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H. Author/Requestor D.H. Chapin [signature] 04/12/06 (Print and Sign)

Responsible Manager D.T. Evans [signature] 4/12/06 (Print and Sign)

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I. Reviewers

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General Counsel	[X]	D.J. Wilcox	[signature] 4/12/06	(Y) / N
Office of External Affairs	[X]	K.E. Lutz	[signature] 4/12/06	(Y) / N
DOE-RL	[X]	A.B. Joy, OUO SME	[signature] 4/12/06	(Y) / N
Other	[X]	T.W. Ferns, ESD	[signature] 4/12/06	(Y) / N
Other	[X]	J. D. Aardal	Janis Aardal	(Y) / N

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DOE/EA-1547F

Environmental Assessment

Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, Fast Flux Test Facility (FFTF) Project, Hanford Site, Richland, Washington

U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

March 2006

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FIGURES

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APPENDICES

GLOSSARY

Acronyms and Initialisms

ARARs	applicable or relevant and appropriate requirements
1995 EA	DOE/EA-0993, *Shutdown of the Fast Flux Test Facility*
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CY	Calendar Year
dBA	A-weighted decibel(s)
DHX	dump heat exchanger
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
DOT	U.S. Department of Transportation
EA	environmental assessment
EIS	environmental impact statement
ERDF	Environmental Restoration Disposal Facility
ERPG	Emergency Response Planning Guideline
ETF	Effluent Treatment Facility
FFTF	Fast Flux Test Facility
FONSI	Finding of No Significant Impact
FR	Federal Register
FSF	Fuel Storage Facility
FY	Fiscal Year
HCP EIS	Hanford Comprehensive Land-Use Plan EIS
IDS	Interim Decay Storage
IHX	intermediate heat exchanger
ISA	interim storage area
ISC	interim storage cask
LCF	latent cancer fatality
LDCV	Large Diameter Cleaning Vessel
LERF	Liquid Effluent Retention Facility
LMFBR	Liquid Metal Fast Breeder Reactor
LMR	Liquid Metal Reactor
MASF	Maintenance and Storage Facility
MEI	maximally exposed individual
NaK	sodium-potassium eutectic alloy
NaOH	sodium hydroxide
NEPA	*National Environmental Policy Act of 1969*
NRC	U.S. Nuclear Regulatory Commission

PCB	polychlorinated biphenyl
PEIS	*Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility*
PNNL	Pacific Northwest National Laboratory
PPA	property protected area
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
ROD	Record of Decision
SALDS	State-Approved Land Disposal Site
SCFM	standard cubic feet per minute
SHPO	State Historic Preservation Officer
SRE	Sodium Reaction Experiment
SRF	Sodium Reaction Facility
SSF	Sodium Storage Facility
SSP	superheated steam process
TC&WM EIS	Tank Closure and Waste Management EIS
TSD	treatment, storage, and/or disposal
WAC	*Washington Administrative Code*

Definition of Terms

As Low As Reasonably Achievable. An approach to radiation and toxicological protection to control or manage exposures (both individual and collective to the workforce and general public) as low as social, technical, economic, practical, and public policy considerations permit.

Background radiation. That level of radioactivity from naturally occurring sources; principally radiation from cosmogenic and primordial radionuclides.

Deactivation (as defined by DOE Order 430.1B, "Real Property Asset Management"). Placing a facility in a stable and known condition including the removal of hazardous and radioactive materials to ensure adequate protection of workers, 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).

Decontamination (as defined by DOE Order 430.1B, "Real Property Asset Management"). The removal or reduction of residual chemical, biological, or radiological contaminant and hazardous materials by mechanical, chemical, or other techniques to achieve a stated objective or end condition.

Decommissioning (as defined by DOE Order 430.1B, "Real Property Asset Management"). The process of closing and securing a nuclear facility or nuclear materials storage facility to provide adequate protection from radiation exposure and to isolate radioactive contamination from the human environment. It takes place after deactivation and includes surveillance, maintenance, decontamination, and/or dismantlement. These actions are taken at the end of the life of a facility to retire it from service with adequate regard for the health and safety of workers and the public and protection of the environment. The ultimate goal of decommissioning is unrestricted release or restricted use of the site.

Derived Air Concentrations. The airborne concentration that equals the annual limit on intake divided by the volume of air breathed by an average worker for a working year of 2,000 hours [assuming a breathing volume of 2,400 cubic meters (85,000 cubic feet)].

Derived Concentration Guide for Public Exposure. Those concentrations of radionuclides in air or water that would result in a maximum effective committed dose equivalent to 100 millirem per year using appropriate dose methodology under conditions of continuous exposure or use (i.e., continuously breathing or being immersed in contaminated air or exclusively drinking contaminated water).

Emergency Response Planning Guidelines No. 1 (ERPG-1). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

Emergency Response Planning Guidelines No. 2 (ERPG-2). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

Emergency Response Planning Guidelines No. 3 (ERPG-3). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Latent cancer fatalities. Deaths from cancer resulting from, and occurring some time after, exposure to ionizing radiation or other carcinogens.

Maximally exposed individual. A hypothetical member of the public residing near the Hanford Site who, by virtue of location and living habits, could receive the highest possible radiation dose from radioactive effluents released from the Hanford Site.

Millirad. A unit of radiation dose equivalent that is equal to one-one thousandth (1/1000) of a rad.

Millirem. A unit of radiation dose equivalent that is equal to one-one thousandth (1/1000) of a rem.

NaK. A sodium-potassium eutectic alloy, liquid at room temperature, typically used in instrumentation and cooling of auxiliary systems.

Person-rem. A population dose based on the number of exposed persons multiplied by the radiation dose each received.

Rad. The unit of absorbed dose. 1 rad = 0.01 Gray (gy).

Rem. A unit of dose equivalent that indicates the potential for impact on human cells.

Risk. The product of the probability of occurrence of an accident and the consequences of an accident.

Sievert (Sv). The international system (SI) unit for dose equivalent equal to 1 Joule/kilogram. 1 sievert = 100 rem.

METRIC CONVERSION CHART

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.03937	inches
inches	2.54	centimeters	centimeters	0.393701	inches
feet	0.3048	meters	meters	3.28084	feet
yards	0.9144	meters	meters	1.0936	yards
miles (statute)	1.60934	kilometers	kilometers	0.62137	miles (statute)
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.09290304	square meters	square meters	10.7639	square feet
square yards	0.8361274	square meters	square meters	1.19599	square yards
square miles	2.59	square kilometers	square kilometers	0.386102	square miles
acres	0.404687	hectares	hectares	2.47104	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.34952	grams	grams	0.035274	ounces (avoir)
pounds	0.45359237	kilograms	kilograms	2.204623	pounds (avoir)
tons (short)	0.9071847	tons (metric)	tons (metric)	1.1023	tons (short)
Volume			**Volume**		
ounces (U.S., liquid)	29.57353	milliliters	milliliters	0.033814	ounces (U.S., liquid)
quarts (U.S., liquid)	0.9463529	liters	liters	1.0567	quarts (U.S., liquid)
gallons (U.S., liquid)	3.7854	liters	liters	0.26417	gallons (U.S., liquid)
cubic feet	0.02831685	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.7645549	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Energy			**Energy**		
kilowatt hour	3,412	British thermal unit	British thermal unit	0.000293	kilowatt hour
kilowatt	0.94782	British thermal unit per second	British thermal unit per second	1.055	kilowatt
Force/Pressure			**Force/Pressure**		
pounds (force) per square inch	6.894757	kilopascals	kilopascals	0.14504	pounds per square inch
torr	133.32	pascals	pascals	0.0075	torr

06/2001

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Third Ed., 1993, Professional Publications, Inc., Belmont, California.

Scientific Notation Conversion Chart

Multiplier	Equivalent
10^{-1}	0.1
10^{-2}	.01
10^{-3}	.001
10^{-4}	.0001
10^{-5}	.00001
10^{-6}	.000001
10^{-7}	.0000001
10^{-8}	.00000001

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Richland Operations Office (RL) is preparing this National Environmental Policy Act (NEPA) environmental assessment (EA) to analyze the potential environmental consequences of a proposed action. The proposed action, as described in subsection 1.2, involves first reacting (i.e, reducing the hazard of the metallic sodium by a chemical reaction) and then removing the radioactively contaminated sodium residuals associated with the Fast Flux Test Facility (FFTF) Project at the Hanford Site in Richland, Washington. In this EA, the proposed action would continue to support long-term, low cost surveillance and maintenance of the facility in a safer and still stable condition, with reduced risk to plant workers, the public, and the environment, prior to implementing a final FFTF decommissioning end state. The final end state would be defined through the Tank Closure and Waste Management Environmental Impact Statement (TC&WM EIS) and Record of Decision (ROD). This proposed action would maintain the continuity and momentum of FFTF deactivation by using existing on-site experienced sodium-hazard staff, as described in DOE/EA-0993, *Shutdown of the Fast Flux Test Facility* (referred to as the 1995 EA). The 1995 EA addressed leaving the FFTF radioactively contaminated sodium residuals in-place and maintained under an inert gas atmosphere to prevent any chemical reactions during long-term surveillance and maintenance. This EA addresses a different approach to placing FFTF into long-term surveillance by applying technologies to react and remove the sodium residuals. Deactivation activities that would remove associated equipment and components to provide access to the hard-to-reach areas of sodium residuals are also examined. This EA also proposes how to remove, dispose of, and/or stabilize other miscellaneous hazards and waste streams that would be expected as a result of the residual removal activities.

This document was prepared in compliance with the requirements of the Council on Environmental Quality (CEQ) Regulations for Implementing the *National Environmental Policy Act* (NEPA) *of 1969* [40 Code of Federal Regulations (CFR) Parts 1500-1508]; and the DOE Regulations for implementing NEPA (10 CFR Part 1021). NEPA requires the assessment of environmental consequences of Federal actions that may affect the quality of the human environment. Based on the potential for impacts analyzed in this EA, DOE would either publish under NEPA a Finding of No Significant Impact (FONSI) decision or prepare an EIS.

1.1 Background

The FFTF is a DOE-owned, formerly-operating, 400-megawatt (thermal) liquid-metal cooled (sodium) research and test reactor located in the 400 Area of DOE's Hanford Site near the City of Richland, Washington (Figures 1 and 2). A detailed description of the FFTF Complex is provided in *Technical Information Document for the Fast Flux Test Facility Closure Project Environmental Impact Statement* (FFTF-18346).

The original purpose of the facility was to develop and test advanced fuels and materials for the Liquid Metal Fast Breeder Reactor (LMFBR) Program [the FFTF is a Liquid Metal Reactor (LMR)] and to serve as a prototype facility for future LMFBR facilities; other missions were subsequently pursued. Initial criticality was achieved on February 9, 1980, and full power was initially achieved on December 21, 1980. Following an additional year of extensive acceptance testing, FFTF operated safely and successfully from 1982 to 1992 and provided the nuclear industry with significant advances in fuel performance, medical isotope production, materials performance and passive and active safety system testing. In December 1993, DOE decided not to further operate FFTF because of a lack of economically viable missions at that time. DOE issued a shutdown order for FFTF.

In May, 1995, DOE prepared the 1995 EA, evaluating the potential impacts associated with actions necessary to place the FFTF in radiologically safe and industrially safe permanent shutdown and deactivation condition (Phase I), suitable for a long-term surveillance and maintenance (Phase II) prior to decommissioning (Phase III). The 1995 EA did not evaluate Phase III. DOE determined that an EIS was not required for the permanent shutdown and deactivation of the FFTF, and issued a FONSI in May 1995.

In January 1997, DOE decided to maintain FFTF in standby pending an evaluation of a future role in DOE's national tritium production strategy. In December 1998, DOE decided FFTF should not play a role in production of the nation's tritium stockpile. Facility deactivation work continued under the 1995 EA, limited to activities that would not preclude reactor restart.

In December 2000, DOE published the *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility* (NI-PEIS, DOE/EIS-0310F) This NI-PEIS evaluated the role of FFTF as an alternative nuclear irradiation services facility to accomplish civilian nuclear energy research and development, medical and industrial radioisotope production, and production of plutonium-238 to support future National Aeronautics and Space Administration space exploration missions. Also evaluated was an alternative to permanently deactivate the FFTF. Based on the NI-PEIS, DOE decided in the Record of Decision (ROD) [66 Federal Register (FR) 7877, January 26, 2001], that the permanent deactivation of FFTF was to be resumed, with no new missions. Since that time, deactivation has continued, consistent with the 1995 EA and FONSI and the 2000 NI-PEIS and 2001 ROD.

The total Hanford Site radioactively contaminated sodium inventory is estimated to be 1,136,000 liters (300,000 gallons). Approximately 874,000 liters (231,000 gallons) of 984,000 liters (260,000 gallons) of bulk radioactively contaminated sodium has been drained from the FFTF reactor vessel (RV), three primary and three secondary heat transport system loops, and Fuel Storage Facility (FSF), and transferred to the Sodium Storage Facility (SSF, adjacent to FFTF). Additional bulk radioactively contaminated sodium inventory remains stored in the Hanford Site 200 West Area in 5 Hallam tanks [128,700 liters (34,000 gallons)] and in 158 55-gallon storage drums of Sodium Reactor Experiment (SRE) sodium [26,000 liters (7,000 gallons)]. Associated trace heat systems have been de-energized. Approximately 79,000 liters (21,000 gallons) of bulk FFTF sodium remains in the FFTF Interim Decay Storage (IDS) vessel and associated auxiliary systems. The IDS sodium will be drained and transferred to SSF in Calendar Year 2006. The FFTF sodium residuals (i.e., material that remains on the walls of piping and components, or remains in pumps or vessels and other locations not readily drained) are being maintained in an inert environment (under an argon cover gas).

In December 2003, DOE issued a final request for proposals to "clean up and take down" the FFTF Complex. On December 22, 2005, DOE cancelled the solicitation for the Hanford Site FFTF Closure Project. Cancellation of the solicitation was deemed necessary because of budget constraints and the need to support higher-risk/higher-priority Hanford Site cleanup projects. In February 2006, DOE announced its intention to prepare a Tank Closure and Waste Management (TC & WM) EIS for the Hanford Site (71 FR 5655). DOE decided to merge the scope of the FFTF EIS (69 FR 50176) to further coordinate resources and ensure a comprehensive look at environmental impacts at Hanford. In the TC & WM EIS, the potential decision for final decontamination and decommissioning of the FFTF would identify the final end state for the above-ground, below-ground, and ancillary support structures.

This EA is an interim action EA that examines the environmental consequences on an expanded deactivation workscope that was previously analyzed in the 1995 EA to evaluate a different approach to sodium residuals management. The 1995 EA provides the foundation for most of the analyses of environmental impacts included in this EA. This EA evaluates the any potential additional environmental impacts. There have been relatively minor changes in environmental conditions at the 400 Area of the Hanford Site since 1995. The affected environment is described in Section 3.0, and updates the description provided in the 1995 EA (as documented in current 2005 reviews of Hanford Site environmental conditions). As such, this EA supplements or adds to the 1995 EA analysis of deactivation actions. Under the criteria of 40 CFR 1506.1, these actions would not be expected to have an adverse environmental impact or limit the choice of reasonable alternatives under consideration in the pending TC & WM EIS.

Metallic sodium is a strong reducing agent, and prone to exothermic reactions (sodium reacts vigorously with moisture under uncontrolled conditions to generate heat, hydrogen, and sodium oxide). The staff at FFTF has extensive expertise and corporate experience in the hazards of handling metallic sodium gained through startup, operations, maintenance, deactivation, and participation in national and international working groups.

1.2 Purpose and Need for Action

The 1995 EA addressed leaving and maintaining the FFTF radioactively contaminated sodium residuals under an inert gas atmosphere to prevent any chemical reactions during long-term surveillance and maintenance. The purpose of this proposed action is to continue to support long-term, low cost surveillance and maintenance (Phase II) of the facility in a safer and more stable condition with reduced risk to plant workers, the public, and the environment, prior to the final decommissioning end state of the FFTF. It would also maintain the continuity and momentum of FFTF deactivation activities using the advantage of existing knowledge and skills of current FFTF staff who have worked for many years within the confines of FFTF with the attendant sodium hazard (i.e., liquid-metal handling/cleaning expertise). The activities DOE now proposes to undertake include reaction and removal of radioactively contaminated sodium residuals, removal of associated equipment/components, as required, and removal/disposal/stabilization of the resulting miscellaneous hazards and waste streams. The proposed activities would be able to rely on existing staff with expertise in liquid metal handling/cleaning, minimizing risks to directly involved workers and other facility staff. Furthermore, it would eliminate having to maintain the inert cover gas system during the surveillance and maintenance phase, thus reducing costs.

1.3 Coordination with Activities under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980

Completion of the proposed deactivation workscope being evaluated in this EA would reduce a potential threat of release of hazardous substances into the environment. In parallel, DOE is preparing appropriate *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) *of 1980* documentation in order to implement the workscope described in this EA and to obtain a CERCLA decision document allowing waste streams generated from conducting the EA workscope to be disposed of at the existing 200 Area Environmental Restoration and Disposal Facility (ERDF). Relevant portions of this EA would be incorporated by reference into the CERCLA documentation to address NEPA values.

2.0 PROPOSED ACTION AND ALTERNATIVES

This EA evaluates the technologies to react and remove radioactively contaminated sodium residuals associated with the FFTF Project, as well as removal of associated equipment/components to allow removal of the sodium, and removal/disposal/stabilization of miscellaneous hazards and waste streams left over from the residual removal activities. Alternatives to the proposed action are also addressed.

2.1 Proposed Action

This EA focuses on removal and reaction of FFTF radioactively contaminated sodium residuals and other associated deactivation activities. DOE proposes to improve safety and reduce surveillance and maintenance costs by removing sodium residuals and other hazardous materials as a continuation of Phase I deactivation activities. Originally, in the 1995 EA, the proposed action and alternatives for sodium residuals were addressed as follows:

> "Following the drainage of the sodium and NaK systems, approximately 15,000 liters (4,000 gallons) of residual sodium would remain in the main portions of the FFTF's piping and equipment. Additional indeterminate quantities would remain in other portions of the plant systems, especially in complex, small-diameter piping systems. Included in the proposed action would be accommodation of these residuals to a stabilized condition such that long-term monitoring and surveillance of the FFTF could be conducted in a safe and environmentally sound manner. The current concept for accommodating residuals would be to maintain an inert gas atmosphere to prevent any chemical reactions during long-term surveillance and maintenance."

> "Alternative methods for accommodation of the sodium residuals will continue to be evaluated, including alternative cover gases and chemical reactants. These methods would not be expected to provide any additional environmental impacts, nor any new initiators or risks for accidents, and would be subject to appropriate safety and NEPA reviews."

In this EA, a different approach is evaluated whereby reaction of sodium residuals associated with the FFTF Project systems and equipment could be conducted in-place or at designated cleaning locations. These proposed sodium residual reaction activities (refer to Subsections 2.1.2 – 2.1.5) are based on use of the superheated steam process (SSP, refer to Subsection 2.1.1). It is recognized that for select situations that may be encountered, an alternative technology (refer to Subsection 2.2.2) could be implemented on a small scale for sodium residuals reaction.

Liquid wastes generated from removal and reaction of sodium residuals would be required to meet the waste acceptance criteria (including pH, sodium, and total dissolved solids) of existing liquid waste management facilities. These facilities are the existing Liquid Effluent Retention Facility (LERF) and the Effluent Treatment Facility (ETF) in the 200 East Area of the Hanford Site. Solid wastes would be disposed of in existing 200 Areas waste management facilities.

The following discussion presents details associated with activities considered under the proposed action.

2.1.1 Apply Process Technology for Removal and Reaction of Sodium Residuals and Associated Equipment

Removal of sodium residuals from systems/components has always been a part of the operation of LMRs. Removal of sodium residuals has been necessary during the operating period of LMRs to perform maintenance and to remove and repair various LMR components. Sodium residuals removal has also been a part of the disposition of LMR spent nuclear fuel. As part of the development and operation of LMRs, a variety of processes were developed for removing sodium residuals to support reactor operation and maintenance. Further development of these processes has been conducted as LMRs around the world have been shut down and deactivation activities have been initiated.

In 2005, the technical feasibility of various methods to react the sodium residuals was evaluated [*Fast Flux Test Facility Sodium Residual Cleaning Process Selection* (HNF-26715)]. The methods evaluated were: water vapor; SSP; moist carbon dioxide; evaporation; and dissolution of sodium in ammonia. These processes were evaluated against four criteria (past performance, complexity, process hazards, and flexibility). Although each of the technologies evaluated in HNF-26715 had positive attribute(s), overall SSP appeared to have the greatest utility for reacting residual sodium in FFTF. It is recognized that in select instances, one of the other alternative technologies (refer to Subsection 2.2.2) could be implemented on a small scale.

The primary advantages of the SSP are that it does not allow condensation to occur and component cleaning can be performed in a shorter time period. Prior to steam injection into the system to be cleaned the steam is heated to ~ 400^{0}F. The equipment to be cleaned is heated to a minimum of 212^{0}F and higher if possible. Most systems will require multiple injection points. As the superheated steam reacts with the metallic sodium, the temperature increases to ~600-800^{0}F.

Because of the high initial temperature and the increase of the temperature caused by the reaction, no condensation occurs. Since no condensation can occur, no uncontrolled chemical reaction will occur as would be possible in the water vapor process (refer to Subsection 2.2.2.1) The caustic formed is a liquid at the processing temperatures and because it is denser than the liquid sodium, it settles to the bottom of any pools leaving the sodium on top where it is always exposed to the superheated steam. Due to the continued exposure of the molten sodium to the superheated steam, the reaction continues at a constant rate.

Superheated steam injection is continued until hydrogen is no longer being generated. The system is then cooled, the sodium hydroxide solution is diluted, the pH is adjusted to <13, and the fluid is removed from the system. The liquid waste would be transported to LERF and subsequent treatment at ETF in the 200 East Area of the Hanford Site.

The benefits of SSP are:

- Condensation of water vapor does not occur due to the initial high temperature of the steam and the components and the continued high temperature due to the heat generation by the reaction process.
- Since there is no water accumulation in the system, the reaction process can immediately be terminated by stopping the injection of steam.
- Since the surface of the molten sodium is always exposed to the steam, the reaction occurs at a high rate and components can be cleaned more quickly.

2.1.2 Perform In-place Cleaning of Vessels, Components, and Large-Bore Pipe

A portable reaction unit would be used to clean, in-place, large-bore sodium pipe (greater than or equal to 8-inch diameter), components and vessels in the primary and secondary sodium cooling systems (Figures 3 and 4). The portable reaction unit also would be used to clean the IDS and FSF vessels (Note: select components in the primary sodium system, and large diameter piping and components in the secondary sodium system may be removed and cleaned in FSF or MASF, as described in Subsections 2.1.3 or 2.1.4).

Typically, penetrations into the piping/vessels would be made at appropriate locations using a low-speed drill. Existing sodium heating systems would be energized, and piping/vessels heated to liquefy the existing sodium residuals. A portable reaction unit would be connected to the penetration points, and used at various locations to inject the superheated steam into plant systems.

The superheated steam would be injected as described in Subsection 2.1.1. Hydrogen generation would be monitored to follow the reaction. Liquid waste (i.e., sodium hydroxide solution) would be collected in a catch vessel. The pH of the resultant solution would be reduced to <13 (refer to Subsection 2.1.1) and transferred to interim staging vessel, before offloading the solution to tanker transport for overland transfer to LERF and subsequent treatment at ETF.

2.1.3 Remove Small Bore Pipe and Components for Reaction in a Cleaning Station

Small bore piping (<8" diameter), valves and other components [e.g., core component pots from IDS, fuel storage tubes from FSF, and Dump Heat Exchangers (DHX) tube bundles (Figures 3 and 4) may be removed and processed in a proposed stationary cleaning station that would be located in FSF. Mechanical means (e.g., portable saws, pipe cutters) would be used to cut the pipe, valves, and components into manageable size. All heat exchanger tube bundles, which contain multiple parallel flow paths, would be dismantled to assure effective cleaning.

The proposed FSF stationary cleaning station would consist of a chamber with removable rack for loading piping and components. The piping would be loaded at an angle, allowing the residual sodium to drain to a catch basin when heated before the injection of inert gas and/or reaction medium. The process in the cleaning station would be consistent with the in-place process (refer to Subsection 2.1.2) where the resultant waste sodium hydroxide solution is collected, the pH reduced to <13, and transported to the 200 Areas. The FSF is considered an appropriate location due to availability of sufficient floor space, existing overhead crane, available utilities, and proximity to proposed operations.

Cleaned piping and components would be stored at FFTF (e.g., existing lay down area) pending packaging and disposal in a Hanford Site solid waste management facility.

2.1.4 Remove Large Components for Cleaning

The Large Diameter Cleaning Vessel (LDCV) located in the existing MASF could be used for cleaning large components following removal (e.g., primary sodium pumps, intermediate heat exchanger (IHX) tube bundles, and instrument trees). The LDCV would be retrofitted with a new super-heated steam supply and associated control system for use in cleaning the aforementioned components. The IHX tube bundles, which contain multiple parallel flow paths, may be dismantled to assure effective cleaning. Small bore pipe and components (refer to Subsection 2.1.3) also could be cleaned in MASF, if necessary.

Cleaning and disposition of liquid/solid wastes would be as described in Subsection 2.1.2.

2.1.5 Remove Sodium Residuals from Bulk Storage Facilities

For a bounding analysis in this EA, it is assumed that less than 1,135 liters (300 gallons) of sodium residuals would remain after draining the storage containers (i.e., SSF tanks, Hallam tanks, and SRE drums). Drained SSF and Hallam tanks would be cleaned in the 400 Area using the process described in Subsection 2.1.2. The drained SRE drums could be cleaned in the sodium cleaning station located in FSF (refer to Subsection 2.1.3). The SSF tanks would be left in a safe configuration for disposition under FFTF decommissioning, and the Hallam tanks and the SRE drums would be disposed of as solid waste.

2.1.6 Remove Special Components (cesium trap, primary cold trap, two vapor traps)

There are four components that would require special disposition due to high levels of radiological contamination (primarily due to cesium-134 and -137) and/or the inability to drain the component effectively. The "Special Components" (primary cold trap, cesium trap, and two vapor traps[1]) would be removed from their installed position during sodium residual removal and packaged. The packages would be stored in the 400 Area pending final disposition.

Table 1. FFTF Special Components.

Component	Description of Component	Volume of Residual Na (liters/gallons)	Radiation Consideration (maximum anticipated dose rate)	Disposition
Primary Cold Trap	Same	2,680/710	10 Rem/hour at contact	Cut/Cap remotely; Store
Cesium Trap	Same	300/80	60 Rem/hour at contact	Cut/Cap remotely; Store
Vapor Trap A* (5 SCFM)	Condenser vapor trap and two filter vapor traps	Residual only <4/<1	5 Rem/hour at contact	Cut/Cap remotely; Store
Vapor Trap B* (1 SCFM)	Condenser vapor trap and two filter vapor traps	Residual only <4/<1	0.6 Rem/hour at contact	Cut/Cap remotely; Store

*The 'A' and 'B' designation refers to flow capacity through the vapor trap; 'A' is 5 standard cubic feet per minute (SCFM) and 'B' is 1 standard cubic feet per minute.

[1] A trap basically is a piece of equipment or component used to filter out contaminants.

2.1.7 Other Deactivation Activities

Other related deactivation activities that would occur as part of the proposed action are described as follows.

- Remove/Dispose of asbestos

The original design specifications for FFTF included asbestos-free insulation around sodium piping and components. However, asbestos-containing materials were used in several locations. The majority of the asbestos-containing materials are in the form of cable tray fireproofing and asbestos-coated trace heat wiring for the sodium system piping and components. Approximately 100 cubic yards of asbestos-containing materials would be appropriately packaged and disposed.

- Remove/stabilize existing hazards in conjunction with systems and equipment deactivation associated with sodium residuals.

As systems become no longer necessary to support plant deactivation activities, the need for general maintenance and plant support would be reduced. Some of these systems and utilities contain hazardous materials, such as glycol, oils, and polychlorinated biphenyl (PCB) [e.g., approximately 360,000 liters (94,000 gallons) of ethylene glycol and 32,000 liters (8,500 gallons) of PCB transformer oil]. These materials would be recycled or disposed of. Excess chemicals (e.g., maintenance solvents) also would continue to be recycled or disposed of, as appropriate.

Essentially all of the plant systems would be deactivated at final shutdown, placing the FFTF into a long-term surveillance and maintenance phase. Actual facility support would be limited to minimal maintenance and facility walkdowns. Monitoring in the near-term would continue to be required for the SSF.

- Remove/recycle/dispose excess deactivated equipment and components.

Miscellaneous unnecessary/inactive equipment and components are present in FFTF. For example, ventilation ducts and cover gas systems are in locations in FFTF that are a hindrance to access of piping and components associated with sodium residuals. These equipment and components would be extracted by mechanical means to ease removal of sodium piping and components.

For conservatism, it is assumed that these materials would represent an additional approximately 30 percent (by weight) of the total piping [approximately 1,500,000 kilograms (1,600 tons)] directly involved with sodium residuals, or ~440,000 kilograms (~480 tons) [rounded to 450,000 kilograms (500 tons)]. These materials could be managed in a similar fashion as the piping; i.e., clean and dispose of as solid waste at the Hanford Site.

- Remove depleted uranium and/or lead shielding.

The FFTF reactor contains depleted uranium shielding (including head compartment shielding, center island shielding, branch arm piping shielding, and shielding for the fuel transfer ports), and lead shielding. The inventory of depleted uranium is approximately 37,800 kilograms (83,100 pounds). The inventory of lead shielding is approximately 48,000 kilograms (105,600 pounds). These materials would be removed to the extent practicable, and recycled, reused, or stored in the 400 Area.

2.1.8 Management of Waste Streams

As discussed in Subsection 1.3, CERCLA documentation is being prepared in parallel with this EA to obtain a CERCLA decision document that would allow disposal of waste at ERDF. The following is a list of waste streams and the potential applicable or relevant and appropriate requirements (ARARs) that could be applied under CERCLA.

2.1.8.1 Waste Handling

Continued deactivation (including residual sodium removal/reaction) of the FFTF would result in wastes and surplus materials which would be managed in a manner consistent with waste minimization requirements, including the *Pollution Prevention Act of 1990*, State of Washington requirements [i.e., Washington Administrative Code (WAC) 173-303, *Dangerous Waste Regulations*], and DOE Orders and policies (e.g., DOE Order 450.1, Change 1, *Environmental Protection Program*; and DOE Order 435.1, Change 1, *Radioactive Waste Management*). Compliance with the aforementioned laws, regulations, and orders requires, as appropriate, permits and approvals, waste minimization programs and practices, a pollution prevention awareness program, and annual waste reduction reports and goals. All wastes would meet the waste acceptance criteria of the existing waste management units.

2.1.8.2 Liquid Wastes

As discussed previously (refer to Subsection 2.1.1), sodium residual reaction would result in an estimated 3,780,000 liters (1,000,000 gallons) of radioactive sodium hydroxide solution. This liquid waste would be transported, via tanker truck, to the existing Hanford Site 200 Area LERF for subsequent treatment at ETF. The LERF/ETF provides integrated liquid effluent management to support cleanup of the Hanford Site. The LERF/ETF is used to remove hazardous chemicals and low-level radioactive contamination from wastewater effluent streams. The treated wastewater is disposed at a State-Approved Land Disposal Site (SALDS, refer to Figure 1) that discharges treated effluent under a WAC 173-216 Discharge Permit.

2.1.8.3 Solid Wastes

Cleaned piping and components could result in approximately 2,700,000 kilograms (3,000 tons) of low-level solid radioactive waste. At a nominal density of approximately 600 kilograms/cubic meter (37 pounds/cubic foot), this equates to approximately 4,500 cubic meters (162,000 cubic feet). This is comprised of approximately 1,500,000 kilograms (1,700 tons) of piping (large- and small-bore), approximately 670,000 kilograms (740 tons) of components [vessels, valves, pumps, heat exchangers, including 12,700 kilograms (14 tons) of IDS/FSF traps], approximately 450,000 kilograms (500 tons) of miscellaneous components (removed to facilitate access to sodium residuals), non-asbestos insulation [~1,400 cubic meters (~1,800 cubic yards)], and approximately 76 cubic meters (100 cubic yards) of asbestos-containing materials. These wastes would be transported to existing waste management facilities in the 200 Areas of the Hanford Site, or staged in the vicinity of FFTF for eventual transport to and disposal of at the Environmental Restoration Disposal Facility (ERDF, refer to Figure 1).

2.1.8.4 Air Emissions

Conversion of the sodium to a stabilized form would result in some airborne emissions. Radioactive airborne emissions from the cleaning stations are expected to be limited to tritium when cleaning piping and components from the secondary cooling system. Some fission products could be present when cleaning piping and components from the primary and fuel storage sodium systems.

2.1.8.5 Pollution Prevention/Recycling

Hazardous materials associated with the auxiliary systems may represent a quantity of materials that would be reused, recycled, or appropriately packaged and managed as regulated wastes. Such materials include approximately 360,000 liters (94,000 gallons) of ethylene glycol and 32,000 liters (8,500 gallons) of PCB transformer oil.

2.1.8.6 Waste Transportation

The solid and liquid effluents from the deactivation activities that contain radioactive and/or hazardous materials would be appropriately packaged. Primary consideration would be given to transportation of the wastes to (and use of) existing Hanford Site waste management facilities. All activities would be conducted in full compliance with applicable regulations, including the *Clean Air Act of 1977* and U.S. Department of Transportation (DOT) requirements, which would be in force at the time of the action.

2.2 Alternatives to the Proposed Action

Alternatives to the proposed action include the No-Action alternative, alternative process technologies for removal and reaction of sodium residuals, and alternative locations of the sodium residual reaction station(s).

2.2.1 No-Action Alternative

Under the No-Action Alternative, the FFTF would continue to be deactivated as described under the 1995 EA. This alternative would leave the sodium residuals in place.

2.2.2 Alternative Process Technologies for Removal and Reaction of Sodium Residuals and Associated Equipment Including the Proposed Action

Alternative process technologies for removal/reaction of FFTF sodium residuals have been considered. As addressed in HNF-26715, each process was qualitatively evaluated against four criteria of past performance, complexity, process hazards, and flexibility.

2.2.2.1 Water Vapor

This process has been used at Hanford since the 1970's. It was used extensively in the DOE Nuclear Energy Legacy Program to clean residual sodium and sodium/potassium (NaK) from a variety of test loops and components and is currently used at FFTF to clean sodium from fuel elements as part of the Fuel Offload Program.

Two methods are used to inject the water into nitrogen (or some other inert gas):

- A water column; or
- A steam generator.

The inert gas carries the water vapor into the equipment to the sodium where the water reacts with the sodium. The process is controlled by limiting the water content of the inert gas. However, water can build up in the equipment being cleaned and it can take several hours to consume the available water after water addition is terminated. This makes it difficult to quickly shut down the process.

Water vapor is injected into the vessel or piping (multiple injection points are usually required) where the frozen sodium strips the water vapor from the carrier gas, releasing hydrogen and producing sodium hydroxide (NaOH) (Equation 1).

$$2Na + 2H_2O \rightarrow 2NaOH + H_2 \quad (1)$$

As the process continues in vessels with puddles of frozen sodium[2], the sodium hydroxide is normally siphoned off on a regular basis to prevent a rapid reaction and uncontrolled pressurization event. As the water reacts with the sodium on the surface of a sodium puddle, a sodium hydroxide layer is formed. As the thickness of this layer increases, the rate of reaction slows down since the water must diffuse through the hydroxide layer. A substantial gradient of water content can develop, with a high concentration at the "top" of the layer. If the layer is disturbed and the water contacts the sodium, a very rapid reaction will result releasing hydrogen gas and a large amount of heat. This will cause a temperature and pressure surge in the system being cleaned and if sufficient free volume is not available can result in damage to the equipment being cleaned or to the cleaning equipment. One method to mitigate this problem is to expend additional effort to remove additional sodium from the equipment to reduce the size of the sodium puddles.

The progress of the cleaning process is normally monitored by measuring the hydrogen concentration in the effluent gas stream. The oxygen concentration is also measured to assure that flammable conditions cannot exist in the equipment being cleaned. As the hydrogen concentration subsides, the water content of the inert gas is increased. The process eventually switches over to water injection while continuing to monitor oxygen and hydrogen. Local temperature (near the reaction zone) may also be monitored.

The equipment is rinsed, as necessary, to assure the sodium has been reacted and to remove any remaining caustic. The amount of water required varies with the complexity of the item being washed, it could require full submersion. After final rinsing, the equipment is purged with inert gas (e.g., nitrogen) to dry the system.

2.2.2.2 Moist Carbon Dioxide

Sodium metal reacts with carbon dioxide and water to form sodium bicarbonate and/or sodium carbonate, depending upon the temperature and availability of water and carbon dioxide. Under some conditions, both reaction products can be formed. These chemical reactions are generally stated by Equations 2 and 3.

$$2Na + 2CO_2 + 2H_2O \rightarrow 2NaHCO_3 + H_2 \quad (2)$$

$$2Na + CO_2 + H_2O \rightarrow Na_2CO_3 + H_2 \quad (3)$$

In reaction 2, sodium metal reacts with gaseous carbon dioxide and water to form solid sodium bicarbonate and hydrogen gas. In reaction 3, sodium metal reacts with gaseous carbon dioxide and water to form solid sodium carbonate and hydrogen gas. These reactions are called passivation since once these products are formed the sodium will no longer react with air.

The rate of sodium bicarbonate formation depends partly on the concentration of carbon dioxide and partly on the concentration of the water vapor. In the open air where the concentration of carbon dioxide

[2] After draining molten sodium, some of the residual sodium may form a 'puddle' at low points in the piping or components. As the sodium cools, it solidifies; thus the surface of the 'frozen' puddle of sodium is what is available for reaction.

is less that 0.04 volume percent, the conversion to sodium bicarbonate can occur quite slowly (i.e., hours to days). The layer of sodium bicarbonate that forms is porous and allows for the penetration of water and carbon dioxide to the sodium metal underneath; however, the rate of reaction slows as the bicarbonate layer thickens. The volume of the porous layer is approximately five times that of the solid metal. Therefore, the process works well in places where there is space available for the expansion but plugging occurs if sufficient space is not available.

When humidified carbon dioxide reacts with residual sodium at ambient temperature, the product is greater than 90 percent sodium bicarbonate. The rate of reaction is proportional to the moisture concentration and is inversely proportional to the thickness of the sodium bicarbonate layer on top of the residual sodium assuming a constant layer chemical composition and no changes in layer density as the layer thickness increases. The rate of reaction is slower than can be achieved using superheated steam or water vapor.

The carbon dioxide process has been used in two variations: dry carbon dioxide; and moist carbon dioxide. The dry process results in a sodium carbonate layer and the moist process a sodium bicarbonate layer. The dry carbon dioxide process produces a hard carbonate layer on the surface of the sodium. This rather impervious layer effectively limits the reaction to only the first few millimeters of the sodium layer. Moist carbon dioxide reacts faster than the dry carbon dioxide and more of the sodium is reacted.

Passivation allows the sodium or at least the surface sodium to be reacted and left in the piping, tanks, and other equipment in a state with a reduced hazard. Complete reaction of all residual sodium has not been shown to be possible with this process and water vapor, superheated steam or some other processing may still be required to complete reaction of the sodium prior to flushing or dismantling of the equipment/components.

2.2.2.3 Evaporation

The removal of sodium from components using heat and vacuum has been studied and used by most operators of sodium systems (HNF-26715). Tests have shown that successful sodium removal could be accomplished at temperatures as low as 260°C (500°F) using a diffusion-pumped system capable of attaining very low pressures [i.e., 0.013 to 0.0013 pascals (10^{-5} to 10^{-6} torr]. Evaporation of sodium from a component also has been demonstrated successfully by heating the component in a flowing stream of inert gas, such as argon, although the time to remove sodium by evaporation in an inert gas may be several orders of magnitude longer than vacuum evaporation at the same temperature.

In the evaporation process, the component or system to be cleaned would be isolated and heated to the desired temperature. The system would then either be evacuated or purged with an inert gas. The sodium would be removed from the system as a vapor and condensed where it would be disposed of by converting it to sodium hydroxide or some other compound. It could also be added to any bulk sodium disposition process.

One of the potential advantages of evaporation is that it may be able to clean large components in-place. Evaporation appears to be capable of more effectively cleaning some items, particularly those having inverted long tube configurations or long narrow crevices. However, although evaporation of sodium has been investigated and used to clean some components by almost all countries developing LMFBR technology, it has not been applied in the deactivation or decommissioning of LMFBR facilities. Therefore, evaporation, while potentially useful in selected instances, is not considered as adaptive as SSP for reacting FFTF sodium residuals.

2.2.2.4 Dissolution of Sodium in Ammonia

Sodium dissolves in liquid anhydrous ammonia, producing a free electron (Equation 4):

$$NH_3 + Na \rightarrow NH_3 + Na^+ + e^- \qquad (4)$$

This is called a solvated electron solution. At atmospheric pressure, anhydrous ammonia boils at -33°C (-28°F). Thus, when 0.03 cubic meters (1 cubic foot) of liquid anhydrous ammonia at 16°C (60°F) expands, the result is approximately 24 cubic meters (850 cubic feet) of gas.

The ammonia process is a two-phase process since both liquid and gaseous ammonia would be present in the equipment while it is being cleaned. Headspace (minimum of 20 percent) is required to accommodate evaporation (or boiling) of the anhydrous ammonia to provide for appropriate liquid expansion. Headspace would be accommodated in any circulating system simply by providing suitable vessels. In the case of FFTF, these vessels would be external to the sodium systems and the interconnecting piping (and selected vessels themselves) would have safety relief valves installed to prevent excessive pressure buildup. Pressure relief valves would be necessary to discharge ammonia at whatever levels are necessary to protect FFTF systems in case of failure of ammonia vapor recovery (refrigeration) systems. The backup would be to manually discharge the ammonia vapor directly into the scrubber system, where it would be removed by reaction with sulfuric acid. The relief valves would be piped to a header, which is subsequently piped to the scrubber. It is expected that the entire system would be monitored 24 hours per day during ammonia recovery operations.

Advantage is taken of the thermodynamics of the ammonia refrigeration cycle wherever possible, and the refrigeration system takes care of vapor pressures and heat loads. The FFTF trace heaters and circulation pumps would be off, with the systems allowed to reach ambient temperature before ammonia introduction. Ammonia would be forced through the equipment being cleaned using the pressure generated when the ammonia vaporizes in a closed system. While the systems being cleaned would never be completely filled with ammonia it is hoped that all system surfaces would be washed by the flushing action of the liquid ammonia as it is forced through the system.

Once sodium has dissolved in anhydrous ammonia, it cannot revert to its metallic form. If an absolutely "pure" solvated solution is evaporated, as the sodium concentration reaches a high level the sodium will finally react with ammonia to form solid sodium amide ($NaNH_2$) and hydrogen gas. Sodium amide will react with water (or water vapor) to produce ammonia and sodium hydroxide, which is corrosive, and would be regulated for disposal as such. No ammonia solution (sodium dissolved in ammonia) would be left in the FFTF systems, recirculation of the solution through a reaction vessel to remove the sodium would be continued until its conductivity reaches zero. At this point there are essentially no remaining reactive sodium molecules in the system.

A primary concern with this process is the release of ammonia vapor. Actions would be taken to alleviate these concerns. For example, during processing, scavenger nozzles could be used to sweep tramp (i.e., residual) ammonia into flex hoses, using cage blowers to evacuate leak areas. The ammonia would be routed to a scrubber for absorption and acid neutralization. Work areas would need to be continuously monitored for ammonia leaks using gas detectors, both permanently mounted and carried by operating technicians. These controls are necessary to comply with DOE's occupational safety and health requirements for permissible exposure to the vapors.

The anhydrous ammonia process was not developed and tested as part of the LMR program and it has not been used to remove sodium from equipment as part of operations or maintenance of a LMR and has not been used for the deactivation of an LMR. The main application of the anhydrous ammonia process has been in the treatment of hazardous (organic) wastes. However, sodium is known to dissolve readily in liquid anhydrous ammonia and since the use of this process has been proposed for the FFTF, it is included in this evaluation. However, as with the evaporation technology addressed in Subsection 2.2.2.3, while potentially useful in selected instances, is not considered as adaptive as SSP for reacting FFTF sodium residuals.

2.2.3 Alternative Locations of Sodium Residual Reaction Station(s)

Alternatives to the proposed locations of the sodium residual reaction stations (i.e., mobile unit, FSF stationary unit, and LDCV in MASF) were considered. For example, additional modifications to MASF would be required to accommodate the small bore piping. The Small Diameter Cleaning Vessel has utility for cleaning external surfaces of equipment, but would have to be modified to accommodate reacting residual sodium on the internals of piping. Additional handling would be required to re-locate the materials to be reacted to MASF, rather than to the adjacent location (FSF).

Offsite treatment/disposal also was considered. Hanford Site alkali metal test loops have been dispositioned using privately operated, *Resource Conservation and Recovery Act* (RCRA) *of 1976* treatment, storage, and/or disposal (TSD) facilities for treatment and/or disposal (*Environmental Assessment: Disposition of Alkali Metal Test Loops, Hanford Site, Richland, Washington*, DOE/EA-0987). However, those activities involved reacting relatively small quantities of nonradioactive materials at available facilities. If a facility were available for offsite treatment of radioactively contaminated sodium residuals, there would be additional expense and potential transportation impacts incurred.

3.0 AFFECTED ENVIRONMENT

Details regarding the Hanford Site can be found in the *Hanford Site Environmental Report for Calendar Year 2004* [Pacific Northwest National Laboratory (PNNL)-15222] and *Hanford Site National Environmental Policy Act (NEPA) Characterization* (PNNL-6415), and *Hanford Site Groundwater Monitoring for Fiscal Year 2004* (PNNL-15070). These documents (all 2005 revisions) are updated annually for the Hanford Site, and are based on current site inventories, modeling data, and related information.

3.1 Land Use

The FFTF, located in the 400 Area of the Hanford Site, is not located within a wetland or a floodplain. The final decommissioning end state of the FFTF (which will be addressed in the TC&WM EIS) would determine ultimate land use. Presently, the *Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS) Record of Decision* (ROD, 64 FR 61615, November 12, 1999), issued after the 1995 EA updated land used considerations and analyses for the FFTF, states that the 400 Area is designated Industrial.

3.2 Meteorology and Climatology

The Hanford Site has a semiarid climate with 15 to 18 centimeters (6 to 7 inches) of annual precipitation, and infrequent periods of high winds of up to 128-kilometers (80-miles) per hour. Tornadoes are extremely rare; no destructive tornadoes have occurred in the region surrounding the Hanford Site. The probability of a tornado hitting any given location on the Hanford Site is estimated at 1 chance in 100,000 during any given year. No notable changes in meteorology and climatology at the Hanford Site have occurred since the 1995 EA was published. Additional details on Hanford Site meteorology and climatology may be found in PNNL-6415.

3.3 Geology and Seismology

The Hanford Site contains all the main geologic characteristics of the Columbia Basin. The Columbia Basin is the area bounded by the Cascade Range to the west, the Rocky Mountains to the northeast, and the Blue Mountains to the southeast. Four major geologic processes occurring over millions of years formed the soil, rocks, and geologic features (ridges and valleys) in the Columbia Basin and therefore the Hanford Site. The region is categorized as one of low to moderate seismicity. Additional details on Hanford Site geology and seismology may be found in PNNL-6415.

3.4 Ecological and Cultural Resources

Ecological and cultural resources are routinely evaluated (and updated annually) for the Hanford Site in general. The latest status and discussion of changes can be found in PNNL-15222 and PNNL-6415. The following Subsections briefly summarize these resource areas as they pertain to the FFTF.

3.4.1 Ecological Resources

General information pertaining to ecological resources on the Hanford Site may be found in PNNL-6415.

The cities of Richland, Pasco, and Kennewick constitute the nearest population centers and are located southeast of the Hanford Site. The 2003 census figures indicate the distribution of the Tri-Cities population by city as follows: Richland 41,650; Pasco 37,580; and Kennewick 57,900.

Threatened and endangered plants and animals identified on the Hanford Site, as listed by the federal government [50 Code of Federal Regulations (CFR) 17] and Washington State (Washington Natural Heritage Program 1997), typically are not found in the vicinity of the FFTF. However, migratory birds (including the house finch, Say's phoebe, barn swallow, violet-green swallow, American robin, and western kingbird) and/or their nests have been observed in the 400 Area. Two species of birds (Aleutian Canada goose and bald eagle) on the federal list of threatened and endangered species have been observed on the Hanford Site but are not present at the FFTF.

The Columbia River and other water bodies on the Hanford Site provide valuable habitat for aquatic organisms. The Hanford Reach represents the only remaining significant mainstream Columbia River spawning habitat for stocks of upriver bright fall chinook salmon and white sturgeon. The Upper Columbia River spring run chinook salmon, Middle Columbia River steelhead, and Upper Columbia River steelhead have been placed under the protection of the *Endangered Species Act of 1973*. These fish spawn in or migrate through the Hanford Reach. No species of aquatic organisms are present at FFTF.

As discussed in PNNL-6415, natural plant communities have been altered by Euro-American activities that have resulted in the proliferation of nonnative species. Of the 590 species of vascular plants recorded for the Hanford Site, approximately 20% of all species are considered nonnative. The biodiversity inventories conducted by The Nature Conservancy of Washington have identified 85 additional taxa[3], establishing the actual number of plant taxa on the Hanford Site at 675. Cheatgrass is the dominant nonnative species at FFTF. No species of the natural plant communities are found at FFTF.

3.4.2 Archeological Resources

General information regarding the cultural resources on the Hanford Site can be found in PNNL-6415. A number of site-specific biological and cultural resource reviews for FFTF have been conducted. Most of the buildings and structures in the 400 Area were constructed during the Cold War era. Six buildings/structures were determined eligible for the National Register of Historic Places as contributing properties within the Historic District recommended for mitigation. These include the 405 Reactor Containment Building, 436 Training Facility, 4621-W Auxiliary Equipment Facility, 4703 FFTF Control Building, 4710 Operations Support Building, and the 4790 Patrol Headquarters.

3.4.3 Hydrology/Water Quality

A discussion of the Hanford Site hydrology and water quality may be found in PNNL-6415. Surface water at Hanford includes the Columbia River, springs, and ponds. Intermittent surface streams, such as Cold Creek, may also contain water after large precipitation or snowmelt events. In addition, the Yakima River flows along a short section of the southern boundary of the Hanford Site, and there is surface water associated with irrigation east and north of the Site. The water quality of the Columbia River from Grand Coulee Dam to the Washington-Oregon border, which includes the Hanford Reach, has been designated as Class A, Excellent, by Washington State.

Groundwater originates as surface water, either from natural recharge, such as rain, streams, and lakes, or from artificial recharge, such as reservoirs, excess irrigation, canal seepage, deliberate augmentation,

[3] Orderly classifications of plants and animals according to their presumed natural relationships.

industrial processing and wastewater disposal. Groundwater beneath the Hanford Site is found in an upper unconfined aquifer system and deeper basalt-confined aquifers. Groundwater in the unconfined aquifer at Hanford generally flows from recharge areas in the elevated region near the western boundary of the Hanford Site, and toward the Columbia River on the eastern and northern boundaries. Natural area recharge from precipitation across the entire Hanford Site ranges from about 0 to 10 centimeters (0 to 4 inches) per year. Groundwater beneath large areas of the Hanford Site has been impacted by radiological and chemical contaminants resulting from past Hanford Site operations. Groundwater contamination is monitored. At the Hanford Site, radiological constituents, including carbon-14, cesium-137, iodine-129, strontium-90, technetium-99, total alpha, total beta, tritium, uranium, and plutonium-239/240 have been detected at concentrations greater than the maximum contaminant level in one or more onsite wells within the unconfined aquifer. Certain non-radioactive chemicals have been detected as well: carbon tetrachloride, chloroform, chromium, cyanide, cis-1,1 dichloroethene, fluoride, nitrate, sulfate, and trichloroethene.

The groundwater in the 400 Area is influenced by artificial recharge associated with the North Richland recharge basins and nearby irrigated farming. The southern portion of the tritium plume from the 200 East Area extends under the 400 Area. Nitrate contamination is also found; this is the result of industrial and agricultural sources off the Hanford Site. The nitrate plume is migrating eastward and entering the Columbia River.

3.4.4 Noise/Aesthetics

A discussion of Hanford Site noise levels and aesthetics may be found in PNNL-6415. Noise is technically defined as sound waves that are unwanted and perceived as a nuisance by humans. Sound waves are characterized by frequency, measured in Hertz, and sound pressure expressed as decibels. Most humans have a perceptible hearing range of 31 to 20,000 Hertz. A decibel is a standard unit of sound pressure. The threshold of audibility for most humans ranges from about 60 decibels at a frequency of 31 Hertz to less than about 1 decibel between 900 and 8,000 Hertz. For regulatory purposes, noise levels for perceptible frequencies are weighted to provide a weighted sound level (dBA) that correlates highly with individual community response to noise. Environmental noise measurements were made on the Hanford Site in 1981 and in 1987. Site characterization activities ranged from about 30 dBA to 60 dBA. Wind was identified as the primary contributor to background noise levels. Noise levels as a result of field activities, such as well drilling and sampling were measured. Baseline offsite noise measurements attributable to automobile traffic also were determined; baseline noise levels for operational and construction workforces were around 70 dBA.

Aesthetics pertaining to the Hanford Site also are discussed in PNNL-6415. With the exception of Rattlesnake Mountain, the land near the Hanford Site is generally flat with little relief. Rattlesnake Mountain, rising to 1060 m (3477 ft) above mean sea level forms the western boundary of the Hanford Site, and Gable Mountain and Gable Butte are the highest landforms within the Site. The White Bluffs, steep whitish-brown bluffs adjacent to the Columbia River and above the northern boundary of the river in this region, are a major feature of the landscape.

A main feature of the 400 Area is the FFTF. The central structure of FFTF is the reactor containment building, an all-welded cylindrical steel structure 41 meters (135 feet) in diameter and 57 meters (187 feet) high. There is an array of buildings and equipment that surround the containment building and comprise the FFTF complex. Within the FFTF fenced area there are 44 structures or buildings. Specific details of the FFTF Complex are discussed in HNF-18346.

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4.0 ENVIRONMENTAL IMPACTS

The following presents information on those potential environmental impacts that may result from the proposed action and alternatives for the changed approach to the continued deactivation of FFTF. There are uncertainties and risks associated with even the most routine operations.

4.1 Impacts from Siting and Construction

The potential impacts from siting and construction activities would be similar to those associated with routine industrial activities. The areas associated with sodium residual cleaning stations are within the FFTF property protected area (PPA), which is a highly disturbed area. It would be expected that siting activities would be consistent with appropriate land use designations from the ROD for the HCP EIS (64 FR 61615).

Specific ecological resource review(s) would be conducted, as appropriate, before any construction activities. Certain restrictions may be applied as a result of these surveys; e.g., limitations of construction activities during migratory bird nesting seasons and bald eagle winter roosting seasons. If cultural or paleontologic (i.e., fossils) resources were to be encountered during construction, all work would stop immediately and the Hanford Cultural Resource Center would be notified. Construction and operational activities would be consistent with the *Hanford Site Biological Resources Management Plan* (DOE/RL-96-32) and the *Hanford Site Biological Resources Mitigation Strategy* (DOE/RL-98-10).

No harmful radiological or toxicological exposure to personnel or the general public is expected to occur as a result of routine construction operations. The materials would be handled in a manner consistent with commercial industrial construction activities. Hanford Site personnel handle these types of materials daily. Routine methods (e.g., use of appropriate personnel protective clothing), specific training, and equipment safeguards are in place, and are adequate to ensure the safe recovery and handling of this material.

Temporary particulate emissions likely would result from using heavy equipment for excavation or materials transport. Specific emissions estimates and modeling were not performed because particulate matter emissions would be controlled by using appropriate wetting procedures and surfactants, resulting in compliance with federal and state air quality standards.

4.2 Impacts from Routine Operations

Environmental consequences from routine operations have been considered and are discussed in the following Subsections.

4.2.1 Radiological Exposure

The potential for release of radioactive emissions during routine activities exists. Additional radioactive airborne emissions from the cleaning stations are expected to be limited to tritium when cleaning piping and components from the secondary cooling system (some fission products could be available when cleaning piping and components from the primary sodium cooling system). The emissions would be in compliance with applicable DOE and other Federal and State guidelines and regulations.

The cleaning stations would be used to convert metallic sodium to aqueous sodium hydroxide. A facility could be designed to process about 100 kilograms (220 pounds) of sodium per batch. The hydrogen produced by the process would be swept out of the reaction vessel using approximately 730 kilograms

(1,600 pounds) of nitrogen per hour. At this processing rate, theoretically, the maximum tritium concentration in the effluent would be about 2.1 E-05 microcuries per milliliter. At the point of public access, the DOE guideline for public exposure to tritium would not be exceeded. This maximum discharge value would result in an onsite dose rate (i.e., non-involved worker at approximately 100 meters or 300 yards) of approximately 0.16 millirem (1.6 microSv) per year, substantially less than the DOE onsite limit of 5 rem (0.05Sv) per year. The calculated dose rate at the site boundary to the maximally exposed individual (MEI) from airborne emissions, 2.6 E-04 millirem (2.6 E-03 microSv) per year, would be less than the DOE limit of 10 millirem (0.1 milliSv) per year for members of the public due to airborne emissions. These calculated release values are considered conservative because the calculations assume all the tritium would be released to the atmosphere. In reality, the radiological inventory in the airborne discharge concentration would be less since much of the tritium would remain in the sodium hydroxide solution as tritiated water.

There would be some radiological exposure for the workers involved in the proposed activities. Personnel exposure to radiation from removal of sodium piping and components was considered. It is estimated that a total of approximately 288 person-rem exposure to radiation workers could be expected from the removal of small-diameter piping (FFTF-18346). This value is conservatively doubled to account for exposure during removal of large components and 'special components' ('special components' were discussed in Subsection 2.1.6). Thus, a total worker dose of 576 person-rem (5.8 person-Sv) is assumed from the proposed activity. Based on the current dose-to-risk conversion factor of 6 E-04 latent cancer fatalities (LCF) per person-rem (DOE 2002), 0.35 LCFs would be expected for the involved worker population.

Essentially no public exposure above that currently experienced from Hanford Site operations is anticipated as a result of these actions. That is, the potential dose to the hypothetical offsite MEI during Calendar Year (CY) 2004 from Hanford Site operations was 0.014 millirem (0.14 microSv) (PNNL-15222). The potential dose to the local population of 486,000 persons from 2004 operations was 0.32 person-rem (0.0032 person-Sv). The 2004 average dose to the population was 0.0007 millirem (0.007 microSv) per person. The current DOE radiation limit for an individual member of the public is 100 millirem (1 milliSv) per year, and the national average dose from natural sources is 300 millirem (3 milliSv) per year. No adverse health effects from routine operations would be expected to result from these low doses. Further, it is anticipated that routine operations would not provide additional exposure of toxic or noxious vapors to workers or members of the general public.

4.2.2 Waste Management

Essentially no environmental impacts from the transportation of liquid wastes would be anticipated as a result of the proposed action. The routine transport of low-level liquid wastes from the 400 Area to the 200 Areas would be similar to waste water transports that occur throughout the Hanford Site. From January 2000 to August 2005, approximately 470 shipments of liquid waste from various locations on the Hanford Site to the 200 Area liquid effluents waste management facility were conducted, transporting approximately 8,800,000 liters (2,300,000 gallons).

Environmental impacts from the treatment/disposal of the estimated 3,780,000 liters (1,000,000 gallons) of waste water (refer to Subsection 2.1.8.2) would be expected. The waste water would be disposed of at LERF/ETF in the 200 Areas (there would be no waste water discharged to the environment in the 400 Area). The waste stream meeting LERF/ETF waste acceptance criteria would be a sodium hydroxide solution with small amounts of tritium. This waste stream would be treated and disposed of in a similar fashion as typical day-to-day operations at the existing LERF/ETF. The ETF routinely is used to remove toxic metals, radionuclides, and ammonia, and destroy organic compounds. The treated effluent is stored in tanks, sampled and analyzed, and discharged to the SALDS (refer to Figure 1). Treatment capacity of the facility is a maximum of approximately 570 liters (150 gallons) per minute. Approximately 107,000,000 liters (28,250,000 gallons) of liquid waste were treated in Calendar Year 2004 (PNNL-15222). For perspective, as discussed in Subsection 2.1.8, the maximum estimated volume of aqueous liquid waste to be transported from FFTF to ETF for the proposed action would be less than 473,000 liters (125,000 gallons) per year. No modifications to the existing LERF/ETF would be required to support the proposed action.

Radioactive material, radioactively contaminated equipment, and radioactive mixed wastes would be appropriately packaged, stored, and disposed of at existing facilities on the Hanford Site. None of the materials would be anticipated to be generated in substantial quantities when compared to the annual amount routinely generated throughout the Hanford Site. For example, as reported in DOE/EIS-0286F, the Hanford Site low-level waste forecast for onsite life-cycle waste for the years 2002 through 2046 was 106,681 cubic meters (3,800,000 cubic feet). This is compared with the projection (refer to Subsection 2.1.8) of approximately 4,500 cubic meters (157,000 cubic feet) of cleaned piping and components associated with the proposed action. For perspective, the existing capacity for disposal of solid wastes at the Hanford Site in lined trenches is approximately 22,330 cubic meters (788,000 cubic feet); approximately 5,000 cubic meters (177,000 cubic feet) of this existing capacity have been used through September 2005. Current available disposal capacity at ERDF is much greater than the lined trenches; approximately 993,000 cubic meters (1,300,000 cubic feet).

Hazardous materials (e.g., asbestos) which may be removed or stabilized would be managed and reused, recycled, stored, or disposed of in accordance with applicable federal and state regulations. Confirmatory analyses, as appropriate, on insulation would verify the relatively small amount [76 cubic meters (100 cubic yards)] of asbestos (refer to Subsection 2.1.8).

4.2.3 Other Impacts

Noise levels would be comparable to existing conditions in the 400 Area (refer to Subsection 3.4.4). The amount of equipment and materials to be used, such as materials (e.g., steel, plastic) for sodium washing stations and fossil fuels for vehicles, represent a minor long-term commitment of nonrenewable resources. It would be expected that annual electrical usage requirements would be less than 110,000 megawatts [Note: during historical FFTF operations the average annual electrical usage was approximately 110,000 megawatts; during FFTF standby the annual average electrical usage was about 55,000 megawatts.] The estimated nitrogen volume for sodium residuals reaction is approximately 8,000,000 cubic meters (300,000,000 cubic feet).

The proposed action is not expected to impact the flora and fauna, air quality, geology, hydrology and/or water quality, land use, or the population. Minor modifications to the existing 400 Area for access and lay down areas would be conducted in previously disturbed areas.

No impacts to archeological properties are expected occur as a result of the proposed action. A cultural resource review was completed for the FFTF Complex (FFTF-18346, Attachment 7). The State Historic Preservation Officer (SHPO) has concurred with the finding that this project would have an adverse effect to five historic buildings identified for individual documentation and mitigation (Griffith 2003), but these affects have been mitigated by the completion of walkthroughs and assessments of these buildings. Artifacts were identified that may have interpretive or educational value and these items have been tagged. SHPO also concurred that this project will have no effect to archaeological properties (Griffith 2003).

Present staff at FFTF would be used to the extent practicable for the continued deactivation activities, including the disposition of the sodium residuals. Current skills mix would be evaluated, and personnel changes may be required to support some specific activities associated with the sodium residuals removal due to the hazards involved and the special expertise required. Personnel changes required to complete sodium residual work would be expected to be small (plus or minus 20 people). Regardless, the FFTF staffing would remain less than one percent of the current workforce at Hanford (approximately 11,000 Hanford Site workers, including DOE and contractor staff). This small incremental manpower change would not be expected to result in noticeable social or economic impacts to the local community.

4.3 Impacts from Accidents

The specific accident scenarios discussed below are drawn from in the 1995 EA because DOE believes they continue to provide the bounding consequences for the proposed deactivation activities. That is, the 1995 EA analyzed the consequences of events involving 984,000 liters (260,000 gallons) of bulk, molten sodium (as well as reactor fuel). This EA addresses the residual volume of sodium remaining after the bulk sodium was drained and transferred to the SSF. The sodium residuals [approximately 15,000 liters (4,000 gallons) remaining in the main portions of FFTF's piping and equipment plus indeterminate quantities remaining in other portions of the plant systems, especially in complex, small-diameter piping systems] represent a small fraction (less than 2 volume percent) of the bulk sodium inventory evaluated in the 1995 EA.

Environmental impacts associated with sodium residuals on the Hanford Site also were addressed in the aforementioned DOE/EA-0987 (*Environmental Assessment: Disposition of Alkali Metal Test Loops, Hanford Site, Richland, Washington*, refer to Section 2.9.3) Therein, postulated accidents during disposition of alkali metal test loops were evaluated. Since the test loops contained relatively (to FFTF) small quantities of nonradiological material only, the environmental effects of accidents related to disposition of the test loops were limited to those associated with routine industrial activity and accidents associated with sodium metal (e.g., sodium spills, fire). All accident scenarios in DOE/EA-0987 are bounded by those presented in the 1995 EA; specific events addressed in DOE/EA-0987 are not addressed further.

Scenarios related to sodium drain/reaction were presented in the 1995 EA. These events, involving large quantities of sodium and some radiation, included both high consequence/low probability, and low consequence/high probability scenarios for the onsite (100 meters, 0.062 miles) worker and the MEI offsite (i.e., approximately 7 kilometers or 4.3 miles). For the following accident scenarios, the daytime population of the 400 Area was estimated to be no greater than 1,000 people, including visitors[4]. The maximum offsite population sector for analysis is assumed to be toward the south-southeast (population approximately 80,000).

The risk to the directly involved worker (i.e., an individual in the immediate vicinity of an event) is highly dependent upon the worker's specific location, meteorological conditions, and nature of the accident. All of the aforementioned circumstances could either increase or minimize the severity of the consequences. Further, although the consequences of the most serious postulated event (a sodium fire as discussed in Subsection 4.3.5) could be severe, the probability of such an occurrence is extremely low, and therefore the risk is considered to be small.

Also, the handling of materials such as alkali metals is similar to routine activities that have been conducted at FFTF, and the current workforce is experienced with handling the hazards and initiators that would be associated with potential events for the proposed actions. Workers wear required protective clothing and follow administrative controls in accordance with a radiation work permit and hazardous

[4] This estimate of 1,000 persons is drawn from the 1995 EA; current (2006) 400 Area population is less than 400 persons. Therefore, this scenario is considered bounding.

materials permit. The DOE's reviews of appropriate procedures, work plans, and related information, would help reduce the potential for future unanticipated events and minimize the potential impacts.

4.3.1 Reasonably Foreseeable Accident Scenarios During Residual Sodium Removal/Reaction

Reasonably foreseeable accident scenarios, associated with residual sodium removal and/or reaction, are identified in the 1995 EA, and are discussed in the following subsections.

4.3.1.1 FFTF Sodium Drain and Storage Supporting Shutdown

In a reasonably foreseeable accident scenario (probability greater than 1 E-02), approximately 9 kilograms (20 pounds) of radioactive sodium leaks from a mechanical joint during a transfer from the primary heat transport system to the sodium storage facility located adjacent to FFTF. The sodium is at low temperature (300 to 400°F) and at low pressure (25 pounds per square inch). Under these conditions, the sodium is assumed to burn. However, if a small fire were to occur, trained onsite personnel and emergency response equipment are available for immediate intervention to minimize potential environmental consequences both onsite and to the general public.

Conservatively, assuming the release fraction for a fire to be bounding in this case, the estimated onsite and offsite dose consequences were 5.3 E-02 rem (5.3 E-04 Sv) and 8.8 E-03 rem (8.8 E-05 Sv), respectively. These equate to calculated onsite (assuming 200 affected personnel) and offsite (assuming 80,000 persons) population LCFs of approximately 6.4 E-03 and 0.42, respectively (using 6 E-04 LCF per person-rem conversion factor). The corresponding toxicological releases would be small.

This accident is considered to be bounding because of the relatively small volume of residual sodium that would be available for a leak. Re-energizing heat trace systems to melt residual sodium would result in isolated, smaller volumes of molten sodium. Additionally, there would be no pressure transfer of molten sodium, thus minimizing releases.

4.3.1.2 Postulated Accidents During Sodium Reaction

The release of sodium hydroxide solution, hydrogen fire, and a tritium release are all possible accident scenarios applicable to the reaction of sodium residuals, and the consequences of these scenarios presented in the 1995 EA are still considered to be bounding for the activities proposed in this EA. Two reasonably foreseeable accidents in the Sodium Reaction Facility (SRF) were identified. These events could occur, on a smaller scale, during proposed in-place cleaning or during operations at a cleaning station.

One postulated accident is a potential sodium hydroxide spill. A maximum discharge of radioactively contaminated, 50-percent aqueous sodium hydroxide would be approximately 3,780 liters (1,000 gallons) from a storage tank. This material would not burn and would be contained in catch pans within the facility. All radionuclides except tritium would be retained in the sodium hydroxide solution and would not be discharged to the environment. Any small amount of tritium that would be released would be much less than that discharged during plant operation.

A second postulated accident is accumulation of hydrogen in the process equipment during reaction activities, such that flammable concentrations resulted in a brief hydrogen fire. Hydrogen gas is released during the reaction of sodium metal and water. The hydrogen typically would be vented from the process along with the nitrogen purge used to maintain mixing in the reaction vessel. For safety, the percentage of hydrogen is maintained below that which can burn in air (i.e., 4 percent by volume). Should the nitrogen gas supply fail, the reaction process would be automatically stopped. The fire itself is not expected to result in any environmental impacts; the loss of nitrogen flow might allow the measured concentration of tritium being exhausted to temporarily increase (i.e., amount of tritium per unit volume of sample). The annual average allowable limit for release of tritium (1.0 E-07 microcuries per milliliter per year) would not be exceeded.

It was conservatively assumed that all the tritium (1.2 E-02 curies) contained in 105 kilograms (230 pounds) of sodium (that amount of sodium processed in an hour) is released as a result of the postulated hydrogen fire. If the 1.2 E-02 curies of tritium were released into, and mixed with, the air in the building (2.1 E+09 milliliters or 74,000 cubic feet), the tritium concentration would be 5.7 E-06 microcuries per milliliter. This was compared with the allowable worker limits (derived air concentrations) for tritium of 2 E-05 microcuries per milliliter. A facility worker would receive a dose of 0.7 millirem from a 1-hour exposure. If the entire 1.2 E-02 curies were released from the facility, the maximum dose to an onsite worker (assumed to be located 100 meters [300 feet] from the facility) would be less than 1.1 E-05 rem (1.1 E -07 Sv). Assuming an onsite population of 1,000 people, and that each received the maximum dose, the collective onsite population dose would be 1.1 E-02 person-rem (1.1 E-04 person-Sv). This equates to 4.4 E-06 LCFs for the onsite worker population. Release of the 1.2 E-02 curies would result in a dose of 1.2 E-08 rem (1.2 E-10 Sv) to the maximum offsite individual. Assuming a maximum offsite population of 80,000 people, the collective dose to the offsite population would be 9.6 E-04 person-rem (9.6 E-06 person-Sv). This equates to 4.8 E-07 LCFs. Such a brief release would provide minimal risk to workers and the general public.

It is recognized that approximately one-half of the tritium has decayed away (tritium half-life is 12.3 years), the work force at FFTF is approximately one-half of that identified in the 1995 EA, and realignment of public access structures at FFTF has reduced the probability of a general daytime population of 1,000 persons. Therefore, in both scenarios, the low probability and minimal effects associated with the postulated events remain bounding, and make the risks small.

4.3.1.3 Reasonably Foreseeable Nonradiological Accident Scenario(s)

The environmental effects of accidents related to nonradiological materials are represented by those associated with most routine industrial activity. Personnel injuries, such as back strains or minor abrasions, would receive appropriate medical treatment. Implementation of the DOE Integrated Safety Management System, including work planning, administrative controls, proper training and specification of detailed procedures used in handling the materials would be in place, all of which would minimize the potential of effects from such accidents.

An example of the environmental effects of accidents related to nonradiological materials would be a postulated spill of ethylene glycol (i.e., antifreeze) in the FFTF itself. As with typical industrial activities, ethylene glycol is used routinely in chilled water systems. The existing FFTF chilled water system was designed to preclude such a spill. Impervious sumps or alternative control measures are used to ensure containment of the ethylene glycol should a pump seal fail or a pipe leak occur. Any spill would be isolated, and trained personnel would take the necessary steps to contain the spill and effect cleanup. Proper training and specification of detailed procedures used in handling the materials are in place, which also would minimize any effects of such an accident.

Additionally, many isolated areas of oxygen-deficient atmospheres not only routinely exist, but could appear with leakage of cover gas into confined areas. The potential for accidents associated with such an environment are minimized by proper monitoring equipment and alarms. Also, personnel training and appropriate administrative controls (e.g., placards, barricades) further enhance personnel safety.

4.3.2 Maximum Reasonably Foreseeable Accident

The Maximum Reasonably Foreseeable Accident is postulated to be a large leak (due to growth of a metal defect in a storage tank) in the sodium storage facility. The tank is initially filled with approximately 265,000 liters (70,000 gallons) of molten sodium at about 177°C (350°F) with a static head of approximately 6 meters (20 feet). The entire inventory of the tank is assumed to discharge onto the steel floor of the secondary containment (an area of approximately 770 square meters (8,200 square feet) and to burn, releasing a sodium hydroxide aerosol plume. Although hydrogen generation would occur in the scenario, the environmental impacts of an ignition or explosion would be expected to be bounded by a continuous burn of the sodium. Finally, even though the facility structure is assumed to remain intact, the sodium hydroxide aerosol release fraction is assumed to be 35 percent.

This scenario is extremely conservative. The calculated frequency of tank leaks is approximately 1 E-05 per year, based primarily on commercial light water reactor data. However, this is for small leaks initiated by growth of manufacturing defects; the frequency of large leaks would be much lower. Furthermore, this leakage frequency is conservatively based on applications which typically experience much more severe duty (i.e., higher pressures and temperatures, and substantial thermal transient usage). In a more realistic accident scenario, the sodium would leak from a small crack at a relatively slow rate, and the covered sump system would self-extinguish the burning sodium. No credit was taken in the analysis for this safety feature. The scenario described was selected to bound the consequences of a sodium spill and fire, even though the scenario is considered to be extremely low probability of occurrence (less than 1 E-06). Simultaneous failure of more than one tank was considered too remote and not within the range of credible accidents, and was not analyzed.

For this scenario, it is assumed that the onsite receptor is exposed to only the first 10 minutes of the plume. This is based on the obvious nature of the plume, which is a visible, very irritating, white cloud. The calculated onsite dose consequence is 2.5 E-04 rem (2.5 E-06 Sv). The offsite receptor is assumed to be exposed for the duration of the fire. The additional exposure time results in a calculated offsite dose consequence of 3.9 E-04 rem (3.9 E-06 Sv).

The daytime population of the 400 Area was estimated to be no greater than 1,000 people, including visitors. Only a fraction of the population would be exposed as a result of this postulated event. Even so, using 1,000 people as the exposed onsite population, no more than approximately 1 E-04 LCFs (i.e., essentially zero) would occur. However, the daytime population of the 400 Area is substantially less today than in 1995 (e.g., a visitor's center has been removed, and the estimate of 1,000 persons in 1995 is less than 400 in 2006). The maximum offsite population dose would be approximately 31 person-rem, equating to 1.6 x E-02 LCFs. Therefore, no latent fatalities due to radiation from this accident would be expected.

Of greater potential impact are the toxicological consequences of the sodium hydroxide plume from the postulated fire associated with the maximum reasonably foreseeable accident. The calculated onsite [100 meters (330 feet)] sodium hydroxide concentration is approximately 166 milligrams per cubic meter. The sodium hydroxide concentration at the site boundary [approximately 7 kilometers (5 miles)] was calculated to be approximately 0.05 milligrams per cubic meter.

The resultant calculated toxicological consequences are identified as Hanford-specific Emergency Response Planning Guidelines (ERPG, refer to the 1995 EA) for sodium hydroxide. These guidelines, which are based on lesser consequences being acceptable for higher frequency events, provide the basis for evaluating potential risk to onsite workers and the offsite population.

Emergency Response Planning Guidelines 1 (ERPG-1) is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects (e.g., headaches, dizziness, nausea) or perceiving a clearly defined objectionable odor. Similarly, ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action. Finally, ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Typically, calculated onsite consequences are limited to a range from ERPG-2 to ERPG-3, dependent upon event frequency (1 per year and 1 E-06 per year, respectively). The criteria for sodium hydroxide are 40 milligrams per cubic meter (ERPG-2), and 100 milligrams per cubic meter (ERPG-3). The calculated onsite consequences of 166 milligrams per cubic meter would fall above the ERPG-2 to ERPG-3 range. However, experienced personnel working near sodium facilities would be well aware of the potential hazards and response procedures, and would evacuate and remain clear of any white plume of smoke coming from a sodium facility. Based on the extremely low probability of occurrence, even if the consequences of such an event are as severe as calculated for the onsite worker, the extremely low probability of occurrence and administrative training and controls make the risks of a sodium fire from the proposed action small.

Similarly, the offsite consequences are limited from ERPG-1 (corresponding to an event frequency of 1 per year) to ERPG-2 (corresponding to an event frequency of 1 E-06 per year). These guidelines correspond to 2 milligrams of sodium hydroxide per cubic meter and 40 milligrams of sodium hydroxide per cubic meter, respectively. The calculated offsite toxicological consequences of approximately 0.05 milligrams sodium hydroxide per cubic meter fall well below the applicable guidelines. The aforementioned training, procedures, and controls, coupled with local municipal emergency preparedness (e.g., telecommunications, law enforcement response) would minimize risks to the public.

The projected effects from the maximum reasonably foreseeable accident are considered bounding for the proposed sodium residuals removal activities evaluated in this EA. While large quantities of sodium currently are being stored in the sodium storage facility, the sodium is not in molten form, thereby minimizing the probability of release. Heating pockets of residual sodium for removal and reaction, with subsequent failure of containment, could result in a release of no more than approximately 3,780 liters (1,000 gallons). This is substantially less than the 265,000 liters (70,000 gallons) of molten sodium analyzed in the 1995 EA.

4.3.3 Transportation

Transportation accidents during transport of liquid and solid wastes associated with disposition of sodium residuals have been considered.

4.3.3.1 Liquid Wastes

Transport of liquid waste from FFTF [the estimated 3,789,000 liters (1,000,000 gallons) of sodium hydroxide solution] to LERF would involve an estimated approximately 48 kilometers (30 miles) round-trip. As noted in Subsection 4.2.2, it is expected that there would be less than 473,000 liters (125,000 gallons) transported to LERF per year (2 shipments per month). For perspective, from January 2000 to August 2005, approximately 470 shipments of liquid waste from various locations on the Hanford Site to the 200 Area liquid effluents waste management facility were conducted, transporting approximately 8,800,000 liters (2,300,000 gallons). During that time, no vehicular accidents were reported. Three small spills occurred, resulting in less than approximately 200 liters (50 gallons) of slightly-contaminated liquid waste to be discharged to the environment. No measurable exposure to workers or the public resulted from these spills. No unique circumstances associated with the proposed transfer of waste water from FFTF to the 200 Areas have been identified.

4.3.3.2 Solid Wastes

The potential consequences of transport of solid wastes (predominantly low-level waste piping and components) to the 200 Areas would be expected to be bounded by those associated with liquid wastes. The residual contamination associated with the rinsed piping and components is in a less dispersible form than the liquid sodium hydroxide solution, and therefore would be less likely to present an adverse impact to workers or the public. Further, transportation of Hanford Site solid wastes has a proven safety record. Overall, ERDF transportation has driven over 8.9 million kilometers (5.5 million miles) without an at fault accident, while transporting over 3 million tons of waste since inception.

4.4 Potential Impacts of Alternatives to the Proposed Action

Potential environmental impacts from the No-Action Alternative and other alternatives identified in Section 2.2 are addressed as follows.

4.4.1 No-Action Alternative

As stated earlier, the potential impacts associated with deactivation of the FFTF were addressed in the 1995 EA. It is anticipated that the No-Action Alternative for this EA would present no greater environmental impacts than those evaluated as the proposed action alternative in the 1995 EA. In fact, the potential impacts presented in the 1995 EA would be reduced; fuel has been removed from the 400 Area, the bulk of the sodium has been transferred to storage in a solid form, there has been a 10-year decay in the radioisotope inventory, and the population in and outside of the FFTF PPA has been reduced (as discussed in Subsection 4.3.5, a daytime population in 1995 was assumed to be 1,000 persons; today that population is less than 400).

4.4.2 Alternative Process Technologies

The potential environmental impacts from the alternative process technologies (refer to SubSection 2.2.2) for removal/reaction of FFTF sodium residuals have been considered. In general, it would be expected that overall, impacts would be very similar for each technology (i.e., similar energy requirements, same radiological dose consequences, same volume of solid waste generated) as with SSP. There would be some difference in liquid waste generated, depending on the technology (refer to Table 2). Specific technologies could require materials not used in other technologies [e.g., an estimated 980 cubic meters (35,000 cubic feet) of carbon dioxide gas would be required for the moist carbon dioxide process].

Table 2. Summary of Liquid/Solid Wastes for Reaction Technologies.

Technology	Total Liquid Waste (liters/gallons)	Total Solid Waste (cubic meters/cubic feet)
Superheated Steam	3,780,000/1,000,000 sodium hydroxide	4,500/162,000
Water Vapor	3,780,000/1,000,000 sodium hydroxide	4,500/162,000
Moist Carbon Dioxide	3,780,000/1,000,000 sodium hydroxide, carbonate/bicarbonate	4,500/162,000
Evaporation	1,134,000/300,000 sodium hydroxide	4,500/162,000
Ammonia*	<3,780,000/1,000,000 sodium hydroxide	4,500/162,000

*Insufficient information for production scale operation. Assume process could be applied on individual pieces of equipment with limited volume mixed and included with the aqueous sodium hydroxide waste stream.

4.4.3 Alternative Locations

The potential environmental impacts from alternative locations for residual sodium reaction stations briefly were addressed in Subsection 2.2.3. As noted, alternative onsite locations would require additional handling of radiologically- and sodium-contaminated piping and components. Offsite treatment could result in increased handling (for packaging) and transportation impacts, as well as additional expense.

4.5 Socioeconomic Impacts and Environmental Justice

The proposed action would not result in substantial socioeconomic impacts. It would be expected that the existing FFTF workforce of approximately 200 people would provide the bulk of necessary personnel to support the proposed activities. There would be no discernible impact to employment levels within Benton and Franklin counties.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs and activities on minority and low-income populations. Based on the analyses in this EA, it is not expected that there would be any disproportionately high and adverse impacts to any minority or low-income populations.

4.6 Cumulative Impacts

The proposed actions would contribute minimal risks in addition to those associated with routine Hanford Site operations. The proposed actions also would reduce the potential for, and consequences of, inadvertent releases of radioactive and hazardous materials from FFTF. The proposed actions would result in a long-term decrease in radiation exposure, due to removal of residual sodium and the attendant radioactivity.

The proposed action would involve existing operations personnel to the extent practicable; therefore, no substantial change in the Hanford Site workforce would be expected. There would be no adverse socioeconomic impacts or any disproportionately high and adverse impacts to any minority or low-income population of the community.

The proposed action would result in radioactive air emissions consisting predominantly of tritium. As discussed in Subsection 4.2.1, minimal public exposure to radiation above that currently experienced from routine Hanford Site operations would be anticipated as a result of these proposed actions. Specifically, as discussed in Subsection 4.2.1of this EA, the calculated exposure to the maximally exposed member of the public due to the proposed action is approximately 2.6 E-04 millirem (2.6 E-03 microSv) per year. As reported in PNNL-15222, the potential dose to the maximally exposed individual during calendar year 2004 from Hanford Site operations was 0.014 millirem (0.14 microSv). Collectively, the potential dose to the local population of 486,000 persons [within 80-kilometer (50-mile) radius of center of Hanford Site] from 2004 operations was 0.32 person-rem (0.0032 person-Sv). These doses are well below the current DOE radiation limit for an individual member of the public of 100 millirem (1 milliSv) per year, and the national average dose from natural sources of 300 millirem (3 milliSv) per year (PNNL-15222). The low doses associated with the radioactive inventory within the scope of this EA would not result in substantial offsite public exposure. No adverse health effects to the public would be expected.

The proposed action would result in minimal nonradioactive air emissions. The Hanford Site and surrounding areas are in attainment with ambient air quality standards. Particulate concentrations can reach relatively high levels in eastern Washington State because of exceptional natural events (i.e., dust storms, volcanic eruptions, and large brushfires) that occur in the region. Washington State ambient air quality standards have not considered 'rural fugitive dust' from exceptional natural events when estimating the maximum background concentrations of particulates in the area east of the Cascade Mountain crest. The potential low concentrations of particulate emissions from FFTF activities would not be expected to contribute substantially to recent releases. The Washington State Department of Ecology in 1998 conducted offsite monitoring near the Hanford Site for particulate matter. Particulate matter was monitored at one location in Benton County, at the Tri-Tech Vocational Center, near the Hanford Site network's Vista Field meteorological monitoring site in Kennewick. During 1998, the 24-hour and annual particulate matter standards established by Washington State were not exceeded. The highest and second highest 24-hour particulate matter concentrations recorded in 1998 were 123 micrograms per cubic meter and 90 micrograms per cubic meter respectively. The arithmetic mean for 1998 was 18 micrograms per cubic meter (most recent data as provided in PNNL-6415).

No long-term groundwater impacts are anticipated. No long-term radionuclides would be present in waste waters generated from FFTF deactivation activities. The proposed action would result in liquid wastes that would be treated and disposed of in the SALDS under a WAC 173-216 Discharge Permit. Releases would be in accord with limits addressed in 40 CFR 191, *Environmental Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Radioactive Wastes* (Subpart C, "Environmental Standards for Groundwater Protection").

Minimal impacts are anticipated from disposition of solid wastes. Existing Hanford Site disposal facilities have the capacities to receive the estimated 4,500 cubic meters (157,000 cubic feet) of cleaned piping and components associated with the proposed action.

As stated in Subsection 4.2.2, hazardous materials (e.g., solvents, glycols, PCBs, asbestos) which may be removed or stabilized would be managed and reused, recycled, or disposed of in accordance with applicable federal and state regulations. Such materials include approximately 360,000 liters (94,000 gallons) of ethylene glycol and 32,000 liters (8,500 gallons) of PCB transformer oil. None of the materials would be anticipated to be generated in substantial quantities when compared to the annual amount routinely generated throughout the Hanford Site.

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5.0 PERMITS AND REGULATORY REQUIREMENTS

The activities described in this EA are planned to be implemented pursuant to CERCLA and current TPA requirements. Appropriate CERCLA decision documents would be prepared and issued. Determinations of applicable or relevant and appropriate requirements would be made in those documents.

Any generated radioactive solid waste would be subject to the requirements of DOE Order 435.1, Change 1. Disposal of solid, low-level mixed waste would be subject to DOE Order 435.1 and the applicable requirements of RCRA, and WAC 173-303. No specific permits under RCRA are anticipated for the proposed action.

All activities would be conducted in accordance with applicable Federal Clean Air Act requirements (e.g., *Clean Air Act of 1977*, as amended), and State requirements [e.g., *Washington Clean Air Act* (Chapter 70.94, Revised Code of Washington)]. No substantial additive radioactive airborne emissions are anticipated from FFTF as a result of the proposed action. The FFTF is registered with the State of Washington Department of Health, pursuant to WAC 246-247, "Radiation Protection - Air Emissions." This regulation establishes the same standards as the "National Emission Standards for Hazardous Air Pollutants" (40 CFR 61) (0.01 rem, maximum individual effective dose equivalent), and additional requirements such as source registration. Best Available Radionuclide Control Technology is required for new or modified sources by WAC 402-80, "Monitoring and Enforcement of Air Quality and Emission Standards for Radionuclides," and WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides." Appropriate notifications would be provided. Fugitive emissions (especially dust) from any activities would be controlled in accordance with normal practices, as per Benton County Clean Air Authority, Regulation 1, and in accordance with the requirements in WAC 173-400, "General Regulations for Air Pollution Sources."

A small quantity of waste solvents may be handled as a liquid hazardous waste. Present plans do not involve storing this waste onsite for more than 90 days. All applicable requirements pertaining to generators of hazardous waste (i.e., RCRA, WAC 173-303) would be met. Liquid waste would be appropriately stored and disposed of in the existing 200 Area liquid effluents waste management facility.

Waste transportation would be in accordance with applicable regulations and orders, including DOE Order 460.1B, *Packaging and Transportation Safety* and DOE Order 5480.4, Change 4, *Environmental Protection, Health, and Safety Protection Standards*. In addition, applicable requirements promulgated by DOT and U.S. Nuclear Regulatory Commission (NRC) would be followed, including 10 CFR 71 and 49 CFR 171 through 178 (as applicable).

In addition, under the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 2003), the Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office (DOE-RL) negotiated a series of milestones (M-81) associated with deactivation of FFTF.

6.0 AGENCIES CONSULTED

The States of Washington and Oregon, the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Colville, the Wanapum, the Nez Perce Tribe, and associated stakeholders have been notified regarding the proposed action. The States of Washington and Oregon, the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Colville, the Wanapum, the Nez Perce Tribe, Benton and Franklin counties, and interest groups were provided copies of the draft EA for pre-approval review.

Copies were made available in the Tri-Party Agreement repositories including the DOE Hanford public reading room. Notice was made in the Tri-City Herald of the availability of the EA.

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7.0 REFERENCES

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10 CFR 1021, "National Environmental Policy Act Implementing Procedures", *Code of Federal Regulations*, as amended.

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40 CFR 191, 1985, "Environmental Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Radioactive Wastes," *Code of Federal Regulations*, as amended.

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49 CFR 171, 1993, "General Information, Regulations, and Definitions," *Code of Federal Regulations*, as amended.

49 CFR 172, 1993, "Hazardous Materials Tables and Hazardous Materials Communications Regulations," *Code of Federal Regulations*, as amended.

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DOE/RL-96-88, *Hanford Site Biological Resources Mitigation Strategy*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE Order 430.1B, *Real Property Management*, U.S. Department of Energy, Washington, D.C.

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Appendix A

Comments and Responses

Included in this attachment are all comments received by DOE on the Draft DOE/EA-1547D. Several public comments presented views and concerns not related to the scope or content of the Proposed Action. Examples of these comments include statements in general support of, or opposition to the future potential uses of FFTF, or perceived inequities and political aspects of the DOE activities. DOE considered and recorded these concerns, but has not included analyses of these issues in this EA. Those comments considered relevant to the future decommissioning decision pending in DOE's Tank Closure & Waste Management EIS have been forwarded.

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Comments on the Draft Fast Flux Test Facility Environmental Assessment (EA) For Proposed Sodium Residuals Reaction/Removal and Other Deactivation Work Activities

Richard I Smith, P.E.
February 15, 2006

The document appears reasonably complete, and generally describes the proposed activities adequately. However, there are several items not mentioned or discussed that could be of some significance. Perhaps these items are included, but I couldn't find them.

(1) Consideration of recycle of non-radioactive materials. It would seem likely that the secondary sodium loop would be uncontaminated by radioactivity. If that is so, then it would make good sense to consider recycling the piping, pumps, and heat dump exchangers into commercial scrap channels, rather than burying them in ERDF and taking up valuable disposal space. If the sodium cleaning and disassembly operations began with the secondary loop, the planned sodium cleaning stations would still be uncontaminated, and the cleaned piping, etc., should be acceptable into the commercial recycle stream. There may be other segments of the plant systems that are still uncontaminated, and those systems should also be cleaned and recycled. In any event, the work plan should discuss this possibility and justify why recycling was rejected.

It would be interesting and useful to have an indication of how much of the total plant piping, pumps, etc., would be suitable for recycle and how much would require regulated disposal. A general characterization of the radioactivity on the components requiring regulated disposal should be provided for inclusion in the total site inventory used in the site composite analyses.

(2) Treatment of the large volume of sodium hydroxide liquid arising from the sodium cleaning operations. I may be mistaken, but I thought the LERF/ETF complex was supposed to remove the chemicals from the water, appropriately treat and package the chemicals/radioactivity, and dispose of the treated wastes in an appropriate disposal facility, while discharging the clean water to the soil. I could find no discussion about characterization of the chemicals/radioactivity removed from the liquid solution, nor of the treatment method for stabilizing and immobilizing the solid waste stream arising from treatment of the solution stream. Also, no indication of the types and numbers of containers of immobilized waste arising from these treatments, nor the volume of disposal space required to accept these wastes. Because these wastes will contain some inventory of radioactive materials, they could have an effect on the size of the total site inventory examined in the site composite analyses. In any event, the characterization and quantity of immobilized wastes should be presented, if only to show that they are inconsequential in the total picture.

Response to Mr. Richard I Smith comment of February 15, 2006

In January 2000, the Department placed a moratorium on the release of volumetrically contaminated metals pending a decision by the NRC whether to establish national standards. In July 13, 2000 in memorandum "Release of Surplus and Scrap Materials", the Department also suspended the release for recycling of scrap metals from radiation areas within DOE facilities as well as release of scrap metals for recycling if contamination from DOE operations is detectable. For FFTF, the generally accepted assumption is that the tritium levels in the secondary coolant system had reached equilibrium with tritium levels in the primary cooling system during FFTF Operations. Laboratory analysis of the primary sodium in February 1993 found tritium concentrations of 1.6E-7 curies per gram. The "Volumetric Release Criteria" is the same as the detectability limit, which for tritium is 400 pci/l. Washing of the pipe and components would not achieve this release criterion.

The EA describes the treatment of the secondary waste resulting from processing NaOH at the Effluent Treatment Facility. The treatment and disposal is included in the ETF's annual waste volume projection. The ETF disposes of waste in accordance with CERCLA.

March 9, 2006

Mr. Douglas H. Chapin

NEPA Document Manager

U.S. Department of Energy

P.O. Box 550, Mailstop A3-04

Richland, WA 99352

Subject: Comments on Draft FFTF EA for Proposed Sodium Residuals Reaction/Removal and Other Deactivation Work Activities

Dear Mr. Chapin

Thank you for the opportunity to provide comments on the Fast flux Test Facility Draft Environmental Assessment for Proposed Sodium Residuals Reaction/Removal and other Deactivation Work Activities. I did some investigation related to the selection of superheated steam for this project, as referred to on page 2-2 of this EA, for the reaction and removal of residual sodium. I was able to locate a copy of the study: Fast Flux Test Facility Sodium Residual Cleaning Process Selection (HNF-26715, Rev.1) that led to the selection of superheated steam.

In the UK, there is a vast amount of experience using the more proven sodium residuals cleaning method, which in this report is called Water Vapor. Our UK company RWE NUKEM Limited, has been involved in most of the UK work and has extensive experience in the D&D of sodium and NaK cooling systems for reactors located at Dounreay. We call the Water Vapor approach WVN or Water Vapor Nitrogen. In the FFTF major D&D procurements of the past two years we were on a team that planned to use the WVN approach. In putting together our proposal, we also looked at the other sodium residual cleaning options and came to a different conclusion than that in the above report.

To prepare our prior proposals for cleaning out FFTF system residual sodium, we laid out an extensive plan for cleaning out the residuals. This included reducing sodium pools to a minimum. One factor in our decision was that whereas WVN can be used effectively in the 40-80C range, we believe that there is a range between 80 and 315C where the reaction between sodium and steam is slowed. Another factor favoring WVN is that the hydrogen concentration is always maintained below the deflagration point, in the event that oxygen became present, compared to relatively high concentrations of hydrogen with the superheated steam process.

We concluded that it would be very difficult, if not impossible to heat all of the sodium residual containing sections of the FFTF to a temperature in the range of 212 to 315C

RWE NUKEM Corporation

800 Oak Ridge Tpke Ste A-701
Oak Ridge TN 37830-6956

T 865-813-4000
F 865-813-4024
I www.rwe.nukem.com
E info@rwe.nukem.com

Mission Statement:

To provide safe, compliant, and cost-effective radioactive waste management solutions through the innovative application of proven technologies.

for the use of superheated steam. In addition to difficulty heating the FFTF components to temperature, there may be further issues regarding total and complete reaction of the sodium pooled in the bottoms of vessels or isolated areas. However, I will note that we did propose to use superheated steam for cleaning small bore pipe and other removed components in the MASF at the FFTF site.

We have used steam jetting in the past to clean out sodium wetted components and we have used WVN in the past to clean out sodium wetted rigs and reactor equipment. More recently, at the PFR reactor our expertise has been utilized to address the safety case for the WVN and we have been recruited to assist our client with the upgrade of WVN skids to make them fit for purpose. We have also recently completed trials on WVN cleaning of sodium residuals from drums in conjunction with a bulk sodium disposition facility, as a means to clean out sodium drums once emptied.

Fluor has decided to utilize superheated steam for cleaning the residual sodium including the potentially deep sodium pools. While there may be some pops and bangs with WVN, they are usually contained due to the smaller quantity of sodium and a lower hydrogen concentration. In the case of using superheated steam, we expect that there will probably be a lot more pops and it would not be impossible to get a localized area where the heat generation is very significant.

Sincerely,

Jack McElroy,
Senior Business Development Manager

RWE NUKEM Corporation

1933 Jadwin Ave. Suite 135

Richland WA 99354

509-943-9505 W

509-539-4803 C

Response to Mr. Jack McElroy (RWE NUKEM) Comment of March 9, 2006

As described in the referenced report (HNF-26715) the Superheated Steam process was selected as the best available process for removing residual sodium from the FFTF considering past experience, process complexity, process hazards and process flexibility. The EA also recognized that in select instances WVN as an alternate process could be implemented on a small scale.

It is acknowledged that there is probably more experience world wide with the Water Vapor process than with any of the other processes for removing residual sodium. Fluor Hanford/FFTF personnel also have more experience with the Water Vapor process than any of the other processes. The most recent Fluor Hanford/FFTF experience has been with the Superheated Steam process and this experience has clearly demonstrated its advantages.

One of the major advantages of the Superheated Steam process is that it proceeds at a fairly rapid but steady rate compared to the Water Vapor process. This is due to a combination of effects attributed to the higher water vapor content and higher temperatures of the process. Liquid water does not accumulate in the system using Superheated Steam leading to a much more controllable process. Perhaps most importantly is the attribute that allows the sodium hydroxide to settle to the bottom of sodium pools allowing the process to continue. The WVN's characteristic process tends to create a top layer on pooled sodium isolating the sodium from the moisture. Experience with the Water Vapor process shows that the reaction process can sometimes stop and then restart violently unless the hydroxide layer is periodically removed.

The higher hydrogen levels developed in the Superheated Steam process is a direct result of the higher reaction rate but are safe and acceptable provided that oxygen (air) intrusion into the system is prevented. This has not been a problem with application of the Superheated Steam process.

It should not be difficult to heat all of the sodium residual containing sections of the FFTF to the temperature desired to initiate the Superheated Steam process as stated in the EA (minimum of 212°F [100°C], not the 212 to 315°C stated in the comment). Most sodium containing systems at FFTF are provided with electrical trace heat capable of heating the systems to a minimum of 200°C (usually considerably higher). The reactor vessel can be heated with its gas heating system. It also includes two immersion heaters that were used during sodium drain and may be used to supplement the heat provided by the hot gas system. Also, the planned Superheated Steam cleaning systems will include the capability to deliver hot inert gas (e.g., nitrogen) to the systems to help heat them prior to introducing steam. Finally, the energy produced by the reaction between the moisture and sodium adds additional heat.

It is agreed that deep pools of residual sodium can present a problem in the reaction process. For that reason, every reasonable effort has been made to eliminate such pools during the sodium drain process. We generally anticipate sodium pool depths of no more than a few inches. In any case, for the reasons discussed previously, the Superheated Steam process is considered more capable of safely and efficiently dealing with deeper sodium pools than the Water Vapor process. This is especially true if these pools exist in locations where periodic removal of the sodium hydroxide is not practical or possible. Our experience is that "pops and bangs" are more likely and more severe with the Water Vapor process than with the Superheated Steam process. The pops and bangs are the result of rapid reactions (and the resultant rapid energy production) caused by the interaction between liquid water and sodium; the presence of liquid water in the system is minimized in the Superheated Steam process. As stated previously, the rate of reaction can be controlled much better using the Superheated Steam process than the Water Vapor process. Temperatures can be reliably controlled to well below the limits of the FFTF systems, all of which are designed for steady operation between approximately 450 and 550°C (and are capable of short term operation at substantially higher temperature).

COMMODORE
ADVANCED SCIENCES, INC.

March 16, 2006

Douglas H. Chapin
NEPA Document Manager
U.S. Department of Energy
P. O. Box 550, Mailstop A3-04
Richland, Washington 99352

RE: DOE/EA-1547D, FFTF Draft Environmental Assessment

Mr. Chapin:

In September 2005 representatives of the world's owners of liquid metal cooled fast reactors met in Cadarache, France, as a part of the International Atomic Energy Association's (IAEA) technical meeting covering decommissioning of these facilities. The records of the proceedings, some 900 pages long, covered every conceivable method of removing residual sodium from reactor components. The IAEA proceedings only mention ammonia twice (Fermi), and superheated steam once (FFTF). Numerous references were made to steam-gas and other processes such as Wet Vapor Nitrogen (WVN) to remove residual sodium from reactors.

The FFTF draft Environmental Assessment (EA) mentions ammonia several times, with the following conclusion:

> **The anhydrous ammonia process was not developed and tested as part of the LMR program and it has not been used to remove sodium from equipment as part of operations or maintenance of a LMR and has not been used for the deactivation of an LMR.**

We offer an equally valid and similarly condemning statement about the superheated steam process that we believe invalidates this major portion of the draft EA:

> **The superheated steam process ("SSP", which created a flash fire/explosion at FFTF on November 6, 2005, and is recommended as the preferred alternative in the draft EA) was not developed and tested as part of the LMR program, has not been routinely used to remove sodium from equipment as part of operations or maintenance of a LMR, and has not been used for the deactivation of an LMR.**

The EA describes a completely different superheated steam process than is described in both the Fast Flux Test Facility Sodium Residual Cleaning Process Selection (HNF-26715) and the descriptions of the SSP on a vendor's web site (the vendor responsible for the November fire/explosion). The EA assumes that the steam is heated to about 400°F, and the equipment to be cleaned is pre-heated to a minimum of 212°F.

The EA statement that "As the superheated steam reacts with the metallic sodium, the temperature increases to ~600-800°F" does not match the essential parameters of this particular version of the superheated steam process, *i.e.*, one cannot guarantee that the sodium hydroxide will remain anhydrous and that it will be molten at all times when the steam is reacting with sodium.

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507 KNIGHT STREET RICHLAND, WA 99352 509.943.2565 FAX: 509.943.2910

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The time it takes for sodium hydroxide's temperature to exceed ~605°F and become and stay molten is a function of a number of processing and system parameters. Initial pre-heat temperature of the component being cleaned, heat capacity of the system being cleaned, initial pre-heat temperature of the steam, moisture injection rate, and other factors influence whether or not and how fast molten sodium hydroxide will be formed. **Consequently, the EA is addressing a set of processing parameters that cannot be reasonably assured with the result that the safety and performance outcomes of the draft EA have been seriously compromised even if this very hot, hydrogen gas creating, dangerous, and costly DOE preferred alternative were safe – *and clearly it is not safe* as evidenced by experts' reports noted below, recent shifts away from rapid, vapor/steam processes by the British after years of study and testing, and the recent flash fire/explosion at FFTF.**

Both HNF-26715 and the vendor's web site for the SSP assume that anhydrous sodium hydroxide is formed and melts throughout the system being treated, requiring temperatures greater than 605°F at all times (*"(sodium) pool temperature would be ideally maintained above 344°C (644°F)"*, reference vendor's web site). To get the bulleted benefits touted by the vendor, it is necessary that the sodium hydroxide be anhydrous and that it be liquid:

- *"The anhydrous caustic stays molten (above 605°F), so there are no inclusions"*
- *"The density of the molten caustic is significantly higher than the alkali metal, so the caustic settles at the bottom of the vessel and the metal stays at the top, continuously exposing fresh surfaces for reaction."*
- *"Alkali metals are typically not miscible with their caustic reaction products, so there is a distinct interface with the metal on top, making the end point of the reaction easier to detect."*

I am enclosing a CD containing the full transcript (all 900 pages) of the most recent and most thorough review of reactor sodium residuals removal operations anywhere in the world. Here is what the IAEA participants (seasoned experts) conducting residual sodium removal from shut-down reactors had to say last fall about sodium steam removal processes:

Fermi 1:

"Most of the sodium processing at Fermi 1 has been using steam.

Lessons Learned - learning occurs during each new system being processed. Some lessons learned about processing at Fermi 1 are as follow.

- *The vent path configuration is important. The vent needs to be large enough that it will not be plugged with NaOH particles. In one case, the sodium vent line did plug with NaOH when there was a right angle elbow approximately one meter above the top of the tank being processed.*

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- *A hot reaction or supplemental heat better ensures sodium does not become trapped under the NaOH.*
- *Unfortunately, heating also causes hazards. If propane is used, CO_2 is a concern.*
- *Hot surfaces can burn people or cause fire retardant materials to ignite, even if electric heat is being used. Plugs of sodium can remain underneath processed sodium. For example, sodium remained in a secondary cold trap bottom drain line, even though the cold trap was processed with steam and flooded with water.*
- *The primary sodium storage tanks each had a bottom stub. At the end of processing, the procedure required the bottom stub be heated. When heated, the sodium in the stub melted and rose into the NaOH and then reacted, as intended."*

Kazakhstan BN350

"Taking into account the significant temperature and speeds of chemical reactions in process of the steam-gas washing, possibility of alkali cracking of the construction materials, failures of the integrity of the circuits and generation the hydrogen and oxygen fire-dump mixture, the safety level of the steam-gas washing technology for BN-350 reactor conditions could not be considered as satisfactory. Additionally the (sic) significant amount of derived radioactive wastes is produced in the process of the steam-gas washing. These radioactive wastes should be treated."

Superphenix

"Hot wet vapor nitrogen (WVN) was selected as the preferred option from safety and efficiency standpoints after testing for Superphenix cold traps."

Summary and Conclusion of Session 4.1: Reactor decommissioning strategy

"In this session three presentations were made for three different plants: Dounreay, FFTF and Phenix. In each presentation, different kinds of treatment for sodium residues removal were presented:

- *Dounreay use the WVN (Water Vapour Nitrogen) process without draining of the caustic soda. They developed ten years before.*
- *FFTF cleaned the reactor vessel (FFTF mockup) with super heated steam in 7h.* (writer understands the amount of sodium removed from the FFTF mockup was insignificant compared to amounts of sodium removed from other LMR's by other methods).
- *The Phenix solution up to now is a CO_2 passivation method for the residual sodium."*

We are very surprised that DOE would summarily select in this draft EA a process for the removal of the majority of the FFTF residual sodium that is fraught with fundamental safety problems and challenges. <u>There appears to be an unwarranted bias by DOE towards an extremely dangerous, high temperature process requiring supplemental heating of</u>

60314013

March 16, 2006
Mr. Douglas H. Chapin
Page Four

reactor components, superheated steam, and molten anhydrous sodium hydroxide – all in the presence of copious quantities of fire or explosion-prone hydrogen gas generated throughout the processing cycle. The site-wide emergency alert event on November 6 was caused by a vendor using the referenced superheated steam process on a relatively simple piping system containing relatively small amounts of NaK. It would logically appear that a small explosion in a small system might extrapolate linearly to bigger systems.

With the resources available to DOE, it is unfathomable that DOE has not yet evaluated safer and perhaps much more economical sodium removal technologies, e.g., Commodore's cold (room temperature) competitive technology that simply dissolves sodium, NaK, and other alkali metals in-situ or ex-reactor, and does not produce hydrogen as a by product. To my knowledge, no engineer or technical person in the entire Department of Energy has actually witnessed how simple and safe (and economical) it is to dissolve sodium in anhydrous ammonia. Rather, conclusions regarding this process appear to have been drawn based on unfounded concerns over the use of anhydrous ammonia – one of the ten most produced chemicals in the world, used safely in massive quantities throughout America's agricultural industry.

In summary, Commodore finds the EA seriously deficient and requests that you revise it and provide in the revised EA a method for the potential use of safer, competitive, alternative technologies for this vital work that needs to be performed safely, efficiently and cost effectively.

Thank you for the opportunity to comment.

Sincerely,

O. M. Jones, President

OMJ: do

60314013

Response to Mr. O. M. Jones comment of March 16, 2006

As described in the referenced report (HNF-26715) the Superheated Steam process was selected as the best available process for removing residual sodium from the FFTF considering past experience, process complexity, process hazards and process flexibility. The EA also recognized that in select instances alternative processes considered could be implemented on a small scale. These include dissolution of sodium in ammonia. DOE considered in its evaluation of alternative residual cleaning processes the information provided in the comment and is familiar with the information provided by the September 2005 IAEA meeting at Cadarache France. A representative from the DOE FFTF Program Office was in attendance.

The superheated steam process parameters referred to in the draft EA were intended as representative conditions. The EA relies on the superheated steam process described in HNF-26715 in which equipment is normally heated before steam is injected, uses multiple injection points, vents gases to a scrubber, and continues for a period beyond the point that no hydrogen is being released. As stated in the comment, the actual conditions achieved are a function of system and processing parameters. Extensive experience using the superheated steam process to remove residual sodium from both reactor and non-reactor systems shows that it can be controlled such that it is safe and effective. The superheated steam process sodium cleaning process was successfully executed at the mockup of the FFTF reactor vessel on approximately 350 liters of sodium residuals. This cleaning evolution was performed in a complex geometry typical of that which will be encountered in cleaning the FFTF systems. The unexpected reaction that occurred during the cleaning of residual NaK from a system at the FFTF in November of 2005 did not occur during the actual steam cleaning process. Rather, a small quantity of NaK was pushed out of the system during system purging with dry inert gas into an effluent scrubber that had a pool of water in the bottom. A rapid reaction between the NaK and water resulted in a small, momentary flame at the exit of the scrubber.

Although the comment states that the superheated steam process has not been used for the deactivation of an LMR, the superheated steam process has been, and continues to be, the primary process used in the removal of residual sodium from the Fermi 1 reactor located near Detroit Michigan. This is described in the IAEA proceedings referenced in the comment. The paper presented by the manager of the Fermi 1 decommissioning project described the selection of the steam in nitrogen process as the process with the best probability of reaching sodium residuals and lowest in risk. "Most of the sodium processing performed at Fermi 1 has been using steam." "Overall, steam processing experience at Fermi 1 has been favorable." A lesson learned identified at Fermi 1 concerning the plugging of a vent line with sodium hydroxide particles was found to be relatively minor operational problem that was easily and safely resolved.

The French have selected a "hot water vapor nitrogen" process for cleaning sodium from the fifteen cold traps from the Superphenix reactor. The process, as described in a paper presented at the referenced IAEA meeting, is substantially the same as the superheated steam process selected for use at the FFTF. The reasons given for selecting the process are the same as those for selecting the process for FFTF.

The moist carbon dioxide process (commonly called passivation) has been selected to react the residuals at the BN350 reactor in Kazakhstan due to concerns with the steam-gas washing process. At this time, the passivation process has only been selected for dealing with residuals in the reactor vessel due to the presence of relatively deep layers of sodium trapped in inaccessible regions of the vessel. The FFTF drain processes have been designed and executed to assure that no such deep pockets remain. Even if they did exist, the superheated steam process is capable of safely and efficiently reacting them. Processes for cleaning other portions of the BN350 plant will be selected at a later time.

The EA adequately considered the ammonia process along with other alternatives and recognized that in select instances these alternative processes could be implemented on a small scale in the proposed action.

From: Carl Holder [mailto:holdercarl@hotmail.com]
Sent: Thursday, March 16, 2006 9:48 AM
To: Al Farabee; Chapin, Douglas H
Cc: Claude Oliver
Subject: Global Nuclear Energy Partnership

"The closed fuel cycle model envisioned by this partnership requires development and deployment of technologies that enable recycling and consumption of long-lived radioactive waste." President George W. Bush, February 2006.

Develop Advanced Burner Reactors

Demonstrate and deploy Advanced Burner Reactors to produce energy from recycled nuclear fuel. (sodium cooled fast reactor burning plutonium fuel).

Source: www.gnep.energy.gov

Dear Mr. Farabee:

The Public Comment period for EA1547D must remain open until release of official DOE notice which as announced will include Expressions of Interest and concurrent Notice to Prepare a GNEP EIS. This is significant new information for your consideration.

As previously submitted, I support the NO ACTION alternative.

Please advise.

Best regards,

Carl Holder

Pasco, WA 99301

509-547-7343

CC: Douglas Chapin, NEPA Document Manager, USDOE-RL

Some more news.

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Domenici Subcommittee Studies GNEP as Key to Long-Term Nuclear Power & Waste Problems

from the Office of Senator Pete V. Domenici

Thursday, March 2, 2006

WASHINGTON – U.S. Senator Pete Domenici today pledged to work toward implementation of President Bush's Global Nuclear Energy Partnership (GNEP), a program to address new solutions to deal with wastes associated with the burgeoning nuclear power sector.

Domenici's Senate Energy and Water Development Appropriations Subcommittee today held a hearing to receive Department of Energy testimony on GNEP. The plan would address nuclear waste through an advance fuel cycle that will reduce the overall volume of waste and protect against possible proliferation by eliminating separated plutonium.

The administration has requested $250 million through the DOE Office of Nuclear Energy for an advanced Fuel Cycle Initiative (ACFI).

"The United States in the 1970s abandoned its leadership on nuclear recycling and let the rest of the world pass us by. With the creation of the GNEP, we're getting back in the game," Domenici said. "I am all for setting forth on a comprehensive global nuclear strategy that promotes nuclear nonproliferation goals while helping resolve nuclear waste issues."

"With GNEP, we begin to close the cycle on nuclear waste in ways that prevent proliferation and reduce both the volume and toxicity of waste. By recycling spent nuclear fuel, we can reuse the uranium, which is 96 percent of spent fuel, and separate the most toxic radioactive material to be burned in an advanced burner reactor. By reusing uranium fuel and burning the transuranic material in a new generation of modern reactors, we can reduce the amount of waste placed in Yucca Mountain by a factor of 100," he said.

Response to Mr. Carl Holder comment of March 16, 2006

DOE/EA-1547 evaluates the potential impacts of sodium residuals removal only, and does not revisit previous DOE decisions concerning the potential reuse of the FFTF as a nuclear reactor. Those decisions and decision documents are discussed in the EA. Based on the evaluation performed in the EA, if a FONSI decision were to be issued, it would constitute a determination by DOE that the impacts were evaluated and found to be not significant enough to require preparation of an EIS, and that DOE may proceed to implement the proposed action. This comment has been forwarded to the Office of Nuclear Energy for consideration in the GNEP EIS.

CHARLES ST. GEORGE HOLDEN
ATTORNEY AT LAW
TELEPHONE (415) 398-7878
360 PINE STREET
SUITE 600
SAN FRANCISCO, CA 94104
TELEFAX (415) 989-7319

March 17, 2006

Mr. Al Farabee
FFTF Manager
US Department of Energy
P.O. Box 550
Richland, WA 99352

Via Telefax 509 376 0177

Copies Sent US Mail
Samuel Bodman, Secretary of Energy
Douglas Chapin, NEPA Document Manager

RE: Public Comment, EA 1547D (Supplemental)

Dear Mr. Farabee:

This letter supplements my letter to you dated March 2, 2006. I must bring to your attention significant new items that have developed since I wrote you last. With regard to the Global Nuclear Energy Partnership (GNEP) announced by the President last month, the Department of Energy intends to publish in the Federal Register the Department of Energy's official notice seeking Expressions of Interest from communities and from private industry regarding the location and construction of facilities that will be integrated to support the mission of GNEP. Key assets to be called for in the upcoming Federal Register notice exist in the FFTF 400 Area at the Hanford facility. The notice in the Federal Register is deemed notice to your department and provides reason for a cessation of any plan to demolish facilities in the FFTF 400 Area as these have significant value for the Nation. There is no rational basis to call for the decommissioning of the facilities in light of the priories known to the Department to be evidenced by the upcoming publication in the Federal Register.

CHARLES ST. GEORGE HOLDEN
ATTORNEY AT LAW

The Department of Energy is soliciting Expressions or Statements of Interest from communities around the United States to participate in the development of needed facilities. The Department seeks expressions of interest from communities having the personnel, land and facilities to make nuclear energy sustainable by the construction of demonstration facilities using closed nuclear fuel cycle models.

The Department has budget authority to commence planning, to develop pilot plants to 1) recycle fuel, 2) to make new fuel from plutonium and minor actinides, and 3) to fission away and to transmute the transuranics: neptunium, plutonium, americium and curium in a fast spectrum plutonium burning reactor. The fissioning away of the waste will most likely be done in a liquid-metal sodium cooled fast spectrum reactor. Advanced Fuel Cycle activities are fundamental for long term environmental management of nuclear energy and area 400 at Hanford has the recycling facilities and the containment for much of the research. Further, the FFTF was sodium cooled and the system in place could be used for the testing of other liquid metal coolants or organic coolants.

The Notice in the Federal Register is a "significant new event" within the meaning of NEPA. An Agency's NEPA analysis must be supplemented if there "are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts..." 40 C.F.R. Sec 1502.9 (c). I quote this language from the decision of the trial court filed in the matter Benton County v. US Department of Energy No CT-02-5100-EES filed on February 28, 2003. Just in case the passage of time has caused the Department's local representatives to overlook language from the trial judge's opinion, I direct the readers in the Department to review the decision at this time along side of the text in the Federal Register. The District Court did not rule on whether the FFTF facilities could be decommissioned because there was no record of decision concerning a decommissioning plan because the NEPA analysis did not deal with decommissioning of the FFTF. There is no reason to decommission the facilities presently.

"Prior to committing any resources to any one of the options for decommissioning, the DOE must prepare an EIS. 40 C.F.R. Sec.1502.2 (f). This ensures the opportunity for public comment. Upon completion of the EIS, DOE will have made a final decision on decommissioning that can be the subject of a lawsuit seeking court review. "(Order at p. 14.)

The Hanford Site Fast Flux Test Facility Closure Project was cancelled by letter dated December 22, 2005 under the signature of the contracting officer Andrew H. Wirkkala. The 2003 decision of the trial court no doubt played a factor in the December, 2005 decision by the Department to cancel the solicitation to demolish the facilities. The NEPA work has not been done and the Federal Register notes a "significant new event" the potential use of some or all of the facilities for the GNEP.

Because of the Federal Register's Expression of Interest, the DOE Environmental Management division must cease considering the decommissioning of the FFTF facilities since the notice in the Federal Register bearing today's date is a "significant new event." Not only would the Secretary of Energy find that the continuing actions of staff to decommission the facility were mistaken and contrary to Agency policy during the site selection phase of the GNEP protocols, the United State District Court would be likely to hold that decommissioning the facilities is arbitrary and capricious within the meaning of applicable Ninth Circuit authorities as such administrative action would be contrary to present agency policies.

Now, the leadership of the Department of Energy is requesting the Hanford community to provide the Department with a statement of interest regarding the facilities needed for realizing the important international goals of the GNEP. These same facilities should not be wasted under an outmoded and ill-considered environmental rubric.

EM cannot be heard to say that Hanford's assets are not needed for consideration by the leadership of the Department of Energy. The facilities at the FFTF area can be used for fuel recycling, fuel fabrication and for testing of liquid metal cooled fast reactors. There is no rational basis to call for an EIS for the decommissioning of the FFTF when the facilities are needed for the evaluation of means and methods presently available through the international and domestic communities on subjects dealing with the treatment of fission products and transuranic materials to enhance the sustainability of nuclear energy. The arbitrary and capricious acts of the lower officials of the Department could be established by their failure to heed the President's call for answers to the national addiction to oil.

A companion to the Expression of Interest is the Notice to Prepare an EIS. GNEP is a national energy initiative tying together numerous international partnerships. The EIS will undoubtedly evaluate key Hanford Area capability. There is high likelihood that some FFTF restart or other significant usage is an alternative in scoping the GNEP EIS. Further action to accomplish an expanded work scope found in the proposed EA1547D could be established to be arbitrary and capricious for failure to protect the advanced planning precepts of the National Environmental Policy Act moving forward in the GNEP EIS. With the GNEP EIS the likely action will be to make use of the facilities not covert them to rubble.

The design of the Fast Flux Test Facility included liquid-metal cooling, specifically sodium cooling, and the use of plutonium as a fuel. Because the present national and international effort is focused on finding ways to make nuclear energy more sustainable and to reduce the quantity of transuranics needing long term storage under guard and on ways to reduce the world's rapidly growing inventory of civilian produced plutonium, any steps anticipating any DOE plan to convert the FFTF facility to rubble is inconsistent with the national agenda set by the political leadership in the GNEP. The facility has already been used to burn plutonium and this use could be revived as a pilot plant under a new fuel plan that could also burn the transuranics. To test the viability of liquid metal cooling technology presently available or to be developed will require the use of the FFTF as an existing test platform for many purposes, short of start up.

CHARLES ST. GEORGE HOLDEN
ATTORNEY AT LAW

Because the facility exists it should be considered an asset giving the local community a head start on finding the best practicable technology to make nuclear energy more sustainable and proliferation resistant. It does not serve the national interest for anyone employed by the Department of Energy to assert that the FFTF should now be filled with cement, converted to rubble or otherwise demolished when the Department has published its GNEP needs in the Federal Register.

Further, the existing facilities could be used to house, inside of certified containment, smaller reactors to make medical isotopes. The Department of Energy has been criticized by its Inspector General on the subject of lapses in the medical isotope program. To correct the lapses noted by the Inspector General in his report of November 2005 (DOE/IG-0709), the existing facility must also be considered also as a home for a small fast spectrum reactor to produce medical isotopes and to be a test reactor to promote the development of small transportable reactors all called for by the GNEP. NASA also has requirements for test reactor operations inside of certified containment.

Most importantly the materials handling facilities located along side of the FFTF should be utilized in the national effort to develop fast spectrum fuels and to recycle spent thermal and fast spectrum fuels. This is integral to the President's program. Materials handing for fast spectrum and thermal spectrum fuels both virgin and recycled. .fuel recycling programs will need to use the facilities. The Fuel Material Examination Facility was designed for exactly the purposes that are called for by the GNEP initiative. FMEF is mission ready. This asset is complimented by the test platform adjacent to it.

Further, the State of Washington requested that environmental funding be put to use on higher priority projects and not for converting the FFTF to rubble.

In conclusion, I believe that the Secretary's office will weigh in on any ill considered planned destruction of facilities greatly needed for the efforts contemplated by Congress's, the Secretary's and the President's Global Nuclear Energy Partnership.

Very Truly Yours,

Charles S. Holden

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CHARLES ST. GEORGE HOLDEN
ATTORNEY AT LAW

CC
Mr. Douglas H. Chapin, NEPA Document Manager,
U.S. Department of Energy,
P.O. Box 550, Mailstop A3-04,
Richland, Washington 99352

Fax: (509)376-0177,
Email: Douglas_h_chapin@rl.gov

Office of the Secretary of Energy
Honorable Samuel Bodman
Attention National Policy Coordinator
Global Nuclear Partnership
Department of Energy
1000 Independence Avenue
Washington DC 20585

Response to Mr. Charles S. Holden comment of March 17, 2006

DOE/EA-1547 evaluates the potential impacts of sodium residuals removal only, and does not revisit previous DOE decisions concerning the potential reuse of the FFTF as a nuclear reactor. Those decisions and decision documents are discussed in the EA. Based on the evaluation performed in the EA, if a FONSI decision were to be issued, it would constitute a determination by DOE that the impacts were evaluated and found to be not significant enough to require preparation of an EIS, and that DOE may proceed to implement the proposed action. This comment has been forwarded to the Office of Nuclear Energy for consideration in the GNEP EIS.

From: Clinton Bastin [mailto:clintonbastin@bellsouth.net]
Sent: Friday, March 17, 2006 01:13 PM
To: Chapin, Douglas H
Subject: RE: EA1547D: US Energy and Nuclear Technology
Importance: High

Mr. Chapin, this is being resent to include RE: EA1547D

Mr. Chapin, some of my friends and colleagues at Richland have suggested that I submit the following letter to leaders of America into the Public Comment record (RE: EA1547D) for Hanford that is open through today:

"**Clinton Bastin**, Chemical Engineer, United States Department of Energy (Retired) Vice President for the United States, World Council of Nuclear Workers, Chair, Georgia Section, American Nuclear Society, 987 Viscount Court, Avondale Estates, Georgia 30002, Telephone 404 297 2005 E-Mail clintonbastin@bellsouth.net

"March 16, 2006

"The President, The Vice President, Senate Energy Chairman Pete Domenici, House Energy Chairman Joe Barton, Constellation Energy CEO Mike Wallace, Southern Company CEO David Ratcliffe, Fisk University President Hazel R. O'Leary, GA Tech President Wayne Clough, MIT Institute Professor John Deutch, RPI President Shirley Ann Jackson, University of Miami President Donna Shalala, NRC Chairman Nils Diaz, *AJC* Publisher John Mellott, *NYTimes* Publisher Arthur Ochs Sulzberger, Jr., Senator Saxby Chambliss, ANS President James Reinsch, NEI President Frank L. (Skip) Bowman, Energy Secretary Sam Bodman, Du Pont Senior Vice President Thomas Connelly, *Nuclear News* Publisher Betsy Tompkins

"Dear Mr. President, Mr. Vice President, Chairman Domenici, Chairman Barton, Mr. Wallace, Mr. Radcliffe, Dr. O'Leary, Dr. Clough, Dr. Deutch, Dr. Jackson, Dr. Shalala, Chairman Diaz, Mr. Sulzberger, Senator Chambliss, Mr. Mellott, Mr. Reinsch, Mr. Bowman, Secretary Bodman, Dr. Connelly and Ms. Tompkins:

"Management of energy and nuclear technology by the U.S. Department of Energy (DOE) and its laboratories is similer to that of the former Soviet Union (FSU). Since the United States works by competent corporate enterprise, the DOE/FSU system works against U.S. interests. This letter describes actions that led to this system and some of its adverse consequences. I propose that we form a "Partnership for America" to develop and implement a better approach to resolve long-neglected energy and nuclear technology challenges and avoid adverse consequences inherent in government management of complex technology.

"Manhattan Project Director Leslie Groves recognized in 1942 that the scale and complexity of reprocessing of irradiated nuclear fuels would be a challenge even to the most experienced chemical engineering organization. He asked the Du Pont Company to design, build and operate the nuclear reactor/reprocessing pilot plant at Oak Ridge, TN, and production facilities at Hanford, WA. Du Pont accepted the assignment, but insisted that it manage activities similar to that for its commercial activities.

"Manhattan Project scientists at the University of Chicago, many of whom had no industrial experience, believed that they were capable of carrying the project through to completion and that they had earned the right to do so. They participated with Du Pont in experiments at the Oak Ridge pilot plant, but after completion of experiments had no further Project role. General Groves authorized them to operate the pilot plant in a production mode, a compromise of good safety and management practice. A 1994 DOE report of the Oak Ridge National Laboratory (ORNL) Chemical Technology Division history states "the first kilogram quantities of plutonium were produced (during this 14-month campaign) in the pilot plant."

"This "success" was a major factor in General Groves decision to create national laboratories whose scientists, often inexperienced with industrial technology, would be responsible to government officials, who lack incentives of corporate enterprise and accountability for their actions, and often lack experience with industrial technology and understanding of past successes, failures and evaluations.

"Production in the Oak Ridge pilot plant was not kilogram quantities but 326.39 grams.

"The pilot plant was a major effort of ORNL. From 1949 through 1952, ORNL pilot plant scientists and engineers directed the design, construction and initial operation of the Idaho Chemical Processing Plant (ICPP). The ICPP, whose function was to reprocess all highly enriched uranium (HEU) fuel from U.S. reactors and research reactors in other nations, incorporated ORNL pilot plant technology. A 1957 report prepared by ORNL and published by the Atomic Energy Commission (AEC) in 1957 for its policy on reprocessing of nuclear power plant fuels stated that ICPP operation had been successful, with a productivity of 80%.

"Productivity of the ICPP from startup through 1957 was not 80% but 3%.

"General Electric replaced Du Pont at Hanford in 1946, but did not provide corporate management similar to that of Du Pont. This resulted in many problems, particularly in reprocessing, and a later decision by GE to leave Hanford. **Failure of GE to learn from experiences at Hanford led to problems with its commercial reprocessing plant at Morris, Illinois.**

"Former U.S. Army Corps of Engineers officers of the Manhattan Project remained with the AEC to direct important programs. They told President Harry S. Truman about the outstanding achievements of Du Pont during World War II and the need for comparable effort for the AEC. President Truman asked Du Pont to design, build and operate the Savannah River Plant (SRP) to produce and process nuclear materials for important national programs. The 1990 Du Pont Book by W. P. Bebbington, *History of Du Pont at the Savannah River Plant*, describes many Du Pont achievements including best-ever safety, criticality control and radiation protection, and outstanding production, processing and reprocessing of many types of nuclear materials for space exploration, defense, medicine, research and industrial uses. The Du Pont Book does not provide full information about two exceptional activities of Du Pont at the SRP:

> **"Investigation of the nations only nuclear waste repository that was endorsed by a committee appointed by the governor of the state where the repository was located, and whose multiple, formidable, measurable geologic barriers would ensure isolation for geologic periods of time.**
>
> "The program for production of transcalifornium elements by irradiation of excess weapons plutonium in a superhigh neutron flux in C reactor, and processing for separation of transcalifornium elements in the Multiple Purpose Processing Facility in F Canyon.

"The proposal to Congress for continuing the investigation for a nuclear waste repository at the SRP was withdrawn in 1972 by AEC Chairman James Schlesinger and the transcalifornium production and processing program was cancelled.

"Nuclear energy is the ultimate source of all energy. Well-managed nuclear power is our safest, least polluting and potentially most abundant energy source to support civilization. However, U.S. type nuclear power plants recover less than 1% of the energy in nuclear materials. Their use began and continued through 1974 with full expectation that used nuclear fuels would be reprocessed to permit more efficient use of nuclear materials, and to permit disposal of wastes that would not require indefinite safeguards, which cannot be assured.

"The successful reprocessing experiences of Du Pont provided full assurances that reprocessing of nuclear power plant fuels would be safe, successful and cost-effective.

"Implementation of the 1957 AEC policy on reprocessing for commercial nuclear power included the assignment to Du Pont to receive, store and reprocess used fuel from nuclear power plants in the U.S. and those in other nations supplied by the U.S. I was assigned responsibility for AEC leadership of this program.

"However, the 1957 AEC policy also offered incentives for U.S. corporations to reprocess nuclear power plant fuels at prices comparable to those claimed for ICPP reprocessing. Officials and staff of some AEC Divisions promoted use in the U.S. and many other nations of the ORNL/ICPP pilot plant reprocessing technology. Scientists and engineers from Hanford, Idaho and ORNL who consulted for nuclear power plant operators and vendors also supported use of the pilot plant technology.

"Scientists and engineers from Britain, Belgium, Italy, Japan, South Africa, Germany, Sweden, Norway, Finland, Yugoslavia, Australia, India, France and Spain visited ORNL and ICPP to obtain information about pilot plant reprocessing technology and up to two years training at the ORNL pilot plant. (AEC also supported the design, by American Vitro, of the reprocessing plant at the Bhaba Atomic Research Center in Trombay (near Bombay), India, to recover weapons grade plutonium produced in CIRUS (Canada Isotope Reactor United States), which was based on the NRX reactor which was built by Canada and funded by the U.S. to produce plutonium for US nuclear weapons under a mutual security agreement).

"Highly enriched uranium irradiated in SRP reactors to produce tritium was shipped to the ICPP for reprocessing there. However, failure of the ICPP led to need to modify H Canyon in early 1959 to permit processing of HEU. The SRP F Canyon had been modified earlier to increase capacity from 4.5 to 14 tons per day of natural uranium irradiated for plutonium production.

"Thus AEC officials and technical staff at SRP knew that:

> **"technology being proposed for commercial reprocessing was flawed**
>
> **"return of used fuel from other nations for reprocessing in the United States was an important nonproliferation initiative, and**
>
> **"the huge economy of scale of successful reprocessing facilities was a strong incentive for a few reprocessing facilities in nations with large nuclear power programs, which would also limit proliferation threats.**

"They warned nuclear power plant operators about the problem, but to no avail. If operators had looked at accountability records, as I did in 1973, they would have seen the problem.

"Nuclear Fuels Services, Inc.(NFS), announced in early 1962 that it would accept the AEC offer and build and operate a reprocessing plant at West Valley, NY, to reprocess used fuel from U.S. nuclear power plants at costs comparable to those of the AEC policy announcement (less than $20 per kilogram). However, NFS decided that it would not reprocess used fuel from other nations.

"The AEC cancelled its program for receipt and reprocessing with successful technology of used fuel from nuclear power plants and its offer to accept return of used fuel from other nations.

"When the U.S. lost ability to produce enough oil to meet U.S. demands in 1970, President Richard Nixon declared a national commitment to efficient use of nuclear resources. Iran, then a U.S. ally and aware that the world would later lose the ability to produce enough oil to meet world demands, made a similar commitment, and ordered five large nuclear power plants from U.S. corporations.

"If the initial U.S. program had continued, fuel for those plants would have been leased to Iran and returned to the U.S. for reprocessing. But that program was no longer available, so Iran requested necessary support technology, including reprocessing. An AEC staff paper was prepared in 1972 to consider Iran's request, which would have provided ORNL/ICPP reprocessing technology similar to that provided to other nations. By this time, senior AEC officials were becoming aware of past mistakes in use and export of that technology and denied its transfer to Iran.

"Leaders of Iran were furious, cancelled the reactor orders with the U.S. and placed them with France and Germany, who agreed to provide reprocessing technology. The oil embargo against the U.S. occurred a year later. The conflict with the U.S. about critical future energy needs for Iran weakened the Shah Government and its efforts to move Iran into the 21st Century.

"Radiation exposures to workers at the NFS West Valley reprocessing plant in 1971 were well above maximum allowable Federal standards and rising exponentially, release of radioactivity to surface streams exceeded technical specifications and there were other problems. In March 1972, the AEC Director, Division of Compliance, wrote to the NFS President ordering a halt of operations.

"Allied Chemical Company accepted responsibility for operation of the ICPP in 1966. Its officials read annual reports indicating an economically attractive operation, joined forces with General Atomics (then owned by Gulf Oil Company, later Gulf and Shell Oil Companies) and decided to build and operate a reprocessing plant at Barnwell, SC., based on the ICPP technology, and some adaptations provided by French reprocessors.

"After AEC officials asked me to transfer to headquarters in 1972 to help resolve U.S. reprocessing problems, a visit to the ICPP revealed that safety, criticality control and radiation protection for workers were out of control. My efforts for improvements included making arrangements for detailed review of practices at ICPP by experienced Du Pont reprocessors and safety and radiation protection officials. There were improvements, but problems remained more than a year later.

"I mentioned concerns to a senior AEC official, who responded, "Yes, but the ICPP program is important, particularly for fuels from U.S. Navy ships and submarines. That HEU fuel is highly irradiated and contains a lot of uranium-236, the precursor to neptunium-237, which is used in SRP reactors to produce plutonium-238, which provides energy for vehicles that travel into deep space. It also contains a lot of neptunium-237." The statement was a reminder of forecasts from ICPP for delivery of neptunium to the SRP that never arrived, which raised questions about ICPP production and led to my comparison of accountability records with statements of production achievements in annual reports.

"The annual ICPP reports overstated production by a factor of about five.

"Allied Chemical Company officials were notified that their contract for operation of ICPP would be discontinued. But they also realized that their investment with General Atomics in the Barnwell reprocessing plant was based on false premises, and informally notified AEC officials that they would not operate the plant without support from the U.S. Government.

"During this same time period, Gulf and Shell Oil Companies as General Atomics were trying to commercialize High Temperature Gas-cooled Reactors, and relying on ICPP for projected reprocessing costs, and a planned demonstration of the technology. Congress authorized the demonstration project, estimated to cost $30 million.

"During a design review, I realized that ICPP managers lacked understanding of the challenges of reprocessing HTGR fuels and notified the AEC HTGR program manager. He appointed a task force who reviewed project plans and concluded that the demonstration could not be carried out as planned.

"At the same time, General Atomics contracted with Bechtel for a conceptual design and cost estimate for the commercial reprocessing plant, and learned that the cost estimate provided by the AEC was underestimated by a factor of almost ten. Gulf and Shell Oil Companies left General Atomics and plans for commercialization of the HTGR were cancelled.

"In addition to Gulf and Shell Oil Companies, Atlantic Richfield, Exxon, and Getty Oil made major investments for important uses of nuclear technology for energy, but all investments were lost because they relied on misinformation from the AEC and successor agencies, could not meet low costs offered by operators of laboratory type facilities, or were cancelled as a result of government actions. Phillips Petroleum had operated the ICPP from startup until 1966 and was aware of problems.

"Boeing started construction during the early 1980s of a much more energy efficient uranium enrichment plant using gas centrifuges, but this was cancelled by DOE in order to support development by a national laboratory of another enrichment process - which has not been developed.

"With best technology for many important nuclear applications, Du Pont considered commercial nuclear initiatives, but was aware of problems from government and government laboratory management and domination of nuclear technology. Of particular concern were false claims of low costs and other advantages of facility concepts of inexperienced scientists and engineers in government laboratories. Knowing that properly designed facilities could not compete with those promised, Du Pont wisely decided not to proceed.

"From early 1973 until mid-1974, AEC technical staff under my leadership reviewed the status and history of reprocessing for lessons learned and made recommendations for reassignment of responsibilities to build on successes and avoid failures.

"I learned during a visit in October 1972 of formidable problems at General Electric Company's Midwest Fuel Recovery Plant (MFRP) that made successful operation of the plant unlikely. This information was shared with AEC officials and technical staff. Thus in July 1974, when GE notified the AEC that the MFRP was inoperable, leaders of AEC reprocessing programs were ready to lead efforts for successful reprocessing of nuclear power plant fuels.

"Later that month, AEC technical staff met with the Edison Electric Institute Nuclear Fuel Cycle Committee at EEI offices in New York City. The recommendation of Chairman Bill Lee (Duke Power Company President) coincided precisely with recommendations of knowledgeable AEC reprocessors: Deliver used fuel from nuclear power plants to the SRP for reprocessing there. However, our response was that SRP did not at that time have capacity in existing facilities to meet then present demands for reprocessing.

"An AEC General Manager's task force review endorsed recommendations of technical staff and reassigned responsibilities for commercial nuclear fuel cycle to the organization knowledgeable of reprocessing, i.e., the Division of Production. Management responsibilities were assigned to Du Pont.

"Designs were completed by Du Pont for fuel recycle (integrated fuel reprocessing and refabrication) facilities that would have precluded access to or accumulations of separated plutonium and resolved other concerns. Cost for reprocessing would have been about $200 per kilogram, about one-fifth of French charges.

"Unfortunately, the AEC was replaced by the Energy Research and Development Administration, whose politically appointed leaders had no experience in or understanding of reprocessing and in particular the difference between successful facilities and those based on laboratory concepts that had failed and resulted in proliferation and proliferation threats. They reassigned headquarters program responsibilities for reprocessing from those who knew about successes and failures to those who did not. Management responsibilities were reassigned from Du Pont to ORNL.

"Du Pont designs that would have resolved problems were set aside in order to support reprocessing concepts that had failed, and research on other laboratory reprocessing concepts that had no potential for success. Presidents Gerald Ford, Jimmy Carter and Ronald Reagan did not seek and were not provided information about reprocessing facility designs that would have resolved problems.

"Failure of ERDA and DOE officials to distinguish between successful reprocessing technology and laboratory concepts that resulted in proliferation led to the U.S. myth that:

"reprocessing is a proliferation threat;

"flawed U.S. policies and programs based on that myth;

"no plan or program for responsible disposal of nuclear wastes or efficient use of nuclear materials; and

"the thirty-plus year moratorium on new nuclear power plants in the U.S.

"This moratorium, combined with concern about atmospheric pollution from coal-fired power plants, resulted in use of natural gas for all new electric generating plants, which has resulted in huge cost increases for natural gas to heat homes, increased imports and other problems and challenges.

"The need to end our addiction to imported oil is an important incentive for the end of the moratorium on nuclear power plants. Additional plants are being considered and will likely be built and operated safely and successively. But there are no plans for reprocessing to permit efficient use of nuclear materials or responsible disposal of nuclear wastes.

"The DOE and its laboratories are aware of the need for reprocessing. In July 2005 an Argonne National Laboratory (ANL) official testified to Congress that ANL's pyrometallurgical process was proliferation-resistant and would be needed to reprocess used fuel from future nuclear power plants.

"In 1991, the DOE's Office of Nuclear Energy asked me to evaluate ANL's pyrometallurgical process in order to develop criteria for a planned demonstration that had been endorsed by DOE officials, an ANL peer review group and a committee of the National Academy of Sciences.

"Major deficiencies were identified. Of most concern were high plutonium losses and great difficulties for measuring nuclear materials, which would permit an undetected diversion of significant amounts of plutonium. The process would not be proliferation resistant but a serious proliferation threat. These and other deficiencies were reviewed with DOE and ANL officials and staff and many others. No significant disagreement with findings was expressed.

"The DOE was established in 1977 to address energy challenges resulting from U.S. inability to recover enough oil to meet U.S. demands, and recognition that within several decades the world would be unable to meet world demands. It has:

"spent most of a trillion dollars and accomplished virtually nothing of value;

"failed to provide full and accurate information to Americans about the importance of nuclear power, the increased safety and performance of nuclear power plants as a result of coordinating efforts of the Institute of Nuclear Power Operators, and limitations of some energy sources such as solar generated electricity;

"failed to correct false allegations of great dangers of nuclear waste stored at DOE sites which has resulted in wasteful expenditures of scores of billions of dollars and greater dangers and radiation exposure to humans than if the work had not been done;

"failed to correct false allegations that plutonium is highly toxic and low levels of radiation are dangerous,

"dismissed all competent corporations that successfully managed activities,

"never addressed the indefinite proliferation threat from creation of geologic deposits of enough plutonium and neptunium-237 at Yucca Mountain to produce 120,000 nuclear weapons, and

"lost ability to produce nuclear materials needed for space exploration, defense, medicine, industry, research and other important applications.

"Its inability to produce tritium for nuclear weapons led to its production in nuclear power plants, a violation of nuclear nonproliferation policies of virtually all nations. Its inability to produce plutonium-238 needed for electric power for space vehicles such as Galileo at Planet Jupiter and Cassini at Planet Saturn has resulted in need to purchase this material from Russia, and plans for its production by laboratory personnel in laboratory facilities, a violation of good safety and management practice.

"The following ideas for a new approach are based on lessons learned from experiences that would avoid problems inherent in government and government laboratory management of complex technology and help resolve energy and nuclear technology challenges. They were initially proposed in my paper presented at the 1996 meeting of the Global Foundation (University of Miami Center for Theoretical Studies) in November 1996 and subsequently provided to and/or discussed with President Bill Clinton, Vice President Al Gore, former and present Senate Energy Chairmen Frank Murkowski and Pete Domenici and many others.

"A U.S. Energy and Nuclear Technology Board with ex-officio members and those appointed by The President with the advice and consent of The Senate that would meet periodically to recommend long-term energy and nuclear technology plans, policies, and strategies for America

"Competent corporate instead of government management of energy and nuclear technology

"Beneficial use of nuclear materials instead of their disposal

"Full and accurate information to Americans about nuclear technology and limitations, challenges and/or non-viability of alternative energy sources

"Revitalization of President Eisenhower's vision of Atoms for Peace, with cooperation among nations for full use of well safeguarded, well managed, and well conceived nuclear technology for peaceful purposes

"Partnership-type actions between workers and managers to resolve concerns about nuclear safety and nuclear materials safeguards, and between regulators and those regulated to ensure the best safety, productivity, and cost effectiveness of nuclear power plants and other licensed nuclear facilities.

"All responses were positive. That from Vice President Gore said that ideas would be considered. At the Global Foundation meeting the following year, Nuclear Regulatory Commission Chairman Nils Diaz said that Senators Domenici and Murkowski supported ideas for a new approach for use of nuclear technology.

"I propose that we form a "Partnership for America" to further develop and implement these ideas for a better approach to resolve long-neglected energy and nuclear technology challenges and avoid adverse consequences inherent in government management of complex technology. I also propose that the U.S. Energy and Nuclear Technology Board, corporations that manage energy and nuclear technology and our partnership adopt the core values of safety, health and the environment, ethics and respect for people that have been exceptional constants of Du Pont for 204 years.

"I hope that you will help form and participate in this partnership.

"Best wishes!

"Sincerely,

"Clinton Bastin"

Response to Mr. Clinton Bastin comment of March 17, 2006

DOE/EA-1547 evaluates the potential impacts of sodium residuals removal only, and does not revisit previous DOE decisions concerning the potential reuse of the FFTF as a nuclear reactor. Those decisions and decision documents are discussed in the EA. Based on the evaluation performed in the EA, if a FONSI decision were to be issued, it would constitute a determination by DOE that the impacts were evaluated and found to be not significant enough to require preparation of an EIS, and that DOE may proceed to implement the proposed action. This comment has been forwarded to the Office of Nuclear Energy for consideration in the GNEP EIS.

From: Kris and GaryTroyer [mailto:kgtroyer@charter.net]
Sent: Friday, March 17, 2006 08:42 AM
To: Chapin, Douglas H
Subject: Comments regarding the Environmental Assessment for residual sodium removal at the FFTF

The following comments are with regard to US DOE request for public comment on the proposed Environmental Assessment affecting the status of the Fast Flux Test Facility at the Hanford Site in the State of Washington.

For the record, these comments should also be considered with on-going public comment period on decision processes for the remainder of the Hanford site. Please include them there, since proper use of the FFTF voids inclusion in the global site planning.

I am aware of several significant items documented by the US DOE and requested by Congress relating to current and emergent energy needs. These build into the Global Nuclear Energy Partnership (GNEP) recently agreed to by the USA and many other nuclear capable countries. This is literally a 180' reversal of energy policy during the momentum of the illegal destruction path in progress for the Fast Flux Test Facility (FFTF). In concert with these initiatives is the pending Federal Registry request for public and private proposals for full advanced nuclear fuel cycle demonstrations anchored on liquid metal cooled advanced burner reactor technology. These emergent concepts are in direct mapping to existing, unused, and under-utilized facilities within the US DOE complex and particularly at Hanford.

I am aware of or in possession of several documents of significance which shows incorrect and likely illegal actions related to the deactivation of the FFTF. Directives, direct wording, and actions show that the intent of the DOE is to decommission the FFTF, not de-activate. This means that if actions are continued, it will illegally succumb to destruction at a time when its technology and infrastructure are desperately needed for the Advanced Fuel Cycle Initiative, the GNEP, and the fast track required for the US to have any timely response to its long term energy needs.

For example, there is a better way of removing residual sodium. Steam has been described by the International Atomic Energy Agency as too dangerous. Two much more benign approaches can be used. The first is merely cap off with existing inert cover gas and close the doors. The second is removal through commercial ammonia process followed by inert gas cap. Both leave the FFTF in a recoverable situation suitable for consideration in the above national policy programs. The EIS alternative 'preserve and make ready for use' is the proper path.

A proposal exists to cut piping out of the containment system. This destroys containment and violates the Record of Decision to only de-activate. This is a decommissioning action that disallows EIS consideration of all options, among these, mothballing, re-utilization, entombment, or green field. The preferred option is 'preserve and make ready for use' in light of emergent policy changes.

The wording of a 'liquid metal cooled advanced burner reactor' is double speak for the fourth generation (GENIV) metal sodium cooled reactor technology demonstrated by the FFTF. We have the initial research reactor in place for this effort. It has a fully NRC approved site for construction. It has proven containment. It has proven performance. The rapidly emergent nuclear energy policy today changes the entire situation heretofore promoted for not using the FFTF. Due to this change, at least the systems must be maintained in a benign and re-useable state until all options are properly considered.

I am also aware of and have participated in discussions of private business operations of the FFTF. Prior to the economically destructive action of drilling the core for sodium removal, a medical isotope venture was viable at all levels. Since those decisions, the US DOE/IG has reported that our country is in serious shortfall of medical and industrial isotope production addressed by the business plan. The ground has changed with both fact and policy. It would be criminal to continue the path to destruction of taxpayer paid resources obviously desperately needed. The proper decision at this time is 'preserve and make ready for use'.

It is illustrative that the former Secretary of Energy Abraham is now employed by a foreign body promoting the infrastructure that he had a hand in directing deactivation. The importance of this technology and resource is obviously very high. The energy picture for the US and the world has dramatically changed in the interim of these events. The proper action at this time is 'preserve and make ready for use'.

Respectfully

Gary L. Troyer
Nuclear Scientist
614 Cottonwood
Richland WA 99352
(509) 946-3425
Chair - Citizens for Medical Isotopes

Response to Mr. Gary L. Troyer comment of March 17, 2006

DOE/EA-1547 evaluates the potential impacts of sodium residuals removal only, and does not revisit previous DOE decisions concerning the potential reuse of the FFTF as a nuclear reactor. Those decisions and decision documents are discussed in the EA. Based on the evaluation performed in the EA, if a FONSI decision were to be issued, it would constitute a determination by DOE that the impacts were evaluated and found to be not significant enough to require preparation of an EIS, and that DOE may proceed to implement the proposed action. This comment has been forwarded to the Office of Nuclear Energy for consideration in the GNEP EIS.

Information which allow for the safe use of the superheated steam process to react sodium residuals is describe in responses on pages 6 and 12. The comment offers two alternative residual sodium approaches. Capping off the system with the existing inert cover gas is equivalent to the no action alternative considered in the EA. The use of the ammonia process was considered by the EA and identified as a potential technology which could be implemented on a small scale at FFTF.

John T. Baxter
3104 W. 46 th
Kennewick, WA 99337
USA
Phone: 509 582-7620

March 17, 2006

Douglas H. Chapin
NEPA Document Manager
U.S. Department of Energy
P.O. Box 550, Mailstop A3-04
Richland, Washington 99352

Reference: Draft Fast Flux Test Facility Environmental Assessment (EA) for Proposed Sodium Residuals Reaction/Removal and Other Deactivation Work Activities

Dear Sir:

Section "2.1.4 Remove Large Components for Cleaning" of the reference document discusses the use of the Large Diameter Cleaning Vessel (LCDV) in the MASF building for cleaning large components of contaminated sodium contents. This would require some retrofit for the existing installation.

HISTORY

I assembled a team of engineers in late 1990 to look at upgrading the qualification of the existing MASF facility for moderate hazard operations. The goal of the analysis was:

"The analysis objective was to perform an engineering analysis of the facility, which demonstrated that the high bay portion met or exceeded SDC-4.1, (1989), seismic and wind design requirements for use as a moderate hazard facility."

This qualification was needed to support the Fast Flux Test Facility (FFTF) spent fuel off-load program.

During conduct of this facility re-analysis, we discovered that the main foundation anchor bolts for the rigid frames supporting the low and high bay portions of the building were probably off lower capacity than assumed in the original design analyses for the building. The following is an excerpt from the draft analysis report that was never issued because of a stop work issued in April, 1991.

"RESULTS

The MASF is located in the 400 Area on the Hanford Site. The Title II Engineering Report describing the design was issued by the Norman Engineering Co. in 1980. According to this report the building structures were 'designed to protect and maintain the functional capability of the building and components during and after a natural disaster according to UBC section 2312, seismic zone 2 and wind-pressure-map area of 25 pounds per square foot, per UBC table 23-F. (1976 UBC)'

High Bay Column Anchor Bolts

The high bay is nominally 105' high, 145' long and 97' wide. The primary steel structure consists of 8 very heavy rigid bents spaced 20' apart. The bents are made up of a tapered girder supported by built up columns. Each column is anchored to a 4' by 7' reinforced concrete foundation pier with 8 bolts (see pages A-4,5). Bolts are 2.5" diameter, 5'-11" long, fully threaded and made from quenched and tempered ASTM A449 steel. Bolts with 8 equally spaced heavy hex nuts are embedded 4'-0" into the pier. Some piers have less reinforcing steel than others. After the columns were erected and grouted in place, a nominal 7 kip preload was applied to each bolt and the base was encased by a 2' concrete slab.

Low Bay Column Anchor Bolts

The low bay is nominally 46' high and also 145' long and 97' wide. The primary steel structure consists of 7 rigid bents spaced 20' apart. The bents are made up of a tapered girder supported by W36x230 columns. Each column is anchored to a 2.5' by 5' reinforced concrete foundation pier with 4 bolts (see pages A-4,5). Bolts are 1.75" diameter, 5'-11" long, fully threaded and made from quenched and tempered ASTM A449 steel. Bolts with 5 heavy hex nuts spaced in the upper 30" are embedded 4'-0" into the pier. All piers are equally reinforced. After the columns were erected and grouted in place, a nominal 4 kip preload was applied to each bolt and the base was encased by a 2' concrete slab.

Unusual Features of the Design

Anchor bolts are typically designed so that strength is controlled by the ductile capability of the steel, that is any failure will be in the bolt under a tensile load. The bolt terminates in a hook or a sturdy end plate that is sized so that the pull out capability is greater than the tensile strength of the steel bolt material. There is a large body of experimental and historical data available on the capability of this conventional design.

The MASF design is unconventional in that there is no hook or end plate. Pull out is resisted by a series of heavy hex nuts spaced 6" apart on a fully threaded bolt. A limited literature search has been made but no test data has been found on the capability of this configuration."

RECOMMENDATION

We developed capacity estimates for the anchor bolts which indicated that they had about 50 percent of the capacity required by the original design analyses from Norman Engineering. This finding eventually led to the decision to construct the separate Fuel Storage Facility rather than modifying the existing MASF building for the fuel off-loading program. I've done additional literature search on the question of the structural capacities of the existing MASF anchor bolts. I've included one key report in the references listed below. A reasonable estimate of the existing anchor bolt capacities can be established by assuming the anchor bolts are large deformed reinforcing steel bars, calculating a required development length using current ACI codes, and comparing the required development length to the embedded length of the anchors in the MASF building column pedestals.

Any future use of the existing MASF facilities for radiological operations should take into account the potential inadequacies in the original anchor bolts design and installation.

ADDITIONAL REFERENCES

Design Drawings

H-4-62201	Rev 2	Typical Details and General Notes
H-4-62202	Rev 2	Foundation Plan
H-4-62203	Rev 3	First Floor Framing Plan
H-4-62204	Rev 2	Concrete Sections and Details - 1
H-4-62230	Rev 0	Steel Framing Sections & Details - 3

Previous Analyses

MASF 8978	Title II Report by Norman Engr. (1980)

Documents

Rehm, Gallus, 1961, "Uber die Grundlagen des Verbundes fur Stahlbeton," Publication 138 of the Deutscher Ausschuss fur Stahlbeton, p. 59, William Ernst & Sohn, Berlin (Translation from the Cement and Concrete Association, London, Translation 134, The Basic Principles of the Bond Between Steel and Concrete, Cj. 134(9/68))

Cordially yours;

(Signature on hard copy in U.S. Mail)

John T. Baxter, P.E.

Response to Mr. John T. Baxter comment of March 17, 2006

The MASF structural analysis for seismic hazard identified was performed to assess a change in mission for the MASF facility to allow the storage of fuel assemblies. As stated in the comment letter, a result of the analysis was the decision to not increase the hazard capability at MASF. The original mission of MASF remained unchanged. MASF's mission includes the maintenance, storage, and cleaning of radioactive hardware, including the removal of residual sodium from large components. The MASF is considered adequate for the radiological operations considered under the proposed action.

OFFICIAL COMMENTS
DOE SOLICITATION FOR A HANFORD
ENVIRONMENTAL ASSESSMENT
February 17, 2006

The following comments are herein officially submitted with regard to US DOE request for public comment on the proposed Environmental Assessment which affects several Hanford issues including the status and ultimate disposal of the Fast Flux Test Facility at the Hanford Site in the State of Washington.

For the record, these comments should also be duly considered with the on-going public comment period on decision processes for the remainder of the Hanford site. It is expected that this input will be a finite contributing portion of the legally required NEPA process; and/or, those public comment requirements required in the CERCLA approval process, if legally applicable. If the request for public comment is independent of both NEPA and CERCLA, I would appreciate being so informed, including the reason if these two regulatory laws are not one of the drivers. Please note that the FFTF must be placed in its proper and legal and appropriate position in several DOE public announcements now in progress.

I am aware of several significant items documented by the US DOE and requested by Congress relating to current and emergent isotope and energy needs. These include two programs addressed by the Inspector General: namely Pu238 production (a national defense issue) and the wholly inadequate supply of medical isotopes for both national research as well as public health. In addition, there is the Global Nuclear Energy Partnership (GNEP) recently agreed to by the USA and many other nuclear capable countries. These new programs represent literally a 180 degree shift in energy policy during the process of planning the ultimate disposition and decommissioning for the Fast Flux Test Facility (FFTF). This reversal in policies places the planning base for the FFTF almost totally in error. Is it going to be corrected? If not, why not?

How is DOE responding to these major changes in policy? When and where does a need for a test reactor arise? How many years could be saved in the national and perhaps the world energy program should the FFTF be renovated and used. This is a multi-billion dollar question; and, I for one insist upon a straight and honest answer from DOE.

These new policies could very likely use the irradiation test capabilities of the FFTF.
What about other billion dollar facilities (some existing; some unused) within the US DOE complex and particularly at Hanford. Will this programmatic facility problem be addressed within the context of the new energy policies? I request as answer as both a taxpayer, as well as a nuclear and business professional.

Because of the horribly outdated planning base on the FFTF, I am aware of incorrect and likely illegal actions in documents related to the deactivation and decommissioning planning of the FFTF. Directives, direct wording, and actions show that the intent of the DOE is to decommission the FFTF, not de-activate which appear to be in direct contradiction of Judge Shea's federal court ruling.

The FFTF is in a recoverable situation (see alleged statements and/or documentation) suitable for consideration for possible use in the above national policy programs. The EIS alternative 'preserve and make ready for use' is the proper temporary path until a thorough and unbiased evaluation can be accomplished [both for new program potential usage as well as the ultimate decommissioning]. This I strongly endorse.

OTHER CONCERNS

A proposal exists to cut piping out of the containment system. This destroys containment (and all of its potential monetary value) and violates the Record of Decision to only de-activate. This is an outright decommissioning action in violation to Judge Shea and disallows EIS consideration of all options, among these, mothballing, re-utilization, entombment, or green field. My preferred option is 'preserve and make ready for use' in light of emergent policy changes.

The FFTF as well as its major support facility—the FMEF—have been reviewed and approved by NRC as an acceptable site for nuclear processes. It has proven containment. It has proven performance. It has been reviewed for seismic adequacy.

The rapidly emergent nuclear energy policy today changes the entire situation heretofore erroneously planned and promoted for not using the FFTF. Due to the recent change in national policies, at least, at a minimum, the systems must be maintained in a benign and re-useable state until all options are properly and legally considered.

The era of THE EMPEROR WEARS NO CLOTHES must, and will end. Stop manipulation and be direct and honest. This is one of the initial activities that starts this rejuvenation. Let us do it ethically, legally, and technically correct for the good of the nation.

Respectfully

Ralph E. Johnson

Response to Mr. Ralph E. Johnson comment of March 17, 2006

DOE/EA-1547 evaluates the potential impacts of sodium residuals removal only, and does not revisit previous DOE decisions concerning the potential reuse of the FFTF as a nuclear reactor. Those decisions and decision documents are discussed in the EA. Based on the evaluation performed in the EA, if a FONSI decision were to be issued, it would constitute a determination by DOE that the impacts were evaluated and found to be not significant enough to require preparation of an EIS, and that DOE may proceed to implement the proposed action. This comment has been forwarded to the Office of Nuclear Energy for consideration in the GNEP EIS.

From: Ralph Johnson [mailto:linktech@ix.netcom.com]
Sent: Sunday, March 19, 2006 01:37 PM
To: Subject: SUPPORT NEPA FW: Give Back Power to the People - A Canada Story 3-19-06

THE LATEST FROM OUR NEPA EXPERT, CONSULTANT, AUTHOR.

From: C ECCLESTON [mailto:ecclestonc@msn.com]
Sent: Sunday, March 19, 2006 12:56 PM
To: Ralph Johnson & others

Subject: Re: Give Back Power to the People - A Canada Story

Amen! Canada has since passed an Environmental Impact Assessment process patterned after guess what - NEPA!

Now if DOE would prepare a P-EIS (as it should) for a national energy program perhaps it, with a little help from citizens who will ultimately pay the bill, could develop a comprehensive strategy for making this nation energy independent.

Charles Eccleston
----- Original Message -----
From: Carl Holder
To: Ralph Johnson & others

Sent: Friday, March 17, 2006 7:36 PM
Subject: Give Back Power to the People - A Canada Story

More proof that a National Environmental Policy Act planning approach with judicious amounts of public comment is a process that is shown, time and time again, to work. I applaud USDOE's Global Nuclear Energy Partnership process that brings NEPA EIS planning alongside Departmental decision-making.
Best regards,
Carl

-----Original Message-----

Give back power to the people
100 years ago Ontarians voted for hydro power over coal. McGuinty must hear citizen voices again, say *David Suzuki and Paul McKay*

Mar. 13, 2006. 01:00 AM

Facing an imminent power crisis, Ontario Premier Dalton McGuinty appears poised to hit the political panic button and launch $70 billion in new power plant spending — half of it on nuclear reactors. It will be the largest infrastructure investment in provincial history.
But he needs to keep a cool head and first take close counsel from those who best know how to save billions and avert catastrophe: the public. The proof of that is in Ontario's past.
Exactly a century ago, Ontario faced a similar crisis.
It was utterly dependent on imported Pennsylvania coal for urban electric power, industry, street lighting, home heating, trains and tramways. That coal also cloaked cities like Toronto and Hamilton in soot every winter and smeared the summers with smog.

When U.S. miners went on strike, the coal barges stopped coming. Punishing prices followed.
Everyone suffered — except a handful of millionaire moguls who then owned private monopolies on coal supply, power production, electric utility distribution, even public transit routes.
Pleas for price relief and replacement coal supplies went unheeded. The moguls, aptly vilified as "The Electric Ring," gouged on.
One, Henry Pellatt, literally built a castle with his profits a few blocks from Toronto's worst slums. Called Casa Loma, it featured 5,000 electric lights and an indoor swimming pool, bowling alley, rifle range, and roller skating rink.
The power crisis crippled Ontario's manufacturing sector, sparked a public uproar, and galvanized a Conservative premier, James Whitney, into provisionally creating North America's first government electric utility. Then, backed by municipal politicians, he initiated an unprecedented series of public referendums in dozens of cities and towns.
The sole ballot issue was whether to maintain the moguls' coal monopoly, or adopt the plan of Whitney's charismatic ally, Adam Beck. He wanted to build the world's biggest hydro power plant at Niagara, and string wires to bring its "white coal" to all of southern Ontario. With public money.
Town by town, city by city, Ontario citizens vigourously debated and then voted on how their money would be spent. They made a brilliant choice.
Niagara soon provided a clean, cheap, reliable foundation for a modern Ontario economy. It is still running, perfectly, nearly a century later. It provides the province's lowest cost power, with zero pollution.
As Ontario grew, Beck's Niagara success was replicated with some 70 other hydro plants across the province. For the first half of the last century Ontario ran solely on clean, low-cost green power.
The giant utility which built and ran them was universally admired. And premiers garnered the political benefits. It was all applause, no headaches.
That changed in the 1970s, when Ontario Hydro began building a vast fleet of coal and nuclear plants at breakneck speed.
Each was bigger and more expensive than the last. New ones were designed and committed before earlier models were operated or even tested.
Virtually no thought was given to air pollution, or nuclear waste and reactor dismantling problems.
Morphing into the kind of arrogant monopoly the public had sacked a century ago, Hydro effectively told the public to shut up and leave the job to professionals.
The phrase "energy efficiency" was not in Hydro's lexicon. Instead, it goosed power demand by rewarding the biggest users with the cheapest rates and by hiding the capital cost and debt of each new power plant from the rate base until it began operating.
The result was that power appeared to be vastly cheaper than it was and a generation of factories, pulp plants, refineries, smelters, office towers, homes and commercial and public buildings were built to consume, consume, consume.
That meant Hydro had to build, build, build. So it hired some 10,000 engineers and technocrats to design, construct and run them.
By the late 1970s, Hydro was a 500-kilovolt colossus. Yet it planned to expand fivefold, warning that peak demand would reach 90,000 megawatts by 2006. To meet that, the equivalent of 180 new Pickering-sized reactors (or comparable coal units) would be required to avoid blackouts. A new one would have to be commissioned every month. No delays could be tolerated.
Those dire predictions were demolished, however, by reality and extensive public hearings under the aegis of the Porter royal commission.
Hydro's 2006 demand projection proved to be wrong by 60,000 megawatts, or the equivalent of 120 Pickering-sized reactors costing at least $1 billion each.
Sullenly, grudgingly, Hydro cut its expansion plan by half. Some $60 billion in planned public spending suddenly evaporated. So, miraculously, did the prospect of blackouts.
Despite this second lesson in the value of public debate, Hydro pressed on with building the Western world's largest nuclear plant at Darlington.
Citing imminent blackouts, it was exempted from public hearings under Ontario's new Environmental Assessment Act. Originally slated to cost $3.4 billion, it eventually cost almost $15 billion.
When Darlington's cost eventually hit the rate base in the early 1990s, another political backlash followed.

Undaunted, Hydro floated a $60 billion capital expansion plan that was shot down in a series of extensive public hearings held under the Environmental Assessment Act — largely because of Hydro's wonky numbers and an energy conservation strategy that was all posters, no program.
Once again, public hearings saved billions.
But that was soon erased by NDP premier Bob Rae, who imposed a three-year power price freeze, followed by a Conservative premier who vowed (before even inspecting Hydro's balance sheet) to maintain it for his entire term of office.
Mike Harris kept his word. The utility debt soared to almost $40 billion. Worse, a decade of artificially low power rates relentlessly goosed demand once again — and guaranteed the crisis now facing Dalton McGuinty.
What's the pattern here? Utility technocrats and politicians all too often spend other people's money recklessly. The public often spends it far more wisely, precisely because they have to earn it first.
A century ago, Ontarians actively chose a slate of power plants that have since excelled in performance, cost, and cleanliness.
Equally important, a pragmatic, progressive premier, Whitney, was wise enough to encourage full public debate, then show his deep respect for democracy by building what citizens chose: green power plants.
Similar stakes now face the Ontario public, and McGuinty. The $70 billion question is: Will the Premier let the public call the tune, or allow technocrats and nuclear soothsayers to trump informed choice?

Response to Mr. Ralph E. Johnson comment of March 19, 2006

See response of page 40.

Mar 17 06 07:00p Franklin Building 509-547-1888 p.1

Board of County Commissioners
BENTON COUNTY
P.O. Box 190 • Prosser, WA 99350-0190
Phone (509) 786-5600 or (509) 736-3080

Mr. Douglas H. Chapin, NEPA Document Manager
U.S. Department of Energy
Richland, Washington 99352

March 17, 2006

Public Comment: Environmental Assessment EA1547D

The Richland Office of the United States Department of Energy (US DOE RL) intends to scrap out the Fast Flux Test Facility with the work planned in the EA1547D seeking to create authority for decommission actions where no authority exists.

It would be appropriate that you are capable of providing NEPA compliance review to determine your authority under Procurement Rule 216. Past attempts to take this action in the FFTF Closure Project, under CERCLA process was denied by US DOE in front of U.S. District Court Judge Edward F. Shea in Benton County v US DOE in November 2002. A solicitation for the CP was cancelled on December 22, 2005. The reasons given by US DOE RL were budgetary priorities, and National Environmental Policy Act (NEPA) compliance. (See letter attached)

Washington State Department of Ecology and the US Environmental Protection Agency wrote letter, January 19, 2005, "Competing demands for increasingly scarce cleanup resources compel us to focus on those projects that have the greatest potential to address environmental risk: FFTF D&D is not one of those projects."

On February 18, 2006, President George W. Bush called for the Advance Energy Initiative. In response, the Secretary of the Department of Energy has announced the Global Nuclear Energy Partnership. www.gnep.doe.gov Your proposed actions would destroy utilization consideration for unique USDOE properties prior to completion of the court ordered NEPA EIS.

The Presidential Initiative is significant new information that requires NEPA evaluation. In fact, a Global Nuclear Energy Partnership Environmental Impact Statement has been announced. The GNEP presentation was made by Tim Frasier, US DOE HQ NE to Energy Communities Conference in Washington DC on March 9, 2006. Copy Attached. Notice in the Federal Register will soon be provided, and attached hereto.

Very truly yours,
Claude L. Oliver
Benton County Commissioner

Cc: DOE-IG, GAO

Response to Mr. Claude Oliver comment of March 17, 2006

DOE/EA-1547 evaluates the potential impacts of sodium residuals removal only, and does not revisit previous DOE decisions concerning the potential reuse of the FFTF as a nuclear reactor. Those decisions and decision documents are discussed in the EA. Based on the evaluation performed in the EA, if a FONSI decision were to be issued, it would constitute a determination by DOE that the impacts were evaluated and found to be not significant enough to require preparation of an EIS, and that DOE may proceed to implement the proposed action. This comment has been forwarded to the Office of Nuclear Energy for consideration in the GNEP EIS.

March 17, 2006
Mr. Douglas H. Chapin, NEPA Document Manager
U.S. Department of Energy
Richland, Washington 99352
Douglas_H_Chapin@RL.gov
Fax (509) 376-0177
Environmental Assessment EA1547D

I read that the Environmental Impact Statement forum for FFTF decommission will be rolled into the Tank Closure and Waste Management Environmental Impact Statement. The scope of this EIS deals with where to bury the FFTF carcass as it is torn apart.

This tactic would avoid any consideration of a NO ACTION alternative that is a good and valuable consideration alternative in the EIS process. There is no decommissioning authority.

With the announcement of the new Global Nuclear Energy Partnership and a companion Environmental Impact Statement, it is time to void decommission planning until the FFTF reactor and facilities are considered in the Presidential Advanced Energy Initiative, GNEP EIS.

Respectfully yours,
Dave Parmeter

Response to Mr. Dave Parmeter comment of March 17, 2006

DOE/EA-1547 evaluates the potential impacts of sodium residuals removal only, and does not revisit previous DOE decisions concerning the potential reuse of the FFTF as a nuclear reactor. Those decisions and decision documents are discussed in the EA. Based on the evaluation performed in the EA, if a FONSI decision were to be issued, it would constitute a determination by DOE that the impacts were evaluated and found to be not significant enough to require preparation of an EIS, and that DOE may proceed to implement the proposed action. This comment has been forwarded to the Office of Nuclear Energy for consideration in the GNEP EIS.

From: Brownell.Helen@epamail.epa.gov [mailto:Brownell.Helen@epamail.epa.gov]
Sent: Tuesday, February 21, 2006 3:33 PM
To: Chapin, Douglas H
Cc: Ceto.Nicholas@epamail.epa.gov
Subject: Draft National Environmental Policy Act Environmental Assessment for the Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, Fast Flux Test Facility Project, Hanford Site

A letter was sent on this subject to the EPA Hanford Project Office dated February 15, 2006, addressed to Nicholas Ceto, and requesting comments by March 17, 2006.

The EPA has no plans to review or comment on this document.

Helen Brownell
Office Manager
U.S. EPA Hanford Project Office
(509)376-6865
(509)376-2396 (fax)
brownell.helen@epa.gov

Appendix B

Finding of No Significant Impact (FONSI)

U.S. DEPARTMENT OF ENERGY FINDING OF NO SIGNIFICANT IMPACT

AGENCY: U.S. Department of Energy (DOE)

ACTION: Finding of No Significant Impact

SUMMARY: The U.S. Department of Energy (DOE) has prepared the "*Environmental Assessment, Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, Fast Flux Test Facility Project, Hanford Site, Richland, Washington*" (DOE/EA-1547F, March 2006). In this EA, DOE addresses a different approach to accomplish the ongoing deactivation work at FFTF that was not extensively discussed in the DOE final *Environmental Assessment, Shutdown of the Fast Flux Test Facility* (referred to as the 1995 EA, DOE/EA-0993, May 1995). The 1995 EA analyzed that FFTF sodium residuals would be maintained in an inert environment (under an argon cover gas) to prevent any chemical reactions during long-term surveillance and maintenance. In DOE/EA-1547F, DOE proposes reaction and removal of radioactively contaminated sodium residuals left over from the drain of the Hanford Site radioactively-contaminated sodium inventory (i.e., FFTF, Hallam Reactor, and Sodium Reactor Experiment) by reacting the sodium metal with water (as superheated steam) to produce caustic sodium hydroxide; removal of associated equipment/components, as required; and removal/disposal/stabilization of the resulting miscellaneous hazards and waste streams. Alternatives considered in the DOE/EA-1547F include: the No Action Alternative; alternative process technologies for removal and reaction of sodium residuals and associated equipment, including the Proposed Action (i.e., superheated steam); and alternative locations of sodium residual reaction cleaning station(s).

The DOE/EA-1547F does not address FFTF decommissioning activities i.e., final end state of the FFTF. That scope of work will be addressed in the Tank Closure and Waste Management Environmental Impact Statement.

Based on the analysis in the EA, and considering preapproval comments received (Appendix A of DOE/EA-1547F), DOE has determined that the proposed action is not a major federal action significantly affecting the quality of the human environment within the meaning of the "*National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4321, et seq.*" Therefore, the preparation of an Environmental Impact Statement (EIS) is not required.

ADDRESSES AND FURTHER INFORMATION:

Single copies of the EA and further information about the proposed action are available from:

Mr. Thomas W. Ferns
Acting NEPA Compliance Officer
U.S. Department of Energy
Richland Operations Office
P.O. Box 550, Mailstop A5-15
Richland, Washington 99352
Telephone: (509)376-7474
Fax: (509)376-0306

Email: Thomas_w_ferns@rl.gov

For further information regarding the DOE NEPA process, contact:
Ms. Carol Borgstrom, Director
Office of NEPA Policy and Compliance (EH-41)
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington D.C., 20585
Telephone: (202)586-4600
Fax: (202)586-7031
Email: Carol.Borgstrom@hq.doe.gov

PURPOSE AND NEED: The DOE final *Environmental Assessment, Shutdown of the Fast Flux Test Facility* (referred to as the 1995 EA, DOE/EA-0993, May 1995) addressed leaving and maintaining the FFTF radioactively contaminated sodium residuals under an inert gas atmosphere to prevent any chemical reactions during long-term surveillance and maintenance. The purpose of this proposed action is to continue to support long-term, low cost surveillance and maintenance (Phase II) of the facility in a safer and more stable condition with reduced risk to plant workers, the public, and the environment, prior to the final decommissioning end state of the FFTF. It would also maintain the continuity and momentum of FFTF deactivation activities using the advantage of existing knowledge and skills of current FFTF staff who have worked for many years within the confines of FFTF with the attendant sodium hazard (i.e., liquid-metal handling/cleaning expertise). The activities DOE now proposes to undertake include reaction and removal of radioactively contaminated sodium residuals, removal of associated equipment/components, as required, and removal/disposal/stabilization of the resulting miscellaneous hazards and waste streams. The proposed activities would be able to rely on existing staff with expertise in liquid metal handling/cleaning, minimizing risks to directly involved workers and other facility staff. Furthermore, it would eliminate having to maintain the inert cover gas system during the surveillance and maintenance phase, thus reducing costs.

BACKGROUND: The FFTF is a DOE-owned, formerly-operating, 400-megawatt (thermal) liquid-metal cooled (sodium) research and test reactor located in the 400 Area of DOE's Hanford Site near the City of Richland, Washington. Built in the 1970's, it was used between 1982 and 1992 to develop and test advanced nuclear fuels, materials, equipment, and reactor safety designs for the Liquid Metal Fast Breeder Reactor Program. The FFTF was used in ancillary experimental activities to produce a variety of medical isotopes. In December 1993, DOE decided not to further operate FFTF due to a lack of an economically-viable mission at that time and ordered shutdown of the facility. The 1995 EA evaluated the potential impacts associated with actions necessary to place the FFTF in radiologically safe and industrially safe permanent shutdown and deactivation condition (Phase I), suitable for a long-term surveillance and maintenance (Phase II) prior to decommissioning (Phase III). The 1995 EA did not evaluate Phase III. The 1995 EA proposed the sodium residuals remain in the main portions of the FFTF's piping and equipment, and be maintained in an inert gas atmosphere to prevent any chemical reactions during long-term surveillance and maintenance. DOE determined that an environmental impact statement (EIS) was not required for the permanent shutdown and deactivation of the FFTF, and issued a NEPA Finding of No Significant Impact (FONSI) decision with the 1995 EA.

In January 1997, DOE decided to maintain FFTF in standby pending an evaluation of a future role in DOE's national tritium production strategy. In December 1998, DOE decided FFTF should not play a role in production of the nation's tritium stockpile. Facility deactivation work continued under the 1995 EA, limited to activities that would not preclude reactor restart.

In December 2000, DOE published the *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility* (NI-PEIS, DOE/EIS-0310F) This NI-PEIS evaluated the role of FFTF as an alternative nuclear irradiation services facility to accomplish civilian nuclear energy research and development, medical and industrial radioisotope production, and production of plutonium-238 to support future National Aeronautics and Space Administration space exploration missions. Also evaluated was an alternative to permanently deactivate the FFTF. Based on the NI-PEIS, DOE decided in the Record of Decision (ROD) [66 Federal Register (FR) 7877, January 26, 2001], that the permanent deactivation of FFTF was to be resumed, with no new missions. Since that time, deactivation has continued, consistent with the 1995 EA and FONSI and the 2000 NI-PEIS and 2001 ROD. Major deactivation activities underway at this time include: washing the FFTF fuel to remove sodium, placing the fuel into dry cask storage, draining sodium systems, and deactivating auxiliary plant systems.

In February 2006, DOE announced its intention to prepare a Tank Closure and Waste Management (TC & WM) EIS for the Hanford Site (71 FR 5655). DOE decided to merge the scope of the FFTF Decommissioning EIS (69 FR 50176) to further coordinate resources and ensure a comprehensive look at environmental impacts at Hanford. In the TC & WM EIS, the potential decision for final decontamination and decommissioning of the FFTF would identify the final end state for the above-ground, below-ground, and ancillary support structures.

The DOE/EA-1547F is an interim action EA that examines the environmental consequences on an expanded deactivation workscope that was previously analyzed in the 1995 EA to evaluate a different approach to sodium residuals management. The 1995 EA analyzed that FFTF sodium residuals (i.e., material that remains on the walls of piping and components, or remains in pumps or vessels and other locations not readily drained) would be maintained in an inert gas atmosphere to prevent any chemical reactions during long-term surveillance and maintenance. The 1995 EA provides the foundation for most of the analyses of environmental impacts included in the DOE/EA-1547F as there have been relatively minor changes in environmental conditions at the 400 Area of the Hanford Site since 1995. As such, DOE/EA-1547F supplements or adds to the 1995 EA analysis of deactivation actions. Under the criteria of 40 CFR 1506.1, these actions would not be expected to have an adverse environmental impact or limit the choice of reasonable FFTF final decontamination and decommissioning alternatives under consideration in the TC & WM EIS.

PROPOSED ACTION: DOE proposes a different approach to accomplish the ongoing deactivation work at FFTF that was not extensively discussed and analyzed in the 1995 EA. DOE now proposes to remove radioactively-contaminated sodium residuals left over from the drain of the Hanford Site radioactively-contaminated sodium inventory (i.e., FFTF, Hallam Reactor, and Sodium Reactor Experiment) by reacting the sodium metal with water (as superheated steam) to produce caustic sodium hydroxide; remove associated equipment/components to allow removal of the sodium; and remove, dispose, and stabilize miscellaneous hazards and waste streams left over from the sodium drain. These activities will further support low cost, environmentally-safe, surveillance and maintenance activities at the FFTF.

Some of the specific issues discussed and evaluated in the DOE/EA-1547F include:

- the use of the superheated steam process (SSP) in-place or at designated cleaning locations to remove sodium residuals. [Superheated steam is where steam is superheated well above the boiling point of water before being injected into the preheated equipment/components (e.g., piping, valves, tanks, etc.) at controlled rates.]
- the locations where the reaction of sodium or sodium residuals associated with the sodium systems and equipment could be done (i.e., in-place or at designated cleaning locations), and the use of an alternative technology(s) in select situations for small-scale reaction of sodium residuals.

Other deactivation work activities discussed and evaluated in the DOE/EA-1547F include removal of associated equipment/components to facilitate removal of the sodium residuals; and removal, disposition, and stabilization of miscellaneous hazards and waste streams resulting from the sodium drain. These activities include:

- clean in-place vessels, components, and large-bore pipe (greater than or equal to 8-inch diameter) in primary and secondary sodium cooling systems
- remove small-bore pipe (less than 8-inch diameter), valves, and other components for reaction in a cleaning station
- remove large components for cleaning
- remove and package FFTF remote-handled special components (cesium trap, primary cold trap, and two vapor traps) for storage in the 400 Area pending final disposition
- remove/dispose of asbestos
- remove/stabilize existing hazards in conjunction with deactivating systems and equipment associated with sodium residuals
- remove/recycle/dispose excess deactivated equipment and components as necessary, and

- remove depleted uranium and/or lead shielding for recycling, reuse, or storage in the 400 Area.

ALTERNATIVES CONSIDERED: DOE/EA-1547F addresses a variety of alternatives to the proposed action, which included the No-Action alternative, alternative process technologies for removal and reaction of sodium residuals, and alternative locations of the sodium residual reaction station(s).

No Action Alternative. Under the No Action Alternative, the FFTF would continue to be deactivated as described under the 1995 EA. This alternative would leave the FFTF radioactively contaminated sodium residuals in place and maintained under an inert gas atmosphere to prevent any chemical reactions during long-term surveillance and maintenance.

Alternative Process Technologies for Removal and Reaction of Sodium Residuals and Associated Equipment Including the Proposed Action. Alternative process technologies for removal/reaction of FFTF sodium residuals were considered. These included water vapor, moist carbon dioxide, evaporation, and dissolution of sodium in ammonia (i.e., solvated electron solution).

Alternative Locations of Sodium Residual Reaction Station(s). Alternatives to the proposed locations of the sodium residual reaction stations (i.e., mobile unit, FSF stationary unit, and LDCV in MASF) were considered.

ENVIRONMENTAL IMPACTS: DOE/EA-1547F evaluates the potential environmental impacts of the proposed action and alternatives considered. Key impact areas are summarized below.

Impacts from Siting and Construction. Potential nonsubstantial impacts from siting and construction activities were considered similar to those associated with routine industrial activities. The areas associated with sodium residual cleaning stations are within the FFTF property protected area (PPA), which is already a highly disturbed area. The expected siting activities and their land use designation (i.e., industrial) were considered consistent with applicable DOE NEPA decisions. Specific ecological resource review(s) would be conducted, as appropriate, before any construction activities, with restrictions possibly applied, as appropriate. If cultural or paleontologic (i.e., fossils) resources were encountered during construction, all work would stop immediately and the Hanford Cultural Resource Center would be notified. Construction and operational activities would be consistent with Hanford Site biological resources management and mitigation strategy. No harmful radiological or toxicological exposure to workers or the general public are expected to occur, with construction materials handled consistent with routine industrial construction activities. Temporary particulate emissions would likely result from use of heavy equipment for excavation or materials transport; these emissions would be controlled using appropriate dust control measures compliant with applicable air quality standards.

Impacts from Routine Operations. The potential for release of radioactive emissions during routine activities exists. However, the emissions would be in compliance with DOE and other applicable guidelines and regulations. Some nonsubstantial radiological exposure for workers involved in the proposed activities could occur. Essentially no public exposure above that currently experienced from Hanford Site operations is anticipated as a result of activities. Furthermore, routine operations are not anticipated to provide additional exposure of toxic or noxious vapors to workers or members of the general public.

Waste Management: Essentially no environmental impacts from the transportation of liquid wastes would be anticipated as a result of the proposed action. Environmental impacts from the treatment/disposal of an estimated large quantity of waste water would be expected. The waste water meeting waste acceptance criteria would be disposed of at LERF/ETF in the 200 Areas (there would be no waste water discharged to the environment in the 400 Area). This waste stream would be treated and disposed of in a similar fashion as typical day-to-day operations at the existing LERF/ETF. The ETF routinely is used to remove toxic metals, radionuclides, and ammonia, and destroy organic compounds. No modifications to the existing LERF/ETF would be required to support the proposed action. Radioactive material, radioactively contaminated equipment, and radioactive mixed wastes would be appropriately packaged, stored, and disposed of at existing facilities on the Hanford Site. None of the materials would be anticipated to be generated in substantial quantities when compared to the annual amount routinely generated throughout the Hanford Site. Hazardous materials (e.g., asbestos) which may be removed or stabilized would be managed and reused, recycled, stored, or disposed of in accordance with applicable federal and state regulations.

Impacts from Postulated Accidents: DOE/EA-1547F discusses a range of reasonably foreseeable accident scenarios that could lead to environmental impacts. Based on current plant conditions, the residual volume of sodium remaining of approximately 15,000 liters or 4000 gallons remaining in portions of the FFTF plant systems is a small fraction of the bulk sodium inventory evaluated in the 1995 EA. Scenarios were related to sodium drain, storage, and reaction. These events include both high consequence and low probability and low consequence and high probability scenarios for the onsite (100 meters, 0.062 miles) worker and the maximally exposed individual offsite (i.e., approximately 7 kilometers or 4.5 miles).

The Maximum Reasonably Foreseeable Accident is postulated to be a large leak (due to growth of a metal defect in a storage tank) in the sodium storage facility. This accident is considered bounding, as it involves bulk sodium and not the residuals remaining after draining. In addition, the assumed 400 Area population of 1,000 persons considered in this 1995 EA analysis is now estimated at 400 persons. The entire inventory of the tank was assumed to discharge onto the steel floor of the secondary containment and to burn, releasing a sodium hydroxide aerosol plume. The calculated onsite dose consequence is 2.5 E-04 rem. The calculated offsite dose consequences is 3.9 E-04 rem. No latent fatalities due to radiation from this non-credible accident would be expected.

Of greater potential impact are the toxicological consequences of the sodium hydroxide plume from the postulated fire associated with the maximum reasonably foreseeable accident. The calculated onsite (100 meters [330 feet]) sodium hydroxide concentration is approximately 166 milligrams per cubic meter. The sodium hydroxide concentration at the site boundary (approximately 7 kilometers [4.5 miles]) was calculated to be approximately 0.05 milligrams per cubic meter. Based on the extremely low probability of occurrence, even if the consequences of such an event are as severe as calculated for the onsite worker, the extremely low probability of occurrence and administrative training and controls make the risks of a sodium fire from the proposed action small. The calculated offsite toxicological consequences of approximately 0.05 milligrams sodium hydroxide per cubic meter fall well below the applicable guidelines for offsite exposure. Further, it is noted that the projected effects from the maximum reasonably foreseeable accident are considered bounding for the proposed sodium residuals removal activities evaluated in this EA. While large quantities of sodium currently are being stored in the sodium storage facility, the sodium is not in molten form, thereby minimizing the probability of release.

Impacts from Transportation. No unique circumstances associated with the proposed transfer of waste water and solid wastes (predominantly low-level waste piping and components) from FFTF to the 200 Areas have been identified. The residual contamination associated with the rinsed piping and components is in a less dispersible form than the liquid sodium hydroxide solution, and therefore would be less likely to present an adverse impact to workers or the public.

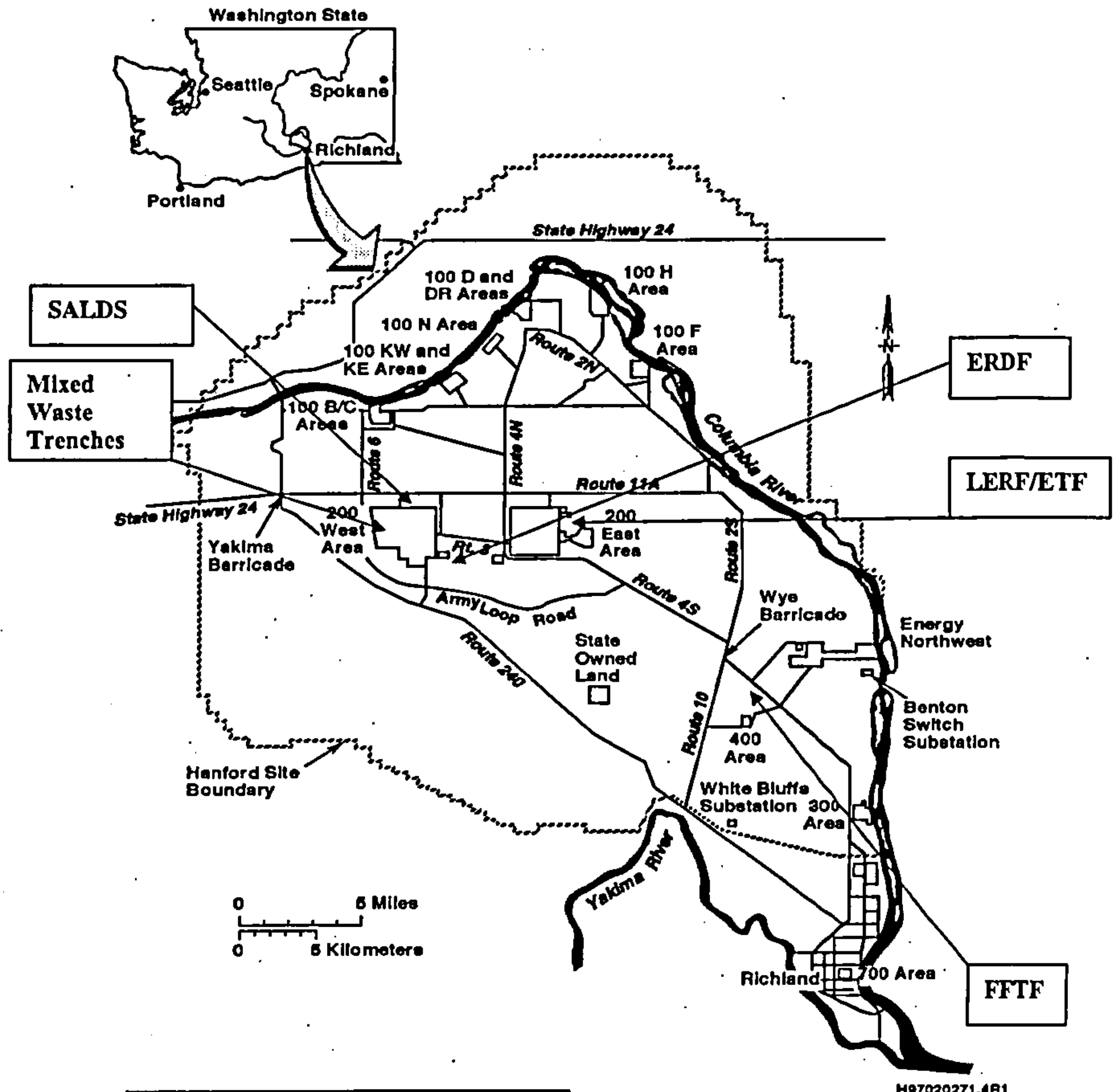
Socioeconomic Impacts and Environmental Justice. The proposed action would not result in substantial socioeconomic impacts. There would be no discernible impact to employment levels within Benton and Franklin counties. Based on the analyses in this EA, it is not expected that there would be any disproportionately high and adverse impacts to any minority or low-income populations.

Cumulative Impacts: The proposed actions would contribute minimal risks in addition to those associated with routine Hanford Site operations. The proposed actions also would reduce the potential for, and consequences of, inadvertent releases of radioactive and hazardous materials from FFTF. The proposed actions would result in a long-term decrease in radiation exposure, due to removal of residual sodium and the attendant radioactivity. The proposed action would involve existing operations personnel to the extent practicable; therefore, no substantial change in the Hanford Site workforce would be expected. There would be no adverse socioeconomic impacts or any disproportionately high and adverse impacts to any minority or low-income population of the community. The proposed action would result in radioactive air emissions consisting predominantly of tritium. Minimal public exposure to radiation above that currently experienced from routine Hanford Site operations would be anticipated as a result of these proposed actions. The low doses associated with the radioactive inventory within the scope of this EA would not result in substantial offsite public exposure. No adverse health effects to the public would be expected. The proposed action would result in minimal nonradioactive air emissions. No long-term groundwater impacts are anticipated. No long-term radionuclides would be present in waste waters generated from FFTF deactivation activities. The proposed action would result in liquid wastes that would be treated and disposed of in accordance with applicable regulations and a state waste discharge permit. Minimal impacts are anticipated from disposition of solid wastes and existing Hanford Site disposal facilities have the capacities to receive the estimated amount of cleaned piping and components associated with the proposed action. Hazardous materials (e.g., solvents, glycols, PCBs, asbestos) which may be removed or stabilized would be managed and reused, recycled, or disposed of in accordance with applicable federal and state regulations. None of the materials would be anticipated to be generated in substantial quantities when compared to the annual amount routinely generated throughout the Hanford Site.

DETERMINATION: Based on the analysis in the DOE/EA-1547F, and, after considering the preapproval comments received, I conclude that the proposed sodium residuals reaction/removal and other deactivation work activities associated with the FFTF Project at the Hanford Site do not constitute a major federal action significantly affecting the quality of the human health and the environment within the meaning of NEPA. Therefore, an EIS for the proposed action is not required.

Issued at Richland, Washington, this 31st day of March 2006.

Keith A. Klein
Manager
Richland Operations Office



ERDF - Environmental Restoration Disposal Facility
LERF/ETF - Liquid Effluent Retention Facility/Effluent Treatment Facility
FFTF – Fast Flux Test Facility
SALDS – State-Approved Land Disposal Site

Figure 1. Hanford Site.

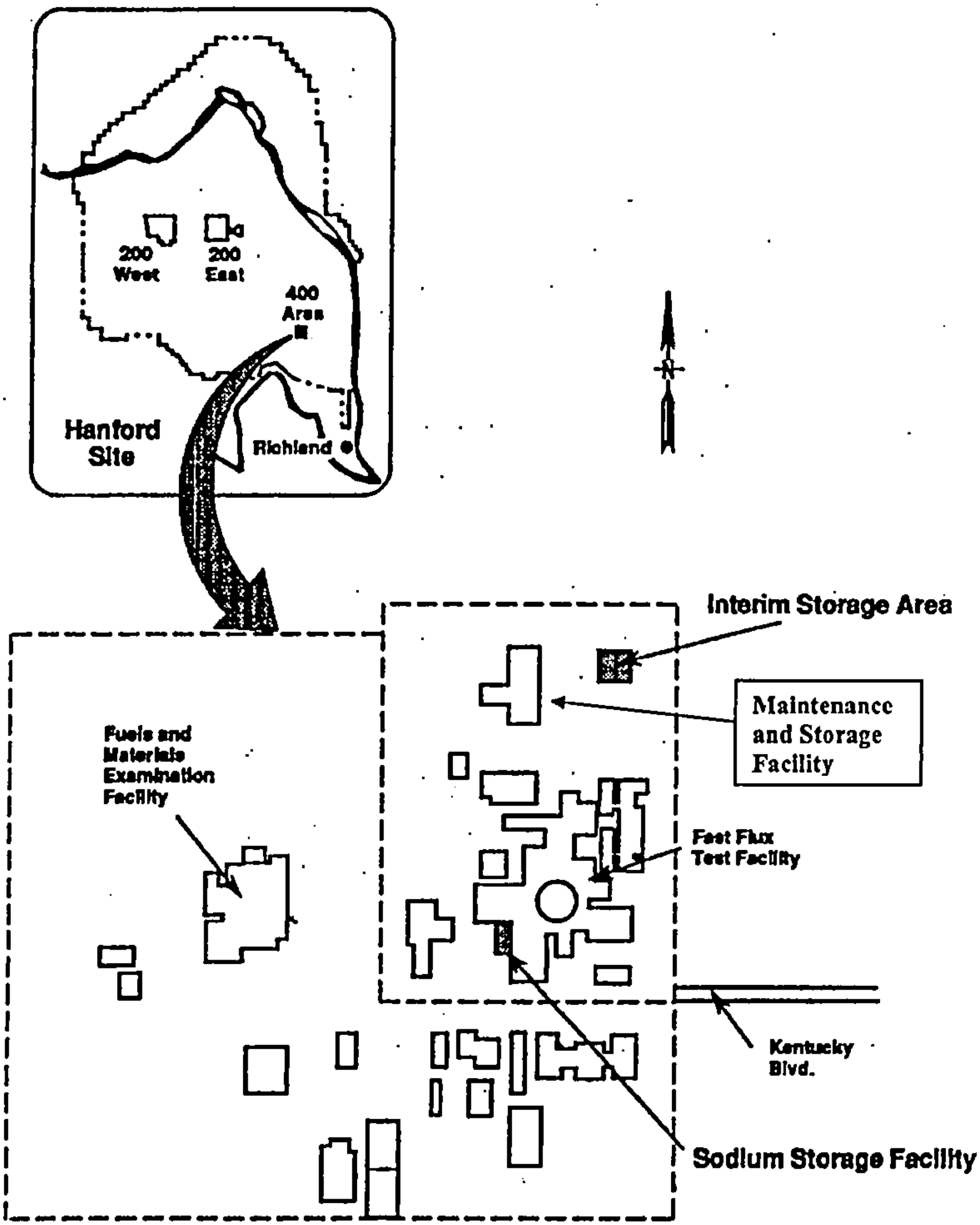


Figure 2. Fast Flux Test Facility; Associated Facilities Location.

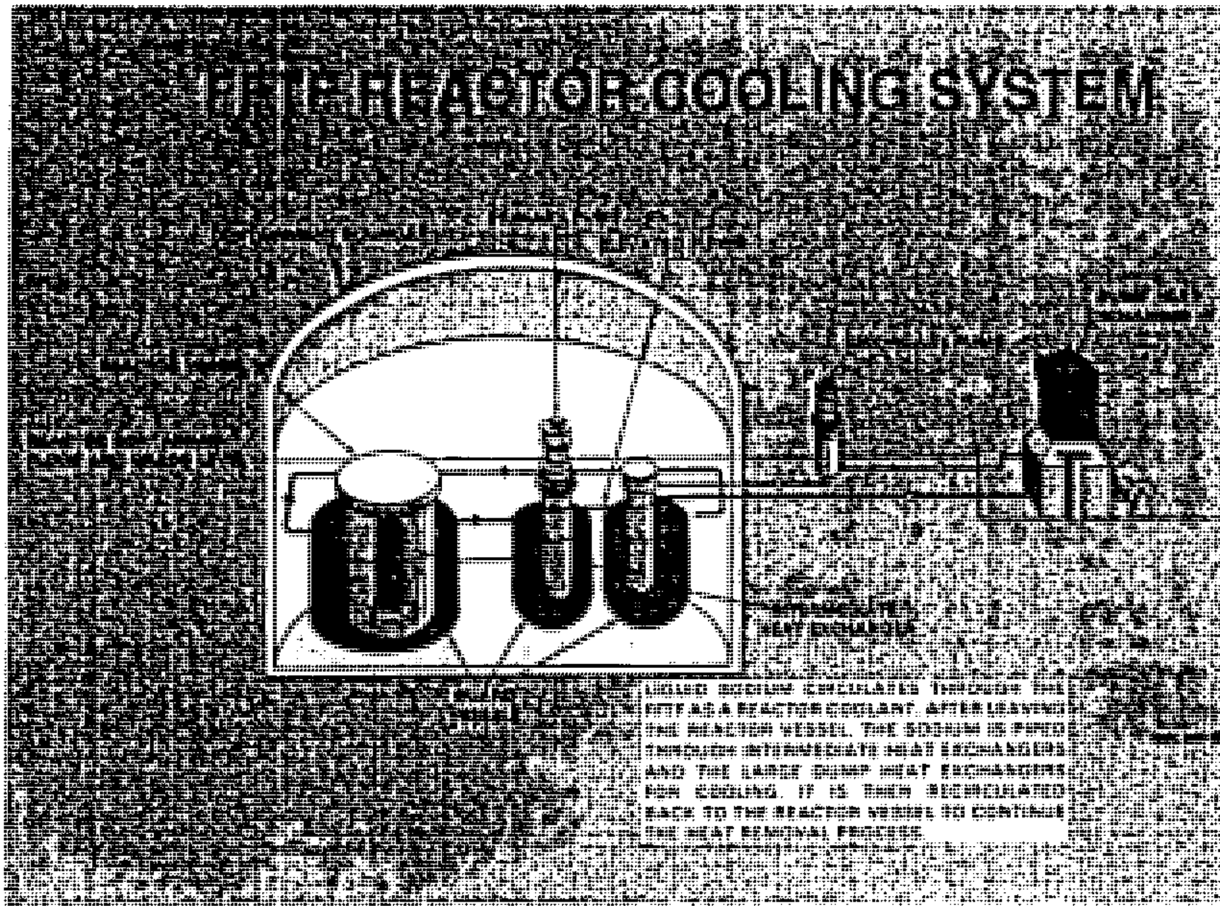


Figure 3. FFTF Reactor Cooling System.

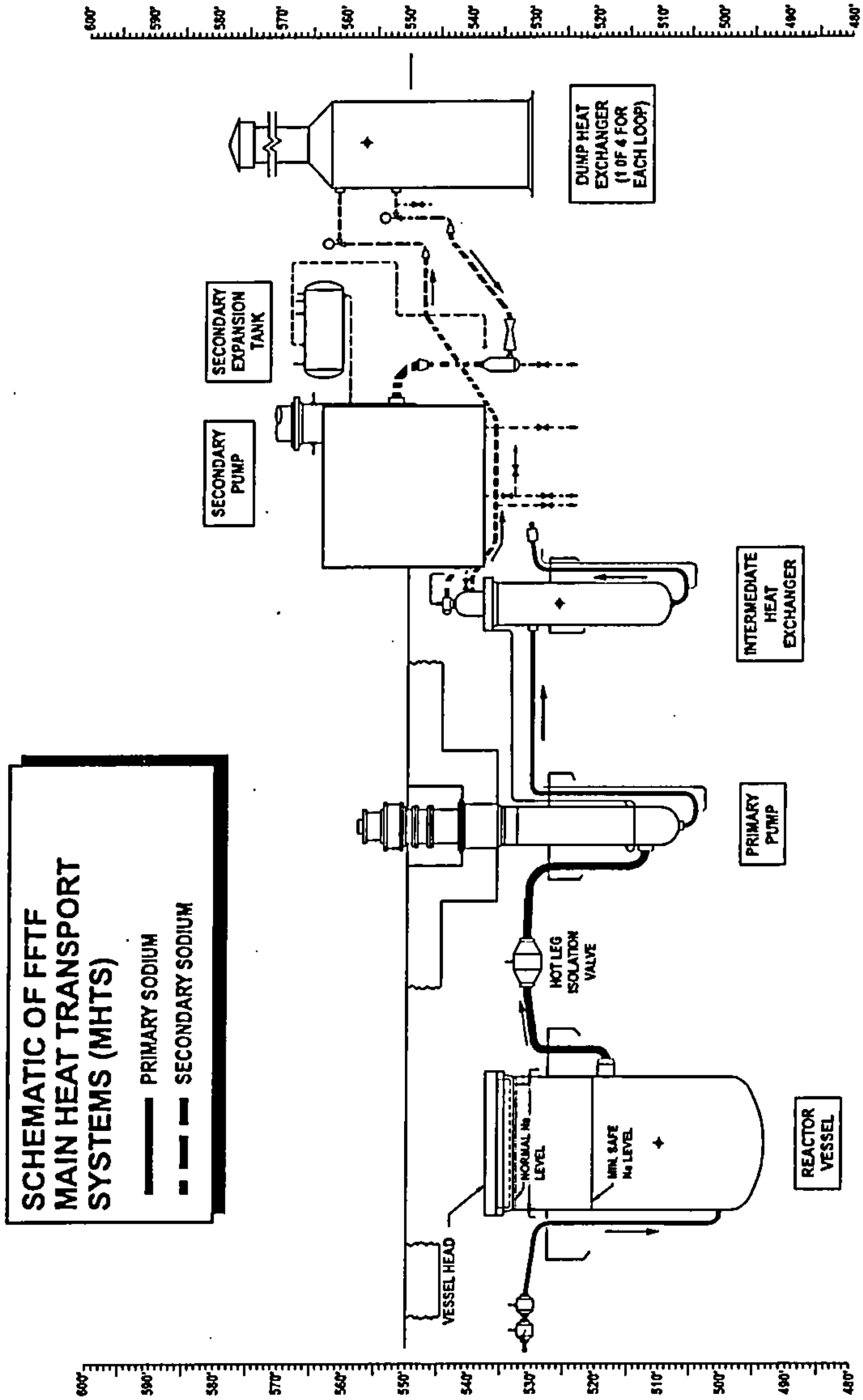


Figure 4. Schematic Showing FFTF Main Heat Transport System.