BUILDING 4024
DECONTAMINATION AND DECOMMISSIONING ENGINEERING EVALUATION/COST ANALYSIS

Prepared by The Boeing Company
for the Department of Energy

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Executive Summary

This Engineering Evaluation/Cost Analysis (EE/CA) has been prepared to fulfill the requirements of Section 300.415(b)(4)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for a proposed non-time critical removal action. It summarizes the objectives of the removal action and evaluates alternatives to implement the decontamination and decommissioning (D&D) of the Department of Energy's (DOE) Building 4024 situated within the Energy Technology Engineering Center (ETEC) at the Santa Susana Field Laboratory (SSFL). SSFL is not on the National Priorities List; however, the U.S. Environmental Protection Agency (EPA) and DOE agreed in a joint policy statement (May 22, 1995) that DOE decommissioning activities will be conducted as non-time critical removal actions consistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), effectively integrating EPA oversight responsibility, DOE lead agency responsibility, and state and stakeholder participation.

This document provided an opportunity for interested persons to comment on the project objectives and the proposed removal action alternative for Building 4024 as required by Section 300.820(a) of the NCP.

The Department of Energy is conducting the cleanup activities at ETEC pursuant to its authority under the Atomic Energy Act (AEA). In addition, the removal action will be conducted in accordance with the 1995 joint DOE/EPA Policy Memorandum in a manner that is consistent with CERCLA.

As the former Systems for Nuclear Auxiliary Power (SNAP) Environmental Test Facility (SETF), Building 4024 tested SNAP reactors in a simulated operational environment. SNAP reactors were originally developed and tested as a nuclear power source for space vehicles. Building 4024 currently consists of an above-grade high-bay and below-grade test vaults. As a result of exposure to neutrons from the reactors, the walls, ceiling, floor and remote handling equipment of the test cells have become radioactive.

The scope of the Building 4024 D&D involves the complete removal of all above- and below-grade structural components and any radiologically impacted soil that may exist within the facility's footprint. The desired outcome of the removal action is a Building 4024 footprint that meets radiological standards of protectiveness for unrestricted use.

This EE/CA identifies "demolition/removal and off-site disposal" as the preferred alternative to address the objectives of the Building 4024 D&D compared against a "no action" alternative. Both alternatives are evaluated for their relative effectiveness, implementability, and cost as the basis for a removal action decision.

The public was encouraged to comment on the preferred alternative presented in this EE/CA during the public comment period. Following public comment, this document was used as the basis for an Action Memorandum to initiate implementation of the chosen D&D approach for Building 4024, demolition/removal and off-site disposal.

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Acronyms and Abbreviations

Acronym	Meaning
AEA	Atomic Energy Act
ARARs	Applicable or Relevant and Appropriate Requirements
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Constituent of Concern
Co-60	Cobalt-60
D&D	Decontamination and Decommissioning
DM	Decommissioned Material
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
EE/CA	Engineering Evaluation and Cost Analysis
EPA	U.S. Environmental Protection Agency
Eu-152	Europium-152
ETEC	Energy Technology Engineering Center
LLW	Low-Level Radioactive Waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
pCi/g	Picocuries per gram
PRG	Preliminary Remediation Goal
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SETF	SNAP Environmental Test Facility
SNAP	Systems for Nuclear Auxiliary Power
SSFL	Santa Susana Field Laboratory
USC	United States Code

Glossary

Applicable or Relevant and Appropriate Requirement (ARAR): The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requires compliance with any promulgated standard requirements, criteria, or limitation under Federal and more stringent State environmental laws. Examples include the Clean Water Act, Endangered Species Act, etc.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A Federal law, known as Superfund passed in 1980, and reauthorized by the Superfund Amendments and Reauthorization Act (SARA) in 1986. The law authorizes the Federal government to respond directly to releases of hazardous substances that may endanger public health or the environment.

Curie: A unit of radioactivity that represents the amount of radioactivity associated with one gram of radium. To say that a sample of radioactive material exhibits one curie of radioactivity means that the element is disintegrating at the rate of 37 billion times per second.

Deactivation: The process of placing a facility in a stable and known condition including the removal of hazardous and radioactive materials to ensure adequate protection of the worker, public health and safety, and the environment, thereby limiting the long-term cost of surveillance and maintenance. Actions include the removal of fuel, draining and/or de-energizing nonessential systems, removal of stored radioactive and hazardous materials, and related actions. Deactivation does not include all decontamination necessary for the dismantlement and demolition phase of decommissioning, e.g., removal of contamination remaining in the fixed structures and equipment after deactivation.

Decommissioning: Decommissioning is inclusive of activities that take place after a facility has been deactivated and placed in an ongoing surveillance and maintenance program. Decommissioning can include decontamination and dismantlement. Decontamination encompasses the removal or reduction of radioactive or hazardous contamination from facilities. Dismantlement involves the disassembly or demolition, and removal, of any structure, system, or component and the interim or long-term disposal of waste materials in compliance with applicable requirements.

Decommissioned Material (DM): Structural materials and soil from decommissioned radiological facilities that have been surveyed/sampled and determined to meet state and federal cleanup standards. These materials have therefore been determined to be suitable for unrestricted use. These materials may or may not have low levels of residual contamination exceeding background. In 2002, California issued a moratorium on the disposal of decommissioned material above background levels at Class III or unclassified (unlined) waste disposal sites.

Decontamination: The removal or reduction of residual radioactive and hazardous materials by mechanical, chemical or other techniques to achieve a stated objective or end condition.

Excess Cancer Risk: A figure that calculates the risk of contracting cancer on a probability scale based on current and future use exposure pathways (i.e., activities that may result in an individual contacting soil, sediment, etc.). Exposure pathways consider how frequently the individual is exposed to the constituent of concern (COC), the quantity of COC that is ingested, inhaled, or absorbed through skin contact, and the period of time for which the individual is exposed to the

COC. Based on the NCP, the Environmental Protection Agency's (EPA) regulations for the evaluation of risk at Superfund sites, the acceptable excess cancer risk range for residential areas is from 10^{-4} (one in ten thousand) to 10^{-6} (one in a million excess risk of developing cancer).

Executive Order 12580: An order entitled "Superfund Implementation" signed on January 23, 1987 by the President of the United States. This document delegates authority and responsibility to implement certain provisions of CERCLA to a number Federal departments (including the Department of Energy (DOE)) and agencies.

Low-Level Waste (LLW): Low-level radioactive waste is defined as any radioactive waste that does not belong in one of the following three categories for radioactive waste: high-level waste (spent nuclear fuel or the highly radioactive waste produced if spent fuel is reprocessed), uranium milling residues, and waste with greater than specified quantities of elements heavier than uranium. Low-level radioactive waste is generated at commercial facilities such as nuclear power plants, hospitals, and research institutions. It includes radioactive materials used in various processes as well as supplies and equipment that have been contaminated with radioactive materials.

Low-Level Waste Disposal Site: Low-level waste disposal occurs at facilities licensed by the Nuclear Regulatory Commission (NRC). The facilities must be designed, constructed, and operated to meet safety standards. The operator of the facility must also extensively characterize the site on which the facility is located and analyze how the facility will perform for thousands of years into the future.

Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM): A document developed by the DOE, the Department of Defense (DOD), EPA, and NRC to provide detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with a dose- or risk-based regulation. MARSSIM focuses on the demonstration of compliance during the final status survey following scoping, characterization, and any necessary remedial actions.

National Contingency Plan (NCP): The federal government's blueprint for responding to both oil spills and hazardous substance releases. The NCP is the result of our country's efforts to develop a national response capability and promote overall coordination among the hierarchy of responders and contingency plans.

Non-Time Critical Removal Action: This is a type of response action recognized by the EPA as appropriate for addressing hazardous substance threats where a planning horizon of six months or more is appropriate. Under an EPA/DOE agreement, DOE uses a non-time critical removal action approach tailored for decommissioning DOE facilities. That approach is comprised of: a threat assessment; identification, analysis, and documentation of decommissioning alternatives; opportunities for public participation in the decommissioning decision; and planning and performance of decommissioning activities.

Picocurie (pCi): One one-trillionth (1/1,000,000,000,000) of a curie.

Removal Action: When DOE identifies a threat of exposure to, or migration of, hazardous substances that poses a risk to health, welfare, or the environment, DOE is authorized by CERCLA to exercise removal action authority to implement an appropriate response to the risks posed. Activities that may be taken under CERCLA removal action authority include any activity that reduces risks or potential risks in a relatively short time frame and can be identified as

appropriate with a relatively limited analysis of alternatives. Removal actions are not limited to immediate action, or action in response to an emergency. (See non-time critical removal action.)

Surveillance and Maintenance: These activities are conducted through-out the facility life cycle phase including when a facility is not operating and is not expected to operate again and continues until phased out during decommissioning. Activities include providing in a cost effective manner periodic inspections and maintenance of structures, systems and equipment necessary for the satisfactory containment of contamination and protection of workers, the public and the environment.

Survey Unit: A physical area consisting of structure or land areas of specified size and shape for which a separate decision will be made as to whether or not that area exceeds the release criterion. The size and shape of the survey unit are based on factors, such as the potential for contamination, the expected distribution of contamination, and any physical boundaries (e.g., buildings, fences, soil type, surface water body) at the site.

Section 1.0 – Introduction

This Engineering Evaluation/Cost Analysis (EE/CA) has been prepared to fulfill the requirements of Section 300.415(b)(4)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for a proposed non-time critical removal action. It summarizes the objectives of the removal action and evaluates alternatives to implement the decontamination and decommissioning (D&D) of the Department of Energy's (DOE) Building 4024 situated within the Energy Technology Engineering Center (ETEC) at the Santa Susana Field Laboratory (SSFL). SSFL is not on the National Priorities List, however the U.S. Environmental Protection Agency (EPA) and DOE agreed in a joint policy statement (May 22, 1995) that DOE decommissioning activities will be conducted as non-time critical removal actions consistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), effectively integrating EPA oversight responsibility, DOE lead agency responsibility, and state and stakeholder participation (EPA, 2003).

This document provided an opportunity for interested persons to comment on the project objectives and the proposed removal action alternative for Building 4024 as required by Section 300.820(a) of the NCP.

1.1 Overview of Building 4024 – SNAP Environmental Test Facility (SETF)

Figure 1-1 shows the perimeter of ETEC within SSFL. Figure 1-2 is a location map of Building 4024 at ETEC. Building 4024 was built in the early 1960s to test systems for nuclear auxiliary power (SNAP) reactors in a simulated operational environment. The SNAP reactors were originally developed and tested as a nuclear power source for space vehicles.

Building 4024 is a 13,972 square-foot facility constructed with a steel frame, metal siding, and roofing. Figure 1-3 shows an image of Building 4024 from the exterior. The above-grade structure consists of a high bay area, which was cleaned, surveyed, and designated as decommissioned material (DM). Some of the above-grade structures and equipment associated with the general support/operating area and the mechanical/electrical support area were removed in 2005. The two concrete foundations for these buildings remain.

The below-grade structure consists of a concrete vault beneath the high bay area that is separated into three cells. Two cells were used to contain the reactors during testing, with a transfer cell separating the two. Following the end of testing in the mid-1970s, the reactor systems and their associated radioactive test equipment were removed.

Figure 1-4 shows a cutaway diagram of the underground test vault. The vault is constructed of concrete walls ranging from two feet to nine feet thick, penetrated by various through-tubes, conduits and cooling pipes and lined with aluminum shielding.

A paved yard surrounds the main building. Three radioactive gas holdup tanks and two liquid radioactive waste holdup tanks beneath the paved yard were removed in 1979. Eight empty vaults previously used for the storage of solid radioactive waste remain below the paved yard.

DOE proposes to remove Building 4024 as part of the ongoing D&D of the former ETEC.

Figure 1-1. Location of ETEC at SSFL

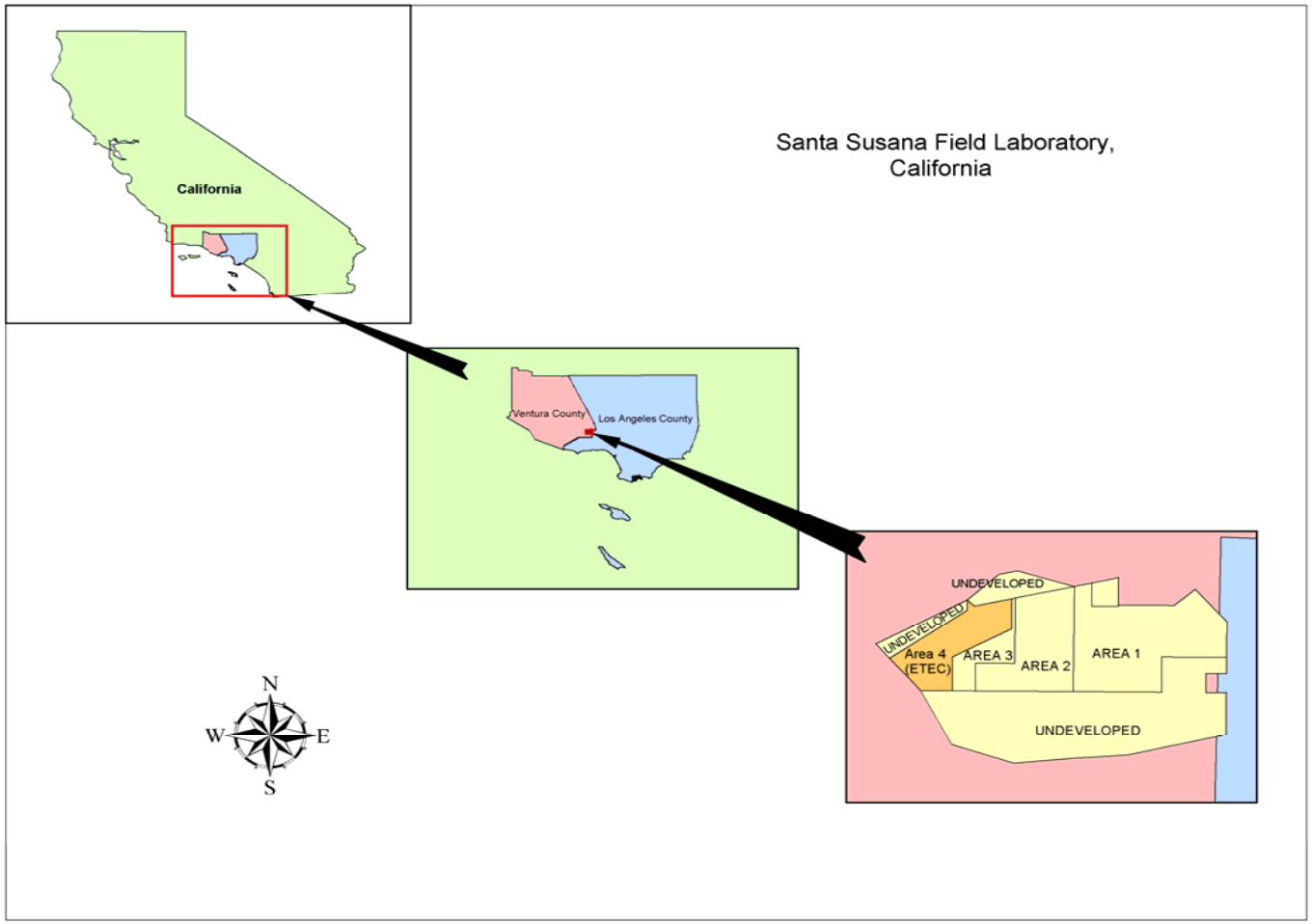


Figure 1-2. Location Map of Building 4024 at ETEC

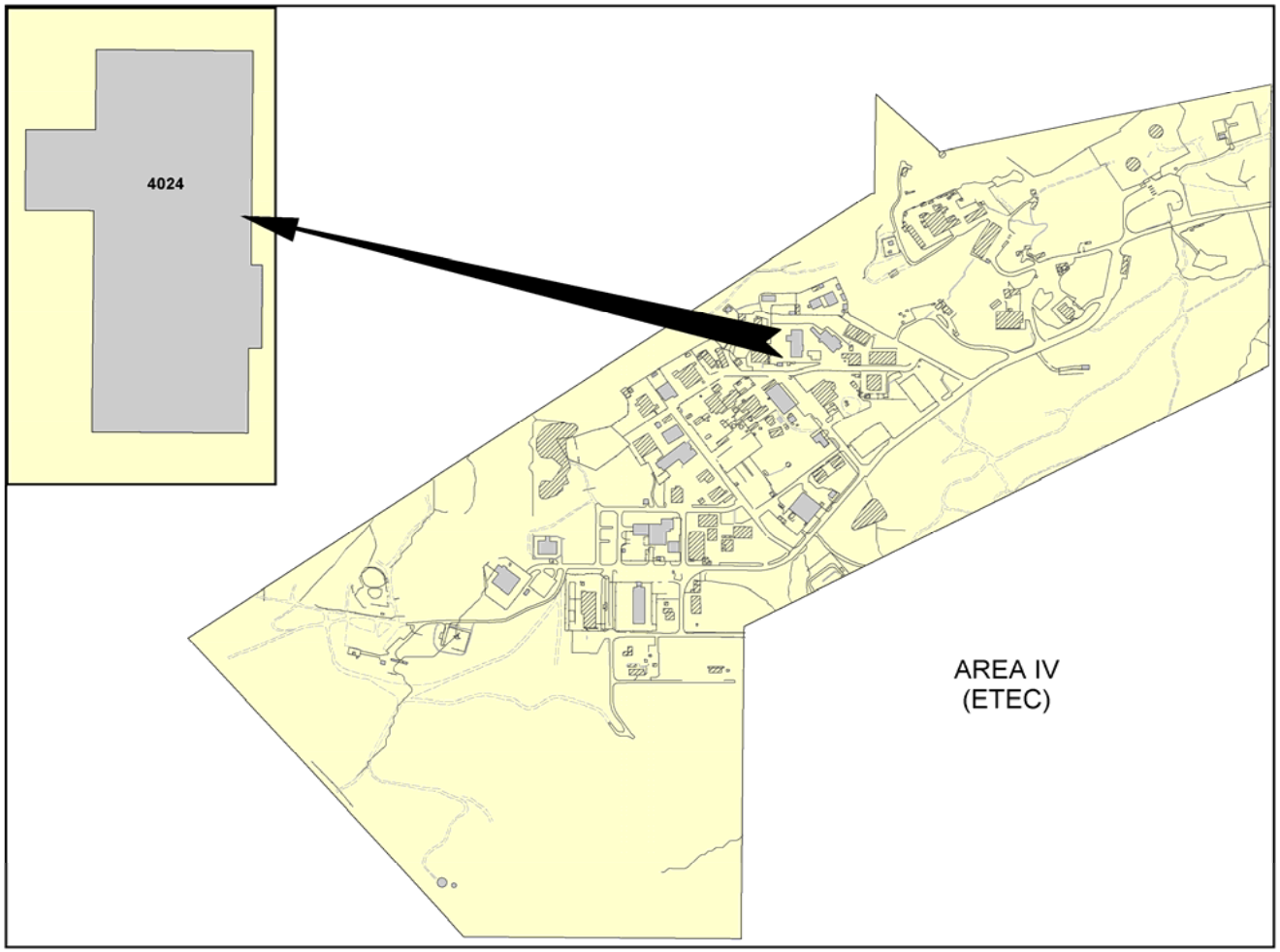
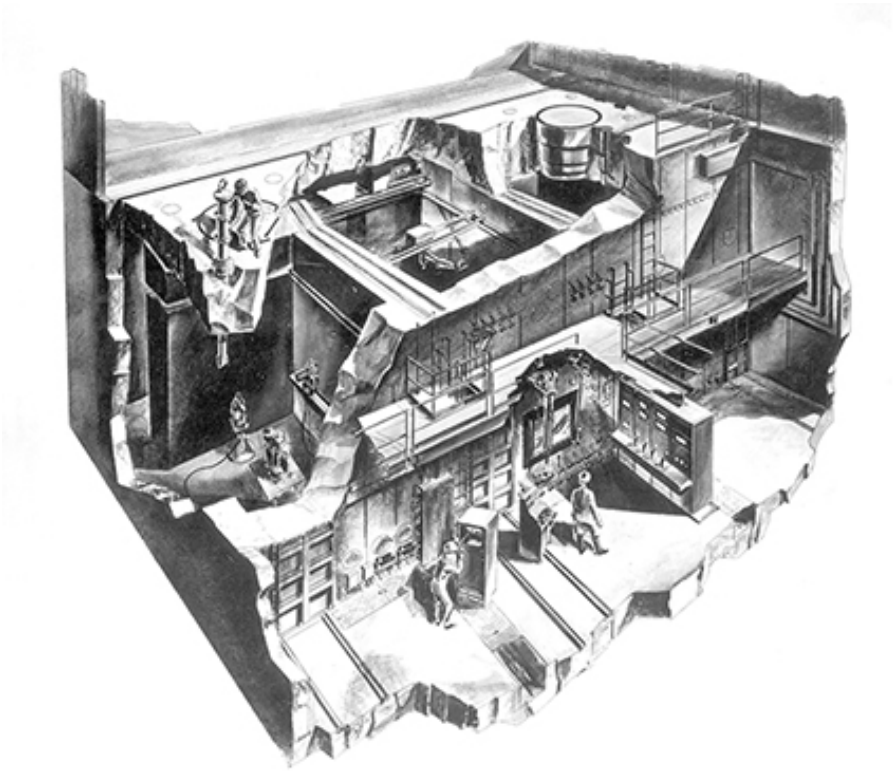


Figure 1-3. Building 4024 Exterior (circa 1999)

Figure 1-4. Underground Test Vault Cutaway Diagram



1.2 Conceptual Site Model

A contaminant conceptual site model identifies contamination sources and potential exposure pathways. This section discusses the potential sources and potential pathways for Building 4024, and Figure 1-5 illustrates this contaminant conceptual site model.

Exposure to neutrons from the two operating reactors activated the walls, ceiling, floor and remote handling equipment of the below-grade vault test cells. As a result, radiological contamination in the concrete of the underground test vault is known to be present above the cleanup goals for soil in Table 2-1. The primary radiological constituents of concern (COCs) in the activated concrete and piping are Cobalt-60 (Co-60) and Europium-152 (Eu-152).

Concrete cores were removed from the facility test cells and analyzed to determine the location and amount of radioactive materials present. The radioactivity within the cores indicates that induced radioactivity is present to a maximum depth of fifteen inches within the walls and floors; however, as the concrete floors are roughly seventy-two inches (six feet) thick, it is assumed that the underlying bedrock does not contain induced radioactivity. Analysis of the bedrock beneath the vault confirmed no contamination. In addition, eight below-grade vaults to the east of Building 4024 previously used for the storage of solid radioactive wastes may have leaked into the subsurface soil.

Shallow groundwater periodically wells upward through the core holes in the vault base, but no tritium or induced radioactive materials have been detected within collected water samples. This finding indicates that there are no impacts to the groundwater resulting from the SNAP Environmental Test Facility (SETF).

Previous decommissioning activities cleaned, surveyed, and designated the above-grade structure and adjacent building foundations as decommissioned material, so no radiological contamination is expected to exist in the high bay area of Building 4024.

Under this proposed action, there is a potential for surface and subsurface soil contamination via demolition activities associated with the removal of the activated concrete.

1.3 Scope of Proposed Action

The scope of Building 4024 D&D involves the complete removal of all above- and below-grade structural components of Building 4024 and any radiologically impacted soil or bedrock within the facility footprint that fails to achieve the removal action objectives in Section 2. The scope of the proposed action includes:

- The above-grade Building 4024 structure and remaining equipment;
- Concrete building foundations, including the vault beneath Building 4024;
- All underground utilities, including utility lines;
- Outdoor paved area;
- Eight remaining radiological waste storage vaults beneath the outdoor paved area and associated drainage pipes;
- All asphalt, incidental soils (i.e., soil directly beneath the asphalt), and incidental bedrock; and
- Any residual radiological contamination where the building footprint and surrounding area fail to achieve the removal action objectives.

Two radiological COCs are known to be present in Building 4024: Co-60 and Eu-152. No other radiological constituents are expected to exist in the building footprint, but excavation and removal of asphalt and incidental soils will likely remove any radiological constituents in soil surrounding the structure if they exist. DOE will conduct characterization surveys following removal of the Building 4024 physical components to determine whether any soil areas fail to achieve the removal action objectives discussed in Section 2.1. DOE will remove all radiologically contaminated soil that fails to achieve the removal action objectives.

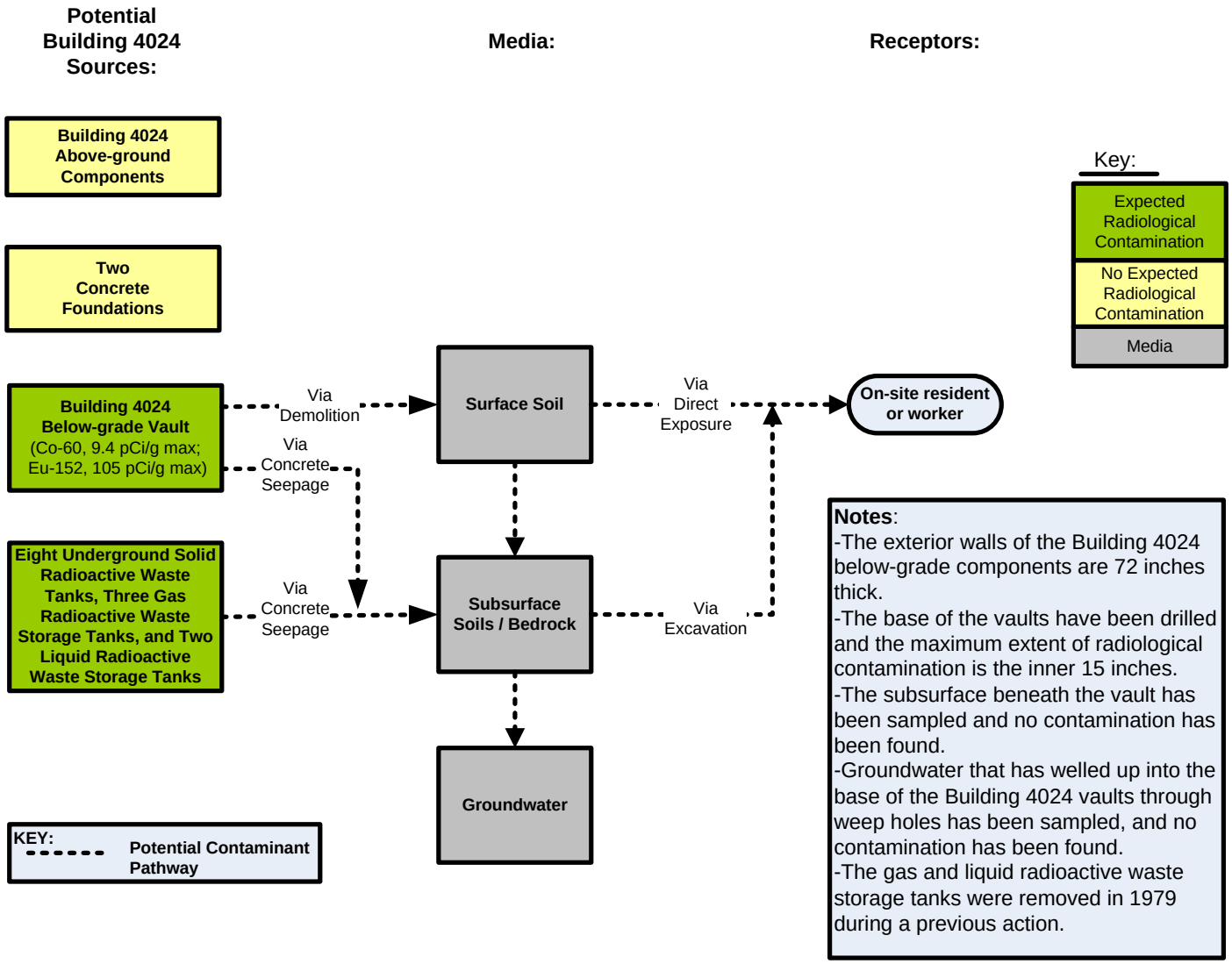
1.4 Justification for the Proposed Action

DOE has chosen a non-time critical removal action approach under CERCLA as the best strategy to address the D&D of Building 4024 because it will provide the most appropriate level of analysis, oversight, public participation, and flexibility to conduct decommissioning in a cost-effective manner that fully protects human health and the environment.

DOE has proposed to implement this approach to D&D in accordance with a joint DOE/EPA policy, signed by the U.S. Environmental Protection Agency in May 1995. The *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act* (*CERCLA*) recognizes that DOE will use its CERCLA authority under Executive Order 12580 to implement non-time critical removal actions for the decommissioning of DOE facilities unless circumstances make it inappropriate.[1] Executive Order 12580 delegated CERCLA Section 104 authority to the Secretary of Energy, making DOE the lead agency for removal actions at DOE sites (DOE, 1995).

[1] "Unless the circumstances at the facility make it inappropriate, decommissioning activities will be conducted as non-time critical removal actions. Non-time critical removal actions generally will provide the most appropriate level of analysis, oversight, public participation, and flexibility to conduct decommissioning in a cost-effective manner that fully protects [human] health and the environment. Using non-time critical removal action authority will enable DOE to exercise the flexibility provided in the NCP to reduce risks and achieve results without unnecessary expenditure or delay." - *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA,* (May 1995).

Figure 1-5. Building 4024 (SNAP Environmental Test Facility) Contaminant Conceptual Site Model



Section 2.0 – Removal Action Objectives

The selected alternative will remove all remaining physical components associated with Building 4024 and any radiologically impacted soil above acceptable limits that may exist within the facility footprint. The desired outcome of this removal action is to have the Building 4024 facility footprint meet radiological standards of protectiveness for unrestricted use. Attainment of this objective will require:

1) Removal of all above- and below-grade buildings, foundations, utilities, and physical components associated with Building 4024; and
2) Survey and removal of all radiologically impacted soils above unrestricted use criteria within the Building 4024 facility footprint.

2.1 Criteria and Cleanup Objectives for Action in Soil

Based on the Preamble to the NCP, the acceptable excess cancer risk to humans from exposure to carcinogens (e.g., radiological constituents) in residential areas is 10^{-4} (one in ten thousand) to 10^{-6} (one in a million) excess risk of developing cancer.[2] EPA's National Preliminary Remediation Goals (PRG) Calculator for residential land provides the concentrations in Table 2-1 as the equivalent of a 10^{-6} risk from individual radionuclides. The objectives of the removal action are:

1) Lower the excess cumulative cancer risk to an individual from exposure to site radiological contaminants in soil to a nominal range of 10^{-4} to 10^{-6}, using 10^{-6} as the point of departure;
2) Reduce the non-cancer hazard indices of radiological constituents below a value of 1; and
3) Mitigate potential ecological impacts during and after the removal action.

After Building 4024 has been removed and the characterization survey of the facility footprint has been completed, if any single soil sample fails to achieve the above objectives, DOE will remove soil. This is to ensure that the Building 4024 facility footprint is radiologically protective of human health and the environment.

The primary radiological COCs in Building 4024, Co-60 and Eu-152, are activation products that have been identified in the shielding concrete of the below-grade vaults. In addition, Table 2-1 includes a number of radionuclides that have the potential to be present in Building 4024 but have not been identified. These are secondary radiological COCs that potentially originated as products of: the fission process (i.e., Cesium-137, Strontium-90); possible neutron activation in concrete, rebar, or reactor coolant (Europium-154, Hydrogen-3, Iron-55, Nickel-59, Nickel-63, Manganese-54, Potassium-40, Sodium-22); SNAP reactor uranium fuel materials (Uranium-234, Uranium-235, Uranium-238); or transuranic isotopes formed by neutron absorption of uranium-238 (Americium-241, Plutonium-238, Plutonium-239/240, Plutonium-241, Plutonium-242). These resulting radiological COCs are listed alphabetically in Table 2-1 and will be included in the soil sampling and analysis plan for the proposed action at Building 4024.

[2] Excess cancer risk is a figure that calculates the risk of contracting cancer on a probability scale based on current and future use exposure pathways (i.e., activities that may result in an individual contacting soil, sediment, etc.). Exposure pathways consider how frequently the individual is exposed to the COC, the quantity of COC that is ingested, inhaled, or absorbed through skin contact, and the period of time for which the individual is exposed to the COC. Based on the NCP, EPA's regulations for the evaluation of risk at Superfund sites, the acceptable cancer risk range for residential areas is from 10^{-4} (one in ten thousand) to 10^{-6} (one in a million).

Table 2-1. Radiological COC Cleanup Goals for Soil Removal

Radiological Constituent of Concern	Cleanup Goals for Soil (pCi/g)
Americium-241	1.87E+00
Cobalt-60	**3.61E-02**
Cesium-134	1.57E-01
Cesium-137	5.97E-02
Europium-152	**4.16E-02**
Europium-154	4.99E-02
Hydrogen-3	2.28E+00
Iron-55	2.69E+03
Manganese-54	6.92E-01
Nickel-59	2.08E+02
Nickel-63	9.48E+01
Plutonium-238	2.97E+00
Plutonium-239	2.59E+00
Plutonium-240	2.60E+00
Plutonium-241	4.06E+02
Plutonium-242	2.73E+00
Potassium-40	1.08E-01
Sodium-22	8.65E-02
Strontium-90	2.31E-01
Uranium-234	4.01E+00
Uranium-235	1.95E-01
Uranium-238	7.42E-01

Primary Radiological COCs are in bold.

2.2 Final Status Survey and Confirmation Report

When all radiologically impacted soil that fails to achieve the removal objectives has been excavated, DOE will conduct a Final Status Survey of the Building 4024 facility footprint and surrounding area using the guidance of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) to confirm that the removal action objectives have been met.[3] DOE will prepare a Removal Action Confirmation Report, which will include the results of the Final Status Survey and recommendations for additional cleanup activities, if any. EPA guidance "Superfund Removal Procedures, Removal Response Reporting: POLREPS and OSC Reports" (1994) will be used as a reference.

An area in which all individual sample concentrations are below the soil cleanup goals in Table 2-1 will be confirmed suitable for unrestricted use. If any soil activities fall between 10^{-6} and 10^{-4}, a risk management decision will be made. The locations and activities of the samples will be

[3] MARSSIM was developed by the DOE, U.S. Department of Defense (DOD), EPA, and Nuclear Regulatory Commission (NRC) to provide detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with a dose- or risk-based regulation. MARSSIM focuses on the demonstration of regulatory compliance during the final status survey following scoping, characterization, and any necessary remedial actions.

evaluated to determine if there is a need for any further engineering (e.g., excavation) or administrative (e.g., land use controls) response.

A map will be provided clearly delineating the area that has been (and has not been) surveyed and classified for re-use.

2.3 Sampling and Analysis Plan

Prior to conducting post-removal sampling or analysis, DOE will submit a Sampling and Analysis Plan (SAP) for EPA review consistent with EPA guidance "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations" (October 1997) (EPA QA/R-5) and "Preparation of a U.S. EPA Region 9 Field Sampling Plan for Private and State-Lead Superfund Projects" (August 1993) (9QA-06-93). The SAP will address the soil cleanup goals identified above in Table 2-1, and will include development of data quality objectives and a Quality Assurance Project Plan. The SAP will follow MARSSIM guidance and protocols.

2.4 Mitigating Potential Ecological Impacts

Before field work begins, DOE will conduct a biological assessment of the area to ensure that implementation of the D&D of Building 4024 will not pose any negative impacts to onsite ecological receptors (i.e., plants and animals). DOE will consider and mitigate the potential impacts to ecological receptors identified in the biological assessment.

2.5 Applicable or Relevant and Appropriate Requirements

In accordance with the NCP, non-time-critical removal actions conducted under CERCLA are required to attain applicable or relevant and appropriate requirements (ARARs) to the extent practicable, considering the scope and urgency of the situation.

ARARs include federal and state environmental or facility siting laws or regulations and action-specific requirements such as occupational safety or worker radiation protection regulations. Additionally, other advisories, criteria, or guidance may need to be considered when determining remedies (40 Code of Federal Regulations (CFR) §300.405(g)(3)).

ARARs are divided into three groups: (1) constituent-specific, (2) location-specific, and (3) action-specific. Constituent-specific ARARs establish an acceptable amount or concentration that may remain in or be discharged to the ambient environment. Location-specific ARARs include restrictions placed on the conduct of activities solely because they occur in special locations such as wetlands, floodplains, historic properties, or critical habitat. Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances or other particular circumstances at a site. Action-specific ARARS include requirements imposed on removal actions such as worker safety, dust control requirements, storm water pollution plans and runoff control, transportation and disposal of hazardous and non-hazardous wastes, and control of air emissions. State requirements are ARARs if they are promulgated, substantive laws or regulations that are consistently applied and are more stringent than Federal requirements.

The D&D of Building 4024 will adhere to all practicable Federal, state and local ARARs identified by DOE for the Building 4024 land area. ARARs are summarized in Appendix A and will be updated as needed.

Section 3.0 – Identification of Removal Action Alternatives

Using the removal action objectives as standards for evaluation, DOE was able to identify two plausible alternatives for Building 4024 D&D: No Action and Removal/Off-Site Disposal. This section summarizes the projected scope for each alternative.

3.1 No Action Alternative

Under this alternative, Building 4024 would not undergo final D&D and would not achieve the removal action objectives identified in Section 2 of this EE/CA. Surveillance and maintenance operations would continue indefinitely to monitor and address site needs and radiological risk to human health and the environment as the facility ages. Inclusion of a No Action alternative is consistent with CERCLA. This alternative provides a baseline against which other alternatives can be compared.

3.2 Demolition/Removal and Off-Site Disposal Alternative

This alternative would involve removal of Building 4024 in its entirety and any soil in the project area that fails to achieve the removal action objectives. The following activities are included in this alternative:

- Remove equipment and demolish buildings;
- Remove all concrete foundations, including the test cells beneath Building 4024;
- Excavate and remove underground storage vaults;
- Remove all associated hazardous materials;
- Remove all underground utilities;
- Remove asphalt and incidental soils and bedrock;
- Conduct sampling and remove soil or bedrock that fails to achieve removal action objectives, repeating this process as necessary until objectives are achieved;
- Characterize, segregate, package and load waste materials for transport and disposal at approved off-site permitted facilities;
- Backfill the area with clean soil from on-site source and regrade with natural contours;
- Perform a MARSSIM-guided final status survey of the Building 4024 facility footprint;
- Finish site restoration

All structures and pavement would be removed using all appropriate safety and protection considerations. Soil and bedrock would be excavated using standard construction equipment with all appropriate safety and protection considerations similarly in place.

Fugitive dust mitigation and storm water pollution prevention measures would be taken during all earthwork activities, and proper safeguards would be implemented for the transport of wastes to appropriate disposal facilities.

A MARSSIM-guided final status survey in the excavated areas would ensure that the objectives described in Section 2.1 have been met. Following a verification survey by the Oak Ridge Institute for Science and Education (ORISE), the excavations would be backfilled with clean

backfill material and compacted. The backfilled footprint would then be subject to a second MARSSIM-guided final status survey and again verified by ORISE.

Wastes generated from this removal action alternative would be characterized and segregated by waste type (i.e., DM or low-level radioactive waste (LLW)). The waste would be transported to and disposed of at a disposal facility appropriate to each waste type.

All waste will be sent to an approved federally-owned or commercial disposal site. No waste would be sent to any municipal landfills.

All waste shipments would be containerized according to U.S. Department of Transportation requirements, and would be transported using established commercial truck routes.

Section 4.0 – Analysis of Alternatives

This section evaluates the alternatives for the D&D of Building 4024 based on their effectiveness, implementability, and cost. The NCP and the DOE guidance document for non-time critical removal actions *Phased Response/Early Actions, Module 4* (DOE, 1995) identify these three criteria for the evaluation of removal action alternatives as a basis for decision-makers to compare removal action alternatives.

4.1 Effectiveness

Alternatives were evaluated relative to their effectiveness in meeting the removal action objectives presented in Section 2. For this evaluation, the following NCP threshold and balancing criteria were considered:

- Overall protection of human health and environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Short-term effectiveness
- Reduction of toxicity, mobility, or volume
- Ability to achieve removal action objectives

No Action:

The No Action alternative does not reduce or remove any of the suspected radiological COCs from the facility footprint. The buildings and all associated equipment and structures would remain onsite under surveillance and maintenance. The No Action alternative would prevent the facility from achieving its removal action objectives established in Section 2.

Demolition/Removal and Offsite Disposal Alternative:

This alternative represents a complete removal option, and the area will meet unrestricted land use requirements and be protective of human health and the environment in the long term. Exposure or release of radiological contaminants to the public will be reduced or prevented in the short-term through compliance with ARARs, including safe-handling requirements for workers and appropriate material transportation controls.

4.2 Implementability

When evaluating the implementability of the retained alternatives, the following questions were considered:

- Is the alternative technically feasible with currently available technology?
- Is the alternative technically complex or difficult to implement?
- Is the alternative administratively feasible in terms of administrative or procedural requirements?
- Are there services and materials readily available for performing the alternative?

No Action:

The No Action alternative is highly implementable because it requires no action. This alternative, however, would require continued surveillance and maintenance for an indefinite period of time.

Demolition/Removal and Offsite Disposal Alternative:

Based on D&D experiences at other DOE facilities nationwide, this alternative is implementable and relatively straightforward. Decontamination, demolition, and excavation are not technically complex and could be readily performed with the proper equipment, materials, and protective gear. Services and materials are readily available for decontamination, demolition, and excavation activities. Conventional earthmoving equipment is available from contractors with experience working at radiological and hazardous waste sites, and personnel experienced with decontamination techniques are available.

This alternative is administratively feasible because administrative or procedural requirements are met on a continual basis during D&D efforts implemented by DOE. The scope of this alternative does not diverge from actions commonly employed by DOE.

4.3 Cost

In this section, costs of alternatives are presented for comparison purposes only. In general, cost estimates include capital costs, labor costs, transportation and disposal costs, and surveillance and maintenance costs.

EPA guidance for feasibility studies suggests that actual costs should be within -30% to +50% of the estimate included in the feasibility study. The same estimation standards will be applied in this EE/CA for the purposes of analysis.

No Action Alternative:

The no action alternative would result in the need for continued surveillance and maintenance activities at Building 4024. Annual surveillance and maintenance program costs assume a 30 year duration for estimation purposes. The approximate cost to fulfill these requirements would be $15 million dollars over the 30 year period and includes radiation safety labor support and materials (dosimeters, etc.), and the production of an Annual Site Evaluation Report. Surveillance and maintenance costs would continue as long as the facility remains. This estimate does not include the cost of future D&D activities if DOE deems such activities to be desirable or necessary.

Demolition/Removal and Offsite Disposal Alternative:

Total implementation costs for this alternative were determined based on standard unit costs from R.S. Means and estimated quantities of materials, professional judgment, previous experience of performing work at ETEC, and vendor estimates. The estimated cost for D&D of Building 4024 under this alternative is approximately $5 million, which includes demolition of the physical structures, excavation of soil, packaging, transportation, and offsite disposal of waste, verification surveys, and site restoration. No surveillance and maintenance costs would be necessary after D&D is complete and it is assumed that this alternative would not incur any other future costs.

Examples of items that may affect the actual cost of this alternative during D&D activities include:

- Changes in the anticipated characteristics of the wastes generated, resulting in higher disposal fees;
- Discovery of unanticipated contamination which would increase the volume of debris and soil that must be handled and/or disposed; and
- Changes in the cost of labor, fuel, and regulations that differ from historical averages.

4.4 Preferred Alternative

Based on the analysis in this section, the preferred alternative based on effectiveness, implementability, and cost is Demolition/Removal and Offsite Disposal alternative. This alternative will provide the most effective protection of human health and the environment while restoring the Building 4024 facility footprint to a state that is suitable for unrestricted land use. An evaluation of risks associated with the implementation of this alternative is included as Appendix B.

Section 5.0 – Recommended Removal Action Alternative

The selected removal action alternative for the D&D of Building 4024 is the preferred alternative identified in Section 4, Demolition/Removal and Offsite Disposal.

The public was encouraged to comment on the preferred alternative during the public comment period that ended April 9, 2007. DOE conducted a public meeting on February 21, 2007, to provide relevant information, as well as to solicit public comment on this proposal.

All comments submitted during the comment period were reviewed and considered by DOE, and all DOE responses to relevant public comments are addressed in the Building 4024 Decontamination and Decommissioning Responsiveness Summary, which is included in the administrative record file, and is also available on the ETEC website.

Following the public comment period, this document was revised and used as the basis for an Action Memorandum to initiate implementation of the chosen D&D approach.

Additional copies of this EE/CA and its administrative record file are available at the following locations:

Simi Valley Library
2969 Tapo Canyon Road
Simi Valley, CA 93063
(805) 526-1735

Platt Branch Library
23600 Victory Blvd.
Woodland Hills, CA 91367
(818) 340-9386

California State University, Northridge
Oviatt Library
2nd Floor, Room 265
Northridge, CA 91330
(818) 677-2285

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42 U.S.C. 9601 *et seq*., "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986."

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Appendix A – Identified ARARs or To-Be-Considered Requirements for the Building 4024 D&D

In accordance with the NCP, non-time-critical removal actions conducted under CERCLA are required to comply with applicable or relevant and appropriate requirements (ARARs) to the extent practicable, considering the scope and urgency of the situation.

ARARs are divided into three groups: (1) constituent-specific, (2) location-specific, and (3) action-specific. Constituent-specific ARARs establish an acceptable amount or concentration that may remain in or be discharged to the ambient environment. Location-specific ARARs include restrictions placed on the conduct of activities solely because they occur in special locations such as wetlands, floodplains, historic properties, or critical habitat. Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances or other particular circumstances at a site. Action-specific ARARS include requirements imposed on removal actions such as worker safety, dust control requirements, storm water pollution plans and runoff control, transportation and disposal of hazardous and non-hazardous wastes, and control of air emissions. State requirements are ARARs if they are promulgated, substantive laws or regulations that are consistently applied and are more stringent than federal requirements.

The D&D of the Building 4024 will adhere to all practicable ARARs specific to the Building 4024 footprint. These ARARs are identified in the table below.

Table A-1. ARARs and To-Be-Considered Requirements

Citation & Title	Federal, State, or Local	Description of Requirement	Type of ARAR or To Be Considered
40 CFR 61 Subparts H and I—National Emission Standards for Hazardous Air Pollutants (NESHAPs) and 42 USC §7401— Clean Air Act	Federal	Limits emissions of radionuclides so that the total effective dose equivalent to any member of the public must be less than 10 mrem/year. Emissions of radioactive iodine must not exceed 3 mrem/year.	Applicable, Chemical-specific
40 CFR Parts 260-265—Resource Conservation and Recovery Act	Federal	Defines hazardous wastes and requires all wastes classified as hazardous to be handled, stored, and disposed of in accordance with these regulations.	Applicable, Chemical-Specific
40 CFR Part 61, Subpart M—National Emission Standard for Asbestos	Federal	Requires EPA notification when demolition of asbestos-containing materials is planned.	Relevant And Appropriate, Chemical-Specific

Citation & Title	Federal, State, or Local	Description of Requirement	Type of ARAR or To Be Considered
15 USC §2601—Toxic Substance Control Act	Federal	Regulates manufacturing, processing, distributing in commerce, using, or disposing substances that may present an unreasonable risk of injury to health or the environment.	Relevant and Appropriate, Chemcial-Specific
49 USC 5101—Hazardous Material Transportation Act (HMTA) and 49 CFR Part 171 Hazardous Materials regulations	Federal	Requires specific packaging, labeling, handling, and reporting requirements for the transportation of hazardous materials.	Applicable, Action-Specific
The Clean Water Act ("CWA"), 33 U.S.C. § 1251 et seq	Federal	Federal water pollution and prevention control.	Applicable, Action Specific
NPDES Permit N. CA0001309, CI No. 6027.	State	Waste Discharge Requirements for The Boeing Company, Santa Susana Field Laboratory	Applicable, Action Specific
California Executive Order D-62-02	State	Decommissioned material must be shipped to a licensed Class I hazardous waste facility	Applicable, Action Specific
Porter- Cologne Water Quality Control Act	State	Act to preserve, enhance and restore the quality of the State's water resources.	Applicable, Action Specific
10 CFR Part 835—Occupational Radiation Protection	Federal	Establishes requirements for controlling and managing radiologically contaminated areas.	Applicable, Action-Specific
16 USC §1531—Endangered Species Act of 1973 and 30 CFR Parts 200 and 402.	Federal	Requires that actions taken do not cause or contribute to the taking of any federally-listed endangered or threatened species of plants or wildlife.	Relevant and Appropriate, Location-Specific
DOE Order 5400.5 – Radiation Protection of the Public and the Environment	Federal	Specifies soil concentration limits for remediation.	To Be Considered

Citation & Title	Federal, State, or Local	Description of Requirement	Type of ARAR or To Be Considered
DOE Order 231.1A—Environment, Safety and Health Reporting Note: This Order cancels paragraph 1a(3)(a) of Chapter 2 of DOE O 5400.5.	Federal	Ensure timely collection, reporting, analysis, and dissemination of information on environment, safety, and health issues as required by law or regulations or as needed to ensure that DOE is kept fully informed of events that could adversely affect the health and safety of the public or the workers, the environment, the intended purpose of DOE facilities, or the credibility of the Department.	To Be Considered
DOE Order 440.1—Worker Protection Management for DOE Federal and Contractor Employees	Federal	Establishes Department of Energy work safety requirements that are at least as stringent as OSHA requirements.	To Be Considered
DOE Order 435.1—Radioactive Waste Management	Federal	Ensure that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety, and the environment.	To Be Considered
California H&SC section 25100-24250, 22 CCR 66001-67786 Hazardous Material Control Law (HMCL)	State	Controls hazardous wastes from point of generation through accumulation, transportation, treatment, storage, and disposal.	Applicable, Action-Specific
California Department of Fish and Game § 2050-2068—California Endangered Species Act	State	Requires that actions taken do not cause or contribute to the taking of any California-listed endangered or threatened species of plants or wildlife.	Relevant and Appropriate, Location-Specific

Citation & Title	Federal, State, or Local	Description of Requirement	Type of ARAR or To Be Considered
8 CCR 4; 8 CCR 5; 8 CCR 7; and 8 CCR Sections 1504, 1539-1543 — Construction Safety Orders, Electrical Safety Orders, and General Safety Orders	State	Establishes California work safety requirements.	To Be Considered
Ventura County Environmental Health Division (VCEHD) Codes and Standards	Local	Ensures conformance with State laws and County ordinances pertaining to hazardous materials, hazardous waste, land use, and solid waste.	Applicable, Action-Specific
South Coast Air Quality Management District (SCAQMD) Rule 1166—	Local	Requires air monitoring when excavating contaminated concrete, soil, and asphalt to manage VOC emissions and dust control.	Applicable, Action-Specific
Ventura County Air Pollution Control District (VCAPCD) Rules, including Rule 62.7— Asbestos, Removal and Demolition	Local	Requires notification, permitting, and payment of fees for activities such as demolition of structures with asbestos-containing materials.	Applicable, Action-Specific
Site Work, Demolition, and Construction Uniform Building Code, Chapter 33	Other	Provides guidance on safe construction, modification, and demolition projects.	To Be Considered
American National Standards Institute (ANSI) Series A-10 and Series B-30.9— Safety Requirements for Construction and Rigging	Other	Provides guidance on safe construction and rigging activities.	To Be Considered

Citation & Title	Federal, State, or Local	Description of Requirement	Type of ARAR or To Be Considered
National Fire Protection Association (NFPA) Standard 241—Standard for Safeguarding Construction, Alteration, and Demolition Operations	Other	Provides guidance on safe construction, modification, and demolition projects.	To Be Considered

Appendix B – Risks Associated with Implementation of the Preferred Alternative

Appendix B outlines the risks associated with the implementation of the Building 4024 Removal/Offsite Disposal alternative, their potential impact on the project, their likelihood of occurrence, and how each risk will be mitigated prior to implementation.

Table B-1. Risks Associated with Implementation of the Preferred Alternative

Risk	Impact	Likelihood	Mitigation Approach
Volume of excavation larger than expected	**Medium -** Increased excavation/disposal costs, but sites are relatively small	**Medium -** Actual contamination may differ from expected footprint	An additional volume contingency will be added, and excavation site sampling will confirm volume accuracy.
Resource availability (budget, equipment, workers)	**High -** Work cannot progress	**Low**	Resources will be secured before the removal action begins.
Kettleman Hills Disposal Facility ceases to accept decommissioned material	**High** – Cost of disposal will increase, but the proposed action will not be hindered from implementation	**Low/Medium**	Wastes would be transported to an alternate waste disposal facility (possibly a low level waste disposal facility)
Radiological contamination requiring removal exists in the bedrock below the 4022 vault	**Medium** - Extra labor and cost will be needed to dispose of the excess bedrock	**Low** – There is a substantial concrete layer at the base of the 4022 vault	An additional contingency will be added to account for possible bedrock removal.
Adverse weather (rain) interferes with excavation	**Medium -** May cause schedule delays or contaminant spread	**Low**	Actions will be scheduled for the dry season.
Worker safety (physical hazards during excavation)	**High -** Potential for injuries and work stoppage	**Low**	Job-specific Environmental Health and Safety plans and DOE Order 440.1 protocols will be followed and all appropriate training given to workers.