1}	1.07	–	1.18×10^{2}	1.30×10^{-2}	1.68×10^{1}	2.15×10^{-2}
216-B-28	216-B-28 Trench	Liquid	2001	3.15×10^{1}	1.18	–	1.30×10^{2}	5.12×10^{-1}	1.76×10^{1}	2.72×10^{-2}
216-B-29	216-B-29 Trench	Liquid	2001	3.01×10^{1}	1.17	–	2.49×10^{2}	1.42×10^{-2}	1.84×10^{1}	2.35×10^{-2}
216-B-30	216-B-30 Trench	Liquid	2001	2.99×10^{1}	1.07	–	1.19×10^{2}	1.02	1.50×10^{1}	2.85×10^{-2}
216-B-31	216-B-31 Trench	Liquid	2001	3.03×10^{1}	1.09	–	1.21×10^{2}	1.02	1.52×10^{1}	2.88×10^{-2}
216-B-32	216-B-32 Trench	Liquid	2001	2.97×10^{1}	1.06	–	1.51×10^{2}	1.06	1.47×10^{1}	2.85×10^{-2}
216-B-33	216-B-33 Trench	Liquid	2001	2.97×10^{1}	1.04	–	1.70×10^{2}	1.24	1.42×10^{1}	2.94×10^{-2}
216-B-34	216-B-34 Trench	Liquid	2001	3.05×10^{1}	1.07	–	1.65×10^{2}	1.29	1.45×10^{1}	3.04×10^{-2}
216-B-52	216-B-52 Trench	Liquid	2001	5.33×10^{1}	1.89	–	3.87×10^{2}	2.00	2.61×10^{1}	5.18×10^{-2}
216-B-53A	216-B-53A Trench	Liquid	2001	1.79×10^{-2}	1.44×10^{-2}	–	8.88	4.29×10^{-4}	3.07×10^{-3}	–
216-B-53B	216-B-53B Trench	Liquid	2001	1.05×10^{-2}	4.97×10^{-4}	–	5.19	2.50×10^{-4}	1.79×10^{-3}	–
216-B-58	216-B-58 Trench	Liquid	2001	8.36×10^{-3}	1.09×10^{-2}	–	4.15	2.00×10^{-4}	1.43×10^{-3}	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–57b. Map 13: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
2101-M Pond	2101-M Pond	Liquid	2001	1.15×10^{-3}	–	1.78×10^{-12}	8.75×10^{-3}	2.14×10^{-4}	3.27×10^{-2}	6.76×10^{-4}
216-B-54	216-B-54 Trench	Liquid	2001	6.12	–	2.91×10^{-7}	6.62×10^{-2}	7.93×10^{-4}	1.30	5.52×10^{-1}
216-B-14	216-B-14 Crib	Liquid	2001	3.04×10^{2}	–	8.53×10^{-10}	1.82×10^{-1}	2.61×10^{-1}	7.64	1.44×10^{1}
216-B-15	216-B-15 Crib	Liquid	2001	2.22×10^{2}	–	6.22×10^{-10}	1.32×10^{-1}	1.91×10^{-1}	5.57	1.05×10^{1}
216-B-16	216-B-16 Crib	Liquid	2001	1.97×10^{2}	–	6.51×10^{-10}	1.17×10^{-1}	1.58×10^{-1}	4.94	8.83
216-B-17	216-B-17 Crib	Liquid	2001	1.20×10^{2}	–	5.38×10^{-10}	7.00×10^{-2}	8.04×10^{-2}	3.02	4.65
216-B-18	216-B-18 Crib	Liquid	2001	2.99×10^{2}	–	8.39×10^{-10}	1.79×10^{-1}	2.57×10^{-1}	7.51	1.42×10^{1}
216-B-19	216-B-19 Crib	Liquid	2001	2.23×10^{2}	–	8.86×10^{-10}	1.31×10^{-1}	1.62×10^{-1}	5.61	9.25
216-B-20	216-B-20 Trench	Liquid	2001	5.49×10^{2}	–	6.30×10^{-10}	9.99×10^{-2}	1.22×10^{-1}	4.25	6.94
216-B-21	216-B-21 Trench	Liquid	2001	1.64×10^{2}	–	4.99×10^{-10}	9.76×10^{-2}	1.36×10^{-1}	4.12	7.58
216-B-22	216-B-22 Trench	Liquid	2001	1.66×10^{2}	–	5.76×10^{-10}	9.86×10^{-2}	1.31×10^{-1}	4.18	7.34
216-B-23	216-B-23 Trench	Liquid	2001	1.59×10^{2}	–	5.52×10^{-10}	9.40×10^{-2}	1.24×10^{-1}	3.99	6.99
216-B-24	216-B-24 Trench	Liquid	2001	1.71×10^{2}	–	4.79×10^{-10}	1.02×10^{-1}	1.47×10^{-1}	4.29	8.11
216-B-25	216-B-25 Trench	Liquid	2001	1.72×10^{2}	–	4.83×10^{-10}	1.03×10^{-1}	1.48×10^{-1}	4.33	8.18
216-B-26	216-B-26 Trench	Liquid	2001	5.85×10^{2}	–	4.67×10^{-10}	1.07×10^{-1}	1.43×10^{-1}	4.27	7.91
216-B-27	216-B-27 Trench	Liquid	2001	1.55×10^{2}	–	4.35×10^{-10}	9.27×10^{-2}	1.33×10^{-1}	3.90	7.36
216-B-28	216-B-28 Trench	Liquid	2001	1.77×10^{2}	–	6.00×10^{-10}	1.05×10^{-1}	1.41×10^{-1}	4.46	7.89
216-B-29	216-B-29 Trench	Liquid	2001	1.70×10^{2}	–	4.75×10^{-10}	1.01×10^{-1}	1.46×10^{-1}	4.26	8.05
216-B-30	216-B-30 Trench	Liquid	2001	1.68×10^{2}	–	6.77×10^{-10}	9.87×10^{-2}	1.21×10^{-1}	4.23	6.92
216-B-31	216-B-31 Trench	Liquid	2001	1.70×10^{2}	–	6.84×10^{-10}	1.00×10^{-1}	1.23×10^{-1}	4.29	7.03
216-B-32	216-B-32 Trench	Liquid	2001	1.67×10^{2}	–	6.83×10^{-10}	9.81×10^{-2}	1.19×10^{-1}	4.20	6.83
216-B-33	216-B-33 Trench	Liquid	2001	1.67×10^{2}	–	7.19×10^{-10}	9.78×10^{-2}	1.15×10^{-1}	4.20	6.63
216-B-34	216-B-34 Trench	Liquid	2001	1.71×10^{2}	–	7.44×10^{-10}	1.00×10^{-1}	1.18×10^{-1}	4.31	6.79
216-B-52	216-B-52 Trench	Liquid	2001	3.00×10^{2}	–	1.25×10^{-9}	1.76×10^{-1}	2.12×10^{-1}	7.54	1.21×10^{1}
216-B-53A	216-B-53A Trench	Liquid	2001	1.05×10^{1}	–	4.99×10^{-7}	2.15×10^{-1}	4.35×10^{-4}	3.86	3.08×10^{-1}
216-B-53B	216-B-53B Trench	Liquid	2001	6.10	–	2.91×10^{-7}	6.25×10^{-2}	1.90×10^{-5}	1.11	1.50×10^{-2}
216-B-58	216-B-58 Trench	Liquid	2001	4.89	–	2.33×10^{-7}	5.17×10^{-2}	3.30×10^{-4}	9.67×10^{-1}	2.32×10^{-1}

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–58a. Map 14: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
600 NRDWL	600 Nonrad Dangerous Waste Landfill	Solid	N/A	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–58b. Map 14: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
600 NRDWL	600 Nonrad Dangerous Waste Landfill	Solid	N/A	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–59a. Map 15: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
618-11	300 Wye Burial Ground	Solid	1986	–	–	–	1.00×10^{3}	–	–	–
400 RFD[b]	400 Area Retired French Drains	Liquid	N/A	–	–	–	–	–	–	–
316-4	300 North Cribs, 321 Cribs	Liquid	2001	–	–	–	–	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site had inventories that were in the initial list of constituents but was screened out during the final screening described in Section S.3.6.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–59b. Map 15: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
618-11	300 Wye Burial Ground	Solid	1986	1.00×10^{3}	–	–	–	–	6.23×10^{2}	–
400 RFD[b]	400 Area Retired French Drains	Liquid	N/A	–	–	–	–	–	–	–
316-4	300 North Cribs, 321 Cribs	Liquid	2001	–	–	–	1.30×10^{-4}	–	–	–

[a] Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

[b] This site had inventories that were in the initial list of constituents but was screened out during the final screening described in Section S.3.6.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–60a. Map 16: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	H-3	C-14	K-40	Sr-90	Zr-93	Tc-99	I-129
618-9	300 West Burial Ground	Solid	N/A	–	–	–	–	–	–	–
316-1	300 Area South Process Ponds	Liquid	2001	1.05	1.23×10^{-1}	–	1.17×10^{2}	4.78×10^{-2}	4.35×10^{-1}	1.79×10^{-2}
316-2	300 Area North Process Ponds	Liquid	2001	4.69×10^{-1}	1.11×10^{-1}	–	5.20×10^{1}	2.13×10^{-2}	1.93×10^{-1}	1.76×10^{-2}
316-5	300 Area Process Trenches	Liquid	2001	–	1.41×10^{-1}	–	8.72×10^{-3}	–	–	2.00×10^{-3}
UPR-300-1	307-340 Waste Line Leak	Liquid	1969	–	–	–	1.00×10^{1}	–	–	–
300-19[b]	324 Sodium Removal Pilot Plant	Liquid	Unknown	–	–	–	–	–	–	–
UPR-300-13[b]	Acid Neutralization Tank Leak East of 333 Building	Liquid	N/A	–	–	–	–	–	–	–
300-264	327 Building, Postirradiation Testing Laboratory	Liquid	Unknown	–	–	–	2.25×10^{2}	–	–	–
309-WS-1	309 Plutonium Recycle Test Reactor Ion Exchange Vault	Liquid	1994	–	–	–	1.00	–	–	–
316-3	307 Disposal Trenches	Liquid	N/A	–	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: C=carbon; H=hydrogen; I=iodine; ID=identifier; K=potassium; N/A=not applicable; Sr=strontium; Tc=technetium; WIDS=Waste Information Data System; Zr=zirconium.

Source: SAIC 2006.

Table S–60b. Map 16: Radionuclide Inventories (curies)

WIDS ID/ Building Number	Common Site Name	Source Type	Decay Date[a]	Cs-137	Gd-152	Th-232	U-238 (U-233, U-234, U-235, U-238)	Np-237	Pu-239 (Pu-239, Pu-240)	Am-241
618-9	300 West Burial Ground	Solid	N/A	–	–	–	–	–	–	–
316-1	300 Area South Process Ponds	Liquid	2001	9.61×10^{2}	–	3.28×10^{-10}	8.45×10^{1}	1.59×10^{-2}	4.03	1.52×10^{-1}
316-2	300 Area North Process Ponds	Liquid	2001	4.27×10^{2}	–	3.14×10^{-10}	6.16×10^{1}	1.44×10^{-2}	3.73	6.78×10^{-2}
316-5	300 Area Process Trenches	Liquid	2001	–	–	7.83×10^{-10}	1.41	1.09×10^{-2}	5.03	7.26×10^{-5}
UPR-300-1	307-340 Waste Line Leak	Liquid	1969	1.00×10^{1}	–	–	–	–	–	–
300-19[b]	324 Sodium Removal Pilot Plant	Liquid	Unknown	4.20×10^{4}	–	–	–	–	7.77	5.67×10^{1}
UPR-300-13[b]	Acid Neutralization Tank Leak East of 333 Building	Liquid	N/A	–	–	–	–	–	–	–
300-264	327 Building, Postirradiation Testing Laboratory	Liquid	Unknown	1.60×10^{2}	–	–	–	–	–	–
309-WS-1	309 Plutonium Recycle Test Reactor Ion Exchange Vault	Liquid	1994	1.00	–	–	–	–	–	–
316-3	307 Disposal Trenches	Liquid	N/A	–	–	–	–	–	–	–

a Date of determination of the inventories reflected in this table. For purposes of groundwater modeling (see Appendix N), these concentrations were adjusted (i.e., increased) to account for decay from the date of radionuclide release.

b This site was not modeled because not all the information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: Am=americium; Cs=cesium; Gd=gadolinium; ID=identifier; N/A=not applicable; Np=neptunium; Pu=plutonium; Th=thorium; U=uranium; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–61a. Map 1: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
116-B-1	107-B Liquid Waste Disposal Trench	L	–	–	–	–	–	–	–	–	–	–	2.40×10^{1}	–	–
116-B-4	105-B Dummy Decontamination French Drain	L	–	–	–	–	–	–	–	–	–	–	4.00×10^{2}	–	–
116-B-5	108-B Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-B-6A	116-B-6-1 Crib	L	–	–	–	–	–	–	–	–	–	–	2.00×10^{1}	–	–
116-B-6B	116-B-6-2 Crib	L	–	–	–	–	–	–	–	–	–	–	2.00×10^{1}	–	–
116-B-11	107-B Retention Basins	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-C-5	107-C Retention Basins	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-C-1	107-C Liquid Waste Disposal Trench	L	–	–	–	–	–	–	–	–	–	–	4.00×10^{1}	–	–
116-C-2A	105-C Pluto Crib	L	–	–	–	–	–	–	–	–	–	–	2.00×10^{2}	–	–
116-C-2C	105-C Pluto Crib Sand Filter	L	–	–	–	–	–	–	–	–	–	–	–	–	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–61b. Map 1: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
116-B-1	107-B Liquid Waste Disposal Trench	L		–	–	–	–	–	–	–	–	–	–	–	–
116-B-4	105-B Dummy Decontamination French Drain	L		–	–	–	–	–	–	–	–	–	–	–	–
116-B-5	108-B Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-B-6A	116-B-6-1 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-B-6B	116-B-6-2 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-B-11	107-B Retention Basins	L		–	–	–	–	–	–	–	–	–	–	–	–
116-C-5	107-C Retention Basins	L		–	–	–	–	–	–	–	–	–	–	–	–
116-C-1	107-C Liquid Waste Disposal Trench	L		–	–	–	–	–	–	–	–	–	–	–	–
116-C-2A	105-C Pluto Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-C-2C	105-C Pluto Crib Sand Filter	L		–	–	–	–	–	–	–	–	–	–	–	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–62a. Map 2: Chemical Inventories (kilograms)

WIDS ID/ Building Number.	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
116-K-1	100-K Crib	L	–	–	–	–	–	–	–	–	–	–	1.60×10^{1}	–	–
116-K-2	100-K Mile Long Trench	L	–	–	–	–	–	–	–	–	–	–	1.20×10^{5}	–	–
116-KE-4	107-KE Retention Basins	L		– –	–	–	–	–	–	–	–	–	–	–	–
116-KW-3	107-KW Retention Basin	L		– –	–	–	–	–	–	–	–	–	–	–	–
116-KE-1	115-KE Condensate Crib	L		– –	–	–	–	–	–	–	–	–	–	–	–
116-KE-2	1706-KER Waste Crib	L		– –	–	–	–	–	–	–	–	–	–	–	–
116-KW-1	115-KW Condensate Crib	L		– –	–	–	–	–	–	–	–	–	–	–	–
UPR-100-K-1[a]	100-KE Fuel Storage Basin Leak	L		– –	–	–	–	–	–	–	–	–	–	–	–
120-KE-1	183-KE Filter Waste Facility Drywell	L/S		– –	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–62b. Map 2: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
116-K-1	100-K Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-K-2	100-K Mile Long Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-KE-4	107-KE Retention Basins	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-KW-3	107-KW Retention Basin	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-KE-1	115-KE Condensate Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-KE-2	1706-KER Waste Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-KW-1	115-KW Condensate Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-100-K-1[a]	100-KE Fuel Storage Basin Leak	L	–	–	–	–	–	–	–	–	–	–	–	–	–
120-KE-1	183-KE Filter Waste Facility Drywell	L/S	–	–	–	2.20×10^{2}	–	–	–	–	–	–	–	–	–

a This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–63a. Map 3: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
116-N-1	1301-N Liquid Waste Disposal Facility	L		–	–	–	–	–	–	–	–	–	–	–	–
116-N-3	1325-N Liquid Waste Disposal Facility	L		–	–	–	–	–	–	–	–	–	–	–	–
UPR-100-N-3	Spacer Disposal System Transport Line Leak	L		–	–	–	–	–	–	–	–	–	–	–	–
UPR-100-N-7	Rad Line Leak	L	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-100-N-35[a]	100-N Fuel Storage Basin Drainage System Leak	L		–	–	–	–	–		–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–63b. Map 3: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
116-N-1	1301-N Liquid Waste Disposal Facility	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-N-3	1325-N Liquid Waste Disposal Facility	L	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-100-N-3	Spacer Disposal System Transport Line Leak	L	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-100-N-7	Rad Line Leak	L	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-100-N-35[a]	100-N Fuel Storage Basin Drainage System Leak	L	–	–	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–64a. Map 4: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
116-D-1A	105-D Storage Basin Trenches 1	L	–	–	–	–	–	–	–	–	–	–	4.00×10^{2}	–	–
116-D-1B	105-D Storage Basin Trenches 2	L	–	–	–	–	–	–	–	–	–	–	2.80×10^{2}	–	–
116-D-7	107-D Retention Basin	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-DR-9	107-DR Retention Basin	L	–	–	–	–	–	–	–	–	–	–	–	–	–
100-D-25[a]	107-DR Basin Leaks	L	–	–	–	–	–	–		–	–	–	–	–	
UPR-100-D-4[a]	107-D Basin Leaks	L	–	–	–	–	–	–		–	–	–	–	–	
116-DR-1&2	107-DR Liquid Waste Disposal Trenches	L	–	–	–	–	–	–	–	–	–	–	3.20×10^{1}	–	–
116-DR-6	1608-DR Liquid Disposal Trench	L	–	–	–	–	–	–	–	–	–	–	8.00×10^{-1}	–	–
116-DR-7	105-DR Inkwell Crib	L	–	–	–	–	–	–	–	3.30×10^{2}	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–64b. Map 4: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
116-D-1A	105-D Storage Basin Trenches 1	L		–	–	–	–	–	–	–	–	–	–	–	–
116-D-1B	105-D Storage Basin Trenches 2	L		–	–	–	–	–	–	–	–	–	–	–	–
116-D-7	107-D Retention Basin	L		–	–	–	–	–	–	–	–	–	–	–	–
116-DR-9	107-DR Retention Basin	L		–	–	–	–	–	–	–	–	–	–	–	–
100-D-25[a]	107-DR Basin Leaks	L	–	–		–	–	–	–	–	–		–		–
UPR-100-D-4[a]	107-D Basin Leaks	L	–	–		–	–	–	–	–	–		–		–
116-DR-1&2	107-DR Liquid Waste Disposal Trenches	L		–	–	–	–	–	–	–	–	–	–	–	–
116-DR-6	1608-DR Liquid Disposal Trench	L		–	–	–	–	–	–	–	–	–	–	–	–
116-DR-7	105-DR Inkwell Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–65a. Map 5: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
100-H-33	183-H Solar Evaporation Basins Radionuclide Components	L	–	–	–	–	–	–	–	–	–	–	7.35×10^{2}	–	8.74×10^{4}
116-H-6	183-H Solar Evaporation Basins	L	Site consolidated with Site WIDS ID 100-H-33												
116-H-1	107-H Liquid Disposal Trench	L	–	–	–	–	–	–	–	–	–	–	3.60×10^{1}	–	–
116-H-2	1608-H Liquid Waste Disposal Trench	L	–	–	–	–	–	–	–	–	–	–	2.40×10^{2}	–	–
116-H-4	105-H Pluto Crib	L	–	–	–	–	–	–	–	–	–	–	4.00×10^{2}	–	–
116-H-7	107-H Retention Basin	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-H-3	105-H Dummy Decontamination French Drain	L	–	–	–	–	–	–	–	–	–	–	8.00×10^{2}	–	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–65b. Map 5: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
100-H-33	183-H Solar Evaporation Basins Radionuclide Components	L	–	–	1.39×10^{3}	–	–	–	1.36×10^{6}	–	–	–	–	1.96×10^{3}	–
116-H-6	183-H Solar Evaporation Basins	L	Site consolidated with Site WIDS ID 100-H-33												
116-H-1	107-H Liquid Disposal Trench	L		–	–	–	–	–	–	–	–	–	–	–	–
116-H-2	1608-H Liquid Waste Disposal Trench	L		–	–	–	–	–	–	–	–	–	–	–	–
116-H-4	105-H Pluto Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-H-7	107-H Retention Basin	L		–	–	–	–	–	–	–	–	–	–	–	–
116-H-3	105-H Dummy Decontamination French Drain	L		–	–	–	–	–	–	–	–	–	–	–	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–66a. Map 6: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
116-F-1[a]	Lewis Canal	L	–	–	–	–	–	–	–	–	–	–	4.00×10^{1}	–	–
116-F-2	107-F Liquid Waste Disposal Trench	L	–	–	–	–	–	–	–	–	–	–	2.40×10^{1}	–	–
116-F-9	Animal Waste Leaching Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-3	105-F Storage Basin Trench	L	–	–	–	–	–	–	–	–	–	–	1.60	–	–
116-F-6	105-F Cooling Water Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-4	105-F Pluto Crib	L	–	–	–	–	–	–	–	–	–	–	1.60×10^{-3}	–	–
116-F-10	105-F Dummy Decon French Drain	L	–	–	–	–	–	–	–	–	–	–	8.00×10^{2}	–	–
116-F-14	107-F Retention Basin	L	–	–	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because it emptied directly into the Columbia River.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–66b. Map 6: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
116-F-1[a]	Lewis Canal	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-2	107-F Liquid Waste Disposal Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-9	Animal Waste Leaching Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-3	105-F Storage Basin Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-6	105-F Cooling Water Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-4	105-F Pluto Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-10	105-F Dummy Decon French Drain	L	–	–	–	–	–	–	–	–	–	–	–	–	–
116-F-14	107-F Retention Basin	L	–	–	–	–	–	–	–	–	–	–	–	–	–

a This site was not modeled because it emptied directly into the Columbia River.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–67a. Map 7: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-N-1	216-N-1 Pond	L	–	–	–	–	–	–	–	–	–	–	–	–	1.22×10^{2}
216-N-2	216-N-2 Trench	L	–	–	–	–	–	–	–	–	–	–	2.00×10^{-2}	–	1.14
216-N-3	216-N-3 Trench	L	–	–	–	–	–	–	–	–	–	–	2.00×10^{-2}	–	1.14
216-N-4	216-N-4 Pond	L	–	–	–	–	–	–	–	–	–	–	2.01×10^{-2}	–	1.23×10^{2}
216-N-5	216-N-5 Trench	L	–	–	–	–	–	–	–	–	–	–	2.00×10^{-2}	–	1.14
216-N-6	216-N-6 Pond	L	–	–	–	–	–	–	–	–	–	–	2.01×10^{-2}	–	1.23×10^{2}
216-N-7	216-N-7 Trench	L	–	–	–	–	–	–	–	–	–	–	2.00×10^{-2}	–	1.14

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–67b. Map 7: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-N-1	216-N-1 Pond	L	–	8.61	2.94×10^{1}	–	–	–	–	–	–	–	–	5.77×10^{-1}	–
216-N-2	216-N-2 Trench	L	–	6.55×10^{-2}	2.24×10^{-1}	6.04×10^{-6}	–	6.46×10^{-3}	4.53	–	–	–	–	2.23×10^{-2}	–
216-N-3	216-N-3 Trench	L	–	6.55×10^{-2}	2.24×10^{-1}	6.04×10^{-6}	–	6.46×10^{-3}	4.53	–	–	–	–	2.23×10^{-2}	–
216-N-4	216-N-4 Pond	L	–	8.61	2.94×10^{1}	6.05×10^{-6}	–	6.47×10^{-3}	4.54	–	–	–	–	5.95×10^{-1}	–
216-N-5	216-N-5 Trench	L	–	6.55×10^{-2}	2.24×10^{-1}	6.04×10^{-6}	–	6.45×10^{-3}	4.53	–	–	–	–	2.23×10^{-2}	–
216-N-6	216-N-6 Pond	L	–	8.61	2.94×10^{1}	6.05×10^{-6}	–	6.46×10^{-3}	4.54	–	–	–	–	5.95×10^{-1}	–
216-N-7	216-N-7 Trench	L	–	6.55×10^{-2}	2.24×10^{-1}	6.04×10^{-6}	–	6.46×10^{-3}	4.53	–	–	–	–	2.23×10^{-2}	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–68a. Map 8: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-A-25	216-A-25 Gable Mountain Pond	L	–	–	1.05×10^{4}	–	–	–	–	–	–	2.20×10^{3}	4.58	–	4.88×10^{4}
UPR-200-E-34	UPR-200-E-34	L	Site consolidated with Site WIDS ID 216-A-25												
600-118	600-118 Ditch	L	Site consolidated with Site WIDS ID 216-A-25												

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–68b. Map 8: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-A-25	216-A-25 Gable Mountain Pond	L	–	9.37×10^{1}	1.74×10^{3}	8.80×10^{-1}	–	1.35	1.64×10^{5}	–	–	–	–	1.22×10^{4}	–
UPR-200-E-34	UPR-200-E-34	L	Site consolidated with Site WIDS ID 216-A-25												
600-118	600-118 Ditch	L	Site consolidated with Site WIDS ID 216-A-25												

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–69a. Map 9: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-S-5	216-S-5 Crib	L	–	–	1.04×10^{-3}	–	–	–	–	–	–	–	3.58	–	5.15
216-S-6	216-S-6 Crib	L	–		7.97×10^{-4}	–	–	–	–	–	–	–	1.84×10^{-1}	–	3.94
216-S-10D[a]	216-S-10D Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-10P	216-S-10P Pond	L	–	–	–	–	–	–	–	–	–	–	2.98×10^{3}	–	7.43×10^{2}
216-S-11P	216-S-11 Pond	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-16D[a]	216-S-16D Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-16P	216-S-16P Pond	L	–	–	6.10×10^{-4}	–	–	–	–	–	–	–	1.54	–	3.01
216-S-17	216-S-17 Pond	L	–	–	2.22×10^{-4}	–	–	–	–	–	–	–	3.32	–	4.88×10^{2}
UPR-200-W-47	UPR-200-W-47	L	Site consolidated with Site WIDS ID 216-S-16P												
UPR-200-W-59	UPR-200-W-59	L	Site consolidated with Site WIDS ID 216-S-16P												
UPR-200-W-34	UPR-200-W-34	L	Site consolidated with Site WIDS ID 216-S-10D												
218-W-1	218-W-1 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-2	218-W-2 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-4B	218-W-4B Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-4C	218-W-4C Burial Ground	S	–	–	–	–	–	8.08	1.42×10^{-1}	4.90	1.81×10^{2}	8.16×10^{2}	3.75×10^{2}	6.14	5.84×10^{1}
218-W-5	218-W-5 Burial Ground	S	–	–	–	3.20×10^{3}	–	1.83×10^{1}	2.14	1.01×10^{1}	1.21×10^{2}	7.62×10^{-1}	5.08×10^{1}	1.16×10^{2}	7.62×10^{-1}
218-W-3AE	218-W-3AE Burial Ground	S	–	–	–	–	–	9.90×10^{-3}	–	–	3.82×10^{-1}	1.87	3.18×10^{2}	–	1.63×10^{-1}
218-W-3A	218-W-3A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
Z Plant BP	Z Plant Burning Pit	S	Site consolidated with Site WIDS ID 218-W-4C												

[a] This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–69b. Map 9: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-S-5	216-S-5 Crib	L	–	1.16×10^{-3}	1.68×10^{-1}	3.99	–	1.53×10^{-1}	5.07×10^{5}	–	–	–	–	1.10×10^{3}	–
216-S-6	216-S-6 Crib	L	–	1.26×10^{-3}	2.66×10^{-3}	4.33	–	1.57×10^{-2}	5.52×10^{5}	–	–	–	–	8.53×10^{2}	–
216-S-10D[a]	216-S-10D Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-10P	216-S-10P Pond	L	–	2.97×10^{3}	4.29×10^{1}	1.20×10^{2}	–	1.97×10^{-1}	9.55×10^{4}	–	–	–	–	5.12×10^{2}	–
216-S-11P	216-S-11 Pond	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-16D[a]	216-S-16D Ditch	L	–	–	–	–	–	–	1.00×10^{1}	–	–	–	–	–	–
216-S-16P	216-S-16P Pond	L	–	1.16×10^{-2}	1.23×10^{-2}	3.97×10^{1}	–	7.01×10^{-2}	5.03×10^{6}	–	–	–	–	6.57×10^{2}	–
216-S-17	216-S-17 Pond	L	–	3.08×10^{-2}	7.06×10^{-2}	5.34	–	1.37×10^{-1}	6.76×10^{5}	–	–	–	–	3.54	–
UPR-200-W-47	UPR-200-W-47	L	Site consolidated with Site WIDS ID 216-S-16P												
UPR-200-W-59	UPR-200-W-59	L	Site consolidated with Site WIDS ID 216-S-16P												
UPR-200-W-34	UPR-200-W-34	L	Site consolidated with Site WIDS ID 216-S-10D												
218-W-1	218-W-1 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-2	218-W-2 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-4B	218-W-4B Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-4C	218-W-4C Burial Ground	S	–	3.77×10^{5}	7.96×10^{1}	8.42×10^{1}	3.23×10^{1}	1.19×10^{2}	2.86×10^{2}	6.67×10^{-2}	2.98×10^{2}	2.46	1.35×10^{-1}	8.35×10^{1}	9.50×10^{-1}
218-W-5	218-W-5 Burial Ground	S	6.04	4.19×10^{5}	8.28×10^{-1}	1.21×10^{1}	4.98×10^{-3}	3.67×10^{1}	8.63×10^{2}	9.68	7.11×10^{1}	3.40×10^{-4}	1.49×10^{1}	5.54×10^{-2}	1.10
218-W-3AE	218-W-3AE Burial Ground	S	–	7.03×10^{3}	9.00	1.53×10^{2}	4.00×10^{-4}	1.17×10^{-1}	3.21×10^{1}	2.50×10^{-3}	1.64	–	–	–	–
218-W-3A	218-W-3A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
Z Plant BP	Z Plant Burning Pit	S	Site consolidated with Site WIDS ID 218-W-4C												

[a] This site was consolidated with another site for purposes of modeling.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–70a. Map 9A: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
218-W-3	218-W-3 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-4A	218-W-4A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-2A	218-W-2A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-84	UPR-200-W-84	L	Site consolidated with Site WIDS ID 218-W-3A												
UPR-200-W-134	UPR-200-W-134	S	Site consolidated with Site WIDS ID 218-W-3A												
UPR-200-W-53	UPR-200-W-53	L	Site consolidated with Site WIDS ID 218-W-2A												
UPR-200-W-72	UPR-200-W-72	S	Site consolidated with Site WIDS ID 218-W-4A												
UPR-200-W-16	UPR-200-W-16	S	Site consolidated with Site WIDS ID 218-W-1												
216-T-4A	216-T-4A Pond	L	–	–	3.51×10^{-3}	–	–	–	–	–	–	3.62×10^{2}	1.14×10^{4}	–	4.90×10^{3}
216-T-4B	216-T-4B Pond	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-T-36	216-T-36 Crib	L	–	–	–	–	–	–	–	–	–	–	2.12×10^{2}	–	–
216-T-4-2	216-T-4-2 Ditch	L	Site consolidated with Site WIDS ID 216-T-4A												
UPR-200-W-97	UPR-200-W-97 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	7.66×10^{-1}	–	8.33
UPR-200-W-29	UPR-200-W-29 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	1.36	–	1.42×10^{1}
216-T-13	216-T-13 Trench	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-T-27	216-T-27 Crib	L	–	–	–	–	–	–	–	–	–	–	1.25×10^{3}	–	5.52×10^{-1}
216-TY-201	216-TY-201 Settling Tank	L		–	–	–	–	–	–	–	–	–	–	–	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–70b. Map 9A: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
218-W-3	218-W-3 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-4A	218-W-4A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-W-2A	218-W-2A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-84	UPR-200-W-84	L	Site consolidated with Site WIDS ID 218-W-3A												
UPR-200-W-134	UPR-200-W-134	S	Site consolidated with Site WIDS ID 218-W-3A												
UPR-200-W-53	UPR-200-W-53	L	Site consolidated with Site WIDS ID 218-W-2A												
UPR-200-W-72	UPR-200-W-72	S	Site consolidated with Site WIDS ID 218-W-4A												
UPR-200-W-16	UPR-200-W-16	S	Site consolidated with Site WIDS ID 218-W-1												
216-T-4A	216-T-4A Pond	L	–	1.35	1.26×10^{1}	1.12	–	2.96×10^{3}	4.11×10^{5}	–	–	–	–	6.07×10^{2}	–
216-T-4B	216-T-4B Pond	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-T-36	216-T-36 Crib	L	–	–	–	–	–	9.44×10^{1}	5.71×10^{3}	–	–	–	–	1.72×10^{2}	–
216-T-4-2	216-T-4-2 Ditch	L	Site consolidated with Site WIDS ID 216-T-4A												
UPR-200-W-97	UPR-200-W-97 Unplanned Release	L	–	–	–	–	–	1.87×10^{-1}	1.53×10^{2}	–	–	–	–	1.53×10^{-2}	–
UPR-200-W-29	UPR-200-W-29 Unplanned Release	L	–	–	–	1.23×10^{-3}	–	3.77×10^{-1}	4.18×10^{2}	–	–	–	–	1.17×10^{-1}	–
216-T-13	216-T-13 Trench	L	–	–	–	–	–	–	–	–	–	–	–	5.00×10^{-2}	–
216-T-27	216-T-27 Crib	L	–	2.19	2.30×10^{-2}	9.21×10^{-2}	–	3.20×10^{2}	3.42×10^{4}	–	–	–	–	3.07×10^{1}	–
216-TY-201	216-TY-201 Settling Tank	L	–	1.06×10^{1}	–	–	–	–	–	–	–	8.38	–	8.30	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–71a. Map 9B: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-T-12	216-T-12 Trench	L	–	–	2.52×10^{-2}	–	–	–	–	–	–	–	2.34	–	1.43×10^{2}
218-W-1A	218-W-1A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-26	UPR-200-W-26	S	Site consolidated with Site WIDS ID 218-W-1A												
216-T-29	216-T-29 Crib	L	–	–	–	–	–	–	–	–	–	–	3.48×10^{-2}	–	2.24×10^{-2}
216-T-33	216-T-33 Crib	L	–	–	2.51×10^{-4}	–	–	–	–	–	–	–	2.16×10^{1}	–	1.24
216-T-34	216-T-34 Crib	L	–	–	–	–	–	–	–	–	–	–	5.83×10^{3}	–	4.37×10^{-1}
216-T-35	216-T-35 Crib	L	–	–	–	–	–	–	–	–	–	–	3.00	–	7.56×10^{-1}
216-T-1	216-T-1 Ditch (221-T Ditch)	L	–	–	–	–	–	–	–	–	–	–	8.24×10^{2}	–	2.44×10^{1}
216-T-2	216-T-2 Reverse Well	L	–	–	–	–	–	–	–	–	–	–	2.50×10^{3}	–	–
216-T-3	216-T-3 Reverse Well	L	–	–	–	–	–	–	–	–	–	–	2.65×10^{3}	–	3.86×10^{4}
216-T-6	216-T-6 Cribs	L	–	–	–	–	–	–	–	–	–	–	6.83×10^{2}	–	1.26×10^{4}
216-T-8	216-T-8 Crib	L	–	–	–	–	–	–	–	–	–	–	2.10×10^{1}	–	–
200-W-45	200-W-45 Sand Filter	S	–	–	–	–	–	–		–	–	–	–	–	–
200-W-20	2706-T Equipment Decontamination Building	S	–	–	–	–	–	–		–	–	–	–	–	–
200-W-20	T Plant Complex (including 221-T Canyon)	S	–	–	–	–	–	–	–	–	–	–	–	–	–
224-T	224-T Canyon	L/S	–	–	–	–	–	–		–	–	–	–	–	–
200-W-9	200-W-9 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	5.66×10^{1}	–	–
UPR-200-W-2[a]	UPR-200-W-2 Unplanned Release	L		–	–	–	–	–	–	–	–	–	2.24	–	–
UPR-200-W-21	UPR-200-W-21	L	–	–	–	–	–	–	–	–	–	–	2.06	–	–
UPR-200-W-38	UPR-200-W-38 Unplanned Release	L		–	–	–	–	–	–	–	–	–	1.43	–	–
UPR-200-W-98[a]	UPR-200-W-98 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	6.02×10^{-2}	–	–
UPR-200-W-102	UPR-200-W-102 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	9.38	–	1.36×10^{2}

Table S-71a. Map 9B: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
TRUSAF	TRUSAF (in 224-T Canyon)	L/S		– –	–	–	–	–	–	–	–	–	–	–	–
241-T-361	241-T-361 Settling Tank	L/S		– –	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–71b. Map 9B: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-T-12	216-T-12 Trench	L	–	–	4.54×10^{-2}	1.65×10^{-2}	–	7.75×10^{-1}	7.71×10^{4}	–	–	–	–	2.17×10^{2}	–
218-W-1A	218-W-1A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-26	UPR-200-W-26	S	Site consolidated with Site WIDS ID 218-W-1A												
216-T-29	216-T-29 Crib	L	–	–	5.51×10^{-5}	6.46×10^{-7}	–	9.07×10^{-3}	1.36	–	–	–	–	1.91×10^{-3}	–
216-T-33	216-T-33 Crib	L	–	–	4.52×10^{-4}	1.85×10^{-4}	–	9.45	1.34×10^{3}	–	–	–	–	6.02×10^{1}	–
216-T-34	216-T-34 Crib	L	–	1.73	1.82×10^{-2}	7.28×10^{-2}	–	1.51×10^{3}	1.57×10^{5}	–	–	–	–	6.37×10^{1}	–
216-T-35	216-T-35 Crib	L	–	3.00	3.15×10^{-2}	1.26×10^{-1}	–	–	3.00	–	–	–	–	3.01×10^{1}	–
216-T-1	216-T-1 Ditch (221-T Ditch)	L	–	2.37	3.39	8.36×10^{-1}	–	2.13×10^{2}	2.24×10^{4}	–	–	–	–	2.13×10^{-1}	–
216-T-2	216-T-2 Reverse Well	L	–	–	–	–	–	6.44×10^{2}	6.75×10^{4}	–	–	–	–	2.99×10^{-1}	–
216-T-3	216-T-3 Reverse Well	L	–	–	1.05×10^{3}	–	–	6.97×10^{2}	6.47×10^{5}	–	–	–	–	2.01	–
216-T-6	216-T-6 Cribs	L	–	–	8.22×10^{1}	–	–	2.78×10^{2}	2.30×10^{5}	–	–	–	–	2.08×10^{1}	–
216-T-8	216-T-8 Crib	L	–	–	–	–	–	9.31	5.66×10^{2}	–	–	–	–	4.75×10^{1}	–
200-W-45	200-W-45 Sand Filter	S	–	–	–	–	–	–	–	–	–	–	–	–	–

Table S-71b. Map 9B: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
200-W-20	2706-T Equipment Decontamination Building	S	–	–	–	–	–	–	8.93×10^{2}	–	–	–	–	–	–
200-W-20	T Plant complex (including 221-T Canyon)	S	–	–	–	–	–	–	3.13×10^{3}	–	–	–	–	–	–
224-T	224-T Canyon	L/S	–	–	–	–	–	–	–	–	–	–	–	–	–
200-W-9	200-W-9 Unplanned Release	L	–	–	–	–	–	1.46×10^{1}	1.53×10^{3}	–	–	–	–	6.75×10^{-3}	–
UPR-200-W-2[a]	UPR-200-W-2 Unplanned Release	L	–	–	–	–	–	1.27	1.54×10^{2}	–	–	–	–	1.17×10^{1}	–
UPR-200-W-21	UPR-200-W-21	L	–	–	–	3.60×10^{-3}	–	1.16	1.42×10^{2}	–	–	–	–	1.06×10^{1}	–
UPR-200-W-38	UPR-200-W-38 Unplanned Release	L	–	–	–	2.50×10^{-3}	–	8.06×10^{-1}	9.83×10^{1}	–	–	–	–	7.34	–
UPR-200-W-98[a]	UPR-200-W-98 Unplanned Release	L	–	–	–	–	–	3.40×10^{-2}	4.15	–	–	–	–	3.15×10^{-1}	–
UPR-200-W-102	UPR-200-W-102 Unplanned Release	L	–	–	1.24×10^{2}	–	–	2.44	2.27×10^{3}	–	–	–	–	5.37×10^{-4}	–
TRUSAF	TRUSAF (in 224-T Canyon)	L/S		– –	–	–	–	–	–	–	–	–	–	–	–
241-T-361	241-T-361 Settling Tank	L/S		– –	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–72a. Map 9C: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-Z-16	216-Z-16 Crib	L	–	–	–	–	–	–	–	–	–	–	1.27×10^{1}	–	5.81×10^{6}
231-Z	231-Z Plutonium Isolation Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-Z-4	216-Z-4 Trench	L	–	–	3.16	–	–	–	–	–	–	5.42×10^{-1}	1.14×10^{-4}	–	9.36×10^{-1}
216-Z-5	216-Z-5 Crib	L	–	–	5.02×10^{1}	–	–	–	–	–	–	8.60	3.22×10^{-1}	–	1.49×10^{1}
216-Z-6	216-Z-6 Crib	L	–	–	6.73	–	–	–	–	–	–	1.15	1.02×10^{-3}	–	1.99
216-Z-7	216-Z-7 Crib	L	–	–	2.12×10^{3}	–	–	–	–	–	–	3.63×10^{2}	2.63×10^{3}	–	6.26×10^{2}
216-Z-8	216-Z-8 Trench	L	–	–	3.14×10^{1}	–	–	–	–	–	–	3.62×10^{2}	2.42×10^{-3}	–	1.21×10^{-3}
216-Z-9	216-Z-9 Trench	L	–	–	1.79×10^{4}	–	–	–	–	–	–	2.08×10^{5}	–	–	2.11×10^{4}
216-Z-10	216-Z-10 Reverse Well	L	–	–	6.61×10^{1}	–	–	–	–	–	–	1.13×10^{1}	1.04×10^{-2}	–	1.96×10^{1}
UPR-200-W-130[a]	UPR-200-W-130	L	–	–	–	–	–	–	–	–	–	–	4.12×10^{-5}	–	1.88×10^{1}
216-Z-17	216-Z-17 Trench	L	–	–	–	–	–	–	–	–	–	–	4.59	–	2.10×10^{6}
216-Z-15	216-Z-15 French Drain	L	–	–	–	–	–	–	–	–	–	–	2.43×10^{1}	–	6.56
234-5Z	234-5Z Plutonium Finishing Plant	S	–	–	–	–	–	–	–	–	–	–	–	–	–
2736-Z	2736-Z Plutonium Finishing Plant	S/L		– –	–	–	–	–	–	–	–	–	–	–	–
242-Z	242-Z Americium Recovery Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-Z-1D[b]	216-Z-1(D) Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
236-Z	236-Z Plutonium Reclamation Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-Z-14	216-Z-14 French Drain	L	–	–	–	–	–	–	–	–	–	2.18×10^{2}	1.31×10^{1}	–	6.53
291-Z	291-Z Exhaust Fan and Compressor House	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-103	UPR-200-W-103	L	–	–	1.12×10^{1}	–	–	–	–	–	–	1.29×10^{2}	–	–	–
241-Z[b]	241-Z Treatment Tank	L		– –	–	–	–	–	–	–	–	–	–	–	–
241-Z-361	241-Z-361 Settling Tank	L		– –	–	–	–	–	–	–	–	–	–	–	–

Table S-72a. Map 9C: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-Z-13	216-Z-13 French Drain	L	–	–	–	–	–	–	–	–	–	2.18×10^{2}	1.26×10^{1}	–	6.28
216-Z-1&2	216-Z-1 & 2 Cribs	L	–	–	1.09×10^{3}	–	–	–	–	–	–	3.80×10^{4}	1.61×10^{1}	–	1.20×10^{3}
216-Z-3	216-Z-3 Crib	L	–	–	–	–	–	–	–	–	–	2.25×10^{4}	1.56×10^{1}	–	3.79
216-Z-12	216-Z-12 Crib	L	–	–	5.03×10^{3}	–	–	–	–	–	–	1.35×10^{5}	5.18×10^{1}	–	9.81×10^{4}
216-Z-1A	216-Z-1A Tile Field	L	–	–	2.63×10^{4}	–	–	–	–	–	–	3.07×10^{5}	9.32×10^{1}	–	2.59×10^{4}
216-Z-18	216-Z-18 Crib	L	–	–	1.65×10^{4}	–	–	–	–	–	–	1.92×10^{5}	7.11	–	1.96×10^{4}
216-Z-20	216-Z-20 Crib	L	–	–	2.51×10^{4}	–	–	–	–	–	–	2.90×10^{2}	2.89×10^{2}	–	1.67×10^{2}
216-Z-21	216-Z-21 Seepage Basin	L	–	–	–	–	–	–	–	–	–	7.92×10^{3}	3.96×10^{2}	–	1.98×10^{2}
216-Z-11	216-Z-11 Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-U-13	216-U-13 Trench	L	–	–	–	–	–	–	–	–	–	–	4.73	–	–
216-U-14[c]	216-U-14 Ditch	L	–	–	3.46×10^{-3}	–	–	–	–	–	–	–	8.82	–	1.22×10^{3}
207-U	207-U Retention Basin	L		–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-135	UPR-200-W-135 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	7.02×10^{-1}	–	–
UPR-200-W-28	UPR-200-W-28	L	–	–	1.58×10^{-3}	–	–	–	–	–	–	–	3.84×10^{-1}	–	–
UPR-200-W-131[a]	UPR-200-W-131	L	–	–	1.03×10^{-5}	–	–	–	–	–	–	–	2.51×10^{-3}	–	–
200-W PP	200-W PP Powerhouse Pond	L	–	–	–	–	–	–	–	–	–	–	3.44×10^{-2}	–	1.72×10^{3}
216-T-20	216-T-20 Trench	L	–	–	2.02×10^{-5}	–	–	–	–	–	–	–	1.57×10^{-2}	–	1.20×10^{-1}
232-Z	232-Z Waste Incinerator	S	–	–	–	–	–	–	–	–	–	–	–	–	–

a This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
b This site had inventories that were in the initial list of constituents, but was screened out during final screening described in Section S.3.6.
c This site was consolidated with another site for purposes of modeling.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–72b. Map 9C: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-Z-16	216-Z-16 Crib	L	–	–	–	–	–	1.30×10^{1}	–	–	–	–	–	4.16×10^{-1}	–
231-Z	231-Z Plutonium Isolation Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-Z-4	216-Z-4 Trench	L	–	–	2.26×10^{-4}	–	–	1.27×10^{-4}	3.04×10^{1}	–	–	–	–	1.41×10^{-2}	–
216-Z-5	216-Z-5 Crib	L	–	–	6.82×10^{-1}	–	–	3.60×10^{-1}	3.93×10^{4}	–	–	–	–	2.25×10^{-1}	–
216-Z-6	216-Z-6 Crib	L	–	–	2.12×10^{-3}	–	–	1.14×10^{-3}	1.59×10^{2}	–	–	–	–	2.99×10^{-2}	–
216-Z-7	216-Z-7 Crib	L	–	–	1.61	–	–	7.27×10^{2}	1.75×10^{5}	–	–	–	–	2.20×10^{2}	–
216-Z-8	216-Z-8 Trench	L	–	9.57×10^{-5}	3.39×10^{-5}	1.38×10^{-4}	–	4.92×10^{-5}	–	–	–	–	–	4.75×10^{-6}	–
216-Z-9	216-Z-9 Trench	L	–	–	–	9.21×10^{4}	–	–	8.86×10^{5}	–	–	–	–	2.52×10^{-2}	–
216-Z-10	216-Z-10 Reverse Well	L	–	–	2.17×10^{-2}	–	–	1.16×10^{-2}	1.60×10^{3}	–	–	–	–	2.94×10^{-1}	–
UPR-200-W-130[a]	UPR-200-W-130	L	–	–	–	–	–	4.21×10^{-5}	–	–	–	–	–	1.33×10^{-6}	–
216-Z-17	216-Z-17 Trench	L	–	–	–	–	–	4.70	–	–	–	–	–	1.50×10^{-1}	–
216-Z-15	216-Z-15 French Drain	L	–	2.43×10^{1}	9.71×10^{-1}	1.34×10^{-2}	–	2.72×10^{-1}	–	–	–	–	–	2.11×10^{-2}	–
234-5Z	234-5Z Plutonium Finishing Plant	S	–	–	–	–	–	–	–	–	–	–	–	–	–
2736-Z	2736-Z Plutonium Finishing Plant	S/L		– –	–	–	–	–	–	–	–	–	–	–	–
242-Z	242-Z Americium Recovery Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-Z-1D[b]	216-Z-1(D) Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
236-Z	236-Z Plutonium Reclamation Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-Z-14	216-Z-14 French Drain	L	–	5.16×10^{-1}	1.83×10^{-1}	7.42×10^{-1}	–	2.62×10^{-1}	–	–	–	–	–	2.04×10^{-2}	–
291-Z	291-Z Exhaust Fan and Compressor House	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-103	UPR-200-W-103	L	–	–	–	–	–	–	–	–	–	–	–	3.29×10^{-7}	–
241-Z[b]	241-Z Treatment Tank	L		–	–	–	–	–	–	–	–	–	–	–	–
241-Z-361	241-Z-361 Settling Tank	L		–	–	–	–	–	–	–	–	–	–	–	–

Table S-72b. Map 9C: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-Z-13	216-Z-13 French Drain	L	–	4.97×10^{-1}	1.76×10^{-1}	7.14×10^{-1}	–	2.52×10^{-1}	–	–	–	–	–	1.96×10^{-2}	–
216-Z-1&2	216-Z-1 & 2 Cribs	L	–	1.61×10^{1}	2.06×10^{-1}	5.30×10^{3}	–	1.50×10^{-1}	5.51×10^{4}	–	–	–	–	1.04×10^{-2}	–
216-Z-3	216-Z-3 Crib	L	–	1.40×10^{1}	3.34	7.73×10^{-3}	–	1.76	1.91×10^{5}	–	–	–	–	1.64×10^{-2}	–
216-Z-12	216-Z-12 Crib	L	–	4.99×10^{1}	8.73	4.31×10^{5}	–	6.11	4.37×10^{6}	–	–	–	–	1.94×10^{-1}	–
216-Z-1A	216-Z-1A Tile Field	L	–	9.28×10^{1}	4.93×10^{1}	1.41×10^{5}	–	4.16×10^{1}	1.32×10^{6}	–	–	–	–	9.34×10^{-2}	–
216-Z-18	216-Z-18 Crib	L	–	7.08	3.76	8.78×10^{4}	–	3.17	8.41×10^{5}	–	–	–	–	2.40×10^{-2}	–
216-Z-20	216-Z-20 Crib	L	–	2.89×10^{2}	2.60×10^{1}	1.59×10^{-1}	–	3.24	1.04×10^{5}	–	–	–	–	2.52×10^{-1}	–
216-Z-21	216-Z-21 Seepage Basin	L	–	1.56×10^{1}	5.54	2.25×10^{1}	–	8.05	–	–	–	–	–	6.27×10^{-1}	–
216-Z-11	216-Z-11 Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-U-13	216-U-13 Trench	L	–	–	–	–	–	1.26	1.27×10^{2}	–	–	–	–	5.42×10^{-1}	–
216-U-14[c]	216-U-14 Ditch	L	–	1.93×10^{1}	2.64×10^{1}	1.15	–	1.37×10^{1}	1.83×10^{5}	–	–	–	–	8.28×10^{1}	–
207-U	207-U Retention Basin	L	–	–	–	–	–	–	–	–	–	–	–	4.54×10^{1}	–
UPR-200-W-135	UPR-200-W-135 Unplanned Release	L	–	–	–	1.23×10^{-3}	–	3.96×10^{-1}	4.83×10^{1}	–	–	–	–	3.60	–
UPR-200-W-28	UPR-200-W-28	L	–	–	–	7.33×10^{-4}	–	2.17×10^{-1}	4.44×10^{2}	–	–	–	–	7.18×10^{-2}	–
UPR-200-W-131[a]	UPR-200-W-131	L	–	–	–	4.81×10^{-6}	–	1.42×10^{-3}	2.90	–	–	–	–	4.67×10^{-4}	–
200-W PP	200-W PP Powerhouse Pond	L	–	1.03×10^{-1}	5.85×10^{-2}	3.44×10^{-4}	–	3.44×10^{-2}	1.72×10^{3}	–	–	–	–	–	–
216-T-20	216-T-20 Trench	L	–	–	–	1.08×10^{-5}	–	3.58×10^{-3}	2.00×10^{1}	–	–	–	–	1.07×10^{-3}	–
232-Z	232-Z Waste Incinerator	S	–	–	–	–	–	–	1.33×10^{2}	–	–	–	–	–	–

a This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
b This site had inventories that were in the initial list of constituents, but was screened out during final screening described in Section S.3.6.
c This site was consolidated with another site for purposes of modeling.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–73a. Map 9D: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-U-10	216-U-10 Pond	L	–	–	1.12×10^{5}	–	–	–	–	–	–	3.91×10^{4}	9.01×10^{3}	–	3.45×10^{4}
216-U-3	216-U-3 French Drain	L	–	–	1.00×10^{-4}	–	–	–	–	–	–	–	3.91×10^{-1}	–	6.90×10^{-1}
UPR-200-W-104	UPR-200-W-104	L	Site consolidated with Site WIDS ID 216-U-10.												
UPR-200-W-105	UPR-200-W-105	L	Site consolidated with Site WIDS ID 216-U-10.												
UPR-200-W-106	UPR-200-W-106	L	Site consolidated with Site WIDS ID 216-U-10.												
216-S-4	216-S-4 French Drain	L	–	–	–	–	–	–	–	–	–	–	5.04×10^{-1}	–	2.52×10^{-1}
216-S-3	216-S-3 Crib	L	–	–	9.09×10^{-3}	–	–	–	–	–	–	–	2.50	–	1.12
216-S-21	216-S-21 Crib	L	–	–	1.04	–	–	–	–	–	–	–	5.08×10^{1}	–	2.19×10^{1}
UPR-200-W-107	UPR-200-W-107	L	Site consolidated with Site WIDS ID 216-U-10.												
216-S-25	216-S-25 Crib	L	–	–	7.34×10^{-2}	–	–	–	–	–	–	–	1.40×10^{2}	–	4.27×10^{2}
216-S-1&2	216-S-1 & 216-S-2 Cribs	L		– –	–	–	–	–	–	–	–	–	–	–	–
216-S-8	216-S-8 Trench	L	–	–	–	–	–	–	–	–	–	–	2.88×10^{4}	–	–
UPR-200-W-95	UPR-200-W-95	L	–	–	–	–	–	–	–	–	–	–	1.41×10^{-1}	–	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–73b. Map 9D: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-U-10	216-U-10 Pond	L	–	9.29×10^{3}	1.10×10^{3}	3.46×10^{1}	–	4.54×10^{2}	5.20×10^{6}	–	–	–	–	2.16×10^{3}	–
216-U-3	216-U-3 French Drain	L	–	4.10×10^{-3}	1.81×10^{-4}	1.56×10^{-2}	–	1.10×10^{-3}	3.06×10^{2}	–	–	–	–	1.73×10^{1}	–
UPR-200-W-104	UPR-200-W-104	L	Site consolidated with Site WIDS ID 216-U-10.												
UPR-200-W-105	UPR-200-W-105	L	Site consolidated with Site WIDS ID 216-U-10.												
UPR-200-W-106	UPR-200-W-106	L	Site consolidated with Site WIDS ID 216-U-10.												
216-S-4	216-S-4 French Drain	L	–	5.31×10^{-3}	–	2.02×10^{-2}	–	–	5.19×10^{-1}	–	–	–	–	3.02×10^{-4}	–
216-S-3	216-S-3 Crib	L	–	2.55×10^{-2}	4.09×10^{-3}	8.49×10^{-2}	–	1.44×10^{-2}	8.65×10^{1}	–	–	–	–	2.08	–
216-S-21	216-S-21 Crib	L	–	5.10×10^{-1}	7.48×10^{2}	1.75	–	2.78×10^{-1}	7.71×10^{2}	–	–	–	–	1.06×10^{-1}	–
UPR-200-W-107	UPR-200-W-107	L	Site consolidated with Site WIDS ID 216-U-10.												
216-S-25	216-S-25 Crib	L	–	9.95	2.57×10^{-1}	5.57	–	8.08×10^{-1}	2.23×10^{5}	–	–	–	–	6.89×10^{-1}	–
216-S-1&2	216-S-1 & 216-S-2 Cribs	L	–	–	–	–	–	–	2.11×10^{5}	–	–	–	–	2.22×10^{3}	–
216-S-8	216-S-8 Trench	L	–	–	3.05×10^{2}	3.24	–	1.07×10^{3}	1.87×10^{6}	–	–	–	–	3.10×10^{2}	–
UPR-200-W-95	UPR-200-W-95	L	–	–	1.21×10^{-3}	1.29×10^{-5}	–	4.24×10^{-3}	7.43	–	–	–	–	1.23×10^{-3}	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–74a. Map 9E: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-U-5	216-U-5 Trench	L	–	–	–	–	–	–	–	–	–	–	9.41×10^{2}	–	–
216-U-6	216-U-6 Trench	L	–	–	–	–	–	–	–	–	–	–	9.41×10^{2}	–	–
221-U	221-U Process Canyon	L/S		– –	–	–	–	–	–	–	–	–	–	–	–
241-WR-Vault	241-WR Vault	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-U-15	216-U-15 Trench	L	–	–	4.62	–	–	–	–	–	–	–	1.78×10^{1}	–	–
UPR-200-W-138	UPR-200-W-138	L	–	–	7.46×10^{-5}	–	–	–	–	–	–	–	1.61×10^{-3}	–	3.68×10^{-1}
200-W-44	200-W-44 Sand Filter	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-U-7	216-U-7 French Drain	L	–	–	7.67×10^{-8}	–	–	–	–	–	–	–	1.82×10^{-4}	–	3.91×10^{-3}
UPR-200-W-101	UPR-200-W-101 Unplanned Release	L	–	–	2.26×10^{-5}	–	–	–	–	–	–	–	4.88×10^{-4}	–	1.12×10^{-1}
216-U-4	216-U-4 Reverse Well	L	–	–	–	–	–	–	–	–	–	–	1.25×10^{2}	–	1.55
216-U-4A	216-U-4A French Drain	L	–	–	–	–	–	–	–	–	–	–	4.85×10^{-1}	–	7.20×10^{-2}
216-U-1&2	216-U-1 & 2 Cribs	L	–	–	9.27×10^{2}	–	–	–	–	–	–	–	2.15×10^{2}	–	2.56×10^{2}
241-U-361	241-U-361 Settling Tank	L		– –	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-39	UPR-200-W-39 Unplanned Release	L	–	–	1.93×10^{-6}	–	–	–	–	–	–	–	4.17×10^{-5}	–	9.55×10^{-3}
200-W-42[a]	200-W-42 Process Sewer	L	–	–	5.61×10^{-5}	–	–	–	–	–	–	–	1.21×10^{-3}	–	2.75×10^{-1}
UPR-200-W-163	UPR-200-W-163 Unplanned Release	L	–	–	1.48×10^{-4}	–	–	–	–	–	–	–	3.20×10^{-3}	–	7.31×10^{-1}
216-U-16	216-U-16 Crib	L	–	–	8.68×10^{3}	–	–	–	–	–	–	–	–	–	1.55×10^{2}
216-S-9	216-S-9 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-23	216-S-23 Crib	L	–	–	–	–	–	–	–	–	–	–	1.28×10^{-3}	–	–
216-U-8	216-U-8 Crib	L	–	–	1.49	–	–	–	–	–	–	–	3.21×10^{1}	–	7.30×10^{3}
216-U-12	216-U-12 Crib	L	–	–	2.25	–	–	–	–	–	–	–	1.91×10^{1}	–	3.71×10^{3}

[a] This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–74b. Map 9E: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-U-5	216-U-5 Trench	L	–	5.23×10^{1}	–	1.09	–	2.50×10^{2}	6.31×10^{4}	–	–	–	–	6.35×10^{2}	–
216-U-6	216-U-6 Trench	L	–	5.23×10^{1}	–	1.09	–	2.50×10^{2}	6.31×10^{4}	–	–	–	–	6.34×10^{2}	–
221-U	221-U Process Canyon	L/S	–	–	–	–	–	–	–	–	–	–	–	–	–
241-WR-Vault	241-WR Vault	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-U-15	216-U-15 Trench	L	–	–	–	–	–	4.73	5.27×10^{2}	–	–	–	–	9.93	–
UPR-200-W-138	UPR-200-W-138	L	–	–	1.34×10^{-4}	5.50×10^{-5}	–	8.21×10^{-4}	2.27×10^{2}	–	–	–	–	1.29×10^{1}	–
200-W-44	200-W-44 Sand Filter	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-U-7	216-U-7 French Drain	L	–	1.82×10^{-8}	2.65×10^{-9}	3.49×10^{-11}	–	1.52×10^{-4}	2.11	–	–	–	–	9.80×10^{-9}	–
UPR-200-W-101	UPR-200-W-101 Unplanned Release	L	–	–	4.07×10^{-5}	1.66×10^{-5}	–	2.49×10^{-4}	6.87×10^{1}	–	–	–	–	3.89	–
216-U-4	216-U-4 Reverse Well	L	–	–	9.07×10^{-3}	–	–	3.21×10^{1}	3.39×10^{3}	–	–	–	–	1.49×10^{-2}	–
216-U-4A	216-U-4A French Drain	L	–	2.86×10^{-1}	3.00×10^{-3}	1.20×10^{-2}	–	5.13×10^{-2}	5.66	–	–	–	–	2.87	–
216-U-1&2	216-U-1 & 2 Cribs	L	–	–	9.37×10^{-2}	3.18×10^{-2}	–	8.54×10^{1}	1.73×10^{5}	–	–	–	–	3.96×10^{3}	–
241-U-361	241-U-361 Settling Tank	L	–	–	–	–	–	–	–	–	–	–	–	6.90×10^{4}	–
UPR-200-W-39	UPR-200-W-39 Unplanned Release	L	–	–	3.47×10^{-6}	1.42×10^{-6}	–	2.12×10^{-5}	5.87	–	–	–	–	3.32×10^{-1}	–
200-W-42[a]	200-W-42 Process Sewer	L	–	–	1.01×10^{-4}	3.23×10^{-5}	–	6.17×10^{-4}	1.70×10^{2}	–	–	–	–	4.59×10^{-4}	–
UPR-200-W-163	UPR-200-W-163 Unplanned Release	L	–	–	2.67×10^{-4}	1.06×10^{-4}	–	1.63×10^{-3}	4.53×10^{2}	–	–	–	–	2.22×10^{1}	–
216-U-16	216-U-16 Crib	L	–	1.53	4.32	1.60×10^{-1}	–	2.46	1.66×10^{4}	–	–	–	–	1.26×10^{-1}	–
216-S-9	216-S-9 Crib	L	–	–	–	–	–	–	4.18×10^{4}	–	–	–	–	2.76×10^{2}	–
216-S-23	216-S-23 Crib	L	–	9.68×10^{-6}	9.38×10^{-6}	3.32×10^{-2}	–	5.30×10^{-5}	4.20×10^{3}	–	–	–	–	1.57×10^{-5}	–
216-U-8	216-U-8 Crib	L	–	–	2.67	8.79×10^{-1}	–	1.63×10^{1}	4.56×10^{6}	–	–	–	–	2.55×10^{4}	–
216-U-12	216-U-12 Crib	L	–	1.81×10^{-7}	1.35	4.39×10^{-1}	–	9.17	2.28×10^{6}	–	–	–	–	6.46×10^{3}	–

[a] This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–75a. Map 9F: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-S-19	216-S-19 Pond	L	–	–	–	–	–	–	–	–	–	–	$6.56×10^{2}$	–	$1.64×10^{2}$
216-S-14	216-S-14 Trench	L	–	–	–	–	–	–	–	–	–	–	$2.94×10^{-1}$	–	–
216-S-7	216-S-7 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-W-32[a]	UPR-200-W-32	L	–	–	$1.66×10^{-6}$	–	–	–	–	–	–	–	$3.58×10^{-5}$	–	$8.18×10^{-3}$
216-S-13	216-S-13 Crib	L	–	–	$9.75×10^{-3}$	–	–	–	–	–	–	–	$1.21×10^{1}$	–	$4.79×10^{1}$
216-S-12	216-S-12 Trench	L	–	–	–	–	–	–	–	–	–	–	$6.40×10^{-3}$	–	–
200-W-22	200-W-22 Unplanned Release	L	–	–	$1.61×10^{-7}$	–	–	–	–	–	–	–	$3.47×10^{-6}$	–	$7.93×10^{-4}$
233-S	233-S Plutonium Concentration Facility	S	–	–	–	–	–	–		–	–	–	–	–	
200-W-69	200-W-69 Lab Complex (includes 222-S Lab, 222-S DMWSA, 219-S, 222-SA, 296-S-21, 296-S-16, 296-S-23, 296-S-13)	L/S	–	–	–	–	–	–		–	–	–	–	–	$1.12×10^{1}$
UPR-200-W-61	UPR-200-W-61	L	–	–	–	–	–	–	–	–	–	–	2.39	–	–
202-S	202-S (REDOX)	S	–	–	–	–	–	–	–	–	–	–	–	–	–
291-S	291-S Sand Filter	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-20	216-S-20 Crib	L	–	–	–	–	–	–	–	–	–	–	$5.88×10^{3}$	–	$1.60×10^{1}$
216-S-22	216-S-22 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-26	216-S-26 Crib	L	–	–	–	–	–	–	–	–	–	–	$1.11×10^{2}$	–	$2.76×10^{1}$
218-W-7	218-W-7 Burial Ground (222-S Vault)	S	–	–	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; REDOX=Reduction-Oxidation (Facility); S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–75b. Map 9F: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-S-19	216-S-19 Pond	L	–	6.56×10^{2}	9.51	2.62×10^{1}	–	–	7.54×10^{2}	–	–	–	–	6.87×10^{-1}	–
216-S-14	216-S-14 Trench	L	–	–	–	–	–	1.14×10^{-2}	1.78×10^{2}	–	–	–	–	7.36×10^{-2}	–
216-S-7	216-S-7 Crib	L	–	–	–	–	–	–	4.32×10^{5}	–	–	–	–	3.41×10^{3}	–
UPR-200-W-32[a]	UPR-200-W-32	L	–	–	2.98×10^{-6}	1.22×10^{-6}	–	1.82×10^{-5}	5.03	–	–	–	–	2.83×10^{-1}	–
216-S-13	216-S-13 Crib	L	–	–	1.76×10^{-2}	5.62×10^{-3}	–	5.69×10^{-1}	3.67×10^{4}	–	–	–	–	3.05	–
216-S-12	216-S-12 Trench	L	–	4.92×10^{-5}	2.14×10^{-6}	2.97×10^{-7}	–	1.26×10^{-4}	3.06×10^{2}	–	–	–	–	3.21	–
200-W-22	200-W-22 Unplanned Release	L	–	–	2.89×10^{-7}	1.18×10^{-7}	–	1.77×10^{-6}	4.88×10^{-1}	–	–	–	–	2.77×10^{-2}	–
233-S	233-S Plutonium Concentration Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
200-W-69	200-W-69 Lab Complex (includes 222-S Lab, 222-S DMWSA, 219-S, 222-SA, 296-S-21, 296-S-16, 296-S-23, 296-S-13)	L/S	–	–	–	–	–	–	1.55×10^{2}	–	–	–	–	–	–
UPR-200-W-61	UPR-200-W-61	L	–	2.63×10^{-11}	2.54×10^{-2}	2.70×10^{-4}	–	8.90×10^{-2}	1.56×10^{2}	–	–	–	–	2.58×10^{-2}	–
202-S	202-S (REDOX)	S	–	–	–	–	–	–	–	–	–	–	–	–	–
291-S	291-S Sand Filter	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-S-20	216-S-20 Crib	L	–	6.34×10^{1}	7.04×10^{-1}	2.64	–	1.50×10^{3}	1.69×10^{5}	–	–	–	–	5.64×10^{2}	–
216-S-22	216-S-22 Crib	L	–	–	–	–	–	–	6.44×10^{1}	–	–	–	–	4.52×10^{-8}	–
216-S-26	216-S-26 Crib	L	–	1.11×10^{2}	1.60	4.42	–	7.12×10^{-5}	1.27×10^{2}	–	–	–	–	1.16×10^{-1}	–
218-W-7	218-W-7 Burial Ground (222-S Vault)	S	–	–	–	–	–	–	–	–	–	–	–	–	–

a This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; REDOX=Reduction-Oxidation (Facility); S=solid; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–76a. Map 10: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
600-148	Environmental Restoration Disposal Facility	S	–	–	–	–	–	–		–	–	–	–	–	–
N/A	US Ecology	S	–	–	–	–	–	–		–	–	–	–	–	–
216-W-LWC	216-W-LWC Crib	L	–	–	–	–	–	–	–	–	–	–	3.23×10^{1}	–	7.21×10^{2}
216-U-17	216-U-17 Crib	L	–	–	3.00×10^{-2}	–	–	–	–	–	–	–	6.47×10^{-1}	–	1.47×10^{2}

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; N/A=not applicable; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–76b. Map 10: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
600-148	Environmental Restoration Disposal Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
N/A	US Ecology	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-W-LWC	216-W-LWC Crib	L	–	1.09×10^{2}	6.71×10^{1}	3.13×10^{-1}	–	4.89×10^{1}	1.38×10^{3}	–	–	–	–	2.87	–
216-U-17	216-U-17 Crib	L	–	–	5.39×10^{-2}	1.72×10^{-2}	–	3.30×10^{-1}	9.08×10^{4}	–	–	–	–	2.46×10^{-1}	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; N/A=not applicable; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–77a. Map 11: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
218-E-10	218-E-10 Trench	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-23	UPR-200-E-23	S	Site consolidated with Site WIDS ID 218-E-10												
UPR-200-E-24	UPR-200-E-24	S	Site consolidated with Site WIDS ID 218-E-10												
216-B-50	216-B-50 Crib	L	–	–	5.64×10^{-1}	–	–	–	–	–	–	–	1.48×10^{1}	–	7.59
216-B-57	216-B-57 Crib	L	–	–	1.69	–	–	–	–	–	–	–	2.42×10^{1}	–	1.27×10^{1}
UPR-200-E-9	UPR-200-E-9	L	–	–	2.83×10^{-2}	–	–	–	–	–	–	– –	6.91		–
216-B-11A & B	216-B-11A & B	L	–	–	6.08×10^{-4}	–	–	–	–	–	–	–	4.72×10^{-1}	–	3.60
216-B-51	216-B-51 French Drain	L	–	–	–	–	–	–	–	–	–	–	1.72×10^{-1}	–	4.05
218-E-5	218-E-5 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-E-5A	218-E-5A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-E-2	218-E-2 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-79	UPR-200-E-79 Unplanned Release	L	–	–	2.34×10^{-3}	–	–	–	–	–	–	–	1.82	–	1.38×10^{1}
UPR-200-E-78	UPR-200-E-78 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	6.13×10^{-2}	–	–
218-E-4	218-E-4 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-5	216-B-5 Reverse Well	L	–	–	–	–	–	–	–	–	–	–	3.79×10^{3}	–	5.63×10^{4}
216-B-9	216-B-9 Crib	L	–	–	–	–	–	–	–	–	–	–	6.40×10^{2}	–	9.53×10^{3}
216-B-59	216-B-59 Trench	L	–	–	6.99×10^{-12}	–	–	–	–	–	–	–	5.88×10^{-6}	–	6.36×10^{-2}
241-B-361	241-B-361 Settling Tank	L	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-7	UPR-200-E-7 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	4.15×10^{-1}	–	5.22
221-B	221-B B Plant/Canyon	S	–	–	–	–	–	–	–	–	4.20×10^{-1}	–	1.86×10^{1}	–	–
200-E-28	200-E-28 UPR	L	–	–	–	–	–	–	–	–	–	–	–	–	–

Table S-77a. Map 11: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
200-E-97	200-E-97 French Drain	L		–	–	–	–	–	–	–	–	–	1.95×10^{-3}	–	2.04×10^{-2}
200-E-98[a]	200-E-98 French Drain	L		–	–	–	–	–	–	–	–	–	1.63×10^{-3}	–	1.70×10^{-2}
WESF	WESF (Building 225-B)	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-62	216-B-62 Crib	L	–	–	4.10×10^{-9}	–	–	–	–	–	–	–	2.96×10^{1}	–	3.77×10^{1}
216-B-12	216-B-12 Crib	L	–	–	9.58×10^{-1}	–	–	–	–	–	–	–	5.61×10^{2}	–	4.74×10^{3}
216-B-55	216-B-55 Crib	L	–	–	1.75×10^{-8}	–	–	–	–	–	–	–	1.47×10^{-2}	–	1.60×10^{2}
212-B	212-B Cask Loading Station	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-60	216-B-60 Crib	L	–	–	–	–	–	–	–	–	–	–	7.87	–	–
UPR-200-E-84	UPR-200-E-84 Unplanned Release	L		–	–	–	–	–	–	–	–	–	–	–	–
224-B	224-B Plutonium Concentration Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-87	UPR-200-E-87 Unplanned Release	L		–	–	–	–	–	–	–	–	–	9.41	–	1.37×10^{2}
UPR-200-E-1[a]	UPR-200-E-1 Unplanned Release	L		–	–	–	–	–	–	–	–	–	7.30	–	7.64×10^{1}
UPR-200-E-3[a]	UPR-200-E-3 Unplanned Release	L		–	–	–	–	–	–	–	–	–	1.18×10^{-1}	–	1.24
UPR-200-E-85	UPR-200-E-85 Unplanned Release	L		–	–	–	–	–	–	–	–	–	4.08	–	9.07×10^{-2}
216-B-4	216-B-4 Reverse Well	L		–	–	–	–	–	–	–	–	–	5.57×10^{-4}	–	5.83×10^{-3}
216-B-6	216-B-6 Reverse Well	L		–	–	–	–	–	–	–	–	–	2.50×10^{3}	–	–
200-E-30	200-E-30 Sand Filter (291-B Sand Filter)	S	–	–	–	–	–	–	–	–	–	–	–	–	–
200-E-55	200-E-55 French Drain	L		–	–	–	–	–	–	–	–	–	1.91×10^{-3}	–	2.00×10^{-2}
200-E-95	200-E-95 French Drain	L		–	–	–	–	–	–	–	–	–	1.95×10^{-3}	–	2.04×10^{-2}
216-B-10A	216-B-10A Crib	L	–	–	2.51×10^{-5}	–	–	–	–	–	–	–	4.22×10^{1}	–	5.88

Table S-77a. Map 11: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-B-10B	216-B-10B Crib	L	–	–	–	–	–	–	–	–	–	–	1.17×10^{1}	–	–
UPR-200-E-77	UPR-200-E-77 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	6.33×10^{-3}	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–77b. Map 11: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
218-E-10	218-E-10 Trench	S	–	4.53×10^{2}	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-23	UPR-200-E-23	S	Site consolidated with Site WIDS ID 218-E-10												
UPR-200-E-24	UPR-200-E-24	S	Site consolidated with Site WIDS ID 218-E-10												
216-B-50	216-B-50 Crib	L	–	5.94×10^{-1}	2.01×10^{-1}	7.85×10^{-1}	–	3.55×10^{-2}	1.64×10^{2}	–	–	–	–	2.88×10^{-2}	–
216-B-57	216-B-57 Crib	L	–	9.86×10^{-1}	3.21×10^{-1}	1.21	–	1.07×10^{-1}	4.34×10^{2}	–	–	–	–	5.94×10^{-2}	–
UPR-200-E-9	UPR-200-E-9	L	–	–	–	1.33×10^{-2}	–	3.90	7.99×10^{3}	–	–	–	–	1.29	–
216-B-11A & B	216-B-11A & B	L	–	4.34×10^{-1}	2.09×10^{-1}	2.52×10^{-1}	–	1.07×10^{-1}	2.56×10^{2}	–	–	–	–	4.21×10^{-2}	–
216-B-51	216-B-51 French Drain	L	–	–	–	3.19×10^{-4}	–	1.05×10^{-1}	1.99×10^{2}	–	–	–	–	3.10×10^{-2}	–
218-E-5	218-E-5 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-E-5A	218-E-5A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–

Table S-77b. Map 11: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
218-E-2	218-E-2 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-79	UPR-200-E-79 Unplanned Release	L	–	–	–	1.25×10^{-3}	–	4.14×10^{-1}	8.83×10^{2}	–	–	–	–	1.20×10^{-1}	–
UPR-200-E-78	UPR-200-E-78 Unplanned Release	L	–	7.00×10^{-2}	–	5.00×10^{-5}	–	3.62×10^{-2}	1.04×10^{1}	–	–	–	–	4.74×10^{-3}	–
218-E-4	218-E-4 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-5	216-B-5 Reverse Well	L	–	–	1.93×10^{3}	–	–	1.04×10^{3}	9.50×10^{5}	–	–	–	–	1.05×10^{1}	–
216-B-9	216-B-9 Crib	L	–	–	1.69×10^{1}	–	–	2.02×10^{2}	1.71×10^{5}	–	–	–	–	1.23×10^{1}	–
216-B-59	216-B-59 Trench	L	–	2.65×10^{-3}	2.41×10^{-3}	1.17×10^{-9}	–	3.95×10^{-7}	2.41×10^{-1}	–	–	–	–	1.12×10^{-7}	–
241-B-361	241-B-361 Settling Tank	L		–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-7	UPR-200-E-7 Unplanned Release	L	–	–	1.68×10^{-2}	–	–	1.06×10^{-1}	9.13×10^{1}	–	–	–	–	4.40×10^{-3}	–
221-B	221-B B Plant/Canyon	S	–	9.71×10^{4}	–	–	–	–	–	–	–	–	–	–	–
200-E-28	200-E-28 UPR	L	–	8.58×10^{-3}	4.14×10^{-3}	4.97×10^{-3}	–	–	5.33×10^{-1}	–	–	–	–	2.18×10^{-4}	–
200-E-97	200-E-97 French Drain	L	–	2.89×10^{-3}	1.44×10^{-3}	1.67×10^{-3}	–	6.29×10^{-4}	6.20×10^{-1}	–	–	–	–	1.82×10^{-3}	–
200-E-98[a]	200-E-98 French Drain	L	–	2.38×10^{-3}	1.19×10^{-3}	1.38×10^{-3}	–	5.24×10^{-4}	5.16×10^{-1}	–	–	–	–	1.51×10^{-3}	–
WESF	WESF (Building 225-B)	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-62	216-B-62 Crib	L	–	3.11	1.74	1.08×10^{-2}	–	3.56	1.75×10^{3}	–	–	–	–	–	–
216-B-12	216-B-12 Crib	L	–	3.54	3.75	2.14	–	1.59×10^{2}	2.86×10^{6}	–	–	–	–	1.51×10^{4}	–
216-B-55	216-B-55 Crib	L	–	6.65	6.04	2.94×10^{-6}	–	9.90×10^{-4}	6.05×10^{2}	–	–	–	–	2.80×10^{-4}	–
212-B	212-B Cask Loading Station	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-60	216-B-60 Crib	L	–	–	–	–	–	2.17	2.12×10^{2}	–	–	–	–	6.33×10^{-1}	–
UPR-200-E-84	UPR-200-E-84 Unplanned Release	L	–	–	–	–	–	–	4.22	–	–	–	–	7.81×10^{-4}	–
224-B	224-B Plutonium Concentration Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-87	UPR-200-E-87 Unplanned Release	L	–	–	1.40×10^{2}	–	–	2.48	2.28×10^{3}	–	–	–	–	5.39×10^{-4}	–

Table S-77b. Map 11: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
UPR-200-E-1[a]	UPR-200-E-1 Unplanned Release	L	–	–	–	–	–	2.03	2.28×10^{3}	–	–	–	–	6.33×10^{-1}	–
UPR-200-E-3[a]	UPR-200-E-3 Unplanned Release	L	–	–	–	1.07×10^{-4}	–	3.29×10^{-2}	3.64×10^{1}	–	–	–	–	1.02×10^{-2}	–
UPR-200-E-85	UPR-200-E-85 Unplanned Release	L	–	2.51×10^{-1}	4.40×10^{-2}	8.06×10^{-4}	–	2.65×10^{-1}	3.27×10^{2}	–	–	–	–	7.76×10^{-2}	–
216-B-4	216-B-4 Reverse Well	L	–	–	1.43×10^{-5}	1.68×10^{-7}	–	1.80×10^{-4}	1.26×10^{-1}	–	–	–	–	4.98×10^{-4}	–
216-B-6	216-B-6 Reverse Well	L	–	–	–	–	–	6.42×10^{2}	6.73×10^{4}	–	–	–	–	2.98×10^{-1}	
200-E-30	200-E-30 Sand Filter (291-B Sand Filter)	S	–		–	–	–	–		–	–	–	–	–	–
200-E-55	200-E-55 French Drain	L	–	2.88×10^{-3}	1.44×10^{-3}	1.67×10^{-3}	–	6.16×10^{-4}	6.11×10^{-1}	–	–	–	–	1.78×10^{-3}	–
200-E-95	200-E-95 French Drain	L	–	2.69×10^{-3}	1.35×10^{-3}	1.56×10^{-3}	–	6.29×10^{-4}	6.09×10^{-1}	–	–	–	–	1.81×10^{-3}	–
216-B-10A	216-B-10A Crib	L	–	–	1.42×10^{-2}	1.85×10^{-4}	–	1.09×10^{1}	1.32×10^{3}	–	–	–	–	4.83	–
216-B-10B	216-B-10B Crib	L	–	–	–	–	–	3.00	3.14×10^{2}	–	–	–	–	2.63×10^{-8}	–
UPR-200-E-77	UPR-200-E-77 Unplanned Release	L	–	–	–	–	–	3.57×10^{-3}	4.36×10^{-1}	–	–	–	–	3.30×10^{-2}	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–78a. Map 12: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
218-E-12B	218-E-12B Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-E-12A	218-E-12A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-63	216-B-63 Ditch	L	–	–	1.00×10^{-3}	–	–	–	–	–	–	–	1.38×10^{1}	–	1.12×10^{3}
216-B-2-2	216-B-2-2 Ditch	L	Site consolidated with Site WIDS ID 216-B-3												
216-B-2-1	216-B-2-1 Ditch	L	Site consolidated with Site WIDS ID 216-B-3												
UPR-200-E-138	UPR-200-E-138 Unplanned Release	L	Site consolidated with Site WIDS ID 216-B-3												
218-E-8	218-E-8 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-E-1	218-E-1 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-3	216-B-3 Pond	L	–	–	4.26×10^{4}	–	–	–	–	–	–	4.68×10^{3}	1.41×10^{3}	–	4.61×10^{4}
216-B-3A Pond / 216-B-3A RAD	216-B-3A Pond / 216-B-3A RAD	L	Site consolidated with Site WIDS ID 216-B-3												
216-B-3B Pond / 216-B-3B-RAD	216-B-3B Pond / 216-B-3B-RAD	L	Site consolidated with Site WIDS ID 216-B-3												
216-B-3C Pond / 216-B-3C RAD	216-B-3C Pond / 216-B-3C RAD	L	Site consolidated with Site WIDS ID 216-B-3												
UPR-200-E-14	Unplanned Release-UPR-200-E-14	L	Site consolidated with Site WIDS ID 216-B-3												
UPR-200-E-34	UPR-200-E-34	L	Site consolidated with Site WIDS ID 216-A-25 and 216-B-3												

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–78b. Map 12: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
218-E-12B	218-E-12B Burial Ground	S	–	1.06×10^{7}	–	–	–	–	–	1.82×10^{3}	–	–	–	–	–
218-E-12A	218-E-12A Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-63	216-B-63 Ditch	L	–	1.06	4.62×10^{1}	7.81×10^{-1}	–	1.11×10^{-2}	3.14×10^{3}	–	–	–	–	1.78×10^{2}	–
216-B-2-2	216-B-2-2 Ditch	L	Site consolidated with Site WIDS ID 216-B-3												
216-B-2-1	216-B-2-1 Ditch	L	Site consolidated with Site WIDS ID 216-B-3												
UPR-200-E-138	UPR-200-E-138 Unplanned Release	L	Site consolidated with Site WIDS ID 216-B-3												
218-E-8	218-E-8 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-E-1	218-E-1 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-B-3	216-B-3 Pond	L	–	5.88×10^{3}	2.27×10^{3}	2.79×10^{2}	–	2.50×10^{2}	2.94×10^{5}	–	–	–	–	2.79×10^{3}	–
216-B-3A Pond / 216-B-3A RAD	216-B-3A Pond / 216-B-3A RAD	L	Site consolidated with Site WIDS ID 216-B-3												
216-B-3B Pond / 216-B-3B-RAD	216-B-3B Pond / 216-B-3B-RAD	L	Site consolidated with Site WIDS ID 216-B-3												
216-B-3C Pond / 216-B-3C RAD	216-B-3C Pond / 216-B-3C RAD	L	Site consolidated with Site WIDS ID 216-B-3												
UPR-200-E-14	Unplanned Release-UPR-200-E-14	L	Site consolidated with Site WIDS ID 216-B-3												
UPR-200-E-34	UPR-200-E-34	L	Site consolidated with Site WIDS ID 216-A-25 and 216-B-3												

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–79a. Map 12A: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-C-9	216-C-9 Swamp	L	–	–	1.37×10^{-8}	–	–	–	–	–	–	–	1.15×10^{-2}	–	1.32×10^{2}
218-C-9	218-C-9 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-141[a]	UPR-200-E-141	L	–	–	1.04×10^{-6}	–	–	–	–	–	–	–	2.26×10^{-5}	–	5.16×10^{-3}
200-E-56[a]	200-E-56 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	3.01×10^{1}	–	–
201-C	201-C Process Building	L/S		– –	–	–	–	–		–	–	–	–	–	–
216-C-1	216-C-1 Hot Semi Work Crib	L	–	–	–	–	–	–	–	–	–	–	5.77×10^{4}	–	–
216-C-3	216-C-3 Hot Semi Work Crib	L	–	–	2.52×10^{-2}	–	–	–	–	–	–	–	5.85×10^{-1}	–	1.24×10^{2}
216-C-4	216-C-4 Hot Semi Work Crib	L	–	–	–	–	–	–	–	–	–	–	1.04×10^{-6}	–	–
216-C-5	216-C-5 Hot Semi Work Crib	L	–	–	–	–	–	–	–	–	–	–	1.63×10^{1}	–	–
216-C-6	216-C-6 Hot Semi Work Crib	L	–	–	–	–	–	–	–	–	–	–	2.82×10^{-6}	–	–
216-C-10	216-C-10 Hot Semi Work Crib	L	–	–	–	–	–	–	–	–	–	–	7.96×10^{-2}	–	–
216-C-2	216-C-2 Semi Works Reverse Well	L		– –	–	–	–	–	–	–	–	–	–	–	–
200-E-57[a]	200-E-57 Unplanned Release	L	–	–	–	–	–	–	–	–	–	–	4.51×10^{1}	–	–
241-CX-72	241-CX-72 Storage Tank and Vault	L/S		– –	–	–	–	–	–	–	–	–	–	–	–
291-C-1	291-C-1 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–79b. Map 12A: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-C-9	216-C-9 Swamp	L	–	5.98	5.47	4.39×10^{-1}	–	7.74×10^{-4}	5.20×10^{2}	–	–	–	–	4.52×10^{-2}	–
218-C-9	218-C-9 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-141[a]	UPR-200-E-141	L	–	–	1.88×10^{-6}	7.69×10^{-7}	–	1.15×10^{-5}	3.18	–	–	–	–	1.80×10^{-1}	–
200-E-56[a]	200-E-56 Unplanned Release	L	–	3.43×10^{1}	–	2.45×10^{-2}	–	1.77×10^{1}	5.10×10^{3}	–	–	–	–	2.35	–
201-C	201-C Process Building	L/S	–	2.27×10^{3}	–	–	–	–	–	–	–	–	–	–	–
216-C-1	216-C-1 Hot Semi Work Crib	L	–	9.15×10^{1}	5.94×10^{2}	7.70	–	2.51×10^{3}	3.76×10^{6}	–	–	–	–	9.08×10^{2}	–
216-C-3	216-C-3 Hot Semi Work Crib	L	–	4.54×10^{-2}	4.54×10^{-2}	1.46×10^{-2}	–	3.01×10^{-1}	7.65×10^{4}	–	–	–	–	4.54	–
216-C-4	216-C-4 Hot Semi Work Crib	L	–	2.49×10^{-3}	1.20×10^{-3}	1.47×10^{-3}	–	5.89×10^{-2}	5.67	–	–	–	–	3.17×10^{-3}	–
216-C-5	216-C-5 Hot Semi Work Crib	L	–	9.03×10^{-1}	–	2.50×10^{-2}	–	4.49	1.09×10^{3}	–	–	–	–	2.07×10^{1}	–
216-C-6	216-C-6 Hot Semi Work Crib	L	–	–	–	8.75×10^{-5}	–	1.59×10^{-1}	2.83×10^{2}	–	–	–	–	1.78	–
216-C-10	216-C-10 Hot Semi Work Crib	L	–	1.04×10^{-1}	6.34×10^{-3}	7.67×10^{-3}	–	4.70×10^{-2}	1.43×10^{1}	–	–	–	–	6.52×10^{-3}	–
216-C-2	216-C-2 Semi Works Reverse Well	L	–	4.62×10^{-2}	2.23×10^{-2}	2.68×10^{-2}	–	–	2.86	–	–	–	–	1.18×10^{-3}	–
200-E-57[a]	200-E-57 Unplanned Release	L	–	5.15×10^{1}	–	$3.67\times10^{-}$	–	2.66×10^{1}	7.65×10^{3}	–	–	–	–	3.51	–
241-CX-72	241-CX-72 Storage Tank and Vault	L/S		– –	–	–	–	–	–	–	–	–	–	–	–
291-C-1	291-C-1 Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–80a. Map 12B: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
UPR-200-E-86	UPR-200-E-86	L	–	–	–	–	–	–	–	–	–	–	6.04×10^{1}	–	8.43×10^{-1}
216-A-40	216-A-40 Trench	L	–	–	1.39×10^{-11}	–	–	–	–	–	–	–	1.17×10^{-5}	–	1.26×10^{-1}
216-A-41	216-A-41 Crib	L	–	–	7.83×10^{-8}	–	–	–	–	–	–	–	1.86×10^{-4}	–	3.99×10^{-3}
216-A-9	216-A-9 Crib	L	–	–	3.60×10^{2}	–	–	–	–	–	–	–	8.36×10^{2}	–	1.32×10^{2}
216-A-3	216-A-3 Crib	L	–	–	1.53×10^{-2}	–	–	–	–	–	–	–	3.39×10^{-1}	–	7.56×10^{1}
216-A-39	216-A-39 Crib	L	–	–	–	–	–	–	–	–	–	–	8.47×10^{-3}	–	–
216-A-18	216-A-18 Trench	L	–	–	–	–	–	–	–	–	–	–	2.04×10^{2}	–	–
216-A-1	216-A-1 Crib	L	–	–	–	–	–	–	–	–	–	–	4.11×10^{1}	–	–
216-A-7	216-A-7 Crib	L	–	–	1.32×10^{5}	–	–	–	–	–	–	–	4.84×10^{-3}	–	1.05×10^{-2}
UPR-200-E-145	UPR-200-E-145	L	–	–	3.13×10^{-5}	–	–	–	–	–	–	–	6.77×10^{-4}	–	1.55×10^{-1}
216-A-16	216-A-16 French Drain	L	–	–	1.34×10^{-6}	–	–	–	–	–	–	–	3.17×10^{-3}	–	6.81×10^{-2}
216-A-17	216-A-17 French Drain	L	–	–	6.57×10^{-7}	–	–	–	–	–	–	–	1.56×10^{-3}	–	3.35×10^{-2}
242-A	242-A Evaporator	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-A-22	216-A-22 Crib (French Drain)	L	–	–	3.70×10^{-1}	–	–	–	–	–	–	–	–	–	4.93×10^{-3}
216-A-28	216-A-28 French Drain	L	–	–	1.43×10^{-4}	–	–	–	–	–	–	–	3.09×10^{-3}	–	7.07×10^{-1}
216-A-32	216-A-32 Crib	L	–	–	4.39×10^{-8}	–	–	–	–	–	–	–	1.04×10^{-4}	–	2.24×10^{-3}
200-E-78	200-E-78 Reverse Well	L	–	–	–	–	–	–	–	–	–	–	–	–	2.51×10^{-2}

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–80b. Map 12B: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
UPR-200-E-86	UPR-200-E-86	L	–	3.17	6.64×10^{-1}	2.20×10^{-2}	–	7.26	3.28×10^{3}	–	–	–	–	2.11	–
216-A-40	216-A-40 Trench	L	–	5.25×10^{-3}	4.78×10^{-3}	2.32×10^{-9}	–	7.83×10^{-7}	4.78×10^{-1}	–	–	–	–	2.22×10^{-7}	–
216-A-41	216-A-41 Crib	L	–	1.86×10^{-8}	2.71×10^{-9}	3.56×10^{-11}	–	1.55×10^{-4}	4.03	–	–	–	–	3.40×10^{-4}	–
216-A-9	216-A-9 Crib	L	–	1.54	8.60	3.20×10^{-2}	–	6.42×10^{2}	2.18×10^{4}	–	–	–	–	1.89×10^{3}	–
216-A-3	216-A-3 Crib	L	–	–	2.75×10^{-2}	1.13×10^{-2}	–	1.70×10^{-1}	4.65×10^{4}	–	–	–	–	2.64×10^{3}	–
216-A-39	216-A-39 Crib	L	–	2.98×10^{-3}	–	6.49×10^{-6}	–	2.14×10^{-3}	9.13×10^{-1}	–	–	–	–	6.21×10^{-4}	–
216-A-18	216-A-18 Trench	L	–	1.13×10^{1}	–	5.82×10^{-1}	–	6.33×10^{1}	1.37×10^{4}	–	–	–	–	6.82×10^{2}	–
216-A-1	216-A-1 Crib	L	–	2.29	–	1.17×10^{-1}	–	1.28×10^{1}	2.76×10^{3}	–	–	–	–	1.38×10^{2}	–
216-A-7	216-A-7 Crib	L	–	4.08×10^{-4}	1.16×10^{-3}	8.49×10^{-6}	–	7.33×10^{-4}	1.49×10^{3}	–	–	–	–	4.81×10^{2}	–
UPR-200-E-145	UPR-200-E-145	L	–	–	5.64×10^{-5}	2.31×10^{-5}	–	3.45×10^{-4}	9.53×10^{1}	–	–	–	–	5.41	–
216-A-16	216-A-16 French Drain	L	–	3.18×10^{-7}	4.62×10^{-8}	6.08×10^{-10}	–	2.65×10^{-3}	3.67×10^{1}	–	–	–	–	1.71×10^{-7}	–
216-A-17	216-A-17 French Drain	L	–	1.56×10^{-7}	2.27×10^{-8}	2.99×10^{-10}	–	1.30×10^{-3}	1.81×10^{1}	–	–	–	–	8.40×10^{-8}	–
242-A	242-A Evaporator	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-A-22	216-A-22 Crib (French Drain)	L	–	–	8.38×10^{-5}	2.64×10^{-5}	–	4.23×10^{-4}	6.01×10^{-1}	–	–	–	–	4.61	–
216-A-28	216-A-28 French Drain	L	–	–	2.57×10^{-4}	1.05×10^{-4}	–	1.57×10^{-3}	4.35×10^{2}	–	–	–	–	6.54×10^{2}	–
216-A-32	216-A-32 Crib	L	–	1.04×10^{-8}	1.52×10^{-9}	2.00×10^{-11}	–	8.70×10^{-5}	1.21	–	–	–	–	5.61×10^{-9}	–
200-E-78	200-E-78 Reverse Well	L	–	–	1.15×10^{-3}	–	–	–	1.04×10^{-1}	–	–	–	–	8.87×10^{-3}	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–81a. Map 12C: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
UPR-200-E-51	UPR-200-E-51	L	Site consolidated with Site WIDS ID 216-A-29												
216-A-24	216-A-24 Crib	L	–	–	1.88×10^{4}	–	–	–	–	–	–	–	6.49×10^{-4}	–	1.08×10^{2}
216-A-6	216-A-6 Crib	L	–	–	3.72×10^{-4}	–	–	–	–	–	–	–	5.00×10^{3}	–	4.56×10^{2}
216-A-19	216-A-19 Trench	L	–	–	–	–	–	–	–	–	–	–	4.59×10^{2}	–	–
216-A-20	216-A-20 Trench	L	–	–	1.04	–	–	–	–	–	–	–	5.65×10^{1}	–	1.07×10^{-1}
216-A-8	216-A-8 Crib	L	–	–	1.08×10^{5}	–	–	–	–	–	–	–	3.90×10^{-3}	–	1.52×10^{2}
216-A-29[a]	216-A-29 Ditch	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-A-30	216-A-30 Crib	L	–	–	2.29×10^{-3}	–	–	–	–	–	–	–	6.04×10^{3}	–	1.13×10^{3}
216-A-37-1	216-A-37-1 Crib	L	–	–	4.65×10^{2}	–	–	–	–	–	–	6.68×10^{1}	–	–	4.79×10^{1}
216-A-37-2	216-A-37-2 Crib	L	–	–	1.39×10^{2}	–	–	–	–	–	–	–	–	–	1.49×10^{2}

a This site was consolidated with another site for purposes of modeling.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–81b. Map 12C: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
UPR-200-E-51	UPR-200-E-51	L	Site consolidated with Site WIDS ID 216-A-29												
216-A-24	216-A-24 Crib	L	–	4.31×10^{1}	1.49×10^{1}	1.65	–	9.86×10^{-5}	6.53×10^{2}	–	–	–	–	6.51×10^{1}	–
216-A-6	216-A-6 Crib	L	–	1.36×10^{-1}	2.02×10^{1}	2.71×10^{-3}	–	1.29×10^{3}	2.20×10^{5}	–	–	–	–	1.70×10^{2}	–
216-A-19	216-A-19 Trench	L	–	2.55×10^{1}	–	2.79×10^{1}	–	8.41×10^{2}	3.08×10^{4}	–	–	–	–	4.34×10^{4}	–
216-A-20	216-A-20 Trench	L	–	3.14	1.19×10^{-2}	4.34×10^{-1}	–	2.47×10^{1}	3.79×10^{3}	–	–	–	–	6.21×10^{2}	–
216-A-8	216-A-8 Crib	L	–	1.16×10^{2}	2.49×10^{1}	4.54	–	5.91×10^{-4}	1.83×10^{3}	–	–	–	–	3.91×10^{2}	–
216-A-29[a]	216-A-29 Ditch	L	–	–	–	–	–	–	3.24×10^{2}	–	–	–	–		–
216-A-30	216-A-30 Crib	L	–	3.68×10^{-1}	4.68×10^{1}	7.35×10^{-3}	–	1.63×10^{3}	2.30×10^{5}	–	–	–	–	6.56×10^{2}	–
216-A-37-1	216-A-37-1 Crib	L	–	1.86	5.30	3.87×10^{-2}	–	–	2.05×10^{2}	–	–	–	–	1.93×10^{-1}	–
216-A-37-2	216-A-37-2 Crib	L	–	5.55×10^{-1}	7.73	1.16×10^{-2}	–	–	6.18×10^{2}	–	–	–	–	4.76×10^{1}	–

a This site was consolidated with another site for purposes of modeling.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–82a. Map 12D: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-A-13	216-A-13 French Drain	L	–	–	1.10×10^{-7}	–	–	–	–	–	–	–	2.60×10^{-4}	–	5.59×10^{-3}
200-E-61	200-E-61 Reverse Well	L	–	–	1.97×10^{-5}	–	–	–	–	–	–	–	4.67×10^{-2}	–	1.01
200-E-136	200-E-136 PUREX Plant (202-A and Others)	S	–	–	–	–	–	–	–	–	1.29×10^{2}	–	–	–	–
UPR-200-E-39	UPR-200-E-39 (@ 216-A-36B)	L		–	–	–	–	–	–	–	–	–	–	–	–
UPR-200-E-40	UPR-200-E-40	L	–	–	–	–	–	–	–	–	–	–	–	–	–
200-E-85	200-E-85 Reverse Well	L	–	–	1.56×10^{-5}	–	–	–	–	–	–	–	3.70×10^{-2}	–	7.96×10^{-1}
216-A-35	216-A-35 French Drain	L	–	–	1.10×10^{-7}	–	–	–	–	–	–	–	2.60×10^{-4}	–	5.59×10^{-3}
200-E-54	200-E-54 Unplanned Release	L	–	–	2.20×10^{-6}	–	–	–	–	–	–	–	5.21×10^{-3}	–	1.12×10^{-1}
200-E-103	200-E-103 PUREX Stabilized Area	L	–	–	4.38×10^{-8}	–	–	–	–	–	–	–	1.04×10^{-4}	–	2.23×10^{-3}
UPR-200-E-117[a]	UPR-200-E-117	L	–	–	–	–	–	–	–	–	–	–	2.94×10^{-1}	–	4.09×10^{-3}
216-A-2	216-A-2 Crib	L	–	–	1.24×10^{5}	–	–	–	–	–	–	–	4.56×10^{-3}	–	–
216-A-26	216-A-26 French Drain	L	–		4.23×10^{-8}	–	–	–	–		–	–	1.00×10^{-4}	–	2.16×10^{-3}
216-A-26A	216-A-26A French Drain	L	–		1.10×10^{-8}	–	–	–	–		–	–	2.60×10^{-5}	–	5.59×10^{-4}
216-A-15	216-A-15 French Drain	L		–	–	–	–	–	–		–	–	–	–	1.36
200-E-107	200-E-107 Unplanned Release	L		–	–	–	–	–	–		–	–	1.67	–	–
218-E-14	218-E-14 PUREX Tunnel 1	S	–	–	–	–	–	–	–	–	–	–	–	–	–
218-E-15	218-E-15 PUREX Tunnel 2	S	–	–	–	–	–	–	–	–	6.85×10^{1}	–	9.00	–	–
216-A-4	216-A-4 Crib	L	–	–	3.11×10^{-2}	–	–	–	–	–	–	–	2.34	–	1.54×10^{2}
216-A-5	216-A-5 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–

Table S-82a. Map 12D: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
216-A-10	216-A-10 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	3.19×10^{1}
216-A-21	216-A-21 Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-A-27	216-A-27 Crib	L	–	–	2.54×10^{-4}	–	–	–	–	–	–	–	1.06×10^{1}	–	1.29×10^{1}
216-A-31	216-A-31 Crib	L	–	–	1.64×10^{4}	–	–	–	–	–	–	–	6.00×10^{-4}	–	–
216-A-36-A	216-A-36A Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-A-36-B	216-A-36B Crib	L	–	–	–	–	–	–	–	–	–	–	–	–	–
216-A-45	216-A-45 Crib	L	–	–	2.53×10^{-1}	–	–	–	–	–	–	–	5.45	–	1.24×10^{3}

a This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HF=hydrogen fluoride; ID=identifier;; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; PUREX=Plutonium-Uranium Extraction; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–82b. Map 12D: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-A-13	216-A-13 French Drain	L	–	2.61×10^{-8}	3.79×10^{-9}	4.99×10^{-11}	–	2.17×10^{-4}	3.01	–	–	–	–	1.40×10^{-8}	–
200-E-61	200-E-61 Reverse Well	L	–	4.69×10^{-6}	6.82×10^{-7}	8.97×10^{-9}	–	3.91×10^{-2}	5.42×10^{2}	–	–	–	–	2.52×10^{-6}	–
200-E-136	200-E-136 PUREX Plant (202-A and Others)	S	–	1.81×10^{4}	–	1.14×10^{2}	–	–	–	–	–	–	–	–	–
UPR-200-E-39	UPR-200-E-39 (@ 216-A-36B)	L	–	–	–	–	–	–	6.24	–	–	–	–	2.08×10^{-1}	–
UPR-200-E-40	UPR-200-E-40	L	–	–	–	–	–	–	4.80×10^{-1}	–	–	–	–	1.59×10^{-2}	–
200-E-85	200-E-85 Reverse Well	L	–	3.71×10^{-6}	5.40×10^{-7}	7.11×10^{-9}	–	3.10×10^{-2}	4.29×10^{2}	–	–	–	–	2.00×10^{-6}	–

Table S-82b. Map 12D: Chemical Inventories (kilograms) *(continued)*

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
216-A-35	216-A-35 French Drain	L	–	2.60×10^{-8}	3.79×10^{-9}	4.98×10^{-11}	–	2.17×10^{-4}	3.01	–	–	–	–	1.40×10^{-8}	–
200-E-54	200-E-54 Unplanned Release	L	–	5.22×10^{-7}	7.61×10^{-8}	1.00×10^{-9}	–	4.36×10^{-3}	6.04×10^{1}	–	–	–	–	2.81×10^{-7}	–
200-E-103	200-E-103 PUREX Stabilized Area	L	–	1.04×10^{-8}	1.52×10^{-9}	1.99×10^{-11}	–	8.68×10^{-5}	1.20	–	–	–	–	5.61×10^{-9}	–
UPR-200-E-117[a]	UPR-200-E-117	L	–	1.54×10^{-2}	3.23×10^{-3}	1.07×10^{-4}	–	3.53×10^{-2}	1.60×10^{1}	–	–	–	–	1.01×10^{-2}	–
216-A-2	216-A-2 Crib	L	–	–	–	–	–	7.00×10^{-4}	2.37×10^{3}	–	–	–	–	2.28×10^{2}	–
216-A-26	216-A-26 French Drain	L	–	1.00×10^{-8}	1.46×10^{-9}	1.92×10^{-11}	–	8.38×10^{-5}	1.16	–	–	–	–	5.40×10^{-9}	–
216-A-26A	216-A-26A French Drain	L	–	2.61×10^{-9}	3.79×10^{-10}	4.99×10^{-12}	–	2.17×10^{-5}	3.01×10^{-1}	–	–	–	–	1.40×10^{-9}	–
216-A-15	216-A-15 French Drain	L	–	–	6.23×10^{-2}	–	–	–	5.64	–	–	–	–	4.82×10^{-1}	–
200-E-107	200-E-107 Unplanned Release	L	–	–	–	–	–	4.28×10^{-1}	4.49×10^{1}	–	–	–	–	3.75×10^{-9}	–
218-E-14	218-E-14 PUREX Tunnel 1	S	–	2.30×10^{2}	–	–	–		–	–	–	–	–	–	–
218-E-15	218-E-15 PUREX Tunnel 2	S	–	9.73×10^{3}	–	1.30×10^{2}	–		–	–	7.40×10^{2}	–	–	–	–
216-A-4	216-A-4 Crib	L	–	–	5.61×10^{-2}	2.29×10^{-2}	–	1.16	9.54×10^{4}	–	–	–	–	5.39×10^{3}	–
216-A-5	216-A-5 Crib	L	–	–	–	–	–	–	1.07×10^{6}	–	–	–	–	1.98×10^{2}	–
216-A-10	216-A-10 Crib	L	–	–	–	–	–	–	1.92×10^{6}	–	–	–	–	3.58×10^{2}	–
216-A-21	216-A-21 Crib	L	–	–	–	–	–	–	3.20×10^{5}	–	–	–	–	1.95×10^{2}	–
216-A-27	216-A-27 Crib	L	–	6.03×10^{-5}	8.77×10^{-6}	1.15×10^{-7}	–	5.40	1.13×10^{4}	–	–	–	–	6.51×10^{1}	–
216-A-31	216-A-31 Crib	L	–	–	–	–	–	9.10×10^{-5}	1.85×10^{2}	–	–	–	–	5.98×10^{1}	–
216-A-36-A	216-A-36A Crib	L	–	–	–	–	–	–	4.39×10^{3}	–	–	–	–	1.45×10^{2}	–
216-A-36-B	216-A-36B Crib	L	–	–	–	–	–	–	1.30×10^{6}	–	–	–	–	1.22×10^{2}	–
216-A-45	216-A-45 Crib	L	–	4.82×10^{-3}	4.59×10^{-1}	1.45×10^{-1}	–	2.78	8.00×10^{5}	–	–	–	–	7.82	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.

Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; PUREX=Plutonium-Uranium Extraction; S=solid; WIDS=Waste Information Data System.

Source: SAIC 2006.

Table S–83a. Map 13: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
2101-M Pond	2101-M Pond	L	–	–	–	–	–	–	–	–	–	–	4.30×10^{2}	–	1.43×10^{2}
216-B-54	216-B-54 Trench	L	–	–	–	–	–	–	–	–	–	–	2.61	–	1.32×10^{-1}
216-B-14	216-B-14 Crib	L	–	–	–	–	–	–	–	–	–	–	1.49×10^{3}	–	3.51×10^{4}
216-B-15	216-B-15 Crib	L	–	–	–	–	–	–	–	–	–	–	1.09×10^{3}	–	2.56×10^{4}
216-B-16	216-B-16 Crib	L	–	–	1.89	–	–	–	–	–	–	–	1.08×10^{3}	–	1.89×10^{4}
216-B-17	216-B-17 Crib	L	–	–	3.82	–	–	–	–	–	–	–	8.19×10^{2}	–	6.11×10^{3}
216-B-18	216-B-18 Crib	L	–	–	–	–	–	–	–	–	–	–	1.46×10^{3}	–	3.45×10^{4}
216-B-19	216-B-19 Crib	L	–	–	4.94	–	–	–	–	–	–	–	1.39×10^{3}	–	1.58×10^{4}
216-B-20	216-B-20 Trench	L	–	–	3.19	–	–	–	–	–	–	–	9.98×10^{2}	–	1.25×10^{4}
216-B-21	216-B-21 Trench	L	–	–	7.50×10^{-1}	–	–	–	–	–	–	–	8.49×10^{2}	–	1.74×10^{4}
216-B-22	216-B-22 Trench	L	–	–	2.06	–	–	–	–	–	–	–	9.41×10^{2}	–	1.50×10^{4}
216-B-23	216-B-23 Trench	L	–	–	2.02	–	–	–	–	–	–	–	9.00×10^{2}	–	1.42×10^{4}
216-B-24	216-B-24 Trench	L	–	–	–	–	–	–	–	–	–	–	8.38×10^{2}	–	1.97×10^{4}
216-B-25	216-B-25 Trench	L	–	–	–	–	–	–	–	–	–	–	8.44×10^{2}	–	1.99×10^{4}
216-B-26	216-B-26 Trench	L	–	–	–	–	–	–	–	–	–	–	8.17×10^{2}	–	1.92×10^{4}
216-B-27	216-B-27 Trench	L	–	–	–	–	–	–	–	–	–	–	7.60×10^{2}	–	1.79×10^{4}
216-B-28	216-B-28 Trench	L	–	–	1.94	–	–	–	–	–	–	–	9.86×10^{2}	–	1.65×10^{4}
216-B-29	216-B-29 Trench	L	–	–	–	–	–	–	–	–	–	–	8.31×10^{2}	–	1.96×10^{4}
216-B-30	216-B-30 Trench	L	–	–	3.91	–	–	–	–	–	–	–	1.06×10^{3}	–	1.15×10^{4}
216-B-31	216-B-31 Trench	L	–	–	3.91	–	–	–	–	–	–	–	1.07×10^{3}	–	1.18×10^{4}
216-B-32	216-B-32 Trench	L	–	–	4.06	–	–	–	–	–	–	–	1.06×10^{3}	–	1.11×10^{4}
216-B-33	216-B-33 Trench	L	–	–	4.76	–	–	–	–	–	–	–	1.11×10^{3}	–	9.63×10^{3}
216-B-34	216-B-34 Trench	L	–	–	4.98	–	–	–	–	–	–	–	1.14×10^{3}	–	9.70×10^{3}
216-B-52	216-B-52 Trench	L	–	–	7.71	–	–	–	–	–	–	–	1.94×10^{3}	–	1.90×10^{4}
216-B-53A	216-B-53A Trench	L	–	–	–	–	–	–	–	–	–	–	3.86	–	7.15×10^{-2}
216-B-53B	216-B-53B Trench	L	–	–	–	–	–	–	–	–	–	–	2.10	–	2.00×10^{-3}
216-B-58	216-B-58 Trench	L	–	–	–	–	–	–	–	–	–	–	1.89	–	5.46×10^{-2}

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–83b. Map 13: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
2101-M Pond	2101-M Pond	L	–	4.29×10^{2}	7.84	1.72×10^{1}	–	–	6.40×10^{2}	–	–	–	–	1.29×10^{1}	–
216-B-54	216-B-54 Trench	L	–	5.22×10^{-1}	5.48×10^{-3}	2.19×10^{-2}	–	8.26×10^{-1}	8.99×10^{2}	–	–	–	–	1.34×10^{1}	–
216-B-14	216-B-14 Crib	L	–	–	–	2.76	–	9.11×10^{2}	1.73×10^{6}	–	–	–	–	2.69×10^{2}	–
216-B-15	216-B-15 Crib	L	–	–	–	2.01	–	6.64×10^{2}	1.26×10^{6}	–	–	–	–	1.96×10^{2}	–
216-B-16	216-B-16 Crib	L	–	2.28	–	1.68	–	5.89×10^{2}	1.07×10^{6}	–	–	–	–	1.73×10^{2}	–
216-B-17	216-B-17 Crib	L	–	4.60	–	8.72×10^{-1}	–	3.58×10^{2}	5.87×10^{5}	–	–	–	–	1.04×10^{2}	–
216-B-18	216-B-18 Crib	L	–	–	–	2.71	–	8.95×10^{2}	1.70×10^{6}	–	–	–	–	2.64×10^{2}	–
216-B-19	216-B-19 Crib	L	–	5.94	–	1.75	–	6.67×10^{2}	1.15×10^{6}	–	–	–	–	1.94×10^{2}	–
216-B-20	216-B-20 Trench	L	–	3.84	–	1.36	–	5.18×10^{2}	8.54×10^{5}	–	–	–	–	1.48×10^{2}	–
216-B-21	216-B-21 Trench	L	–	9.03×10^{-1}	–	1.45	–	4.91×10^{2}	9.13×10^{5}	–	–	–	–	1.44×10^{2}	–
216-B-22	216-B-22 Trench	L	–	2.48	–	1.40	–	4.98×10^{2}	8.94×10^{5}	–	–	–	–	1.46×10^{2}	–
216-B-23	216-B-23 Trench	L	–	2.43	–	1.33	–	4.75×10^{2}	8.52×10^{5}	–	–	–	–	1.39×10^{2}	–
216-B-24	216-B-24 Trench	L	–	–	–	1.55	–	5.12×10^{2}	9.71×10^{5}	–	–	–	–	1.51×10^{2}	–
216-B-25	216-B-25 Trench	L	–	–	–	1.56	–	5.16×10^{2}	9.79×10^{5}	–	–	–	–	1.52×10^{2}	–
216-B-26	216-B-26 Trench	L	–	–	–	1.63	–	5.11×10^{2}	9.46×10^{5}	–	–	–	–	1.59×10^{2}	–
216-B-27	216-B-27 Trench	L	–	–	–	1.41	–	4.65×10^{2}	8.81×10^{5}	–	–	–	–	1.37×10^{2}	–
216-B-28	216-B-28 Trench	L	–	2.33	–	1.50	–	5.31×10^{2}	9.59×10^{5}	–	–	–	–	1.56×10^{2}	–
216-B-29	216-B-29 Trench	L	–	–	–	1.54	–	5.07×10^{2}	9.62×10^{5}	–	–	–	–	1.50×10^{2}	–
216-B-30	216-B-30 Trench	L	–	4.71	–	1.30	–	5.02×10^{2}	8.57×10^{5}	–	–	–	–	1.46×10^{2}	–
216-B-31	216-B-31 Trench	L	–	4.70	–	1.33	–	5.10×10^{2}	8.71×10^{5}	–	–	–	–	1.48×10^{2}	–
216-B-32	216-B-32 Trench	L	–	4.89	–	1.29	–	5.00×10^{2}	8.48×10^{5}	–	–	–	–	1.45×10^{2}	–
216-B-33	216-B-33 Trench	L	–	5.73	–	1.25	–	4.99×10^{2}	8.30×10^{5}	–	–	–	–	1.45×10^{2}	–
216-B-34	216-B-34 Trench	L	–	5.99	–	1.28	–	5.13×10^{2}	8.51×10^{5}	–	–	–	–	1.48×10^{2}	–
216-B-52	216-B-52 Trench	L	–	9.29	–	2.29	–	8.96×10^{2}	1.51×10^{6}	–	–	–	–	2.60×10^{2}	–
216-B-53A	216-B-53A Trench	L	–	2.84×10^{-1}	2.98×10^{-3}	1.19×10^{-2}	–	1.92	1.54×10^{3}	–	–	–	–	3.07×10^{1}	–
216-B-53B	216-B-53B Trench	L	–	7.92×10^{-3}	8.32×10^{-5}	3.33×10^{-4}	–	8.26×10^{-1}	8.98×10^{2}	–	–	–	–	8.26	–
216-B-58	216-B-58 Trench	L	–	2.17×10^{-1}	2.27×10^{-3}	9.10×10^{-3}	–	6.60×10^{-1}	7.19×10^{2}	–	–	–	–	8.76	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–84a. Map 14: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
600 NRDWL	600 Nonrad Dangerous Waste Landfill	S	3.00	7.95×10^{1}	1.35×10^{1}	–	4.50	2.72×10^{-1}	3.56×10^{2}	6.51×10^{2}	4.48×10^{2}	9.40×10^{1}	2.64×10^{1}	2.10×10^{1}	7.62×10^{1}

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–84b. Map 14: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
600 NRDWL	600 Nonrad Dangerous Waste Landfill	S	3.15×10^{2}	1.04×10^{1}	6.09	1.36×10^{2}	1.90	2.24×10^{3}	1.06×10^{4}	–	1.27×10^{-1}	4.10×10^{-2}	6.31×10^{2}	–	–

Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–85a. Map 15: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
618-11	300 Wye Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
400 RFD[a]	400 Area Retired French Drains	L	–	–	–	–	–	–	–	–	–	–	–	–	–
316-4	300 North Cribs, 321 Cribs	L	–	–	–	–	–	–	–	–	–	–	7.73×10^{-1}	–	–

[a] This site had inventories that were on the initial list of constituents, but was screened out during final screening described in Section S.3.6.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–85b. Map 15: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
618-11	300 Wye Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
400 RFD[a]	400 Area Retired French Drains	L	–	–	–	–	–	–	–	–	–	–	–	–	–
316-4	300 North Cribs, 321 Cribs	L	–	–	–	–	–	3.01×10^{-2}	4.68×10^{2}	–	–	–	–	1.94×10^{-1}	–

[a] This site had inventories that were on the initial list of constituents, but was screened out during final screening described in Section S.3.6.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–86a. Map 16: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	1,2-Dichloroethane	1,4-Dioxane	1-Butanol (includes Butanol and 1-Butanol from TBP)	2,4,6-Trichlorophenol	Acetonitrile	Arsenic (Inorganic)	Benzene	Boron and Compound	Cadmium	Carbon tetrachloride	Chromium (includes Hexavalent Chromium and Chromium from $Na_2Cr_2O_7$)	Dichloromethane	Fluoride (soluble fluoride) (includes Fluorine and Fluorine from HF)
618-9	300 West Burial Ground	S	–	–	4.98×10^{3}	–	–	–		–	–	–	–	–	–
316-1	300 Area South Process Ponds	L	–	–	–	–	–	–	–	–	–	–	2.78×10^{4}	–	4.07×10^{3}
316-2	300 Area North Process Ponds	L	–	–	–	–	–	–	–	–	–	–	2.03×10^{4}	–	3.80×10^{3}
316-5	300 Area Process Trenches	L	–	–	–	–	–	–	–	–	–	–	–	–	4.94×10^{3}
UPR-300-1	307-340 Waste Line Leak	L	–	–	–	–	–	–	–	–	–	–	–	–	–
300-19[a]	324 Sodium Removal Pilot Plant	L	–	–	–	–	–	–		–	–	–	–	–	–
UPR-300-13[a]	Acid Neutralization Tank Leak East of 333 Building	L	–	–	–	–	–	–	–	–	–	–	–	–	–
300-264	327 Building, Postirradiation Testing Laboratory	L	–	–	–	–	–	–	–	–	–	–	–	–	–
309-WS-1	309 Plutonium Recycle Test Reactor Ion Exchange Vault	L	–	–	–	–	–	–	–	–	–	–	–	–	–
316-3	307 Disposal Trenches	L	–	–	–	–	–	–	–	–	2.00×10^{1}	–	1.00×10^{3}	–	2.00×10^{3}

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HF=hydrogen fluoride; ID=identifier; L=liquid; $Na_2Cr_2O_7$=sodium dichromate; S=solid; TBP=tributyl phosphate; WIDS=Waste Information Data System.
Source: SAIC 2006.

Table S–86b. Map 16: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
618-9	300 West Burial Ground	S	–	–	–	–	–	–	–	–	–	–	–	–	–
316-1	300 Area South Process Ponds	L	–	3.48×10^{4}	1.65×10^{2}	1.45×10^{-2}	–	8.89×10^{3}	3.86×10^{6}	–	–	–	–	2.62×10^{4}	–
316-2	300 Area North Process Ponds	L	–	2.54×10^{4}	1.64×10^{2}	6.49×10^{-3}	–	6.48×10^{3}	2.82×10^{6}	–	–	–	–	1.94×10^{4}	–
316-5	300 Area Process Trenches	L	–	–	2.26×10^{2}	–	–	–	2.05×10^{4}	–	–	–	–	1.75×10^{3}	–
UPR-300-1	307-340 Waste Line Leak	L	–	–	–	–	–	–	–	–	–	–	–	–	–
300-19[a]	324 Sodium Removal Pilot Plant	L	–	–		–	–	–	–	–	–	–	–	–	–
UPR-300-13[a]	Acid Neutralization Tank Leak East of 333 Building	L	–	–	–	–	–	–	1.99×10^{3}	–	–	–	–	1.35	–
300-264	327 Building, Postirradiation Testing Laboratory	L	–	–	–	–	–	–	–	–	–	–	–	–	–
309-WS-1	309 Plutonium Recycle Test Reactor Ion Exchange Vault	L	–	–	–	–	–	–	–	–	–	–	–	–	–
316-3	307 Disposal Trenches	L	–	6.00×10^{2}	–	1.00×10^{1}	–	3.00×10^{3}	–	–	–	–	–	1.00×10^{4}	–

[a] This site was not modeled because not all information needed to prepare model input files was available and assumptions could not be made.
Note: Dash (–) means no data found or inventory is estimated to be 0 or below detectable levels.
Key: HNO_3=nitric acid; ID=identifier; L=liquid; NO_2=nitrogen dioxide; S=solid; WIDS=Waste Information Data System.
Source: SAIC 2006.

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APPENDIX T
SUPPORTING INFORMATION FOR THE SHORT-TERM CUMULATIVE IMPACT ANALYSES

This appendix contains the detailed tables that support the short-term cumulative impacts presented in Chapter 6 of this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*. The cumulative impact methodologies are described in Appendix R.

This section presents detailed tables for short-term cumulative impacts for the following resource areas: land resources, ecological resources, cultural and paleontological resources, socioeconomics, and transportation (see Tables T–1 through T–4). Other resource areas do not need detailed tables to support their short-term cumulative impact analyses.

The tables in this appendix describe the past, present, and reasonably foreseeable future actions in the regions of influence that were considered in the cumulative impact assessment for these resource areas. Past and present actions that may contribute to cumulative impacts include those conducted by government agencies, businesses, or individuals within the regions of influence considered. As described in Appendix R, Table R–4, 52 projects or sets of projects were evaluated for their contributions to cumulative impacts.

Cumulative Impacts

Effects on the environment that result from the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7).

The methodology used in this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* to estimate cumulative impacts was divided into four phases: (1) selection of resource areas and appropriate regions of influence, (2) selection of reasonably foreseeable future actions, (3) estimation of cumulative impacts, and (4) identification of monitoring and mitigation. A flow chart showing the four phases of cumulative impacts analysis is presented in Appendix R, Figure R–2. The tables presented in this Appendix T form a portion of Phases 2 and 3 and contain detailed information to support the short-term cumulative impacts analysis presented in Chapter 6.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
***TC & WM EIS* Activities**						
Alternative Combination 1[b]	2/2	0	See Chapter 4, Section 4.4.6.3, for a discussion of species potentially impacted by Alternative Combination 1.	Not applicable	Chapter 4, Sections 4.4.1 and 4.4.6, provide information on *TC & WM EIS* Alternative Combination 1.	Chapter 4, Table 4–153, Table 4–157.
Alternative Combination 2[b]	307/207	65.5	See Chapter 4, Section 4.4.6.3, for a discussion of species potentially impacted by Alternative Combination 2.	Not applicable	Chapter 4, Sections 4.4.1 and 4.4.6, provide information on *TC & WM EIS* Alternative Combination 2.	Chapter 4, Table 4–153, Table 4–157.
Alternative Combination 3[b]	793/749	346	See Chapter 4, Section 4.4.6.3, for a discussion of species potentially impacted by Alternative Combination 3.	Not applicable	Chapter 4, Sections 4.4.1 and 4.4.6, provide information on *TC & WM EIS* Alternative Combination 3.	Chapter 4, Table 4–153 Table 4–157.
Other DOE Activities at the Hanford Site						
Central Plateau closure[b]	112.1	56.3	Not addressed.	On site	The area would be required as a source for geologic material to be used for covers and to fill voids. Although specific mining plans and precise areas and schedules for material excavation have not been identified, Borrow Area C and/or gravel pit No. 30 are the designated source areas for all geologic materials. It was further assumed that 50 percent of the disturbed area would be shrub-steppe habitat.	Fluor Hanford 2004:2-13, 2-15.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other DOE Activities at the Hanford Site *(continued)*						
Decommissioning of eight surplus production reactors and their support facilities in the 100 Areas[b, c]	6.1	6.1	Impacts are not expected because reactor sites are highly disturbed.	On site	The land requirement is related to the disposal of radioactive waste in the 200 Areas. It was conservatively assumed that all of this land is shrub-steppe habitat. Five of the eight reactors have been decommissioned. Habitat loss could be offset by a gain of 5 hectares that would become available for reuse within the 100 Areas once the reactors are removed.	DOE 1992:1-27.
Decommissioning of the N Reactor and its support facilities[b]	0	0	Impacts are not expected because the project area is highly developed.	On site	Undergoing interim safe storage (2006–2009).	DOE 2005:10, 12.
Actions to empty the K Basins in the 100-K Area and implement dry storage of the fuel rods in the Canister Storage Building in the 200-East Area[b]	3.6	0	Impacts are not expected because the new facility was built within a disturbed area.	On site	The facility was built in the vicinity of the Canister Storage Building.	DOE 1995:5.12, 5.38, 5.39.
Excavation and use of geologic materials from existing borrow pits[b]	31.2	8.1	Potential impacts are expected on gray cryptantha, dwarf evening primrose, Piper's daisy, and loggerhead shrike. Ecological reviews would be necessary prior to excavation.	On site	Land use would be consistent with current designations. Some shrub-steppe habitat could be impacted. Land use was assumed to be 25 percent (8.1 hectares) of total newly disturbed area.	DOE 2001a:3-1, 5-2, Appendix A.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other DOE Activities at the Hanford Site *(continued)*						
Reactivation and use of three former borrow sites in the 100-F, 100-H, and 100-N Areas[b]	38.9	0	Not present.	On site	Extraction would be authorized as an existing nonconforming use within the "Preservation" land use category. There would be minimal visual impact because existing sites would not be visible to the public from the Hanford Reach National Monument or the Columbia River, and they would be revegetated where possible during and after site usage.	DOE 2003a:5-1–5-3, B-1, B-2.
Construction and operation of the Environmental Restoration Disposal Facility near the 200-West Area[b]	414.4	414.4	Stalked-pod milkvetch and loggerhead shrike were observed on site.	On site	Total land use would be 414 hectares. Phase III (which is complete) occupies 34.4 hectares. The area is low-lying, so there would be minimal visual impact. The facility would detract from the view from Rattlesnake Mountain. Because the disposal area would be capped and revegetated where possible during and after facility usage, long-term impacts would be minimal.	DOE 1999a:9-24; 2001b:6; Sackschewsky 2003:8.
Transport of Navy reactor compartments from the Columbia River and their disposal[b]	4	0	Not present.	On site	Four hectares would be used. (in trench 218-E-12B). The area to be used is classified as a disturbed area.	Navy 1996:2-2, 3-14.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other DOE Activities at the Hanford Site *(continued)*						
Construction and operation of a Pacific Northwest National Laboratory Physical Sciences Facility[b]	40.1	25.9	Burrowing owls were observed on site. Potential impacts are expected on sage sparrow and loggerhead shrike.	On site		DOE 2007:26, 38.
Total for Other DOE Activities at the Hanford Site	**650.3**	**510.7**	**Not applicable**	**Not applicable**	**Not applicable**	**Not applicable**
Non-DOE Activities at the Hanford Site						
Management of the Hanford Reach National Monument and Saddle Mountain National Wildlife Refuge[b]	404.7	101.2	Impacts on threatened and endangered species would be generally minor; however, a number of species are present. Those potentially affected by the *TC & WM EIS* alternatives include the loggerhead shrike, sage sparrow, long-billed curlew, and black-tailed jackrabbit.	On site	Many areas that would be affected have been previously disturbed. It was assumed that 25 percent of the area to be disturbed is shrub-steppe habitat. A total of approximately 32,398 hectares of shrub-steppe habitat are found in the monument. 1,214 hectares of shrub-steppe habitat would be restored each year. 405 hectares of land could be disturbed by recreation facilities and visitor services. Goal 8 of the *Hanford Reach National Monument Comprehensive Conservation Plan and Environment Impact Statement* is to "Protect the natural visual character and promote the opportunity to experience solitude on the Monument."	USFWS 2008:2-52, 2-131, 2-132, 4-63, 4-72 to 4-82, 4-109, 4-110.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Non-DOE Activities at the Hanford Site *(continued)*						
Operation of the US Ecology commercial low-level radioactive waste disposal site near the 200-East Area[b]	40.5	40.5	Listed species were not identified on site.	On site	The cover construction would have minimal impact on ecology; revegetation would encourage shrub-steppe habitat development. An undisturbed 6.1-hectare area of shrub-steppe habitat in the northwest corner may need to be developed for spoils.	Ecology and WSDOH 2004:26–28, 128, 130.
Total for Non-DOE Activities at the Hanford Site	**445.2**	**141.6**	**Not applicable**	**Not applicable**	**Not applicable**	**Not applicable**
Total for Hanford Site	**1,095.5**	**652.4**	**Not applicable**	**Not applicable**	**Not applicable**	**Not applicable**
Other Projects/Activities in the Region of Influence						
Southridge development project, Kennewick, Washington	1,023.9	607	Burrowing owls were observed on site.	50 southeast	Habitat at the site includes 607 hectares of shrub-steppe, 253 hectares of apple orchards, and 152 hectares that are developed. An additional 101 hectares are at the planning/permitting stage.	Kennewick 2005:i, 3-17, 3-28, 3-29; Romine 2007.
Hansen Park development project, Kennewick, Washington	152.6	0	Not addressed.	48 southeast	Primarily agricultural land (based on Google Earth aerial photography).	Kennewick 2006:149.
Clearwater development project, Kennewick, Washington	164.3	40.5	Not addressed.	48 southeast	The site is 164.3 hectares. It is estimated that 40.5 hectares of the site is sagebrush habitat. Other land is agricultural, fallow agricultural, and industrial (based on Google Earth aerial photography).	Kennewick 1999:2.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other Projects/Activities in the Region of Influence *(continued)*						
Pasco, Washington (three subdivisions)	115.3	0	Not addressed.	48 south southeast	The subdivisions would be located northwest and southwest of the airport. The land appears to be mostly agricultural (based on Google Earth aerial photography).	Adams 2007.
Red Mountain Center (mixed use development),[b] West Richland, Washington	129.5	129.5	Not addressed.	34 south southeast	The land does not appear to be agricultural and was assumed to be shrub-steppe habitat (based on Google Earth aerial photography).	Gouk 2007.
Red Mountain American Viticulture Area,[b] Benton County, Washington	566.6	509.9	Not addressed.	34 south	The total area is 1,781 hectares. The developed area is currently 283 hectares, but the number of vineyards could double from 10 to 20 in the next 5 years, increasing the developed area to 567 hectares. The area is primarily native habitat with some agricultural land (based on Google Earth aerial photography). It was assumed that 90 percent of past and future development (510 hectares) is shrub-steppe habitat.	Benton County 2006:B-14.
Yakima City, Washington (new subdivisions)	647.5	0	Not addressed.	80 west	Potential for 1,000 new homes to be built. The area is mixed agricultural and rural residential land. The site is to be annexed by the city.	Benson 2007.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other Projects/Activities in the Region of Influence *(continued)*						
Gravel mine, Yakima County, Washington	40.5	20.2	Not addressed.	68 west	The site is located east of the city. The project has been permitted; however, work has not yet begun. The current land use is unknown because the location of the site has not been specified. It was assumed that 50 percent of the area is shrub-steppe habitat.	Patterson 2007.
Residential/golf community, Walla Walla County, Washington	202.3	202.3	Not addressed.	90 southeast	The parcel totals 4,856 hectares, with 202 hectares remaining to be developed. The location of the site was not specified. It was conservatively assumed that all 202 hectares to be developed are shrub-steppe habitat.	Prentice 2007.
Boardman Speedway, Morrow County, Oregon	566.6	0	Not addressed.	80 south southeast	The parcel total is 850 hectares, with 567 hectares currently dedicated for use as a race track. The area is agricultural land (based on Google Earth aerial photography).	McClane 2007.
Boardman Resort, Morrow County, Oregon	647.5	0	Not addressed.	80 south southeast	The resort area is 911 hectares in size. A total of 648 hectares is developable. The site does not appear to be shrub-steppe habitat (based on Google Earth aerial photography).	McClane 2007.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other Projects/Activities in the Region of Influence *(continued)*						
Boardman Industrial Park, Morrow County, Oregon	161.9	0	Not addressed.	76 south	The area is agricultural land (based on Google Earth aerial photography).	McClane 2007.
Sunnyside Water Conservation Program, Washington	35.2	0	No impacts are expected on bald eagle or Ute ladies' tresses.	24 to 48 west and southwest	The area includes three reservoirs on agricultural and pasture land.	BOR 2004:17, 43, 46.
Big Horn Wind Project, Bickleton, Washington	41.2	21.8	No rare plants or federally threatened or endangered species are present.	80 southwest	The project would temporarily disturb 90.2 hectares and permanently disturb 34 hectares. The switching station and the road contain scrub oak and scattered ponderosa pine. The area includes some shrub-steppe habitat, but it is unknown how much would be affected. It was assumed that 50 percent of disturbed land would be shrub-steppe habitat. The wind turbines would be readily visible from houses and roads. Turbines would be painted a neutral color to minimize visual impacts.	BPA 2005:8-14.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Habitat Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other Projects/Activities in the Region of Influence *(continued)*						
Wild Horse Wind Project, Kittitas County, Washington	66.8	60.3	Potential impacts are expected on 10 percent of the individual hedgehog cactus plants.	90 northwest	The 3,480-hectare site is currently zoned as Forest and Range and Commercial Agriculture. 66.8 hectares would be permanently affected. Approximately 90 percent of impacts would occur in shrub-steppe habitat.	Energy Facility Site Evaluation Council 2005:1-6, 1-11, 1-48, 1-49.
Desert Claim Wind Project, Kittitas County, Washington	31.2	12.1	Potential impacts are expected on bald eagle, golden eagle, northern goshawk, sage thrasher, and loggerhead shrike.	97 northwest	12.1 hectares of shrub-steppe habitat would be permanently disturbed. The project would result in visual impacts ranging from low to high, which would represent a significant unavoidable change in the visual environment.	Kittitas County 2004:1-22, 1-36, 1-39, 1-68; Young, Erickson, and Poulton 2006:3, 12.
Black Rock Reservoir,[b] Yakima County, Washington	3,496.5	1,558.1	Habitat for shrub-steppe species is limited within the site area. Loggerhead shrike, sage thrasher, and sage sparrow are most likely to be present. Moderate impacts are expected on sage sparrow.	23 west southwest	The site is 2,590 hectares. The valley floor is composed of fallow fields, cultivated land, and sparse patches of sagebrush. The largest contiguous patch of sagebrush is 24.3 hectares.	Benton County Sustainable Development 2002:1, 8, 12; BOR and Ecology 2008:2-117.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Other Projects/Activities in the Region of Influence *(continued)*						
Transportation Project, Roadway from Interstate 82 to Finley, Washington	32.4	25.1	Not addressed.	53 southeast	The roadway is 17.7 kilometers long and 11 meters wide. Assuming 3.7 meters are needed on each side of the road, the total width is 18.3 meters. The road passes through open land, which appears to be primarily shrub-steppe habitat with some agricultural land (based on Google Earth aerial photography). It was assumed that 13.7 kilometers are shrub-steppe habitat.	WSDOT 2007.
Finley Columbia Ethanol Plant, Benton County, Washington	22.3	0	No impact.	62 southeast	16.2 to 22.3 hectares of agricultural land would be disturbed. Plant is adjacent to industrial facility. Area is zoned industrial. Aesthetic impacts would be negligible	Columbia Ethanol Plant Holdings 2006:22, 23, 27, 29.
Operation of the Perma-Fix Northwest (formerly Pacific EcoSolutions) Waste Treatment Facility in Richland, Washington	18.2	0	No impact.	3.2 southeast	The project would impact 18.2 hectares of disturbed grassland. No sensitive habitats would be affected.	DOE 1998:8, 20, 21, 50.

Table T–1. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Land and Ecological Resources *(continued)*

Project/Action	Total Land Area/ Terrestrial Habitat Affected[a] (hectares)	Area of Shrub-Steppe Affected (hectares)	Threatened and Endangered Species	Distance from 200 Areas (kilometers)	Notes	Source
Total for Other Projects/Activities in the Region of Influence	**8,162.1**	**3,186.9**	Not applicable	Not applicable	Not applicable	Not applicable
Grand Totals						
Combination 1	**9,260/9,260**	**3,839**	**Not applicable**	**Not applicable**	**Not applicable**	**Not applicable**
Combination 2	**9,564/9,465**	**3,905**	**Not applicable**	**Not applicable**	**Not applicable**	**Not applicable**
Combination 3	**10,050/10,006**	**4,185**	**Not applicable**	**Not applicable**	**Not applicable**	**Not applicable**

a For all non–*TC & WM EIS* projects and activities, it was assumed that the total land area affected and the area of undeveloped land affected would be the same; thus, only one value was provided. It is assumed that undeveloped land equates with terrestrial habitat. For those projects and activities where the land cover was not reported, the entire project area was conservatively assumed to be terrestrial habitat. Terrestrial habitat could include shrub-steppe habitat, other native and non-native habitat, grazing land, and cropland.

b All listed projects and activities are within the region of influence for land use and ecological resources. Those within the region of influence for visual resources are indicated with the superscript "b."

c B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*.

Note: To convert hectares to acres, multiply by 2.471; kilometers to miles, by 0.6214; meters to feet, by 3.281.

Key: DOE=U.S. Department of Energy; *TC & WM EIS =Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*.

Table T–2. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Cultural Resources

Action	Total Area Disturbed (hectares)	Cultural Resources and Visual Impacts	Source
***TC & WM EIS* Activities**			
Alternative Combination 1	2	On site. Specific elements of the *TC & WM EIS* Alternative Combination 1 are addressed in Chapter 4, Section 4.4.7.	Chapter 4, Section 4.4.7.
Alternative Combination 2	307	On site. Specific elements of the *TC & WM EIS* Alternative Combination 2 are addressed in Chapter 4, Section 4.4.7.	Chapter 4, Section 4.4.7.
Alternative Combination 3	793	On site. Specific elements of the *TC & WM EIS* Alternative Combination 3 are addressed in Chapter 4, Section 4.4.7.	Chapter 4, Section 4.4.7.
Other DOE Activities at the Hanford Site			
Central Plateau closure	112.1	On site. Although specific mining plans and precise areas and schedules for material excavation have not been identified, Borrow Area C and/or gravel pit No. 30 are the designated source areas for all geologic materials. Changes to the viewshed would occur. Future uses of the Central Plateau would likely include structures and activities consistent with Industrial-Exclusive use.	Fluor Hanford 2004.
Decommissioning of the eight surplus production reactors and their support facilities in the 100 Areas along the Columbia River[a]	6.1	On site. The location is in a highly developed area. There would be a possible impact on archaeological or cultural properties that could be found within the 100 Areas and/or the 100-B Reactor.	DOE 1989:4.39; 1992.
Decommissioning of the N Reactor and its support facilities	0	On site. 105-N and 109-N Buildings. Impacts are not expected because the project is in a highly developed area.	DOE 2005.

Table T–2. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Cultural Resources *(continued)*

Action	Total Area Disturbed (hectares)	Cultural Resources and Visual Impacts	Source
Other DOE Activities at the Hanford Site *(continued)*			
Actions to empty the K Basins in the 100-K Area and implement dry storage of the fuel rods in the Canister Storage Building in the 200-East Area	3.6	On site. No known archaeological or historic sites were located during intensive inventories of the reference site. There would be no impact on visual resources. The new facility was built within a disturbed area.	DOE 1995:5.11.
Excavation and use of geologic materials from existing borrow pits[b]	31.2	On site. The area can be seen from the viewshed of American Indian areas of interest. It is expected that excavation activities would be primarily in a previously disturbed area. No cultural resources are known to exist within the currently active borrow areas. Specific cultural resource reviews would be conducted before any expansion activities.	DOE 2001a:5-2, 5-3.
Reactivation and use of three former borrow sites in the 100-F, 100-H, and 100-N Areas	38.9	On site. No cultural resources, historic properties, or American Indian areas of interest are located in the project location area. There would be no visual impacts within the viewshed of American Indian areas of interest, and the sites would be revegetated where possible during and after site usage.	DOE 2003a:5.1.6, 5.1.7, 5.2.
Construction and operation of the Environmental Restoration Disposal Facility near the 200-West Area	414.4	On site. The facility is within the viewshed of American Indian areas of interest. The rail line that traverses the area could adversely affect a portion of the historic White Bluffs Road. No archaeological or historic sites are considered eligible for the National Register of Historic Places. The area would be revegetated where possible during and after facility operation.	DOE 1994:ES-22–27, 12; 2001b.

Table T–2. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Cultural Resources *(continued)*

Action	Total Area Disturbed (hectares)	Cultural Resources and Visual Impacts	Source
Other DOE Activities at the Hanford Site *(continued)*			
Transport and disposal of Navy reactor compartments from the Columbia River	4	On site. The area to be used is classified as disturbed. There would be no impact on cultural resources or visual impact on American Indian areas of interest.	Navy 1996.
Construction and operation of a Pacific Northwest National Laboratory Physical Sciences Facility	40.1	On site. The fenced area in the eastern portion will protect a site of cultural significance to regional tribes. Two prehistoric sites are located in the eastern buffer area near the Columbia River and are monitored to confirm they remain undisturbed.	DOE 2007:26, 37.
Non-DOE Activities at the Hanford Site			
Management of the Hanford Reach National Monument and Saddle Mountain National Wildlife Refuge	404.7	On site. Many of the areas to be affected have been previously disturbed. Goal 5 of the *Hanford Reach National Monument Comprehensive Conservation Plan and Environmental Impact Statement* is to "Protect and acknowledge the Native American, settler, atomic and Cold War histories of the Monument to ensure present and future generations recognize the significance of the area's past, incorporating a balance of views."	USFWS 2008.
Operation of the US Ecology commercial LLW disposal site near the 200-East Area	40.5	On site. There is a high probability that the proposed actions will not impact any historic buildings, archaeological sites, or specific American Indian areas of interest.	Ecology and WSDOH 2004:134.
Other Activities in the Region of Influence			
Red Mountain American Viticulture Area, Benton County, Washington	566.6	The area is within the viewshed of nearby higher elevations, which are of interest to the American Indians. The developed area could increase from 10 to 20 vineyards in the next 5 years.	Benton County 2006.

Table T–2. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Cultural Resources *(continued)*

Action	Total Area Disturbed (hectares)	Cultural Resources and Visual Impacts	Source
Other Activities in the Region of Influence *(continued)*			
Black Rock Reservoir, Yakima County, Washington	3,496.5	The area is within the viewshed of nearby higher elevations, which are of interest to the American Indians. The proposed location area has a high potential for both historic and prehistoric resources.	BOR and Ecology 2008:4-255.

[a] B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*.

[b] As a result of tribal and public comments on the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 1999b), DOE designated the McGee Ranch as Preservation as a "tradeoff" for keeping Borrow Area C available as the primary source of geologic materials for site remediation. There are discussions of this decision in the following sections of the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*: the Summary, the main text, Appendices D and E, and the Comment Response Document.

Note: To convert hectares to acres, multiply by 2.471.

Key: DOE=U.S. Department of Energy; *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*.

Table T–3. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Socioeconomics

Project/Action	Peak Annual Employment (FTEs)	Peak Daily Traffic		Notes	Source
		Commuter[a]	Offsite Truck		
Existing Site Activities					
Baseline	9,760	7,810	Not Applicable	Construction FTEs were not separated from operations FTEs. No data on truck traffic.	Chapter 3, Section 3.2.9.
***TC & WM EIS* Activities**					
Alternative Combination 1[b]	1,840	1,470	4		Chapter 4, Section 4.4.8, provides information on *TC & WM EIS* Alternative Combination 1.
Alternative Combination 2[b]	8,190	6,550	79		Chapter 4, Section 4.4.8, provides information on *TC & WM EIS* Alternative Combination 2.
Alternative Combination 3[b]	12,500	10,000	102		Chapter 4, Section 4.4.8, provides information on *TC & WM EIS* Alternative Combination 3.
Other DOE Activities at the Hanford Site					
Changes in land use at the Hanford Site	1,100	880	Not Applicable	This ongoing activity includes industrial development, research and development initiatives, limited mining, and increased recreational use at the Hanford Site during the next 50 years.	DOE 1999b:5-48.
Actions to empty the K Basins in the 100-K Area and implement dry storage of the fuel rods in the Canister Storage Building in the 200-East Area	140	326	Not Applicable	This is an ongoing activity. Future milestones could require additional FTEs. Employment would be reduced (negative) after spent nuclear fuel is placed in long-term storage. Most truck trips would be on site.	DOE 1995:3.24, 5.1, 5.10, 5.47; 2008a.

Table T–3. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Socioeconomics *(continued)*

Project/Action	Peak Annual Employment (FTEs)	Peak Daily Traffic: Commuter[a]	Peak Daily Traffic: Offsite Truck	Notes	Source
Other DOE Activities at the Hanford Site *(continued)*					
Final disposition of the canyons, PUREX Plant, PUREX tunnels, and other facilities in the 200 Areas and cleanup to Industrial-Exclusive land use standards	172	138	64	The activity was assumed to have four times the values of the U Plant regional closure. It could possibly use the same workers or could potentially be done consecutively.	Fluor Hanford 2004:ES-7.
Deactivation of the Fast Flux Test Facility in the 400 Area	20	16	Not Applicable	This ongoing activity could require additional FTEs. Most truck trips would be on site.	DOE 2006a:2-8, 4-2, 4-3, 4-4, 4-8, 4-9.
Construction and operation of a Pacific Northwest National Laboratory Physical Sciences Facility	450	450	3	This activity involves construction impacts only. Annual workers were merely relocated, therefore they were already included in the baseline. The commuter numbers are supplied in the source document.	DOE 2007:39–41.
Non-DOE Activities at the Hanford Site					
Operation of the US Ecology commercial LLW disposal site near the 200-East Area	Included in baseline	Included in baseline	4	The facility is currently operating. Workers were already included in the ROI. Offsite truck trips represent potential future construction.	Ecology and WSDOH 2004:25, 35, 94, 141.
Management of the Hanford Reach National Monument and Saddle Mountain National Wildlife Refuge	41	76	Not Applicable	The commuter traffic represents the peak weekend number of national monument visitors.	USFWS 2008:4-202, 4-217.

Table T–3. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Socioeconomics *(continued)*

Project/Action	Peak Annual Employment (FTEs)	Peak Daily Traffic		Notes	Source
		Commuter[a]	Offsite Truck		
Other Projects/Activities in the Region of Influence					
Operation of the Perma-Fix Northwest (formerly Pacific EcoSolutions) Waste Treatment Facility in Richland, Washington	150	129	4	This includes DOE waste generators and other organizations' waste generators.	Richland 1998:14, 24, 25, 39, 40. DOE 1999c:1 of 9, 29 of 33, 32 of 33.
Construction and operation of biofuels facilities	162	96	35		Columbia Ethanol Plant Holdings 2006:13, 21, 43.
Additional Activities Subtotal	**2,235**[c]	**2,111**[c]	**110**[c]		
Grand Totals					
Alternative Combination 1	**4,080**[c]	**3,580**[c]	**115**[c]	Additional activities subtotal added to Alternative Combination 1.	
Alternative Combination 2	**10,400**[c]	**8,660**[c]	**189**[c]	Additional activities subtotal added to Alternative Combination 2.	
Alternative Combination 3	**14,700**[c]	**12,100**[c]	**212**[c]	Additional activities subtotal added to Alternative Combination 3.	

[a] Unless otherwise noted, commuter traffic figures were calculated based on employee numbers.

[b] For each combination, the peaks for each component could potentially occur during different timespans. In order to determine the potential impact from each combination of alternatives, the peak amount for each component was totaled together. The resulting conservative total estimates represent the upper limit of workforce requirements.

[c] Total may not equal the sum of the contributions due to rounding.

Key: DOE=U.S. Department of Energy; FTE=full-time equivalent; LLW=low-level radioactive waste; PUREX=Plutonium-Uranium Extraction; ROI=region of influence; *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington.*

Table T–4. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Transportation

Activity	Worker		General Population		Traffic Fatalities
	Collective Dose (person-rem)	LCFs	Collective Dose (person-rem)	LCFs	
Historical Shipments to the Hanford Site (1943–1993)					
SNF shipments[a]	52	0.03	27	0.02	N/L
Radioactive waste[a]	240	0.14	290	0.17	N/L
Subtotal	**292**	**0.18**	**317**	**0.19**	**N/L**
General Radioactive Material Transport (includes DOE and non-DOE actions)					
1943–1982[a, b]	220,000	132	170,000	102	N/L
1983–2073[a, c]	154,000	92	168,000	101	116
Subtotal	**374,000**	**224**	**338,000**	**203**	**116**
Reasonably Foreseeable Actions					
Surplus Plutonium Disposition EIS[a]	60	0.04	67	0.04	0.05
Naval Reactor Disposal EIS (Navy 1996)	5.8	0.00	5.80	0.0	0.01
Basin Fuel Storage EIS (DOE 1995)	0.06	0.00	N/A	N/A	0.00
Treatment of MLLW EA (DOE 1998)	18	0.01	1.34	0.0	1.25
Treatment of MLLW EA FONSI (DOE 1999c)	0.48	0.0	0.19	0.0	N/L
WM PEIS[a, d]	15,550	9.3	18,430	11.1	36
WIPP SEIS-II[a]	790	0.47	5,900	3.54	5
Idaho HLW and Facilities Disposition EIS[a]	520	0.31	2,900	1.74	1.0
SNL Site-Wide EIS[a]	94	0.06	590	0.35	1.30
Tritium Production in Commercial Light Water Reactor EIS[a]	16	0.01	80	0.05	0.06
LANL Site-Wide EIS (DOE 2008b)	910	0.55	287	0.17	2.96
Plutonium Residue at Rocky Flats EIS[a]	2.10	0.00	1.30	0.00	0.01
Surplus disposition of HEU[a]	400	0.24	520	0.31	1.10
Molybdenum-99 Production EIS[a]	240	0.14	520	0.31	0.10
Import of Russian Plutonium-2 EA[a]	1.80	0.00	4.40	0.00	0.00
Pantex Site-Wide EIS[a]	250	0.15	490	0.29	0.01
NTS Site-Wide EIS[a]	0.0	0.00	155[e]	0.09	8
Storage and disposition of fissile material[a]	0.0	0.00	2,400[e]	1.44	5.5
Stockpile stewardship[a]	0.0	0.0	38[e]	0.02	0.06
Container system for Naval SNF[a]	11	0.010	15	0.01	0.05
DUF Conversion at Paducah EIS (DOE 2004a)	770	0.46	31	0.02	0.42
S G and D1G Prototype Reactor Plant Disposal EIS[a]	2.9	0.00	2.2	0.00	0.01
S1G Prototype Reactor Plant Disposal EIS[a]	6.7	0.00	1.9	0.00	0.00
DUF Conversion at Portsmouth EIS (DOE 2004b)	520	0.31	29	0.02	0.45
ETTP DUF Transport to Portsmouth EIS (DOE 2004b)	99	0.06	3.20	0.00	0.33
Spent Nuclear Fuel PEIS[a]	360	0.22	810	0.49	0.77
FRR SNF EIS (DOE 1996)	90	0.05	222	0.13	0.07
Private Fuel Storage Facility Final EIS (NRC, BIA, BLM, and STB 2001)	30	0.02	190	0.11	1
West Valley Demonstration Project Waste Management EIS (DOE 2003b)	520	0.31	410	0.25	0.15

Table T–4. Past, Present, and Reasonably Foreseeable Future Actions Potentially Affecting Transportation *(continued)*

Activity	Worker Collective Dose (person-rem)	Worker LCFs	General Population Collective Dose (person-rem)	General Population LCFs	Traffic Fatalities
Reasonably Foreseeable Actions *(continued)*					
MOX Fuel Fabrication at SRS EIS (NRC 2005a)	530	0.32	560	0.34	0.20
Enrichment Facility in Lea County EIS (NRC 2005b)[f]	1,500	0.90	5,000	3.00	18
Complex Transformation Programmatic EIS (DOE 2008d)	5,500	3	190	0.10	0.02
EA for the Decontamination, Demolition, and Removal of Certain Facilities at the West Valley Demonstration Project (DOE 2006b)	14	0.00	11	0.00	0.01
West Valley Decommissioning and/or Long-Term Stewardship Draft EIS (DOE and NYSERDA 2008)	403	0.24	71	0.043	4
Subtotal	**29,214**	**18**	**39,936**	**24**	**88**
Total Transportation Impacts Not Related to This *TC & WM EIS*					
Total Impacts (Through 2073)	**403,500[g]**	**242**	**378,300[g]**	**227**	**204**

[a] Values are from the *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (Yucca Mountain SEIS)* (DOE 2008c).

[b] These estimates are very conservative because not that many shipments were made in the 1950s and 1960s. Also, the nonexclusive shipment dose estimates are based on a very conservative method.

[c] The annual dose estimates are similar to those generated for the period 1975–1983. The methodology used to estimate traffic fatalities is detailed in Chapter 6, Section 6.3.11.2.

[d] The values are for the low-level and mixed low-level radioactive waste transportation impacts based on the amended Record of Decision, 65 FR 10061, February 25, 2000.

[e] Includes worker and general population doses.

[f] Maximum values from truck transportation were used. For consistency with other data in this table, occupational traffic fatalities were not considered.

[g] The values are rounded to the nearest hundred.

Key: DOE=U.S. Department of Energy; DUF_6=depleted uranium hexafluoride; EA=environmental assessment; EIS=environmental impact statement; ETTP=East Tennessee Technology Park; *FRR SNF EIS Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel*; HEU=highly enriched uranium; HLW=high-level radioactive waste; *Basin Fuel Storage EIS Draft Environmental Impact Statement, Management of Spent Nuclear Fuel from the Basins at the Hanford Site, Richland, Washington* LANL *Site-Wide EIS Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico*; LCF=latent cancer fatality; MLLW=mixed low-level radioactive waste; *MOX Fuel Fabrication at SRS EIS Environmental Impact Statement on the Construction and Operation of a Proposed Mixed Oxide Fuel Fabrication Facility at the Savannah River Site, South Carolina*; N/A=not applicable; *Naval Reactor Disposal EIS Final Environmental Impact Statement on the Disposal of Decommissioned, Defueled Cruiser, OHIO Class, and LOS ANGELES Class Naval Reactor Plants*; N/L=not listed; *NTS Site-Wide EIS Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* PEIS=programmatic EIS; *Plutonium Residue at Rocky Flats EIS Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site Private Fuel Storage Facility Final EIS Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah* SEIS=supplemental EIS; SNF=spent nuclear fuel; SNL=Sandia National Laboratories; *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*; *Treatment of MLLW EA Environmental Assessment, Non-thermal Treatment of Hanford Site Low-Level Mixed Waste Treatment of MLLW EA FONSI Environmental Assessment, Offsite Thermal Treatment of Low-Level Mixed Waste, Finding of No Significant Impact Yucca Mountain SEIS Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* WIPP *SEIS-II=Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement WM PEIS Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Ha ardous Waste.*

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APPENDIX U
SUPPORTING INFORMATION FOR THE LONG-TERM CUMULATIVE IMPACT ANALYSES

This appendix contains detailed information supporting the long-term cumulative impact analyses presented in Chapter 6. Long-term cumulative impacts would occur following the active project phase under each alternative. For this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, long-term cumulative impacts were assessed out to approximately 10,000 years in the future.

Cumulative Impacts

Effects on the environment that result from the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7).

This section presents detailed information regarding long-term cumulative impacts on groundwater quality and human health. The methodology used to estimate cumulative impacts for this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)* was divided into four phases: (1) selection of resource areas and appropriate regions of influence (ROIs), (2) selection of reasonably foreseeable future actions, (3) estimation of cumulative impacts, and (4) identification of monitoring and mitigation requirements. The general cumulative impacts methodology is described in Appendix R. A flowchart showing the four phases of cumulative impacts analysis is presented in Appendix R, Figure R–2. The information presented in this appendix reflects portions of Phases 2 and 3 and contains detailed information to support the long-term cumulative impacts analysis presented in Chapter 6.

The cumulative impact analyses of these resource areas were based largely on the results of the modeling performed for the cumulative groundwater quality analysis. Inventory development for the past, present, and reasonably foreseeable future action (non–*TC & WM EIS*) sources is described in Appendix S. Appendix S also describes the non–*TC & WM EIS* actions in the ROIs that were considered in the cumulative impact analyses of groundwater quality and human health.

U.1 GROUNDWATER QUALITY

This section discusses the methodology and results for the long-term groundwater impacts of non–*TC & WM EIS* actions. The methodology is described in Section U.1.1, and the results are discussed in Sections U.1.2 through U.1.4. The presentation of the results follows the format developed for the *TC & WM EIS* alternatives (see Appendix O and Chapter 5). This section does not present cumulative groundwater quality impacts (i.e., non–*TC & WM EIS* impacts added to the impacts of the *TC & WM EIS* alternative combinations). Cumulative groundwater quality impacts are presented in Chapter 6.

U.1.1 Methodology

The purpose of the long-term groundwater impacts analysis for non–*TC & WM EIS* sources is to provide a context for the comparison of the *TC & WM EIS* alternatives. Therefore, the methodology was designed to be fully consistent with the long-term groundwater alternatives analysis and the *Technical Guidance Document for Tank Closure Environmental Impact Statement, Vadose one and Groundwater Revised Analyses* (DOE 2005). This design consistency includes the models chosen to conduct the analysis, the parameter selection that affects the analysis, and the presentation and interpretation of the results.

The development of the inventory for the non–*TC & WM EIS* sources is described in Appendix S. The constituents of potential concern (COPCs) considered in this analysis include all the COPCs in the *TC & WM EIS* alternatives analysis, as well as several COPCs that originate from only non–*TC & WM EIS* sources. The inventory development relied on a search of available literature that provided estimates of the inventories for each source, estimates of uncertainties in the inventories, and a characterization of each source type and likely end state.

The approach to analyzing releases to the vadose zone for the non–*TC & WM EIS* sources was the same as that described in Appendix M for the *TC & WM EIS* alternatives. This analysis used site-specific parameters to estimate release rates from each of the sources to the vadose zone. The waste-form performance parameters, release models, and infiltration profiles in the release to vadose zone analysis are fully consistent with their counterparts in the *TC & WM EIS* alternatives analysis. The output from the analysis of the releases to the vadose zone was input into the vadose zone transport analysis.

The vadose zone transport analysis methodology for the non–*TC & WM EIS* sources was the same as that described in Appendix N for the *TC & WM EIS* alternatives. The vadose zone transport analysis used the STOMP [Subsurface Transport Over Multiple Phases] model to solve the nonlinear equations describing water and contaminant mass transport through the vadose zone. A fully three-dimensional model of the subsurface geology for each of the non–*TC & WM EIS* sources was developed using the same techniques that were used in the *TC & WM EIS* alternatives analysis. The material properties, infiltration profiles, and transport properties used in the vadose zone analysis are fully consistent with the *TC & WM EIS* alternatives analysis. The output from the vadose zone transport analysis was input into the groundwater transport analysis.

The methodology used for groundwater transport impacts analysis for non–*TC & WM EIS* sources was the same as that described in Appendices L and O for the *TC & WM EIS* alternatives. Appendix L discusses the development of the Base Case groundwater flow field, which describes the direction and rate of water movement in the aquifer. This Base Case flow field was used for both the *TC & WM EIS* alternatives analysis and the non–*TC & WM EIS* sources analysis. Appendix O discusses the use of the particle-tracking method to calculate a fully three-dimensional, regional-scale transient analysis of contaminant distribution in the aquifer. The flow field, transport properties, and concentration measurement parameters in the groundwater transport analysis are fully consistent with the *TC & WM EIS* alternatives analysis. The outputs from the groundwater transport analysis were analyzed in terms of overall mass balance, concentration versus time at selected locations, and concentration distributions at selected times, which is the same process used for the alternatives impact analysis. The level of protection provided for the drinking water pathway is evaluated by comparison against the maximum contaminant levels of the "National Primary Drinking Water Regulations" (40 CFR 141) and other benchmarks presented in Appendix O.

U.1.2 Release and Mass Balance

This section presents the results of the impacts analysis for non–*TC & WM EIS* sources in terms of total amount of COPCs released to the vadose zone, groundwater, and Columbia River. Releases of radionuclides are totaled in curies, and releases of chemicals are totaled in kilograms. Both are totaled over the 10,000-year period of analysis. Table U–1 lists the releases to the vadose zone, groundwater, and Columbia River for the COPCs that contribute the bulk of the risk.

Table U–1. Release to the Vadose Zone, Groundwater, and the Columbia River of the COPC Drivers from Non–*TC & WM EIS* Sources

Release to:	Radionuclide (curies)				Chemical (kilograms)		
	H-3	I-129	Tc-99	U-238	Cr	NO_3	Utot
Vadose zone	3.43×10^{6}	2.49×10^{1}	7.33×10^{2}	3.13×10^{3}	3.35×10^{5}	7.38×10^{7}	2.53×10^{5}
Groundwater	2.06×10^{6}	2.48×10^{1}	7.12×10^{2}	1.48×10^{2}	3.40×10^{5}	7.42×10^{7}	1.05×10^{5}
Columbia River	1.11×10^{5}	2.46×10^{1}	7.26×10^{2}	1.40×10^{2}	3.51×10^{5}	7.47×10^{7}	9.28×10^{4}

Note: Total amount released over the 10,000-year period of analysis.

Key: COPC = constituent of potential concern; Cr=chromium; H-3=hydrogen-3 (tritium); I=iodine; NO_3=nitrate; Tc=technetium; *TC & WM EIS = Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*; U=uranium; Utot=total uranium.

U.1.3 Concentration Versus Time

This section presents the results of the impacts analysis for non–*TC & WM EIS* sources in terms of groundwater COPC concentrations versus time at the Core Zone Boundary and Columbia River. Table U–2 lists the maximum COPC concentrations at the Core Zone Boundary and the Columbia River nearshore for the peak year of the 10,000-year period of analysis. Figures U–1 through U–9 include concentration versus time plots for hydrogen-3 (tritium), iodine-129, strontium-90, technetium-99, uranium-238, carbon tetrachloride, chromium, nitrate, and total uranium, respectively. Because of the discrete nature of the concentrations carried across a barrier or the river, a line denoting the 95th percentile upper confidence limit of the concentrations is included on several of these figures. This confidence interval was calculated to aid in interpreting data with a significant amount of random fluctuation (noise). The confidence interval was calculated when (1) the concentration had a considerable amount of noise, (2) the concentration trend was level, and (3) the concentration was near the benchmark. The benchmark concentration for each radionuclide and chemical is also shown. Note that the concentrations are plotted on a logarithmic scale to facilitate visual comparison of concentrations that vary over five orders of magnitude.

Table U–2. Maximum Peak Year Concentrations of the COPCs from Non–*TC & WM EIS* Sources at the Core Zone Boundary and the Columbia River Nearshore

Contaminant	Core Zone Boundary (peak year)	Columbia River Nearshore (peak year)	Benchmark Concentration[a]
Radionuclide (picocuries per liter)			
Hydrogen-3 (tritium)	104,000,000 (1996)	4,190,000 (1986)	20,000
Carbon-14	46,700 (1998)	196 (2013)	2,000
Strontium-90	181,000 (1998)	4,160,000 (1991)	8
Technetium-99	1,230 (3301)	2,830 (1999)	900
Iodine-129	50.9 (4043)	9.1 (4540)	1
Cesium-137	0[b] (1997)	1,310,000 (1985)	200
Uranium isotopes (includes U-233, -234, -235, -238)	2,200 (1991)	22,400 (1973)	15
Neptunium-237	114 (2066)	16 (2004)	15
Plutonium isotopes (includes Pu-239, -240)	2,660 (11,848)	4,250 (2983)	15

Table U–2. Maximum Peak Year Concentrations of the COPCs from Non–*TC & WM EIS* Sources at the Core Zone Boundary and the Columbia River Nearshore *(continued)*

Contaminant	Core Zone Boundary (peak year)	Columbia River Nearshore (peak year)	Benchmark Concentration[a]
Chemical (micrograms per liter)			
1-Butanol	17,200 (1998)	49 (11,243)	3,600
Carbon tetrachloride	3,350 (2270)	60.7 (2527)	5
Chromium[c]	2,540 (2216)	16,100 (1978)	100
Dichloromethane	0.7 (3286)	0.1 (4711)	5
Fluoride	90,200 (2003)	14,500 (1982)	4,000
Hydrazine/hydrazine sulfate	0.030 (3343)	0.088 (3627)	0.022
Lead	0[b] (2021)	9,080 (2374)	15
Manganese	392 (8610)	242 (2286)	1,600
Mercury	183 (2015)	25.5 (1997)	2
Nickel (soluble salts)	0[b] (11,871)	8,310 (3877)	700
Nitrate	1,020,000 (2269)	502,000 (1973)	45,000
Total uranium	3,290 (1991)	15,400 (1964)	30
Trichloroethylene (TCE)	0.1 (3404)	0.2 (3764)	5

[a] The sources of the benchmark concentrations are provided in Appendix O, Section O.3.
[b] Values that are less than 0.001 are reported as zero.
[c] It was assumed, for the purposes of analysis, that all chromium was hexavalent.

Note: Peak concentrations for some non–*TC & WM EIS* source constituents occur in the past. The relationship of past to future non–*TC & WM EIS* source constituent concentrations is presented in the concentration versus time plots in Figures U–1 through U–9.

Key: COPC=constituent of potential concern; *TC & WM EIS*=*Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington.*

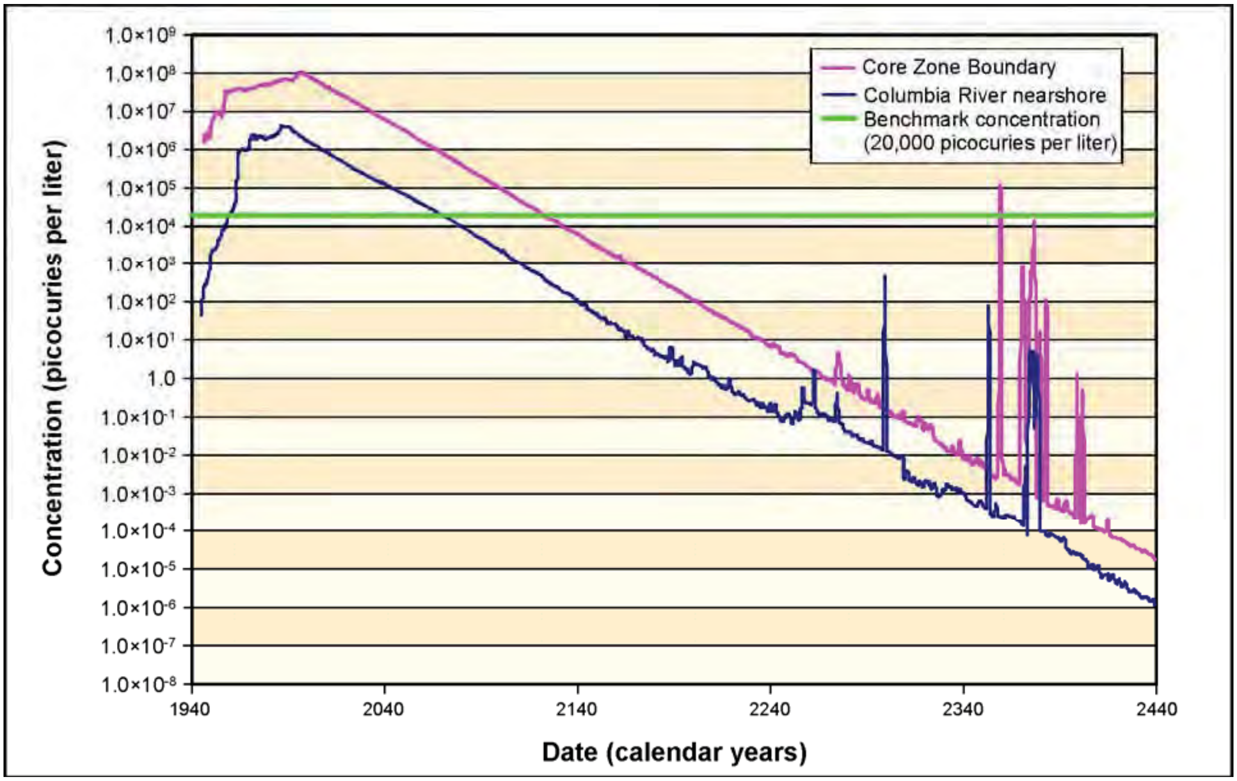


Figure U–1. Hydrogen-3 (Tritium) Concentration Versus Time (Non–*TC & WM EIS* Sources)

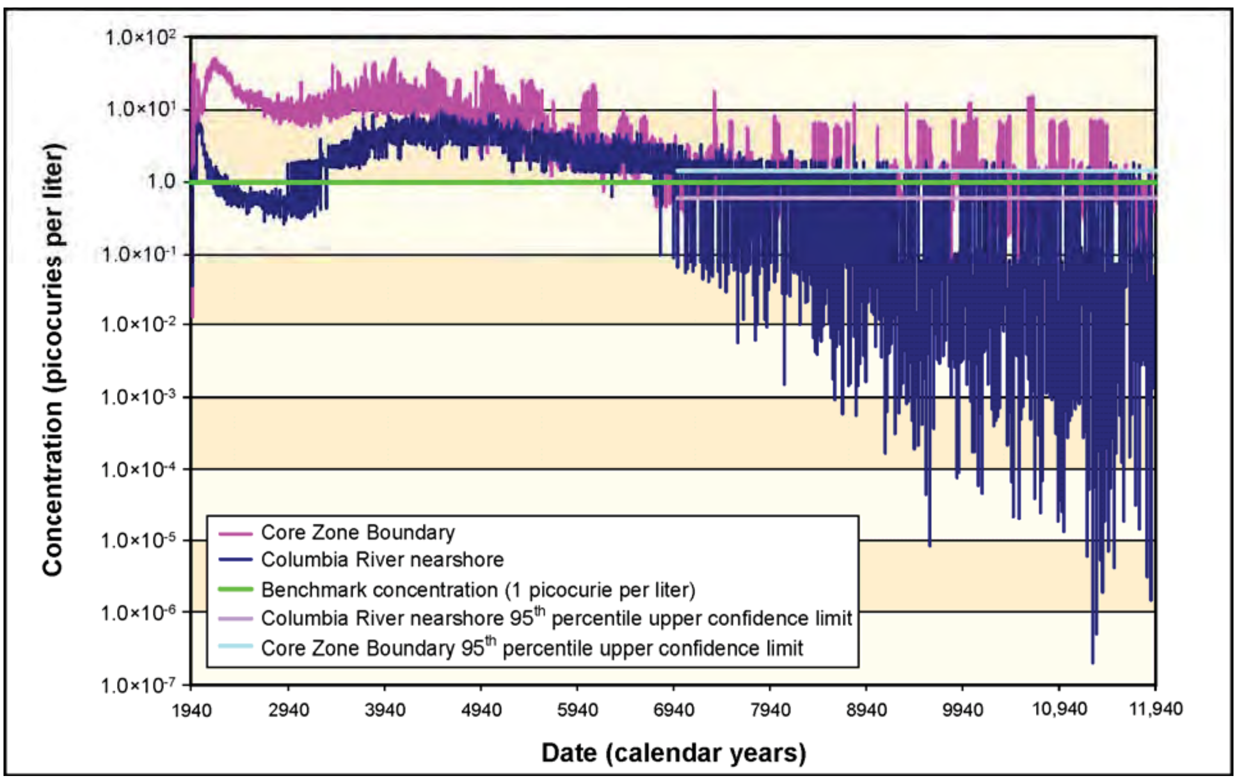


Figure U–2. Iodine-129 Concentration Versus Time (Non–*TC & WM EIS* Sources)

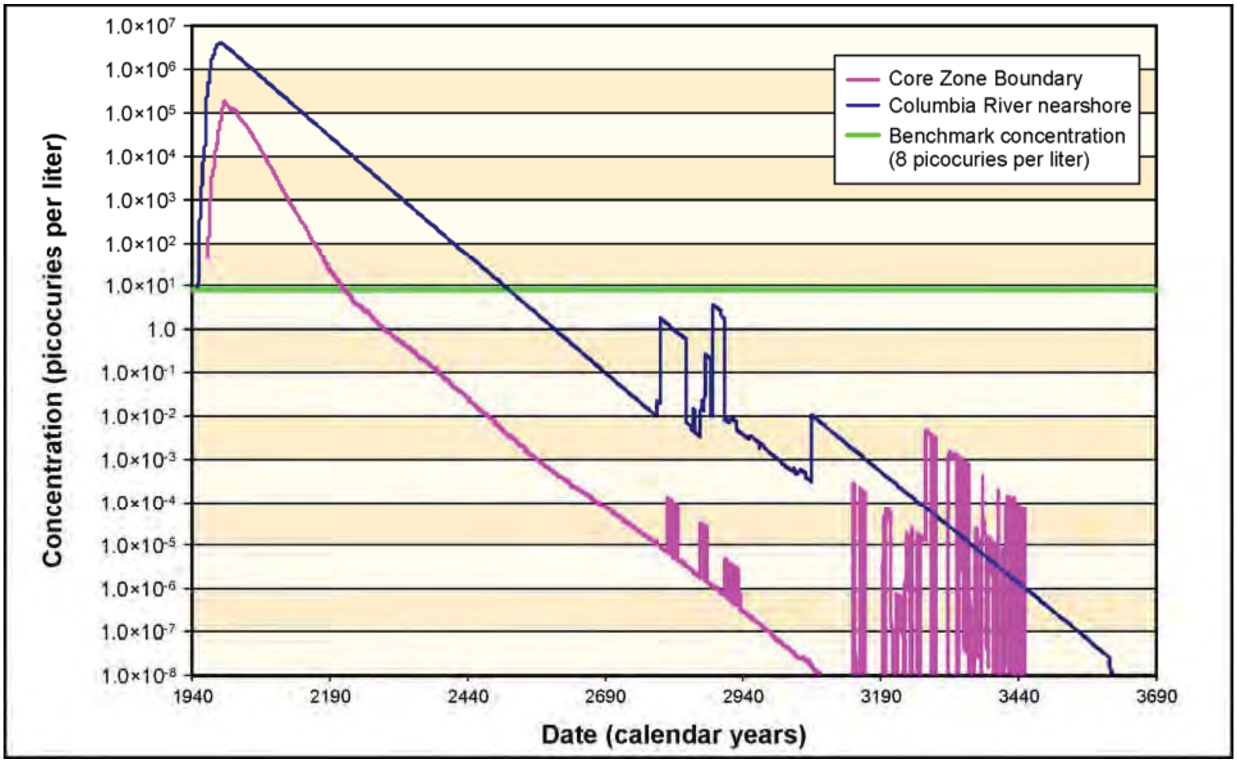


Figure U–3. Strontium-90 Concentration Versus Time (Non–*TC & WM EIS* Sources)

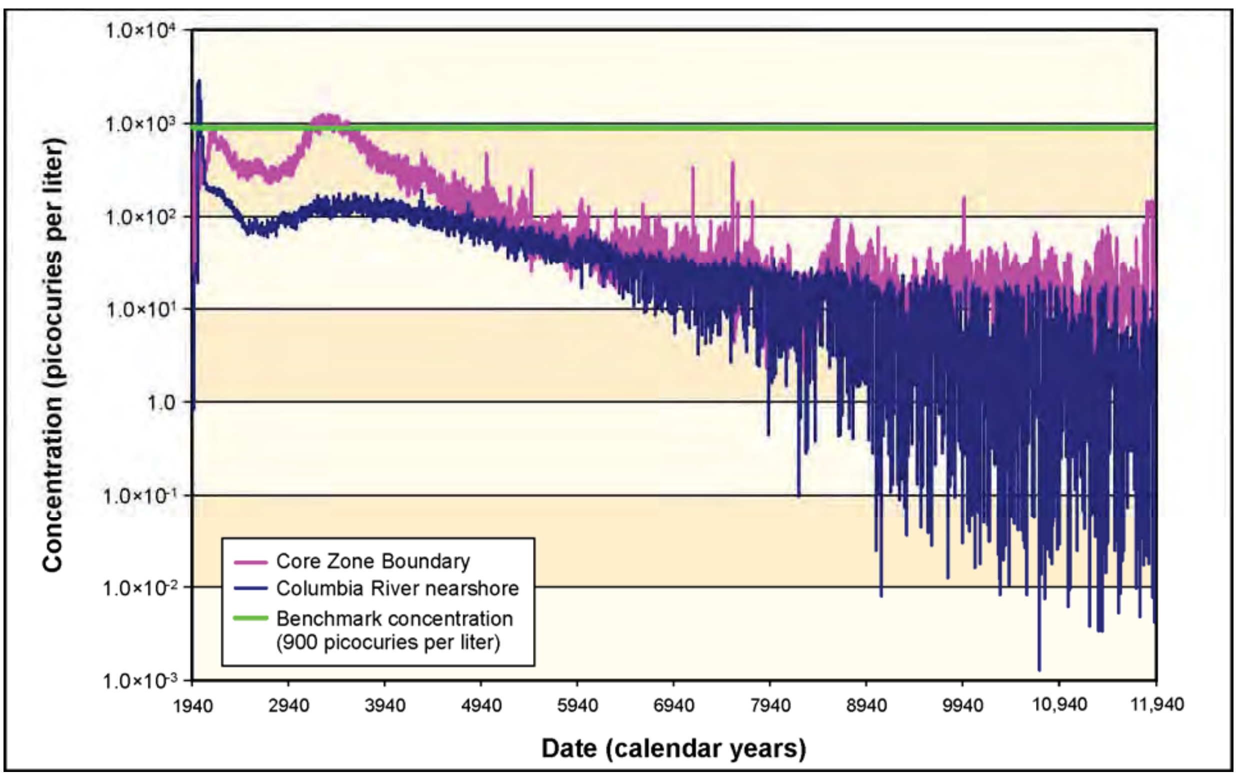


Figure U–4. Technetium-99 Concentration Versus Time (Non–*TC & WM EIS* Sources)

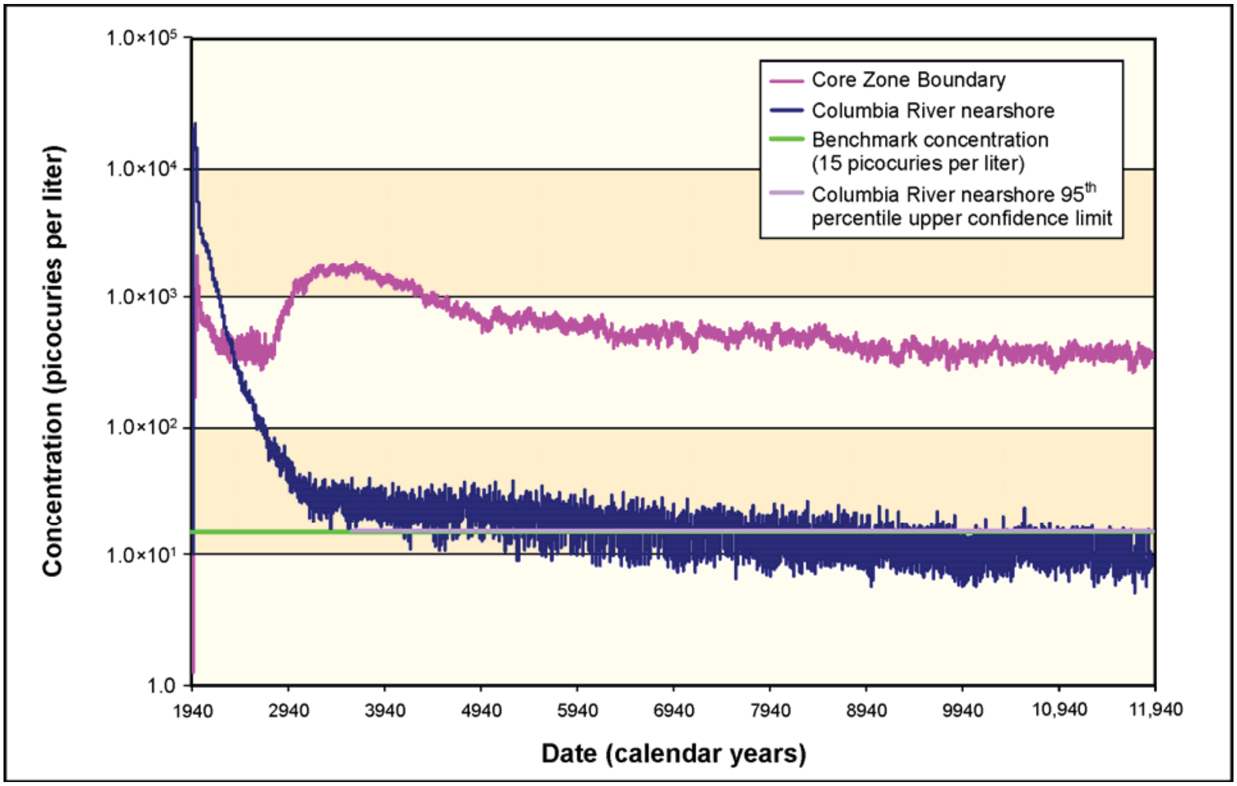


Figure U–5. Uranium-238 Concentration Versus Time (Non–*TC & WM EIS* Sources)

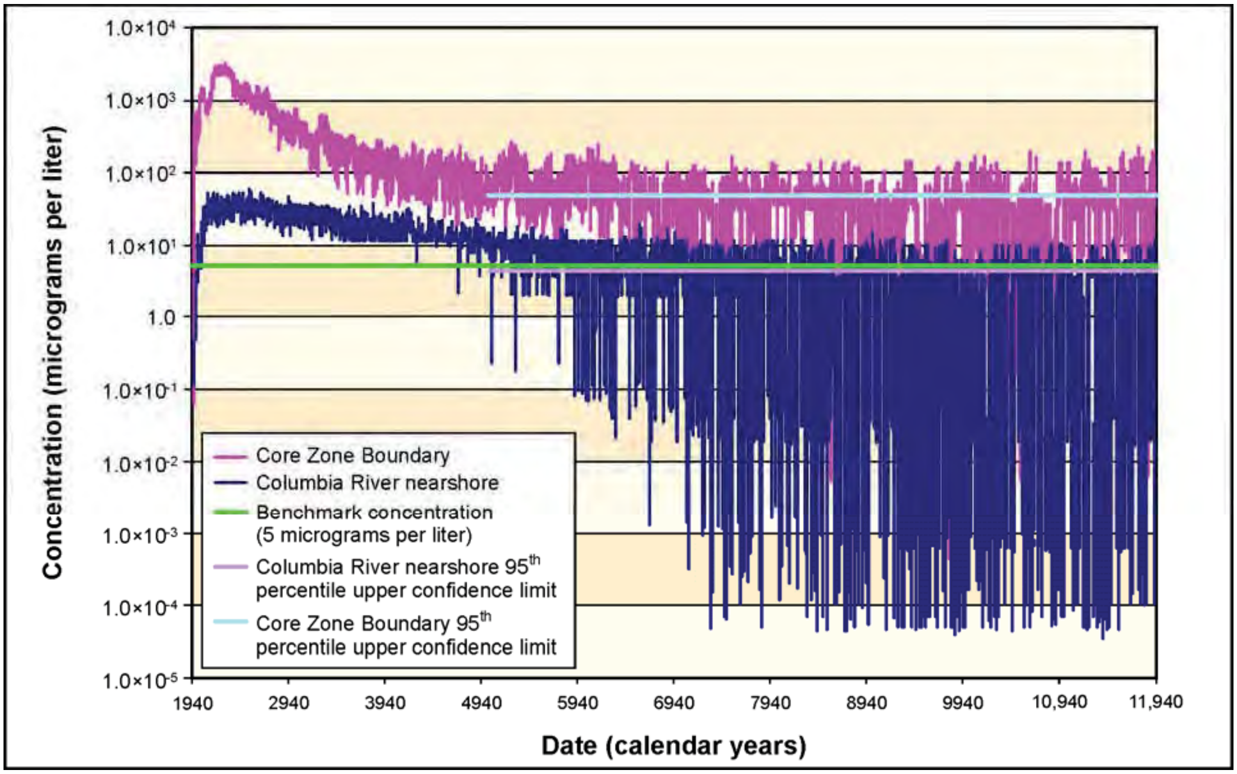


Figure U–6. Carbon Tetrachloride Concentration Versus Time (Non–*TC & WM EIS* Sources)

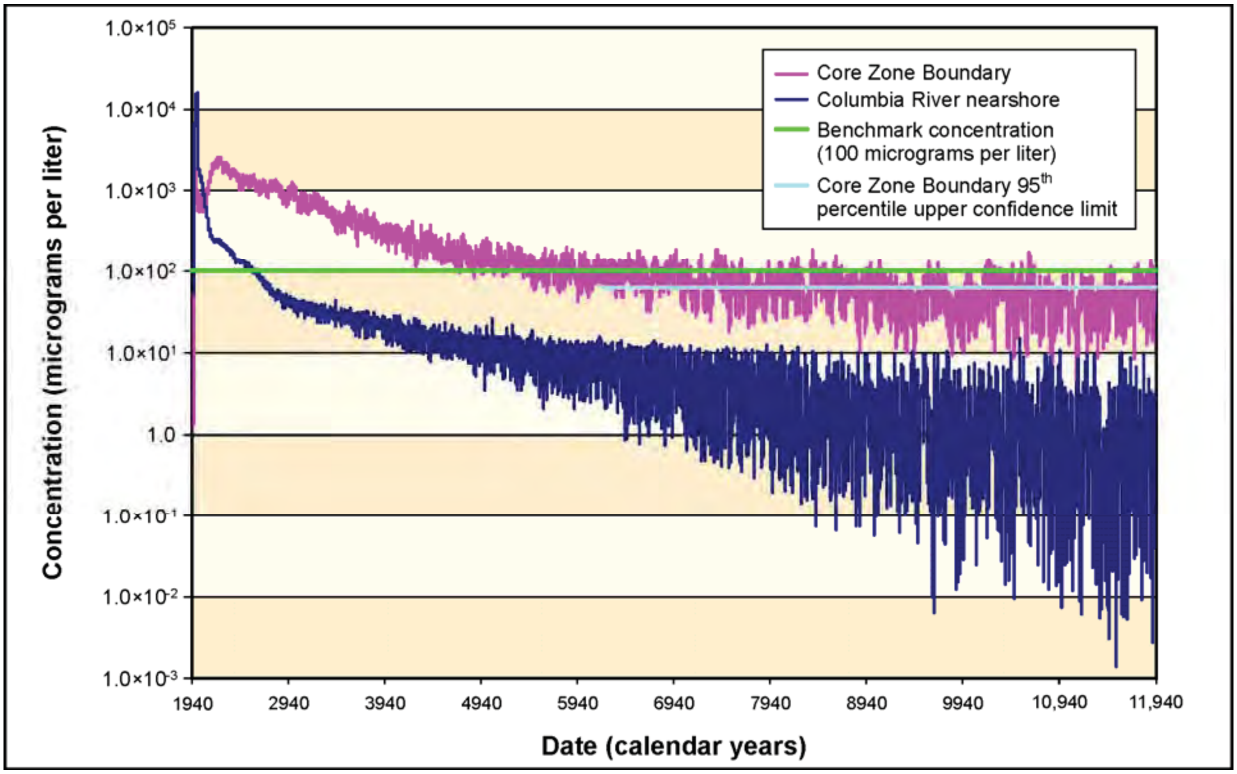


Figure U–7. Chromium Concentration Versus Time (Non–*TC & WM EIS* Sources)

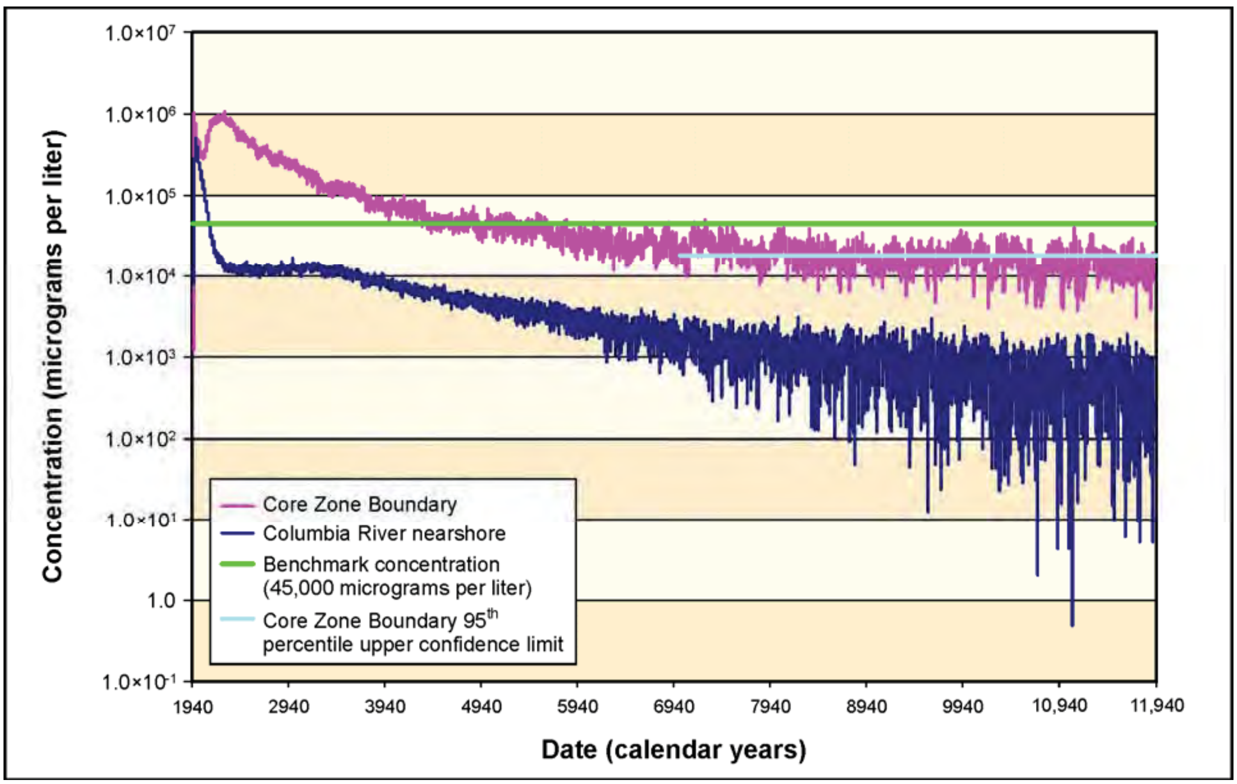


Figure U–8. Nitrate Concentration Versus Time (Non–*TC & WM EIS* Sources)

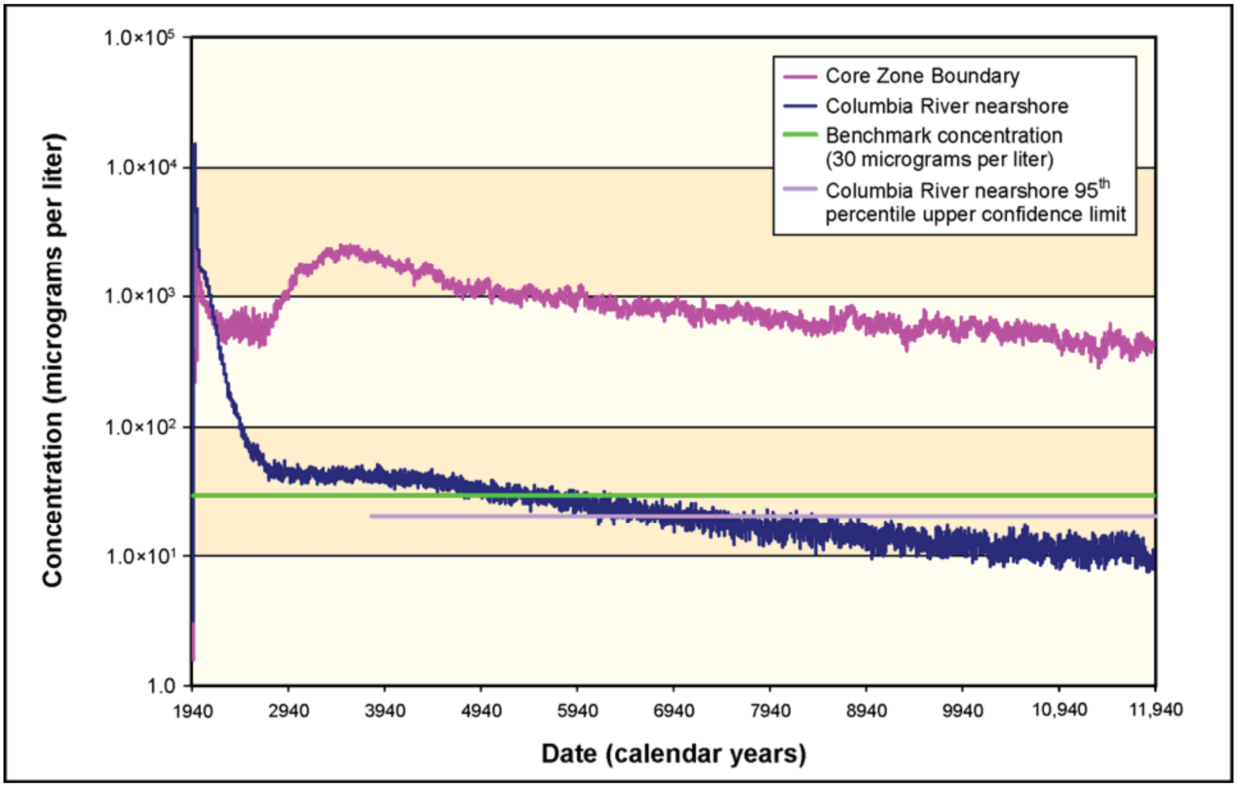


Figure U–9. Total Uranium Concentration Versus Time (Non–*TC & WM EIS* Sources)

U.1.4 Spatial Distribution of Concentration

This section presents the results of the impacts analysis for non–*TC & WM EIS* sources in terms of the spatial distribution of COPC concentrations in the groundwater at selected times. Concentrations for each radionuclide and chemical are indicated by a color scale indicating the benchmark concentration. Concentrations greater than the benchmark concentration are indicated by the fully saturated colors green, yellow, orange, and red in order of increasing concentration. Concentrations less than the benchmark concentration are indicated by the faded colors green, blue, indigo, and violet in order of decreasing concentration. Note that the concentration ranges are on a logarithmic scale to facilitate visual comparison of concentrations that vary over three orders of magnitude. Figures U–10 through U–48 include maps of the projected concentrations of contaminants in the groundwater for the following:

- Tritium in 2005 and 2135 (see Figures U–10 and U–11)
- Iodine-129 in 2005, 2135, 3890, 7140, and 11,885 (see Figures U–12 through U–16)
- Strontium-90 in 2005 and 2135 (see Figures U–17 and U–18)
- Technetium-99 in 2005, 2135, 3890, 7140, and 11,885 (see Figures U–19 through U–23)
- Uranium-238 in 2005, 2135, 3890, 7140, and 11,885 (see Figures U–24 through U–28)
- Carbon tetrachloride in 2005, 2135, 3890, 7140, and 11,885 (see Figures U–29 through U–33)
- Chromium in 2005, 2135, 3890, 7140, and 11,885 (see Figures U–34 through U–38)
- Nitrate in 2005, 2135, 3890, 7140, and 11,885 (see Figures U–39 through U–43)
- Total uranium in 2005, 2135, 3890, 7140, and 11,885 (see Figures U–44 through U–48)

In general, the simulations of groundwater transport in this *TC & WM EIS* replicate the values measured in the field to a close order of magnitude, particularly for discharges to cribs and trenches (ditches), where the historic measurements are most complete and show the strongest signature of past-practice operations. As shown in Appendices N and O, the agreement is good for both *TC & WM EIS* alternative sources and non–*TC & WM EIS* sources. There are two contaminant plumes for which the simulated plumes are in greater disagreement with observation. Both are non–*TC & WM EIS* sources: the carbon tetrachloride plume in the 200-West Area (see Figure U–29), and the uranium-238 plume (see Figure U–24) and total uranium plume (see Figure U–44) in the 200-East Area.

Carbon tetrachloride, when discharged in sufficient quantity, behaves as a dense, non-aqueous-phase liquid (DNAPL) rather than a dissolved solute. Simulation results for DNAPL flow and transport in the vadose zone exhibit sensitivities of more than several orders of magnitude to uncertainties in input parameters, which suggests that DNAPL contaminant behavior is not well understood or constrained. For the purposes of the *TC & WM EIS* long-term groundwater cumulative impacts analysis, these vadose zone uncertainties were recognized to result in variations in predicted groundwater impacts that are qualitatively greater than those for other COPCs in the analysis. Therefore, the *TC & WM EIS* analysis of the carbon tetrachloride plume started with a more-constrained initial condition, the 65,000 kilograms (143,000 pounds) of carbon tetrachloride estimated in the vadose zone in 2005 (Hartman and Webber 2008). This total inventory was assumed to be present in the unconfined aquifer starting in 2005, and the concentrations were modeled forward from this initial condition. In addition, because of the uncertainties in the design and implementation of the groundwater remediation system for Operable Unit 200-ZP-1, no credit was taken in the *TC &WM EIS* modeling for removal or containment of carbon tetrachloride. In light of these approximations, the predicted concentrations of carbon tetrachloride should be considered qualitatively more uncertain than other contaminants in the cumulative impacts analysis.

Uranium-238 and total uranium simulation results show higher impacts resulting from large discharge facilities in the 200-East Area (e.g., B Pond) than actually observed. The disagreement of these plumes with field measurements suggests that two possible areas of uncertainty may dominate the simulation of these impacts. The first is the uncertainty in the inventory of uranium-238 and total uranium in the large discharge ponds (see Appendix S), which is approximately 50 percent. The second, and probably more-important source of uncertainty, is the interaction of uranium-238 and total uranium with subsurface materials beneath these facilities. The *TC & WM EIS* analysis is based on a distribution coefficient for uranium of about 0.6 milliliters per gram (DOE 2005). This value, although appropriate for far-field conditions in the unconfined aquifer, is probably not representative of the conditions beneath the large discharge sources (e.g., B Ponds). Therefore, the prediction of the uranium-238 and total uranium contaminant plumes for large non–*TC & WM EIS* sources should be considered an overestimate of the actual impacts by about an order of magnitude.

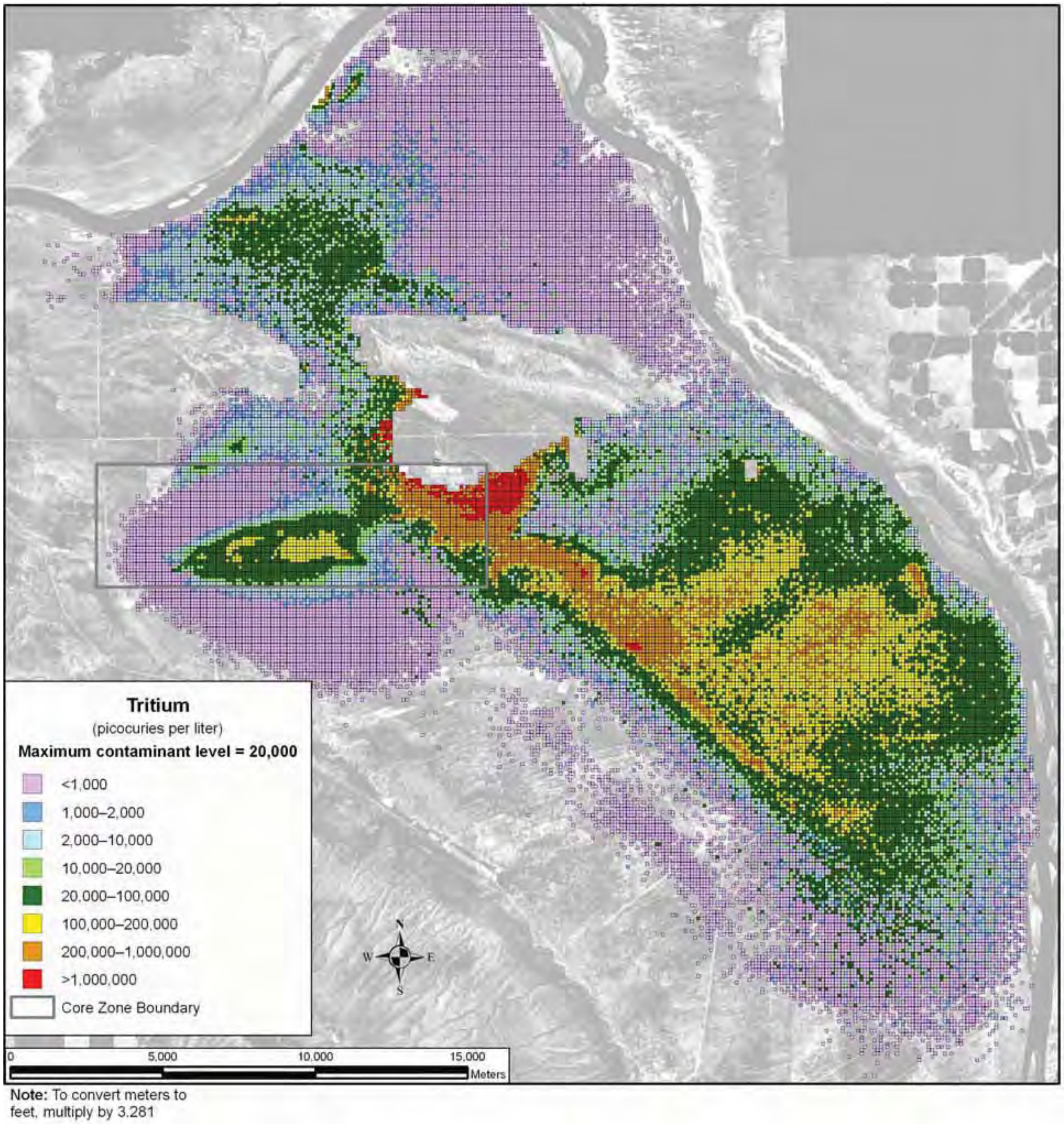


Figure U–10. Spatial Distribution of Groundwater Hydrogen-3 (Tritium) Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005

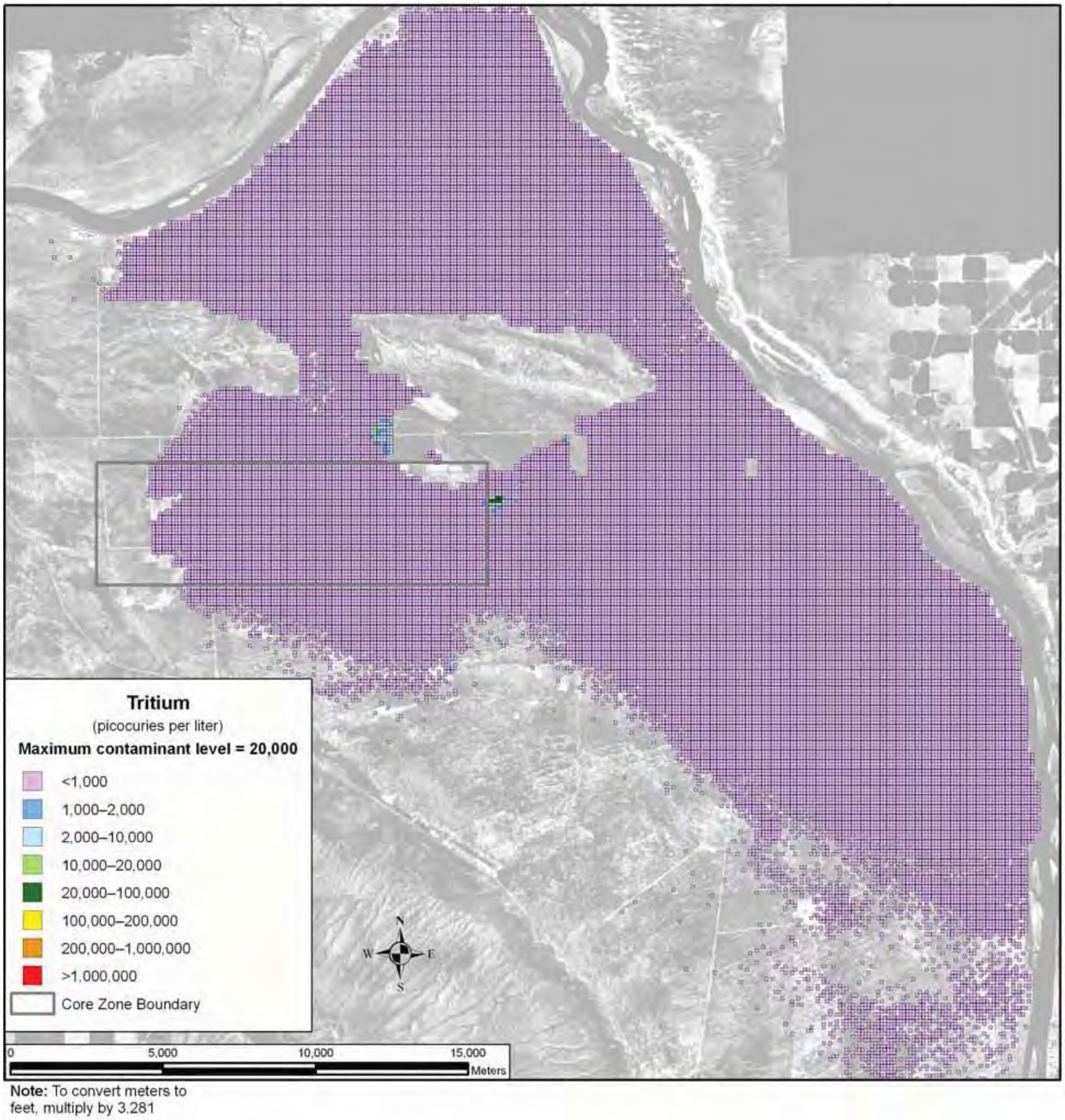


Figure U–11. Spatial Distribution of Groundwater Hydrogen-3 (Tritium) Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135

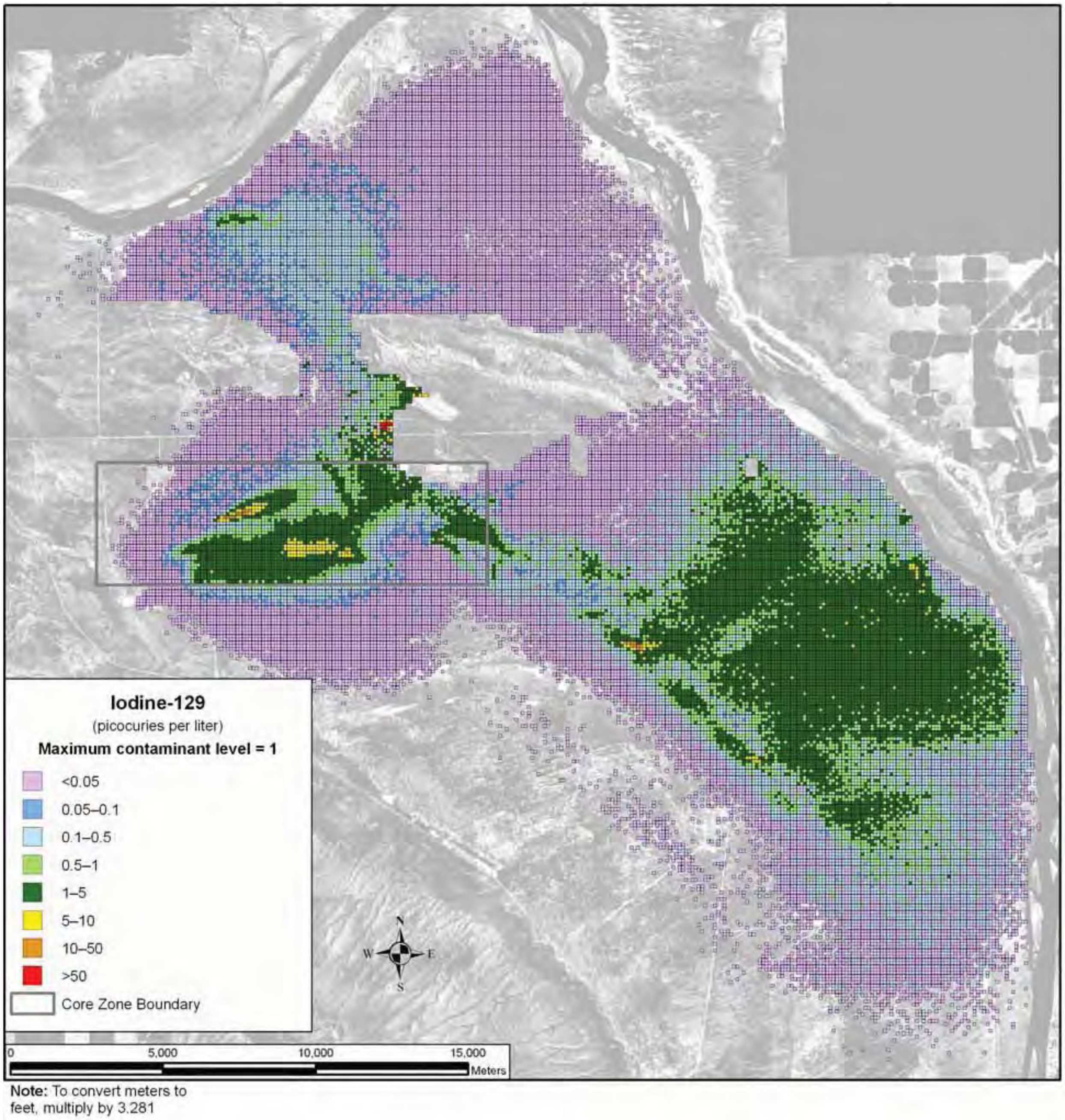
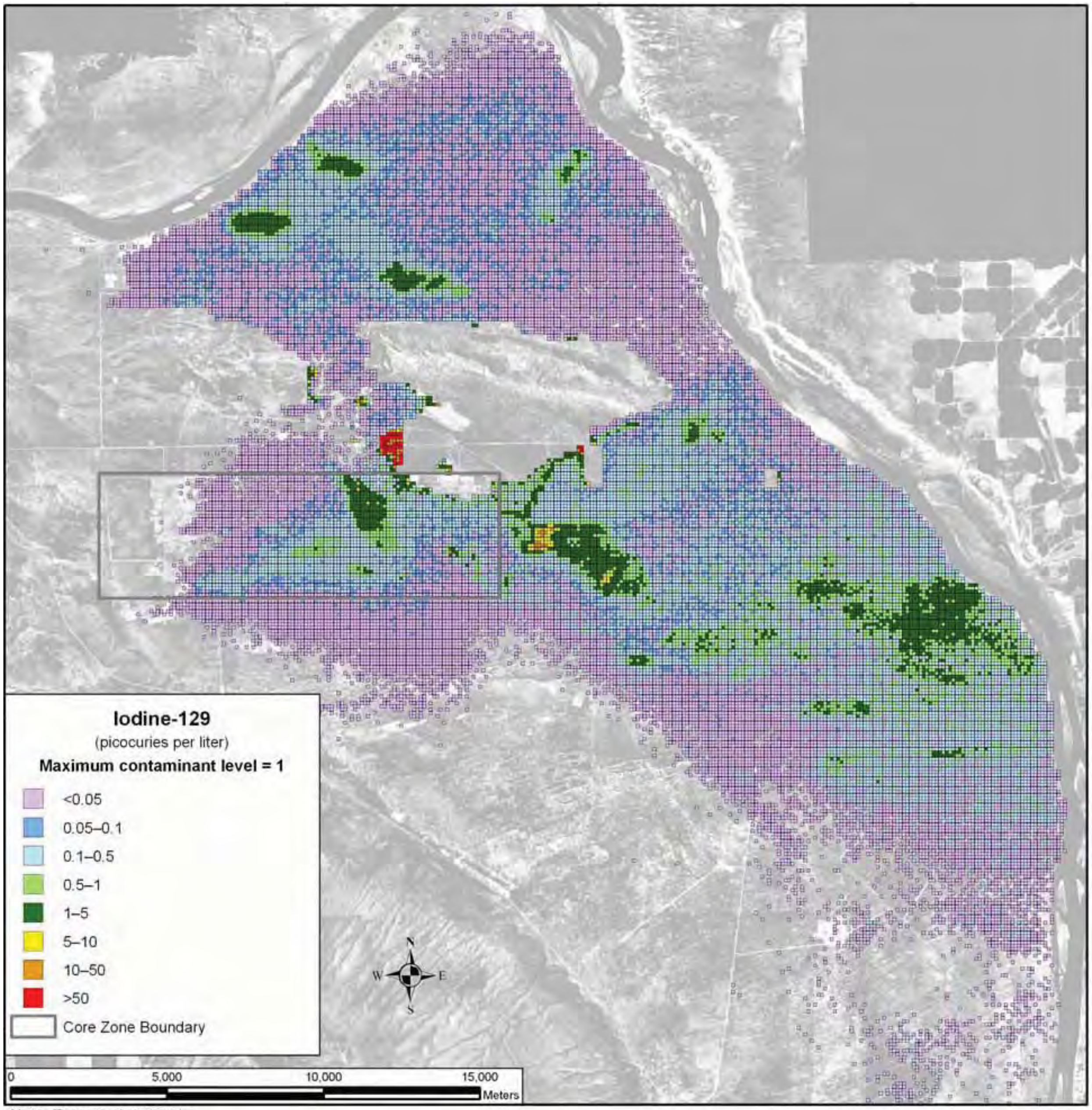


Figure U–12. Spatial Distribution of Groundwater Iodine-129 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005



Note: To convert meters to feet, multiply by 3.281

Figure U–13. Spatial Distribution of Groundwater Iodine-129 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135

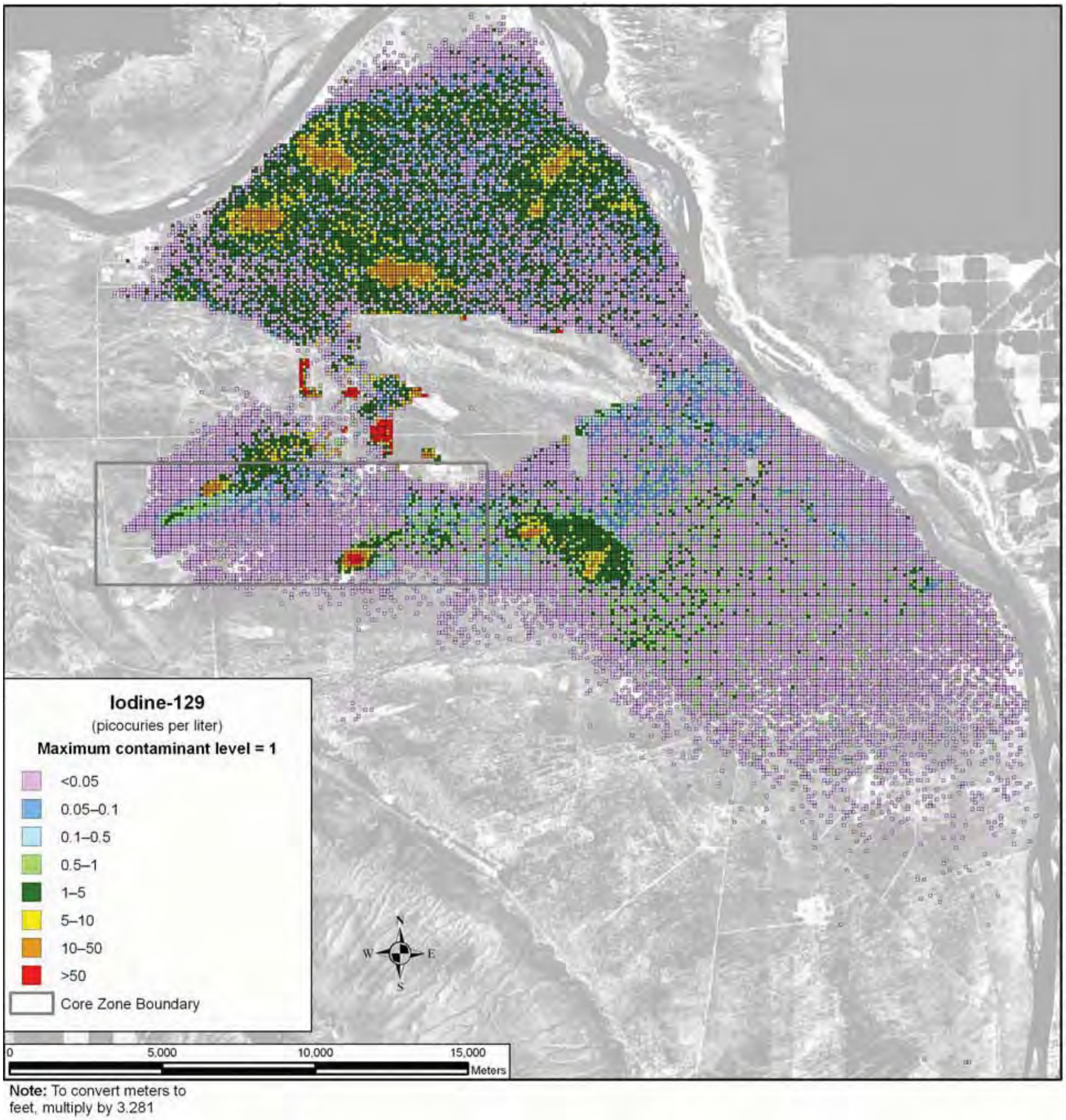


Figure U–14. Spatial Distribution of Groundwater Iodine-129 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 3890

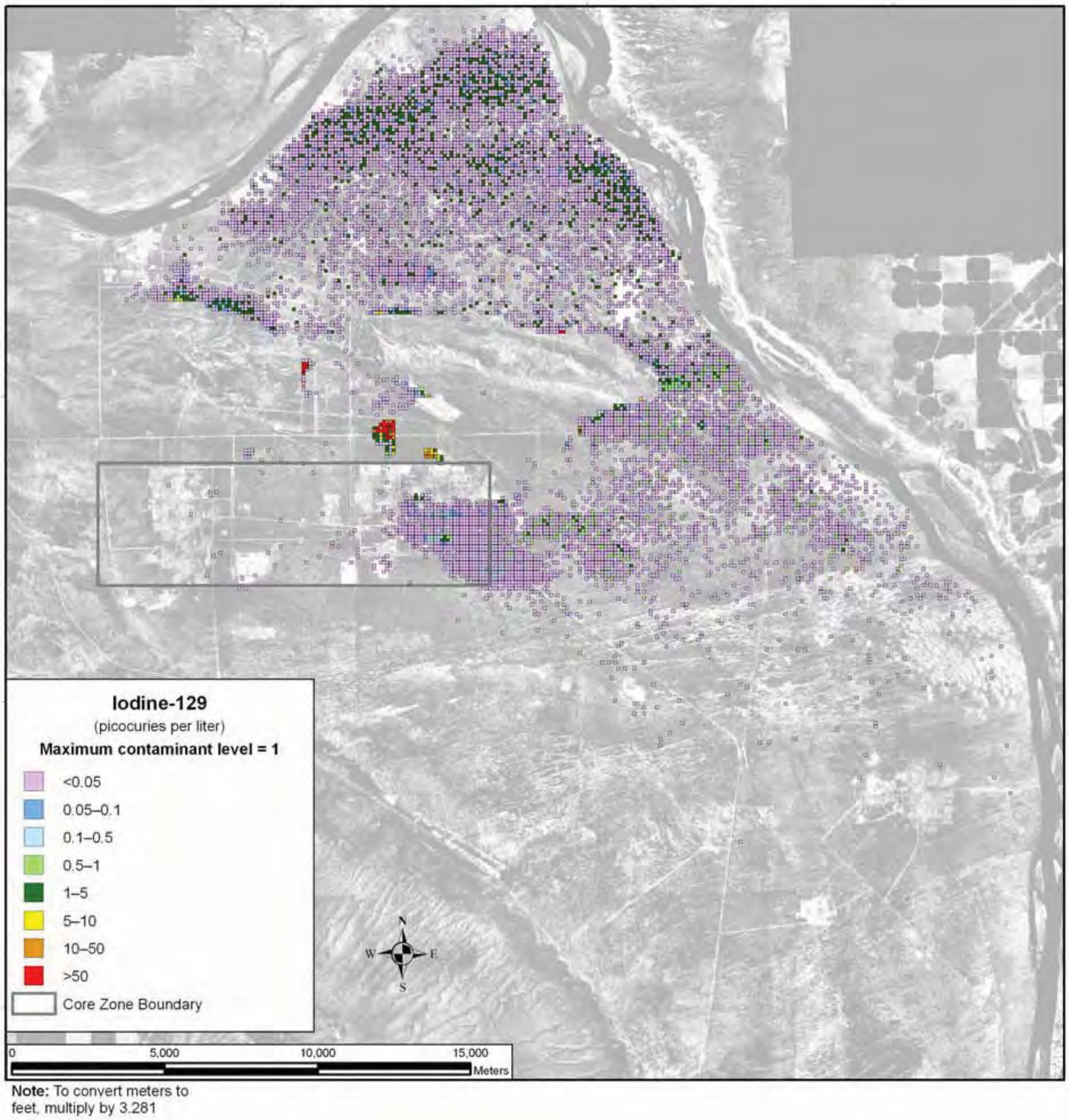


Figure U–15. Spatial Distribution of Groundwater Iodine-129 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 7140

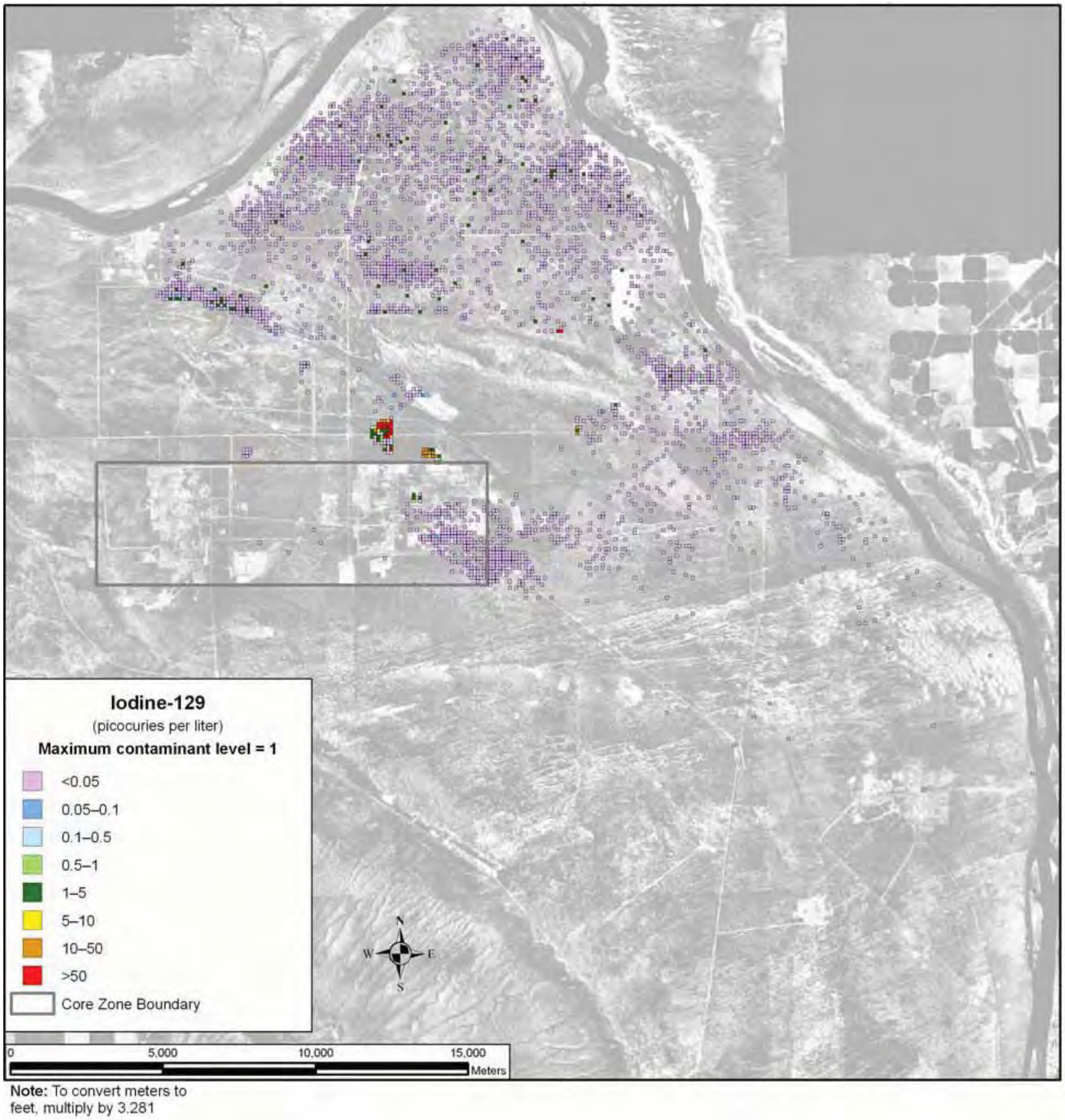


Figure U–16. Spatial Distribution of Groundwater Iodine-129 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 11,885

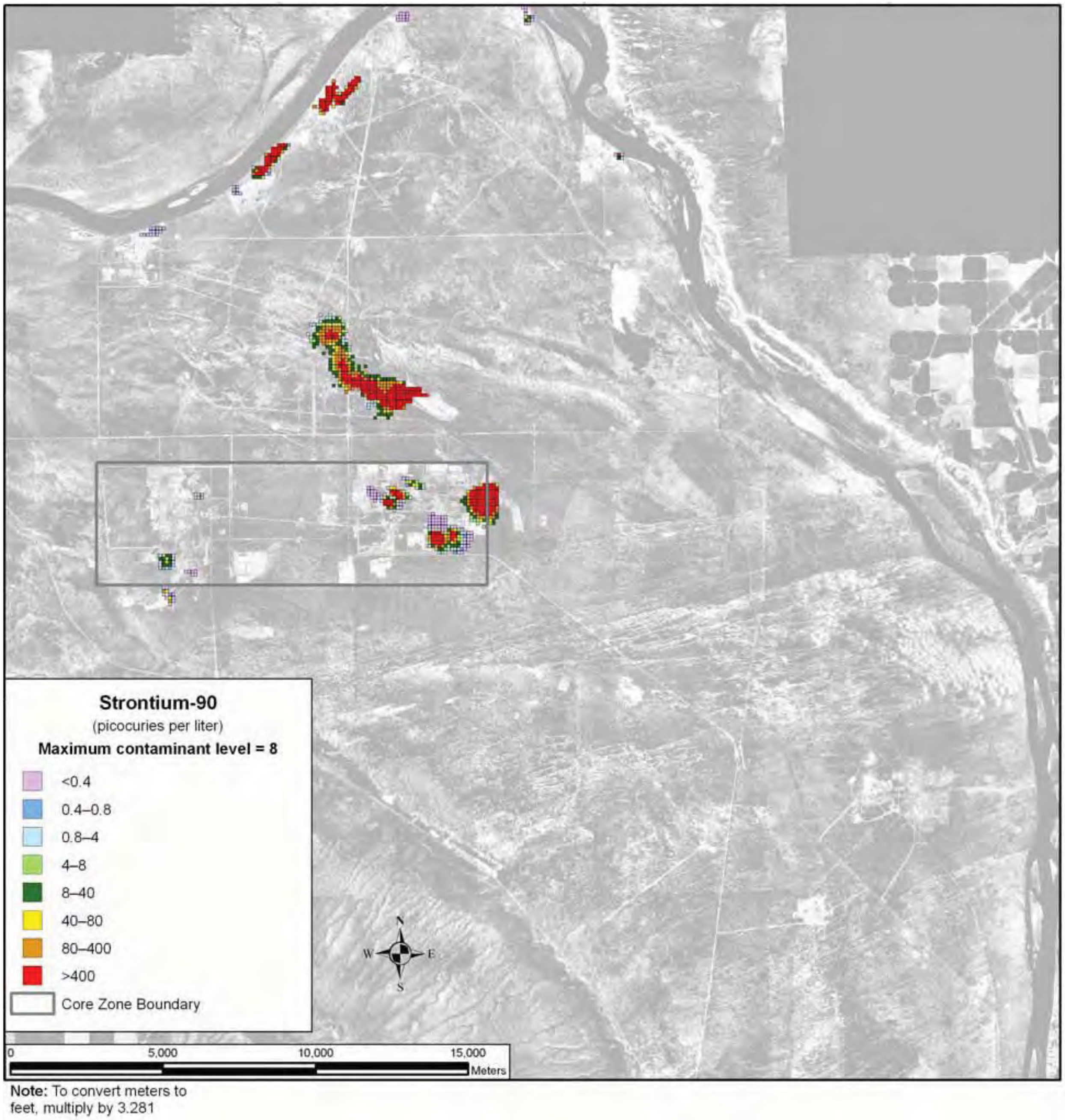
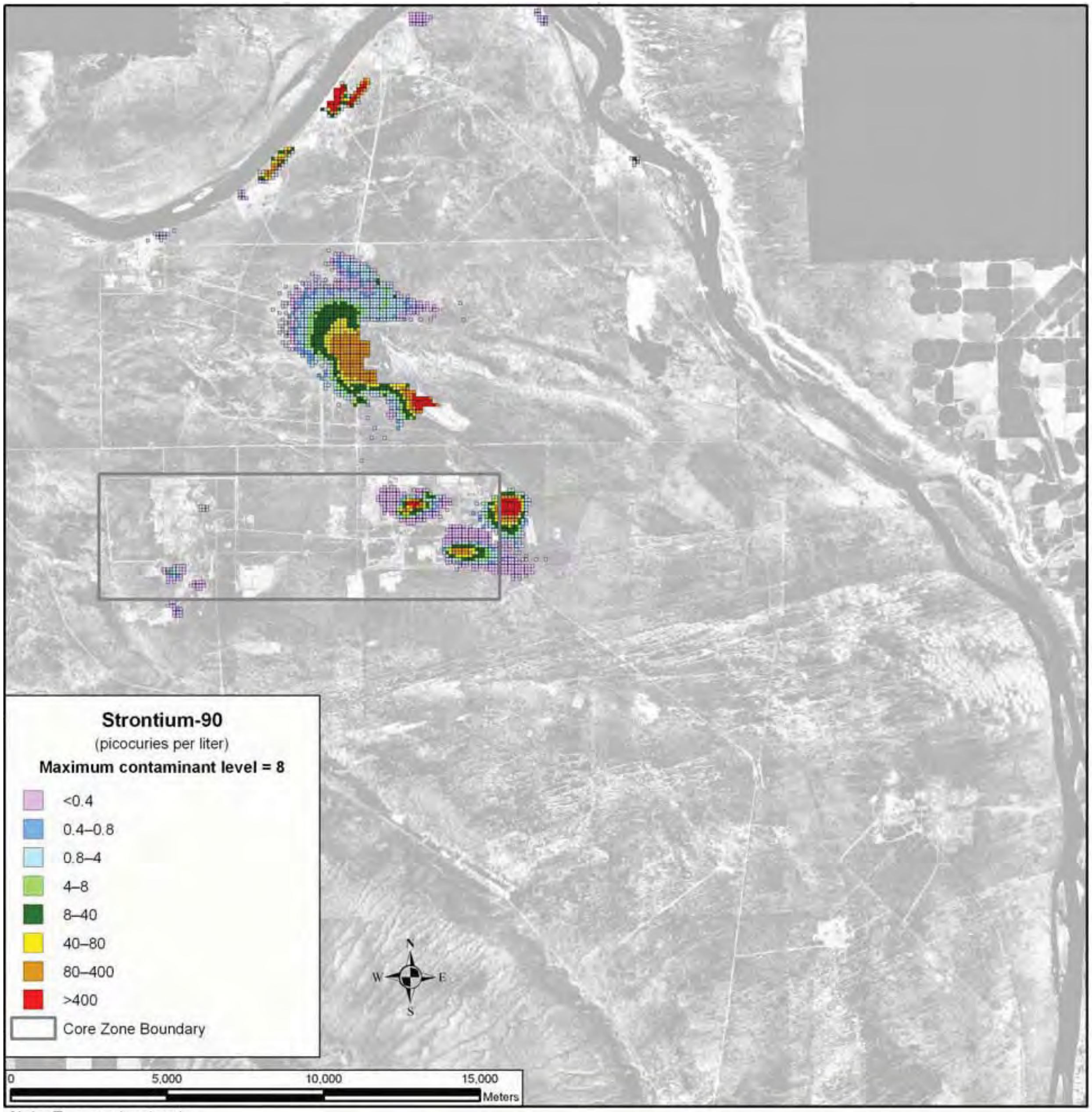
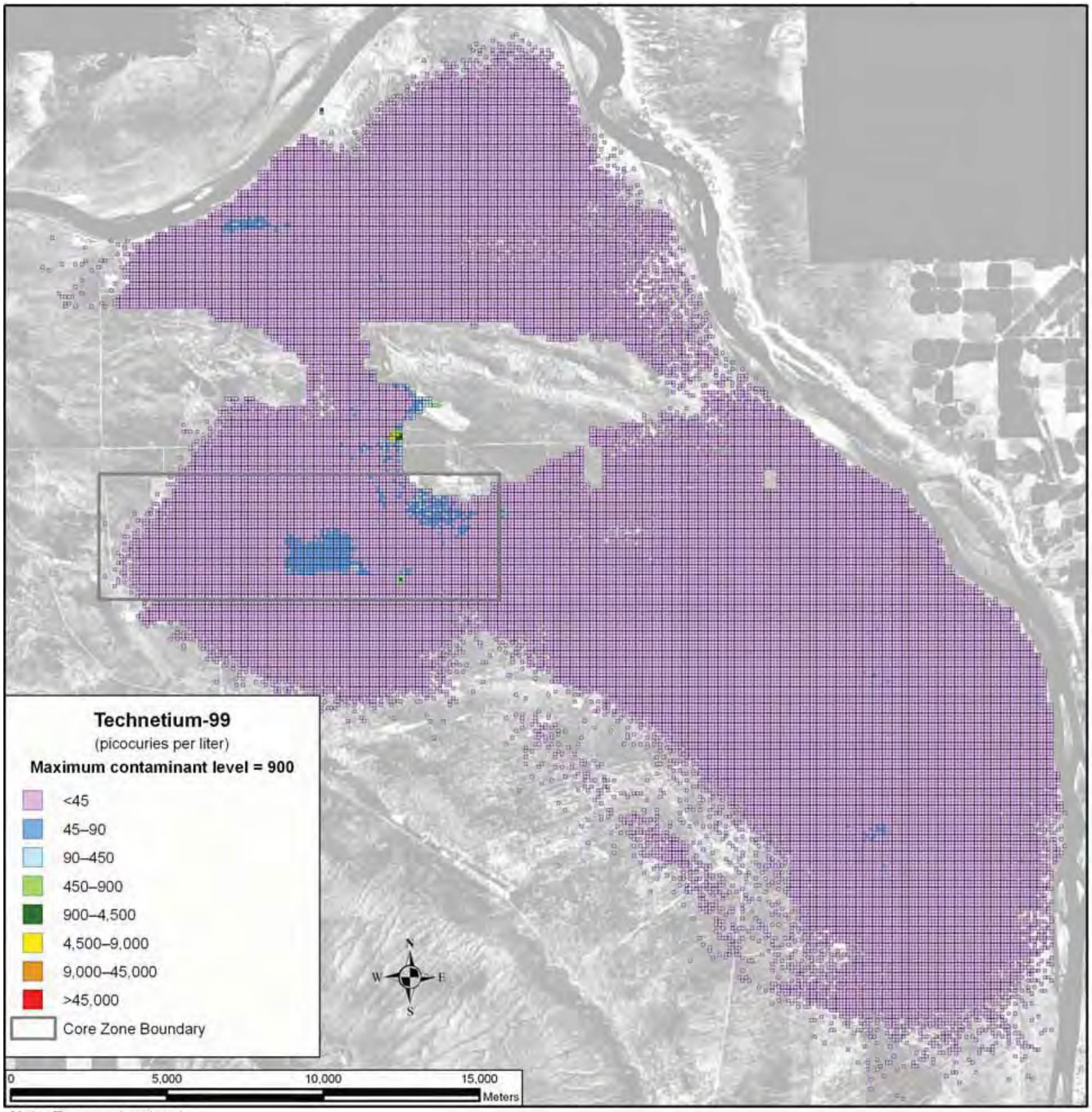


Figure U–17. Spatial Distribution of Groundwater Strontium-90 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005



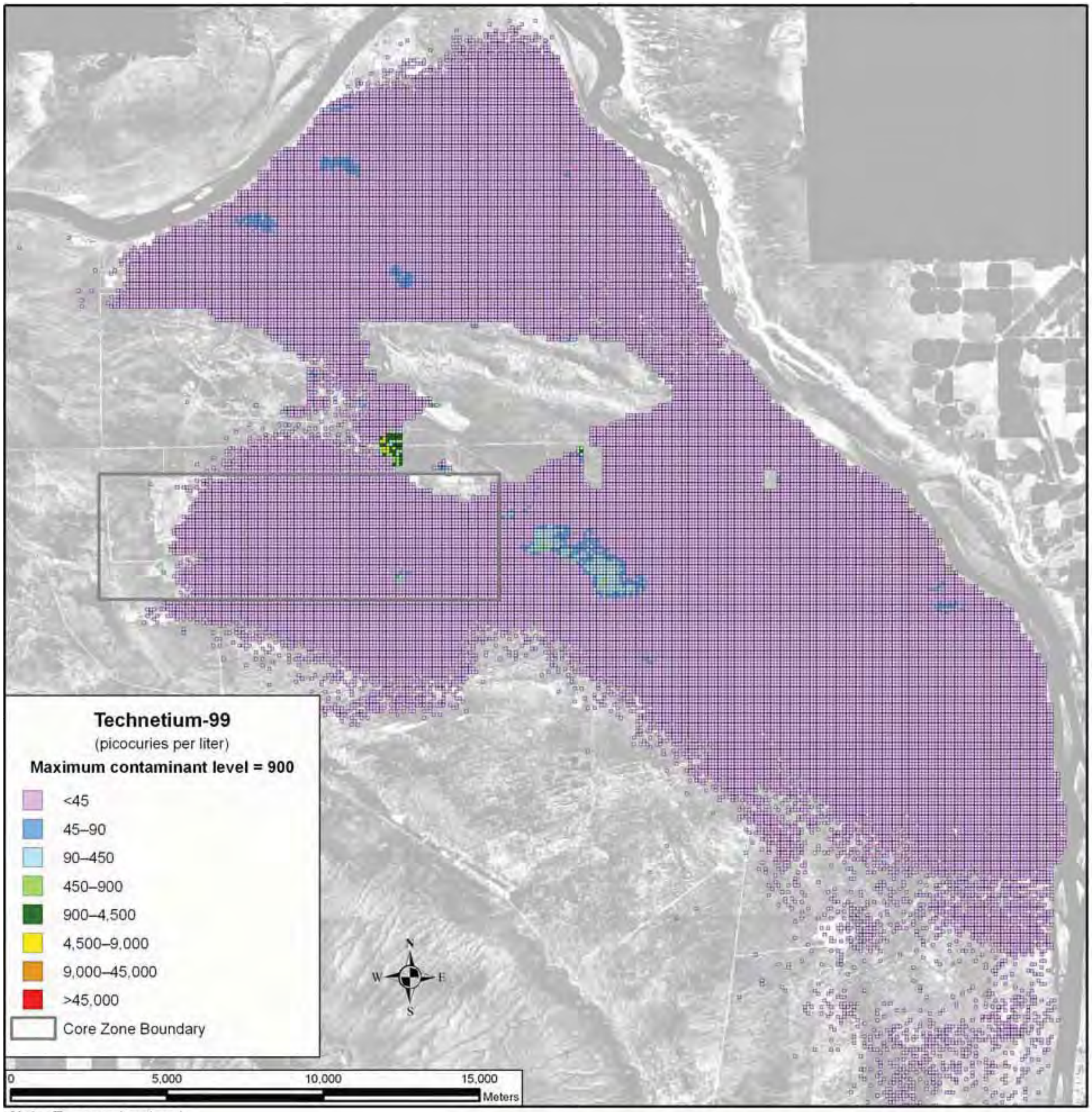
Note: To convert meters to feet, multiply by 3.281

Figure U–18. Spatial Distribution of Groundwater Strontium-90 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135



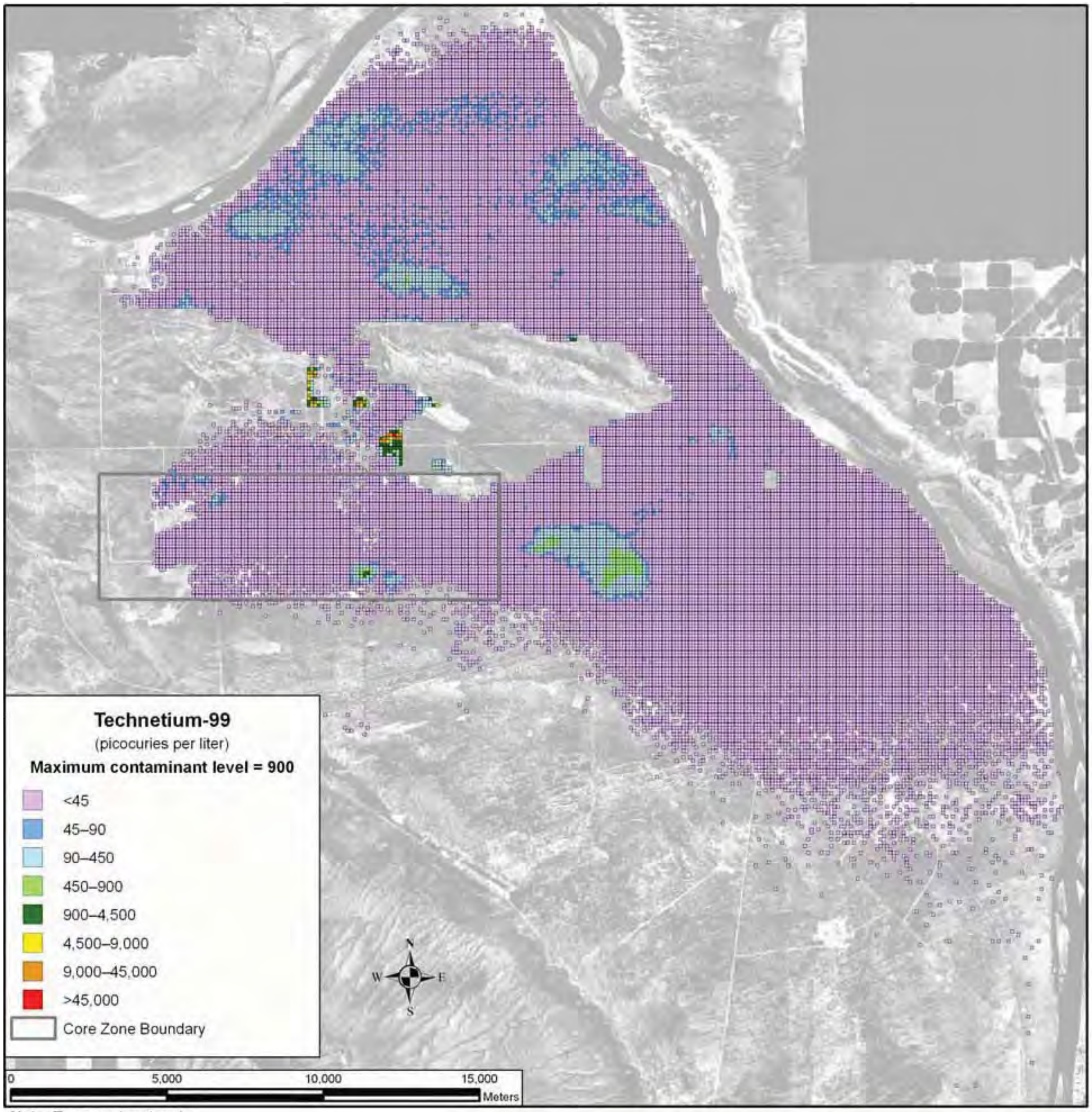
Note: To convert meters to feet, multiply by 3.281

Figure U–19. Spatial Distribution of Groundwater Technetium-99 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005



Note: To convert meters to feet, multiply by 3.281

Figure U–20. Spatial Distribution of Groundwater Technetium-99 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135



Note: To convert meters to feet, multiply by 3.281

Figure U–21. Spatial Distribution of Groundwater Technetium-99 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 3890

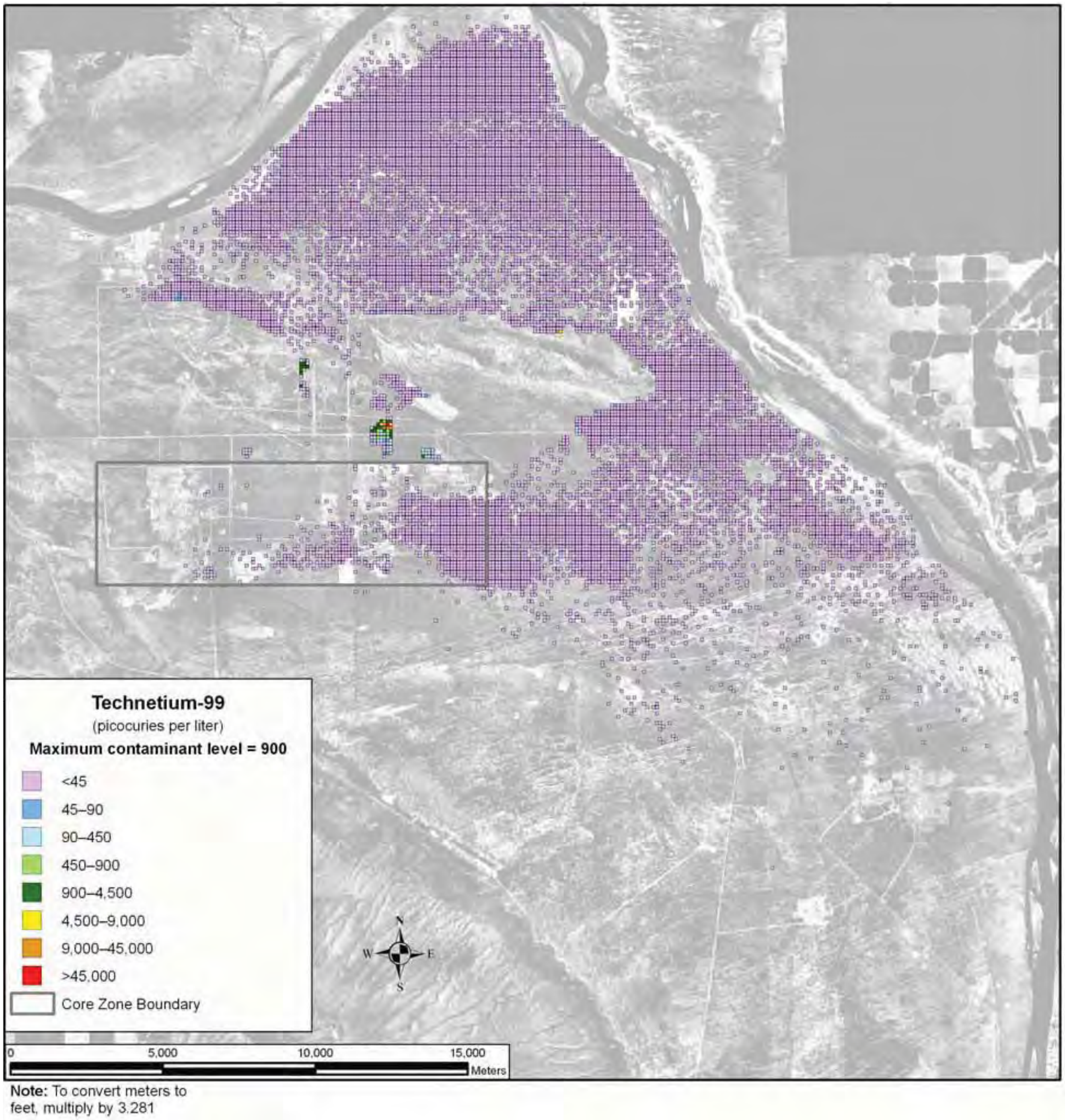
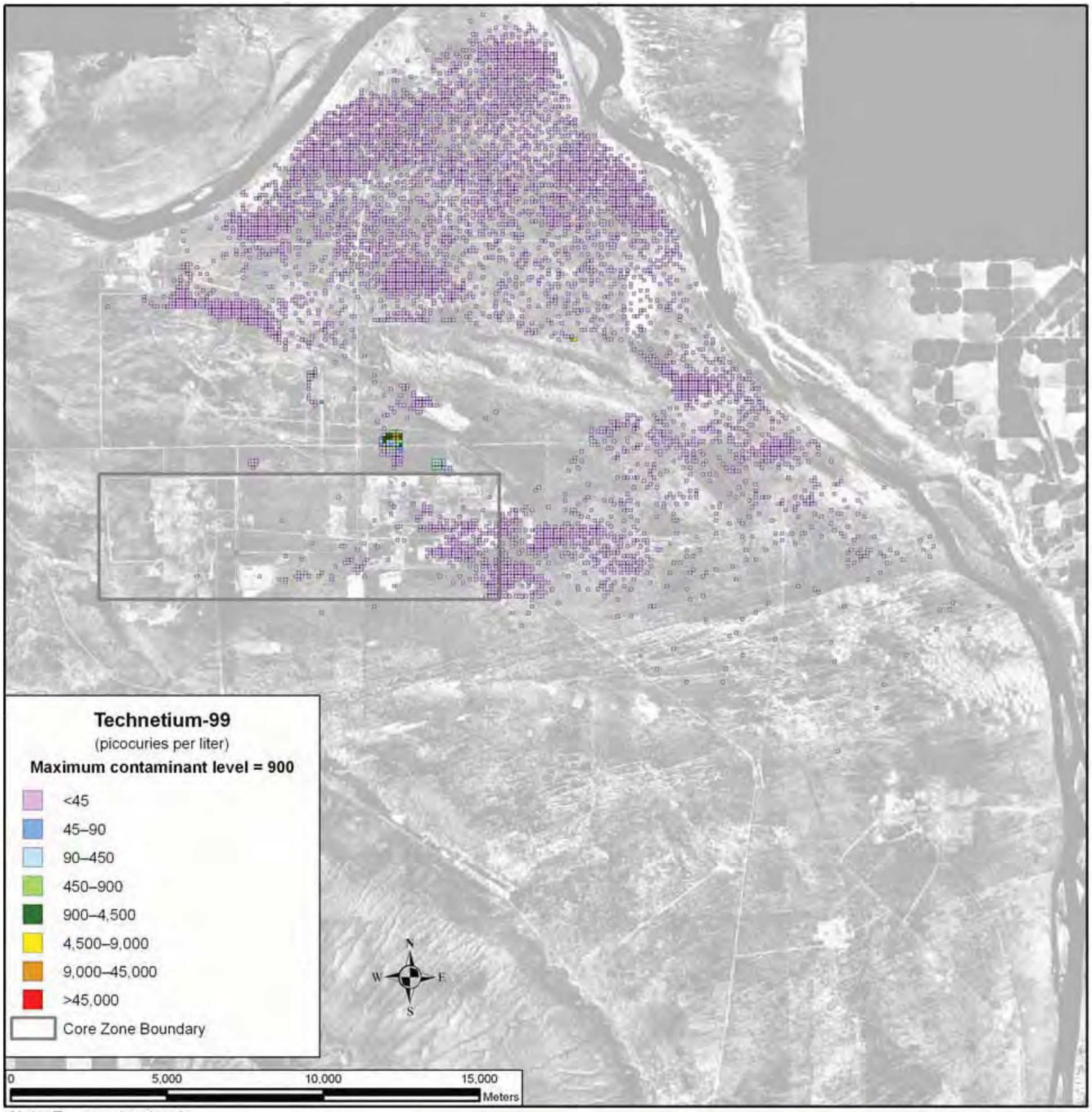


Figure U–22. Spatial Distribution of Groundwater Technetium-99 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 7140



Note: To convert meters to feet, multiply by 3.281

Figure U–23. Spatial Distribution of Groundwater Technetium-99 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 11,885

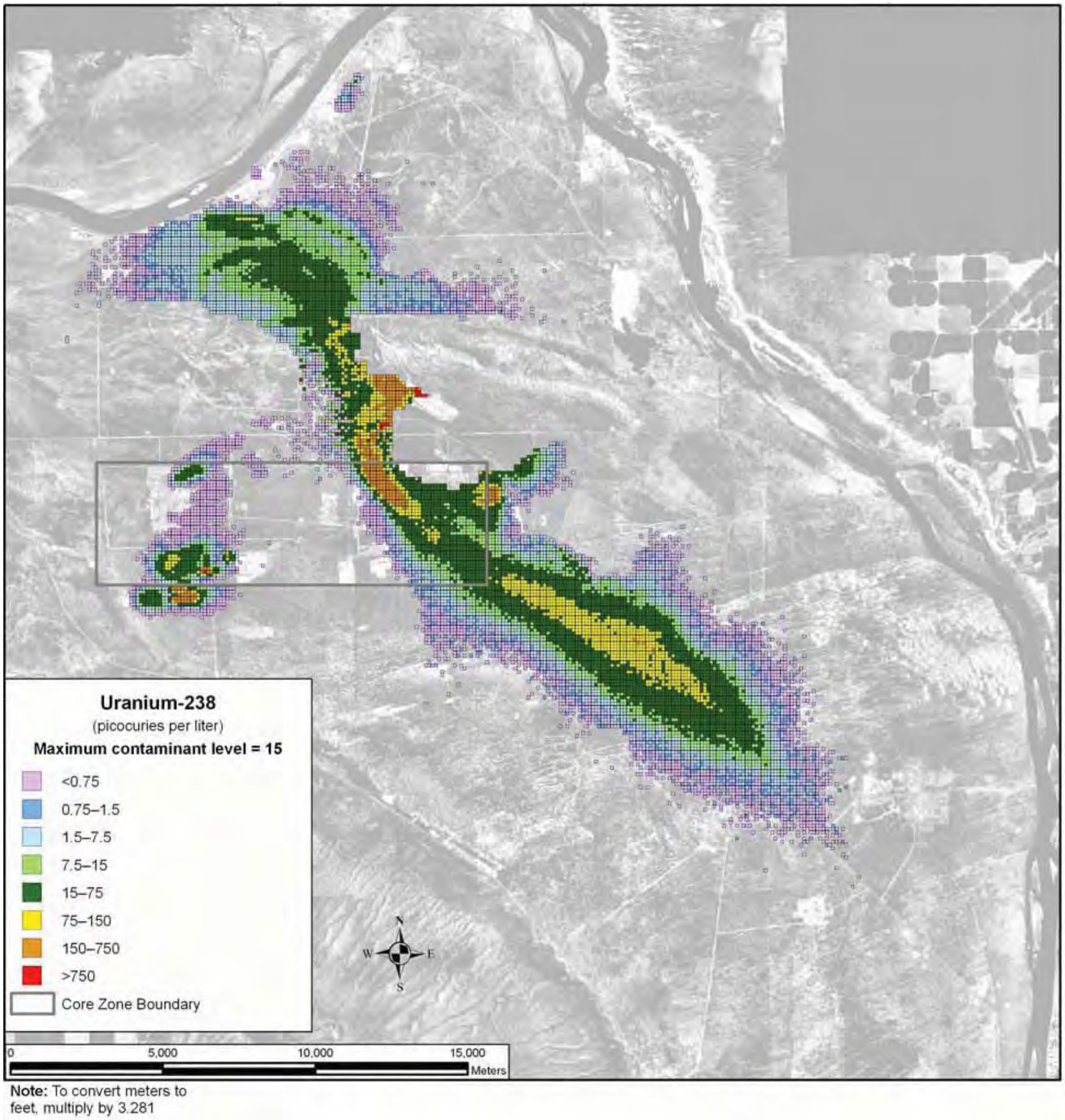


Figure U–24. Spatial Distribution of Groundwater Uranium-238 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005

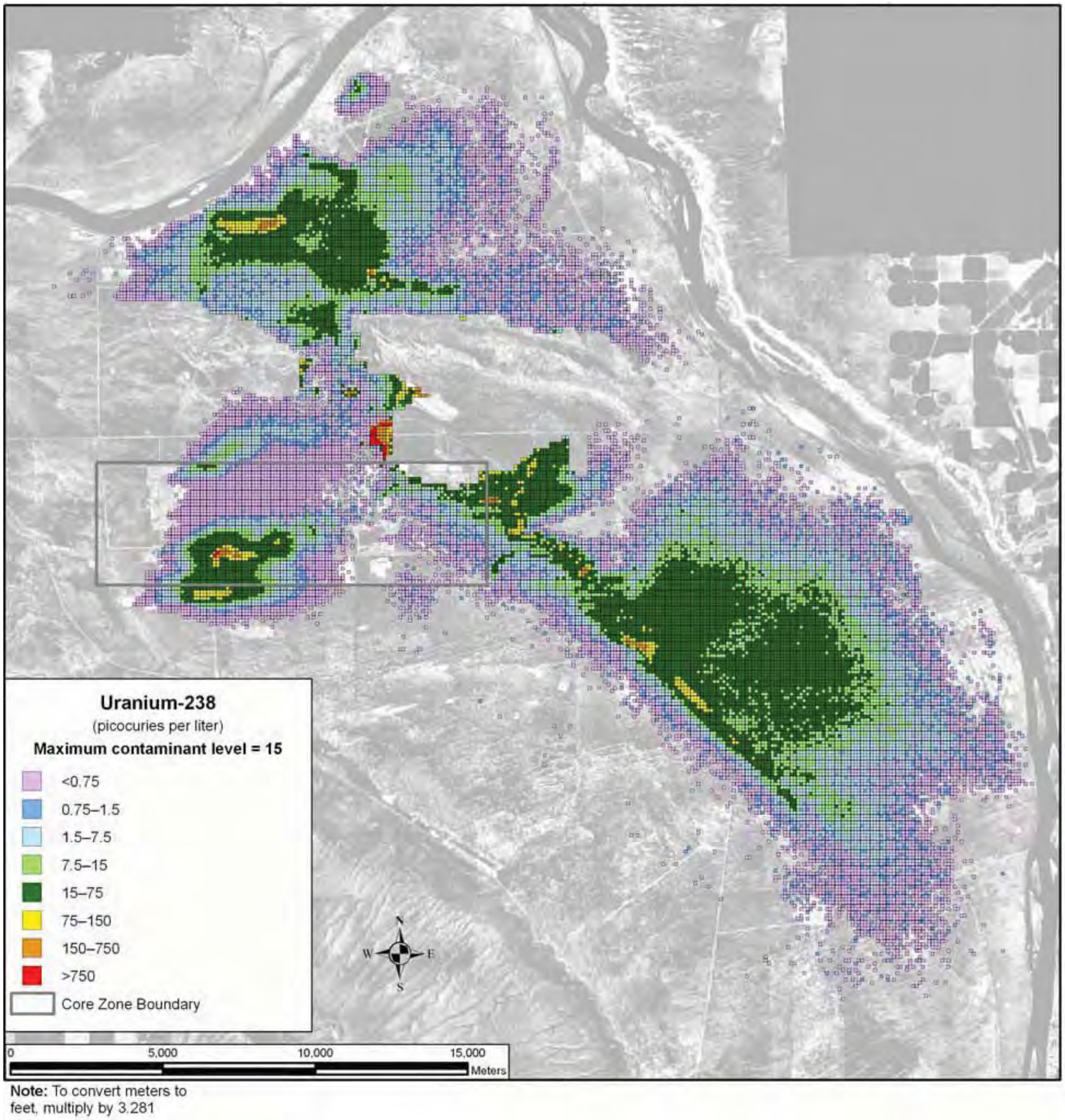
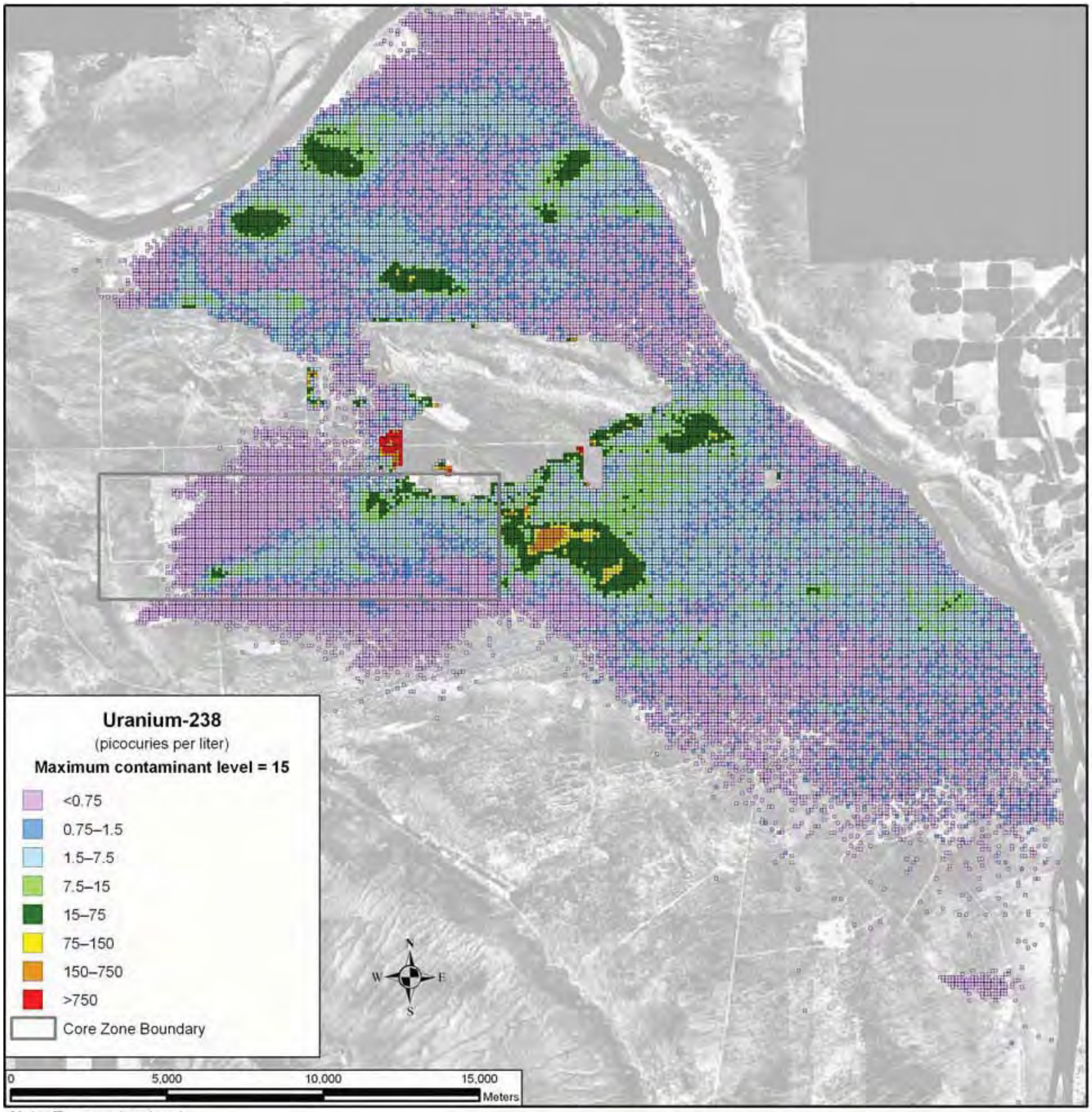
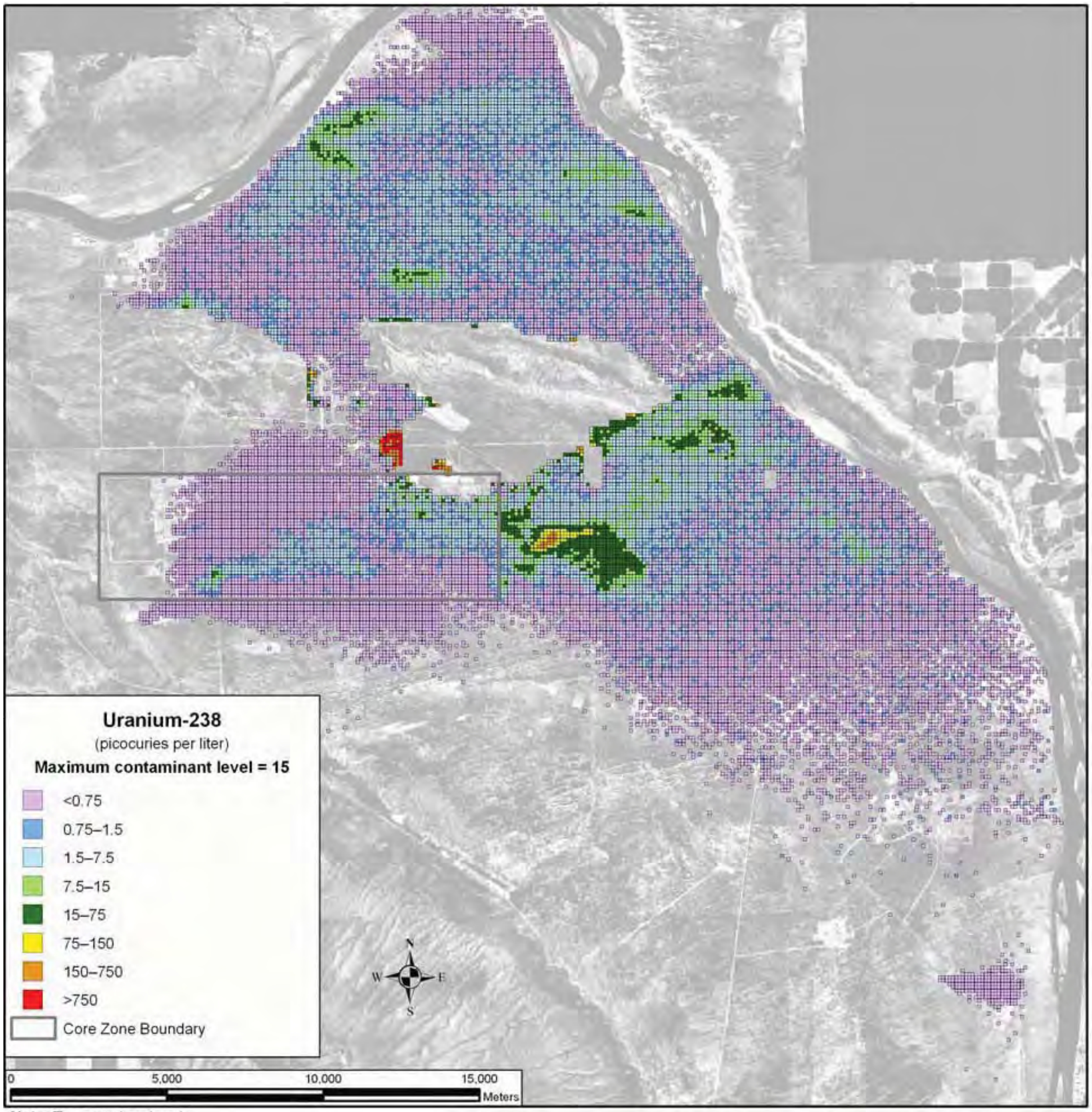


Figure U–25. Spatial Distribution of Groundwater Uranium-238 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135



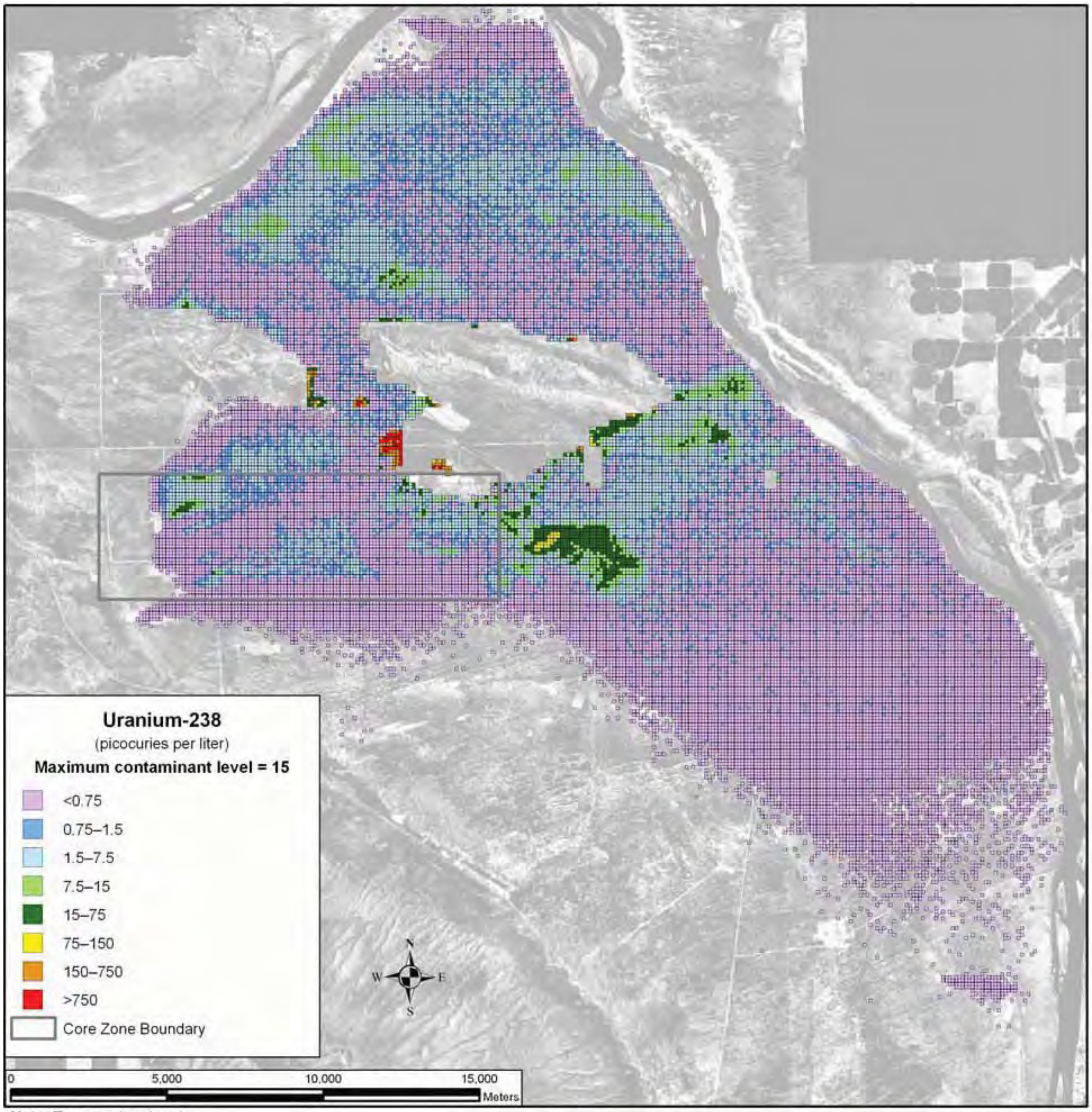
Note: To convert meters to feet, multiply by 3.281

Figure U–26. Spatial Distribution of Groundwater Uranium-238 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 3890



Note: To convert meters to feet, multiply by 3.281

Figure U–27. Spatial Distribution of Groundwater Uranium-238 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 7140



Note: To convert meters to feet, multiply by 3.281

Figure U–28. Spatial Distribution of Groundwater Uranium-238 Concentration (Non–*TC & WM EIS* Sources), Calendar Year 11,885

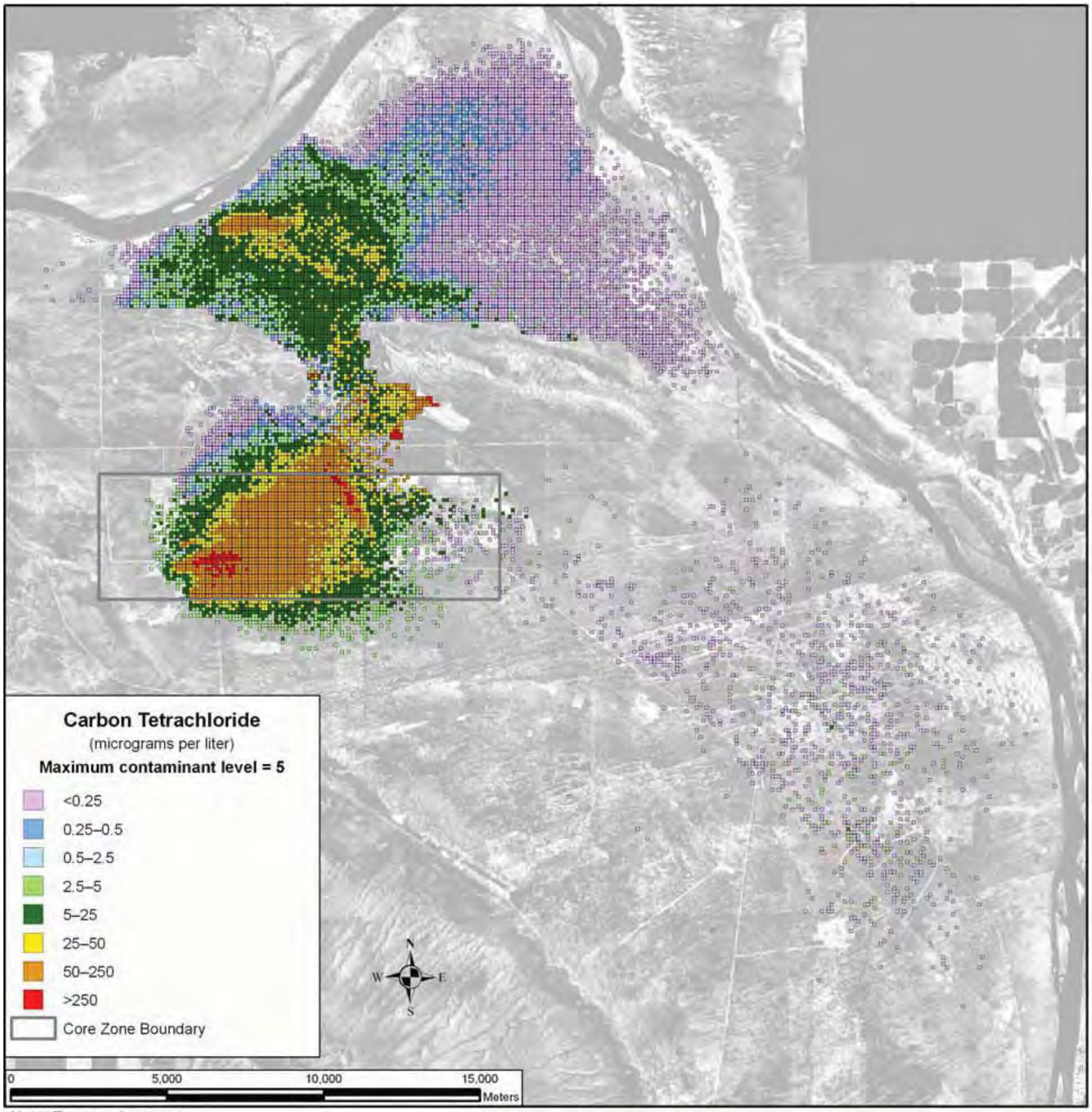
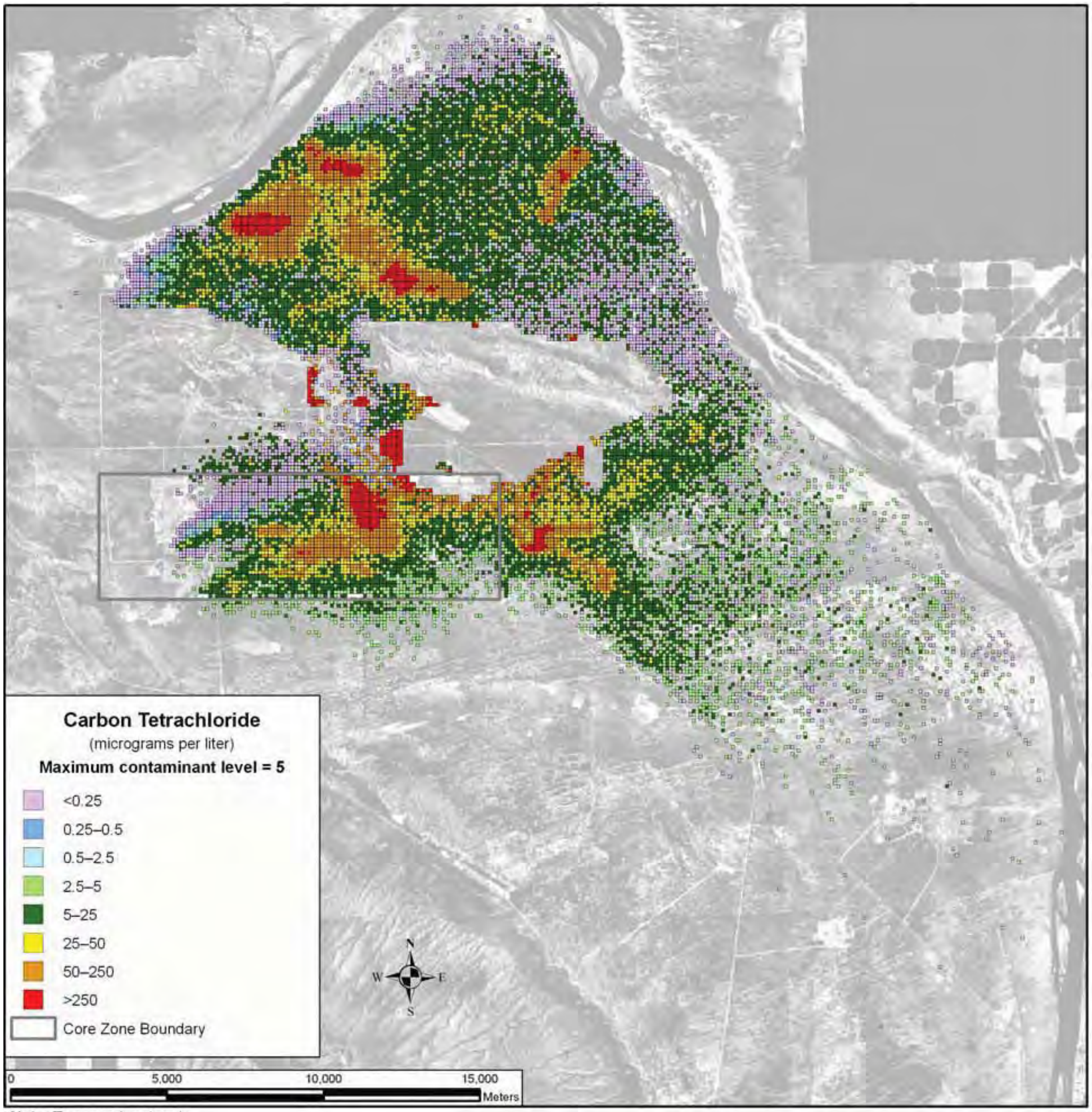


Figure U–29. Spatial Distribution of Groundwater Carbon Tetrachloride Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005



Note: To convert meters to feet, multiply by 3.281

Figure U–30. Spatial Distribution of Groundwater Carbon Tetrachloride Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135

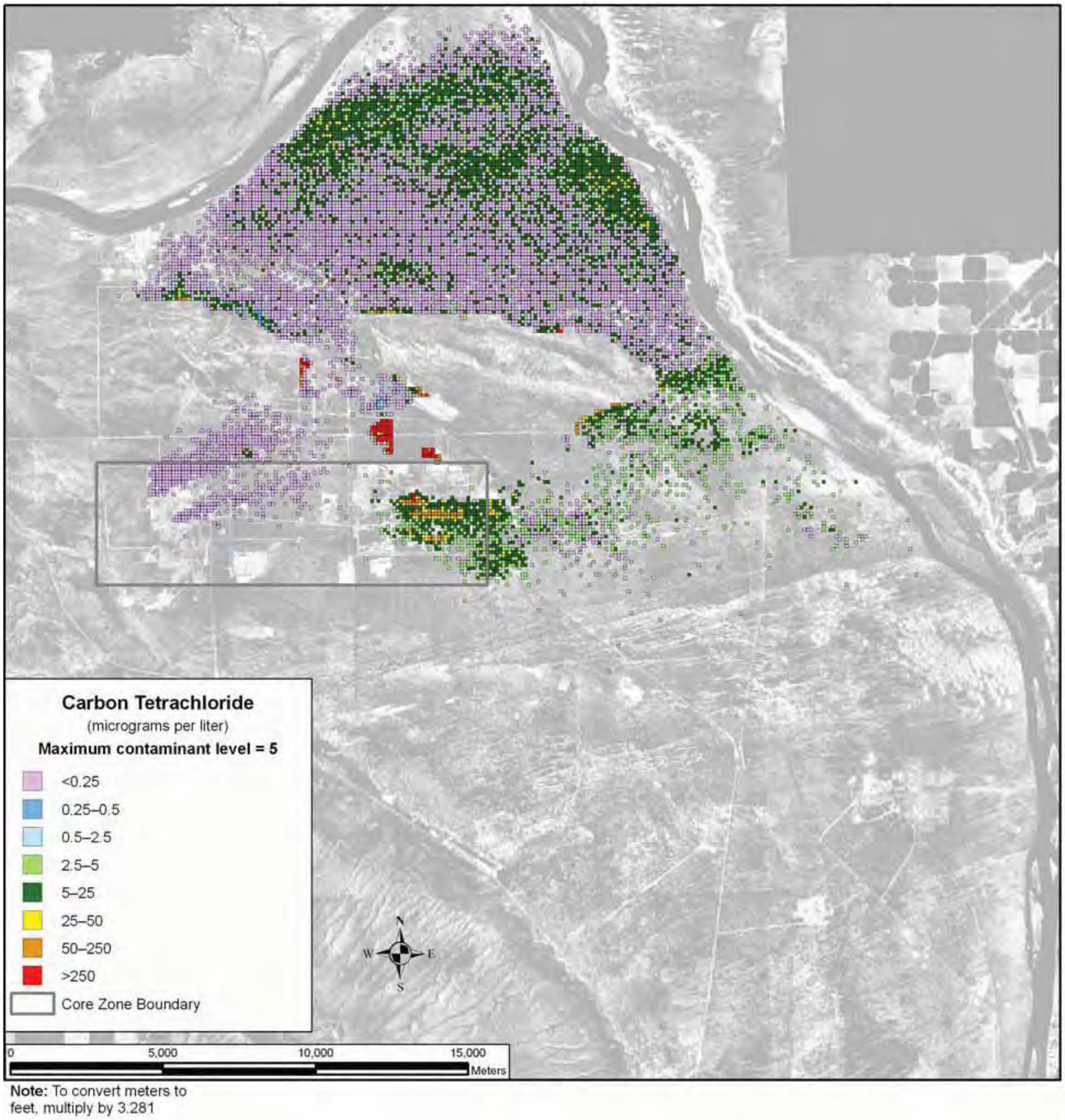
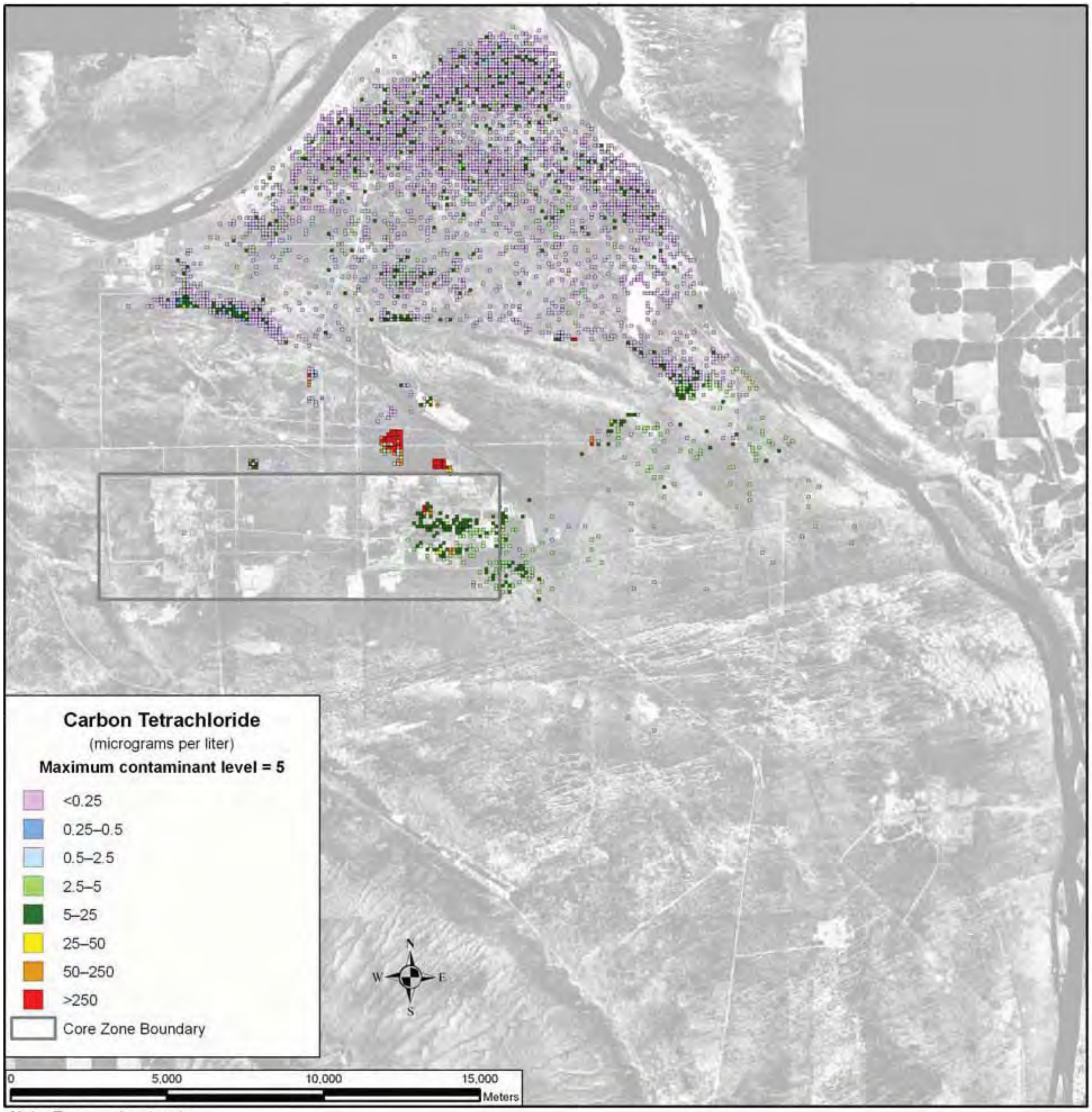


Figure U–31. Spatial Distribution of Groundwater Carbon Tetrachloride Concentration (Non–*TC & WM EIS* Sources), Calendar Year 3890



Note: To convert meters to feet, multiply by 3.281

Figure U–32. Spatial Distribution of Groundwater Carbon Tetrachloride Concentration (Non–*TC & WM EIS* Sources), Calendar Year 7140

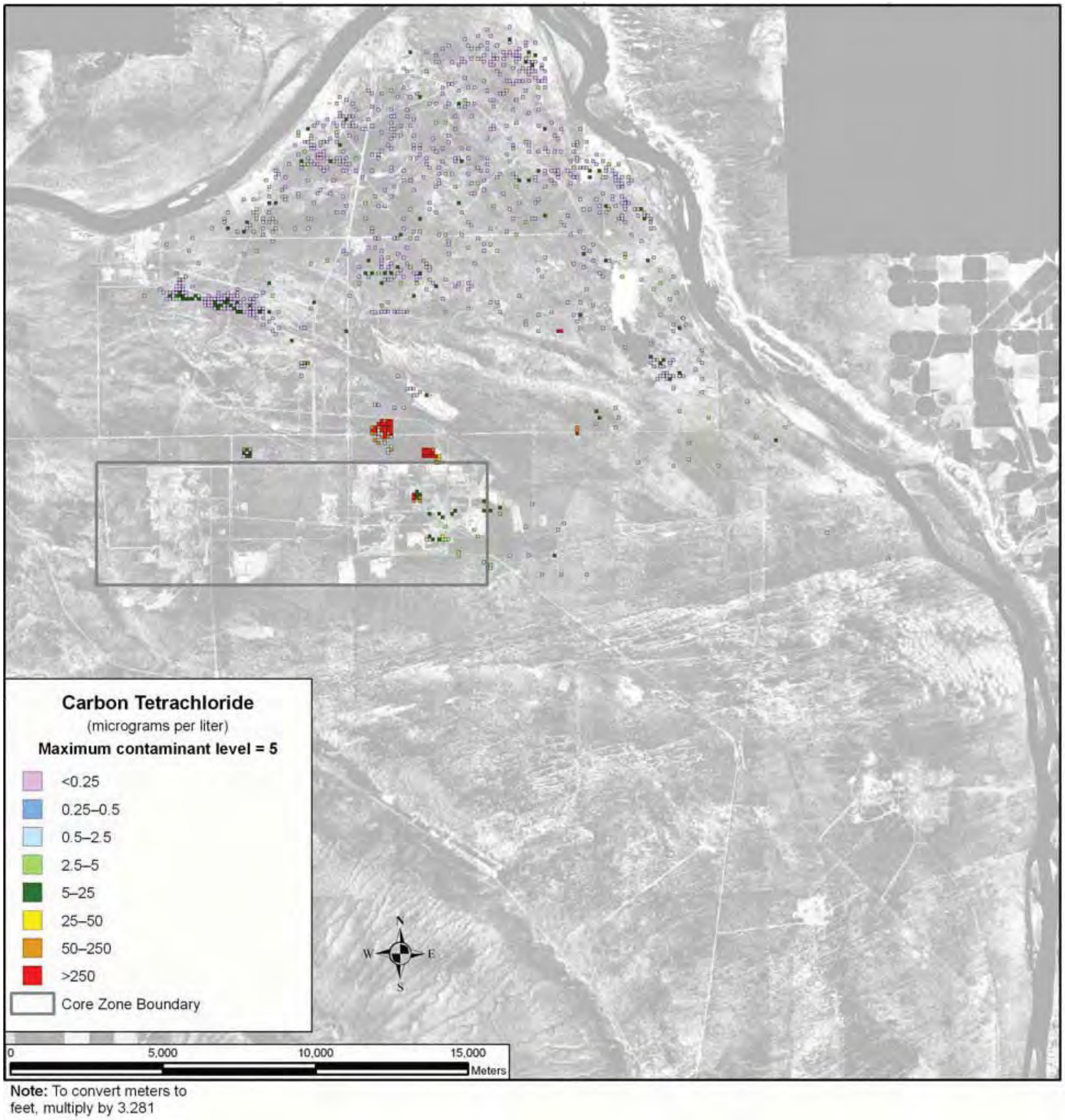
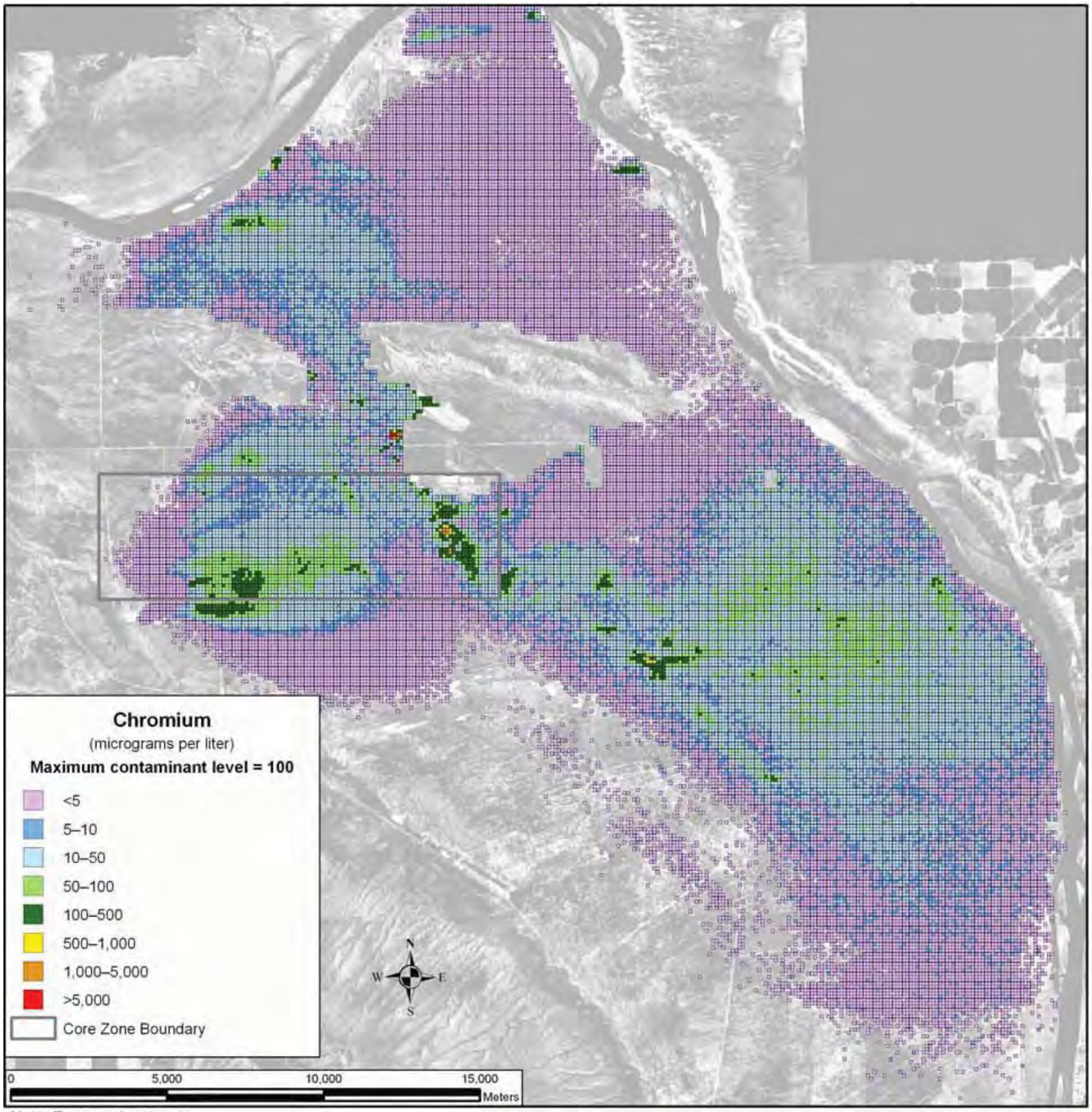
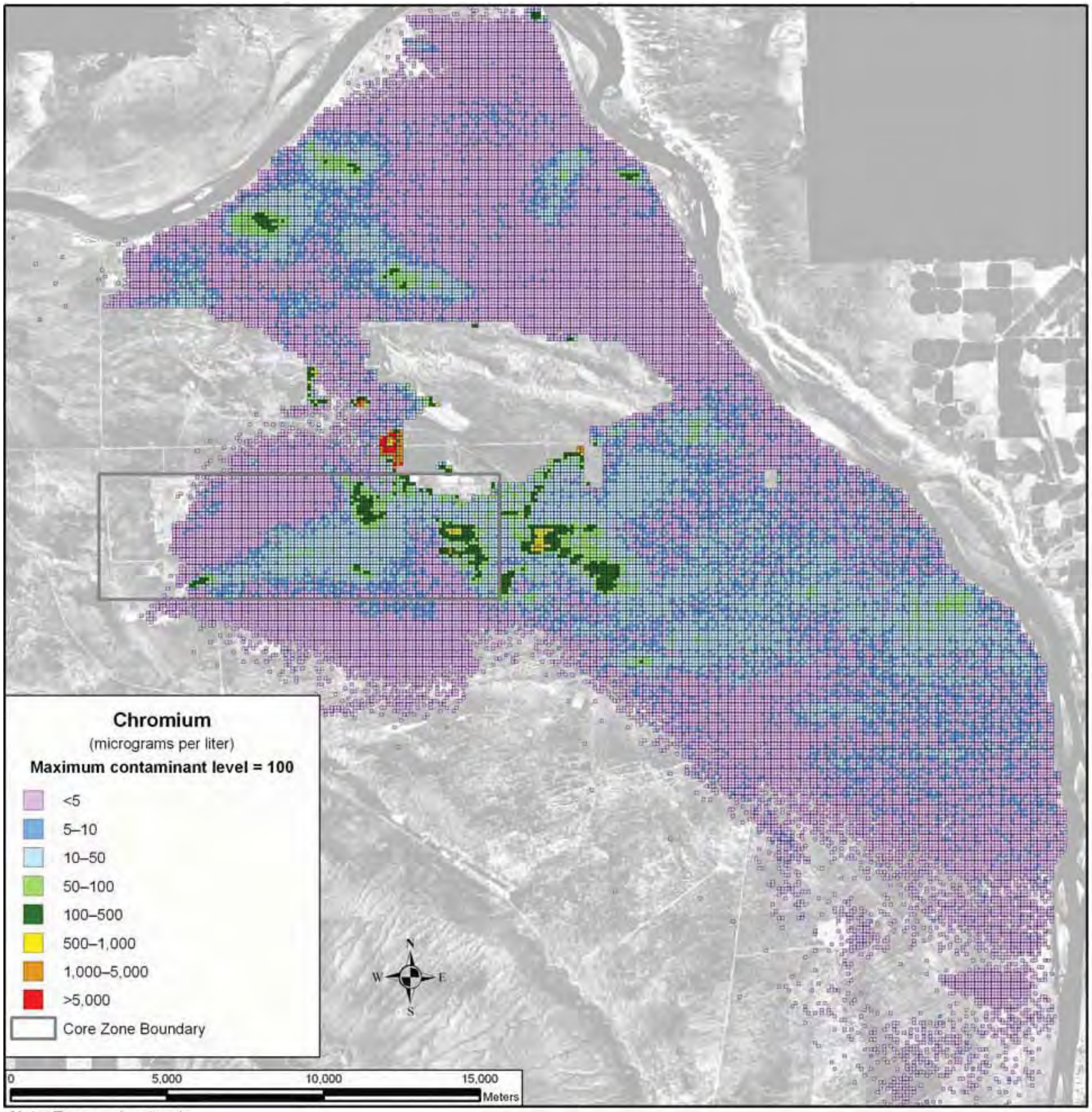


Figure U–33. Spatial Distribution of Groundwater Carbon Tetrachloride Concentration (Non–*TC & WM EIS* Sources), Calendar Year 11,885



Note: To convert meters to feet, multiply by 3.281

Figure U–34. Spatial Distribution of Groundwater Chromium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005



Note: To convert meters to feet, multiply by 3.281

Figure U–35. Spatial Distribution of Groundwater Chromium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135

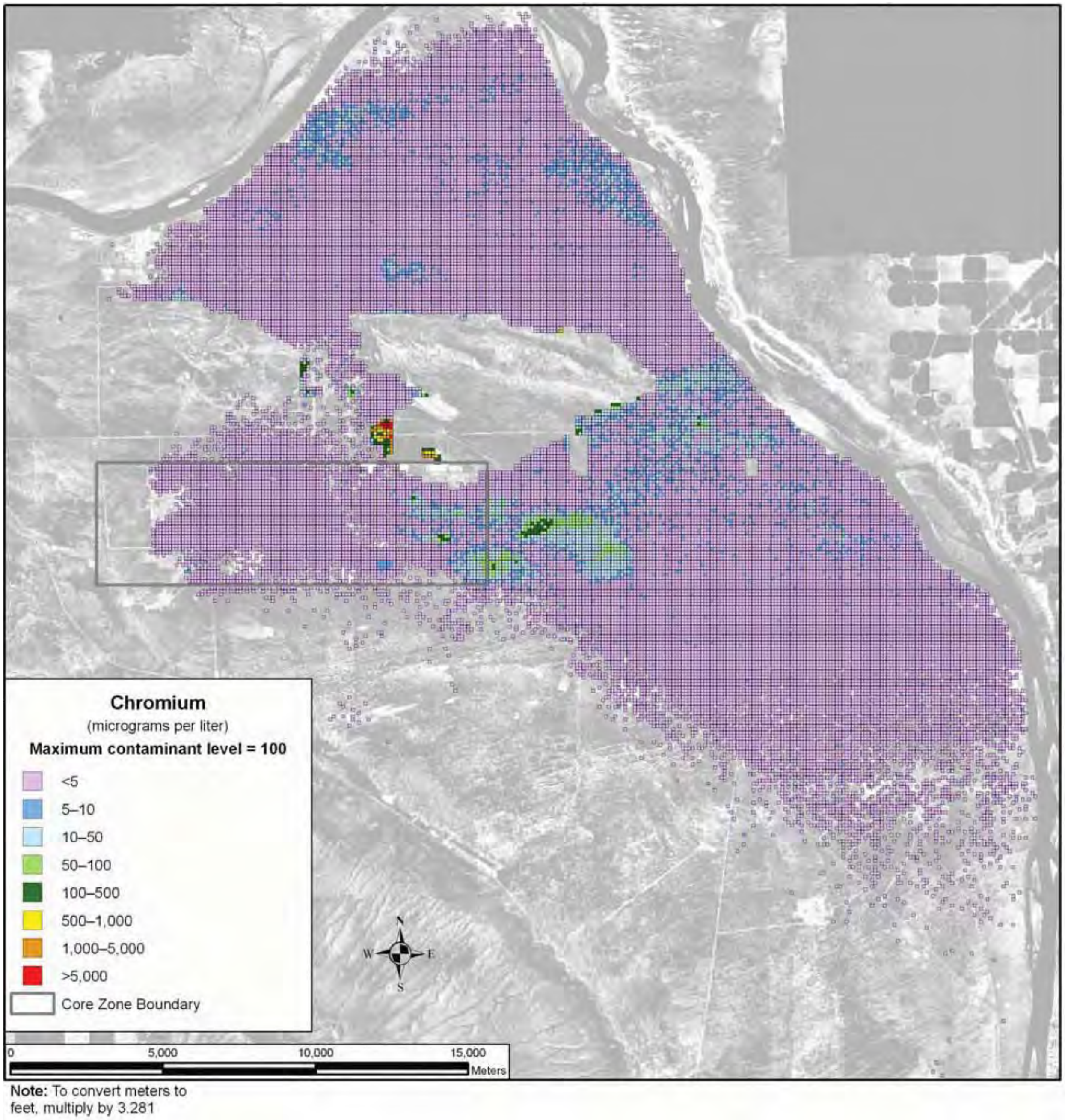


Figure U–36. Spatial Distribution of Groundwater Chromium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 3890

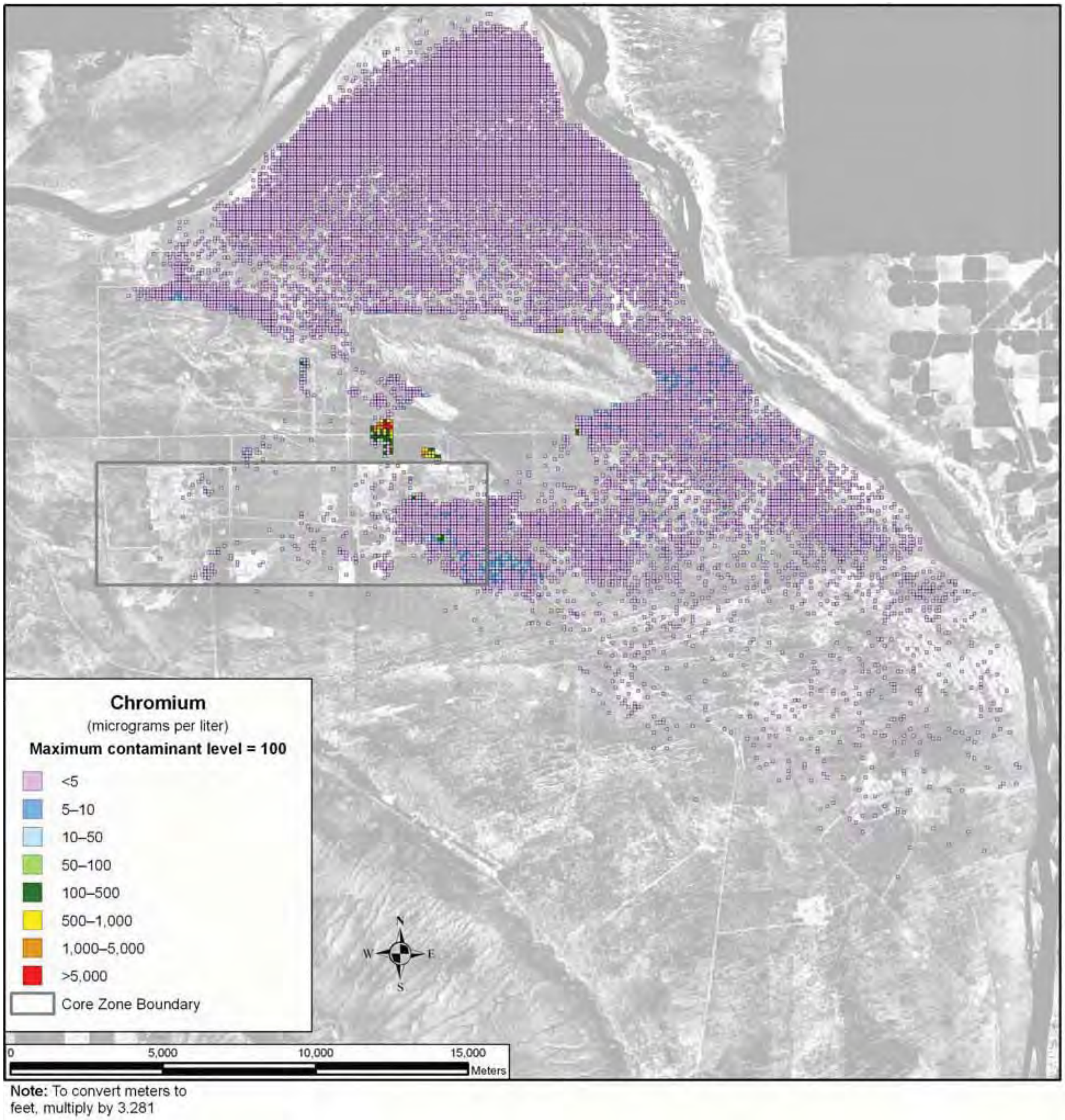
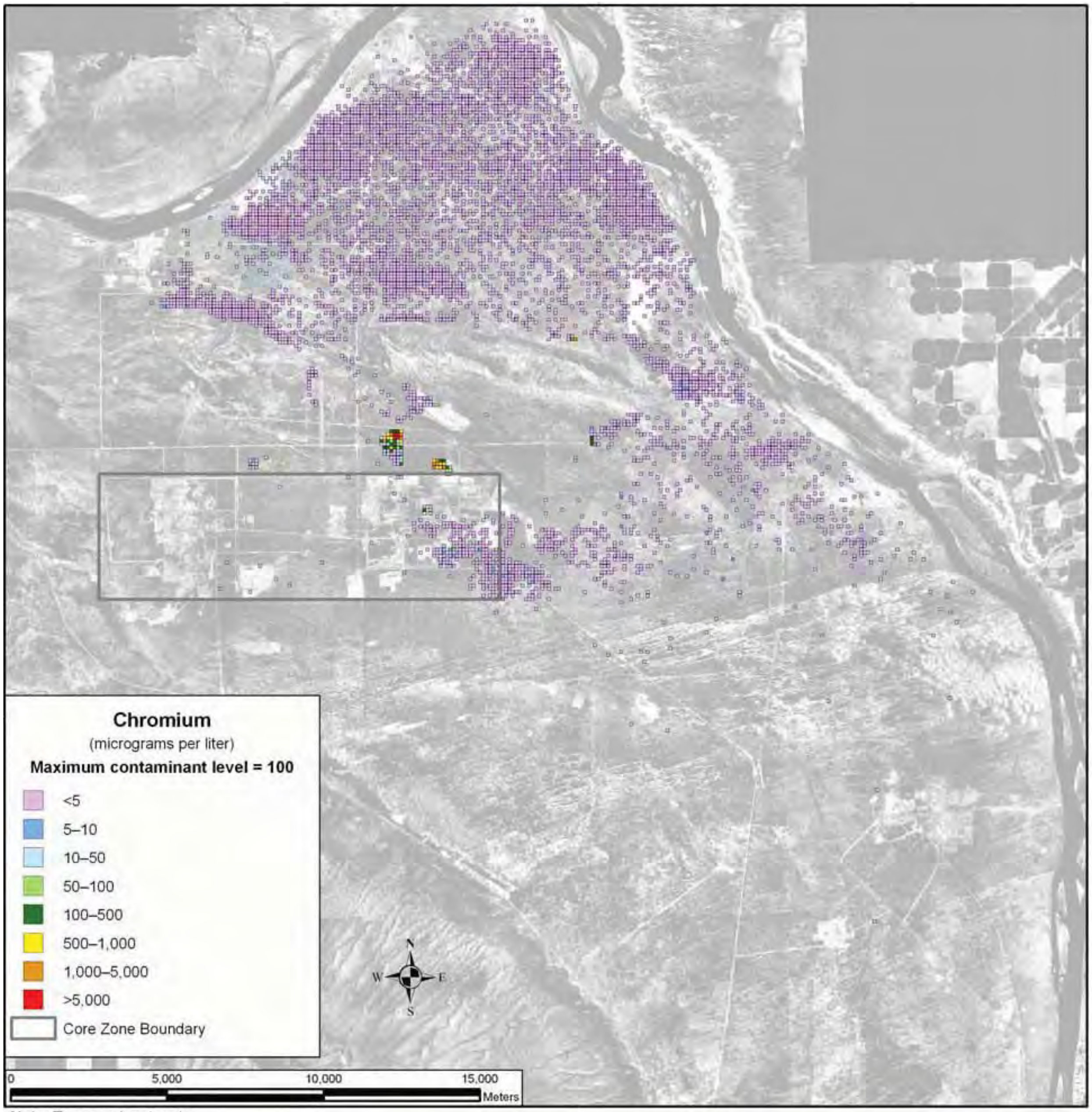
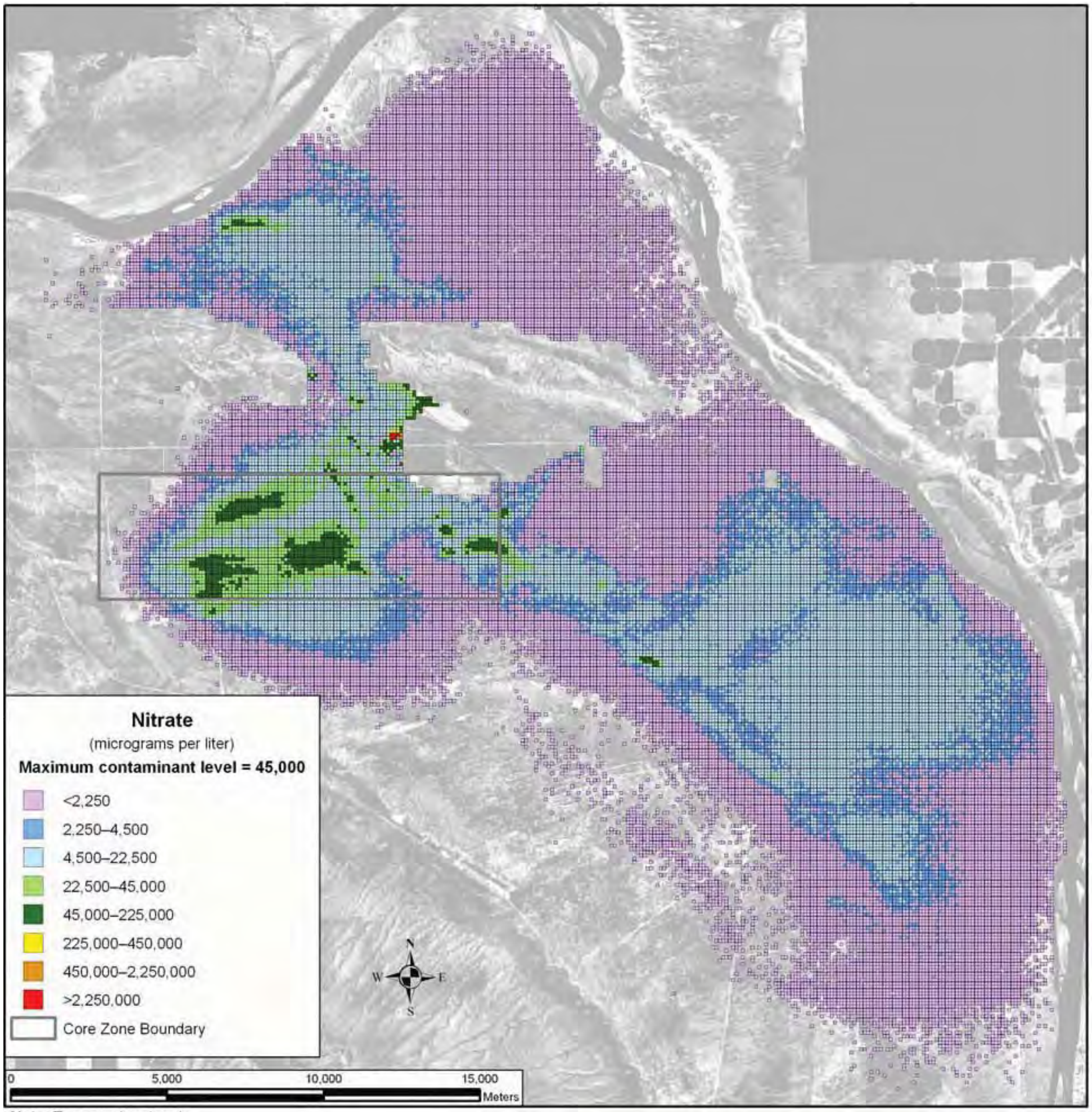


Figure U–37. Spatial Distribution of Groundwater Chromium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 7140



Note: To convert meters to feet, multiply by 3.281

Figure U–38. Spatial Distribution of Groundwater Chromium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 11,885



Note: To convert meters to feet, multiply by 3.281

Figure U–39. Spatial Distribution of Groundwater Nitrate Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005

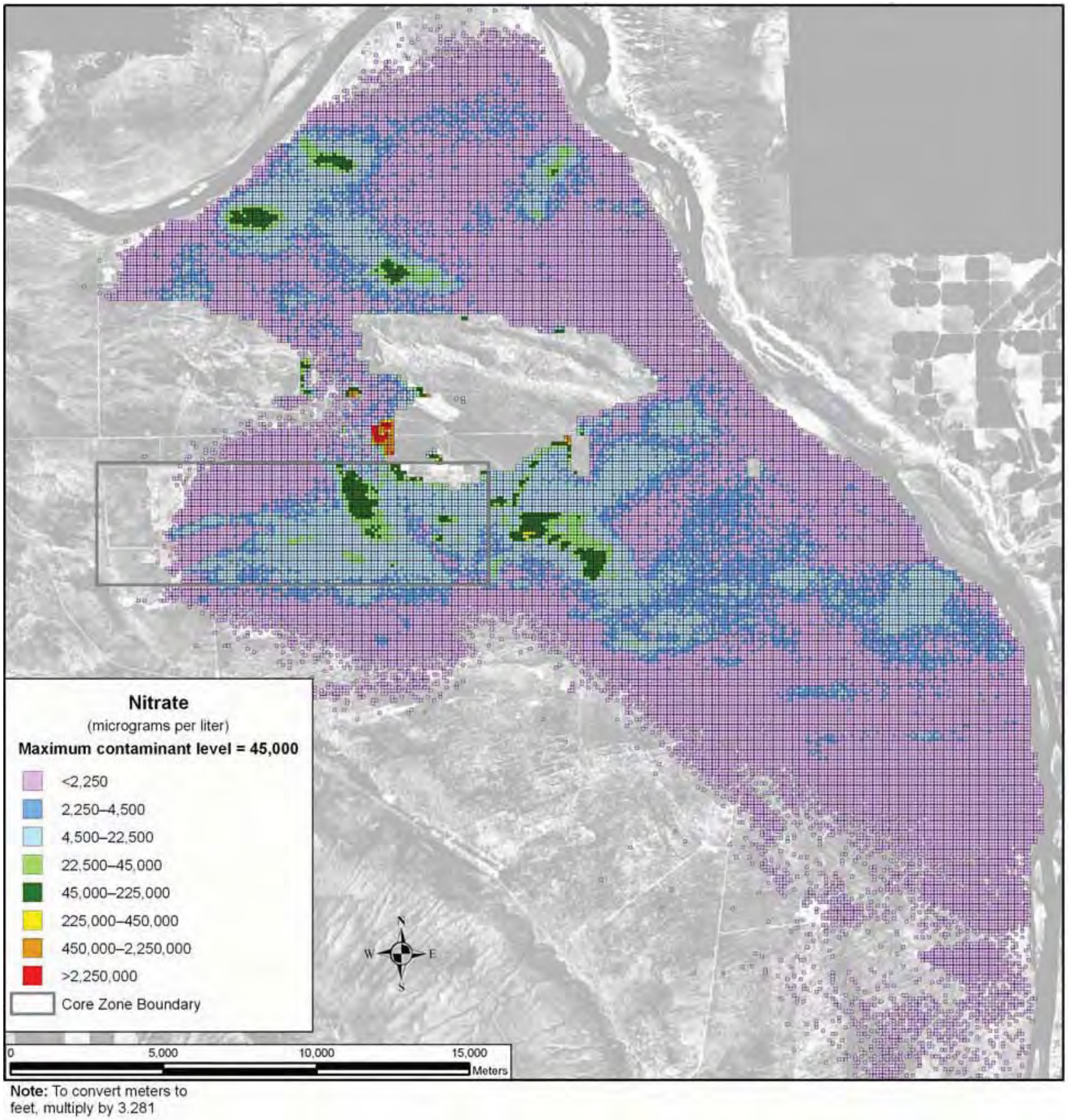


Figure U–40. Spatial Distribution of Groundwater Nitrate Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135

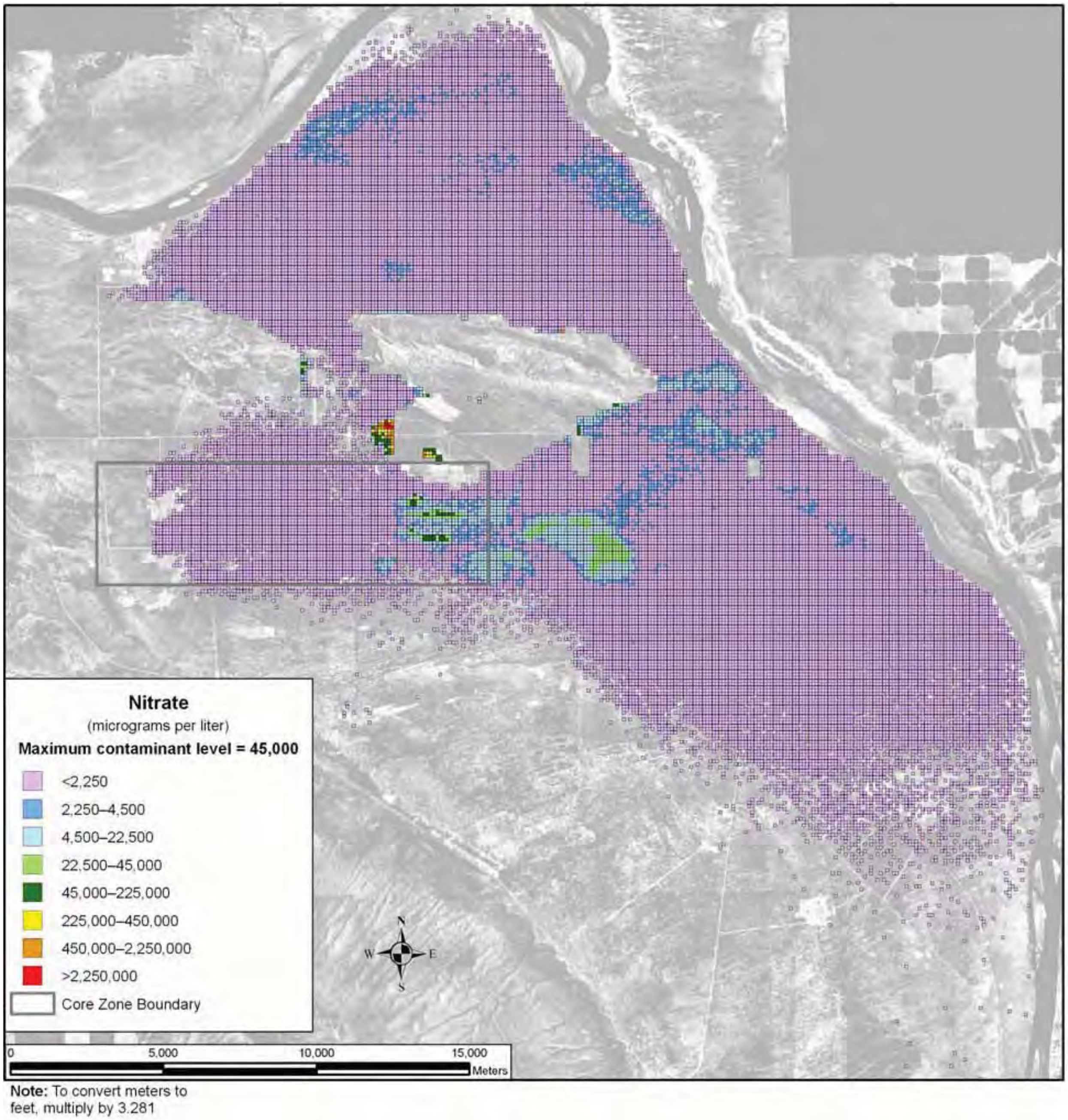
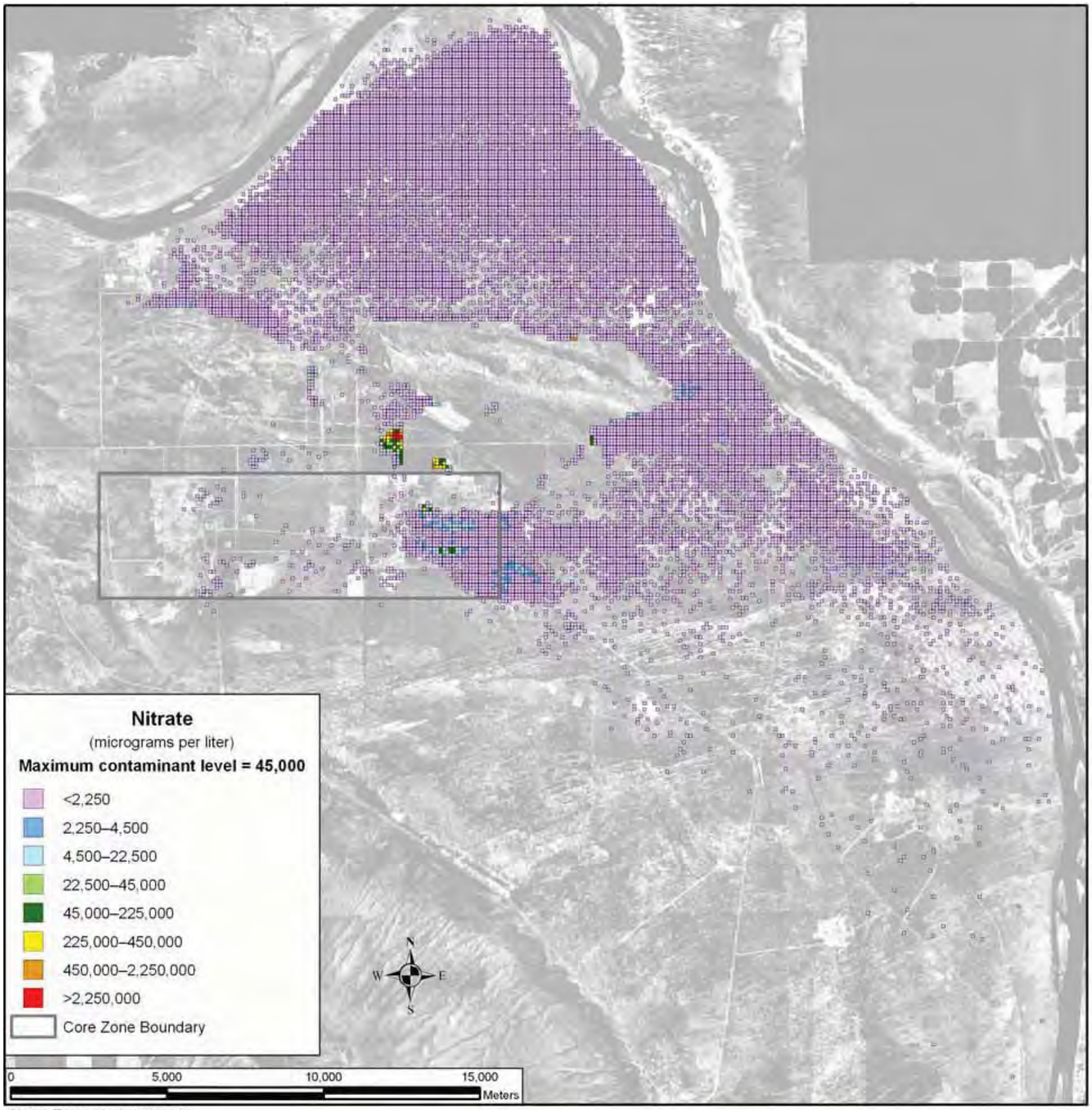


Figure U–41. Spatial Distribution of Groundwater Nitrate Concentration (Non–*TC & WM EIS* Sources), Calendar Year 3890



Note: To convert meters to feet, multiply by 3.281

Figure U–42. Spatial Distribution of Groundwater Nitrate Concentration (Non–*TC & WM EIS* Sources), Calendar Year 7140

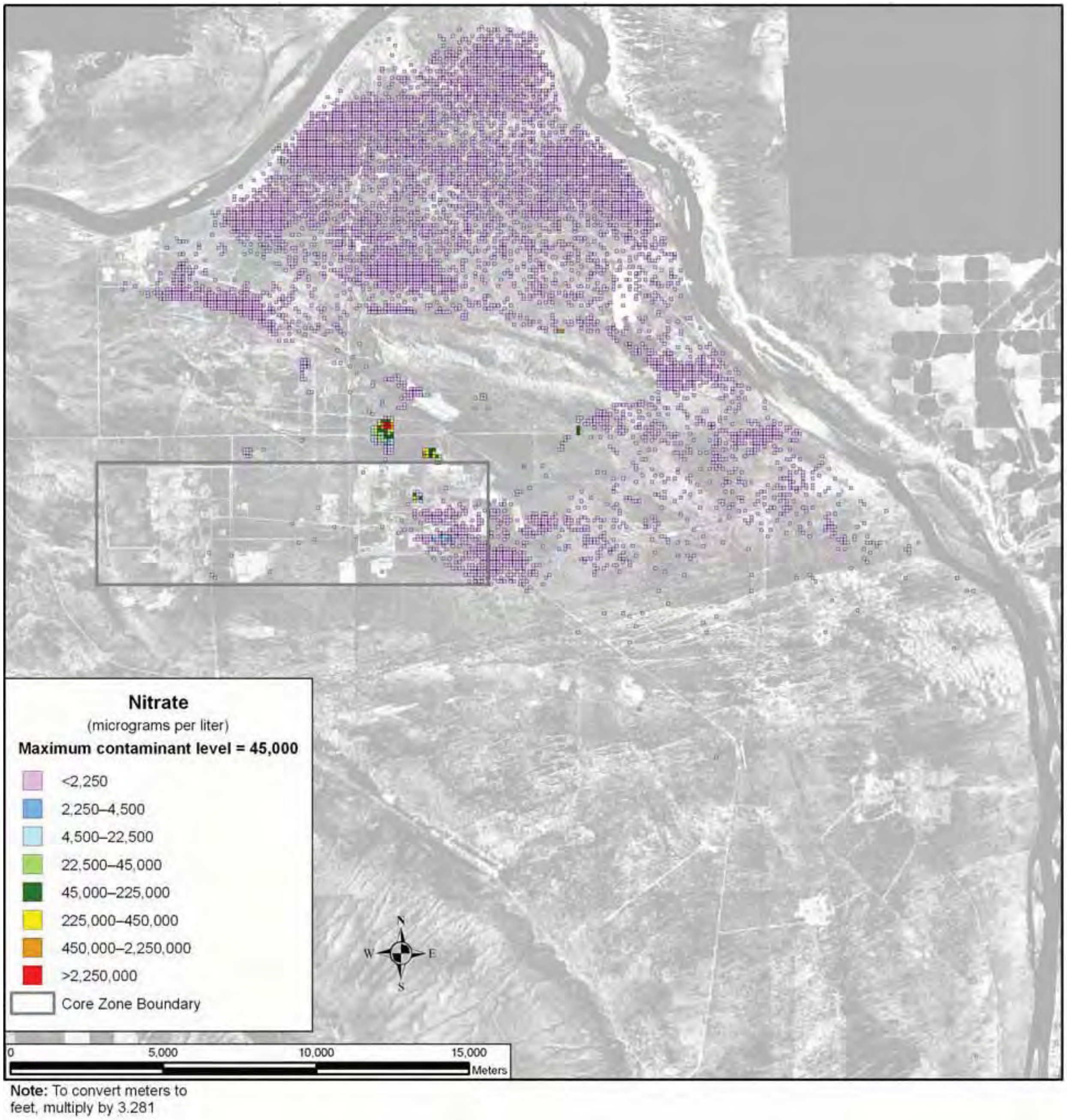
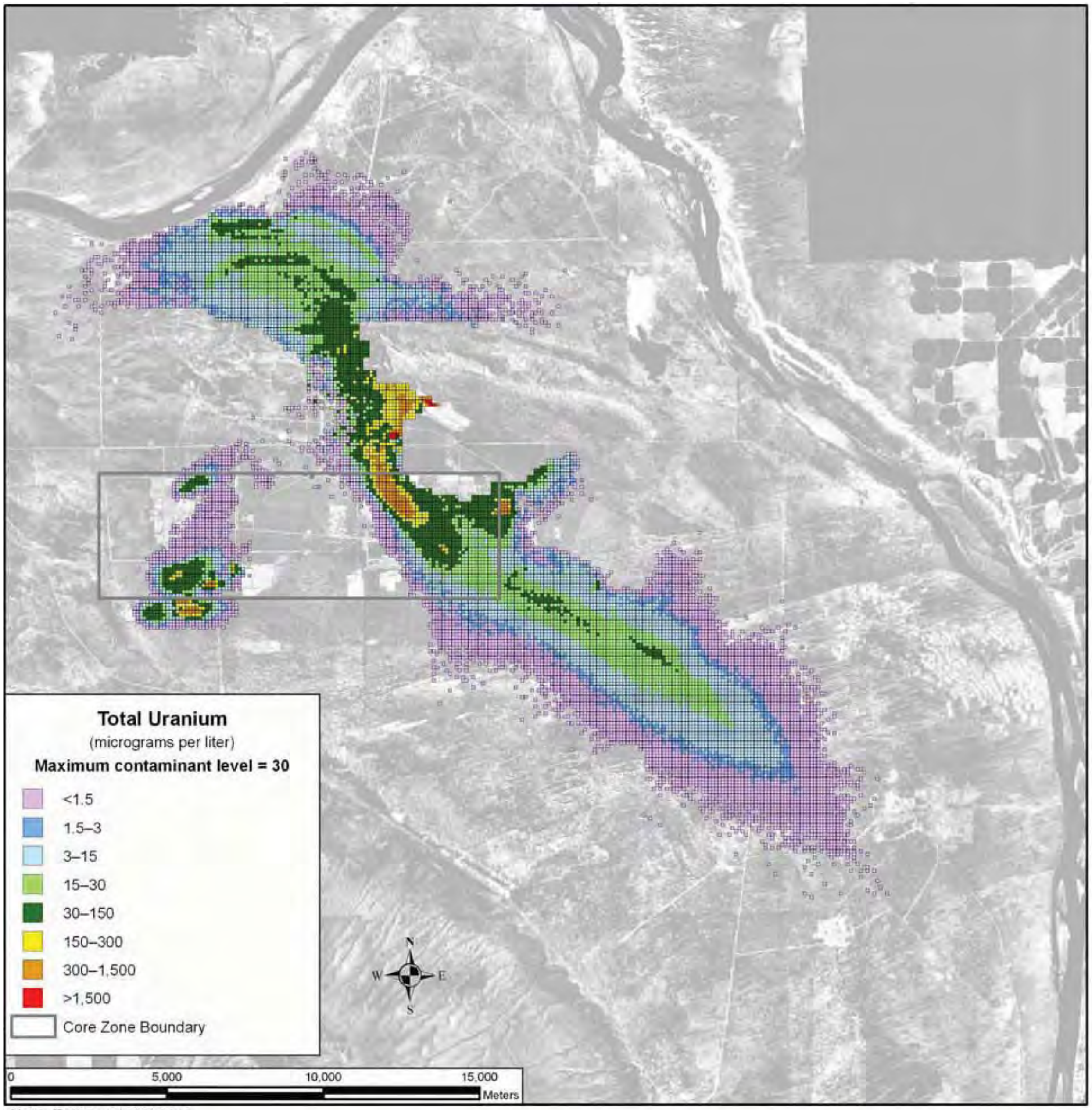


Figure U–43. Spatial Distribution of Groundwater Nitrate Concentration (Non–*TC & WM EIS* Sources), Calendar Year 11,885



Note: To convert meters to feet, multiply by 3.281

Figure U–44. Spatial Distribution of Groundwater Total Uranium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2005

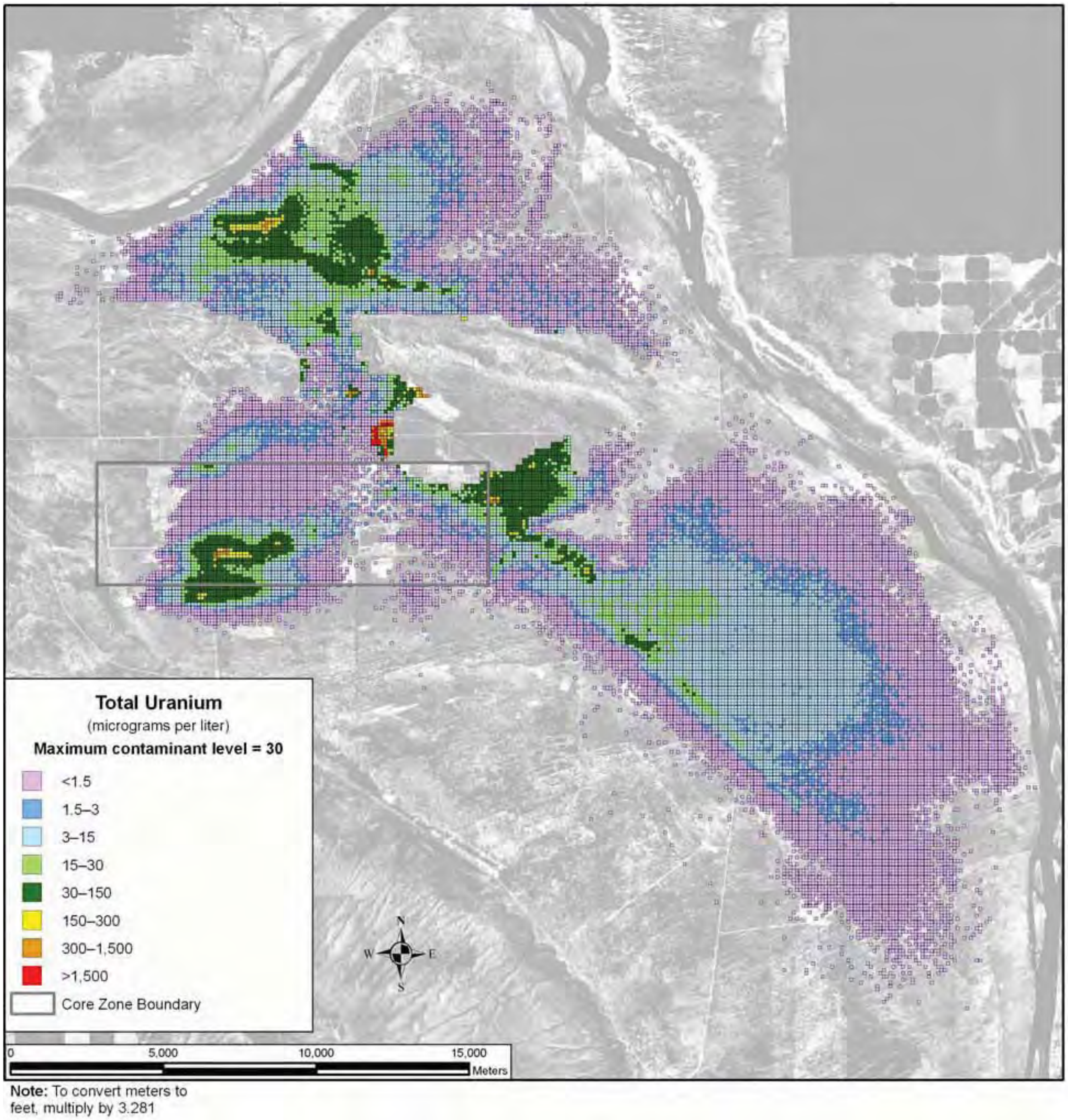


Figure U–45. Spatial Distribution of Groundwater Total Uranium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 2135

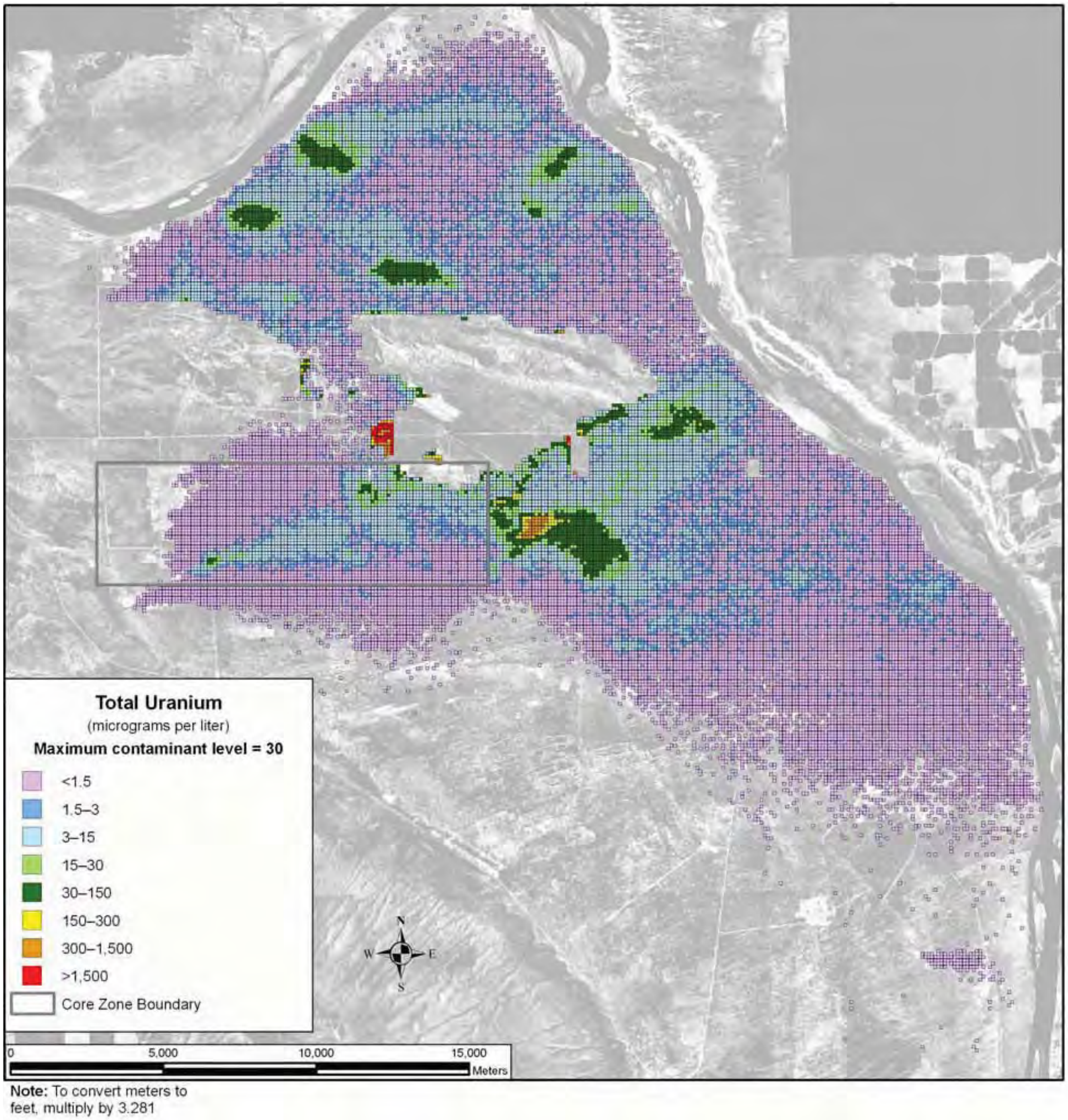


Figure U–46. Spatial Distribution of Groundwater Total Uranium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 3890

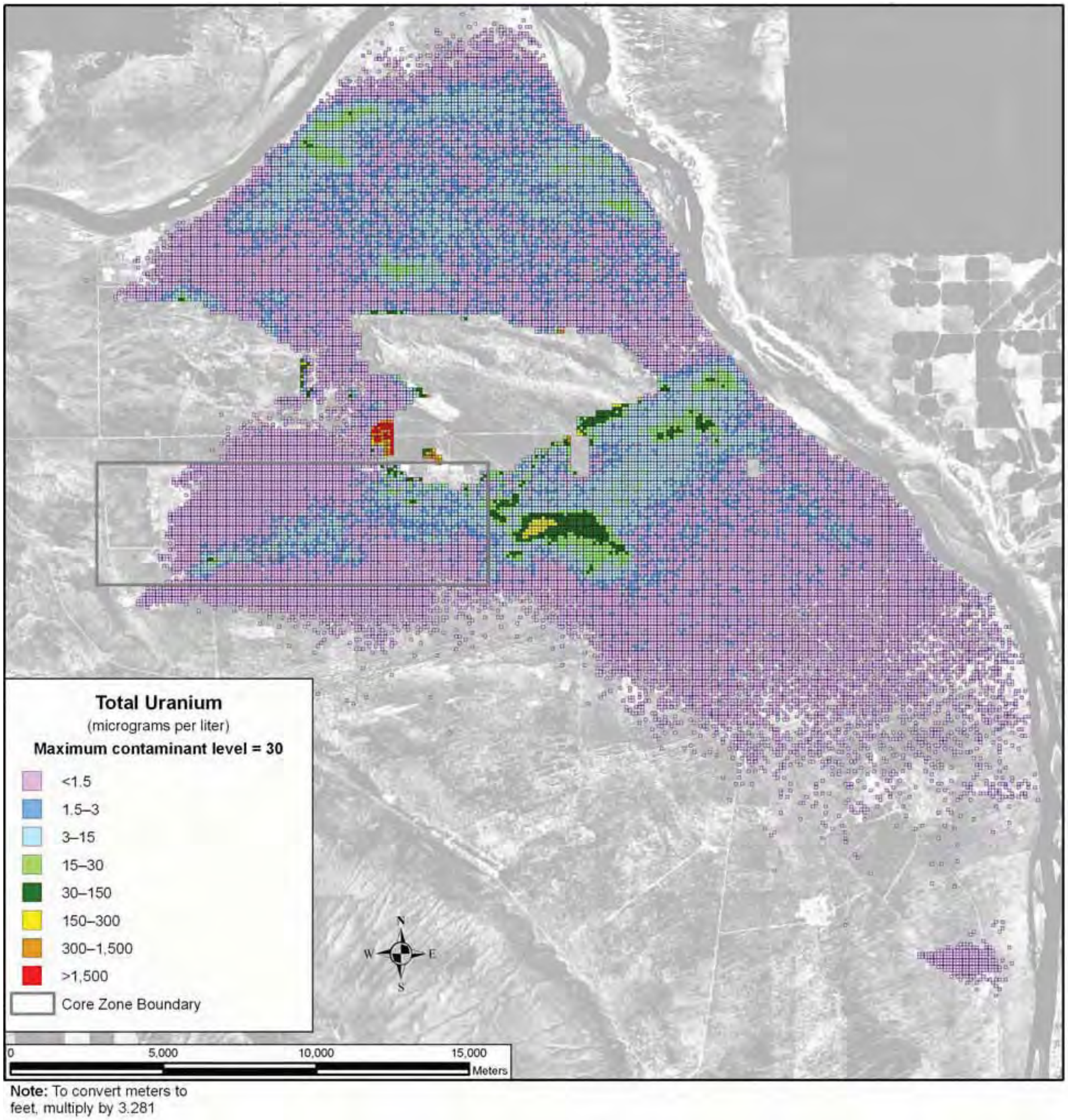
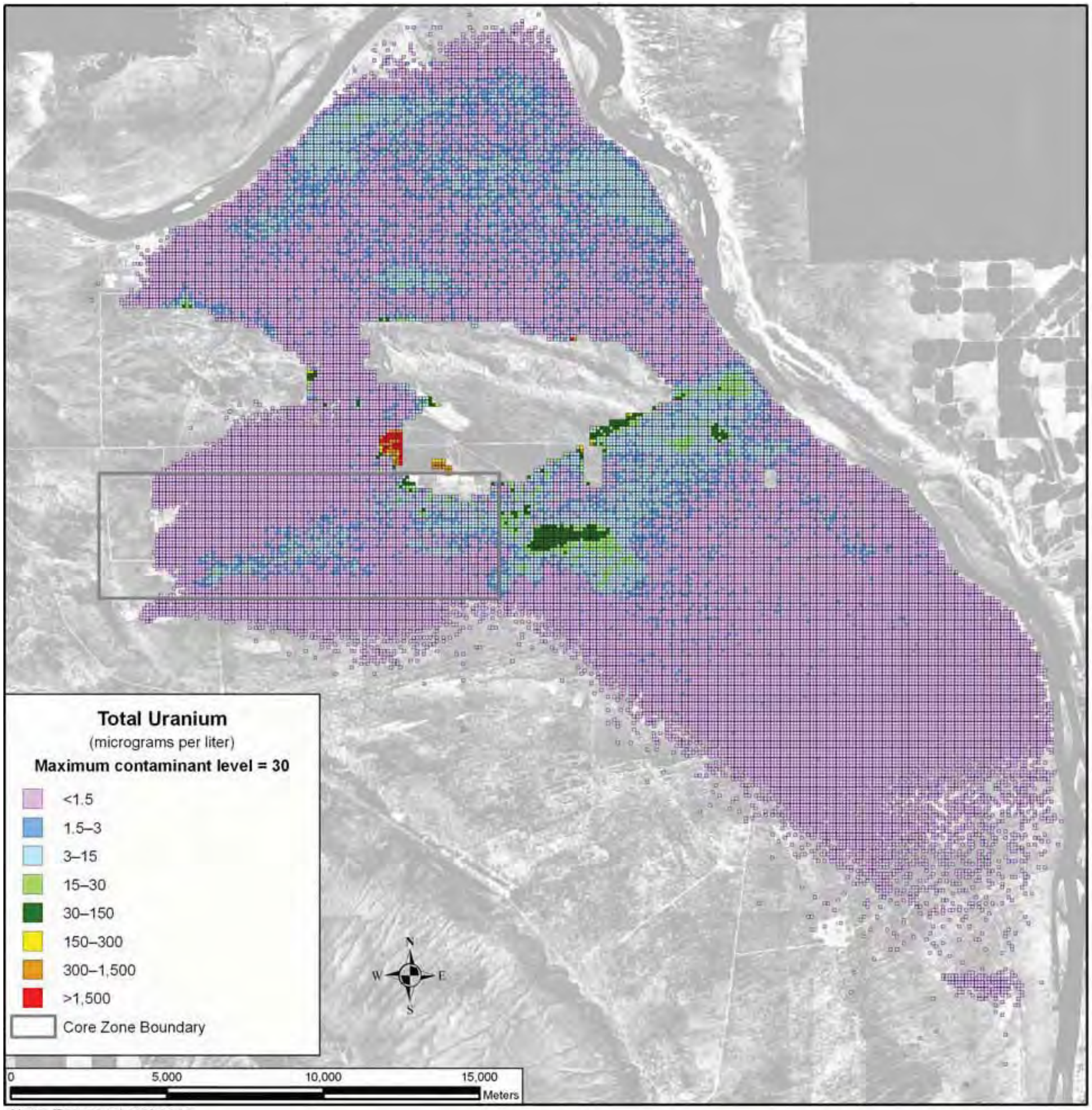


Figure U–47. Spatial Distribution of Groundwater Total Uranium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 7140



Note: To convert meters to feet, multiply by 3.281

Figure U–48. Spatial Distribution of Groundwater Total Uranium Concentration (Non–*TC & WM EIS* Sources), Calendar Year 11,885

U.2 HUMAN HEALTH

This section presents the results of the long-term cumulative impacts analysis for human health. The same methodology used for the alternatives analysis was used to analyze cumulative impacts. A description of this methodology is presented in Appendix Q.

The long-term human health impacts due to release of radionuclides are estimated as dose and as lifetime risk of incidence of cancer. Potential human health impacts due to release of chemical constituents include both carcinogenic effects and other forms of toxicity. Impacts of carcinogenic chemicals are estimated as lifetime risk of incidence of cancer. Noncarcinogenic effects are estimated as a Hazard Quotient, the ratio of the long-term intake of an individual chemical to the intake that produces no observable effect, and as a Hazard Index, the sum of the Hazard Quotient of a group of individual chemical constituents.

As with the individual alternatives, four measures of human health impacts are considered in this analysis—lifetime risk of developing cancer from radiological constituents, lifetime risk of developing cancer from chemical constituents, dose from radiological constituents, and Hazard Index from chemical constituents. These measures are calculated each year for 10,000 years for applicable receptors at three locations of analysis (i.e., Core Zone Boundary, Columbia River nearshore, and Columbia River surface water). This is a large amount of information that must be summarized to allow interpretation of results. The method chosen is to present dose for the year of maximum dose, risk for the year of maximum risk, and Hazard Index for the year of maximum Hazard Index. This choice is based on regulation of radiological impacts as dose and the observation that peak risk and peak noncarcinogenic impacts expressed as Hazard Index may occur at times other than that of peak dose.

The three onsite locations of analysis are the Core Zone Boundary, the Columbia River nearshore, and the Columbia River. The offsite location of analysis is for population centers downstream of the site. The total offsite population is assumed to be 5 million people.

Consistent with DOE guidance (DOE Guide 435.1-1), the potential consequences of loss of administrative or institutional control are considered by estimations of impacts on onsite receptors. Because DOE does not anticipate loss of control of the site, these onsite receptors are considered hypothetical and are used to develop estimates for past and future periods of time.

Four types of receptors are considered. The first type, a drinking-water well user, uses groundwater as a source of drinking water. The second type, a resident farmer, uses groundwater for drinking water consumption and irrigation of crops. Garden size and crop yield are adequate to produce approximately 25 percent of average requirements of crops and animal products. The third type, an American Indian resident farmer, also uses groundwater for drinking water consumption and irrigation of crops. Garden size and crop yield are adequate to produce the entirety of average requirements of crops and animal products. The fourth type, an American Indian hunter-gatherer, is impacted by both groundwater and surface water because he drinks surface water and consumes both wild plant materials, which use groundwater, and game animals, which use surface water.

The significance of dose impacts is evaluated by comparison against the 100-millirem-per-year all-pathway standard specified for protection of the public and the environment in DOE Order 5400.5. The level of protection provided for the drinking water pathway is evaluated by comparison against applicable drinking water standards presented in Chapter 5, Section 5.1.1. The significance of noncarcinogenic chemical health effects is evaluated by comparison against a Hazard Index guideline value of less than unity.

Potential human health impacts of the past, present, and reasonably foreseeable future actions (non–*TC & WM EIS* actions) are summarized in Tables U–3 through U–5. The key radiological constituent contributors to human health risk are tritium, carbon-14, strontium-90, technetium-99, iodine-129, cesium-137, uranium isotopes, neptunium-237, and plutonium isotopes. The chemical risk and hazard drivers are 1-butanol, carbon tetrachloride, chromium, fluoride, hydrazine/hydrazine sulfate, manganese, mercury, nickel (soluble salts), nitrate, total uranium, and trichloroethylene. As shown in Tables U–3 through U–5, the peak radiological dose and risk have already occurred for all locations and all receptors. For the peak Hazard Index and nonradiological risk, the peak has either already occurred or would occur between the years 2200 and 2500. For the period of time prior to calendar year 2000, lifetime radiological risks for the year of peak risk at the Core Zone Boundary and Columbia River locations were high, approaching unity. For the period after calendar year 2000, risks remain high, with values between 1×10^{-3} and 1×10^{-2}. The estimate of radiological dose for the years of peak dose for the offsite population is 215 person-rem per year, approximately 0.01 percent of the average background dose.

Table U–3. Human Health Impacts of Past, Present, and Reasonably Foreseeable Future Non–*TC & WM EIS* Actions at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radioactive Constituent	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	1.04×10^{-1}	1.22×10^{4}	1.16×10^{-1}	1.04×10^{-1}	1.94×10^{4}	2.02×10^{-1}	1.04×10^{-1}	3.56×10^{4}	4.04×10^{-1}
Carbon-14	3.87×10^{-5}	6.21×10^{1}	1.31×10^{-3}	3.87×10^{-5}	1.25×10^{2}	2.95×10^{-3}	3.87×10^{-5}	4.10×10^{2}	1.04×10^{-2}
Strontium-90	1.79×10^{-4}	1.31×10^{4}	2.19×10^{-1}	1.79×10^{-4}	1.68×10^{4}	3.14×10^{-1}	1.79×10^{-4}	2.79×10^{4}	5.95×10^{-1}
Technetium-99	2.24×10^{-7}	3.92×10^{-1}	1.35×10^{-5}	2.24×10^{-7}	1.01	4.42×10^{-5}	2.24×10^{-7}	2.05	9.64×10^{-5}
Iodine-129	5.24×10^{-9}	1.49	1.70×10^{-5}	5.24×10^{-9}	1.73	2.29×10^{-5}	5.24×10^{-9}	2.14	3.30×10^{-5}
Cesium-137	2.47×10^{-13}	9.00×10^{-6}	1.64×10^{-10}	2.47×10^{-13}	7.78×10^{-4}	1.74×10^{-8}	2.47×10^{-13}	2.34×10^{-3}	5.25×10^{-8}
Uranium isotopes (includes U-233, -234, -235, -238)	1.47×10^{-6}	1.83×10^{2}	2.07×10^{-3}	1.47×10^{-6}	1.90×10^{2}	2.21×10^{-3}	1.47×10^{-6}	2.03×10^{2}	2.50×10^{-3}
Neptunium-237	4.64×10^{-8}	1.36×10^{1}	6.28×10^{-5}	4.64×10^{-8}	1.37×10^{1}	6.59×10^{-5}	4.64×10^{-8}	1.64×10^{1}	7.42×10^{-5}
Total	1.04×10^{-1}	2.55×10^{4}	3.38×10^{-1}	1.04×10^{-1}	3.65×10^{4}	5.22×10^{-1}	1.04×10^{-1}	6.42×10^{4}	1.00
Year of peak impact	1997	1997	1997	1997	1997	1997	1997	1997	1997
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
1-Butanol	7.89×10^{-1}	2.25×10^{-1}	0.00	7.89×10^{-1}	4.09×10^{-1}	0.00	7.89×10^{-1}	1.14	0.00
Carbon tetrachloride	3.35	1.37×10^{2}	5.33×10^{-3}	3.35	8.59×10^{2}	3.35×10^{-2}	3.35	3.74×10^{3}	1.46×10^{-1}
Chromium	1.88	1.79×10^{1}	0.00	1.88	1.79×10^{1}	7.38×10^{-9}	1.88	2.62×10^{1}	3.38×10^{-4}
Fluoride	1.44×10^{1}	6.87	0.00	1.44×10^{1}	7.07	0.00	1.44×10^{1}	7.60	0.00
Manganese	6.96×10^{-7}	1.42×10^{-7}	0.00	6.96×10^{-7}	1.82×10^{-7}	0.00	6.96×10^{-7}	8.25×10^{-7}	0.00
Mercury	4.69×10^{-4}	4.47×10^{-2}	0.00	4.69×10^{-4}	5.91×10^{-2}	0.00	4.69×10^{-4}	8.80×10^{-2}	0.00
Nitrate	9.65×10^{2}	1.72×10^{1}	0.00	9.65×10^{2}	2.27×10^{1}	0.00	9.65×10^{2}	4.45×10^{1}	0.00
Total uranium	5.57×10^{-1}	5.31	0.00	5.57×10^{-1}	5.37	0.00	5.57×10^{-1}	5.56	0.00
Total	9.86×10^{2}	1.84×10^{2}	5.33×10^{-3}	9.86×10^{2}	9.13×10^{2}	3.35×10^{-2}	9.86×10^{2}	3.83×10^{3}	1.46×10^{-1}
Year of peak impact	2270	2270	2270	2270	2270	2270	2270	2270	2270

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington.*

Table U–4. Human Health Impacts of Past, Present, and Reasonably Foreseeable Future Non–*TC & WM EIS* Actions at the Columbia River Nearshore

Radioactive Constituent	Drinking-Water Well User: Concentration at Year of Peak Dose (curies per cubic meter)	Drinking-Water Well User: Dose at Year of Peak Dose (millirem per year)	Drinking-Water Well User: Radiological Risk at Year of Peak Radiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	Resident Farmer: Dose at Year of Peak Dose (millirem per year)	Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Dose (curies per cubic meter)	American Indian Resident Farmer: Dose at Year of Peak Dose (millirem per year)	American Indian Resident Farmer: Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	3.76×10^{-3}	4.39×10^{2}	4.17×10^{-3}	2.90×10^{-3}	5.39×10^{2}	5.63×10^{-3}	2.90×10^{-3}	9.91×10^{2}	1.12×10^{-2}
Carbon-14	1.06×10^{-7}	1.70×10^{-1}	3.60×10^{-6}	8.53×10^{-8}	2.77×10^{-1}	6.51×10^{-6}	8.53×10^{-8}	9.03×10^{-1}	2.29×10^{-5}
Strontium-90	4.16×10^{-3}	3.04×10^{5}	1.00	3.88×10^{-3}	3.65×10^{5}	1.00	3.88×10^{-3}	6.05×10^{5}	1.00
Technetium-99	1.12×10^{-6}	1.96	6.74×10^{-5}	1.23×10^{-7}	5.53×10^{-1}	2.43×10^{-5}	1.23×10^{-7}	1.13	5.30×10^{-5}
Iodine-129	2.90×10^{-9}	8.27×10^{-1}	9.41×10^{-6}	1.68×10^{-9}	5.54×10^{-1}	7.33×10^{-6}	1.68×10^{-9}	6.84×10^{-1}	1.06×10^{-5}
Cesium-137	9.63×10^{-4}	3.51×10^{4}	6.41×10^{-1}	1.31×10^{-3}	4.14×10^{6}	1.00	1.31×10^{-3}	1.24×10^{7}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	7.36×10^{-6}	9.14×10^{2}	1.03×10^{-2}	9.38×10^{-6}	1.21×10^{3}	1.41×10^{-2}	9.38×10^{-6}	1.29×10^{3}	1.59×10^{-2}
Neptunium-237	1.04×10^{-8}	3.03	1.40×10^{-5}	1.03×10^{-8}	3.06	1.47×10^{-5}	1.03×10^{-8}	3.65	1.65×10^{-5}
Plutonium isotopes (includes Pu-239, -240)	2.94×10^{-6}	1.99×10^{3}	8.68×10^{-3}	3.33×10^{-6}	2.36×10^{3}	1.06×10^{-2}	3.33×10^{-6}	2.92×10^{3}	1.23×10^{-2}
Total	8.89×10^{-3}	3.42×10^{5}	1.00	8.10×10^{-3}	4.51×10^{6}	1.00	8.10×10^{-3}	1.31×10^{7}	1.00
Year of peak impact	1991	1991	1991	1985	1985	1985	1985	1985	1985

Chemical Constituent	Drinking-Water Well User: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Drinking-Water Well User: Hazard Index at Year of Peak Hazard Index (unitless)	Drinking-Water Well User: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	American Indian Resident Farmer: Concentration at Year of Peak Hazard Index (grams per cubic meter)	American Indian Resident Farmer: Hazard Index at Year of Peak Hazard Index (unitless)	American Indian Resident Farmer: Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
Carbon tetrachloride	1.10×10^{-3}	4.49×10^{-2}	9.66×10^{-5}	1.10×10^{-3}	2.82×10^{-1}	6.07×10^{-4}	1.10×10^{-3}	1.23	4.79×10^{-5}
Chromium	1.61×10^{1}	1.53×10^{2}	0.00	1.61×10^{1}	1.54×10^{2}	4.27×10^{-10}	1.61×10^{1}	2.24×10^{2}	2.90×10^{-3}
Fluoride	1.35×10^{1}	6.44	0.00	1.35×10^{1}	6.63	0.00	1.35×10^{1}	7.13	0.00
Manganese	1.50×10^{-5}	3.07×10^{-6}	0.00	1.50×10^{-5}	3.93×10^{-6}	0.00	1.50×10^{-5}	1.78×10^{-5}	0.00
Mercury	1.76×10^{-2}	1.67	0.00	1.76×10^{-2}	2.22	0.00	1.76×10^{-2}	3.30	0.00
Nitrate	4.04×10^{2}	7.22	0.00	4.04×10^{2}	9.50	0.00	4.04×10^{2}	1.86×10^{1}	0.00
Total uranium	5.03	4.79×10^{1}	0.00	5.03	4.85×10^{1}	0.00	5.03	5.02×10^{1}	0.00
Total	4.39×10^{2}	2.17×10^{2}	9.66×10^{-5}	4.39×10^{2}	2.21×10^{2}	6.07×10^{-4}	4.39×10^{2}	3.05×10^{2}	2.95×10^{-3}
Year of peak impact	1978	1978	2527	1978	1978	2527	1978	1978	1978

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington.*

Table U–5. Human Health Impacts of Past, Present, and Reasonably Foreseeable Future Non–*TC & WM EIS* Actions at the Columbia River Surface Water

Radioactive Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	2.56×10^{-8}	4.75×10^{-3}	4.96×10^{-8}	2.56×10^{-8}	8.84×10^{-3}	1.00×10^{-7}	2.90×10^{-3}	9.15×10^{2}	1.12×10^{-2}
Carbon-14	2.35×10^{-14}	8.40×10^{-8}	2.01×10^{-12}	2.35×10^{-14}	6.65×10^{-5}	1.81×10^{-9}	8.53×10^{-8}	5.93×10^{-2}	1.62×10^{-6}
Strontium-90	3.35×10^{-10}	3.16×10^{-2}	5.89×10^{-7}	3.35×10^{-10}	4.82×10^{-1}	9.99×10^{-6}	3.88×10^{-3}	2.32×10^{5}	1.00
Technetium-99	1.56×10^{-12}	7.04×10^{-6}	3.09×10^{-10}	1.56×10^{-12}	1.63×10^{-5}	7.70×10^{-10}	1.23×10^{-7}	1.35×10^{-3}	7.40×10^{-8}
Iodine-129	6.94×10^{-14}	2.30×10^{-5}	3.05×10^{-10}	6.94×10^{-14}	3.75×10^{-4}	9.02×10^{-9}	1.68×10^{-9}	3.33×10^{-3}	8.16×10^{-8}
Cesium-137	1.64×10^{-12}	5.18×10^{-3}	1.16×10^{-7}	1.64×10^{-12}	2.54×10^{-2}	5.70×10^{-7}	1.31×10^{-3}	8.32×10^{6}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	1.06×10^{-11}	1.37×10^{-3}	1.59×10^{-8}	1.06×10^{-11}	3.77×10^{-3}	5.33×10^{-8}	9.38×10^{-6}	9.33×10^{1}	1.18×10^{-3}
Neptunium-237	4.31×10^{-15}	1.28×10^{-6}	6.12×10^{-12}	4.31×10^{-15}	1.25×10^{-5}	7.54×10^{-11}	1.03×10^{-8}	3.28×10^{-1}	1.67×10^{-6}
Plutonium isotopes (includes Pu-239, -240)	6.75×10^{-15}	4.87×10^{-6}	2.19×10^{-11}	6.75×10^{-15}	7.62×10^{-4}	4.27×10^{-9}	3.33×10^{-6}	3.63×10^{2}	1.32×10^{-3}
Total	2.59×10^{-8}	4.29×10^{-2}	7.71×10^{-7}	2.59×10^{-8}	5.22×10^{-1}	1.07×10^{-5}	8.10×10^{-3}	8.56×10^{6}	1.00
Year of peak impact	1985	1985	1985	1985	1985	1985	1985	1985	1985

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
1-Butanol	0.00	0.00	0.00	0.00	0.00	0.00	1.77×10^{-3}	2.05×10^{-3}	0.00
Boron and compounds	0.00	0.00	0.00	0.00	0.00	0.00	1.20×10^{-4}	1.19×10^{-6}	0.00
Carbon tetrachloride	5.25×10^{-7}	1.35×10^{-4}	3.41×10^{-8}	2.31×10^{-7}	2.67×10^{-4}	7.93×10^{-9}	6.07×10^{-2}	6.53×10^{1}	5.94×10^{-3}
Chromium	8.06×10^{-5}	7.68×10^{-4}	2.92×10^{-14}	7.88×10^{-5}	1.20×10^{-3}	1.01×10^{-10}	1.09×10^{-1}	2.40×10^{-1}	9.79×10^{-6}
Fluoride	3.70×10^{-5}	1.81×10^{-5}	0.00	2.92×10^{-5}	2.02×10^{-5}	0.00	2.15	3.15×10^{-1}	0.00
Hydrazine/hydrazine sulfate	0.00	0.00	0.00	0.00	0.00	6.09×10^{-7}	8.72×10^{-13}	3.18×10^{-210}	4.09×10^{-10}
Manganese	2.59×10^{-15}	6.78×10^{-16}	0.00	2.59×10^{-15}	1.05×10^{-14}	0.00	8.97×10^{-2}	5.67×10^{-2}	0.00

Table U–5. Human Health Impacts of Past, Present, and Reasonably Foreseeable Future Non–*TC & WM EIS* Actions at the Columbia River Surface Water *(continued)*

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Mercury	2.92×10^{-12}	3.69×10^{-10}	0.00	1.95×10^{-14}	6.88×10^{-11}	0.00	5.62×10^{-6}	2.15×10^{-4}	0.00
Nickel (soluble salts)	0.00	0.00	0.00	0.00	0.00	0.00	3.94×10^{-1}	7.35×10^{-1}	0.00
Nitrate	1.97×10^{-3}	6.79×10^{-5}	0.00	2.68×10^{-3}	2.52×10^{-1}	0.00	1.08×10^{1}	4.39×10^{-1}	0.00
Total uranium	1.59×10^{-5}	1.53×10^{-4}	0.00	1.61×10^{-5}	2.14×10^{-4}	0.00	7.39×10^{-2}	3.28×10^{-2}	0.00
Trichloroethylene (TCE)	0.00	0.00	0.00	0.00	0.00	5.06×10^{-10}	1.87×10^{-12}	7.28×10^{-10}	3.74×10^{-14}
Total	2.10×10^{-3}	1.14×10^{-3}	3.41×10^{-8}	2.81×10^{-3}	2.54×10^{-1}	6.18×10^{-7}	2.05×10^{1}	6.71×10^{1}	5.95×10^{-3}
Year of peak impact	1965	1965	1990	1962	1962	3243	2527	2527	2527

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Key: *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington.*

Potential human health impacts of Alternative Combination 1, with the past, present, and reasonably foreseeable future (non–*TC & WM EIS*) actions discussed above, are summarized in Tables U–6 through U–8. The key radiological constituent contributors to human health risk are tritium, carbon-14, strontium-90, technetium-99, iodine-129, cesium-137, uranium isotopes, neptunium-237, and plutonium isotopes. The chemical risk and hazard drivers are 1-butanol, acetonitrile, boron and boron compounds, carbon tetrachloride, chromium, fluoride, hydrazine/hydrazine sulfate, manganese, mercury, nickel (soluble salts), nitrate, total uranium, and trichloroethylene. The impacts of Alternative Combination 1 are dominated by the impacts of non–*TC & WM EIS* sources. The estimate of radiological dose for the year of peak dose for the offsite population is 215 person-rem per year, approximately 0.01 percent of average background dose.

Table U–6. Alternative Combination 1 Cumulative Human Health Impacts at the Core Zone Boundary

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radioactive Constituent	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	1.04×10^{-1}	1.22×10^{4}	1.16×10^{-1}	1.04×10^{-1}	1.94×10^{4}	2.03×10^{-1}	1.04×10^{-1}	3.56×10^{4}	4.04×10^{-1}
Carbon-14	3.87×10^{-5}	6.21×10^{1}	1.31×10^{-3}	3.87×10^{-5}	1.25×10^{2}	2.95×10^{-3}	3.87×10^{-5}	4.10×10^{2}	1.04×10^{-2}
Strontium-90	1.79×10^{-4}	1.31×10^{4}	2.19×10^{-1}	1.79×10^{-4}	1.68×10^{4}	3.14×10^{-1}	1.79×10^{-4}	2.79×10^{4}	5.95×10^{-1}
Technetium-99	2.98×10^{-6}	5.22	1.79×10^{-4}	2.98×10^{-6}	1.34×10^{1}	5.88×10^{-4}	2.98×10^{-6}	2.73×10^{1}	1.28×10^{-3}
Iodine-129	7.65×10^{-9}	2.18	2.48×10^{-5}	7.65×10^{-9}	2.53	3.35×10^{-5}	7.65×10^{-9}	3.12	4.82×10^{-5}
Cesium-137	2.47×10^{-13}	9.00×10^{-6}	1.64×10^{-10}	2.47×10^{-13}	7.78×10^{-4}	1.74×10^{-8}	2.47×10^{-13}	2.34×10^{3}	5.25×10^{-8}
Uranium isotopes (includes U-233, -234, -235, -238)	1.47×10^{-6}	1.83×10^{2}	2.07×10^{-3}	1.47×10^{-5}	1.90×10^{2}	2.21×10^{-3}	1.47×10^{-6}	2.03×10^{2}	2.50×10^{-3}
Neptunium-237	4.64×10^{-8}	1.36×10^{1}	6.28×10^{-5}	4.64×10^{-8}	1.37×10^{1}	6.59×10^{-5}	4.64×10^{-8}	1.64×10^{1}	7.42×10^{-5}
Total	1.04×10^{-1}	2.55×10^{4}	3.38×10^{-1}	1.04×10^{-1}	3.66×10^{4}	5.22×10^{-1}	1.04×10^{-1}	6.42×10^{4}	1.00
Year of peak impact	1997	1997	1997	1997	1997	1997	1997	1997	1997
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
1-Butanol	2.61×10^{-2}	7.47×10^{-3}	0.00	7.89×10^{-1}	4.09×10^{-1}	0.00	7.89×10^{-1}	1.14	0.00
Acetonitrile	0.00	0.00	0.00	1.61×10^{-2}	9.56×10^{-2}	0.00	1.61×10^{-2}	1.73×10^{-1}	0.00
Carbon tetrachloride	4.06×10^{-1}	1.66×10^{1}	5.33×10^{-3}	3.35	8.59×10^{2}	3.35×10^{-2}	3.35	3.74×10^{3}	1.46×10^{-1}
Chromium	2.94×10^{1}	2.80×10^{2}	0.00	3.19	3.04×10^{1}	1.25×10^{-8}	3.19	4.44×10^{1}	5.75×10^{-4}
Fluoride	2.59	1.23	0.00	1.44×10^{1}	7.07	0.00	1.44×10^{1}	7.60	0.00
Manganese	0.00	0.00	0.00	6.96×10^{-7}	1.82×10^{-7}	0.00	6.96×10^{-7}	8.25×10^{-7}	0.00
Mercury	0.00	0.00	0.00	4.69×10^{-4}	5.91×10^{-2}	0.00	4.69×10^{-4}	8.80×10^{-2}	0.00
Nitrate	1.36×10^{4}	2.43×10^{2}	0.00	1.35×10^{3}	3.17×10^{1}	0.00	1.35×10^{3}	6.21×10^{1}	0.00
Total uranium	1.28×10^{-1}	1.22	0.00	5.57×10^{-1}	5.37	0.00	5.57×10^{-1}	5.56	0.00
Total	1.36×10^{4}	5.42×10^{2}	5.33×10^{-3}	1.37×10^{3}	9.34×10^{2}	3.35×10^{-2}	1.37×10^{3}	3.86×10^{3}	1.47×10^{-1}
Year of peak impact	1956	1956	2270	2270	2270	2270	2270	2270	2270

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table U–7. Alternative Combination 1 Cumulative Human Health Impacts at the Columbia River Nearshore

Radioactive Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	3.76×10^{-3}	4.39×10^{2}	4.17×10^{-3}	2.90×10^{-3}	5.39×10^{2}	5.63×10^{-3}	2.90×10^{-3}	9.91×10^{2}	1.12×10^{-2}
Carbon-14	1.06×10^{-7}	1.70×10^{-1}	3.60×10^{-6}	8.53×10^{-8}	2.77×10^{-1}	6.51×10^{-6}	8.53×10^{-8}	9.03×10^{-1}	2.29×10^{-5}
Strontium-90	4.16×10^{-3}	3.04×10^{5}	1.00	3.88×10^{-3}	3.65×10^{5}	1.00	3.88×10^{-3}	6.05×10^{5}	1.00
Technetium-99	1.15×10^{-6}	2.01	6.90×10^{-5}	1.36×10^{-7}	6.10×10^{-1}	2.68×10^{-5}	1.36×10^{-7}	1.24	5.84×10^{-5}
Iodine-129	2.93×10^{-9}	8.35×10^{-1}	9.50×10^{-6}	1.71×10^{-9}	5.65×10^{-1}	7.48×10^{-6}	1.71×10^{-9}	6.98×10^{-1}	1.08×10^{-5}
Cesium-137	9.63×10^{-4}	3.51×10^{4}	6.41×10^{-1}	1.31×10^{-3}	4.14×10^{6}	1.00	1.31×10^{-3}	1.24×10^{7}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	7.36×10^{-6}	9.14×10^{2}	1.03×10^{-2}	9.38×10^{-6}	1.21×10^{3}	1.41×10^{-2}	9.38×10^{-6}	1.29×10^{3}	1.59×10^{-2}
Neptunium-237	1.04×10^{-8}	3.03	1.40×10^{-5}	1.03×10^{-8}	3.06	1.47×10^{-5}	1.03×10^{-8}	3.65	1.65×10^{-5}
Plutonium isotopes (includes Pu-239, -240)	2.94×10^{-6}	1.99×10^{3}	8.68×10^{-3}	3.33×10^{-6}	2.36×10^{3}	1.06×10^{-2}	3.33×10^{-6}	2.92×10^{3}	1.23×10^{-2}
Total	8.89×10^{-3}	3.42×10^{5}	1.00	8.10×10^{-3}	4.51×10^{6}	1.00	8.10×10^{-3}	1.31×10^{7}	1.00
Year of peak impact	1991	1991	1991	1985	1985	1985	1985	1985	1985
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Carbon tetrachloride	1.10×10^{-3}	4.49×10^{-2}	9.66×10^{-5}	1.10×10^{-3}	2.82×10^{-1}	6.07×10^{-4}	1.10×10^{-3}	1.23	4.79×10^{-5}
Chromium	1.61×10^{1}	1.53×10^{2}	0.00	1.61×10^{1}	1.54×10^{2}	5.55×10^{-10}	1.61×10^{1}	2.24×10^{2}	2.90×10^{-3}
Fluoride	1.35×10^{1}	6.44	0.00	1.35×10^{1}	6.63	0.00	1.35×10^{1}	7.13	0.00
Manganese	1.50×10^{-5}	3.07×10^{-6}	0.00	1.50×10^{-5}	3.93×10^{-6}	0.00	1.50×10^{-5}	1.78×10^{-5}	0.00
Mercury	1.76×10^{-2}	1.67	0.00	1.76×10^{-2}	2.22	0.00	1.76×10^{-2}	3.30	0.00
Nitrate	4.08×10^{2}	7.29	0.00	4.08×10^{2}	9.59	0.00	4.08×10^{2}	1.88×10^{1}	0.00
Total uranium	5.03	4.79×10^{1}	0.00	5.03	4.85×10^{1}	0.00	5.03	5.02×10^{1}	0.00
Total	4.43×10^{2}	2.17×10^{2}	9.66×10^{-5}	4.43×10^{2}	2.21×10^{2}	6.07×10^{-4}	4.43×10^{2}	3.05×10^{2}	2.95×10^{-3}
Year of peak impact	1978	1978	2527	1978	1978	2527	1978	1978	1978

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table U–8. Alternative Combination 1 Cumulative Human Health Impacts pat the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radioactive Constituent	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	2.56×10^{-8}	4.76×10^{-3}	4.97×10^{-8}	2.56×10^{-8}	8.85×10^{-3}	1.00×10^{-7}	2.90×10^{-3}	9.15×10^{2}	1.12×10^{-2}
Carbon-14	2.35×10^{-14}	8.40×10^{-8}	2.01×10^{-12}	2.35×10^{-14}	6.65×10^{-5}	1.81×10^{-9}	8.53×10^{-8}	5.93×10^{-2}	1.62×10^{-6}
Strontium-90	3.35×10^{-10}	3.16×10^{-2}	5.89×10^{-7}	3.35×10^{-10}	4.82×10^{-1}	9.99×10^{-6}	3.88×10^{-3}	2.32×10^{5}	1.00
Technetium-99	8.15×10^{-12}	3.67×10^{-5}	1.61×10^{-9}	8.15×10^{-12}	8.47×10^{-5}	4.01×10^{-9}	1.36×10^{-7}	1.53×10^{-3}	8.34×10^{-8}
Iodine-129	7.79×10^{-14}	2.58×10^{-5}	3.42×10^{-10}	7.79×10^{-14}	4.21×10^{-4}	1.01×10^{-8}	1.71×10^{-9}	3.49×10^{-3}	8.54×10^{-8}
Cesium-137	1.64×10^{-12}	5.18×10^{-3}	1.16×10^{-7}	1.64×10^{-12}	2.54×10^{-2}	5.70×10^{-7}	1.31×10^{-3}	8.32×10^{6}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	1.06×10^{-11}	1.37×10^{-3}	1.59×10^{-8}	1.06×10^{-11}	3.77×10^{-3}	5.33×10^{-8}	9.38×10^{-6}	9.33×10^{1}	1.18×10^{-3}
Neptunium-237	4.31×10^{-15}	1.28×10^{-6}	6.12×10^{-12}	4.31×10^{-15}	1.25×10^{-5}	7.54×10^{-11}	1.03×10^{-8}	3.28×10^{-1}	1.67×10^{-6}
Plutonium isotopes (includes Pu-239, -240)	6.75×10^{-15}	4.87×10^{-6}	2.19×10^{-11}	6.75×10^{-15}	7.62×10^{-4}	4.27×10^{-9}	3.33×10^{-6}	3.63×10^{2}	1.32×10^{-3}
Total	2.60×10^{-8}	4.30×10^{-2}	7.73×10^{-7}	2.60×10^{-8}	5.22×10^{-1}	1.07×10^{-5}	8.10×10^{-3}	8.56×10^{6}	1.00
Year of peak impact	1985	1985	1985	1985	1985	1985	1985	1985	1985
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
1-Butanol	0.00	0.00	0.00	0.00	0.00	0.00	1.77×10^{-3}	2.05×10^{-3}	0.00
Acetonitrile	0.00	0.00	0.00	0.00	0.00	0.00	2.12×10^{-3}	1.26×10^{-2}	0.00
Boron and compounds	0.00	0.00	0.00	0.00	0.00	0.00	1.20×10^{-4}	1.19×10^{-6}	0.00
Carbon tetrachloride	3.25×10^{-6}	8.35×10^{-4}	3.41×10^{-8}	2.31×10^{-7}	2.67×10^{-4}	7.93×10^{-9}	6.07×10^{-2}	6.53×10^{1}	5.94×10^{-3}
Chromium	2.23×10^{-5}	2.12×10^{-4}	5.10×10^{-14}	8.32×10^{-5}	1.27×10^{-3}	5.05×10^{-10}	1.41×10^{-1}	3.12×10^{-1}	1.27×10^{-5}
Fluoride	4.63×10^{-5}	2.27×10^{-5}	0.00	2.92×10^{-5}	2.02×10^{-5}	0.00	2.15	3.15×10^{-1}	0.00
Hydrazine/hydrazine sulfate	0.00	0.00	0.00	0.00	0.00	6.09×10^{-7}	8.72×10^{-13}	3.18×10^{-210}	4.09×10^{-10}

Table U–8. Alternative Combination 1 Cumulative Human Health Impacts at the Columbia River Surface Water *(continued)*

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Manganese	8.07×10^{-13}	2.11×10^{-13}	0.00	2.59×10^{-15}	1.05×10^{-14}	0.00	8.97×10^{-2}	5.67×10^{-2}	0.00
Mercury	1.30×10^{-9}	1.64×10^{-7}	0.00	1.95×10^{-14}	6.88×10^{-11}	0.00	5.62×10^{-6}	2.15×10^{-4}	0.00
Nickel (soluble salt)	7.20×10^{-19}	1.31×10^{-18}	0.00	0.00	0.00	0.00	3.94×10^{-1}	7.35×10^{-1}	0.00
Nitrate	3.46×10^{-3}	1.20×10^{-4}	0.00	4.90×10^{-3}	4.60×10^{-1}	0.00	2.03×10^{1}	8.10×10^{-1}	0.00
Total uranium	5.64×10^{-6}	5.43×10^{-5}	0.00	1.61×10^{-5}	2.14×10^{-4}	0.00	7.39×10^{-2}	3.28×10^{-2}	0.00
Trichloroethylene (TCE)	0.00	0.00	0.00	0.00	0.00	5.06×10^{-10}	1.87×10^{-12}	7.28×10^{-10}	3.74×10^{-14}
Total	3.54×10^{-3}	1.24×10^{-3}	3.41×10^{-8}	5.03×10^{-3}	4.62×10^{-1}	6.18×10^{-7}	3.01×10^{1}	6.76×10^{1}	5.95×10^{-3}
Year of peak impact	1984	1984	1990	1962	1962	3243	2527	2527	2527

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Potential human health impacts of Alternative Combination 2, with the past, present, and reasonably foreseeable future (non–*TC & WM EIS*) actions discussed above, are summarized in Tables U–9 through U–11. The key radiological constituent contributors to human health risk are tritium, carbon-14, strontium-90, technetium-99, iodine-129, cesium-137, uranium isotopes, neptunium-237, and plutonium isotopes. The chemical risk and hazard drivers are 1-butanol, boron compounds, carbon tetrachloride, chromium, fluoride, hydrazine/hydrazine sulfate, manganese, mercury, nickel (soluble salts), nitrate, total uranium, and trichloroethylene. The impacts of Alternative Combination 2 are dominated by the impacts of non–*TC & WM EIS* sources. The estimate of radiological dose for the year of peak dose for the offsite population is 215 person-rem per year, approximately 0.01 percent of the average background dose.

Table U–9. Alternative Combination 2 Cumulative Human Health Impacts at the Core Zone Boundary

Radioactive Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	1.04×10^{-1}	1.22×10^{4}	1.16×10^{-1}	1.04×10^{-1}	1.94×10^{4}	2.03×10^{-1}	1.04×10^{-1}	3.56×10^{4}	4.04×10^{-1}
Carbon-14	3.87×10^{-5}	6.21×10^{1}	1.31×10^{-3}	3.87×10^{-5}	1.25×10^{2}	2.95×10^{-3}	3.87×10^{-5}	4.10×10^{2}	1.04×10^{-2}
Strontium-90	1.79×10^{-4}	1.31×10^{4}	2.19×10^{-1}	1.79×10^{-4}	1.68×10^{4}	3.14×10^{-1}	1.79×10^{-4}	2.79×10^{4}	5.95×10^{-1}
Technetium-99	1.78×10^{-6}	3.11	1.07×10^{-4}	1.78×10^{-6}	7.99	3.51×10^{-4}	1.78×10^{-6}	1.63×10^{1}	7.66×10^{-4}
Iodine-129	8.79×10^{-9}	2.50	2.85×10^{-5}	8.79×10^{-9}	2.91	3.85×10^{-5}	8.79×10^{-9}	3.59	5.54×10^{-5}
Cesium-137	2.47×10^{-13}	9.00×10^{-6}	1.64×10^{-10}	2.47×10^{-13}	7.78×10^{-4}	1.74×10^{-8}	2.47×10^{-3}	2.34×10^{-3}	5.25×10^{-8}
Uranium isotopes (includes U-233, -234, -235, -238)	1.47×10^{-6}	1.83×10^{2}	2.07×10^{-3}	1.47×10^{-6}	1.90×10^{2}	2.21×10^{-3}	1.47×10^{-6}	2.03×10^{2}	2.50×10^{-3}
Neptunium-237	4.64×10^{-8}	1.36×10^{1}	6.28×10^{-5}	4.64×10^{-8}	1.37×10^{1}	6.59×10^{-5}	4.64×10^{-8}	1.64×10^{1}	7.42×10^{-5}
Total	1.04×10^{-1}	2.55×10^{4}	3.38×10^{-1}	1.04×10^{-1}	3.66×10^{4}	5.22×10^{-1}	1.04×10^{-1}	6.42×10^{4}	1.00
Year of peak impact	1997	1997	1997	1997	1997	1997	1997	1997	1997
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
1-Butanol	2.61×10^{-2}	7.47×10^{-3}	0.00	7.89×10^{-1}	4.09×10^{-1}	0.00	7.89×10^{-1}	1.14	0.00
Carbon tetrachloride	4.06×10^{-1}	1.66×10^{1}	5.33×10^{-3}	3.35	8.59×10^{2}	3.35×10^{-2}	3.35	3.74×10^{3}	1.46×10^{-1}
Chromium	2.88×10^{1}	2.74×10^{2}	0.00	2.84	2.70×10^{1}	1.11×10^{-8}	2.84	3.95×10^{1}	5.11×10^{-4}
Fluoride	2.59	1.23	0.00	1.44×10^{1}	7.07	0.00	1.44×10^{1}	7.60	0.00
Manganese	0.00	0.00	0.00	6.96×10^{-7}	1.82×10^{-7}	0.00	6.96×10^{-7}	8.25×10^{-7}	0.00
Mercury	0.00	0.00	0.00	4.69×10^{-4}	5.91×10^{-2}	0.00	4.69×10^{-4}	8.80×10^{-2}	0.00
Nitrate	1.31×10^{4}	2.34×10^{2}	0.00	1.48×10^{3}	3.48×10^{1}	0.00	1.48×10^{3}	6.83×10^{1}	0.00
Total uranium	1.28×10^{-1}	1.22	0.00	5.57×10^{-1}	5.37	0.00	5.57×10^{-1}	5.56	0.00
Total	1.32×10^{4}	5.27×10^{2}	5.33×10^{-3}	1.50×10^{3}	9.34×10^{2}	3.35×10^{-2}	1.50×10^{3}	3.86×10^{3}	1.46×10^{-1}
Year of peak impact	1956	1956	2270	2270	2270	2270	2270	2270	2270

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table U–10. Alternative Combination 2 Cumulative Human Health Impacts at the Columbia River Nearshore

Radioactive Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	3.76×10^{-3}	4.39×10^{2}	4.17×10^{-3}	2.90×10^{-3}	5.39×10^{2}	5.63×10^{-3}	2.90×10^{-3}	9.91×10^{2}	1.12×10^{-2}
Carbon-14	1.06×10^{-7}	1.70×10^{-1}	3.60×10^{-6}	8.53×10^{-8}	2.77×10^{-1}	6.51×10^{-6}	8.53×10^{-8}	9.03×10^{-1}	2.29×10^{-5}
Strontium-90	4.16×10^{-3}	3.04×10^{5}	1.00	3.88×10^{-3}	3.65×10^{5}	1.00	3.88×10^{-3}	6.05×10^{5}	1.00
Technetium-99	1.13×10^{-6}	1.98	6.82×10^{-5}	1.49×10^{-7}	6.71×10^{-1}	2.95×10^{-5}	1.49×10^{-7}	1.37	6.43×10^{-5}
Iodine-129	2.94×10^{-9}	8.38×10^{-1}	9.54×10^{-6}	1.70×10^{-9}	5.60×10^{-1}	7.42×10^{-6}	1.70×10^{-9}	6.92×10^{-1}	1.07×10^{-5}
Cesium-137	9.63×10^{-4}	3.51×10^{4}	6.41×10^{-1}	1.31×10^{-3}	4.14×10^{6}	1.00	1.31×10^{-3}	1.24×10^{7}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	7.36×10^{-6}	9.14×10^{2}	1.03×10^{-2}	9.38×10^{-6}	1.21×10^{3}	1.41×10^{-2}	9.38×10^{-6}	1.29×10^{3}	1.59×10^{-2}
Neptunium-237	1.04×10^{-8}	3.03	1.40×10^{-5}	1.03×10^{-8}	3.06	1.47×10^{-5}	1.03×10^{-8}	3.65	1.65×10^{-5}
Plutonium isotopes (includes Pu-239, -240)	2.94×10^{-6}	1.99×10^{3}	8.68×10^{-3}	3.33×10^{-6}	2.36×10^{3}	1.06×10^{-2}	3.33×10^{-6}	2.92×10^{3}	1.23×10^{-2}
Total	8.89×10^{-3}	3.42×10^{5}	1.00	8.10×10^{-3}	4.51×10^{6}	1.00	8.10×10^{-3}	1.31×10^{7}	1.00
Year of peak impact	1991	1991	1991	1985	1985	1985	1985	1985	1985

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Carbon tetrachloride	1.10×10^{-3}	4.49×10^{-2}	9.66×10^{-5}	1.10×10^{-3}	2.82×10^{-1}	6.07×10^{-4}	1.10×10^{-3}	1.23	4.79×10^{-5}
Chromium	1.61×10^{1}	1.53×10^{2}	0.00	1.61×10^{1}	1.54×10^{2}	5.13×10^{-10}	1.61×10^{1}	2.24×10^{2}	2.90×10^{-3}
Fluoride	1.35×10^{1}	6.44	0.00	1.35×10^{1}	6.63	0.00	1.35×10^{1}	7.13	0.00
Manganese	1.50×10^{-5}	3.07×10^{-6}	0.00	1.50×10^{-5}	3.93×10^{-6}	0.00	1.50×10^{-5}	1.78×10^{-5}	0.00
Mercury	1.76×10^{-2}	1.67	0.00	1.76×10^{-2}	2.22	0.00	1.76×10^{-2}	3.30	0.00

Table U-10. Alternative Combination 2 Cumulative Human Health Impacts at the Columbia River Nearshore *(continued)*

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Nitrate	4.08×10^{2}	7.28	0.00	4.08×10^{2}	9.59	0.00	4.08×10^{2}	1.88×10^{1}	0.00
Total uranium	5.03	4.79×10^{1}	0.00	5.03	4.85×10^{1}	0.00	5.03	5.02×10^{1}	0.00
Total	4.42×10^{2}	2.17×10^{2}	9.66×10^{-5}	4.42×10^{2}	2.21×10^{2}	6.07×10^{-4}	4.42×10^{2}	3.05×10^{2}	2.95×10^{-3}
Year of peak impact	1978	1978	2527	1978	1978	2527	1978	1978	1978

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table U–11. Alternative Combination 2 Cumulative Human Health Impacts at the Columbia River Surface Water

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Radioactive Constituent	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	2.56×10^{-8}	4.76×10^{-3}	4.98×10^{-8}	2.56×10^{-9}	8.86×10^{-3}	1.01×10^{-7}	2.90×10^{-3}	9.15×10^{2}	1.12×10^{-2}
Carbon-14	2.35×10^{-14}	8.40×10^{-8}	2.01×10^{-12}	2.35×10^{-14}	6.65×10^{-5}	1.81×10^{-9}	8.53×10^{-8}	5.93×10^{-2}	1.62×10^{-6}
Strontium-90	3.35×10^{-10}	3.16×10^{-2}	5.89×10^{-7}	3.35×10^{-10}	4.82×10^{-1}	9.99×10^{-6}	3.88×10^{-3}	2.32×10^{5}	1.00
Technetium-99	7.24×10^{-12}	3.26×10^{-5}	1.43×10^{-9}	7.24×10^{-12}	7.52×10^{-5}	3.56×10^{-9}	1.49×10^{-7}	1.67×10^{-3}	9.13×10^{-8}
Iodine-129	7.73×10^{-14}	2.56×10^{-5}	3.39×10^{-10}	7.73×10^{-14}	4.18×10^{-4}	1.00×10^{-8}	1.70×10^{-9}	3.46×10^{-3}	8.47×10^{-8}
Cesium-137	1.64×10^{-12}	5.18×10^{-3}	1.16×10^{-7}	1.64×10^{-12}	2.54×10^{-2}	5.70×10^{-7}	1.31×10^{-3}	8.32×10^{6}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	1.06×10^{-11}	1.37×10^{-3}	1.59×10^{-8}	1.06×10^{-11}	3.77×10^{-3}	5.33×10^{-8}	9.38×10^{-6}	9.33×10^{1}	1.18×10^{-3}
Neptunium-237	4.31×10^{-15}	1.28×10^{-6}	6.12×10^{-12}	4.31×10^{-15}	1.25×10^{-5}	7.54×10^{-11}	1.03×10^{-8}	3.28×10^{-1}	1.67×10^{-6}
Plutonium isotopes (includes Pu-239, -240)	6.75×10^{-15}	4.87×10^{-6}	2.19×10^{-11}	6.75×10^{-15}	7.62×10^{-4}	4.27×10^{-9}	3.33×10^{-6}	3.63×10^{2}	1.32×10^{-3}
Total	2.60×10^{-8}	4.30×10^{-2}	7.73×10^{-7}	2.60×10^{-8}	5.22×10^{-1}	1.07×10^{-5}	8.10×10^{-3}	8.56×10^{6}	1.00
Year of peak impact	1985	1985	1985	1985	1985	1985	1985	1985	1985
	Resident Farmer			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
1-Butanol	0.00	0.00	0.00	0.00	0.00	0.00	1.77×10^{-3}	2.05×10^{-3}	0.00
Boron and compounds	0.00	0.00	0.00	0.00	0.00	0.00	1.20×10^{-4}	1.19×10^{-6}	0.00
Carbon tetrachloride	3.25×10^{-6}	8.35×10^{-4}	3.41×10^{-8}	2.31×10^{-7}	2.67×10^{-4}	7.93×10^{-9}	6.07×10^{-2}	6.53×10^{1}	5.94×10^{-3}
Chromium	2.26×10^{-5}	2.15×10^{-4}	5.16×10^{-14}	8.31×10^{-5}	1.27×10^{-3}	1.38×10^{-10}	1.31×10^{-1}	2.88×10^{-1}	1.18×10^{-5}
Fluoride	4.63×10^{-5}	2.27×10^{-5}	0.00	2.92×10^{-5}	2.02×10^{-5}	0.00	2.15	3.15×10^{-1}	0.00
Hydrazine/hydrazine sulfate	0.00	0.00	0.00	0.00	0.00	6.09×10^{-7}	8.72×10^{-13}	3.18×10^{-210}	4.09×10^{-10}
Manganese	8.07×10^{-13}	2.11×10^{-13}	0.00	2.59×10^{-5}	1.05×10^{-14}	0.00	8.97×10^{-2}	5.67×10^{-2}	0.00
Mercury	1.30×10^{-9}	1.64×10^{-7}	0.00	1.95×10^{-14}	6.88×10^{-11}	0.00	5.62×10^{-6}	2.15×10^{-4}	0.00

Table U–11. Alternative Combination 2 Cumulative Human Health Impacts at the Columbia River Surface Water *(continued)*

Chemical Constituent	**Resident Farmer**			**American Indian Resident Farmer**			**American Indian Hunter-Gatherer**		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Nickel (soluble salts)	7.20×10^{-19}	1.31×10^{-18}	0.00	0.00	0.00	0.00	3.94×10^{-1}	7.35×10^{-1}	0.00
Nitrate	3.47×10^{-3}	1.20×10^{-4}	0.00	4.86×10^{-3}	4.57×10^{-1}	0.00	1.65×10^{1}	6.65×10^{-1}	0.00
Total uranium	5.64×10^{-6}	5.43×10^{-5}	0.00	1.61×10^{-5}	2.14×10^{-4}	0.00	7.39×10^{-2}	3.28×10^{-2}	0.00
Trichloroethylene (TCE)	0.00	0.00	0.00	0.00	0.00	5.06×10^{-10}	1.87×10^{-12}	7.28×10^{-10}	3.74×10^{-14}
Total	3.55×10^{-3}	1.25×10^{-3}	3.41×10^{-8}	4.99×10^{-3}	4.59×10^{-1}	6.18×10^{-7}	2.63×10^{1}	6.74×10^{1}	5.95×10^{-3}
Year of peak impact	1984	1984	1990	1962	1962	3243	2527	2527	2527

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Potential human health impacts of Alternative Combination 3, with the past, present, and reasonably foreseeable future (non–*TC & WM EIS*) actions discussed above, are summarized in Tables U–12 through U–14. The key radiological constituent contributors to human health risk are tritium, carbon-14, strontium-90, technetium-99, iodine-129, cesium-137, uranium isotopes, neptunium-237, and plutonium isotopes. The chemical risk and hazard drivers are 1-butanol, boron and boron compounds, carbon tetrachloride, chromium, fluoride, hydrazine/hydrazine sulfate, manganese, mercury, nickel (soluble salts), nitrate, total uranium, and trichloroethylene. The impacts of Alternative Combination 3 are dominated by the impacts of non–*TC & WM EIS* sources. The estimate of radiological dose for the year of peak dose for the offsite population is 215 person-rem per year, approximately 0.01 percent of the average background dose.

With the addition of the alternative combinations to the past, present, and reasonably foreseeable future (non–*TC & WM EIS*) actions, and comparing among the alternative combinations, the peaks for the dose, risk, and Hazard Index occur at similar times and concentrations. A more-detailed discussion of the results of the cumulative impact analyses is presented in Chapter 6.

Table U–12. Alternative Combination 3 Cumulative Human Health Impacts at the Core Zone Boundary

Radioactive Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Dose (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	1.04×10^{-1}	1.22×10^{4}	1.16×10^{-1}	1.04×10^{-1}	1.94×10^{4}	2.03×10^{-1}	1.04×10^{-1}	3.56×10^{4}	4.04×10^{-1}
Carbon-14	3.87×10^{-5}	6.21×10^{1}	1.31×10^{-3}	3.87×10^{-5}	1.25×10^{2}	2.95×10^{-3}	3.87×10^{-5}	4.10×10^{2}	1.04×10^{-2}
Strontium-90	1.79×10^{-4}	1.31×10^{4}	2.19×10^{-1}	1.79×10^{-4}	1.68×10^{4}	3.14×10^{-1}	1.79×10^{-4}	2.79×10^{4}	5.95×10^{-1}
Technetium-99	1.85×10^{-6}	3.24	1.11×10^{-4}	1.85×10^{-6}	8.31	3.65×10^{-4}	1.85×10^{-6}	1.69×10^{1}	7.96×10^{-4}
Iodine-129	8.46×10^{-9}	2.41	2.74×10^{-5}	8.46×10^{-9}	2.80	3.70×10^{-5}	8.46×10^{-9}	3.45	5.33×10^{-5}
Cesium-137	2.47×10^{-13}	9.00×10^{-6}	1.64×10^{-10}	2.47×10^{-13}	7.78×10^{-4}	1.74×10^{-8}	2.47×10^{-13}	2.34×10^{-3}	5.25×10^{-8}
Uranium isotopes (includes U-233, -234, -235, -238)	1.47×10^{-6}	1.83×10^{2}	2.07×10^{-3}	1.47×10^{-6}	1.90×10^{2}	2.21×10^{-3}	1.47×10^{-6}	2.03×10^{2}	2.50×10^{-3}
Neptunium-237	4.64×10^{-8}	1.36×10^{1}	6.28×10^{-5}	4.64×10^{-8}	1.37×10^{1}	6.59×10^{-5}	4.64×10^{-8}	1.64×10^{1}	7.42×10^{-5}
Total	1.04×10^{-1}	2.55×10^{4}	3.38×10^{-1}	1.04×10^{-1}	3.66×10^{4}	5.22×10^{-1}	1.04×10^{-1}	6.42×10^{4}	1.00
Year of peak impact	1997	1997	1997	1997	1997	1997	1997	1997	1997

Chemical Constituent	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
1-Butanol	2.61×10^{-2}	7.47×10^{-3}	0.00	7.89×10^{-1}	4.09×10^{-1}	0.00	7.89×10^{-1}	1.14	0.00
Carbon tetrachloride	4.06×10^{-1}	1.66×10^{1}	5.33×10^{-3}	3.35	8.59×10^{2}	3.35×10^{-2}	3.35	3.74×10^{3}	1.46×10^{-1}
Chromium	2.88×10^{1}	2.74×10^{2}	0.00	2.77	2.64×10^{1}	1.09×10^{-8}	2.77	3.86×10^{1}	4.99×10^{-4}
Fluoride	2.59	1.23	0.00	1.44×10^{1}	7.07	0.00	1.44×10^{1}	7.60	0.00
Manganese	0.00	0.00	0.00	6.96×10^{-7}	1.82×10^{-7}	0.00	6.96×10^{-7}	8.25×10^{-7}	0.00
Mercury	0.00	0.00	0.00	4.69×10^{-4}	5.91×10^{-2}	0.00	4.69×10^{-4}	8.80×10^{-2}	0.00
Nitrate	1.31×10^{4}	2.34×10^{2}	0.00	1.48×10^{3}	3.47×10^{1}	0.00	1.48×10^{3}	6.81×10^{1}	0.00
Total uranium	1.28×10^{-1}	1.22	0.00	5.57×10^{-1}	5.37	0.00	5.57×10^{-1}	5.56	0.00
Total	1.32×10^{4}	5.27×10^{2}	5.33×10^{-3}	1.50×10^{3}	9.33×10^{2}	3.35×10^{-2}	1.50×10^{3}	3.86×10^{3}	1.46×10^{-1}
Year of peak impact	1956	1956	2270	2270	2270	2270	2270	2270	2270

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table U–13. Alternative Combination 3 Cumulative Human Health Impacts at the Columbia River Nearshore

	Drinking-Water Well User			Resident Farmer			American Indian Resident Farmer		
Radioactive Constituent	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)	**Concentration at Year of Peak Dose** (curies per cubic meter)	**Dose at Year of Peak Dose** (millirem per year)	**Radiological Risk at Year of Peak Radiological Risk** (unitless)
Hydrogen-3 (tritium)	3.76×10^{-3}	4.39×10^{2}	4.17×10^{-3}	2.90×10^{-3}	5.39×10^{2}	5.63×10^{-3}	2.90×10^{-3}	9.91×10^{2}	1.12×10^{-2}
Carbon-14	1.06×10^{-7}	1.70×10^{-1}	3.60×10^{-6}	8.53×10^{-8}	2.77×10^{-1}	6.51×10^{-6}	8.53×10^{-8}	9.03×10^{-1}	2.29×10^{-5}
Strontium-90	4.16×10^{-3}	3.04×10^{5}	1.00	3.88×10^{-3}	3.65×10^{5}	1.00	3.88×10^{-3}	6.05×10^{5}	1.00
Technetium-99	1.13×10^{-6}	1.98	6.82×10^{-5}	1.49×10^{-7}	6.72×10^{-1}	2.95×10^{-5}	1.49×10^{-7}	1.37	6.44×10^{-5}
Iodine-129	2.94×10^{-9}	8.38×10^{-1}	9.54×10^{-6}	1.70×10^{-9}	5.61×10^{-1}	7.42×10^{-6}	1.70×10^{-9}	6.92×10^{-1}	1.07×10^{-5}
Cesium-137	9.63×10^{-4}	3.51×10^{4}	6.41×10^{-1}	1.31×10^{-3}	4.14×10^{6}	1.00	1.31×10^{-3}	1.24×10^{7}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	7.36×10^{-6}	9.14×10^{2}	1.03×10^{-2}	9.38×10^{-6}	1.21×10^{3}	1.41×10^{-2}	9.38×10^{-6}	1.29×10^{3}	1.59×10^{-2}
Neptunium-237	1.04×10^{-8}	3.03	1.40×10^{-5}	1.03×10^{-8}	3.06	1.47×10^{-5}	1.03×10^{-8}	3.65	1.65×10^{-5}
Plutonium isotopes (includes Pu-239, -240)	2.94×10^{-6}	1.99×10^{3}	8.68×10^{-3}	3.33×10^{-6}	2.36×10^{3}	1.06×10^{-2}	3.33×10^{-6}	2.92×10^{3}	1.23×10^{-2}
Total	8.89×10^{-3}	3.42×10^{5}	1.00	8.10×10^{-3}	4.51×10^{6}	1.00	8.10×10^{-3}	1.31×10^{7}	1.00
Year of peak impact	1991	1991	1991	1985	1985	1985	1985	1985	1985
	Drinking-Water Well User			**Resident Farmer**			**American Indian Resident Farmer**		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Carbon tetrachloride	1.10×10^{-3}	4.49×10^{-2}	9.66×10^{-5}	1.10×10^{-3}	2.82×10^{-1}	6.07×10^{-4}	1.10×10^{-3}	1.23	4.79×10^{-5}
Chromium	1.61×10^{1}	1.53×10^{2}	0.00	1.61×10^{1}	1.54×10^{2}	5.11×10^{-10}	1.61×10^{1}	2.24×10^{2}	2.90×10^{-3}
Fluoride	1.35×10^{1}	6.44	0.00	1.35×10^{1}	6.63	0.00	1.35×10^{1}	7.13	0.00
Manganese	1.50×10^{-5}	3.07×10^{-6}	0.00	1.50×10^{-5}	3.93×10^{-6}	0.00	1.50×10^{-5}	1.78×10^{-5}	0.00
Mercury	1.76×10^{-2}	1.67	0.00	1.76×10^{-2}	2.22	0.00	1.76×10^{-2}	3.30	0.00
Nitrate	4.08×10^{2}	7.28	0.00	4.08×10^{2}	9.59	0.00	4.08×10^{2}	1.88×10^{1}	0.00
Total uranium	5.03	4.79×10^{1}	0.00	5.03	4.85×10^{1}	0.00	5.03	5.02×10^{1}	0.00
Total	4.42×10^{2}	2.17×10^{2}	9.66×10^{-5}	4.42×10^{2}	2.21×10^{2}	6.07×10^{-4}	4.42×10^{2}	3.05×10^{2}	2.95×10^{-3}
Year of peak impact	1978	1978	2527	1978	1978	2527	1978	1978	1978

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

Table U–14. Alternative Combination 3 Cumulative Human Health Impacts at the Columbia River Surface Water

Radioactive Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)	Concentration at Year of Peak Dose (curies per cubic meter)	Dose at Year of Peak Dose (millirem per year)	Radiological Risk at Year of Peak Radiological Risk (unitless)
Hydrogen-3 (tritium)	2.56×10^{-8}	4.76×10^{-3}	4.98×10^{-8}	2.56×10^{-8}	8.86×10^{-3}	1.01×10^{-7}	2.90×10^{-3}	9.15×10^{2}	1.12×10^{-2}
Carbon-14	2.35×10^{-14}	8.40×10^{-8}	2.01×10^{-12}	2.35×10^{-14}	6.65×10^{-5}	1.81×10^{-9}	8.53×10^{-8}	5.93×10^{-2}	1.62×10^{-6}
Strontium-90	3.35×10^{-10}	3.16×10^{-2}	5.89×10^{-7}	3.35×10^{-10}	4.82×10^{-1}	9.99×10^{-6}	3.88×10^{-3}	2.32×10^{5}	1.00
Technetium-99	7.24×10^{-12}	3.26×10^{-5}	1.43×10^{-9}	7.24×10^{-12}	7.52×10^{-5}	3.56×10^{-9}	1.49×10^{-7}	1.68×10^{-3}	9.14×10^{-8}
Iodine-129	7.73×10^{-14}	2.56×10^{-5}	3.39×10^{-10}	7.73×10^{-14}	4.18×10^{-4}	1.01×10^{-8}	1.70×10^{-9}	3.47×10^{-3}	8.48×10^{-8}
Cesium-137	1.64×10^{-12}	5.18×10^{-3}	1.16×10^{-7}	1.64×10^{-12}	2.54×10^{-2}	5.70×10^{-7}	1.31×10^{-3}	8.32×10^{6}	1.00
Uranium isotopes (includes U-233, -234, -235, -238)	1.06×10^{-11}	1.37×10^{-3}	1.59×10^{-8}	1.06×10^{-11}	3.77×10^{-3}	5.33×10^{-8}	9.38×10^{-6}	9.33×10^{1}	1.18×10^{-3}
Neptunium-237	4.31×10^{-15}	1.28×10^{-6}	6.12×10^{-12}	4.31×10^{-15}	1.25×10^{-5}	7.54×10^{-11}	1.03×10^{-8}	3.28×10^{-1}	1.67×10^{-6}
Plutonium isotopes (includes Pu-239, -240)	6.75×10^{-15}	4.87×10^{-6}	2.19×10^{-11}	6.75×10^{-15}	7.62×10^{-4}	4.27×10^{-9}	3.33×10^{-6}	3.63×10^{2}	1.32×10^{-3}
Total	2.60×10^{-8}	4.30×10^{-2}	7.73×10^{-7}	2.60×10^{-8}	5.22×10^{-1}	1.07×10^{-5}	8.10×10^{-3}	8.56×10^{6}	1.00
Year of peak impact	1985	1985	1985	1985	1985	1985	1985	1985	1985

Chemical Constituent	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)	Concentration at Year of Peak Hazard Index (grams per cubic meter)	Hazard Index at Year of Peak Hazard Index (unitless)	Nonradiological Risk at Year of Peak Nonradiological Risk (unitless)
1-Butanol	0.00	0.00	0.00	0.00	0.00	0.00	1.77×10^{-3}	2.05×10^{-3}	0.00
Boron and compounds	0.00	0.00	0.00	0.00	0.00	0.00	1.20×10^{-4}	1.19×10^{-6}	0.00
Carbon tetrachloride	3.25×10^{-6}	8.35×10^{-4}	3.41×10^{-8}	2.31×10^{-7}	2.67×10^{-4}	7.93×10^{-9}	6.07×10^{-2}	6.53×10^{1}	5.94×10^{-3}
Chromium	2.26×10^{-5}	2.15×10^{-4}	5.16×10^{-14}	8.31×10^{-5}	1.27×10^{-3}	1.32×10^{-10}	1.30×10^{-1}	2.87×10^{-1}	1.17×10^{-5}
Fluoride	4.63×10^{-5}	2.27×10^{-5}	0.00	2.92×10^{-5}	2.02×10^{-5}	0.00	2.15	3.15×10^{-1}	0.00
Hydrazine/hydrazine sulfate	0.00	0.00	0.00	0.00	0.00	6.09×10^{-7}	8.72×10^{-13}	3.18×10^{-210}	4.09×10^{-10}
Manganese	8.07×10^{-13}	2.11×10^{-13}	0.00	2.59×10^{-15}	1.05×10^{-14}	0.00	8.97×10^{-2}	5.67×10^{-2}	0.00

Table U–14. Alternative Combination 3 Cumulative Human Health Impacts at the Columbia River Surface Water *(continued)*

	Resident Farmer			American Indian Resident Farmer			American Indian Hunter-Gatherer		
Chemical Constituent	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)	**Concentration at Year of Peak Hazard Index** (grams per cubic meter)	**Hazard Index at Year of Peak Hazard Index** (unitless)	**Nonradiological Risk at Year of Peak Nonradiological Risk** (unitless)
Mercury	1.30×10^{-9}	1.64×10^{-7}	0.00	1.95×10^{-14}	6.88×10^{-11}	0.00	5.62×10^{-6}	2.15×10^{-4}	0.00
Nickel (soluble salts)	7.20×10^{-19}	1.31×10^{-18}	0.00	0.00	0.00	0.00	3.94×10^{-1}	7.35×10^{-1}	0.00
Nitrate	3.47×10^{-3}	1.20×10^{-4}	0.00	4.86×10^{-3}	4.57×10^{-1}	0.00	1.64×10^{1}	6.59×10^{-1}	0.00
Total uranium	5.64×10^{-6}	5.43×10^{-5}	0.00	1.61×10^{-5}	2.14×10^{-4}	0.00	7.39×10^{-2}	3.28×10^{-2}	0.00
Trichloroethylene (TCE)	0.00	0.00	0.00	0.00	0.00	5.06×10^{-10}	1.87×10^{-12}	7.28×10^{-10}	3.74×10^{-14}
Total	3.55×10^{-3}	1.25×10^{-3}	3.41×10^{-8}	4.99×10^{-3}	4.59×10^{-1}	6.18×10^{-7}	2.62×10^{1}	6.74×10^{1}	5.95×10^{-3}
Year of peak impact	1984	1984	1990	1962	1962	3243	2527	2527	2527

Note: Concentrations are those reported for groundwater at the specified location. Total concentrations, although reported, are not used in the analysis.

U.3 REFERENCES

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Hartman, M.J., and W.D. Webber, eds., 2008, *Hanford Site Groundwater Monitoring for Fiscal Year 200* , DOE/RL-2008-01, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington, March.

<u>Code of Federal Regulations</u>

40 CFR 141, U.S. Environmental Protection Agency, "National Primary Drinking Water Regulations."

40 CFR 1508.7, Council on Environmental Quality, "Terminology and Index: Cumulative Impact."

<u>U.S. Department of Energy Guides and Orders</u>

DOE Guide 435.1-1, *Implementation Guide for Use with DOE M 5.1-1*, July 9, 1999.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, Change 2, January 7, 1993.

APPENDIX V
BLACK ROCK RESERVOIR SENSITIVITY ANALYSIS

This appendix describes a variant of the regional-scale groundwater flow model for the Hanford Site.

V.1 BACKGROUND

The development of the *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)* Base Case flow model that was used to analyze long-term groundwater impacts for the alternative and cumulative impact analyses is presented in Appendix L. The variant discussed in this appendix is presented to provide information on the potential influence of a reasonably foreseeable future scenario—construction of the Black Rock Reservoir (BRR) west of the Hanford Site (Hanford). Previous studies (see Section V.3.1) suggested that leakage from this reservoir has the potential to impact groundwater elevations and flow velocities beneath Hanford, which could in turn affect the comparison of the long-term impacts of the alternatives examined in this *TC & WM EIS*.

V.2 SENSITIVITY ANALYSIS PURPOSE AND SCOPE

V.2.1 Purpose of Analysis

The overall goal of the analysis is to illustrate the consequences of leakage from the proposed BRR on the potential differences among *TC & WM EIS* alternatives with respect to long-term groundwater impacts.

Specific purposes of this analysis are to determine the following:

- The change in water table elevation and flow velocities beneath Hanford resulting from water flux added by leakage from the BRR.
- Potential changes in vadose zone contaminant transport times resulting from a shortened vadose zone.
- Potential changes in groundwater plume predictions resulting from mobilization of vadose zone contaminants under rising water table supply activities. Excluded are evaluation of the BRR's impact on human health and the environment, as well as the comprehensive, long-term (10,000-year) impacts of any alternative addressed in this *TC & WM EIS*.

V.2.2 Scope of Modeling Effort

The scope of the modeling effort included:

- Obtaining predictions of the additional groundwater flux induced by leakage from the proposed BRR from the U.S. Department of the Interior, Bureau of Reclamation (BOR)
- Inserting these fluxes into the Base Case MODFLOW [modular three-dimensional finite-difference groundwater flow model] and predicting changes in water table elevation and flow velocities
- Comparing the BRR flow field with the Base Case flow field
- Using the STOMP [Subsurface Transport Over Multiple Phases] model (see Appendix N) to predict vadose zone travel times under shortened vadose zone conditions

- Comparing the BRR and Base Case flow fields with respect to the time to appearance of peak concentrations of technetium-99 at the Columbia River from a 1-curie release from various 200 Area release locations

- Evaluating the results to determine any differential impacts across the *TC & WM EIS* alternatives

V.3 MODEL DEVELOPMENT

V.3.1 Previous Studies

In preparation of the BRR sensitivity analysis performed by Science Applications International Corporation (SAIC), the following documents were reviewed:

1. *Final Planning Report/Environmental Impact Statement, Yakima River Basin Water Storage Feasibility Study, Yakima Project, Washington*, December 2008 (BOR 2008)

   This document "examined the feasibility and acceptability of storage augmentation for the benefit of fish, irrigation, and future municipal water supply for the Yakima River basin." In efforts to supply additional water storage in the Yakima River basin, the document considered three alternatives other than the No Action Alternative: (1) the Black Rock Reservoir Alternative, (2) the Wymer Dam and Reservoir Alternative, and (3) the Wymer Dam plus Yakima River Pump Exchange Alternative. Other programmatic joint alternatives discussed within the document include the Enhanced Water Conservation Alternative, the Market-Based Reallocation of Water Resources Alternative, and the Groundwater Storage Alternative. For a variety of reasons, most notably issues related to the cost-benefit ratio assessments of each alternative, BOR identified the No Action Alternative as the Preferred Alternative. No site-specific Hanford Reservation groundwater modeling was performed for the examined alternatives. SAIC utilized the document for background knowledge regarding the Black Rock Reservoir Alternative.

2. *Modeling Groundwater Hydrologic Impacts of the Potential Black Rock Reservoir: A Component of the Yakima River Basin Water Storage Feasibility Study, Washington Pacific Northwest Region*, September 2007 (BOR 2007)

   As a component of the *Final Planning Report/Environmental Impact Statement, Yakima River Basin Water Storage Feasibility Study, Yakima Project, Washington* (discussed above), this document was published to further examine the Black Rock Reservoir Alternative. The report documents results pertaining to a potential groundwater seepage analysis of the BRR. The analysis quantifies potential reservoir seepage to surrounding aquifers and provides an indication of flow direction associated with the seepage. The modeling in this report, performed using various MODFLOW software packages, further characterizes potential impacts on the western boundary of Hanford (e.g., increased hydraulic head, estimated groundwater flux, surface-water discharge). The analysis does not examine proposed seepage mitigation controls nor examine potential site-specific impacts on the Hanford Reservation.

   This seepage analysis, performed by BOR, ultimately provided flux values along the western boundary of Hanford, which were used to develop SAIC's BRR variant flow field model discussed in this "Black Rock Reservoir Sensitivity Analysis." The BOR flux values used by SAIC were requested via a formal data request (Schmidt 2007). Further discussion of development of the BRR variant flow field model is included in Section V.3.2. Initially, two BRR permeability cases were developed for analysis as proposed by BOR—BRR Permeability Case 1 and BRR Permeability Case 2. During this analysis, direction was given to SAIC to only proceed with Permeability Case 2.

3. *Potential Impact of Leakage from Black Rock Reservoir on the Hanford Site Unconfined Aquifer: Initial Hypothetical Simulations of Flow and Contaminant Transport,* March 2007 (Freedman 2008)

   This analysis was performed by Pacific Northwest National Laboratory (PNNL) to identify potential impacts associated with the development of the BRR at Hanford. Simulated lateral recharge (or flux) along the western boundary of Hanford was calculated using water table elevations (hydraulic head values) no greater than the highest groundwater elevation attained in the Central Plateau of Hanford during the Hanford operational period. PNNL developed three steady state flow fields to assess the fate and transport of site contaminants; varying western boundary fluxes of (1) 27,000 acre-feet/year, (2) 16,000 acre-feet/year, and (3) a no additional flux Base Case of 365 acre-feet/year. The transport of four radionuclides (hydrogen-3 [tritium], iodine-129, technetium-99, and uranium-238) was modeled over a 300-year period. Simulated radionuclide concentration distributions across Hanford in 2005 were used as initial model conditions prior to running each model. Model transport analysis provided (1) peak concentration downstream and points of compliance, (2) areas of Hanford contaminated above drinking water standards, and (3) the total activity within the model domain at the end of transport simulation.

   PNNL's analysis results of all three simulated BRR models indicated that the models (1) "had little impact on regional flow directions," (2) "accelerated contaminant transport," and (3) "the accelerated transport caused dilution and a more-rapid decline of concentration relative to the Base Case." Further, PNNL results indicated that increased western boundary flux caused an increase in the highly retarded uranium-238, but the concentrations were found not to exceed drinking water standards. PNNL noted no significant effects of contaminant concentrations at the designated Hanford Core Zone or the Columbia River.

   No specific data or results derived from the PNNL study were used for the BRR variant flow field analysis discussed in this appendix. The PNNL study was used as background information only.

V.3.2 Relationship to *TC & WM EIS* Modeling Framework

The *TC & WM EIS* Base Case groundwater flow model was developed for input to the *TC & WM EIS* groundwater transport model, which is used for simulating the fate and transport of contaminants to analyze the alternatives and cumulative impacts. The Base Case groundwater flow model development and the associated flow field extraction methods are discussed in Appendix L. The *TC & WM EIS* Base Case groundwater transport model development and application are discussed in Appendix O.

The Base Case groundwater flow and transport models are calibrated to historical field observations of groundwater hydraulic heads and contaminant concentrations. This calibration to historical field observations provides an indication that the Base Case models can reasonably predict future hydraulic heads and contaminant concentrations. The calibrated results produced in the Base Case groundwater modeling simulations are used as inputs to the long-term impacts analysis in this *TC & WM EIS*.

The BRR is considered to be a reasonably foreseeable future scenario that may impact groundwater flow and transport beneath Hanford. BOR has developed a separate groundwater flow model that simulates the additional water flux to groundwater in areas surrounding the proposed reservoir, including Hanford.

The BOR flow model covers an area of about 4,480.7 square kilometers (1,730 square miles) with discrete model cells that range from 0.2 to 0.83 square kilometers (0.08 to 0.32 square miles) (Schmidt 2007). The *TC & WM EIS* groundwater flow model covers an area of about 1,942.5 square kilometers (750 square miles) with discrete model cells that cover 0.039 square kilometers (0.015 square miles) each. The larger scale and coarser gridding of the BOR model allow macro-level encoding of model properties and macro-level analysis, which are appropriate for the BOR study; however, the smaller scale and finer gridding of the *TC & WM EIS* Base Case flow model is preferred to make predictions about the impacts of the proposed reservoir on contaminant fate and transport beneath Hanford.

To simulate the impacts on Hanford resulting from the proposed BRR, the *TC & WM EIS* groundwater modeling team worked with the BOR groundwater modeling team to identify a line of model interface (line of flux), where the agreed-upon line is included geographically in both the BOR model and the *TC & WM EIS* Base Case flow model. This line of flux or interface was then used to represent the changes in flux into and out of the *TC & WM EIS* model based on the results of the BOR flow model simulation. The line of model interface (as encoded into the *TC & WM EIS* Base Case model) is illustrated in Figure V–1.

This line of water flux from the BOR model was provided to SAIC's *TC & WM EIS* groundwater modeling team in "Data Request #279 Related to Hanford *Tank Closure & Waste Management Environmental Impact Statement*" (Schmidt 2007). This data set provided flux values along the line of flux based on the model gridding in the BOR model. This data set was processed by the *TC & WM EIS* groundwater modeling team to translate the locations and values from the coarser BOR model gridding to the finer *TC & WM EIS* model gridding. This revised data set was then encoded as recharge flux into a BRR variant of the *TC & WM EIS* Base Case flow model. Encoded flux values include positive and negative values and are from the perspective of the BOR model. Therefore, negative values represent fluxes into the BRR variant model, and positive values represent fluxes out of the BRR variant model. Cell (model row and column) specific flux values are included in Table V–1. Within the BRR variant model, row 1 is the first row starting from the north, and column 1 is the first column starting from the west.

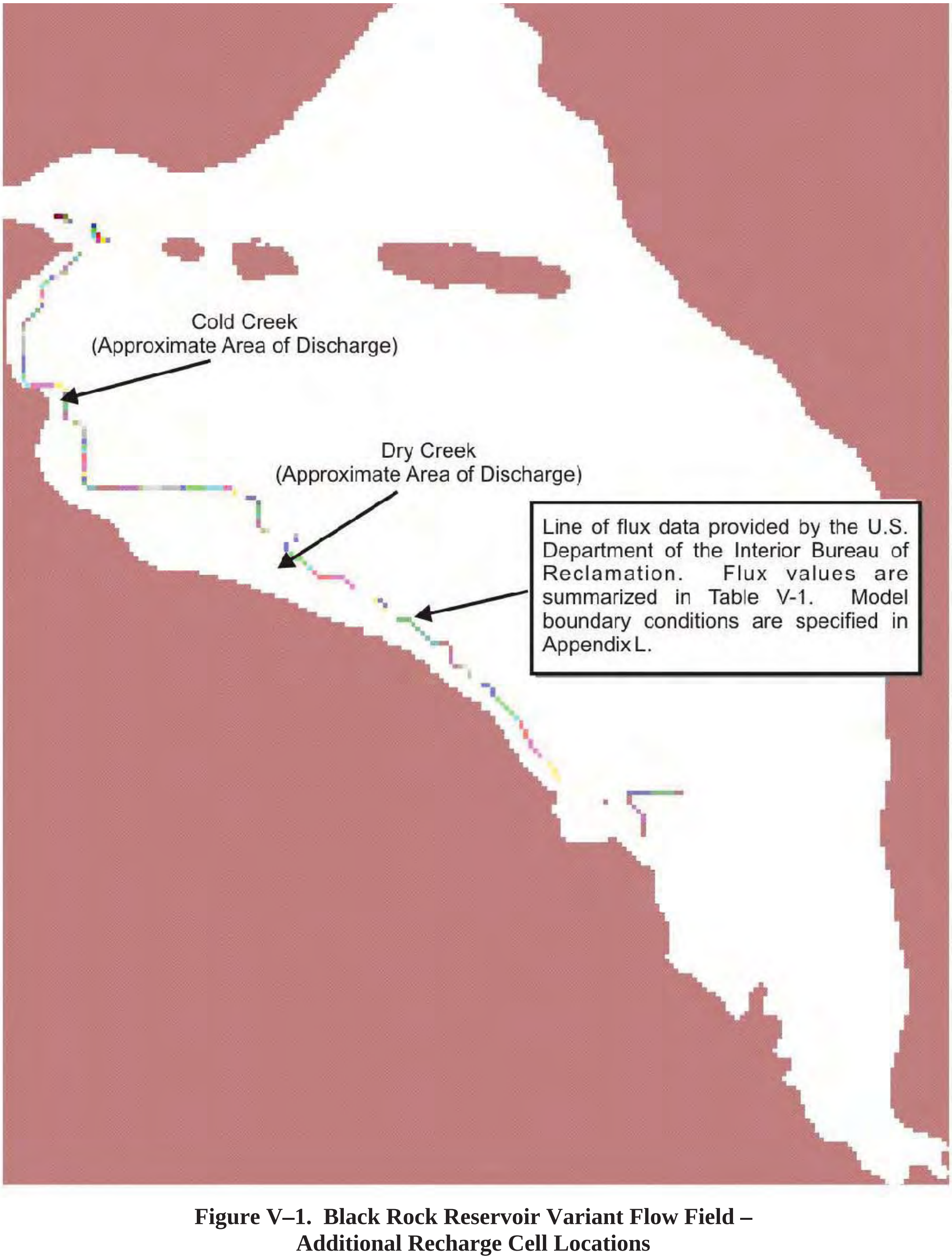

Figure V–1. Black Rock Reservoir Variant Flow Field – Additional Recharge Cell Locations

Table V–1. Black Rock Reservoir Variant Flow Field Flux Values

Model Row	Model Column	BRR Variant Model Cell Specific Flux Values (mm/yr)		Model Row	Model Column	BRR Variant Model Cell Specific Flux Values (mm/yr)[a]
57	1	5.37		93	8	539.65
57	2	5.37		93	9	539.65
57	3	3,467.07		93	10	539.65
57	4	3,467.07		93	11	539.65
57	5	3,467.07		93	12	222.91
58	6	3,467.07		93	13	222.91
59	7	3,467.07		94	14	222.91
60	8	3,032.67		95	14	130.78
61	9	3,032.67		96	14	38.65
62	10	3,032.67		97	14	38.65
62	11	3,032.67		98	14	282.98
62	12	3,085.83		99	14	527.31
62	13	3,085.83		100	14	263.66
63	14	3,085.83		101	15	0.00
64	13	3,085.83		101	16	219.00
65	12	707.64		101	17	438.01
66	11	1,670.54		102	18	438.01
66	10	1,670.54		103	18	200.93
67	9	1,670.54		104	18	200.93
68	9	1,670.54		105	18	327.97
69	9	575.08		106	18	455.00
70	9	575.08		107	18	458.16
71	9	575.08		108	18	461.32
72	9	575.08		109	18	461.32
73	9	973.90		110	18	314.17
74	9	1,372.73		111	18	314.17
75	9	1,372.73		112	18	300.40
76	9	1,372.73		113	18	286.63
77	8	1,372.73		114	18	200.61
78	7	743.31		115	19	114.59
79	6	743.31		115	20	114.59
80	5	743.31		115	21	888.35
81	5	743.31		115	22	888.35
82	5	396.77		115	23	888.35
83	5	50.23		115	24	888.35
84	5	50.23		115	25	888.35
85	5	50.23		115	26	1,518.69
86	5	50.23		115	27	1,518.69
87	5	191.19		115	28	1,518.69
88	5	191.19		115	29	1,518.69
89	5	191.19		115	30	6,650.76
90	5	191.19		115	31	11,782.83
91	5	28.52		115	32	11,782.83
92	5	134.14		115	33	11,782.83

Table V–1. Black Rock Reservoir Variant Flow Field Flux Values *(continued)*

Model Row	Model Column	BRR Variant Model Cell Specific Flux Values (mm/yr)		Model Row	Model Column	BRR Variant Model Cell Specific Flux Values (mm/yr)[a]
93	6	134.14		115	34	11,782.83
93	7	336.89		115	35	10,320.61
115	40	23,680.24		115	36	10,320.61
115	41	23,680.24		115	37	10,320.61
115	42	23,680.24		115	38	10,320.61
115	43	23,680.24		115	39	17,000.42
115	44	19,860.70		143	85	1,447.49
115	45	19,860.70		143	86	1,447.49
115	46	19,860.70		143	87	1,447.49
115	47	19,860.70		144	88	1,447.49
115	48	31,186.16		145	89	1,447.49
115	49	42,511.63		146	90	189.80
116	50	21,255.81		147	91	189.80
117	51	0.00		148	92	189.80
117	52	0.00		148	93	189.80
117	53	35,797.38		148	94	855.88
117	54	35,797.38		148	95	855.88
118	55	35,797.38		149	96	855.88
119	55	16,700.60		150	96	855.88
120	55	16,700.60		151	96	211.89
121	55	17,731.08		152	96	211.89
122	55	18,761.56		153	97	211.89
123	55	9,380.78		153	98	429.64
124	56	0.00		153	99	1,071.18
124	57	8,256.15		154	100	1,071.18
124	58	16,512.31		155	100	535.59
125	59	9,447.78		156	100	0.00
126	59	2,383.26		157	101	0.00
127	60	2,383.26		157	102	0.00
128	61	2,383.26		157	103	543.89
129	62	5,675.52		157	104	543.89
130	63	5,675.52		158	105	543.89
130	64	5,675.52		159	105	543.89
131	65	5,675.52		160	105	255.88
132	66	3,152.26		161	105	255.88
133	67	629.01		162	105	255.88
134	68	629.01		163	106	255.88
134	69	629.01		164	107	136.23
134	70	629.01		165	108	16.58
134	71	2,256.53		166	109	16.58
134	72	2,256.53		167	110	16.58
134	73	2,256.53		168	111	16.58
135	74	2,256.53		169	112	33.72
136	75	2,256.53		170	113	33.72
137	76	0.00		171	114	33.72

Table V–1. Black Rock Reservoir Variant Flow Field Flux Values *(continued)*

Model Row	Model Column	BRR Variant Model Cell Specific Flux Values (mm/yr)		Model Row	Model Column	BRR Variant Model Cell Specific Flux Values (mm/yr)[a]
138	77	0.00		172	115	33.72
139	78	0.00		173	116	3.94
139	79	0.00		174	117	25.83
139	80	1,424.88		175	118	25.83
139	81	2,849.75		176	118	25.83
140	82	2,849.75		177	118	25.83
141	82	1,424.88		178	118	0.00
142	82	0.00		179	118	0.00
143	83	0.00		180	119	0.00
143	84	0.00		180	120	0.00
180	125	403.84		180	121	403.84
180	126	183.45		182	134	421.85
180	127	183.45		183	135	780.18
180	128	183.45		184	136	780.18
180	129	183.45		185	137	780.18
180	130	302.65		186	137	780.18
180	131	421.85		187	137	423.08
180	132	421.85		188	137	423.08
181	133	421.85		189	137	423.08
180	123	403.84		180	122	403.84
180	124	403.84		180	123	403.84

[a] Encoded flux values include positive and negative values and are from the perspective of the U.S. Department of the Interior, Bureau of Reclamation model. Therefore, negative values represent fluxes into the BRR variant model, and positive values represent fluxes out of the BRR variant model.

Note: Values provided by the U.S. Department of the Interior, Bureau of Reclamation.

Key: BRR=Black Rock Reservoir; mm/yr=millimeters per year.

This BRR variant flow field model of the *TC & WM EIS* Base Case flow model included the following modifications to the Base Case flow model:

- Removed all anthropogenic recharge zones except for the long-term expected water fluxes and extractions from the city of Richland, the North Richland Well Field (NR-1100B), and the Richland Wellsian Way Well Field (1182 Pump House)
- Added the water flux values from the BOR flow model, as described above
- Changed the model time-stepping algorithm to ramp up to the BOR total flux values over a period of 45 years to aid model convergence
- Changed the duration of the simulation to 500 years

Sections V.3.3 and V.3.5 describe the methodology and application of the BRR variant flow field model to analyze the impacts of the additional water flux values from the BOR flow model.

Section V.3.4 describes the methodology for evaluating changes to vadose zone thickness and travel times and uses variants of the *TC & WM EIS* Base Case STOMP models. The *TC & WM EIS* Base Case STOMP model development and application are described in Appendix N.

V.3.3 Methodology for Evaluating Changes in Flow Field and Transport Patterns

The BRR variant flow field spread of recharge (flux along the western model domain boundary) extends from Cold Creek (northeastern region of the model domain) surface water discharge, along the western model domain past the Dry Creek discharge regions, to near the northern reaches of West Richland. To aid model convergence, the BRR flux was stepped in at 20 percent flux intervals over the first five model time periods prior to reaching the full designated flux volume.

To evaluate and characterize how the BRR variant flow field model's additional western boundary fluxes affect the flow and transport patterns across Hanford, the following investigative methods were used:

1. **Steady state flow field head distribution analysis generated by MODFLOW.** The BRR variant flow field head distributions were compared to the head distributions in the *TC & WM EIS* Base Case flow field. Standard color ramp scales were used to compare model hydraulic head values. Head information was provided at the end-of-time (long-term steady state) model simulation time step of both models.

2. **Hanford Central Plateau directional flow field tracers (particle pathlines) analysis.** Central Plateau–originating directional flow pathlines (generated by MODPATH [MODFLOW particle-tracking postprocessing package]) from the long-term steady state flow field of the BRR variant flow field model were compared to those from the long-term steady state *TC & WM EIS* Base Case flow model.

3. **Steady state flow field vector analysis.** Groundwater Vistas, Version 4.2.5, Build 22 (ESI 2004), was utilized to interpret MODFLOW-generated flow field vectors within the BRR variant flow field model and compare them to the *TC & WM EIS* Base Case flow model vectors. Groundwater Vistas utilizes end-of-time (long-term steady state) MODFLOW output files to internally calculate model cell X and Y flow vectors. Vector length is on a logarithmic scale for display purposes. Standard color ramp and logarithmic scales used to distinguish vector lengths equally represent the velocities in the two flow fields. Contour lines are used to indicate a relative ratio of velocities between the two models.

The results of these analyses are included in Section V.4.1.

V.3.4 Methodology for Evaluating Vadose Zone Inundation

To determine the inundation depth to be applied to each Base Case STOMP model result, the *TC & WM EIS* Base Case flow model and the BRR variant flow field model were interrogated at each STOMP model location across Hanford to determine the inundation depth resulting from the additional flux from the BOR flow model. The inundation depth at these locations is equal to the calculated difference between the hydraulic head or water table elevation (above mean sea level [amsl]) in the *TC & WM EIS* Base Case flow model and the hydraulic head in the BRR variant flow field model. The inundation depth results from the rising water table. A calculation of the vadose zone decrease in depth (percentage) under BRR variant conditions compared to *TC & WM EIS* Base Case vadose zone depths was also performed.

The results of this analysis are included in Section V.4.2.

V.3.5 Methodology for Evaluating Changes to Vadose Zone Thickness and Travel Times

Analysis of the movement of water and various solutes through the vadose zone (unsaturated zone between the ground surface and groundwater) was required to evaluate the *TC & WM EIS* long-term impacts on groundwater quality. Within this *TC & WM EIS*, simulations of site-specific vadose zones were completed using the STOMP computer code. Further description of the *TC & WM EIS* STOMP modeling effort is included in Appendix N.

To evaluate the effects of the additional flux as described by the BOR model, vadose zone thickness (depth) must first be obtained at selected Hanford sites within the BRR variant flow field model and compared to the same location within the *TC & WM EIS* Base Case flow field model. Selected locations were interrogated in both models to determine the change in vadose zone thickness resulting from the additional BRR flux. The change of vadose zone thickness is the calculated difference between the hydraulic head in the *TC & WM EIS* Base Case model and the hydraulic head in the BRR variant flow field model. Table V–2 provides a summary of the *TC & WM EIS* Base Case model and the BRR variant flow field model head comparisons at selected locations related to the *TC & WM EIS* alternatives presented in Chapter 2.

Table V–2. Changes to Vadose Zone Thickness (Inundation Depth) Resulting from Black Rock Reservoir—Selected Hanford Site Locations Related to the *TC & WM EIS* Alternatives

Hanford Site Location	***TC & WM EIS*** **Base Case Flow Model Hydraulic Head**	**BRR Variant Flow Field Model Hydraulic Head**	**BRR Variant Change to Vadose Zone Thickness**
	(meters)		
Core Zone, 200-East Area Integrated Disposal Facility	122.8	124.5	–1.7
Core Zone, 200-West Area Integrated Disposal Facility	137.5	146.9	–9.4
Core Zone, River Protection Project Disposal Facility	128.5	134.8	–6.3
200-West Area, trenches 31 and 34	136.8	146.3	–9.5

Note: To convert meters to feet, multiply by 3.281.

Key: BRR=Black Rock Reservoir; *TC & WM EIS Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*.

Selection of these Hanford locations for vadose zone analysis was based on a preference for the Waste Management alternatives involving the greatest variety of waste forms evaluated in this *TC & WM EIS*. Those Waste Management alternatives are described in Chapter 2.

Using the change to vadose zone thickness results included in Table V–1, variants to the *TC & WM EIS* Base Case STOMP models used at the selected locations were developed by removing an equivalent number of nodes at the bottom of the STOMP model to account for a shortened vadose zone. Further, the bottom boundary condition was adjusted accordingly to the lowest active layer. These site-specific BRR variant STOMP models and site-equivalent *TC & WM EIS* Base Case STOMP models were run at identical Waste Management alternative locations (10,000 years) using 1 curie of technetium-99, as described in Appendix N. Technetium-99 was chosen as a conservative tracer radionuclide because it is highly mobile and has a relatively long half-life of 2.13×10^5 years (decays approximately 3.2 percent in 10,000 years).

The results of this analysis are included in Section V.4.2.

V.3.6 Methodology for Evaluating Changes to the Year of Peak Concentration at the Columbia River

A groundwater flow and transport analysis was performed using the BRR variant flow field and *TC & WM EIS* Base Case flow field to evaluate peak concentration arrival time to the Columbia River. Particle tracking computer code was used to simulate the migration of contaminants through each flow field (aquifer). Comprehensive discussion of the Base Case flow field development and extraction for use is included in Appendix L. Detailed groundwater transport information can be found in Appendix O.

Contaminant transport analysis was performed to compare the concentration results for technetium-99 at the Columbia River for the *TC & WM EIS* Base Case model and BRR variant model flow fields during the 500-year Hanford postoperational period (1940–2440). This comparison was based on the release of 1 curie of technetium-99 from each of the 10 barriers (A, B, S, T, and U Barrier boundaries; trenches 31 and 34; the 200-East and 200-West Area Integrated Disposal Facilities; the Fast Flux Test Facility (FFTF); and the River Protection Project Disposal Facility). For purposes of analysis, this unit release is assumed to have occurred in calendar year 2090, a time after which the BRR will have achieved long-term steady state condition. These releases occurred in the center of each barrier in a 10- by 10-meter (32.8- by 32.8-foot) square. The peak concentrations results for technetium-99 at the Columbia River for both the *TC & WM EIS* Base Case model and BRR variant model flow fields are further discussed in Section V.4.3.

V.4 MODEL RESULTS

This section describes the results of the analyses described in Sections V.3.3, V.3.4, V.3.5, and V.3.6. In all analyses, the BRR variant flow field model was compared and contrasted with the *TC & WM EIS* Base Case flow model.

V.4.1 Changes to Flow Field and Transport Patterns

<u>Steady State Head Distribution</u>

Model long-term steady state groundwater head values are illustrated in Figure V–2 (*TC & WM EIS* Base Case flow field model), Figure V–3 (BRR variant flow field model), and Figure V–4 (hydraulic head difference between the *TC & WM EIS* Base Case and BRR variant flow field models).

The distribution of head values across the *TC & WM EIS* Base Case flow model indicates a progressive slope across the model from west to east towards the Columbia River. Groundwater head is the highest along the western regions of the model between Cold Creek and Dry Creek at 156 meters (512 feet); the lowest modeled groundwater head along the Columbia River (or eastern model domain) ranges from 106 to 114 meters (348 to 374 feet).

Unlike the *TC & WM EIS* Base Case model, the distribution of head values across the BRR variant flow field model has a steeper slope west to east across the model domain. A mounded groundwater head, 162 meters (532 feet) at its highest point, is observed within the northwestern portion of the model between Cold Creek and Dry Creek east of the flux line provided by BOR. This mound within the western region of the flow field is due to the prominence of relatively low hydraulic conductivity values of the Ringold Formation along with increased recharge from BRR along the western regions of the model. The mounded slope (west to east) of groundwater caused by the increased recharge quickly dissipates in the middle of the model (east of Gable Mountain–Gable Butte Gap [Gable Gap] and east of the 400 Area) where higher hydraulic conductivity values of the Hanford formation are encountered. Eastern region head values in the BRR variant flow field model resemble the head values observed in the *TC & WM EIS* Base Case flow model.

Within the Core Zone of the BRR variant flow field model, the west to east slope of hydraulic head values is steep. Compared to the *TC & WM EIS* Base Case flow field, the head values in the 200-West Area are 9 to 14 meters (30 to 46 feet) higher and those in the 200-East Area are 1 to 2 meters (3 to 7 feet) higher. Tables V–1 and V–2 list the various head differences between the two models at specific site locations.

For comparison, in general, the Hanford operational period increased the groundwater elevation beneath the Core Zone more than 20 meters (66 feet) in the 200-West Area and approximately 10 meters (33 feet) in the 200-East Area through direct injection of wastewater discharge from the surface (Freedman 2008). The BRR variant flow field rise in groundwater elevation in the Core Zone (compared to the *TC & WM EIS* Base Case flow field) is less than the elevations observed during the Hanford operational period.

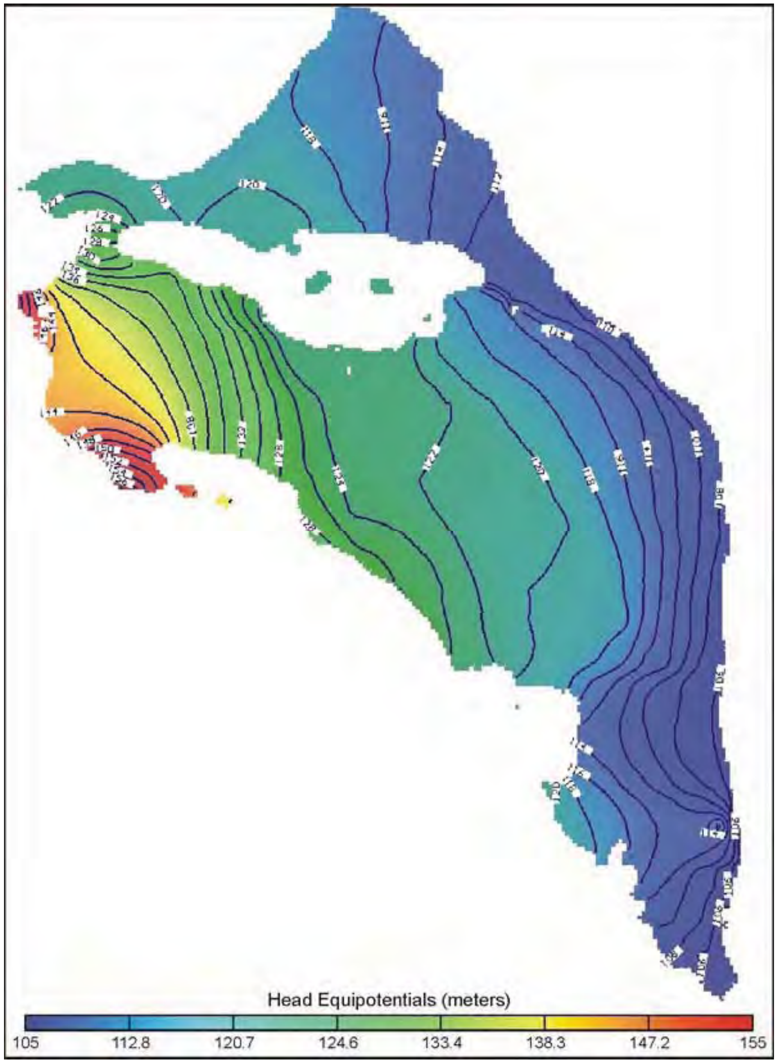

Figure V–2. ***TC & WM EIS*** **Base Case Flow Model – Long-Term Steady State Head Distribution (Hydraulic Head from Model Layer 19, 105–110 meters above mean sea level)**

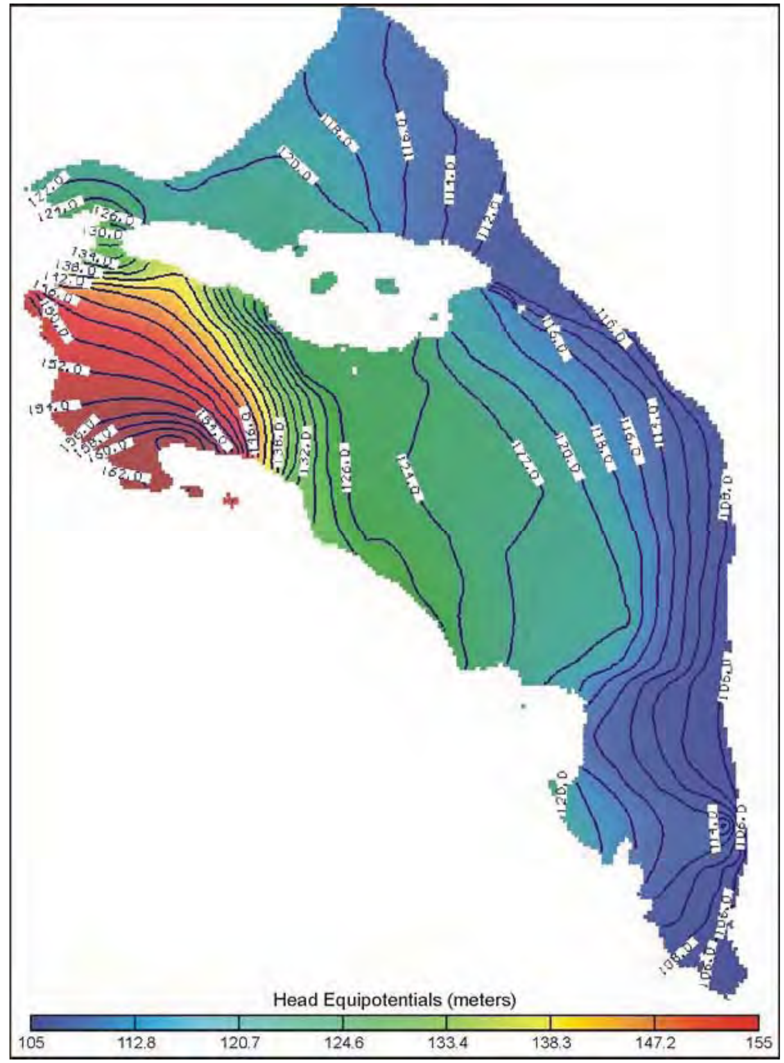

Figure V–3. Black Rock Reservoir Variant Flow Field Model – Long-Term Steady State Head Distribution (Hydraulic Head from Model Layer 19, 105–110 meters above mean sea level)

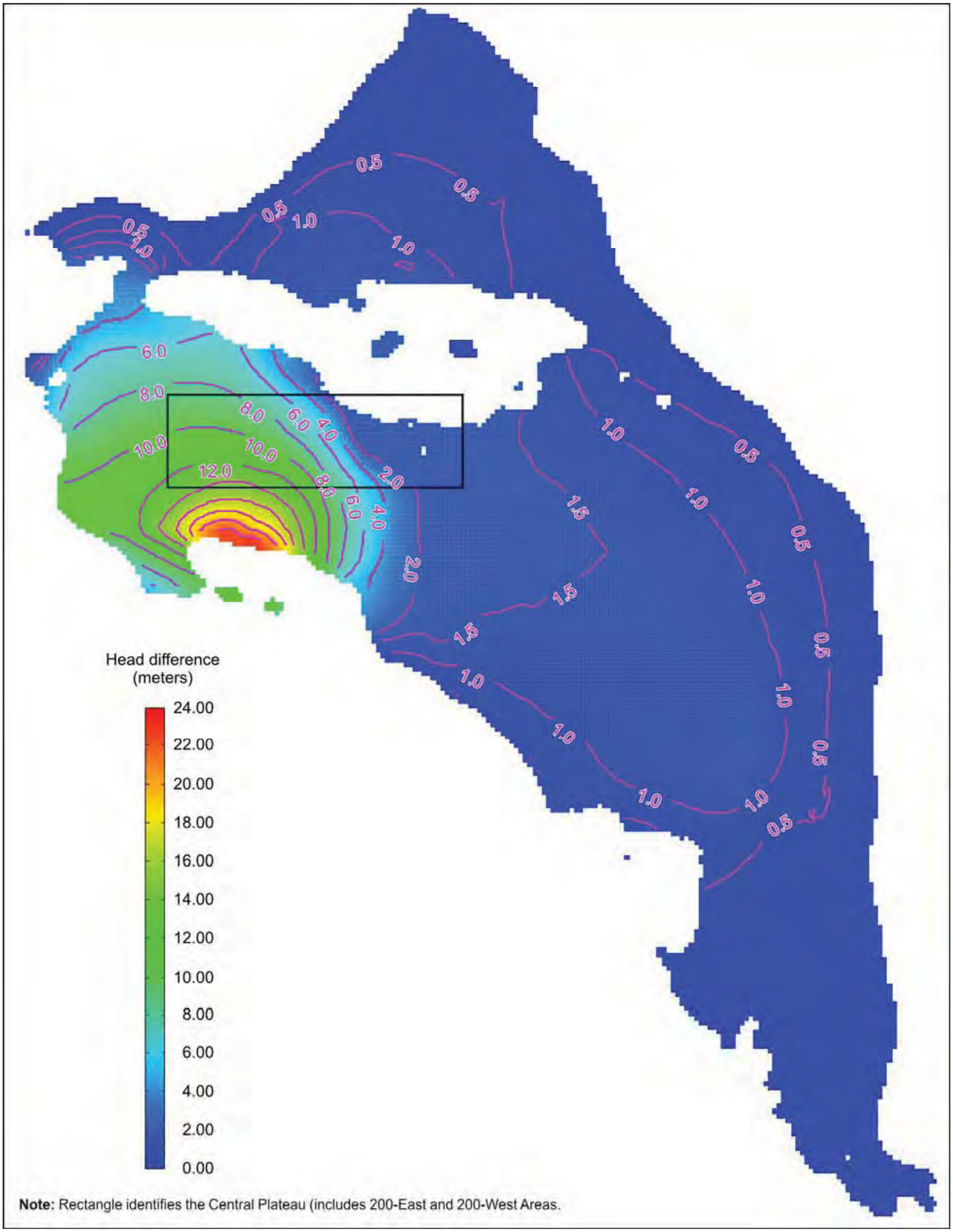

Figure V–4. Hydraulic Head Difference (meters) Between the Base Case Flow Model and Black Rock Reservoir Variant Flow Field Model (Hydraulic Head Difference from Model Layer 19, 105–110 meters above mean sea level)

Hanford Central Plateau Flow Field Particle Pathlines

The Central Plateau is an area located just south of Gable Gap. The Hanford Core Zone, which includes the 200-East and 200-West Areas, is part of the Central Plateau identified by the rectangle in Figure V–4. For particles released from the Central Plateau, there are significant differences in the direction of particle pathlines between the BRR variant flow field and the *TC & WM EIS* Base Case flow field. Directional flow field particle pathlines originating from a fixed Central Plateau regional box (64 square kilometers [24.7 square miles]) are illustrated in Figure V–5 (*TC & WM EIS* Base Case flow model) and Figure V–6 (BRR variant flow field model). In general, under BRR variant conditions, there is a western shift of the bifurcated groundwater divide separating flow to the north through Gable Gap and flow to the east across the flow field. Table V–3 summarizes the differences in the Central Plateau groundwater divide area between the *TC & WM EIS* Base Case flow field and the BRR variant flow field.

Table V–3. Central Plateau Particle Pathline Direction to the Columbia River

Flow Field Model	Area of Central Plateau with Particles Directed North Through Gable Mountain–Gable Butte Gap to the Columbia River		Area of Central Plateau with Particles Directed East to the Columbia River	
	Area (square kilometers)	Area (percent)	Area (square kilometers)	Area (percent)
TC & WM EIS Base Case flow field	24.8	39	39.2	61
BRR variant flow field	39.2	61	24.9	39

Note: To convert square kilometers to square miles, multiply by 0.3861.

Key: BRR=Black Rock Reservoir; *TC & WM EIS*=*Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington.*

In the *TC & WM EIS* Base Case flow model, the majority of particles released in the Central Plateau travel east towards the Columbia River. In general, particles released in the 200-East Area and the southern reaches of the 200-West Area are directed east. Approximately 61 percent (39.2 square kilometers [15.14 square miles]) of the particles released from the Central Plateau Area move to the east. For the remaining 39 percent (24.8 square kilometers [9.58 square miles]) of the Central Plateau, the majority of the 200-West Area, particles flow north through Gable Gap. Once through Gable Gap, the majority of particles move east towards the Columbia River, with a relatively small quantity of particles continuing in a northern direction also towards the Columbia River.

In contrast to the *TC & WM EIS* Base Case flow field, the BRR variant flow field shows significantly more particles in the Central Plateau directed northerly through Gable Gap. Approximately 39 percent (24.9 square kilometers [9.61 square miles]) of the particles released from the Central Plateau move east towards the Columbia River and approximately 61 percent (39.2 square kilometers [15.14 square miles]) move north through Gable Gap. Once through Gable Gap, particles in the BRR variant flow field model have a greater tendency to continue north towards the Columbia River rather than take the longer track turning east towards the Columbia River.

In general, the BRR variant flow field model has a greater amount of particles reaching the Columbia River in a shorter distance (directly north through Gable Gap). Unlike the *TC & WM EIS* Base Case flow field, the BRR variant flow field model shows a larger portion of particles released in the 200-East Area flowing to the north rather than across the model to the east. These additional redirected portions in the 200-East Area include the northern B, BX, and BY tank farms (and associated cribs and trenches [ditches]) and the proposed location of the River Protection Project Disposal Facility located in the northern part of the Central Plateau between the 200-East and 200-West Areas.

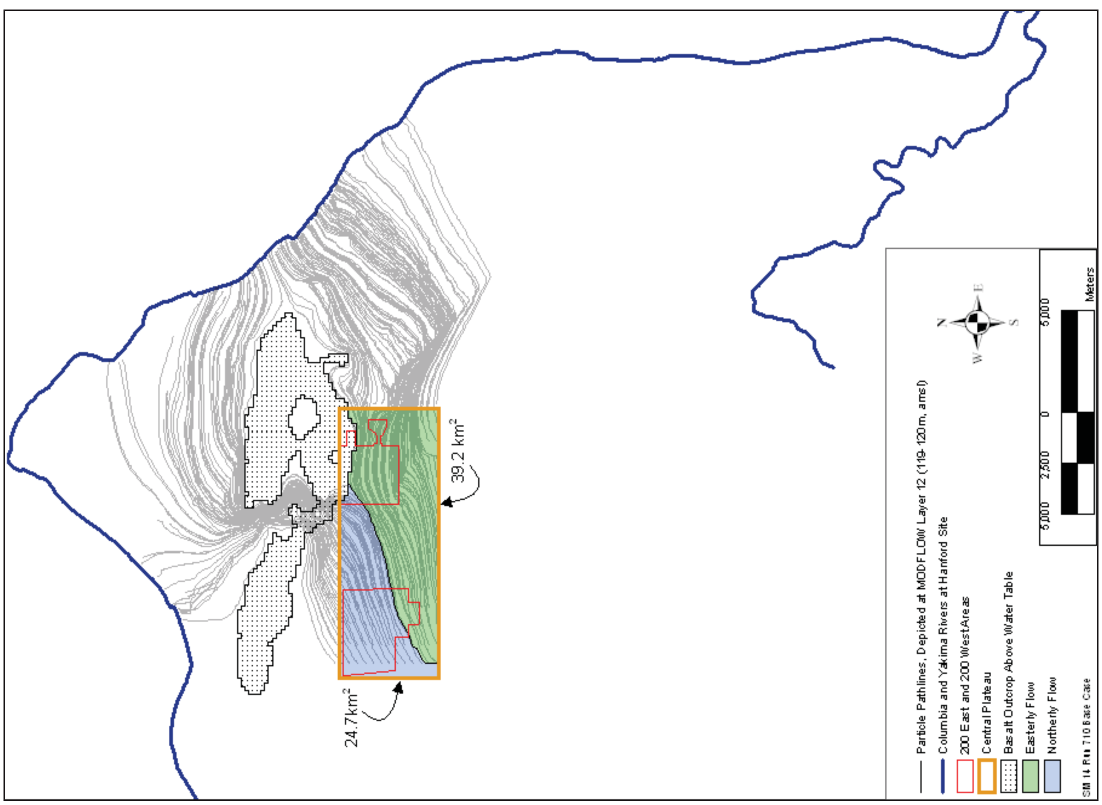

Figure V–5. Base Case Flow Field – Central Plateau Delineated Particle Pathlines

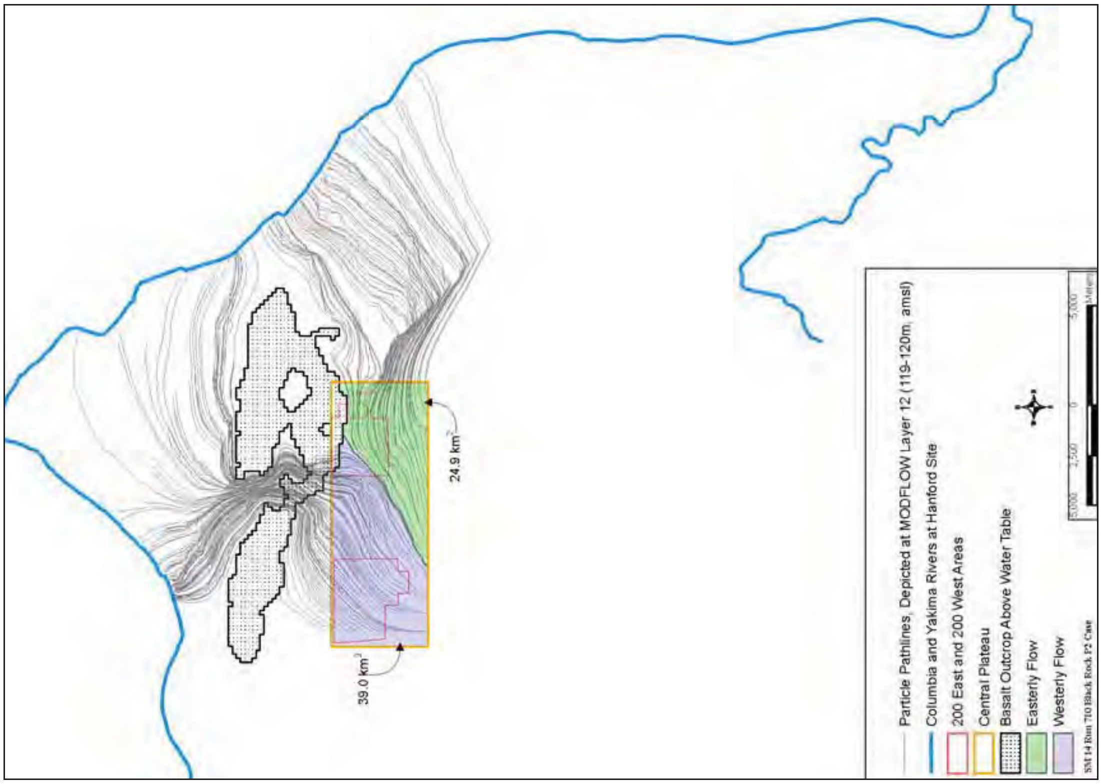

Figure V–6. Black Rock Reservoir Variant Flow Field – Central Plateau Delineated Particle Pathlines

Steady State Flow Field Vectors

Considering that the BRR variant flow field significantly increased recharge flux along the western model boundary and the subsequent increase in hydraulic gradient, groundwater flow velocities have increased relative to the *TC & WM EIS* Base Case flow field. Model cell X and Y steady state vector velocities are used to help quantify lateral flow direction of the BRR variant flow field relative to the *TC & WM EIS* Base Case flow field. Figures V–7 through V–20 are flow field vector illustrations generated by Groundwater Vistas comparing multiple layers within the BRR variant and *TC & WM EIS* Base Case flow fields. Groundwater Vistas utilizes end-of-time (long-term steady state) MODFLOW output files to internally calculate model cell X and Y flow vectors. Vector length is calculated using a logarithmic scale for purposes of display clarity. Standardized color ramps and logarithmic scales are used to uniformly distinguish and equally compare groundwater vectors between the two flow fields. Contour lines are used within the BRR variant flow field vector illustrations to indicate a relative ratio of velocity compared to the *TC & WM EIS* Base Case flow field. Model layers range in thickness but are identical in both models. Depending on model layer elevation, portions of Hanford may not have groundwater available for vector analysis (e.g., the model layer is above the specified water table elevation). Appendix L, Section L.4, further discusses groundwater flow field model grid design, cell properties, and boundary conditions and includes a sample cross section illustrating the depth of each model layer.

Model Layers 3 (135 to 140 meters [442.9 to 459.3 feet] amsl), 9 (122 to 123 meters [400.3 to 403.6 feet] amsl), 11 (120 to 121 meters [393.7 to 397 feet] amsl), 14 (117 to 118 meters [383.9 to 387.2 feet] amsl), 15 (116 to 117 meters [380.6 to 383.9 feet] amsl), 16 (115 to 116 meters [377.3 to 380.6 feet] amsl), and 20 (100 to 105 meters [328.1 to 344.5 feet] amsl) were compared between the two models.

The highest groundwater elevations that are easily comparable are observed in Layer 3 (135 to 140 meters [442.9 to 459.3 feet] amsl) of each model. In Layer 3, groundwater flow is only represented in the western reaches of the model domain near Cold Creek. The area of saturation within the model domain at this elevation is greater in the BRR model. BRR velocities within the Central Plateau are slightly higher, and there is a tendency for vectors to indicate direction to the north rather than to the east (as displayed in the *TC & WM EIS* Base Case model) beneath the Central Plateau. South of the Central Plateau, unlike the *TC & WM EIS* Base Case model, velocities are higher in the BRR model due to saturation of highly conductive Hanford formations due to the rising water table.

In Layer 9 (122 to 123 meters [400.3 to 403.6 feet] amsl) of both models, groundwater covers the entire Central Plateau. In general, velocities (0.1 to 1.5 meters [0.33 to 4.9 feet]/day) found in the area are similar beneath the Central Plateau with the exception of velocities closest to and within Gable Gap, where there is significantly greater velocity (greater than 10 meters [32.8 feet]/day) directed to the north within the BRR variant flow field model. In general, a larger area of the Hanford formation within the BRR model is covered with groundwater flow at this model layer elevation. Within the BRR variant flow field model, significantly more groundwater is flowing at higher velocities between the 200-East Area and the 400 Area, where the highly conductive Hanford formation is encountered.

Similar to Layer 9, Layer 11 (120 to 121 meters [393.7 to 397 feet] amsl) of both models indicates vectors beneath the western regions of the Central Plateau are similar, except the BRR model vector has a general tendency more to the north, while the *TC & WM EIS* Base Case model vector has a general tendency to the east. Order of magnitude velocity differences between the two models are noted in and north of Gable Gap. Unlike the *TC & WM EIS* Base Case model, the BRR model indicates a relatively high velocity channel of groundwater tracking through Gable Gap in a northwestern direction towards the Columbia River. This northwestern channel is further supplied by high velocity flow emitting from another shallow basalt gap west of Gable Gap. No significant differences in flow vectors between the two models are noted in the central and southern regions of Hanford.

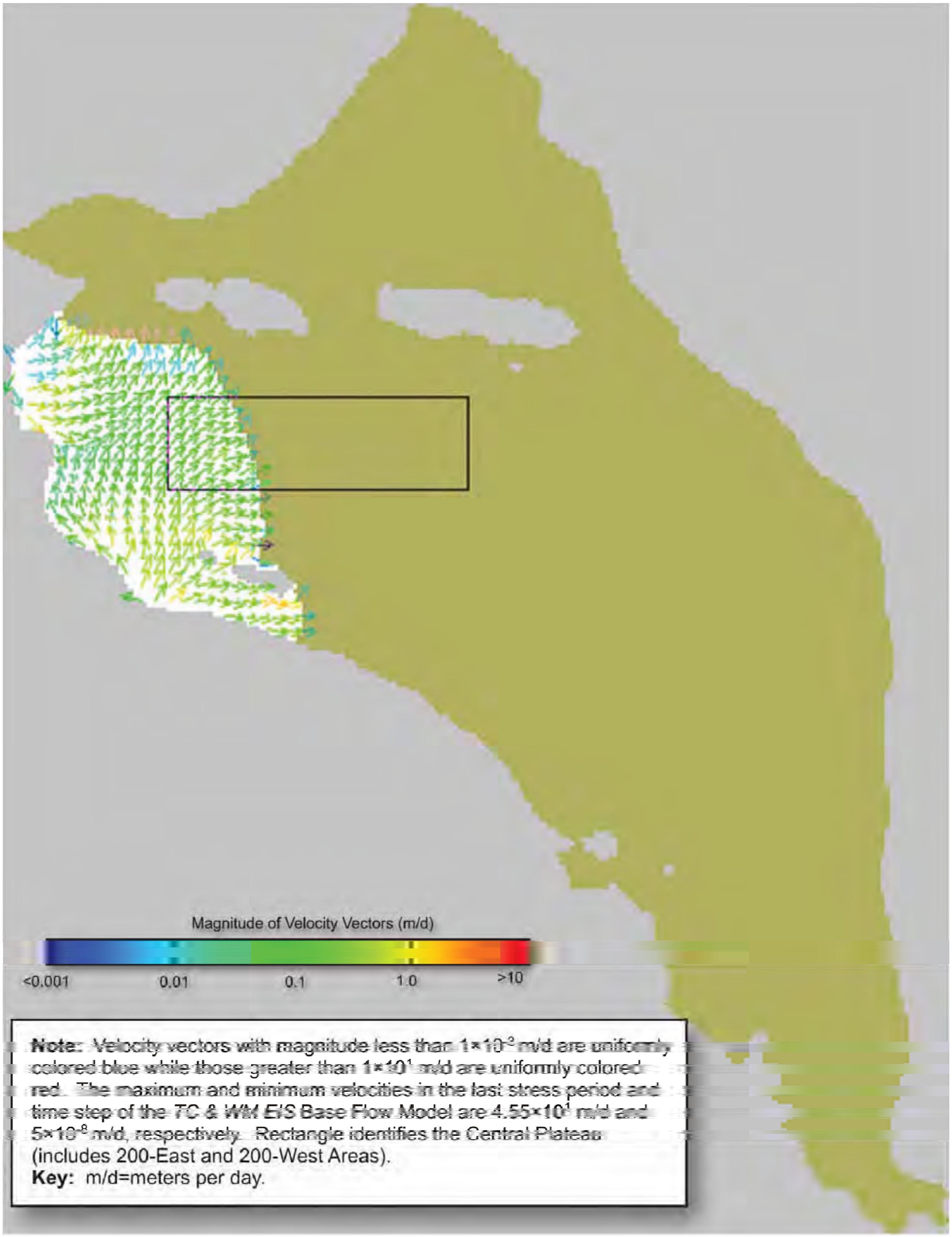

Figure V–7. Base Case Flow Model, Layer 3 (135–140 meters above mean sea level) Vector Velocities

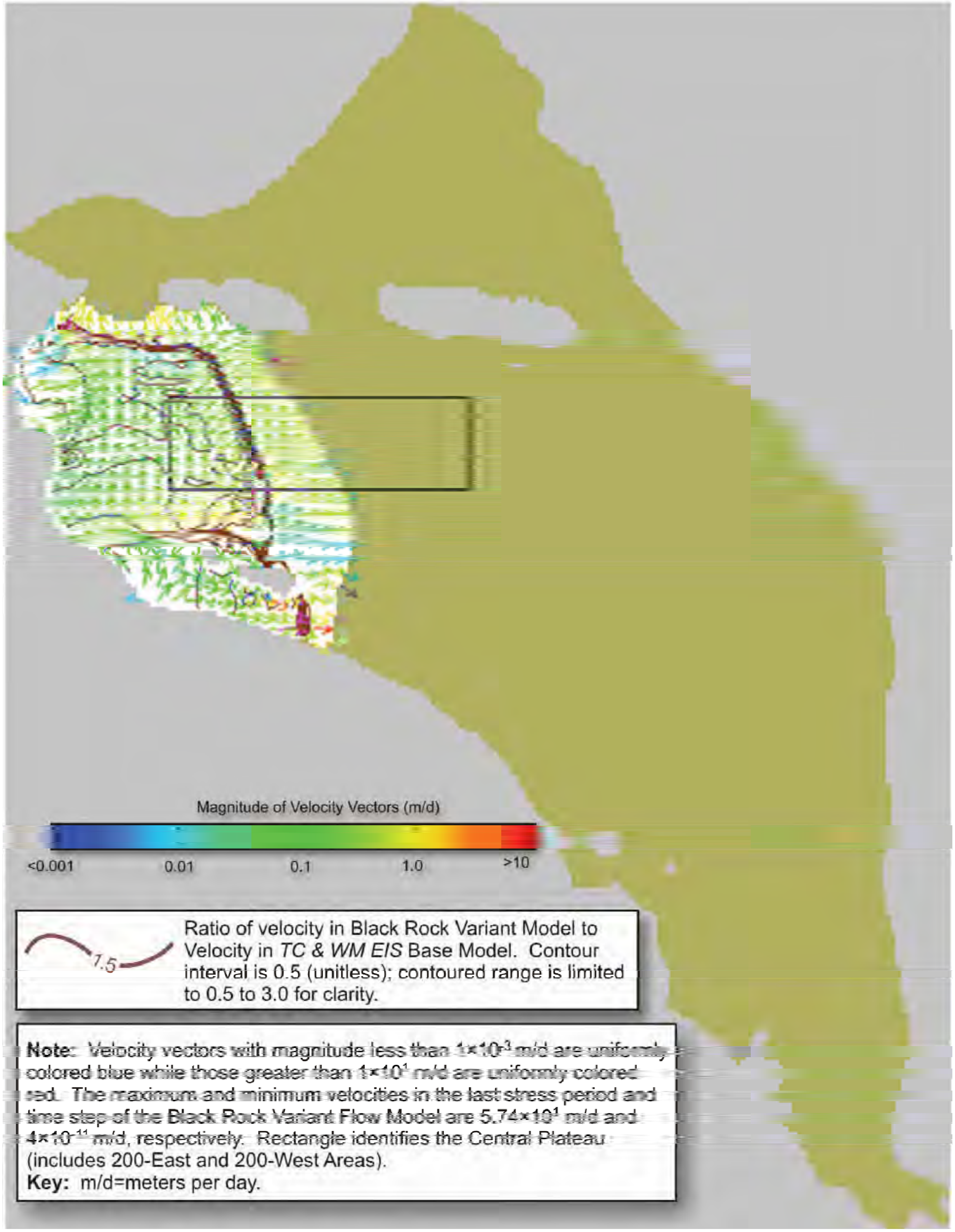

Figure V–8. Black Rock Reservoir Variant Flow Field Model, Layer 3 (135–140 meters above mean sea level) Vector Velocities

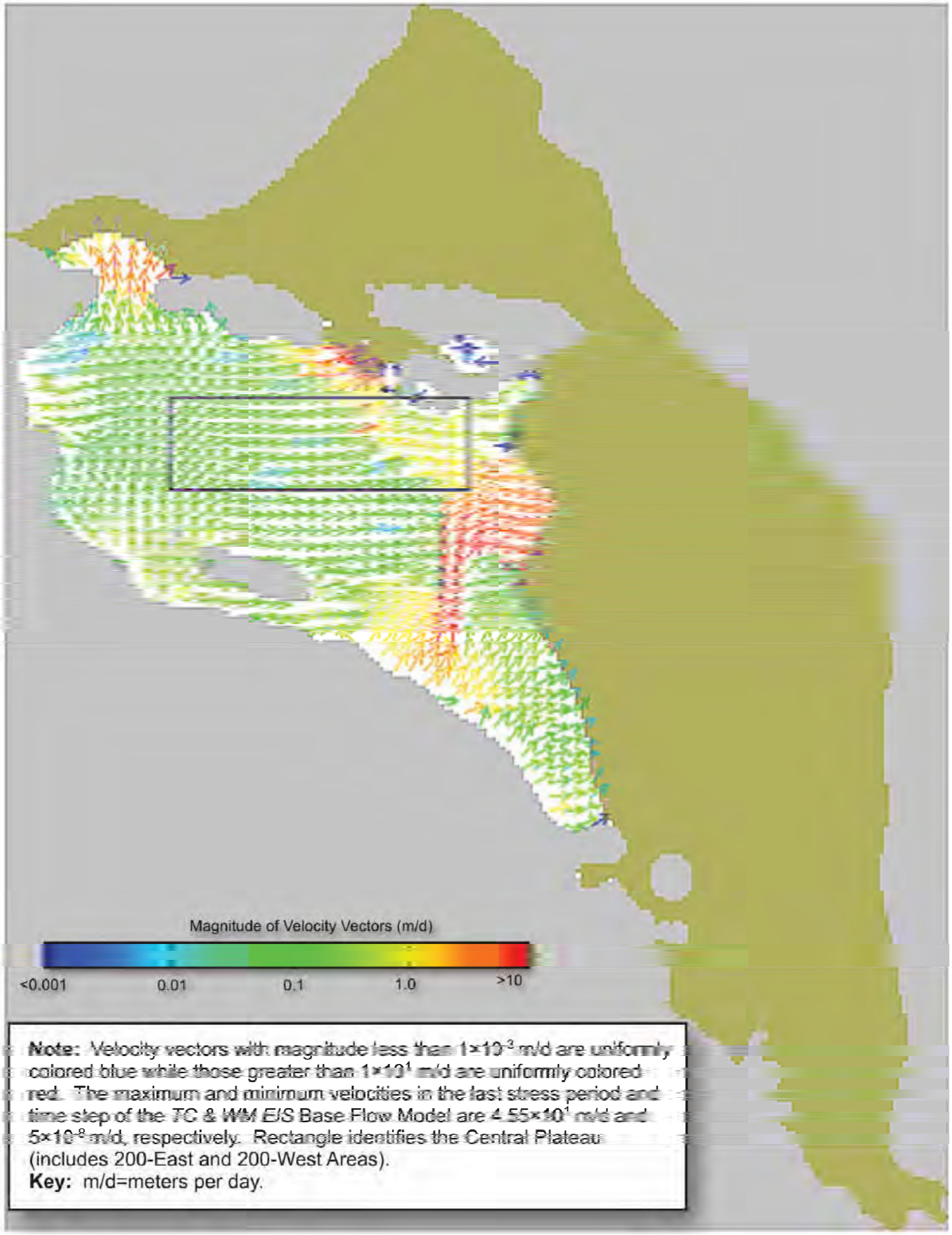

Figure V–9. Base Case Flow Model, Layer 9 (122–123 meters above mean sea level) Vector Velocities

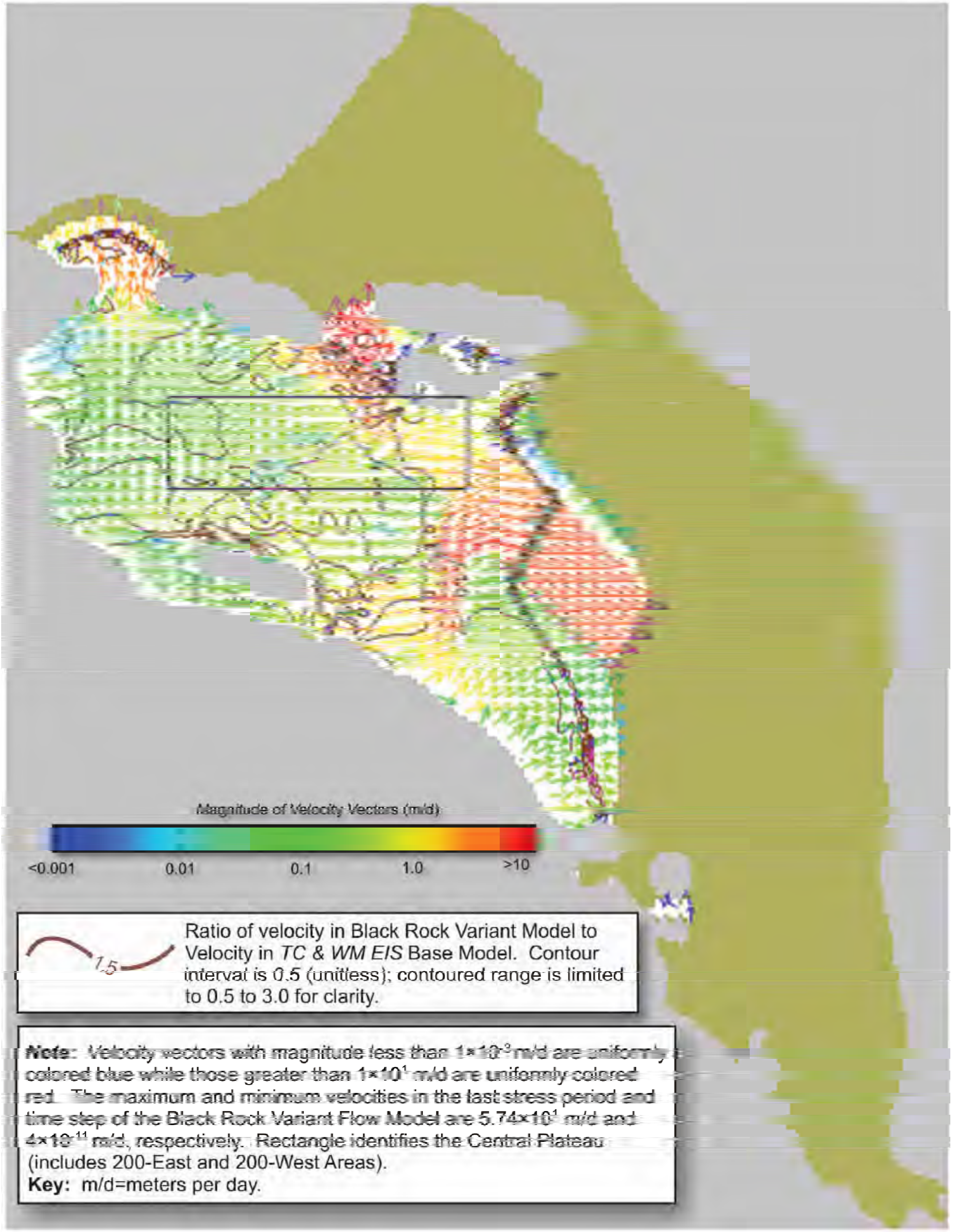

Figure V–10. Black Rock Reservoir Variant Flow Field Model, Layer 9 (122–123 meters above mean sea level) Vector Velocities

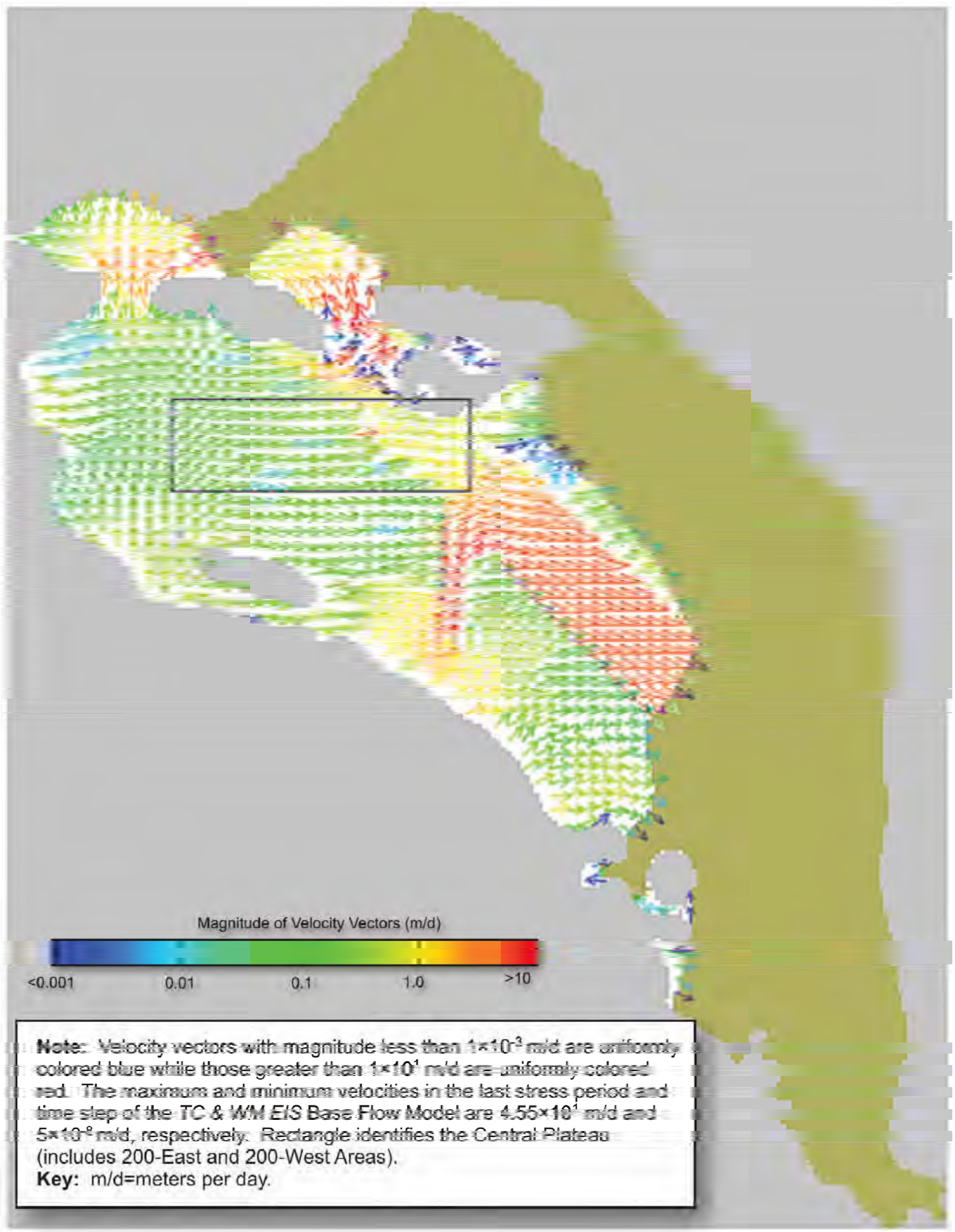

Figure V–11. Base Case Flow Model, Layer 11 (120–121 meters above mean sea level) Vector Velocities

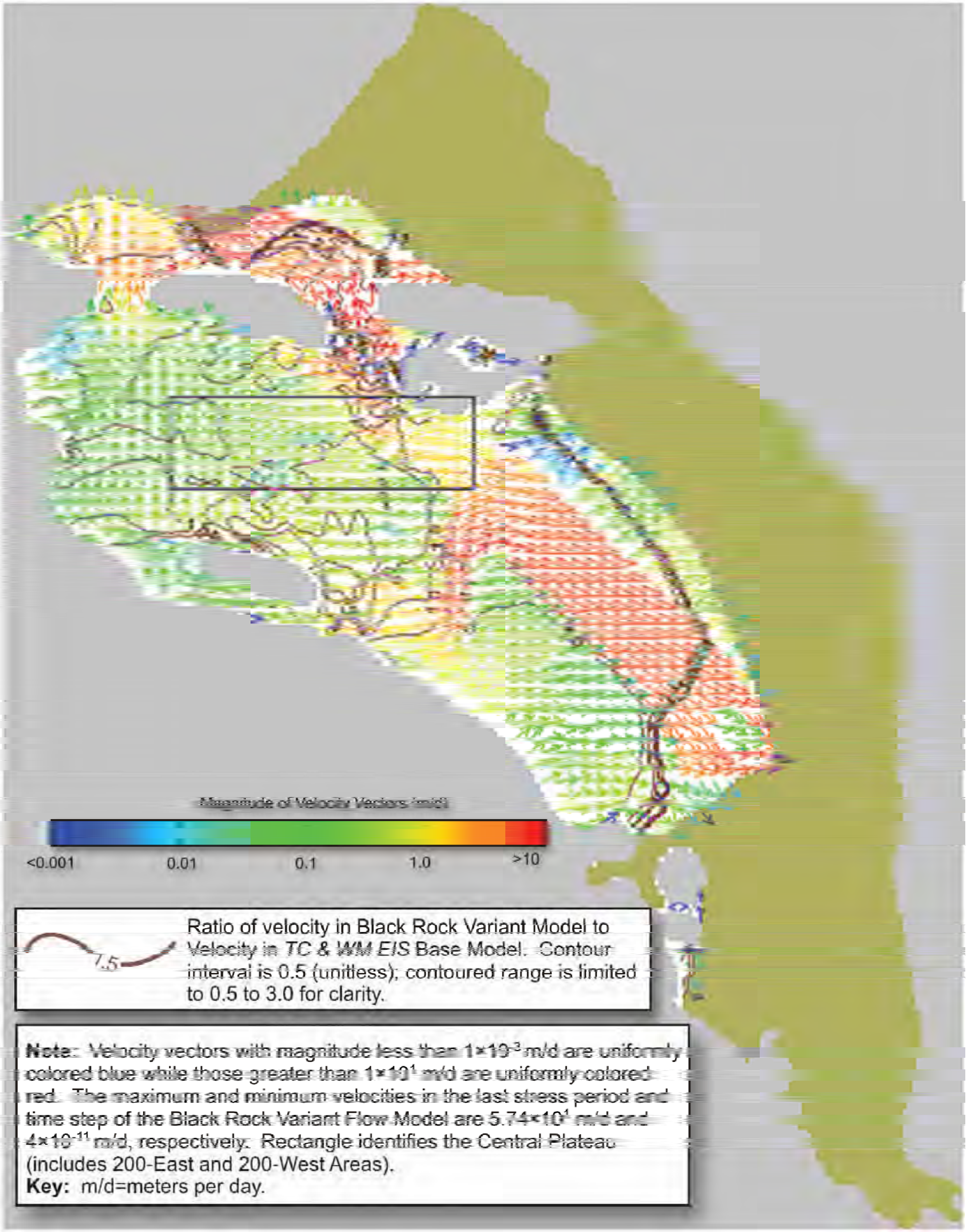

Figure V–12. Black Rock Reservoir Variant Flow Field Model, Layer 11 (120–121 meters above mean sea level) Vector Velocities

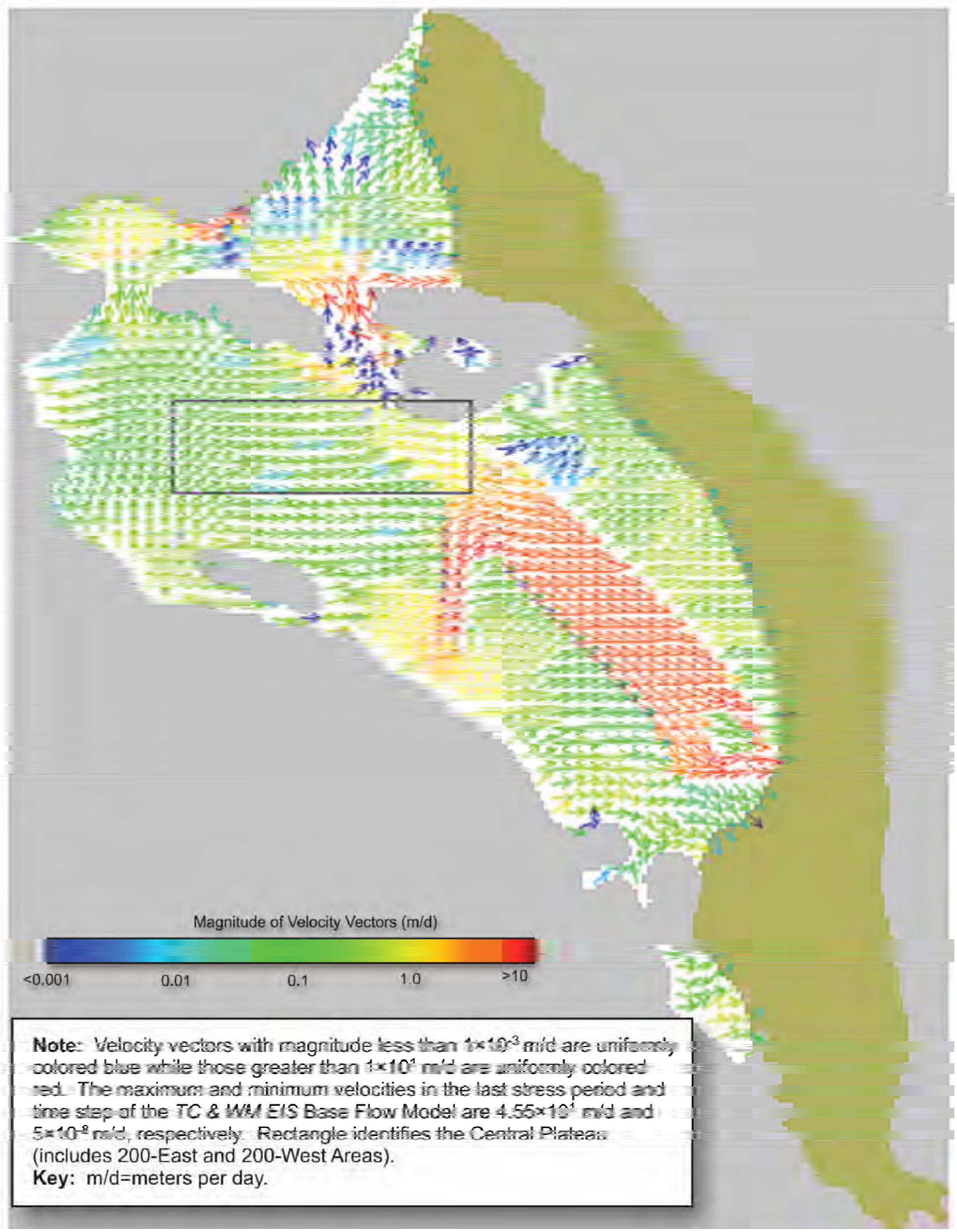

Figure V–13. Base Case Flow Model, Layer 14 (117–118 meters above mean sea level) Vector Velocities

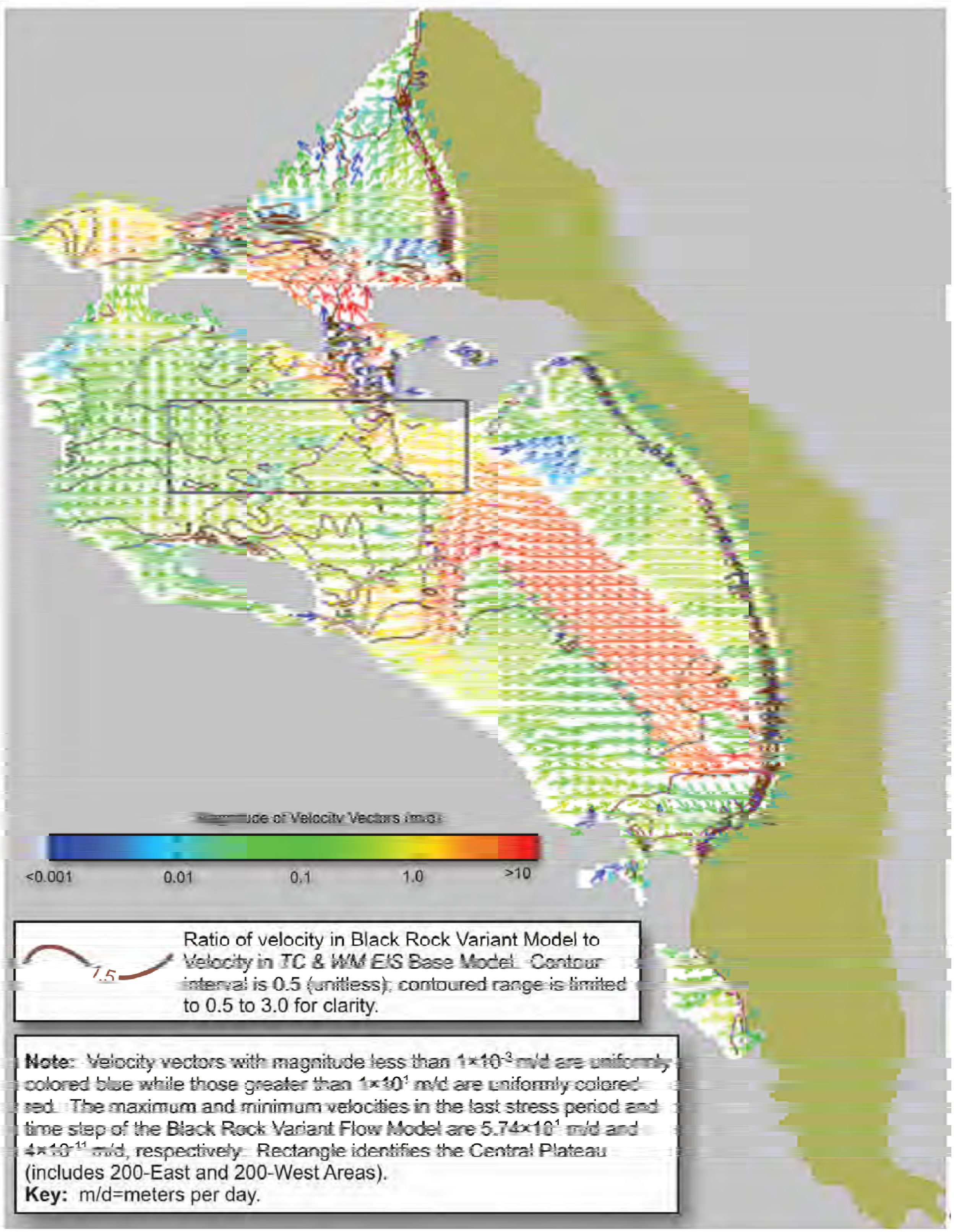

Figure V–14. Black Rock Reservoir Variant Flow Field Model, Layer 14 (117–118 meters above mean sea level) Vector Velocities

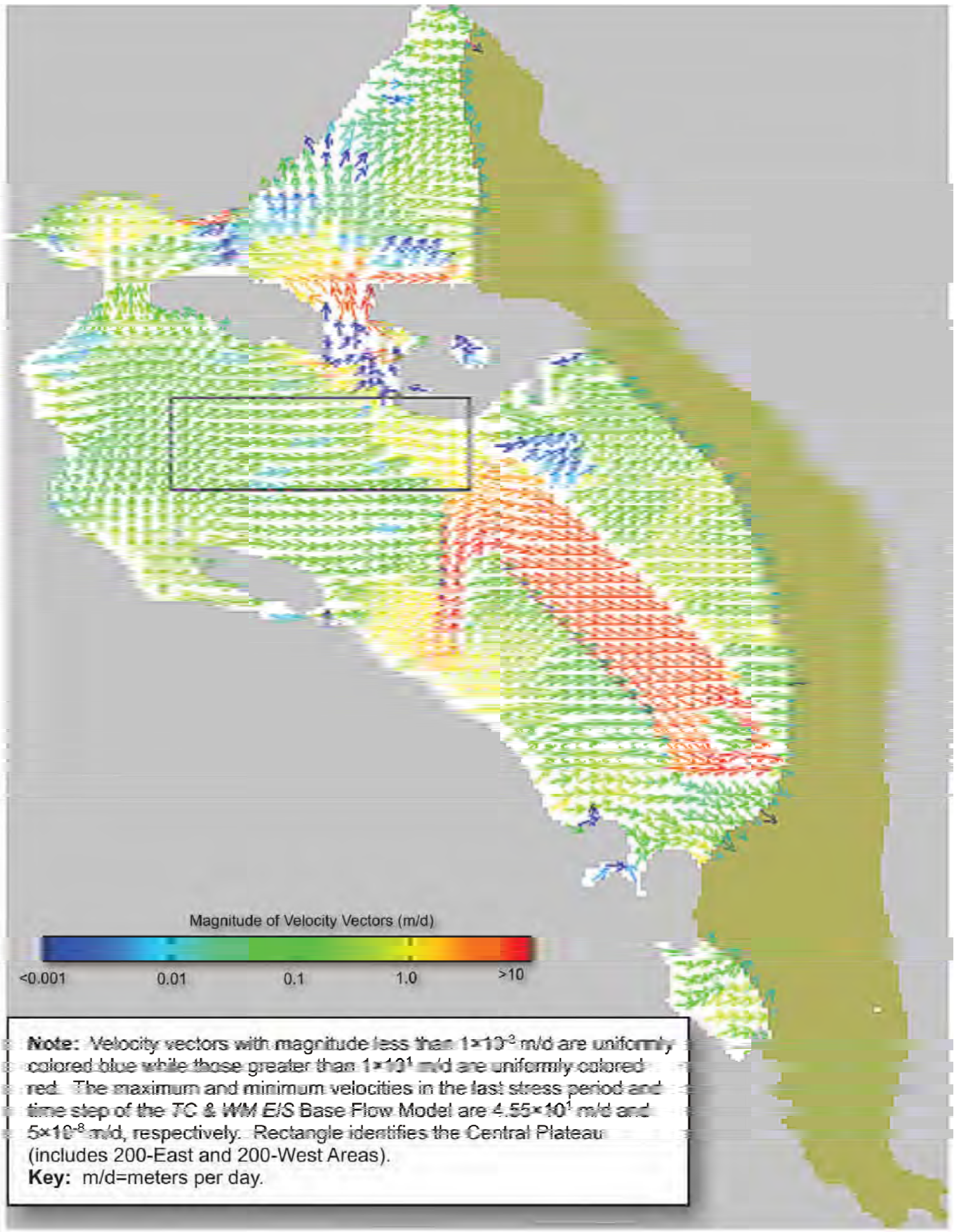

Figure V–15. Base Case Flow Model, Layer 15 (116–117 meters above mean sea level) Vector Velocities

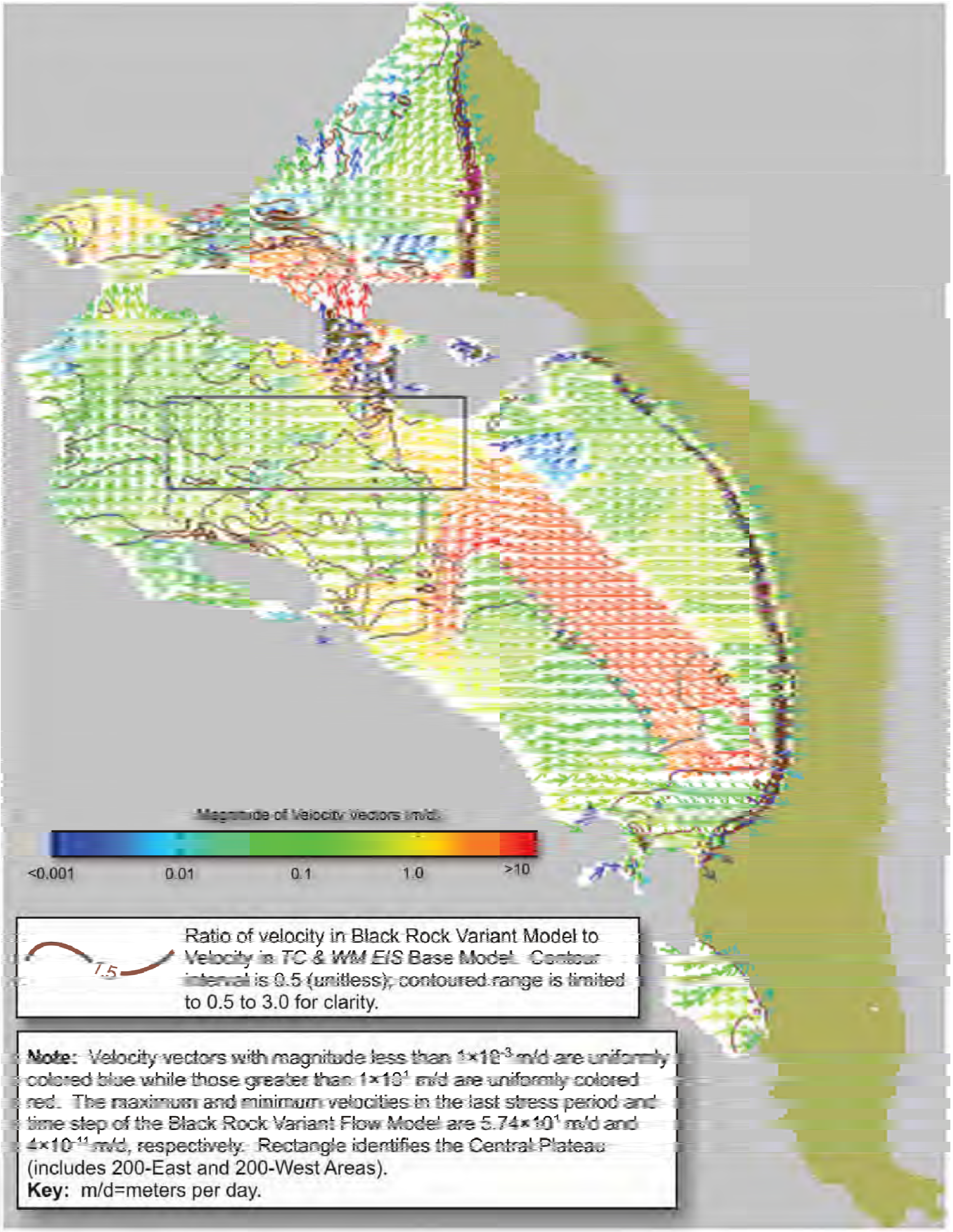

Figure V–16. Black Rock Reservoir Variant Flow Field Model, Layer 15 (116–117 meters above mean sea level) Vector Velocities

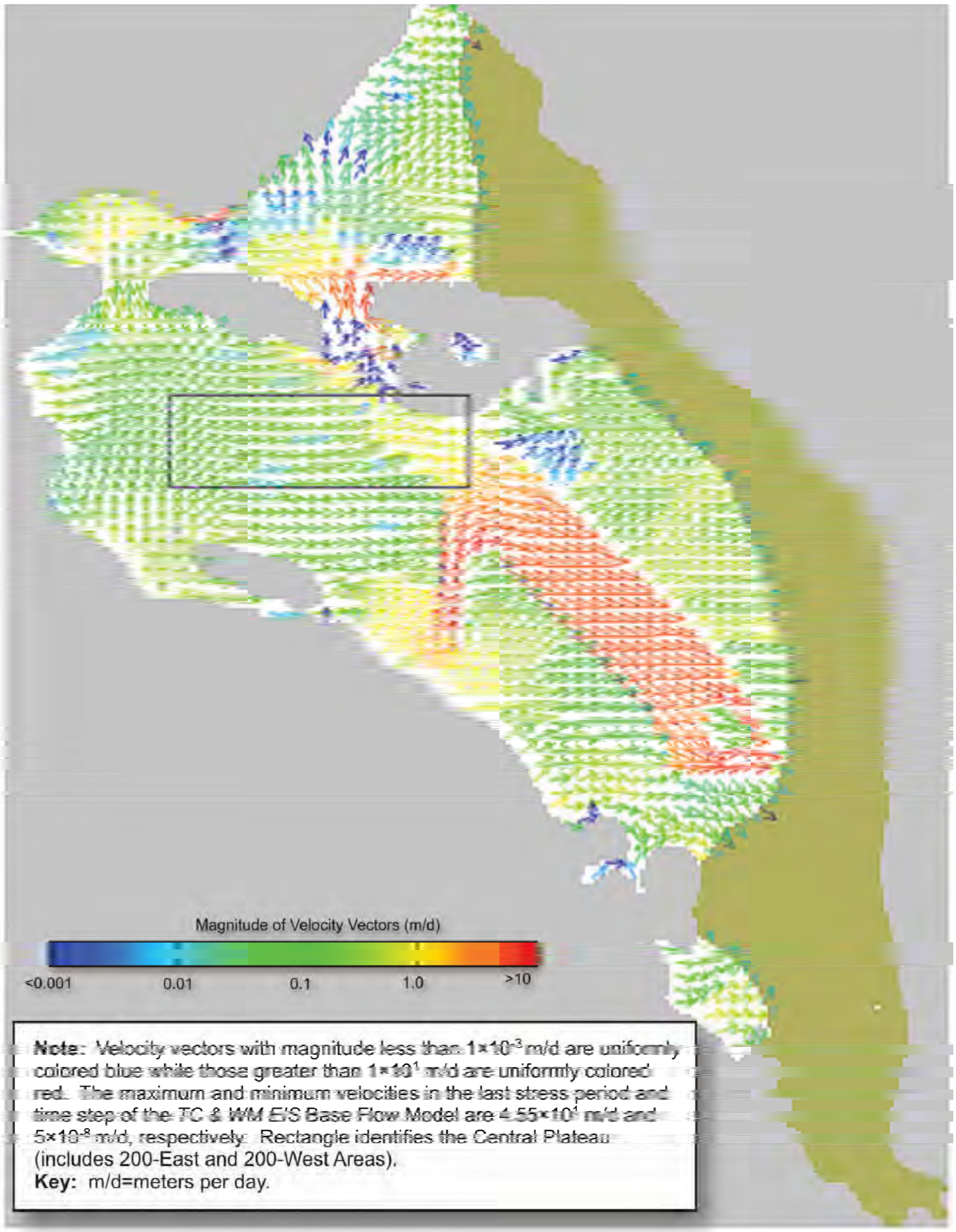

Figure V–17. Base Case Flow Model, Layer 16 (115–116 meters above mean sea level) Vector Velocities

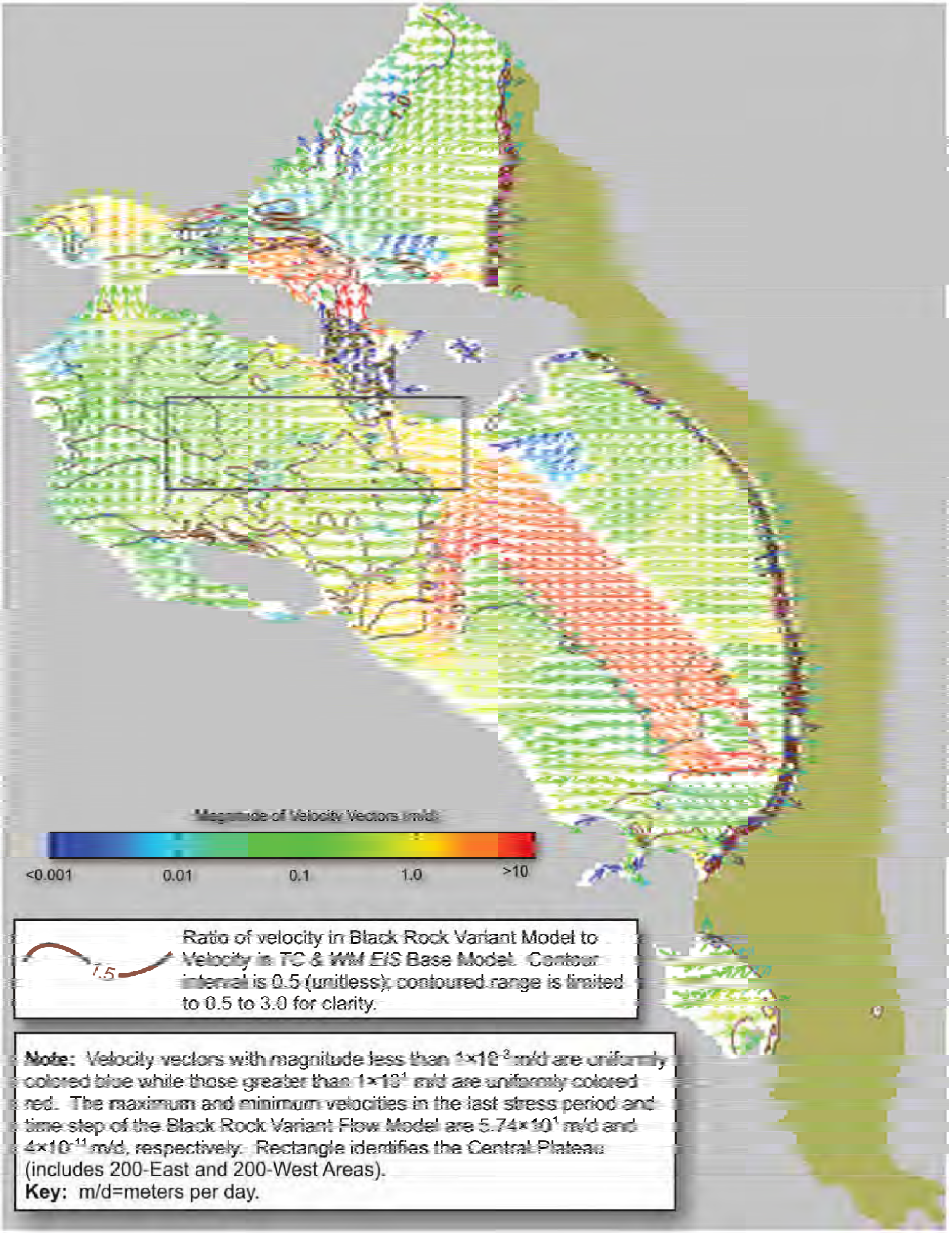

Figure V–18. Black Rock Reservoir Variant Flow Field Model, Layer 16 (115–116 meters above mean sea level) Vector Velocities

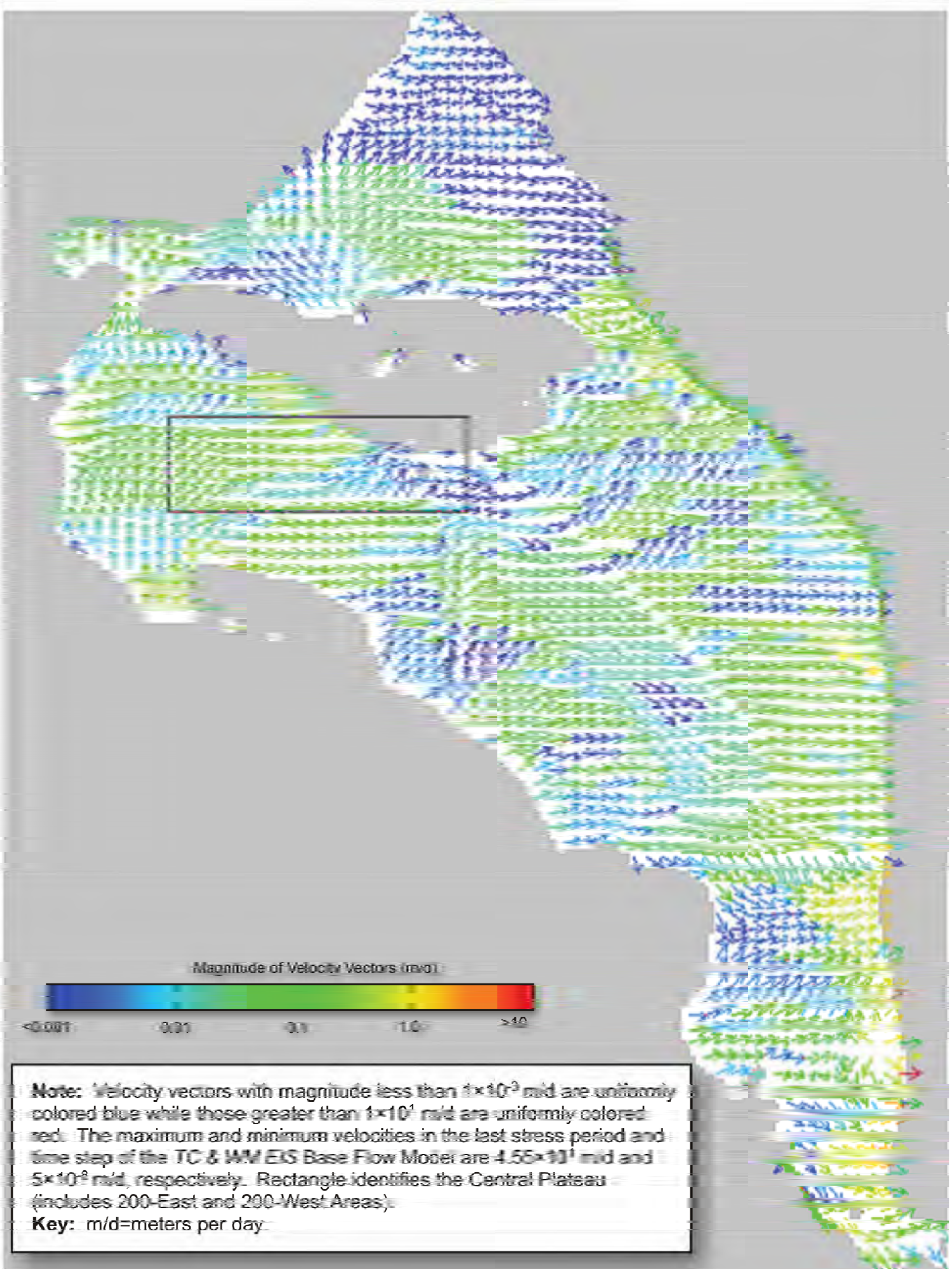

Figure V–19. Base Case Flow Model, Layer 20 (100–105 meters above mean sea level) Vector Velocities

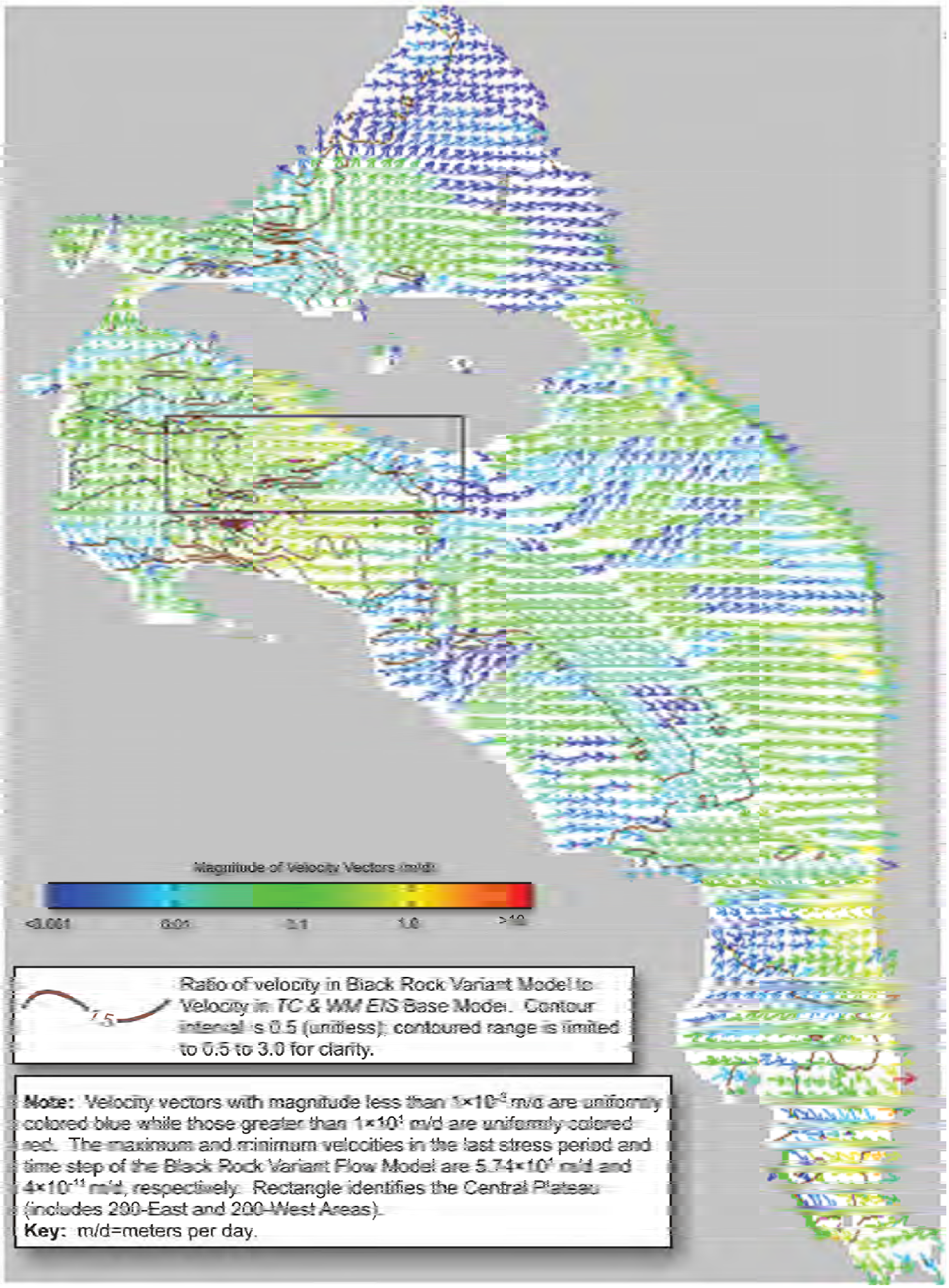

Figure V–20. Black Rock Reservoir Variant Flow Field Model, Layer 20 (100–105 meters above mean sea level) Vector Velocities

In Layers 14 (117 to 118 meters [383.9 to 387.2 feet] amsl), 15 (116 to 117 meters [380.6 to 383.9 feet] amsl), 16 (115 to 116 meters [377.3 to 380.6 feet] amsl), and 20 (100 to 105 meters [328.1 to 344.5 feet] amsl), only minor differences in groundwater flow vectors are noted between the models, with the exception of the tendency of flow through the Central Plateau to the north-northeast and into Gable Gap depicted in the BRR model. In general, the *TC & WM EIS* Base Case model depicts the area in the Central Plateau moving to the east at relatively low velocities. In all layers, unlike the *TC & WM EIS* Base Case model, the BRR model depicts a high velocity of flow channel through Gable Gap and in a northwesterly direction toward the Columbia River.

V.4.2 Changes to Vadose Zone Depth and Transport Travel Times

The inundation depth results from the rising water table associated with the BRR variant model are summarized in Table V–4. A calculation of the vadose zone decrease in depth (percentage) under BRR variant conditions compared to *TC & WM EIS* Base Case vadose zone depths is also included in Table V–4.

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
T Barrier[a]	135.6	145.3	77	9.7	12.6
U Barrier[a]	136.6	148.4	68	11.8	17.4
S Barrier[a]	137.2	150.6	72	13.5	18.8
B Barrier[a]	122.8	124.5	81	1.7	2.1
A Barrier[a]	122.7	124.5	83	1.8	2.2
IDFW Barrier[a]	137.5	146.9	74	9.4	12.7
IDFE Barrier[a]	122.8	124.5	100	1.7	1.7
RPPDF Barrier[a]	128.5	134.8	90	6.3	7.0
FFTF Barrier[a]	119.3	120.7	44	1.4	3.2
T31 & T34 Barrier[a]	136.8	146.3	74	9.5	12.8
116-B-4	120.0	120.2	20	0.2	<1
116-B-6B	120.0	120.3	24	0.3	1.3
116-K-2d	118.6	118.8	12	0.2	1.7
116-K-2e	118.6	118.8	12	0.2	1.7
116-KE-4	118.9	119.3	18	0.4	2.2
116-KW-3	118.7	119	24	0.3	1.3
116-KE-1	119.0	119.5	24	0.5	2.1
116-KW-1	119.0	119.4	24	0.4	1.7
116-KE-2	119.0	119.4	24	0.4	1.7
120-KE-1	119.3	120.0	32	0.7	2.2
116-N-1a	118.2	118.2	24	0.0	0
116-N-1b	118.2	118.2	24	0.0	0
316-5	105.9	105.9	16	0.0	0
116-N-1c	118.2	118.2	24	0.0	0
116-N-1d	118.2	118.2	24	0.0	0
116-N-1e	118.2	118.2	24	0.0	0
116-N-1f	118.2	118.2	24	0.0	0
116-N-3a	118.1	118.2	24	0.1	<1

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
116-N-3b	118.1	118.2	24	0.1	<1
116-N-3c	118.1	118.2	24	0.1	<1
116-N-3d	118.1	118.2	24	0.1	<1
116-N-3e	118.1	118.2	24	0.1	<1
116-N-3f	118.1	118.2	24	0.1	<1
316-1	105.7	105.8	12	0.1	<1
UPR-100-N-7	118.3	118.3	24	0.0	0
UPR-100-N-3	118.3	118.3	24	0.0	0
216-B-14	123.2	125.6	106	2.4	2.3
216-B-15	123.2	125.6	106	2.4	2.3
216-B-16	123.5	126.1	106	2.6	2.5
216-B-17	123.7	126.6	106	2.9	2.7
216-B-18	123.7	126.6	106	2.9	2.7
216-B-19	123.7	126.6	106	2.9	2.7
216-B-20	123.7	126.6	106	2.9	2.7
216-B-21	123.9	127.1	106	3.2	3.0
316-2	105.7	105.7	16	0.0	0
216-B-22	123.9	127.1	106	3.2	3.0
216-B-23	123.9	127.1	106	3.2	3.0
216-B-24	123.9	127.1	106	3.2	3.0
216-B-25	124.1	127.6	106	3.5	3.3
216-B-26	124.1	127.6	106	3.5	3.3
216-B-27	124.1	127.6	106	3.5	3.3
216-B-28	124.1	127.6	106	3.5	3.3
216-B-29	123.8	126.9	106	3.1	2.9
216-B-30	123.8	126.9	106	3.1	2.9
216-B-31	124.1	127.5	106	3.4	3.2
316-4	114.5	115.4	22	0.9	4.1
216-B-32	124.1	127.5	106	3.4	3.2
216-B-33	124.1	127.5	106	3.4	3.2
216-B-34	124.1	127.5	106	3.4	3.2
216-B-52	123.9	127.1	106	3.2	3.0
216-B-53A	123.6	126.4	106	2.8	2.6
216-B-53B	123.6	126.4	106	2.8	2.6
216-B-58	123.9	127.1	106	3.2	3.0
600 NRDWL[b]	122.0	123.6	42	1.6	3.8
600-148[b]	130.0	139.9	90	9.9	11.0
USEcol[b]	125.6	130.8	104	5.2	5.0
618-9	107.3	107.4	16	0.1	<1
200-E-103	122.7	124.5	100	1.8	1.8
200-E-107	122.7	124.5	100	1.8	1.8
200-E-136	122.8	124.5	100	1.7	1.7
200-E-54	122.7	124.5	100	1.8	1.8
200-E-61	122.7	124.5	100	1.8	1.8

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	***TC & WM EIS*** **Base Case Flow Field Head (meters)**	**BRR Variant Flow Field Head (meters)**	***TC & WM EIS*** **Base Case Vadose Zone Length (meters)**	**BRR Variant Inundation Depth (meters)**	**BRR Variant Decrease in Vadose Zone (percent)**
200-E-78	122.7	124.5	100	1.8	1.8
200-E-85	122.8	124.5	100	1.7	1.7
201-C	122.8	124.5	90	1.7	1.9
216-A-1	122.7	124.5	86	1.8	2.1
216-A-10	122.8	124.5	98	1.7	1.7
618-11	117.7	118.9	20	1.2	6.0
216-A-13	122.8	124.5	100	1.7	1.7
216-A-15	122.7	124.5	100	1.8	1.8
216-A-16	122.7	124.5	90	1.8	2.0
216-A-17	122.7	124.5	90	1.8	2.0
216-A-18	122.7	124.5	86	1.8	2.1
216-A-19	122.7	124.4	86	1.7	2.0
216-A-2	122.7	124.5	100	1.8	1.8
216-A-20	122.7	124.4	86	1.7	2.0
216-A-21	122.7	124.5	98	1.8	1.8
216-A-22	122.7	124.5	100	1.8	1.8
316-3	105.8	105.8	18	0.0	0
216-A-24	122.7	124.4	64	1.7	2.7
216-A-26	122.7	124.5	100	1.8	1.8
216-A-26A	122.7	124.5	100	1.8	1.8
216-A-27	122.7	124.5	98	1.8	1.8
216-A-28	122.7	124.5	100	1.8	1.8
216-A-3	122.7	124.5	100	1.8	1.8
216-A-30	122.7	124.4	86	1.7	2.0
216-A-31	122.7	124.5	98	1.8	1.8
216-A-32	122.7	124.5	100	1.8	1.8
216-A-35	122.8	124.5	100	1.7	1.7
UPR-300-1	106.0	106.1	14	0.1	<1
216-A-36-A	122.7	124.5	98	1.8	1.8
216-A-36-B	122.7	124.5	98	1.8	1.8
216-A-37-1	122.7	124.4	86	1.7	2.0
216-A-37-2	122.7	124.4	86	1.7	2.0
216-A-39	122.7	124.5	82	1.8	2.2
216-A-4	122.7	124.5	100	1.8	1.8
216-A-40	122.7	124.5	90	1.8	2.0
216-A-41	122.7	124.5	90	1.8	2.0
216-A-45	122.8	124.5	100	1.7	1.7
216-A-5	122.7	124.5	98	1.8	1.8
309-WS-1	106.1	106.1	20	0.0	0
216-A-6	122.7	124.5	92	1.8	2.0
216-A-7	122.7	124.5	86	1.8	2.1
216-A-8	122.7	124.4	86	1.7	2.0
216-A-9	122.7	124.5	90	1.8	2.0
216-C-1	122.8	124.5	90	1.7	1.9

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
216-C-10	122.8	124.5	88	1.7	1.9
216-C-2	122.8	124.5	90	1.7	1.9
216-C-3	122.8	124.5	90	1.7	1.9
216-C-4	122.8	124.5	90	1.7	1.9
216-C-5	122.8	124.5	90	1.7	1.9
116-C-2A	120.0	120.4	36	0.4	1.1
300-264	106.3	106.3	14	0.0	0
216-C-6	122.8	124.5	90	1.7	1.9
216-C-9	122.8	124.5	88	1.7	1.9
218-C-9	122.8	124.5	88	1.7	1.9
218-E-1	122.8	124.5	100	1.7	1.7
218-E-12A	122.8	124.5	72	1.7	2.4
218-E-12B[b]	124.3	124.3	72	0.0	0
218-E-14	122.7	124.5	94	1.8	1.9
218-E-15	122.7	124.5	94	1.8	1.9
218-E-8	124.0	N/A	72	N/A	N/A
241-CX-72	122.8	124.5	90	1.7	1.9
216-B-3[b]	122.7	124.4	56	1.7	3.0
242-A	122.7	124.5	90	1.8	2.0
291-C-1	122.8	124.5	90	1.7	1.9
UPR-200-E-145	122.7	124.5	86	1.8	2.1
UPR-200-E-39	122.7	124.5	100	1.8	1.8
UPR-200-E-40	122.7	124.5	100	1.8	1.8
UPR-200-E-86	122.7	124.5	72	1.8	2.5
200-W-22	136.4	150.3	72	13.9	19.3
200-W-69	136.4	150.3	72	13.9	19.3
202-S	136.5	150.9	72	14.4	20.0
216-S-1&2	137.0	150.5	74	13.5	18.2
200-E-28	122.8	124.6	100	1.8	1.8
216-S-10P	138.4	154.2	72	15.8	21.9
216-S-11P	138.4	154.2	72	15.8	21.9
216-S-12	136.0	149.7	74	13.7	18.5
216-S-13	136.8	150.7	72	13.9	19.3
216-S-14	136.3	151.2	72	14.9	20.7
216-S-16P[b]	140.5	156.2	72	15.7	21.8
216-S-17[b]	139.1	154.8	72	15.6	21.7
216-S-19	135.8	151.2	72	15.4	21.4
216-S-20	136.1	150.5	72	14.4	20.0
216-S-22	135.6	149.7	74	14.1	19.1
200-E-30	122.8	124.6	100	1.8	1.8
216-S-23	136.3	148.5	74	12.2	16.5
216-S-25	137.8	151.4	68	13.6	20.0
216-S-26	136.1	150.8	72	14.7	20.4
216-S-3	136.8	149.6	74	12.8	17.3

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
216-S-5	138.3	153.5	72	15.2	21.1
216-S-6	138.6	153.8	72	15.2	21.1
216-S-7	136.8	150.7	74	13.9	18.8
216-S-8	137.0	150.5	74	13.5	18.2
216-S-9	136.4	149.2	74	12.8	17.3
218-W-7	136.1	150.3	72	14.2	19.7
200-E-55	122.8	124.6	100	1.8	1.8
233-S	136.4	150.4	72	14.0	19.4
291-S	136.0	149.7	72	13.7	19.0
UPR-200-W-61	136.5	150.9	72	14.4	20.0
UPR-200-W-95	137.3	151.7	72	14.4	20.0
200-W-PP	135.5	145.9	76	10.4	13.7
200-W-45	133.7	142.5	88	8.8	10.0
200-W-9	134.3	143.4	88	9.1	10.3
216-T-1	134.0	142.6	88	8.6	9.8
216-T-12	135.7	144.7	86	9.0	10.5
216-T-13	135.8	145.5	72	9.7	13.5
200-E-95	122.8	124.6	100	1.8	1.8
216-T-2	134.3	143.4	88	9.1	10.3
216-T-20	135.4	145.5	70	10.1	14.4
216-T-27	135.6	145.5	70	9.9	14.1
216-T-29	133.7	142.5	88	8.8	10.0
216-T-3	134.6	143.8	86	9.2	10.7
216-T-33	134.0	143.0	88	9.0	10.2
216-T-34	134.4	143.1	82	8.7	10.6
216-T-35	134.7	143.6	82	8.9	10.9
216-T-36	135.7	145.1	72	9.4	13.1
216-T-4A[b]	135.7	144.8	76	9.1	12.0
200-E-97	122.8	124.6	100	1.8	1.8
216-T-6	135.0	144.3	86	9.3	10.8
216-T-8	133.9	142.8	88	8.9	10.1
216-TY-201	135.5	145.1	74	9.6	13.0
216-W-LWC	134.1	143.9	82	9.8	12.0
224-T	134.3	143.4	88	9.1	10.3
241-T-361	134.6	143.8	86	9.2	10.7
200-W-20a	134.0	143.0	88	9.0	10.2
200-W-20b	134.0	143.0	88	9.0	10.2
TRUSAF	134.3	143.4	88	9.1	10.3
UPR-200-W-102	134.3	143.4	88	9.1	10.3
2101-M-Pond	122.9	124.6	100	1.7	1.7
UPR-200-W-135	135.4	145.5	70	10.1	14.4
UPR-200-W-21	134.0	143.0	88	9.0	10.2
UPR-200-W-28	135.4	145.5	70	10.1	14.4
UPR-200-W-29	135.4	145.5	74	10.1	13.6

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
UPR-200-W-38	134.3	143.4	88	9.1	10.3
UPR-200-W-97	135.5	145.1	74	9.6	13.0
200-W-44	134.8	145.7	78	10.9	14.0
207-U	136.3	148.0	72	11.7	16.3
216-S-21	137.1	150.1	68	13.0	19.1
216-S-4	137.5	150.5	68	13.0	19.1
212-B-CLS	122.8	124.6	100	1.8	1.8
216-U-1&2	135.7	147.1	78	11.4	14.6
216-U-10[b]	137.7	149.7	68	12.0	17.6
216-U-12	135.7	148.4	80	12.7	15.9
216-U-13	136.7	148.3	68	11.6	17.1
216-U-15	135.4	146.7	78	11.3	14.5
216-U-16	135.8	147.6	78	11.8	15.1
216-U-17	134.6	146.0	80	11.4	14.3
216-U-3	136.5	148.4	68	11.9	17.5
216-U-4	135.4	146.7	78	11.3	14.5
216-U-4A	135.4	146.7	78	11.3	14.5
216-B-10A	122.8	124.6	100	1.8	1.8
216-U-5	134.8	145.7	78	10.9	14.0
216-U-6	134.8	145.7	78	10.9	14.0
216-U-7	134.8	145.7	78	10.9	14.0
216-U-8	135.2	147.0	80	11.8	14.8
221-U	135.4	146.7	78	11.3	14.5
241-U-361	135.7	147.1	78	11.4	14.6
241-WR-Vault	134.8	145.7	78	10.9	14.0
UPR-200-W-101	135.4	146.7	78	11.3	14.5
UPR-200-W-138	134.8	145.7	78	10.9	14.0
UPR-200-W-163	135.0	146.5	76	11.5	15.1
116-C-2C	120.0	120.4	36	0.4	1.1
216-B-10B	122.8	124.6	100	1.8	1.8
UPR-200-W-39	135.4	146.7	78	11.3	14.5
216-Z-1&2	136.8	147.9	76	11.1	14.6
216-Z-10	136.5	147.1	76	10.6	13.9
216-Z-11	136.7	148.3	70	11.6	16.6
216-Z-12	137.1	148.2	76	11.1	14.6
216-Z-13	136.8	147.9	74	11.1	15.0
216-Z-14	136.8	147.9	74	11.1	15.0
216-Z-15	136.7	147.5	74	10.8	14.6
216-Z-16	136.5	147.1	76	10.6	13.9
216-B-11A & B	122.8	124.5	78	1.7	2.2
216-Z-17	136.5	147.1	76	10.6	13.9
216-Z-18	136.9	148.3	76	11.4	15.0
216-Z-1A	136.8	147.9	76	11.1	14.6
216-Z-20	136.6	147.9	70	11.3	16.1

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
216-Z-21	136.1	147.1	72	11.0	15.3
216-Z-3	136.8	147.9	76	11.1	14.6
216-Z-4	136.5	147.1	76	10.6	13.9
216-Z-5	136.5	147.1	76	10.6	13.9
216-Z-6	136.5	147.1	76	10.6	13.9
216-Z-7	136.2	146.7	70	10.5	15.0
216-B-12	122.8	124.5	90	1.7	1.9
216-Z-8	136.3	147.1	68	10.8	15.9
216-Z-9	136.3	147.1	72	10.8	15.0
218-W-1	136.6	146.7	74	10.1	13.6
218-W-1A[b]	134.3	142.9	82	8.6	10.5
218-W-2	136.7	147.1	74	10.4	14.1
218-W-2A[b]	135.8	145.0	76	9.2	12.1
218-W-3	136.6	146.3	78	9.7	12.4
218-W-3A[b]	136.0	145.0	74	9.0	12.2
218-W-3AE[b]	135.4	144.2	74	8.8	11.9
218-W-4A[b]	136.3	146.1	78	9.8	12.6
216-B-4	122.8	124.6	100	1.8	1.8
218-W-4B	137.2	147.8	74	10.6	14.3
218-W-4C[b]	137.0	148.8	76	11.8	15.5
218-W-5[b]	136.6	145.8	74	9.2	12.4
231-Z-PuIF	136.5	147.1	76	10.6	13.9
232-Z	136.8	147.9	74	11.1	15.0
236-Z-PuRF	136.7	147.5	74	10.8	14.6
241-Z-361	136.8	147.9	72	11.1	15.4
242-Z-AmRF	136.7	147.5	74	10.8	14.6
2736-Z-PuFP	136.8	147.9	74	11.1	15.0
216-B-5	122.8	124.5	84	1.7	2.0
291-Z-EFCH	136.8	147.9	74	11.1	15.0
UPR-200-W-103	136.8	147.9	74	11.1	15.0
216-B-50	122.8	124.4	76	1.6	2.1
216-B-51	122.8	124.5	72	1.7	2.4
216-B-54	123.9	127.1	106	3.2	3.0
216-B-55	122.8	124.6	90	1.8	2.0
216-B-57	122.8	124.5	76	1.7	2.2
116-B-1	119.9	119.9	16	0.0	0
216-B-59	122.8	124.5	84	1.7	2.0
216-B-6	122.8	124.5	100	1.7	1.7
216-B-60	122.8	124.6	100	1.8	1.8
216-B-62	122.8	124.5	90	1.7	1.9
216-B-63	122.7	124.5	78	1.8	2.3
216-B-9	122.8	124.5	84	1.7	2.0
218-E-10[b]	122.8	124.5	86	1.7	2.0
218-E-2	122.8	124.5	84	1.7	2.0

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
218-E-4	122.8	124.5	84	1.7	2.0
218-E-5	122.8	124.5	84	1.7	2.0
116-B-11	119.9	119.9	16	0.0	0
218-E-5A	122.8	124.5	84	1.7	2.0
221-B-BPS	122.8	124.5	100	1.7	1.7
224-B	122.8	124.6	100	1.8	1.8
241-B-361	122.8	124.5	84	1.7	2.0
UPR-200-E-7	122.8	124.5	84	1.7	2.0
UPR-200-E-77	122.8	124.5	90	1.7	1.9
UPR-200-E-78	122.8	124.5	84	1.7	2.0
UPR-200-E-79	122.8	124.5	80	1.7	2.1
UPR-200-E-84	122.8	124.6	80	1.8	2.3
UPR-200-E-85	122.8	124.5	100	1.7	1.7
116-C-1	119.7	119.8	16	0.1	<1
UPR-200-E-87	122.8	124.6	100	1.8	1.8
UPR-200-E-9	122.8	124.5	76	1.7	2.2
WESF	122.8	124.6	100	1.8	1.8
116-D-1A	117.3	117.4	26	0.1	<1
116-D-1B	117.3	117.4	26	0.1	<1
116-DR-7	117.4	117.5	28	0.1	<1
116-D-7	117.5	117.5	20	0.0	0
116-DR-1&2	117.3	117.3	20	0.0	0
116-DR-9	117.3	117.4	20	0.1	<1
116-DR-6	117.2	117.4	28	0.2	<1
116-C-5	119.9	120.0	16	0.1	<1
116-F-6	113.8	113.9	14	0.1	<1
116-F-10	113.8	113.9	14	0.1	<1
116-F-4	113.9	114.0	14	0.1	<1
116-F-3	113.8	113.9	14	0.1	<1
116-F-2	113.6	113.7	18	0.1	<1
116-F-14	113.6	113.7	18	0.1	<1
116-F-9	113.7	113.7	18	0.0	0
216-A-25a[b]	121.3	123.1	16	1.8	11.3
216-A-25b	123.0	N/A	16	N/A	N/A
216-A-25a[b]	121.3	123.1	16	1.8	11.3
216-A-25b	123.0	N/A	16	N/A	N/A
216-A-25c	123.0	N/A	16	N/A	N/A
116-B-5	120.0	120.2	20	0.2	<1
216-A-25d	123.0	N/A	16	N/A	N/A
216-A-25e	123.0	N/A	16	N/A	N/A
216-A-25f	123.0	N/A	16	N/A	N/A
216-N-1	125.5	128.2	54	2.7	5.0
216-N-2	125.5	N/A	54	N/A	N/A
216-N-3	125.5	N/A	54	N/A	N/A

Table V–4. Inundation Depths Resulting from the Black Rock Reservoir Variant Flow Field Model – All Hanford Site STOMP Model Locations *(continued)*

Location	*TC & WM EIS* Base Case Flow Field Head (meters)	BRR Variant Flow Field Head (meters)	*TC & WM EIS* Base Case Vadose Zone Length (meters)	BRR Variant Inundation Depth (meters)	BRR Variant Decrease in Vadose Zone (percent)
216-N-4	122.8	123.9	54	1.1	2.0
216-N-5	121.5	122.8	54	1.3	2.4
216-N-6	121.7	123.3	58	1.6	2.8
216-N-7	121.0	122.8	54	1.8	3.3
116-B-6A	120.0	120.3	24	0.3	1.3
116-H-3	115.4	115.4	16	0.0	0
116-H-4	115.5	115.5	16	0.0	0
116-H-1	115.2	115.2	14	0.0	0
116-H-7	115.2	115.3	14	0.1	<1
116-H-2	115.5	115.5	16	0.0	0
100-H-33	115.3	115.4	14	0.1	<1
116-K-1	118.6	118.8	8	0.2	2.5
116-K-2a	118.6	118.8	12	0.2	1.7
116-K-2b	118.6	118.8	12	0.2	1.7
116-K-2c	118.6	118.8	12	0.2	1.7

[a] Average values were calculated at barriers. These values were used for all sites within that barrier for STOMP models used in the *TC & WM EIS* alternatives impact analysis. All other STOMP model sites were part of the *TC & WM EIS* cumulative impact analyses.

[b] Site footprint covers more than one model cell. Head values are expressed as an average of all model cells covered.

Note: N/A indicates that the top of basalt is above the water table at these waste sites. To convert meters to feet, multiply by 3.281.

Key: BRR=Black Rock Reservoir; FFTF=Fast Flux Test Facility; IDFE=200-East Area Integrated Disposal Facility; IDFW=200-West Area Integrated Disposal Facility; N/A=not applicable; NRDWL=Nonradioactive Dangerous Waste Landfill; RPPDF=River Protection Project Disposal Facility; STOMP=Subsurface Transport Over Multiple Phases; *TC & WM EIS Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*; WESF=the Waste Encapsulation and Storage Facility.

The results comparing vadose zone travel times under BRR variant flow field model conditions (elevated water table) and *TC & WM EIS* Base Case flow model conditions are illustrated in vadose zone STOMP flux output graphs, included as Figures V–21 through V–32. STOMP vadose zone transport simulations were run at identical Waste Management alternative locations (10,000 years) for each of the compared flow fields using 1 curie of technetium-99. The Hanford *TC & WM EIS* STOMP vadose zone simulation Waste Management alternative descriptions are summarized in Table V–5. Further description of the STOMP modeling process can be found in Appendix N.

Figures V–21 through V–32 are vadose zone STOMP flux output graphs comparing the BRR variant STOMP model conditions to the *TC & WM EIS* Base Case STOMP model conditions. Each graph displays flux output to the flow field (bottom of the vadose zone/top of the water table) over the 10,000-year period of analysis. Output to the flow field is measured in three concentric areas: “Flux 1,” “Flux 2,” and “Flux 3.” “Flux 1” is the solute flux amount released to the flow field in a rectangular area directly below the source of technetium-99, “Flux 2” is the solute flux amount released to the flow field along a 50-meter (164.1-foot) perimeter surrounding the “Flux 1” area, and “Flux 3” is the solute flux amount released to the flow field along the outermost area of the site-specific STOMP modeled domain.

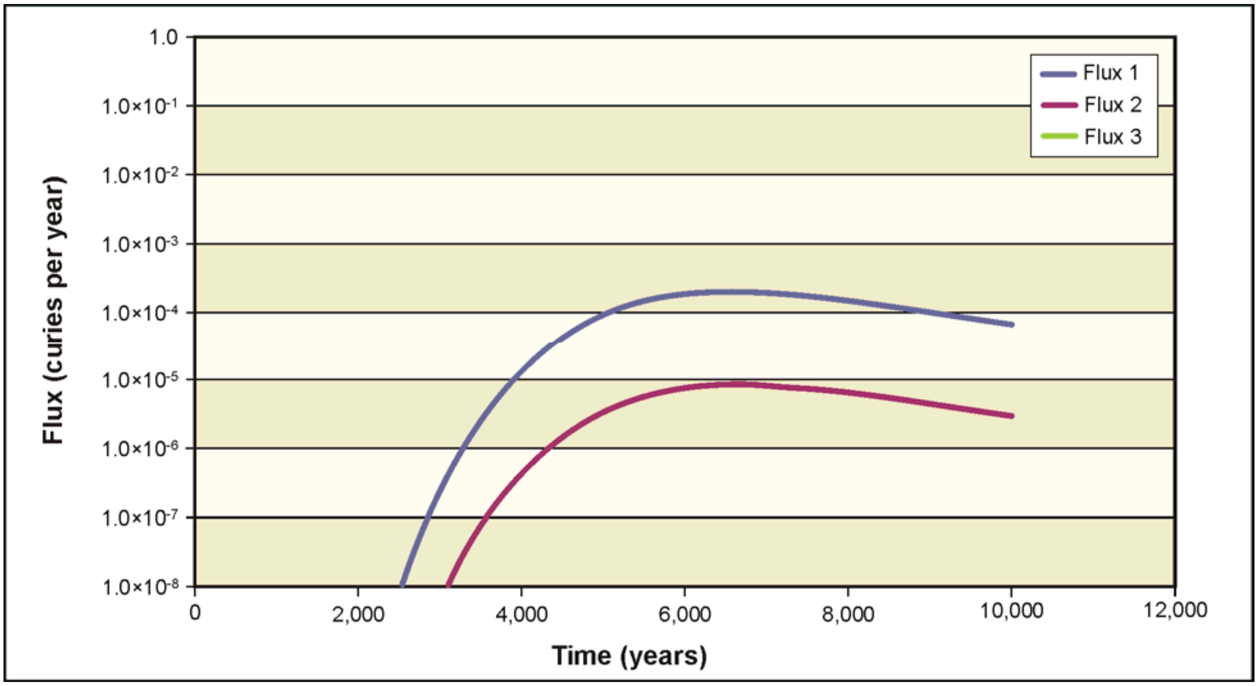

Figure V–21. Base Case Flow Model – Vadose Zone Flux Release over Time, 200-East Area Integrated Disposal Facility

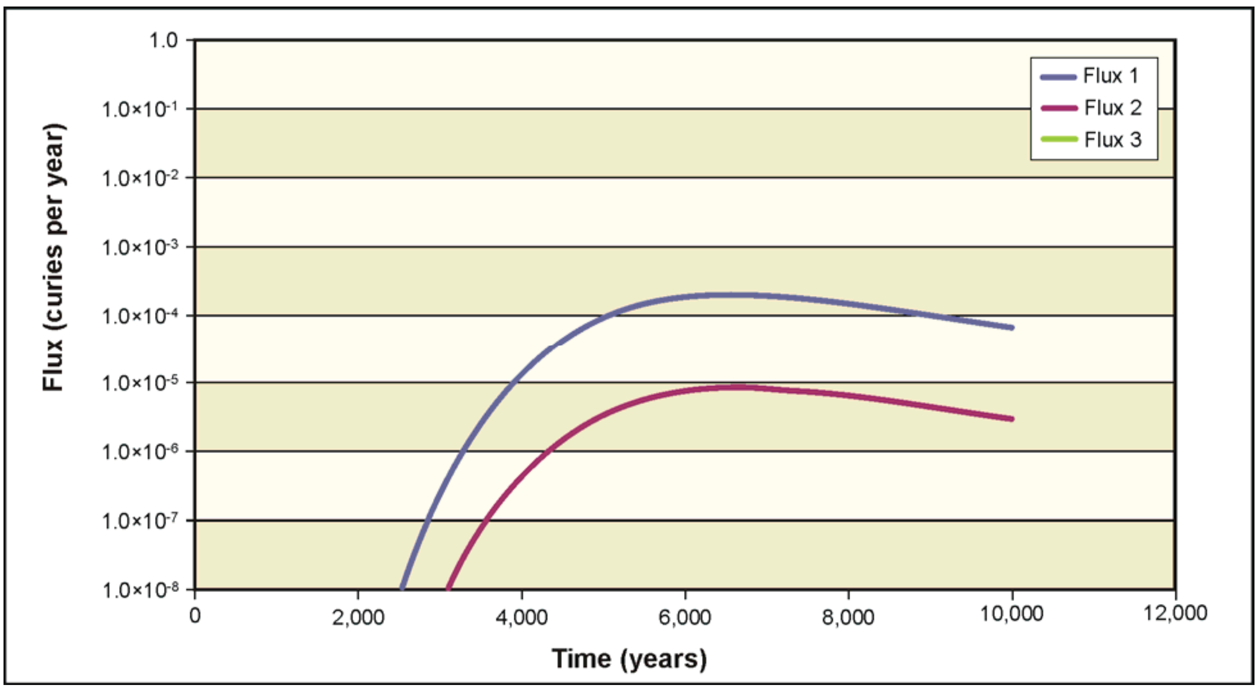

Figure V–22. Black Rock Reservoir Variant Flow Field Model – Vadose Zone Flux Release over Time, 200-East Area Integrated Disposal Facility

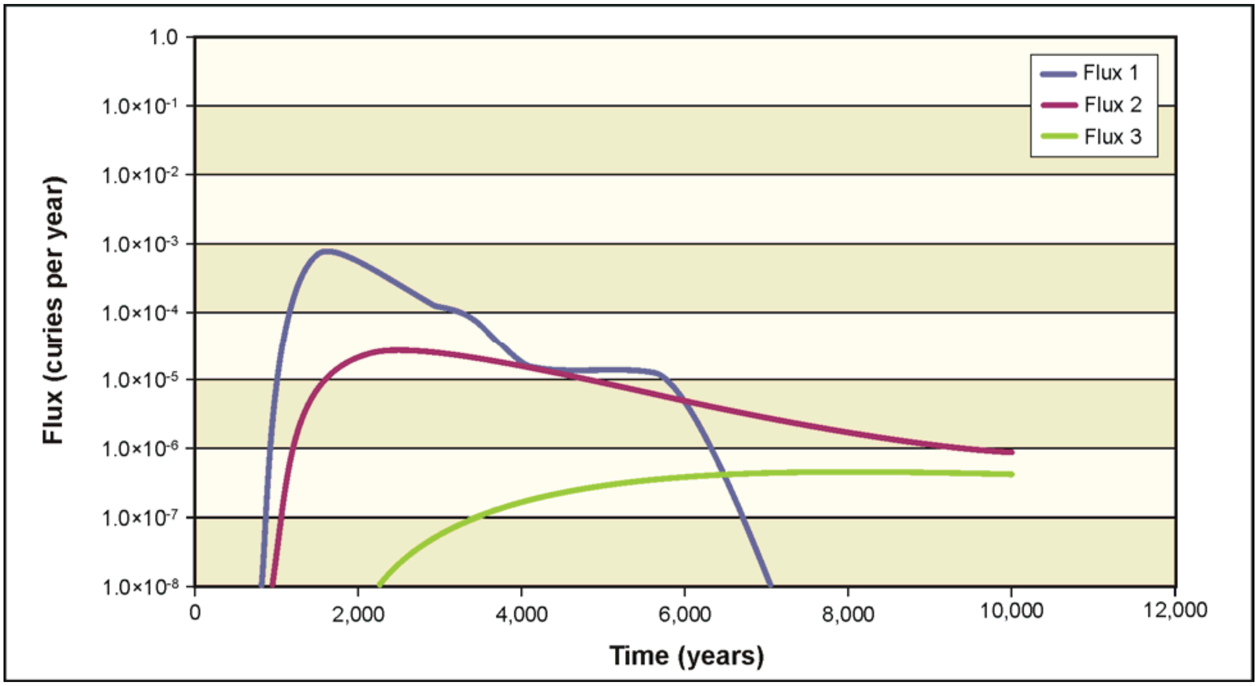

Figure V–23. Base Case Flow Model – Vadose Zone Flux Release over Time, 200-West Area Integrated Disposal Facility

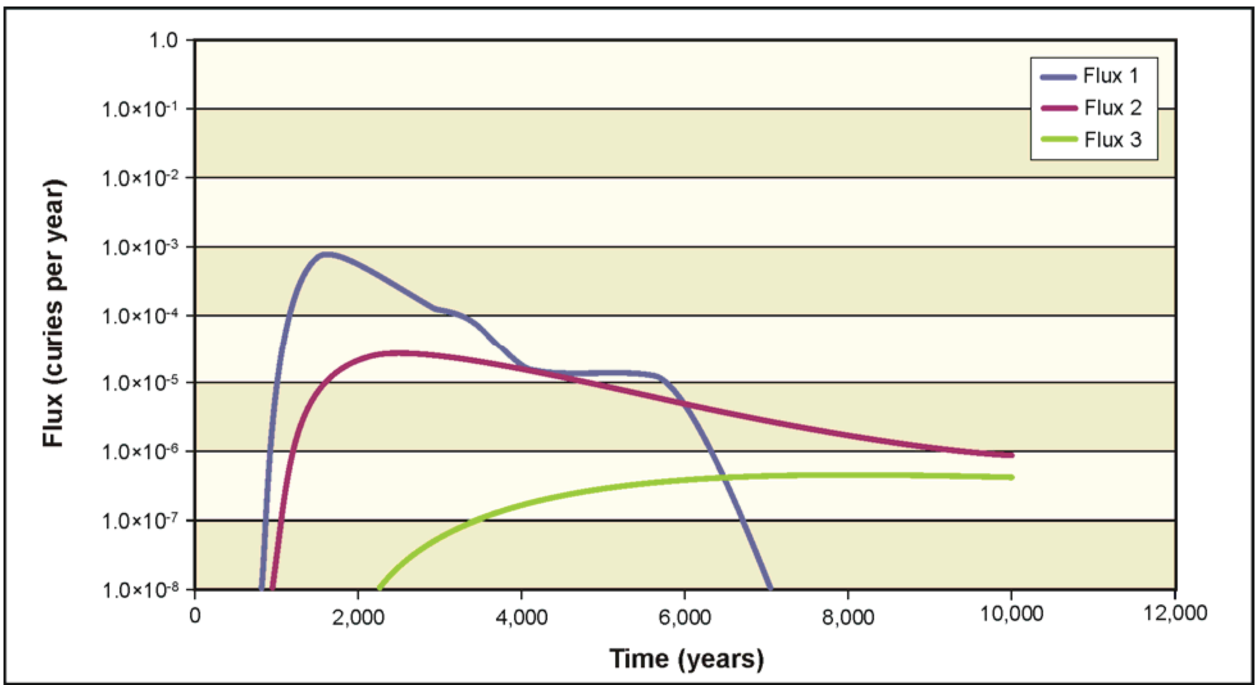

Figure V–24. Black Rock Reservoir Variant Flow Field Model – Vadose Zone Flux Release over Time, 200-West Area Integrated Disposal Facility

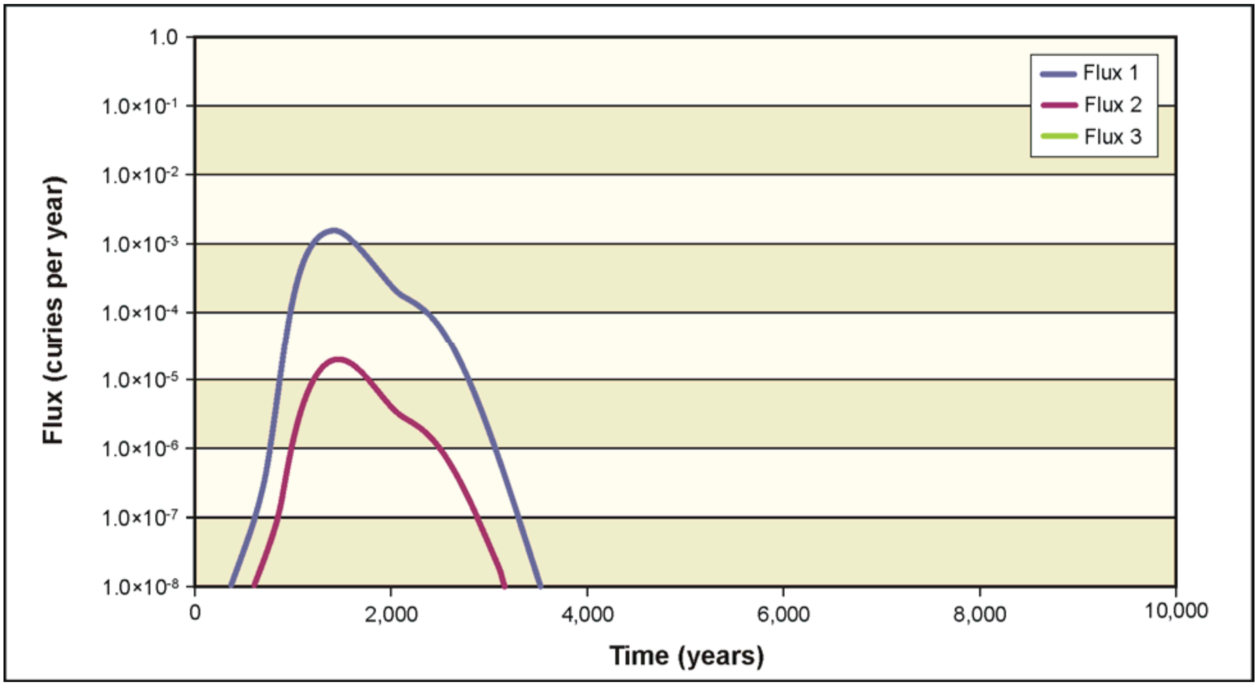

Figure V–25. Base Case Flow Model – Vadose Zone Flux Release over Time, 200-West Area, Trench 31

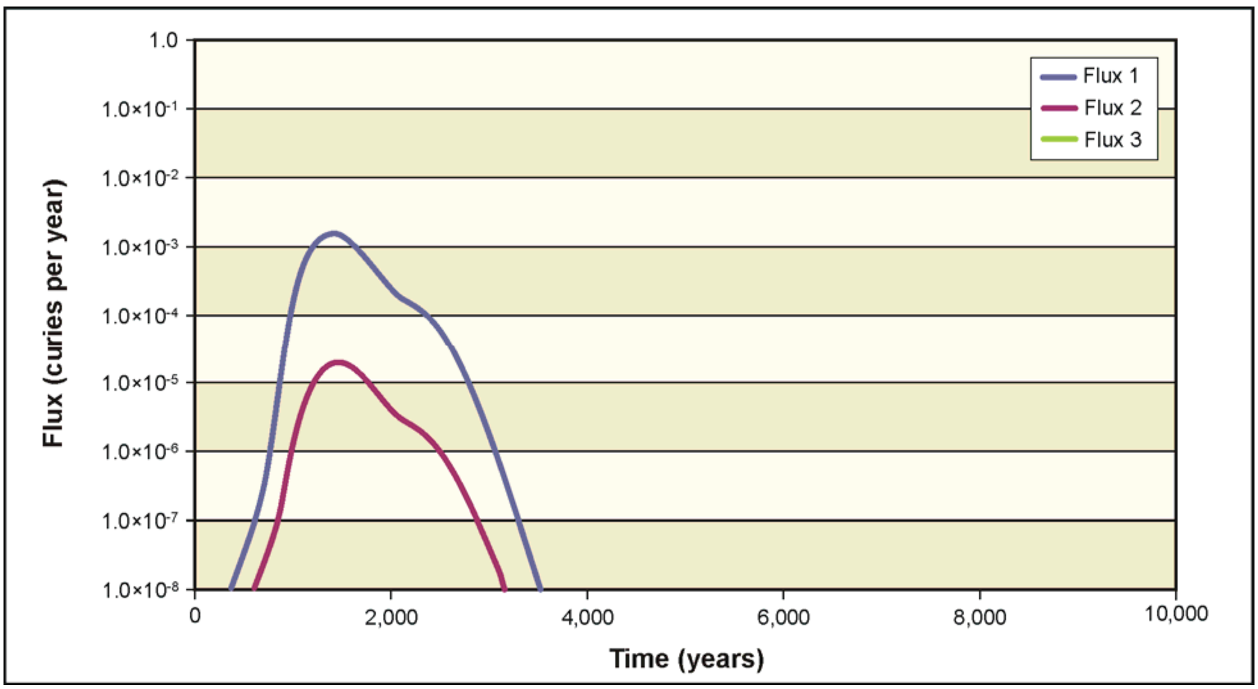

Figure V–26. Black Rock Reservoir Variant Flow Field Model – Vadose Zone Flux Release over Time, 200-West Area, Trench 31

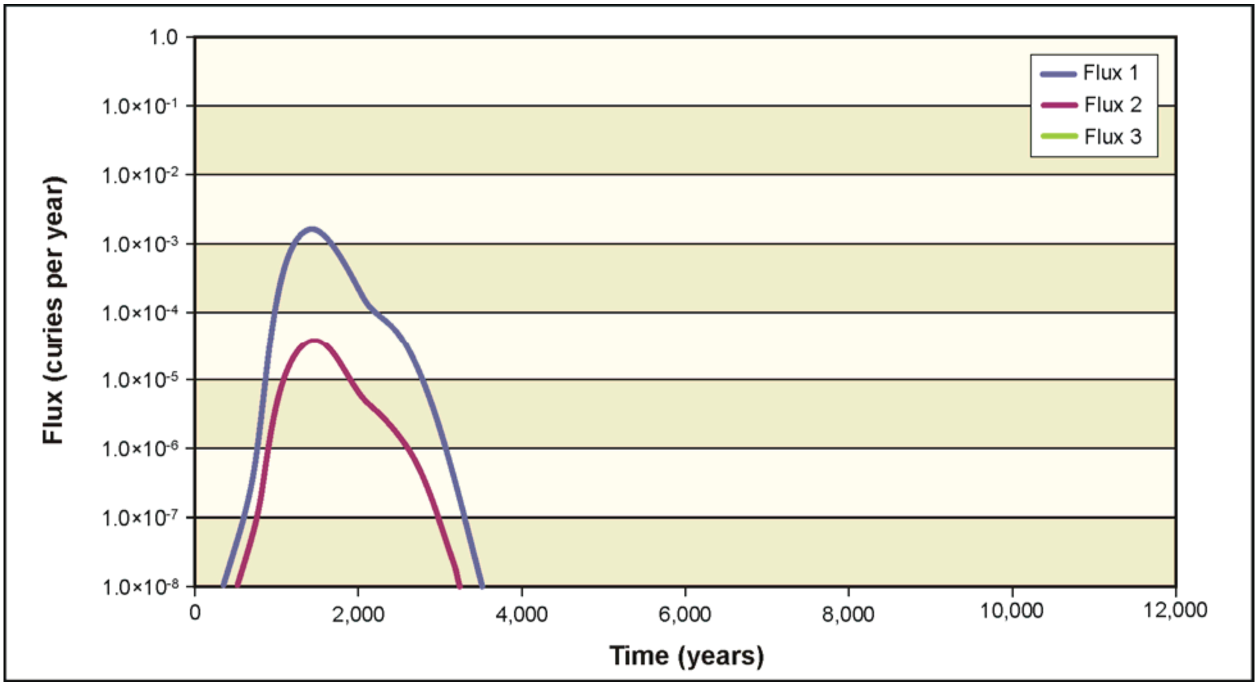

Figure V–27. Base Case Flow Model – Vadose Zone Flux Release over Time, 200-West Area, Trench 34

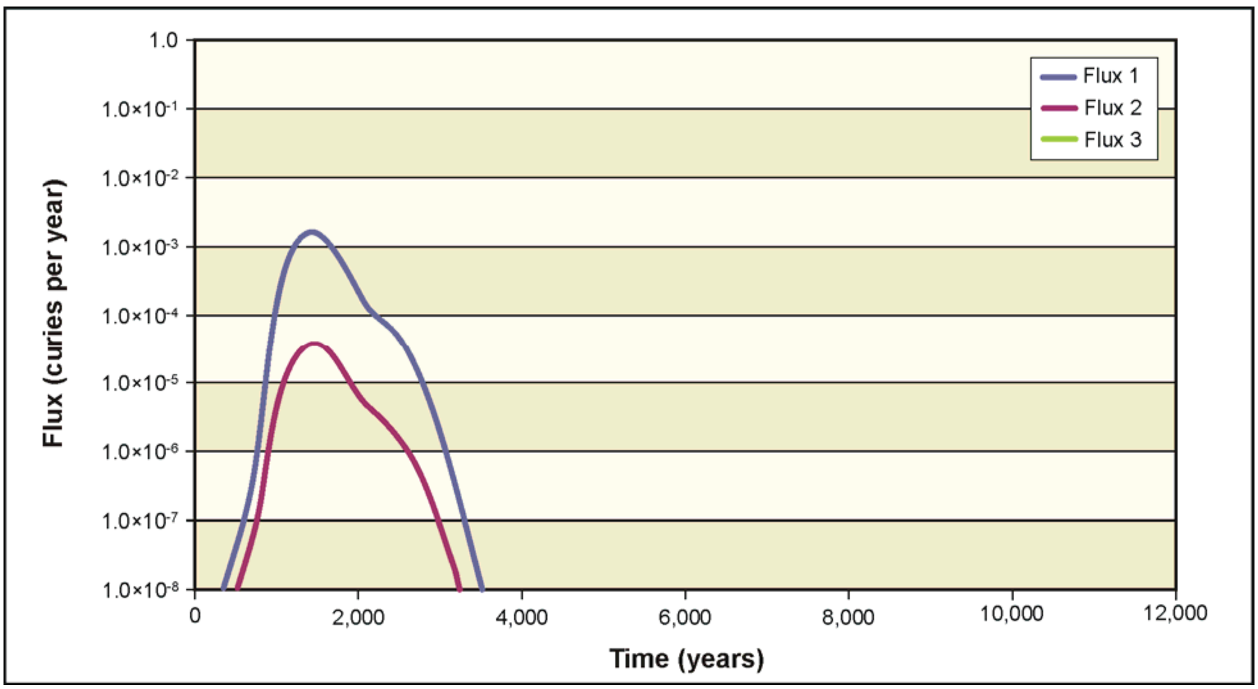

Figure V–28. Black Rock Reservoir Variant Flow Field Model – Vadose Zone Flux Release over Time, 200-West Area, Trench 34

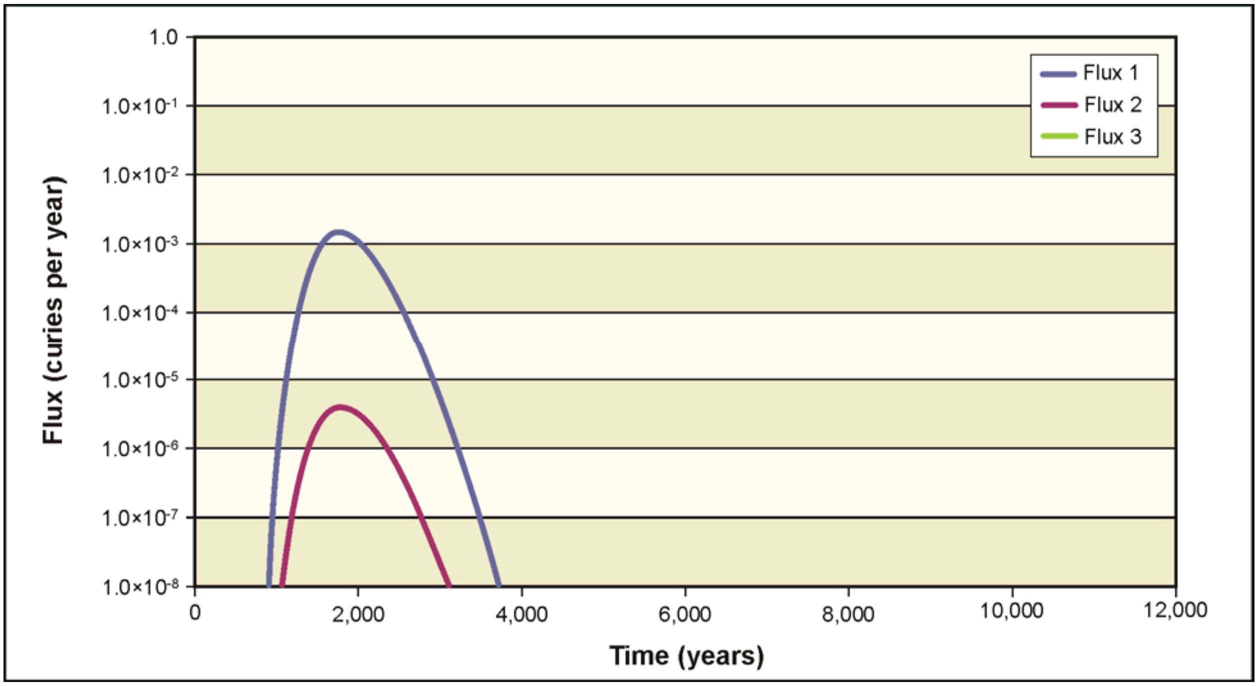

Figure V–29. Base Case Flow Model – Vadose Zone Flux Release over Time, River Protection Project Disposal Facility

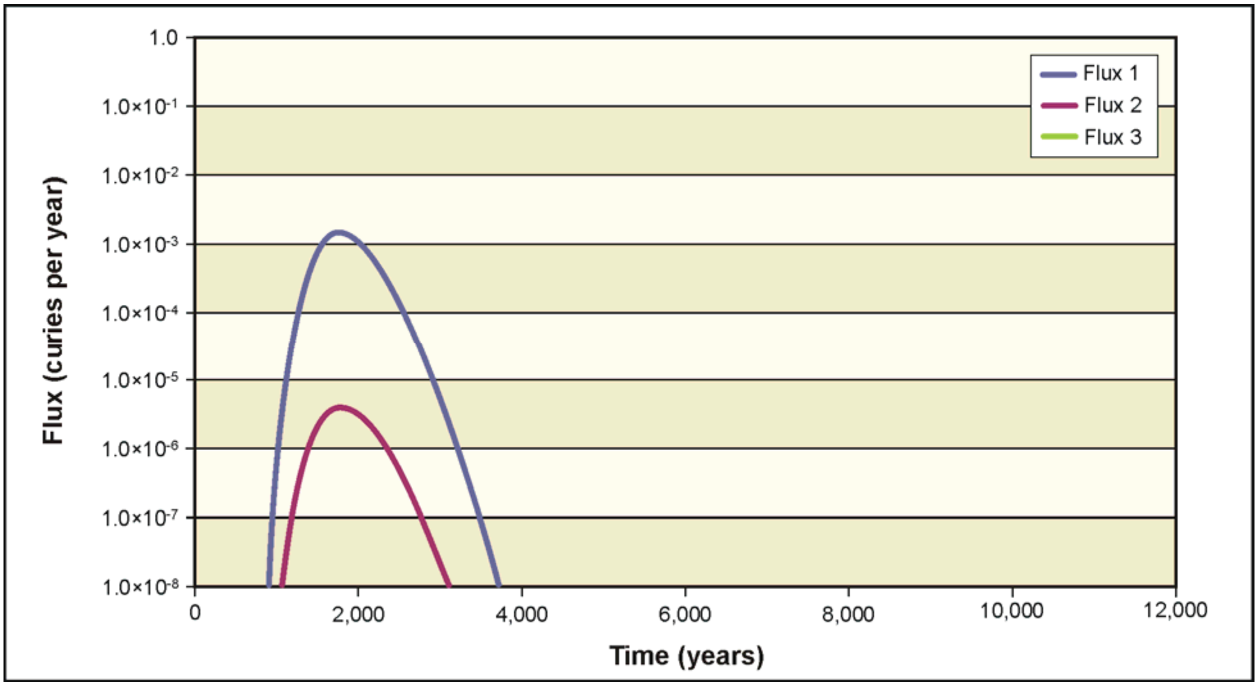

Figure V–30. Black Rock Reservoir Variant Flow Field Model – Vadose Zone Flux Release over Time, River Protection Project Disposal Facility

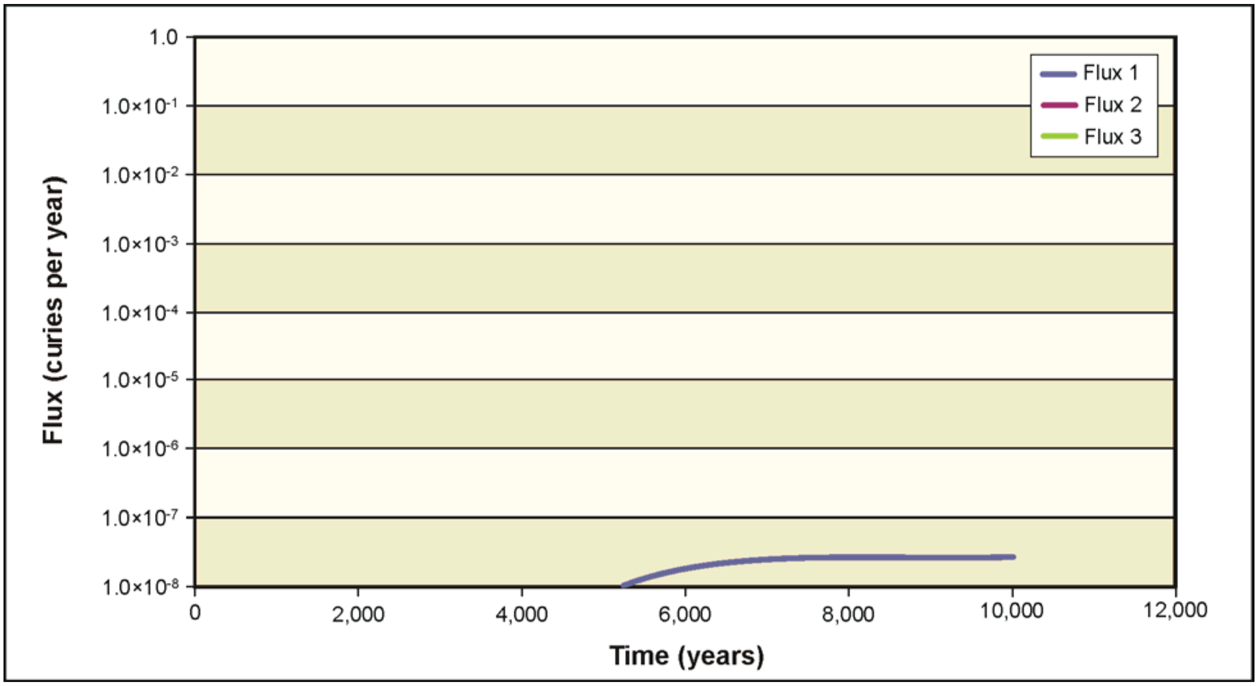

Figure V–31. Base Case Flow Model – Vadose Zone Flux Release over Time, 200-East Area Integrated Disposal Facility

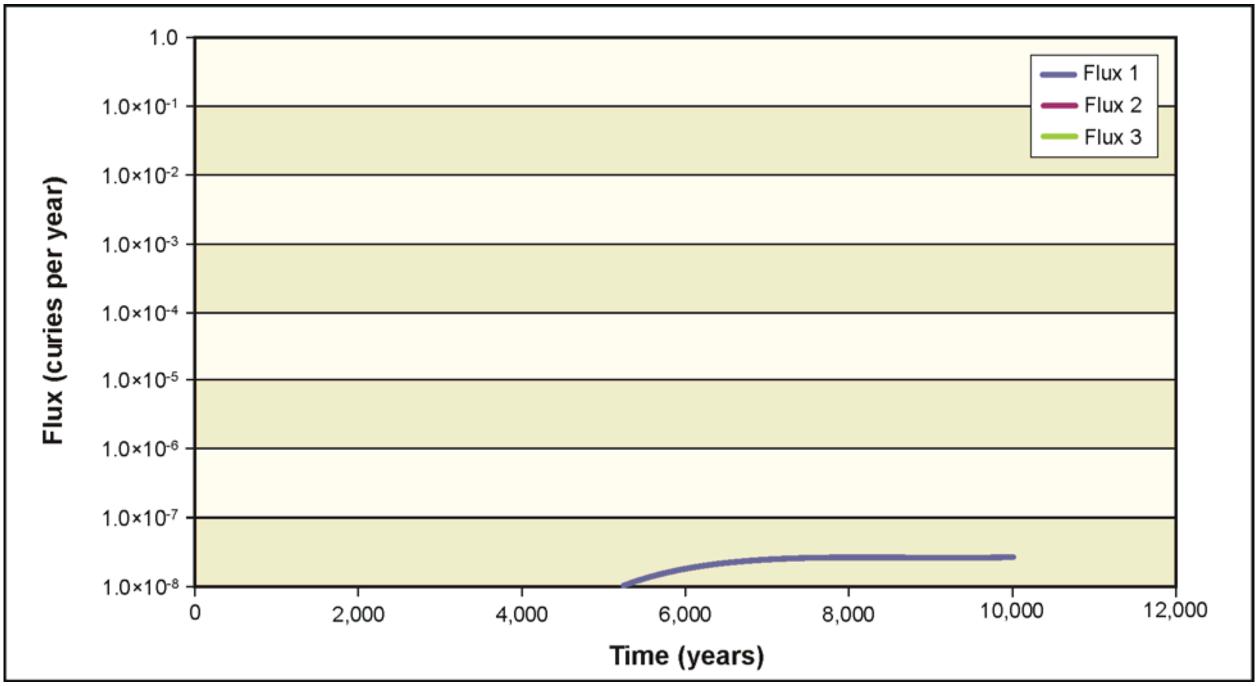

Figure V–32. Black Rock Reservoir Variant Flow Field Model – Vadose Zone Flux Release over Time, 200-East Area Integrated Disposal Facility

Table V–5. STOMP Vadose Zone Waste Management Simulation Summary

Hanford Site Disposal Location	*TC & WM EIS* Waste Management Alternative Description[a]	Solute Modeled (1 Curie)	Vadose Zone Release to Flow Field (Flux/Time) Figure Number	
			TC & WM EIS Base Case Flow Model	BRR Variant Flow Field Model
200-East Area Integrated Disposal Facility	Waste Management Alternative 2, Disposal Group 1 – Offsite waste (waste meeting Hanford Waste Acceptance Criteria, grouted waste form)	Tc-99	Figure V–20	Figure V–21
200-West Area Integrated Disposal Facility	Waste Management Alternative 3, Disposal Group 1 – Offsite waste (waste meeting Hanford Waste Acceptance Criteria, grouted waste form)	Tc-99	Figure V–22	Figure V–23
200-West Area—trench 31	Waste Management Alternative 1, Non-CERCLA Waste – miscellaneous waste meeting Hanford Waste Acceptance Criteria, stored in 55-gallon drums	Tc-99	Figure V–24	Figure V–25
200-West Area—trench 34	Waste Management Alternative 1, Non-CERCLA Waste – miscellaneous waste meeting Hanford Waste Acceptance Criteria, stored in 55-gallon drums	Tc-99	Figure V–26	Figure V–27
Central Plateau—River Protection Project Disposal Facility	Waste Management Alternative 2, Disposal Group 1 – Onsite-generated contaminated soils and decommissioned ancillary equipment	Tc-99	Figure V–28	Figure V–29
200-East Area Integrated Disposal Facility	Waste Management Alternative 2, Disposal Group 1 – immobilized low-activity waste, poured glass in steel canisters	Tc-99	Figure V–30	Figure V–31

[a] Additional details regarding the Waste Management alternatives are included in Chapter 2 of this *TC & WM EIS*.

Key: BRR=Black Rock Reservoir; CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; STOMP=Subsurface Transport Over Multiple Phases; Tc=technetium; *TC & WM EIS* *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*.

In all waste management scenarios examined (see Table V–4), the results of the STOMP modeled long-term vadose zone transport simulations indicate essentially no differences in either timing of the release or the amount released between the BRR variant flow field conditions and the *TC & WM EIS* Base Case conditions.

Additional sensitivity analysis regarding vadose zone transport within this *TC & WM EIS* can be found in Appendix N, Section N.3, "Sensitivity Analysis."

V.4.3 Changes to Timing of Groundwater Peak Concentrations at the Columbia River

Groundwater flow and transport analysis was performed using the BRR variant flow field and the *TC & WM EIS* Base Case flow field to evaluate peak concentration arrival time to the Columbia River from a 1-curie release of technetium-99 at each barrier location. Table V–6 provides the results of this analysis. The year of peak concentration arrival at the Columbia River from all releases is earlier in the BRR variant model. In general, the peak year variances are minimal compared to the overall period of waste release and the length of the *TC & WM EIS* Base Case transport simulation (10,000 years).

Table V–6. Technetium-99 (1-Curie Release) Peak Concentration at Columbia River

Release Location[a]	*TC & WM EIS* Base Case Model		BRR Variant Model		Peak Year Variance[b]
	Peak Concentration (picocuries/liter)	Peak Year	Peak Concentration (picocuries/liter)	Peak Year	
A Barrier	6.44×10^{-1}	2206	6.43×10^{-1}	2190	–16
B Barrier	1.09	2207	1.04	2102	–105
FFTF	9.05×10^{-2}	2171	9.05×10^{-2}	2138	–33
T Barrier	1.02	2211	1.55	2119	–92
U Barrier	7.52×10^{-1}	2242	1.09	2120	–122
S Barrier	5.94×10^{-1}	2373	1.01	2171	–202
IDF-East	3.89	2149	3.62	2151	–2
IDF-West	1.20	2201	8.18×10^{-1}	2127	–74
Trenches 31 and 34	1.30	2238	1.18	2125	–113
RPPDF	1.02	2191	1.64	2101	–90

a Particle released (1 curie) in center of location. Particle released in 2090, at a time after which the BRR is expected to have reached steady state equilibrium.

b Difference between the peak year of the BRR variant model and that of the *TC & WM EIS* Base Case model.

Key: BRR=Black Rock Reservoir; FFTF=Fast Flux Test Facility; IDF-East=200-East Area Integrated Disposal Facility; IDF-West=200-West Area Integrated Disposal Facility; RPPDF=River Protection Project Disposal Facility; *TC & WM EIS Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington.*

V.5 SUMMARY OF IMPLICATIONS FOR THE *TC & WM EIS* ALTERNATIVES

Comprehensive descriptions of the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives can be found in Chapter 2 of this *TC & WM EIS*. In addition, analysis regarding groundwater constituent of potential concern driver identification and discussion can be found in Chapter 5 and Chapter 6 of this *TC & WM EIS*.

In summary, based on results presented in Section V.4, the following conclusions can be made regarding the BRR variant model:

- Localized changes in the flow field are noted primarily in the northwestern region of Hanford. Groundwater is more likely to flow north (rather than east) through Gable Gap toward the Columbia River. A decrease in vadose zone thickness (due to elevated water table) at various sites is minimal.

- The BRR variant model has no discernible effects on the short-term Tank Closure and associated long-term Waste Management alternatives presented in this *TC & WM EIS*.

- The BRR variant model has no discernible effects on additional mobilization of deep vadose zone contaminants.

V.6 REFERENCES

BOR (U.S. Bureau of Reclamation), 2007, *Modeling Groundwater Hydrologic Impacts of the Potential Black Rock Reservoir: A Component of the Yakima River Basin Water Storage Feasibility Study, Washington Pacific Northwest Region*, Technical Series No. TS-YSS-19, Pacific Northwest Region, Boise, Idaho, September.

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Schmidt, R., 2007, U.S. Department of the Interior, Bureau of Reclamation, Boise, Idaho, personal communication (email) to M. Burandt, U.S. Department of Energy, Office of River Protection, Richland, Washington, "Data Request #279 Related to Hanford *Tank Closure & Waste Management Environmental Impact Statement*," September 6.