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Environmental Assessment

Environmental Assessment for the Deactivation of the N Reactor Facilities

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ENVIRONMENTAL ASSESSMENT
FOR THE
DEACTIVATION
OF THE
N REACTOR FACILITIES

HANFORD SITE, RICHLAND, WASHINGTON

U.S. DEPARTMENT OF ENERGY

SUMMARY

This environmental assessment (EA) provides information for the U.S Department of Energy (DOE) to decide whether the Proposed Action for the N Reactor facilities warrants a Finding of No Significant Impact or *requires the preparation of an environmental impact statement (EIS)* The EA describes current conditions at the N Reactor facilities, the need to take action at the facilities, the elements of the Proposed Action and alternatives, and the potential environmental impacts As required by the *National Environmental Policy Act of 1969* (NEPA), this EA complies with Title 40, Code of Federal Regulations (CFR), parts 1500 - 1508, "Regulations for Implementing the Procedural Provisions of NEPA " It also implements the "National Environmental Policy Act, Implementing Procedures and Guidelines" (10 CFR 1021)

The N Reactor operated in the 100-N Area of the Hanford Site from 1963 until 1987 The N Reactor facilities are currently in a surveillance and maintenance program, and will eventually be decontaminated and decommissioned (D&D) Operation and maintenance of the facilities resulted in conditions that could adversely impact human health or the environment if left as is until final D&D These conditions include the presence of contaminated liquids, sediment, and equipment, small amounts of irradiated fuel fragments, hazardous substances, loose surface contamination, and unsealed penetrations between building interiors and the environment In addition, many support systems that are no longer needed are still active These conditions, coupled with proximity to the Columbia River, present the potential for an environmental release or for exposure to workers, and require higher surveillance and maintenance costs The conditions also will require increased maintenance in future years to protect against releases and ensure worker safety The DOE needs to place the facilities in a condition that protects human health and the environment and reduces costs for surveillance and maintenance

The Proposed Action would deactivate the facilities to remove the conditions that present a potential threat to human health and the environment and to reduce surveillance and maintenance requirements The action would include surveillance and maintenance after deactivation. Deactivation would take about three years and would involve about 80 facilities Surveillance and maintenance would continue until final D&D, which is expected to be complete for all facilities except the N Reactor itself by the year 2018

The following activities would occur as part of the Proposed Action

- Existing equipment would be restarted to support deactivation activities
- Equipment fluids, hazardous substances and unattached equipment and materials would be removed and characterized, packaged, and transported to the 200 Areas for use, reuse, recycling, storage, or disposal as waste
- Basins and tanks would be drained, and contaminated water and residuals would be removed and transported to the 200 Areas for disposal
- The 105-N Fuel Storage Basin would be inspected for irradiated fuel fragments Fragments would be removed, packaged, and stored in the basin, until such time as decisions are made as to interim storage
- Contaminated water would be removed, pretreated in a facility specially-constructed in the 100-N Area, then transported to the Effluent Treatment Facility (ETF) in the 200 East Area for additional treatment and disposal to the soil

- Contaminated sediment, hardware, and pieces of lithium targets would be removed, packaged, and transported to 200 Areas for storage or disposal

- Irradiated fuel spacers would be removed and transported to the 200 Areas for disposal

- Temporary radiation zones would be decontaminated and removed, and permanent radiation zones would be decontaminated or stabilized to fix loose contamination

- Support systems such as electrical, heating, ventilation, and air conditioning (HVAC), water, and monitoring that are not required for future environmental compliance or personnel safety would be de-energized

- Structural repairs would be made as necessary for future surveillance and maintenance needs

- Building penetrations would be sealed to prevent entry of animals, and personnel access controls would be installed

- Routine surveillance and maintenance, including inspections, routine maintenance, and vermin and weed control, would be continued

DOE has undertaken an interim action to modify the 105-N Fuel Storage Basin by installing water treatment capabilities and additional radiation shielding This interim action, consistent with 40 CFR 1506 1, would not preclude the selection of any reasonable alternative. The interim action was initiated under a DOE NEPA categorical exclusion that allows "modifications of an existing structure to enhance workplace habitability" (10 CFR 1021, Subpart D, Appendix B)

Two other alternatives to the Proposed Action were considered

- No-Action Alternative (as required by 40 CFR 1500-1508) Leave existing conditions and continue routine surveillance and maintenance This alternative would not meet the goal of more effective protection of human health and the environment It would require increased maintenance in the future to meet minimum requirements for environmental protection and worker safety Deactivation would still be required at some time in the future before final D&D of the facilities

- Alternative 1 Identical to the Proposed Action, except that contaminated water would be treated in the 100-N Area, at a facility to be constructed, then discharged to the Columbia River, rather than being pretreated in the 100-N Area and transported to the ETF for further treatment and soil disposal

Table ES-1 summarizes key environmental impacts of the Proposed Action and the alternatives in terms of radiation exposure, waste volumes, socioeconomic effects, and costs

Other past, present, and reasonable foreseeable future activities in the 100-N Area and across the Hanford Site were considered for cumulative impacts of the Proposed Action in terms of exposure to workers and the public, waste generation and disposal, and socioeconomic effects No adverse impacts on human health or the environment resulting from the activities of the Proposed Action were identified

An accident involving the release of all contaminated water from the 105-N Fuel Storage Basin to the Columbia River was evaluated The resulting radiation dose to the public from this accident would be 0.37 millirem effective dose equivalent to the maximally exposed individual

The only permit identified as required for the Proposed Action is a Radioactive Air Emissions Notification of Construction (NOC) The NOC application was submitted to and approved by the Washington State Department of Health (DOH) and the U S Environmental Protection Agency (EPA) Several agencies were consulted, either during preparation of this EA or in developing project plans for the Proposed Action These included the National Park Service, EPA, Washington State Department of Ecology, and DOH

Table S-1 Summary of Impacts by Alternative (2 sheets)

Impact	No Action Alternative	Alternative 1	Proposed Action
Time Frame	24 Years	24 Years	24 Years
		Exposure	
N Reactor Facility Personnel (work force)	120 person-rem cumulative No health effects expected	199 person-rem cumulative No health effects expected	199 person-rem cumulative No health effects expected
Other Hanford Site Personnel (individual)	Current levels No health effects expected	Current levels plus an additional 10 mrem/yr or less No health effects expected	Current levels plus an additional 10 mrem/yr or less No health effects expected
Offsite Population (individual)	Current levels No health effects expected	Current levels plus < 0 0023 mrem/yr < 0 0069 mrem total No health effects expected	Current levels plus <0 0023 mrem/yr <0 0069 mrem total No health effects expected
Offsite Population (population)	Current levels No health effects expected	Current levels plus 0 025 person-rem 0 075 person-rem total No health effects expected	Current levels plus 0 025 person-rem 0 075 person-rem total No health effects expected
		Waste	
Radioactive, low-level (solid)	105 m^3 (3,700 ft^3)	1,200 m^3 (43,000 ft^3)	1,200 m^3 (43,000 ft^3)
Radioactive, low-level (liquid)	None	5,300,000 L (1,400,000 gal)	5,300,000 L (1,400,000 gal)
Radioactive, mixed (solid)	8 m^3 (300 ft^3)	40 m^3 (1,400 ft^3)	40 m^3 (1,400 ft^3)
Radioactive, mixed (liquid)	None	65,000 L (17,000 gal)	65,000 L (17,000 gal)

Table S-1 Summary of Impacts by Alternative (2 sheets)

Impact	No Action Alternative	Alternative 1	Proposed Action
Waste (cont.)			
Radioactive, mixed (petroleum)	None	47,000 L (12,000 gal)	47,000 L (12,000 gal)
Radioactive potential transuranic (> 100 nCi/g)	None	2 m^3 (70 ft^3) solid, or 75,700 L (20,000 gal) as a slurry	2 m^3 (70 ft^3) solid, or 75,700 L (20,000 gal) as a slurry
Dangerous (solid)	13 m^3 (450 ft^3)	58 m^3 (2,000 ft^3)	58 m^3 (2,000 ft^3)
Dangerous (liquid)	64,000 L (17,000 gal)	250,000 L (66,000 gal)	250,000 L (66,000 gal)
Dangerous (petroleum)	None	103,000 L (27,000 gal)	103,000 L (27,000 gal)
Dangerous (Compressed gas)	None	115 kg (252 lb)	115 kg (252 lb)
Liquid Effluents	None	5,300,000 L (1,400,000 gal) to the Columbia River	5,300,000 L (1,400,000 gal) to soil
Socioeconomic	50 Workers (1995-2018)	194 workers (1995-1997) 3 workers (1998-2018)	194 workers (1995-1997) 3 workers (1998-2018)
Ecological/Cultural Resources	No impacts identified	No impacts identified	No impacts identified
Cost	$327 million	$173 million	$173 million

GLOSSARY

ACRONYMS

ALARA	as low as reasonably achievable
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
D&D	decontamination and decommissioning
DOE	U S Department of Energy
DOH	State of Washington Department of Health
DOI	U S Department of the Interior
DOT	U S Department of Transportation
EA	environmental assessment
EDE	effective dose equivalent
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
ETF	Effluent Treatment Facility (also referred to as Project C-018H)
EPA	U S Environmental Protection Agency
FONSI	finding of no significant impact
HCRL	Hanford Cultural Resources Laboratory
HEPA	high efficiency particulate air
HGP	Hanford Generating Plant
HVAC	heating, ventilation and air conditioning
ICRP	International Commission on Radiological Protection
LCF	latent cancer fatalities
LSA	low specific activity
MEI	maximally exposed individual
MMI	Modified Mercalli Intensity
NAAQS	National Ambient Air Quality Standards
NEPA	*National Environmental Policy Act of 1969*
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRDWSF	616 Nonradioactive Dangerous Waste Storage Facility
NRHP	National Register of Historic Places
PCB	polychlorinated biphenyls
PNL	Pacific Northwest Laboratory
RCRA	*Resource Conservation and Recovery Act of 1976*
RCW	Revised Code of Washington
RQ	reportable quantity
SSE	Safe-Shutdown Earthquake
TRU	transuranic
VOC	volatile organic compound
WHC	Westinghouse Hanford Company
yr	year

DEFINITIONS OF TERMS

As low as reasonably achievable (ALARA) An approach to radiation and toxicological protection to control or manage exposures (individual and collective, to the workforce the public, and the environment) as low as social, technical, economic, practical, and public policy considerations permit

Dangerous waste: Any solid, liquid, or gaseous waste designated in WAC 173-303-070 through 173-303-103 as dangerous or extremely hazardous wastes Generally similar to federal hazardous waste designation under *The Resource Conservation and Recovery Act of 1976* (RCRA), but regulated under the Washington State Dangerous Waste Program

Deactivation: Actions taken to place facilities in a radiologically and environmentally safe condition such that they can be decontaminated and decommissioned at a later date

Decontamination and Decommissioning (D&D):
Decontamination: The reduction or removal of radioactive contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques

Decommissioning: Commonly, dismantlement or demolition of government-owned facilities In a more general sense, refers to any actions taken to reduce potential health and safety impacts of DOE contaminated facilities, including activities to stabilize, reduce, or remove radioactive materials or to demolish facilities

Effective dose equivalent (EDE) The sum of the products of the dose equivalent received by specific tissues of the body and a tissue-specific weighing factor Includes the committed EDE from internal deposition of radionuclides (such as through ingestion or inhalation) and the EDE due to penetrating radiation from external sources

Hazardous substance: Substances regulated under CERCLA, as defined in CERCLA Section 101(14) Typically includes a wide variety of chemicals and radioactive materials

Latent cancer fatality: The excess cancer fatalities in a population due to exposure to a carcinogen

Maximally exposed individual (MEI): 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

Person-rem: The summation of individual dose to the affected population

Radioactive mixed waste: Also called "mixed waste," wastes that contain both hazardous waste subject to RCRA, as amended, and radioactive waste subject to the Atomic Energy Act of 1954, as amended The dangerous constituents of mixed waste are regulated under the Washington State Dangerous Waste Program

Radioactive waste: A solid, liquid, or gaseous material of negligible economic value that contains radionuclides in excess of threshold quantities, except for radioactive material from post-weapons-test activities

Rem: A unit of radiation dose that indicates the potential for impact on human cells

Stabilization: Typically, use of chemical or physical methods to immobilize contaminants

Scientific Notation Conversion Chart

Prefix	Multiplier	Equivalent
deci	10^{-1}	0 1
centi	10^{-2}	0 01
milli	10^{-3}	0 001
micro	10^{-6}	0 000001
nano	10^{-9}	0 000000001
pico	10^{-12}	0 000000000001

Radioactivity Level Conversions

Ci/L	uCi/ml
10^{-9}	0 000001
10^{8}	0 00001
10^{-7}	0 0001
10^{-6}	0 001
10^{-5}	0 01
10^{-4}	0 1
10^{-3}	1
10^{-2}	10
10^{-1}	100
1	1000

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1.0 PURPOSE AND NEED FOR AGENCY ACTION

The U S Department of Energy (DOE) needs to place the N Reactor facilities in a condition that enhances worker safety and environmental protection, and reduces the cost of surveillance and maintenance (S&M) Current conditions at the N Reactor facilities, if left as they are, present a potential threat of an environmental release or exposure to workers who maintain and monitor the facilities The current conditions are also likely to require increased S&M costs in the future These conditions are a result of past operation of the N Reactor facilities and include the following

- Radiologically contaminated water, sediment, and hardware in the 105-N Fuel Storage Basin, and contaminated water and sediment in the 1300-N Emergency Dump Basin
- Small quantities of radioactive fuel fragments and potential lithium target or target fragments that might be present in the fuel storage basin
- Hazardous substances, including asbestos, transformer oils, lead shielding, contaminated resins, and various chemicals contained in tanks and buildings
- Radioactive liquids in piping systems
- Loose surface contamination and unstabilized radiation zones in buildings
- Unsealed penetrations between building interiors and the environment
- *Potentially dangerous structural conditions*

The presence of contaminated material in a mobile form (such as liquids) coupled with the close proximity to the Columbia River, a distance of approximately 100 m (300 ft) from the basins, presents the potential for an environmental release It also presents a potential exposure and hazard to workers who maintain and monitor the facilities In addition, as the facilities continue to age, maintenance requirements and costs will increase Finally, the facilities still contain active electrical, ventilation, water, and monitoring systems that are necessary for regulatory compliance, but are expensive to maintain The systems are no longer needed for operation of the facilities

1.1 BACKGROUND

The N Reactor and associated facilities are located in the 100-N Area of the Hanford Site (Figure 1) The N Reactor was the last production reactor to be constructed at the Hanford Site, and differed from the other reactors in that it could produce both special nuclear materials and steam for the production of electrical power The N Reactor operated from December 1963 until December 1987, when it was placed in standdown status for an extensive maintenance and safety enhancements program In February 1988, the DOE ordered the N Reactor to be placed in cold standby status (i e , inactive but capable of being restarted within a 3-year period) Cold standby condition was achieved by October 1990 In July 1991, after evaluating national defense needs, the DOE made the decision to cease preservation and to proceed with activities leading to the ultimate decommissioning of the N Reactor (Watkins 1991)

To meet the cold standby requirements, the following actions were taken

- All fuel was removed from the N Reactor core Irradiated fuel, previously stored in the 105-N Fuel Storage Basin, was relocated to the 100-K Area Fuel Storage Basins The unirradiated, contaminated fuel removed from the N Reactor core was moved to the fuel storage facilities in the 300 Area

- Most of the 100-N Area process piping systems were drained, except those required for fire protection, radioactive waste disposal, and environmental or personnel safety compliance

- Major operational equipment (i e , reactor systems and support equipment) were shut down and deenergized Pertinent S&M tasks for these systems are still performed to ensure compliance with safety and regulatory requirements

Routine activities designed to ensure compliance with safety and regulatory requirements have continued from 1987 to the present time These have included S&M of the remaining active systems, and identification and removal of many hazardous substances In mid-1994, DOE undertook an interim action, consistent with 40 CFR 1506 1, to modify the 105-N Fuel Storage Basin by installing the following

- A water filtration and ion exchange system to remove dissolved and suspended radioactive material and establish water clarity

- A radiation shield door and radiation shield cover in the North Cask Pit

This interim action does not preclude the selection of any reasonable alternative for the N Reactor facilities The interim action was initiated under a *National Environmental Policy Act of 1969 (NEPA)* categorical exclusion that allows "Modifications of an existing structure to enhance workplace habitability (including, but not limited to improvements to lighting, radiation shielding, or heating/ventilation/air conditioning and its instrumentation, and noise reduction) " (10 CFR 1021, Subpart D, Appendix B)

Deactivation of the N Reactor facilities would include the following

- Remove contaminated materials, fuel fragments, liquids in piping, and hazardous substances

- Remove or stabilize loose contamination

- Seal penetrations

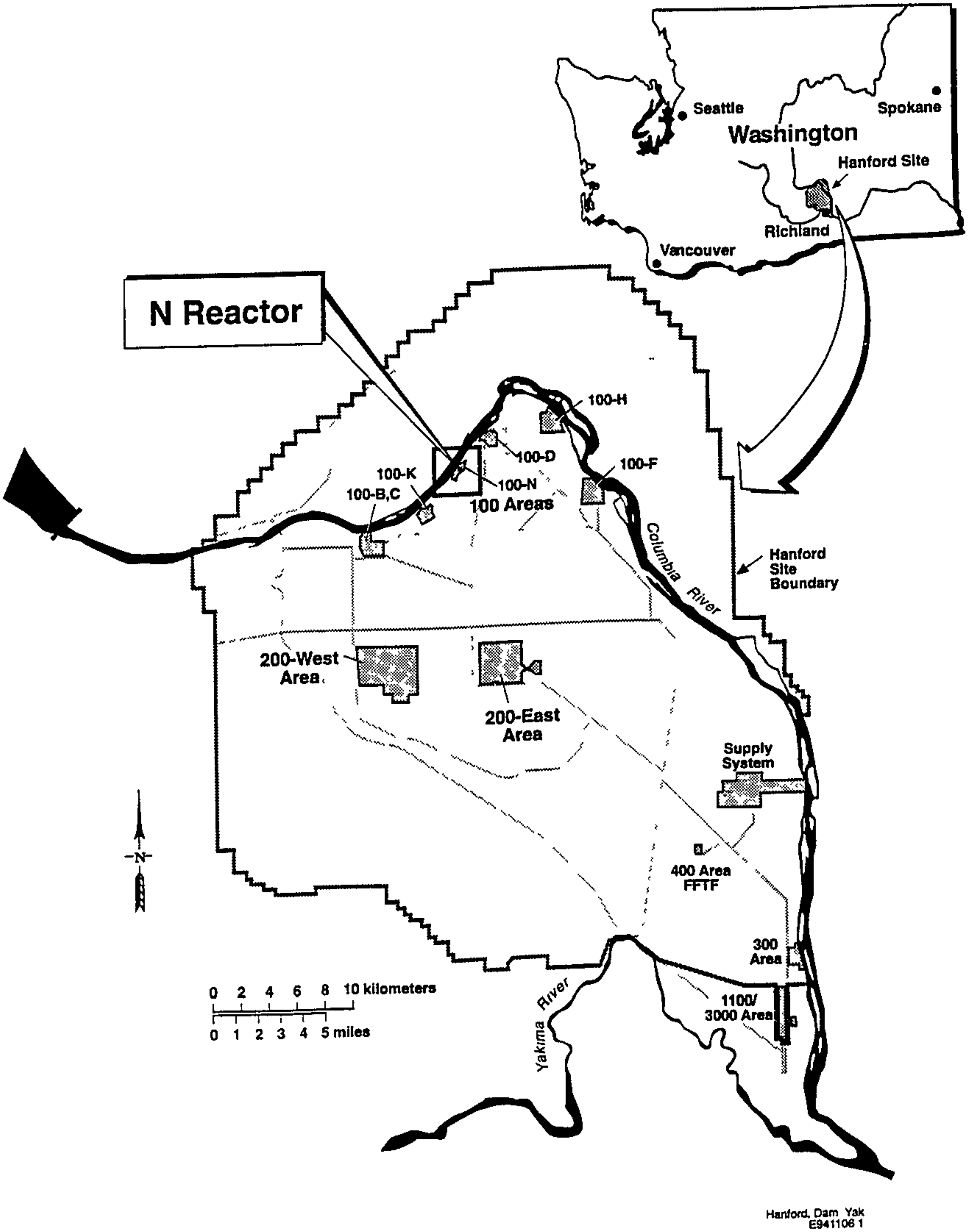
- Make structural repairs

- Deenergize active systems

- Cap and isolate utilities

This would reduce the potential for an environmental release and worker exposure, and reduce the required level of S&M now and in the future In addition, implementation of the Proposed Action would support the DOE pilot project for coordinating deactivation, decontamination and decommissioning (D&D), and remediation of the 100-N Area The pilot project is defined in the fourth amendment of the *Hanford Federal Facilities Agreement and Consent Order* (Ecology et al 1994)

Figure 1-1. The Hanford Site



2.0 DESCRIPTION OF THE PROPOSED ACTION

The proposed action would place the N Reactor facilities in a radiologically, environmentally, and structurally stable condition that would require minimal S&M until D&D is initiated About 80 facilities (identified in Table 2-1 and shown in Figure 2-1) would be involved Activities under the Proposed Action would be conducted in two phases· a 3-year deactivation phase, followed by a S&M phase of up to 21 years The scope of work includes the following

2.1 DEACTIVATION

The following deactivation activities are from WHC 1993d

- Existing equipment would be restarted to support deactivation activities
- Equipment fluids, hazardous substances, and unattached equipment and materials would be removed, characterized, packaged, and transported to the 200 Areas for use, reuse, recycling, or designation and disposal as waste
- The 1300-N Emergency Dump Basin, the 1304-N Emergency Dump Tank, and other N Reactor facility tanks would be drained and residuals removed for transportation to the 200 Areas for disposal
- The 105-N Fuel Storage Basin would be inspected for irradiated fuel fragments Fragments would be removed, packaged, and stored for an interim period in the basin
- Contaminated water, sediment, hardware, and lithium target fragments would be removed from the 105-N Fuel Storage Basin and transported to the 200 Areas for disposal Basin surfaces would be washed down and stabilized
- Irradiated fuel spacers would be removed and transported to the 200 Areas for disposal
- Temporary radiation zones would be decontaminated and removed, and permanent radiation zones would be decontaminated or stabilized
- Electrical, heating, ventilation and air conditioning (HVAC), water, and monitoring systems would be deenergized to the minimum required for future S&M and D&D
- Potentially reusable assets (e g , installed equipment) would be removed and transferred for use elsewhere
- Buildings would be repaired to make them structurally safe (e g , repair roof leaks), to the extent necessary to support future S&M and D&D
- Building penetrations such as drains and vents would be sealed to prevent entry of animals, and personnel access controls would be installed

Sections 2 1 through 2 5 provide a detailed description of the major activities of the deactivation phase The specific activities to be conducted at each facility are identified in Table 2-1 Section 2 8 provides specific detail on the deactivation of the 105-N Fuel Storage Basin The activities proposed in the 105-N Fuel Storage Basin would present the greatest potential for impacts in the areas of radiation exposure, waste generation, and releases to the environment

2.2 SURVEILLANCE AND MAINTENANCE

- Deactivated facilities would be inspected quarterly and active facilities would be inspected daily
- Routine maintenance would be performed as necessary to maintain safe conditions
- Vermin and weed control would be provided

Section 2 9 provides a detailed description of the S&M

2.3 HAZARDOUS SUBSTANCE AND WASTE REMOVAL AND DISPOSAL

Hazardous substances, both radioactive and nonradioactive, would be removed from the N Reactor facilities as part of deactivation Some of these have already been removed during routine S&M Additional materials that might be encountered during the Proposed Action include the following

- Unused chemicals (e g , ammonia, acids, caustics)
- Petrochemical products (e g , lubricants, solvents)
- Transformer oils with polychlorinated biphenyls (PCB)
- Batteries
- Metals (e g , lead bricks)
- Equipment with surface contamination
- Compressed gases (e g , freon, halon)
- Paint and paint-strippers
- Pesticides

Upon removal from the facilities, these materials would be evaluated to determine if they can be used, reused, or recycled for use elsewhere on the Hanford Site If not, they will be characterized to determine the appropriate waste designation

Characterization would be performed based on either process knowledge or sampling and analysis Designation using process knowledge relies primarily on knowledge of the raw materials, processes, and material balances Process knowledge typically is used when there is good written information on a material, when a waste stream is difficult to sample, when sampling could result in unacceptable risks to workers, or when the waste is too heterogeneous to be characterized by one set of samples (e g , drums containing contaminated protective clothing and rags)

Four major types of waste that might be generated from the N Reactor facilities as part of the Proposed Action are defined in DOE Order 5820 2A, *Radioactive Waste Management*

- **Transuranic (TRU) Waste** Without regard to source or form, waste that is contaminated with alpha-emitting transuranic radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g

- **Low-Level Waste:** Waste containing radioactivity and not classified as high-level waste, TRU waste, or spent nuclear fuel

- **Hazardous Waste:** Wastes designated by the Environmental Protection Agency (EPA) under 40 CFR 261, in accordance with the RCRA Ecology has been delegated authority to administer the hazardous waste program, and uses the term "dangerous waste", this term will be used throughout this document

- **Mixed Waste:** Waste that contains both radioactive and hazardous components as defined by the *Atomic Energy Act* and RCRA, respectively

Quantities of each waste type estimated for individual facilities are presented in WHC (1993d) and summary quantities are presented in Table 2-2 These volumes are based on building walkdowns performed in 1992, as adjusted for materials removed as of April 1993 Current volumes would be expected to be less due to routine maintenance conducted since April 1993 These quantities are conservative estimates that do not take credit for any use, reuse, or recycling of hazardous substances removed from the facilities, although every effort will be made to identify such opportunities

The handling, packaging, transportation, and storage or disposal of waste removed from the N Reactor facilities would be performed in accordance with *Hanford Site Solid Waste Acceptance Criteria* (WHC 1993b), applicable federal and state regulations, and DOE Orders Table 2-3 provides a listing and brief explanation of key regulations and orders In general, they are designed to minimize releases of wastes from packages and to ensure that storage and disposal do not adversely affect human health or the environment

2.3.1 Radioactive Waste Generation

Radioactive waste would include low-level waste, mixed waste, and TRU waste

2.3.1.1 Low-Level and Mixed Waste Sources of low-level and mixed waste would include the following

- Irradiated fuel spacers currently located in the 1303-N Spacer Storage Silos (north of the 105-N Reactor Building) The fuel spacers do not contain TRU radionuclides, nor do they contain constituents that would cause them to be designated as dangerous waste Therefore, they would be designated as low-level waste

- The lithium target fragments containing tritium, currently located in the 105-N Fuel Storage Basin Lithium targets meet the definition of low-level waste, as test specimens of fissionable material used for research and development

- Equipment, materials (such as lead), and hardware with radioactive surface contamination from the 105-N Fuel Storage Basin that could be designated as either low-level or mixed waste, depending on chemical constituents

- Miscellaneous radioactive materials, equipment, and sediment from other facilities

The following are estimated quantities of low-level and mixed waste (WHC 1993d)

Low-level waste (solid)	1,200 m^3 (43,000 ft^3)
Mixed waste (solid)	40 m^3 (1,400 ft^3)
Mixed waste (liquid)	20 m^3 (665 ft^3) [equal to 65,000 L (17,000 gal)]
Mixed waste (petroleum)	260 m^3 (9,000 ft^3) [equal to 47,000 L (12,000 gal)]

The irradiated fuel spacers are currently located in the 1303-N Spacer Storage Silos, which are underground galvanized steel structures Two removal alternatives are being considered The silos with the spacers in place could be filled with grout (a concrete-like material) and the silo-spacer unit removed intact In that case, the grout would provide shielding for the spacers Alternatively, the spacers would be pulled from the silos directly into shielded containers The silo-spacer units or the containers would be transported, by either truck or rail car, for disposal in the low-level burial grounds in the 200 West Area of the Hanford Site

Other low-level and mixed waste would be packaged and labeled in accordance with the appropriate U S Department of Transportation (DOT) regulations (49 CFR 100 to 199) and DOE Orders (DOE Order 1540 3A and DOE Order 5480 3) Packaging for other low-level waste could consist of steel or plywood low-specific activity (LSA) burial boxes, concrete shielded boxes, shielded casks, 208 L (55-gal) drums, or other approved containers. Mixed waste would be packaged in DOT-approved containers The type of container selected would depend on waste form (e g , liquids would be contained in leak-proof drums) and shielding requirements The selected containers would also be made of materials that are compatible with the waste type and would be designed to prevent accidental releases The low-level waste would be transported by truck for disposal in the burial grounds in the 200 Areas Mixed waste would be taken by truck to the Radioactive Mixed Waste (RMW) facility of the Central Waste Complex in the 200 West Area for storage or disposal All transport would take place over DOE-owned restricted access roads The distance from the 100-N Area to the waste management units in the 200 Areas is approximately 24 km (15 mi)

Safety documentation would be prepared before transport to ensure the safety of both deactivation personnel and other Hanford Site personnel who might be located in the vicinity of a shipment No special road controls are anticipated for over-the-road transport of most of the low-level and mixed wastes The potential exception is the transport of the irradiated fuel spacers. The waste packaging of most wastes would be sufficient such that, under normal conditions of transport in a closed vehicle, the following limits specified in 49 CFR 173 44 would be met

- The radiation level would not exceed 200 mrem/hr at any point on the external surface of the vehicle, or 10 mrem/hr at any point 2 m (6 6 ft) from the external surfaces of the transport vehicle

- The radiation exposure of the driver of the vehicle would not exceed 2 mrem/hr

The radiation level on the external surface of the vehicle transporting the silos/spacers has the potential to exceed 200 mrem/hr Special controls, which might include blocking roads on the

Hanford Site or railroad intersections, would be used to ensure that incidental exposure to Hanford Site personnel is limited to 10 mrem/hr Exposure to a driver transporting a silo-spacer unit or container would be controlled to no more than 2 mrem/hr using the appropriate combination of shielding and distance

2.3.1.2 Potential TRU Waste. Approximately 2 m^3 (70 ft^3) (dry volume) of sediment have accumulated in the 105-N Fuel Storage Basin (WHC 1993d) As part of deactivation, this sediment would be removed and dispositioned as appropriate Sampling and analysis have identified TRU radionuclides in the sediment However, analyses of individual samples vary widely and classification as TRU or non-TRU waste cannot be made until the sediment is consolidated

As part of the deactivation, the sediment would be collected from throughout the basin using an underwater vacuum system and placed in the North Cask Pit of the basin, where it would be sampled and designated A preliminary criticality analysis has determined that consolidation would not result in criticality concerns (Altschuler 1991, Appendix F) Additional safety documentation will be developed to confirm that storage of the sludge in the North Cask Pit and final removal of the sludge would not result in any criticality concerns Maintenance of adequate criticality safety margins would be a condition of any storage or removal option. If determined to be a low-level waste, the sediment would be packaged as a solid and transported for disposal in the low-level burial grounds on the RMW in the 200 Areas If designated as a TRU waste, the sediment would be transported as a liquid slurry (566 m^3 [20,000 ft^3]) in double-walled railroad tank cars to the 204-AR Tank Farm Tank car Unloading Facility and placed in a double-shell tank in the 200 East Area Tank Farms About three tank cars would be required to transport this material, each holding approximately 198 m^3 (7,000 ft^3) of the slurry (Duncan 1995, provided in Appendix E)

2.3.2 Dangerous Waste Generation

Potential sources of dangerous waste would be batteries, lead, freon refrigerant, used and unused chemical products, and materials contaminated with those products Petroleum products could be designated as dangerous waste if they are determined to contain other contaminants such as solvents The estimated quantities of dangerous waste to be removed during deactivation are (WHC 1993d)

Solid	58 m^3 (2,000 ft^3)
Liquid	260 m^3 (9,000 ft^3)/250,000 L (66,000 gal)
Petroleum	103 m^3 (3,700 ft^3)/103,000 L (27,000 gal)
Compressed gas	115 kg (252 lb)

Once materials that are identified as potential dangerous wastes are found, they would be characterized and designated according to WAC 173-303-070 to -103 The wastes would then be packaged and transported by truck over DOE-owned restricted access roads to the 616 Nonradioactive Dangerous Waste Storage Facility (NRDWSF) in the 200 West Area of the Hanford Site The NRDWSF is a RCRA-permitted treatment and storage facility that provides a central location to receive and store nonradioactive waste generated on the Hanford Site, and prepare it for offsite shipment to an approved waste disposal facility

2.4 LIQUID EFFLUENT DISPOSAL

During the deactivation phase of the Proposed Action, about 5,300,000 L (1,400,000 gal) of radiologically contaminated water would be removed from N Reactor facilities, primarily from the 105-N Fuel Storage Basin and the 1300-N Emergency Dump Basin (WHC 1993d) and pretreated The water would be transported to the Effluent Treatment Facility (ETF) in the 200 East Area for further treatment and discharge to the soil The *200 Area Effluent Treatment Facility (C-018H) Delisting Petition* (DOE-RL 1992) specifically identifies "fuel basin waters" as one of the aqueous streams that might be treated at the ETF The acceptance criteria at the ETF are based on the following requirements

- Influent to the ETF will not cause the liquid effluent to exceed permitted levels after treatment
- Influent to the ETF will not generate a TRU solid waste as a consequence of the treatment process at the ETF

Pretreatment may be necessary to meet the acceptance criteria (BHI 1995) Pretreatment would be performed in the 100-N Area, in a system specifically designed for this purpose, and would consist of filtration and ion exchange Pretreatment of the N Reactor facility water would generate about 120 m^3 (4,200 ft^3) of low-level waste and 55 m^3 (1,900 ft^3) of mixed waste (BHI 1995), consisting of contaminated filter material and ion exchange resin These quantities of secondary waste have been included in the solid waste volumes provided in Section 2 3 1

Following pretreatment, the water would be transported by tanker truck to the ETF The ETF has been constructed to treat and dispose of radiologically contaminated water from various Hanford facilities and was addressed by previous NEPA documentation (DOE-RL 1991) It has been designed with both primary and secondary waste treatment trains The primary treatment train of the ETF removes most of the radionuclide and chemical contaminants from the waste water, and the treated waste water is then discharged to the soil The secondary treatment train processes the contaminants removed by the primary treatment train and generates a dry powder waste that is containerized and transferred to an appropriate storage or disposal facility

The U S Department of Energy, Richland Operations Office (RL) has received approval to construct and operate the ETF facility from the U S Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the Washington State Department of Health (DOH) The agencies have determined that the ETF plant design is consistent with best available technology (BAT) economically achievable, all known, available, and reasonable method of prevention, control, and treatment (AKART) (McDonald 1992), and best available radionuclide control technology (BARCT) (Conklin 1993)

The effluent from ETF containing tritiated water will be discharged to the soil via a permitted State Approval Land Disposal Site, the total activity of the tritium discharged to the soil has been projected to be from 200 to 2,000 curies over any given year (Breckel 1994) This method of disposal was evaluated against other methods such as evaporation, reuse, storage, and discharge to the river (WHC 1993a) State and federal regulatory approval processes, which included public comment and review through the State Environmental Policy Act (SEPA) approval process (Breckel 1994), have accepted the subsurface disposal method This acceptance was based on the determination that the ETF's plant design and operation was consistent with the BAT economically achievable, and that currently there is no technology feasible for the removal of tritium from effluent waste streams Additionally, the subsurface disposal method was approved by the regulatory agencies because it would minimize potential radiation exposure to the public and because geologic retention would reduce tritium via radioactive decay

The final concentrations and total curies of radionuclides discharged to the soil as a result of the Proposed Action are shown in Table 2-4.

2.5 RADIATION ZONE REDUCTION/STABILIZATION

Several N Reactor facilities have areas with radiologically contaminated surfaces (i e , radiation zones) that require decontamination or stabilization to prevent the spread of radioactive contaminants Decontamination and stabilization of radiation zones would be performed in accordance with as low as reasonably achievable (ALARA) principles, with the goal of minimizing worker exposure and environmental impacts

The types of decontamination used under the Proposed Action would consist of various methods of washing surfaces As appropriate, washing would be done either by manually wiping surfaces using wet cloths, or by using a pressure spray Washing is expected to be sufficient to allow temporary radiation zones to be eliminated In permanent radiation zones, washing might reduce but not eliminate surface contamination If surface contamination remains, it would be stabilized to prevent worker exposure and the spread of contaminants Stabilization of a radiation area could include using surface fixatives, physically blocking access to the area, and administrative controls. Alternately, the contaminated hardware, piping or other components may be removed. Aggressive methods of decontamination, such as scabbling to remove surface layers of concrete, would not typically be used as part of the Proposed Action However, additional alternative decontamination technologies may be utilized An estimated 43,000 m^2 (462,703 ft^2) of surface-contaminated areas would be decontaminated or stabilized (WHC 1993d) Wastes generated during this activity would include contaminated cloths used for wiping surfaces and radiation worker clothing The quantities of waste generated are included in the total volumes of radioactive waste provided in Section 2 3 1 These quantities will be small because contaminated cloths and overclothes would be recycled though the Hanford Site laundry

2.6 SYSTEM DEENERGIZATION

System deenergization would deactivate unneeded systems Under the Proposed Action, the key systems for deenergization would include the following.

- HVAC
- Potable and filtered water
- Communications
- Radiation monitoring
- Water processing
- Fire protection
- Cranes and hoists
- Environmental monitoring
- Drains

Not all such systems in all facilities would be deenergized Systems required to maintain the facility in an environmentally safe condition would remain active Specific system deenergization activities would include the following activities:

- Deenergize switch gear and motor control centers, and disconnect leads to electrical power components
- Deenergize heaters as various heating requirements are removed
- Isolate and discontinue fire protection to facilities to the extent that environmental protection is maintained and the value of the facilities has decreased This includes excavation, cutting, and capping fire lines at building boundaries, deenergizing alarm boxes, and draining isolated lines
- Cut and cap lines to isolate utilities These systems include the compressed air, filtered water, sanitary water, and potable water
- Reroute piping for drain systems to maintain compliance with state and federal environmental regulations
- Isolate and remove from service unneeded instrument and control systems

2.7 REPAIRING AND SECURING FACILITY

Under the Proposed Action, buildings and other structures would be repaired to the extent necessary to provide a safe condition for future S&M and D&D activities A particular focus would be repairing leaks in roofs to prevent more serious long-term damage Other structural repairs would be made as needed

The building would be secured to limit access both to personnel and animal intrusion Personnel access would be limited by appropriately blocking and posting building access points Animal intrusion would be limited by sealing openings to the environment such as drains, vents, and windows The goal would be to reduce potential habitation by bats, swallows, and vermin

2.8 105-N FUEL STORAGE BASIN

The 105-N Fuel Storage Basin and related pits and sumps are located within the 105-N Reactor Building The basin area is comprised of the Discharge ("D") Pit, a water tunnel that connects the "D" Pit with the Fuel Segregation Pit, two storage basins designated as North Basin and South Basin, two cask load-out pits, and a fuel examination facility all constructed of reinforced concrete as shown in Figure 2-2 The North Basin floor is entirely covered and the South Basin floor is partly covered by a modular array of cubicles formed by boron concrete posts and panels The fuel storage basin areas currently contain hardware from reactor operations, sediment that has accumulated, and water used as a shielding medium

Under the Proposed Action, the 105-N Fuel Storage Basin would be deactivated by removing and disposing of basin hardware, collecting, characterizing and removing basin sediment, removing the basin water, and cleaning and stabilizing the basin surfaces to prevent resuspension of radioactive particulate matter The sequence for stabilizing the 105-N Fuel Storage Basin would be as follows (WHC 1993d)

- Cranes and other systems would be restarted as necessary to support activities in the basin

- Hardware would be removed from the basin using overhead cranes As the hardware is pulled from the basin, it would be washed with a water spray from either filtered recirculated basin water or potable water to remove contaminated water and sediment The hardware would be handled as low-level radioactive waste for packaging, transportation, and disposal as discussed in Section 2 3 1 A listing of the types and quantities of waste is available in WHC 1993d

- Sediment in the basin would be collected using an underwater vacuum system, centrifuged to remove water, and transferred to the North Cask Pit of the basin Characterization, packaging, transportation, and removal of the sediment are described in Section 2 3 1

- As the hardware and sediment are removed, the basin would be inspected both visually and using radiation detectors to locate fragments or chips of irradiated fuel A maximum of 330 kg (725 lb) of irradiated fuel is expected to be found in this inspection Fuel fragments and chips would be removed from the basin and packaged in a stainless steel canister of the same type used to package fuel elements during reactor operations The canister would then be placed into a lead-lined shipping container The shipping container would remain at the 105-N Fuel Storage Basin until decisions are made regarding interim storage

- The basin would be inspected visually for lithium target fragments A maximum quantity of fragments that in total would make up one target are expected to be found The fragments would be treated as low-level radioactive waste for packaging, transportation, and disposal as discussed in Section 2 3 1

- Radiologically contaminated water would be removed from the basin, pretreated, and transported to the ETF in the 200 East Area as described in Section 2 4

- Surfaces would be decontaminated using a high-pressure water spray to minimize the later resuspension of contaminated particulate matter after the 105-N Fuel Storage Basin is emptied

- A sealant would be placed on all exposed surfaces (basin walls and cubicles) to ensure no resuspension of contaminated particulate matter occurs.

- Shielding blocks and zone isolation covers would be used as appropriate during basin cleanup activities to ensure ventilation zone isolation and reduce personnel radiation exposure

2.9 POST-DEACTIVATION ACTIVITIES

A few N Reactor facilities would continue to function after deactivation is complete They include the primary ventilation system for the reactor building, the primary electrical facility, a storage and training facility, a carpenter shop, and a vehicle inspection building Those facilities remaining active are identified in Table 2-1

In addition, S&M would continue for all N Reactor facilities until final D&D is performed For facilities that remain active, the current level of S&M would continue This would include daily inspections, routine maintenance of active systems, freeze protection in the winter, weed and pest control, full monitoring, and annual safety certifications For facilities that have been deactivated and secured, S&M would be reduced to inspections every 90 days, minor maintenance (sufficient to support later D&D), weed and pest control, and reduced monitoring Weed and pest control agents would conform with state laws governing approved pesticides and herbicides The D&D of all auxiliary facilities is expected to be complete by the year 2018

Figure 2-1. N Reactor Facilities

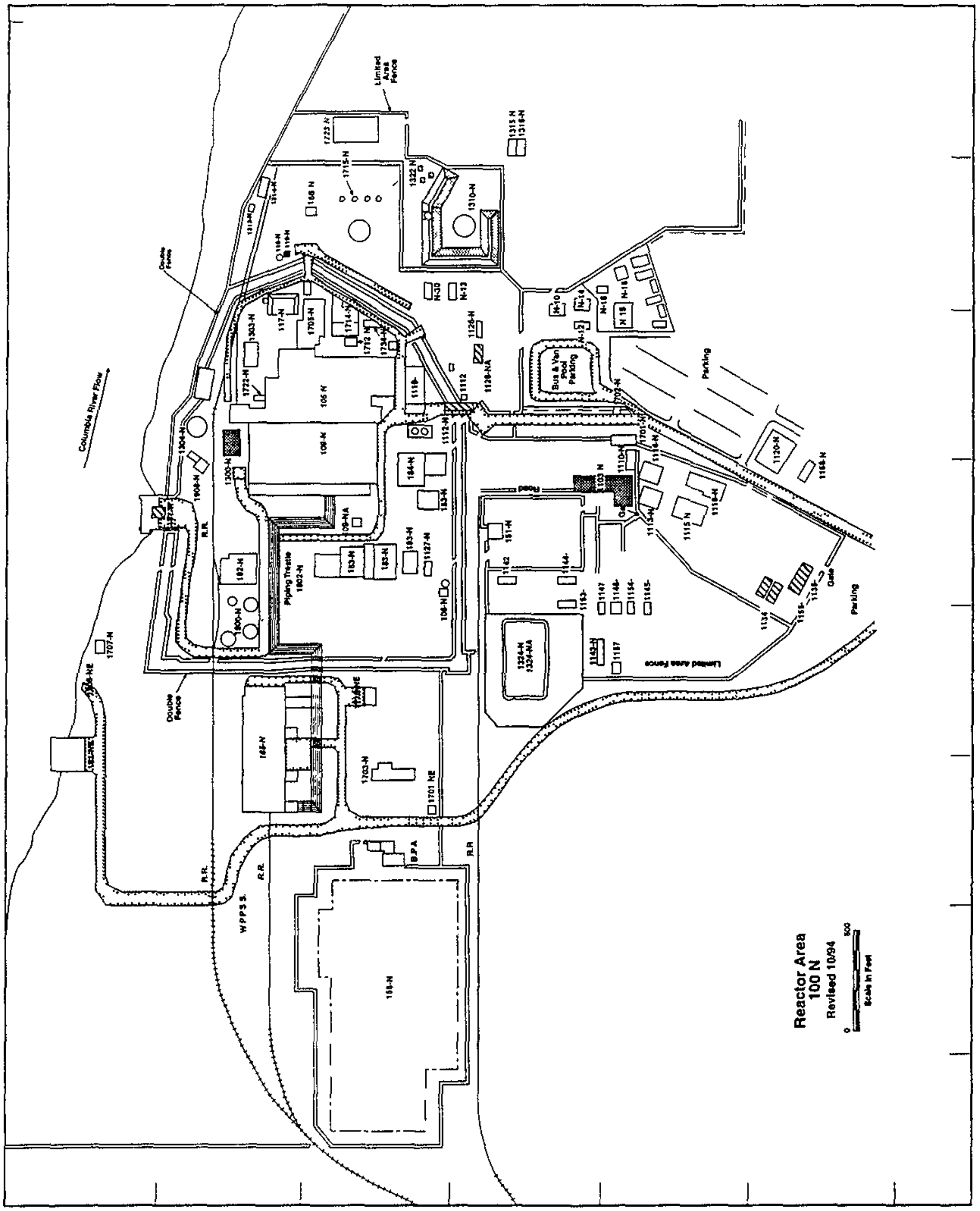


Figure 2-2 Schematic of 105-N Fuel Storage Basin

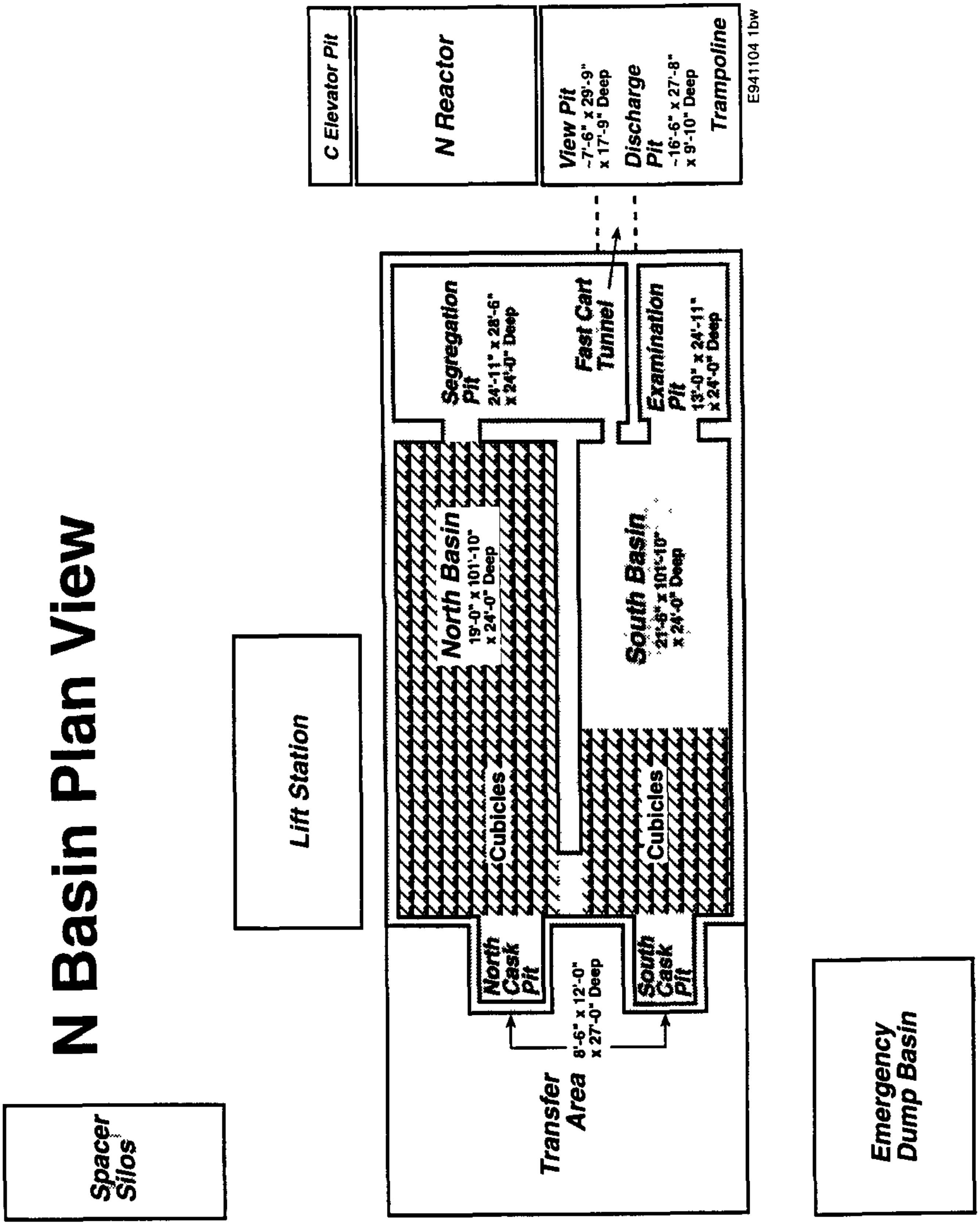


Table 2-1 Deactivation Activities by Facility (7 sheets)

Building number	Building description	Deactivation Activities						
		Solid waste disposal		Liquid effluent disposal	Reduce/stabilize radiation zones	De-energize systems equipment	Secure Facility	Remain active
		Radioactive	Nonradioactive					
11-N	Change Room	X	X		X	X	X	
13-N	Storage Building		X			X	X	
104-N	Metal Storage Building					X		
105-N	Reactor Building	X	X	X	X	X	X	
105-NA	Emergency Diesel Building	X	X	X	X	X	X	
105-NB	Mechanical Shop Addition	X			X	X	X	
107-N	Recirculation Cooling Building	X	X	X	X	X	X	
108-N	Chemical Unloading Facility		X			X	X	
109-N	Heat Exchanger Building	X	X	X	X	X	X	
109-NA	Steam and Flow Instrument Building					X	X	
109-NB	Hydro Power Unit Building		X			X	X	
116-N	Air Stack							1
117-N	Air Filter Confinement Building							1
117-NVH	Valve Control House	X			X	X	X	

Table 2-1 Deactivation Activities by Facility (7 sheets)

Building number	Building description	Deactivation Activities						
		Solid waste disposal		Liquid effluent disposal	Reduce/stabilize radiation zones	De-energize systems equipment	Secure Facility	Remain active
		Radioactive	Nonradioactive					
119-N	Air Sampling Monitor Building							1
119-NA	Air Sampling Monitor Annex							1
151-N	230 KV Electrical Facility		X			X	X	2
153-N	Switch Gear Building		X			X	X	
163-N	De-mineralizer Plant Building		X			X		3
163-NA	Waste Pad							4
166-N	Fuel Oil Storage Building		X			X	X	
181-N	River Water Pump House					X	X	
181-NA	*Pump House Guard* Tower		X			X	X	
181-NB	#3 Diesel Enclosure					X	X	
182-N	High Lift Pump House Building	X	X		X	X	X	
183-N	Water Filter Plant Building		X			X	X	
183-NB	Clear Well Overflow							3

Table 2-1 Deactivation Activities by Facility (7 sheets)

Building number	Building description	Deactivation Activities						
		Solid waste disposal		Liquid effluent disposal	Reduce/stabilize radiation zones	De-energize systems equipment	Secure Facility	Remain active
		Radioactive	Nonradioactive					
183-NC	Filter Back Wash Sump						X	
183-N Pond	Filter Back Wash Pond						X	
184-N	Plant Service Boiler House		X			X	X	
184-NA	Auxiliary Power Annex		X			X	X	
184-NB	Airhandler Main Building					X	X	
184-NC	Airhandler Annex Building					X	X	
184-ND	Oil Day Tanks		X			X	X	
1102-N	Drafting Office Building		X			X	X	
1112-N	Guard Station		X			X	X	
1112-NA	Microwave Tower Annex							5
1112-NB	Badge House (SEA)					X	X	

Table 2-1 Deactivation Activities by Facility (7 sheets)

Building number	Building description	Deactivation Activities						
		Solid waste disposal		Liquid effluent disposal	Reduce/stabilize radiation zones	De-energize systems equipment	Secure Facility	Remain active
		Radioactive	Nonradioactive					
1120-N	Storage and Training Facility		X			X		6
1143-N	Carpenter Shop							7
1300-N	Emergency Dump Basin	X		X	X	X	X	
1303-N	Fuel Spacer Silo	X	X		X			
1304-N	Emergency Dump Tank	X			X		X	
1310-N	Chemical Waste Storage	X	X	X	X	X	X	
1312-N	Liquid Effluent Retention Facility						X	
1313-N	Change and Control Building	X			X	X	X	
1314-N	Liquid Waste Loadout Station	X		X	X	X	X	
1315-N	Rctr Eff Diversion Sy Valve House	X			X	X	X	
1316-N	Valve House	X		X	X	X	X	
316-NA	Valve Vault Building	X			X	X	X	
1316-NB	Valve House Annex	X			X	X	X	
1316-NC	Valve House Annex	X			X	X	X	

Table 2-1 Deactivation Activities by Facility (7 sheets)

Building number	Building description	Deactivation Activities						
		Solid waste disposal		Liquid effluent disposal	Reduce/stabilize radiation zones	De-energize systems equipment	Secure Facility	Remain active
		Radioactive	Nonradioactive					
1322-N	Waste Treatment Pilot Plant	X			X	X	X	
1322-N	Effluent Water Pilot Plant	X			X	X	X	
1322-NB	Crib Eff Iodine Monitoring Facility	X			X	X	X	
1322-NC	Sample Pit	X			X	X	X	
1327-N	Valve Vault					X		
1702-N	Vehicle Inspection Building							8
1705-N	Instrument and Electrical Facility	X	X		X	X	X	
1705-NA	Motor Shop					X	X	
1706-N	Storage Building	X	X		X	X	X	
1706-NA	Old sewer lift station						X	
1707-N	Patrol Boat House					X	X	
1712-N	Insulation Shop/ Storage Building		X			X	X	
1714-N	Stores		X			X	X	
1714-NA	Rec/Inspection Facility		X			X	X	
1714-NB	Tool Storage Shed		X			X	X	

Table 2-1 Deactivation Activities by Facility (7 sheets)

Building number	Building description	Deactivation Activities						
		Solid waste disposal		Liquid effluent disposal	Reduce/stabilize radiation zones	De-energize systems equipment	Secure Facility	Remain active
		Radioactive	Nonradioactive					
1715-N	Oil Storage Tanks		X			X	X	
1722-N	Decon Hot Shop Building	X			X	X	X	
1723-N	Warehouse							7
1723-NX	Laydown Storage Yard							7
1734-N	Gas Bottle Storage Building					X	X	
1802-NE	Piping Trestle	X	X		X	X		
1900-N	Water Supply Tanks				X	X		
1903-N	Old Septic system							9
1908-N	Seal Well					X		

Table 2-1 Deactivation Activities by Facility (7 sheets)

NOTES

1 The components of the reactor ventilation system would remain in place and would continue to provide passive ventilation (i e , fans would not actively draw air, but any air release to the air would pass through the filters of the ventilation system) Active ventilation may be resumed at a later time to support decontamination and decommissioning

2 The 151-N Electrical Facility would be partially secured and reconfigured for support to S&M

3 The 163-N Demineralizer Plant and associated 183-NB Clear Well Overflow would remain active, but use of the plant would be reduced from four basins to one basin

4 The 163-N Waste Pad would remain active as the primarily less-than-90-day dangerous waste storage unit for all activities in the 100 Area

5 The 1112-N Microwave Tower Annex would remain active to support communications

6 The 1120-N Facility would continue to be used as a warehouse and training facility

7 These units would remain active to support future decontamination and decommissioning activities

8 The 1702-N Building contains the switch gear for the facility gate and would remain active

9 There would be no action taken at the 1903-N Old Septic System The system would not remain active, but is ready for future remediation

Table 2-2 Waste Generation Summary for Proposed Action

Type of Waste	Volume
Radioactive, low-level (solid)	1,200 m^3 (43,000 ft^3)
Radioactive, low-level (liquid)	5,300,000 L (1,400,000 gal)
Radioactive, mixed (solid)	40 m^3 (1,400 ft^3)
Radioactive, mixed (liquid)	65,000 L (17,000 gal)
Radioactive, mixed (petroleum)	47,000 L (12,000 gal)
Radioactive potential TRU	2 m^3 (70 ft^3) solid, or 75,700 L (20,000 gal) as a slurry in current uncompacted state
Dangerous (solid)	58 m^3 (2,000 ft^3)
Dangerous (liquid)	250,000 L (66,000 gal)
Dangerous (petroleum)	103,000 L (27,000 gal)
Dangerous (compressed gas)	115 kg (252 lb)

Table 2-3 Selected Standards for Handling Low-Level, Mixed, and Dangerous Waste

Standard	**Subject**	**Application**
WAC 173-303-070 to -110	Identification and Listing of Dangerous Wastes	Provides criteria for identification of solid and dangerous waste
WAC 173-303-170 to -230	Standards for Dangerous Waste Generators	Establishes standards for proper packaging, labeling, and storage to prevent releases
WAC 173-303-240 to -270	Standards for Dangerous Waste Transporters	Establishes standards for dangerous waste transporters to prevent releases
40 CFR 761	Polychlorinated Biphenyls (PCBs)	Establishes prohibitions for use of, and requirements for marking, storage, and disposal of PCBs and PCB items
49 CFR 100 to 199	Transportation Regulations	Establish rules for the safe transportation of materials on highways, including marking and handling to prevent releases, incorporated by reference in WAC 173-303 and 40 CFR 761
DOE Order 5480 3	Safety Requirements for the Packaging and Transportation of Hazardous Materials	Addresses the safety-related requirements of transportation
DOE-RL 5820 2A	Radioactive Waste Management	Sets policies, requirements, and guidelines for the safe management and disposal of radioactive wastes

Table 2-4 Radionuclides in Effluent from N Reactor Facilities Following Treatment at the 200 East Area Effluent Treatment Facility

Radionuclides	Effluent Concentration (uCi/L)[a]	Total Curies Discharged to Soil[b]
Americium-241	2 06 x 10^{-8}	1 1 x 10^{7}
Cobalt-60	1 43 x 10^{7}	7 6 x 10^{-7}
Cesium-134	1 61 x 10^{-10}	8 5 x 10^{10}
Cesium-137	1 63 x 10^{7}	8 6 x 10^{7}
Tritium	3 58 x 10^{+1}	190
Potassium-40	1 02 x 10^{10}	5 4 x 10^{-10}
Manganese-54	1 24 x 10^{-9}	6 6 x 10^{9}
Plutonium-238	8 23 x 10^{9}	4 4 x 10^{8}
Plutonium-239/240	5 68 x10^{8}	3 0 x 10^{-7}
Ruthenium-106	2 58 x 10^{-9}	1 4 x 10^{8}
Antimony-125	5 51 x 10^{-7}	2 9 x 10^{-6}
Strontium-90	7 27 x 10^{-4}	3 9 x 10^{-3}

[a] BHI 1995

[b] Based on 5,300,000 L (1,400,000 gal) of effluent

3.0 ALTERNATIVES TO THE PROPOSED ACTION

The alternatives to the Proposed Action considered are the No-Action Alternative and Alternative 1 Other alternatives for disposal of tritiated water, such as reuse, storage and radioactive decay, evaporation and discharge to the river have been previously evaluated for the Hanford Site waste streams (Waters 1988, DOE/RL 1994f, and Breckel 1994) These evaluations did not identify any reuse opportunities, therefore, this alternative was not considered. However, there will continue to be active consideration of reuse opportunities, such as tank sluicing, as new programs ar planned

Current activity levels of tritium would require a storage period of approximately 130 years to decay the tritium to drinking water standard This long-term storage was not deemed practicable or cost effective There is a liquid effluent retention facility (LERF) in the 100-N Area that consists of a high density polyethylene bladder within a lined and bermed impoundment designed to receive primary cooling water This LERF was not designed for continuous or long-term storage It has not been maintained during the past 8 years and its integrity could not be assured. Therefore, this alternative was not further considered

The evaporation alternative was considered less desirable because tritium would be dispersed into the atmosphere which would allow for potential public exposure The air pathway is considered a direct exposure pathway to the body because air is the most variable in direction and unrestricted in dispersion of all pathways considered (Breckel 1994) The discharge to the river option was considered feasible, and is evaluated as an alternative in Section 3 2

3.1 NO-ACTION ALTERNATIVE

Under the no-action alternative, the N Reactor facilities would be maintained in their current condition The current level of S&M would be performed to minimize the potential for environmental release, protect workers, and assure compliance with state and federal regulations and DOE orders Electrical distribution, fire protection, sewer, water, telephone, and other communication needed to support active facilities would remain active and be serviced on a routine basis Contaminated materials would remain in place, including the contaminated water, sediment, and hardware in the 105-N Fuel Storage Basin Other specific activities would include the following

- Daily inspections of facilities.
- Annual safety certifications for all facilities
- Makeup water additions to the 105-N Fuel Storage Basin and the 1300-N Emergency Dump Basin to maintain the water cover for shielding
- Freeze protection of lines in winter.

Relatively small volumes of waste would result from the routine removal of hazardous substances from facilities during surveillance inspections The waste generated by the No-Action Alternative is summarized in Table 3-1

At the current time, no major environmental or safety concerns related to the N Reactor facilities have been identified However, as the facilities continue to age and deteriorate, it is expected that maintenance requirements necessary to continue safe and environmentally protective conditions would increase

3.2 ALTERNATIVE 1 - DISCHARGE TO THE COLUMBIA RIVER

Under Alternative 1, all deactivation activities contained in the Proposed Action would be performed, with the exception of the method of disposal of contaminated water Rather than treating the water at the ETF, the water would be treated at the 100-N Area and discharged to the Columbia River Either a new or revised National Pollution Discharge Elimination System (NPDES) permit would be required for the discharge Discharge limits would be negotiated as part of the permitting process.

Treatment would consist of a combination of filtration and ion exchange, at a facility that would be constructed in the 100-N Area for that purpose Due to technology limitations, the system would not be capable of removing tritium from the water Table 3-2 provides estimates of the radionuclide concentrations that would be expected in the treated effluent that would be discharged to the river All of the waste generated under the Proposed Action would be generated under Alternative 1 This waste would be characterized, packaged, transported, and disposed or stored in the 200 Areas Table 3-1 summarizes the waste generated by Alternative 1

Table 3-1 Waste Generation Summary for No Action Alternative and Alternative 1

Type of Waste	No Action Alternative Volume	Alternative 1 Volume
Radioactive, low-level (solid)	105 m^3 (3,700 ft^3)	1,200 m^3 (43,000 ft^3)
Radioactive, low-level (liquid)	None	5,300,000 L (1,400,000 gal)
Radioactive, mixed (solid)	8 m^3 (300 ft^3)	40 m^3 (1,400 ft^3)
Radioactive, mixed (liquid)	None	65,000 L (17,000 gal)
Radioactive, mixed (petroleum)	None	47,000 L (12,000 gal)
Radioactive potential TRU	None	2 m^3 (70 ft^3) solid, or 75,700 L (20,000 gal) as a slurry in current uncompacted state
Dangerous (solid)	13 m^3 (450 ft^3)	58 m^3 (2,000 ft^3)
Dangerous (liquid)	64,000 L (17,000 gal)	250,000 L (66,000 gal)
Dangerous (petroleum)	None	103,000 L (27,000 gal)
Dangerous (compressed gas)	None	115 kg (252 lb)

Table 3-2 River Discharge from Alternative 1

Radionuclides	Effluent Concentration (uCi/L)[a]	Total Curies Discharged to River[b]
Americium-241	$2\ 06 \times 10^{5}$	$1\ 1 \times 10^{-4}$
Cobalt-60	$1\ 43 \times 10^{-4}$	$7\ 6 \times 10^{-4}$
Cesium-134	$1\ 61 \times 10^{7}$	$8\ 5 \times 10^{7}$
Cesium-137	$1\ 63 \times 10^{-4}$	$8\ 6 \times 10^{-4}$
Tritium	$3\ 58 \times 10^{+1}$	190
Potassium-40	$1\ 02 \times 10^{7}$	$5\ 4 \times 10^{7}$
Manganese-54	$1\ 24 \times 10^{-6}$	$6\ 6 \times 10^{-6}$
Plutonium-238	$8\ 23 \times 10^{6}$	$4\ 4 \times 10^{5}$
Plutonium-239/240	$5\ 68 \times 10^{5}$	$3\ 0 \times 10^{-4}$
Ruthenium-106	$2\ 58 \times 10^{-6}$	$1\ 4 \times 10^{5}$
Antimony-125	$5\ 51 \times 10^{-4}$	$2\ 9 \times 10^{3}$
Strontium-90	$7\ 27 \times 10^{1}$	3 9

[a]From BHI 1995
[b]Based on 5,300,000 L (1,400,000 gal) of effluent

4.0 LOCATION AND AFFECTED ENVIRONMENT

The Hanford Site is located in southcentral Washington State and is about 1,450 km^2 (560 mi^2) of semiarid shrub and grasslands located just north of the confluence of the Snake and Yakima Rivers with the Columbia River (Figure 1-1). The entire Hanford Site has restricted public access and provides a buffer for the smaller areas that were used for production of nuclear materials and that are currently used for waste storage and waste disposal. About 6% of the land area has been disturbed and is actively used. The Columbia River flows eastward through the northern part of the Hanford Site and then turns south, forming part of the eastern boundary. The Yakima River runs along part of the southern boundary of the Hanford Site and joins the Columbia River below the city of Richland. Rattlesnake Mountain, the Yakima Ridge, and the Uhtanum Ridge form the southwestern and western boundary of the Hanford Site. The Saddle Mountains form the northern boundary of the site. Two small east-west ridges, Gable Butte and Gable Mountain, rise above the plateau on the central part of the Hanford Site. Adjoining lands to the west, north, and east are principally range and agricultural lands in Benton, Grant, and Franklin Counties. The cities of Richland, Kennewick, and Pasco (the Tri-Cities), constitute the nearest population center and are located southeast of the Hanford Site. Much of the information in this document, as well as additional details, can be found in *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Cushing 1994) and *RCRA Facility Investigation/Corrective Measures Study work Plan for the 100-NR-1 Operable Unit, Hanford Site, Richland, Washington* (DOE-RL 1994a).

4.1 SITE LOCATION AND REGIONAL POPULATION

The N Reactor facilities are located in the 100-N Area (Figure 1-1), which occupies approximately 259 hectares (640 acres) of the northwestern portion of the Hanford Site, approximately 56 km (35 mi) northwest of the City of Richland. The N Reactor facilities are contiguous to the Columbia River and occupy approximately 2.6 km (1.6 mi) of Columbia River shoreline. Population estimates place the totals for Benton, Franklin, and Grant counties at 122,800, 41,100, and 60,300 respectively (Dirkes et al. 1994). The 1993 estimates for the Tri-Cities populations are Richland, 34,080, Kennewick, 45,110, and Pasco, 21,370 (Dirkes et al. 1994). The population within an 80-km (50-mi) radius of the N Reactor facilities is estimated to be 375,249 people (Shultz 1994).

4.2 REGIONAL AND SITE ACTIVITIES

Activity on the Hanford Site plays a dominant role in the socioeconomic of the Tri-Cities and other parts of Benton and Franklin counties. Major industrial facilities within an 80-km (50-mi) radius include a meat-packing plant, food-processing facilities, fertilizer plants, pulp and paper mill, chemical plant, hydroelectric dams, and small manufacturing firms. Within an 80-km (50-mi) radius of the 100-N Area, but outside the Hanford Site boundary, agriculture is the predominant land use. Government facilities located on the Hanford Site include retired chemical processing plants, radioactive waste management units, decontamination facilities, nuclear materials storage facilities, research laboratories, and the Fast Flux Test Facility. Commercial use of the Hanford Site includes a nuclear power plant (WPPSS Nuclear Plant 2 [WNP-2]) and a low-level radioactive waste burial area administered by Washington State and operated by the U.S. Ecology, Inc. (Cushing 1994).

4.3 PHYSICAL ENVIRONMENT

4.3.1 Geology, Topography, and Seismicity

The Hanford Site overlies the structural low point of the Pasco Basin, a subsection of the Columbia-Snake River Plateau physiographic province (DOE-RL 1994a) The province is the product of flood basalt volcanism and regional deformation that occurred over the past 17 million years (Cushing 1994) The surface features within the Pasco Basin were formed by catastrophic floods and have undergone little modification since that time, with the exception of more recently formed sand dunes (Cushing 1994) The 100 Areas are spread out along the Columbia river in the northern portion of the Pasco Basin

The stratigraphy beneath the Pasco Basin can be divided into six major units (DOE/RL 1994a)

- Basement rocks
- Columbia River Basalt Group,
- Ellensburg Formation
- Ringold Formation
- Early "Palouse" soil
- The Hanford formation

Alluvium, colluvium, and eolian sediments locally veneer the surface of the Pasco Basin The basement rocks are of uncertain composition, but might be composed of sandstones, shales, and granitic rock The Columbia River Basalt Group is compact, dense, and hard lava and is approximately 3,000 m (10,000 ft) thick in the Pasco Basin (DOE-RL 1994a) The Ellensburg, Ringold, and Hanford Formations and Palouse soil are sedimentary units interspersed with and overlying the basalt Not all of the units are present in the 100-N Area Stratigraphic units known to be present are the Saddle Mountain Basalt (an upper unit of the Columbia River Basalt), the Ringold Formation, and the Hanford formation (DOE-RL 1994a) The thickness of the sediments overlying the basalts is about 125 m (410 ft) (Cushing 1994)

The topography of the 100-N Area has elevations ranging from approximately 120 m (390 ft) above mean sea level (amsl) at the Columbia River to approximately 140 m (460 ft) amsl on the east side of the area (DOE-RL 1994a) Some of the area was reworked as part of construction of the N Reactor and associated facilities and is relatively flat with an elevation of approximately 137 m (450 ft) amsl The slope along the riverbank is steep with gradients of at least 15% (DOE-RL 1994a) The surrounding terrain is hummocky, perhaps as a result of catastrophic flooding associated with Pleistocene glaciation (DOE-RL 1994a)

Seismicity of the Columbia Plateau, as determined by the rate of earthquakes per area and the historical magnitude of these events, is relatively low. The largest known earthquake in the Columbia Plateau occurred in 1936 around Milton-Freewater, Oregon

That earthquake had a magnitude of 5.75 and a maximum Modified Mercalli Intensity (MMI) of VII, and was followed by a number of aftershocks that indicate a northeast-trending fault plane (Cushing 1994) Other earthquakes with magnitudes of 5 or larger and/or MMI of VI have been located along the boundaries of the Columbia Plateau in a cluster near Lake Chelan extending into the northern Cascade Range; in northern Idaho and Washington, and along the boundary between the western Columbia Plateau and the Cascade Range Three earthquakes with a MMI of VI have occurred within the Columbia Plateau, including one in the Milton-Freewater region in 1921, one near Yakima, Washington in 1892, and one near Umatilla, Oregon in 1893 (Cushing 1994) In the central portion of the Columbia Plateau, the largest earthquakes near the Hanford Site are two earthquakes that occurred in 1918 and 1973 These two events had magnitudes of 4 4 and MMI of V and were located north of the Hanford Site (Cushing 1994)

4.3.2 Hydrology

The following information was taken from Cushing 1994, except where otherwise noted

4.3.2.1 Surface Hydrology. The only permanently flowing surface water at the 100-N Area is the Columbia River Its flow is regulated by 11 dams within the United States, seven upstream of the Hanford Site, and four downstream The Hanford Reach of the Columbia River is the only stretch of the river within the United States that is not impounded by a dam (DOE-RL 1994a) However, the river levels and stages through the Reach are still controlled by the upstream dams

The Hanford Reach is primarily regulated by the Priest Rapids Dam, which is located approximately 27 river km (17 river mi) upstream from the 100-N Area (DOE-RL 1994a) A minimum regulated discharge of 1,000 m^3/s (36,000 ft^3/s) has been established at the Priest Rapids Dam (DOE-RL 1994a) Typical daily flows during the summer, fall, and winter range from 1,000 to 7,100 m^3/s (36,000 to 250,000 ft^3/s); flows up to 13,000 m^3/s (450,000 ft^3/s) are common during the spring runoff (DOE-RL 1994a) Flow in the Columbia River near the 100-N Area is relatively swift and straight with the riverbed varying in width from 430 to 490 m (1,400 to 1,600 ft) (DOE-RL 1994a) Surface current velocities range from 0 9 to 3 4 m/s (3 to 11 ft/s), depending on the flow rate of the river (DOE-RL 1994a) Average water depths for normal flows range from 7.6 to 11 m (25 to 35 ft) (DOE-RL 1994a)

There are no Federal Emergency Management Agency (FEMA) flood plain maps for the Hanford Reach of the Columbia River The maximum Columbia River flood of historical record occurred in 1894, with a maximum flow of about 21,000 m^3/sec (740,000 ft^3/sec) This event did not cause flooding at what is now the 100-N Area The largest recent event took place in 1948 with an observed peak discharge of 20,000 m^3/sec (706,280 ft^3/sec) at the Hanford Site The construction of dams upstream of the Hanford Site that has occurred since 1948 has significantly reduced the likelihood of floods of this magnitude recurring A theoretical maximum flood for the Columbia River below Priest Rapids Dam was evaluated and determined to produce a flow of approximately 40,000 m^3/sec (1,400,000 ft^3/s) and is greater than the 500-year flood This flood assumed maximum runoff, such as maximum precipitation falling on the drainage area and the upper limits of other hydrologic factors, including antecedent moisture conditions, snowmelt, and tributary conditions Even a flood of this magnitude would not be expected to inundate the 100-N Area

The stretch of the Columbia River from Grand Coulee to the Washington-Oregon border, which includes the Hanford Reach, has been designated as Class A, Excellent Class A waters are suitable for all uses, including raw drinking water, recreation, and wildlife habitat The Columbia River is used as the primary drinking water source by the Tri-Cities State and federal drinking water standards apply to the Columbia River and are currently being met Water quality is routinely monitored from locations upstream and downstream of the Hanford Site by Pacific Northwest Laboratory (PNL) and the U S Geological Survey. The 1993 monitoring results are provided in

Hanford Site Environmental Report 1993 (Dirkes et al 1994) In accordance with Public Law 100-605, a study of the Hanford Reach of the Columbia River was undertaken by the National Park Service, in consultation with DOE The study identified and evaluated the outstanding features of the Hanford Reach of the Columbia River and immediate environment, and examined alternatives for their preservation A final report, *Hanford Reach of the Columbia River - Comprehensive River Conservation Study and Environmental Impact Statement* (DOI 1994), proposes the Hanford Reach for designation as Wild and Scenic River Designation would affect the river from River Mile 396 on the upstream end to River Mile 345 on the downstream end, and 0 4 km (0 25 mi) inland from the shoreline along the length of the study area A majority of the N Reactor facilities lie within the study area

4.3.2.2 Groundwater Hydrology. Both confined and unconfined aquifers occur at the Hanford Site The uppermost confined aquifers include the permeable units within the clay zones of the Ringold Formation, as well as the interflow contacts and interbeds in the Saddle Mountain Basalt (DOE-RL 1994a) The unconfined aquifer is contained within the sands and gravel of the Ringold Formation, however, the water table might extend up into the Hanford formation (DOE-RL 1994a) Sources of natural recharge to the unconfined aquifer are rainfall and runoff from the higher bordering elevations, water infiltrating from small ephemeral streams, and influent river water Observed recharge rates vary from 1 to 10 cm/yr (0 4 to 4 in /yr) or more (DOE-RL 1994a)

The unsaturated sediments, and thus the depth to groundwater, in the 100-N Area range up to 24 m (80 ft) in thickness (DOE-RL 1994a) The uppermost aquifer beneath the 100-N Area is an unconfined sand and gravel unit in the Ringold Formation, in some locations the bottom portion of the Hanford formation was also saturated when groundwater mounds were present (1964-1989) The unconfined aquifer is approximately 12 to 15 m (40 to 50 ft) thick (Hartman and Lindsey 1993) A representative range of transmissivity of the uppermost aquifer is 90 to 600 m^2/d (1,000 to 6,000 ft^2/d), which correspond to a range of hydraulic conductivity of 20 to 90 m/d (50 to 300 ft/d) The values are somewhat higher in the northwest part of 100-N Area (Hartman and Lindsey 1993)

Groundwater in the uppermost aquifer beneath the 100-N Area flows mainly to the north and northwest and discharges to the Columbia River most of the year Effluent disposal to the 1301-N, 1325-N, and 1324-N/NA sites in the past raised the water table beneath these sites and locally altered the hydraulic gradients With the reduction in effluent discharges since the late 1980's, the water table is returning to near pre-operational conditions (DOE-RL 1994a) Groundwater flow in the 100-N Area is also influenced by changes in the Columbia River stage since the aquifer is hydraulically connected to the river River stage fluctuations have been observed as far inland as 230 m (750 ft) (DOE-RL 1994a) In addition, for short periods of time the river level is higher than the water levels in near-river wells, indicating a temporary reversal of hydraulic gradient (DOE-RL 1994a)

Hartman (1993) estimated the rate of groundwater flow beneath the 1301-N and 1324-N/NA sites using a form of the Darcy equation Results indicated the average linear velocity of groundwater beneath the 1301-N site ranged from 0 003 to 0 09 m/d (0 01 to 0 3 ft/d) when the river stage was high, and 0 03 to 1 m/d (0 1 to 4 ft/d) when river stage was low Groundwater velocity beneath the 1324-N/NA site ranged from 0 03 to 0 9 m/d (0 1 to 3 ft/d) when the river stage was high, and 0 06 to 2 m/d) 0 2 to 6 ft/d when the river stage was low

Groundwater quality is routinely monitored as part of the Hanford Environmental Monitoring Program The 1993 results are reported in the *Hanford Site Environmental Report 1993* (Dirkes et al 1994)

4.3.3 Climatology

The following information was taken from Cushing 1994, except where otherwise noted

Climate at the Hanford Site is semiarid, characterized by relatively cool, mild winters, and warm summers For the period 1946 through 1993, the average monthly temperatures recorded at the central Hanford Site meteorological station ranged from a low of -0 9°C (30°F) in January to a high of 24 6°C (76°F) in July The average annual rainfall at the Hanford Site is 16 cm (6 in), with more than half the annual amount occurring in November through February) Days with greater than 1 3 cm (0 5 in) precipitation occur less than 1% of the year

The surface wind pattern at the 100-N Area is greatly affected by the Columbia River and shows a prevailing wind direction from the west-southwest (along the river) Monthly average wind speeds for the Hanford Site are lowest in the winter months, averaging 10 to 11 km/h (6 to 7 mi/h), and highest during the summer, averaging 14 to 16 km/h (8 to 10 mi/h) Summertime drainage winds, which are most prevalent over the northern portion of the Hanford Site including the 100-N Area, are generally northwesterly and frequently reach 50 km/h (30 mi/h) Tornadoes rarely occur in the Hanford Site region and the few that have been sighted were small and did not cause damage. The estimated probability of a tornado striking a point at the Hanford Site is less than 1 in 100,000 per year

4.3.4 Air Quality

The following information was taken from Cushing 1994, except where otherwise noted

During the past 10 years, background concentrations of carbon monoxide, sulfur dioxide, and nitrogen dioxide have been monitored periodically in communities and commercial areas southeast of Hanford These urban measurements are typically used to estimate the maximum background pollutant concentrations for the Hanford Site because of the lack of specific onsite monitoring Because these measurements were made in the vicinity of local sources of pollution, they would overestimate maximum background concentrations within the Hanford Site or at the Site boundaries

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 do not consider "rural fugitive dust" from exceptional natural events when estimating the maximum background concentrations of particulates in the area east of the Cascade Mountain crest Currently, the EPA also exempts the rural fugitive dust component of background concentrations when considering permit applications and enforcement of air quality standards However, EPA is now investigating the prospect of designating parts of Benton, Franklin, and Walla Walla Counties (the Tri-County area) as a nonattainment area for fine particulate material Windblown dust has been identified as a particularly large problem in this area

4.4 ECOLOGY

The following information was taken from Cushing 1994, except where otherwise noted

4.4.1 Terrestrial Ecology

Overall, the Hanford Site has been botanically characterized as shrub-steppe, some areas immediately adjacent to the Columbia River are characterized as riparian Because of the aridity, the productivity of both plants and animals is relatively low In the early 1800's, the dominant plant in the area was big sagebrush with an understory of perennial bunchgrasses. With the advent of settlement, the natural vegetation was invaded by alien annuals, especially cheatgrass More than 600 insect species, most conspicuously grasshoppers and darkling beetles, are presumed to exist at the Hanford Site Twelve species of amphibians and reptiles are found, although their occurrence is infrequent compared with similar fauna in the southwestern United States Numerous types of game birds and water fowl are common as well as migratory species Approximately 39 species of mammals have been identified

In the 100 Areas, cheatgrass is prevalent because of the extensive disturbance of the soils in this area, both by pre-Hanford Site settlers and development of the reactor facilities In a biological review conducted in 1993, it was noted that the insects, reptiles, and amphibians of the 100-N Areas are generally typical of those found elsewhere at the Hanford Site (PNL 1994c, Appendix C) The most abundant game birds nesting in the 100 Areas riverine habitats are the Canada goose, ring-necked pheasant, and California quail. Shoreline trees serve as nesting sites for colonies of great blue herons White pelicans, double-breasted cormorants, common loons, and ospreys are present in the river areas during spring, but only loons have been observed to nest in that area Many species of songbirds nest in the narrow corridor of streamside thickets along the Columbia River The Hanford Site is located in the Pacific Flyway, and in the fall and winter, thousands of ducks and geese rest on the Columbia River islands and shoreline Bald eagles regularly visit the riverine habitat in the winter The Columbia River and adjacent shoreline support populations of beaver, muskrat, mink, raccoon, and striped skunk Coyotes are common, and mule deer forage on shoreline plants and seek shade provided by shoreline trees

4.4.1.2 Threatened and Endangered Species. Both federal and state threatened and endangered plants and animals identified on the Hanford Site are listed in Cushing 1994 No federally-listed species are resident in the 100 Areas However, bald eagles regularly use the Hanford Site during winter months for roosting, perching and forage The eagles are protected onsite according to the *Bald Eagle Site Management Plan for the Hanford Site, South-central Washington* (DOE-RL 1994e) Three species of plants listed by Washington State could be found in the 100 Areas Columbia mill-vetch (*Astragalus columbianus* Barneby), listed as threatened, and Columbia yellowcress (*Rorippa columbiae* Suksd) and northern wormwood (*Artemisia campestris* ssp *borealis* var *wormskioldii*), designated as endangered None of these were encountered in the biological survey of the N Reactor facilities Two candidate molluscans could also occur in the 100 Areas, the shortfaced lanx (*Fisherola nuttali*) and Columbia pebble snail (*Fluminicola columbiana*)

4.4.2 Aquatic Ecology

The Columbia River supports a large and diverse community of plankton, benthic invertebrates, 44 fish species, and other communities Of the fish species, Chinook salmon, sockeye salmon, coho salmon, and steelhead trout use the river as a migration route to and from spawning areas and are of the greatest economic importance. The destruction of other Columbia River spawning grounds by dams has increased the importance of the Hanford Reach spawning Other fish of importance to sport fishermen are the whitefish, sturgeon, smallmouth bass, crappie, catfish, walleye, and perch Large populations of rough fish including carp, shiners, suckers, and squawfish are also present

4.5 CULTURAL RESOURCES

The following information was taken from Cushing 1994, except where otherwise noted

The 100 Areas, including the 100-N Area, are situated on an archaeologically rich segment of the shore of the Columbia River Within 2 km (1.22 mi) of the perimeter of the 100-N Area are fourteen archaeological sites, including five on the south shore of the river and three on the north shore. Four of these sites are either listed, or considered eligible for inclusion, on the National Register of Historic Places None are within the fenceline around the 100-N facilities

The most common evidence of historic activity now found near the 100-N Area consists of gold mine tailings on riverbanks and historic archeological sites where homesteads once stood Few of these vestiges of the early years remain The significance of the 100-N Area buildings, their role in the Cold War, and their potential for eligibility on the National Register have not been determined

5.0 ENVIRONMENTAL IMPACTS

This section compares the environmental impacts attributable to the Proposed Action, Alternative 1, and the No-Action Alternative. The potential impacts analyzed in this EA represent the upper bounding limits of the Proposed Action and alternatives

5.1 IMPACT EVALUATION

Six elements are considered in the evaluation of environmental impacts

- Radiation exposure
- Waste volumes
- Socioeconomic impacts
- Cost impacts
- Ecological and cultural resources
- Cumulative impacts with respect to other Hanford Site activities
- Environmental justice impacts

The environmental impacts are summarized in Table 5-1 and discussed in the following sections It should be noted that the only difference between the Proposed Action and Alternative 1 is the discharge point for treated N Reactor facilities effluent

5.1.1 Radiation Exposure

Radiation exposure would be the primary human health and environmental issue Exposure is discussed in terms of the radiological dose consequences to Hanford Site personnel, the offsite population, and the environment These are defined as follows

- N Reactor Facility Personnel. Hanford Site personnel directly involved in performing the activities of the Proposed Action, Alternative 1, or the No-Action Alternative In the case of the proposed Action and Alternative 1, this includes deactivation personnel, transportation personnel, and S&M personnel For the No Action Alternative, this only includes S&M personnel

- Other Hanford Site Personnel All other personnel within the boundaries of the Hanford Site, not including N Reactor facility personnel

- Offsite Population: All persons located outside the Hanford Site boundary but within an 80-km (50-mi) radius of activities associated with the Proposed Action, Alternative 1, or the No-Action Alternative

- Environment Terrestrial and aquatic biota located on the Hanford Site or within an 80-km (50-mi) radius of activities associated with the Proposed Action, Alternative 1, or the No-Action Alternative Sources of exposure would include all routine activities required to carry out a given alternative Specific sources of routine exposure would include external exposure to radiation fields both in the N Reactor facilities and in the vicinity of vehicles transporting radioactive wastes onsite, and external exposure via emissions and discharges Accident scenarios are considered separately in Section 6 0. Only N Reactor facility personnel and other Hanford Site personnel would receive direct exposure For all alternatives, work-related exposure to an individual worker would be limited to a maximum of 2000 mrem/yr (2 rem/yr) in accordance with DOE administrative control (DOE Order 5480 6) The regulatory limit for worker exposure is 5,000 mrem/yr (5 rem/yr) (10 CFR 835), or 2 5 times the DOE administrative limit Exposure is controlled by ALARA principles such as performing radiation surveys of the workplace, planning activities to minimize time in radiation zones, and controlling exposure time through personnel scheduling Exposure to onsite radioactive waste shipments is controlled through the use of shielding materials and, if necessary, by blocking onsite intersections

The 100-N facility personnel, other Hanford Site personnel, the offsite population, and the environment could receive indirect exposure through contact with, inhalation of, or ingestion of radioactive releases The primary releases under the Proposed Action and Alternative 1 would be radioactive air emissions during deactivation of the 105-N Fuel Storage Basin and liquid discharges from the treatment and disposal of contaminated water from the 105-N Fuel Storage Basin and the 1300-N Emergency Dump Basin

5.1.1.1 Radiation Exposure - Proposed Action

N Reactor Facility Personnel

The whole body collective effective dose equivalent (CEDE) to the N Reactor facility and transportation work force would be approximately 199 person-rem over the life of the Proposed Action About 178 person-rem would be received during deactivation, which occurs during the first 3 years of the Proposed Action The total exposure is the sum of the following

- Based on radiation surveys, preliminary work plans, and the dosimetry records of current N Reactor radiation workers, it was estimated that the N Reactor facility work force would receive a collective exposure of about 177 person-rem from direct exposure inside the facilities (WHC 1993d)

- The dose rate to the driver of the vehicle transporting the fuel spacers would be maintained at or below 2 mrem/hr using shielding or other means Larson 1995, provided in Appendix A) Assuming that this dose rate is the upper bounding exposure for any radioactive waste shipment during the Proposed Action, and assuming a total of 200 person-hours of transportation labor (drivers and other transport personnel), the transportation work force would receive a collective exposure of about 0 4 person-rem

- The N Reactor facility work force would receive a collective exposure of 0 8 person-rem from inhalation of airborne emissions resulting from the Proposed Action (SAIC 1994, provided in Appendix B)

- The potential CEDE to the S&M work force in the years from 1998 through 2018 is estimated as less than 1 person-rem annually This is based on a current collective exposure of 5 person-rem per year for S&M of the N Reactor facilities and an assumed reduction in both radiation levels and S&M person-hour requirements resulting from deactivation.

The person-rem collective dose equivalent can be converted to estimates of health effects, expressed as the number of cancer deaths (latent cancer fatalities [LCF]) resulting from exposure to low dose rates of ionizing radiation For workers, the conversion factor is 400 LCF per million person-rem effective dose equivalent (International Commission on Radiological Protection [ICRP 1991]) Based on a work force of 194 during the deactivation phase and a CEDE of 199 person-rem, the average individual worker would receive an effective dose equivalent (EDE) during the proposed action of 1 person-rem The estimated probability of the worker dying from cancer induced by such radiation doses is approximately 4×10^{-4} (1 in 2,500) Therefore, N Reactor and transportation workers would not be expected to incur any harmful health effects from radiation exposures they receive during the Proposed Action

During the Proposed Action, a maximally exposed worker would receive an EDE of 2000 mrem/yr (the DOE administrative control limit) Assuming that this level of exposure could only be received during the 3-year deactivation phase of the Proposed Action, the maximally exposed worker would receive a total of 6 rem Using the conversion fraction of 400 LCF per million person-rem effective dose equivalent, the estimated probability of the worker dying of cancer induced by such radiation exposures would be approximately 2×10^{-3} or one chance in 500

Other Hanford Site Personnel

Other Hanford Site personnel could be exposed to radiation by being near radioactive waste shipments and through exposure to airborne emissions resulting from the Proposed Action The EDE to an individual in the other Hanford Site personnel group resulting from the Proposed Action would be approximately 10 mrem/yr This level of exposure would only occur during the 3-year deactivation phase Total exposure to an individual would be about 30 mrem over the course of the Proposed Action

Maximum exposure limits for over-the-road truck shipments specify a dose rate of no more than 10 mrem/hr at a distance of 2 m (6 6 ft) from the outer surface of the transport vehicle (49 CFR 173.44) These limits would be achieved for onsite shipments of liquid effluent to the ETF and for most shipments of solid low-level and mixed waste transported as part of the Proposed Action. The fuel spacers and silos and possibly the 105-N Fuel Storage Basin sediment have the potential to exceed a dose rate of 10 mrem/hr at 2 m (Larson 1995 and Duncan 1995) To control exposure to other Hanford Site personnel during these shipments, transportation plans would be developed before waste shipment such that personnel not involved with the shipment would be exposed to a dose rate of no greater than 10 mrem/hr at the point of closest access to the shipment This could be accomplished by several methods, such as blocking traffic at railroad intersections to keep a sufficient distance between personnel and the rail cars

Assuming that a Hanford Site worker not associated with the Proposed Action spends a maximum of 1 hour per year at the minimum distance that would result in a dose rate of 10 mrem/hr, the maximum exposed individual would receive an exposure of 10 mrem/yr from radioactive waste shipments

In addition to exposure during shipments of radioactive materials, onsite personnel not involved in deactivation would be exposed to airborne emissions resulting from the Proposed Action It is anticipated that this exposure to any individual worker would be approximately equal to the exposure received by the maximally exposed individual in the Offsite Population, or less than 0 001 mrem/yr

Offsite Population

The total projected EDE to the maximally exposed individual (MEI) in the offsite population would be less than 4 x 10^{-4} mrem/yr from activities associated with the Proposed Action, and the total population dose would be about 0 025 person-rem This exposure would only occur during the 3-year deactivation phase, and would result from the following airborne emissions

- 105-N Fuel Storage Basin As hardware in the basin is cut, washed, and removed and the basin is cleaned, droplets of contaminated water and sediment could be dispersed into the air space during deactivation In addition, approximately 12 Ci of tritiated water would evaporate into the air space The system that ventilates the basin air space is equipped with HEPA filters that remove 99 95% of particulate matter before air from the basin is released The ventilation system would not remove tritium The total projected EDE to the MEI from fuel storage basin airborne emissions would be 2 2 x 10^{-4} mrem/yr (DOE-RL 1994b), and the total population dose would be 0 009 person-rem/yr. The basin hardware removal activities occur over the course of 2 years, so the total population dose for the region within 80 km (50 mi) of the Hanford Site would be about 0 018 person-rem

- 1300-N Emergency Dump Basin Airborne emissions from the dump basin were estimated by comparing the potential evaporation or tritium from the dump basin to the release of tritium from the 105-N Fuel Storage Basin (The dump basin does not contain hardware that requires removal and therefore does not have the same potential mechanism for the generation of airborne droplets) In the fuel storage basin evaluation, tritium emissions account for one-third of the exposure, or 8 x 10^{-5} mrem/yr (DOE-RL 1994b) The dump basin contains a total of 0 13 Ci of tritium, or about one one-hundredth the quantity of tritium released from the fuel storage basin Assuming that all of the tritium in the dump basin evaporates, the total projected EDE to the MEI from emissions from the dump basin would be approximately 1 x 10^{-6} mrem/yr.

- 1303-N Spacer Storage Silos The cobalt-60 inventory of the spacers is 305 Ci (Larson 1995, provided in Appendix A) Approximately 1% of this inventory is assumed to be particulate (corrosion product) and the rest is solid metal matrix Based on an air emissions factor of 10^{-3} for particulate and 10^{-6} for solids (WAC 246-247), and unit dose equivalent of 5 7 x 10^{-2} mrem/Ci to the offsite MEI (DOE-RL 1994b), emissions from the fuel spacer and silo removal would result in a projected EDE to the MEI about 2 x 10^{-4} mrem The population dose for the region within 80 km (50 mi) of the Hanford Site would be 0 007 person-rem

For the general public, which might include sensitive individuals such as children, the health effects conversion factor is 500 LCF per million person-rem effective dose equivalent (ICRP 1991) Based on the dose-to-risk conversion factor and a total population dose of 0 025 person-rem, the estimated probability of any member of the offsite population having a cancer death caused by radiation exposure from the Proposed Action would be about 1 3 x 10^{-5}, or one chance in 80,000

Environment

The majority of the activities of the Proposed Action would occur inside buildings or other structures, with the exception of activities at the 1300-N Emergency Dump Basin and 1303-N Spacer Storage Silos which are located in previously developed areas Biological surveys suggest that no sensitive habitat would be impacted (PNL 1994c, PNL 1994d provided in Appendix C)

5.1.1.2 Radiation Exposure - Alternatives

N Reactor Facility Personnel

Under the No-Action Alternative, radiation exposure to personnel who would continue to provide S&M support at the N Reactor facilities would be about 5 person-rem per year (Walsh 1993 provided in Appendix E) Exposure to the S&M work force would continue until the N Reactor facilities are deactivated Assuming a S&M work force of 50 persons (Duncan 1995), the cumulative exposure over a period from 1995 through 2018 would be about 120 person-rem Based on a dose-to-risk conversion factor of 400 LCF per million person-rem (ICRP 1991), and a workforce of 50, the estimated probability of a cancer death for the average worker caused by radiation exposure during the action would be about 1 x 10^{-3} or about one chance in a 1000 Therefore, N Reactor facility S&M personnel would not be expected to incur any harmful health effects from radiation exposures they receive under the No Action Alternative

Deactivation is a prerequisite to D&D Even if the no Action Alternative is implemented, it is anticipated that at some time in the future, N Reactor facility personnel would incur about the same as exposure under the Proposed Action (with some decrease due to radioactive decay)

Under Alternative 1, total radiation exposure (199 person-rem) would be the same as under the Proposed Action Administrative controls would be used to ensure that no N Reactor facility personnel would be exposed to more than 2,000 mrem/yr on an individual basis

Other Hanford Site Personnel, Offsite Population, and the Environment

Under the No-Action Alternative, current levels of emissions and discharge would remain the same (except for the effects of radioactive decay) The radiation dose to the offsite MEI from all 100 Area operations in 1993, including the 100-N Area, was 8 x 10^{-4} mrem, and the population dose was 0 004 person-rem (Dirkes, et al 1994) There would be fewer radioactive waste shipments and thus a lower exposure to other Hanford Site personnel that under the Proposed Action

Under Alternative 1, radiation exposure to other Hanford Site personnel and the offsite population from air emissions would be the same as under the Proposed Action. Exposure to other Hanford Site personnel via radioactive waste shipments would be somewhat less than for the Proposed Action, since contaminated water would be treated and discharged at the 100-N Area rather than being transported across the Hanford Site for treatment and discharge No measurable increase in exposure to the offsite population would be expected from effluent discharge to the Columbia River The nearest public drinking water intake is the City of Richland about 60 km (37 mi) downstream of the

100-N Area, and there would be substantial dilution of any river discharges prior to downstream intakes

5.1.2 Waste Volumes

A major activity under the Proposed Action and Alternative 1 would be the removal of hazardous substances, including radioactive materials, from the N Reactor facilities These substances could be designated as wastes upon removal Contaminated water would also be removed under both alternatives, with eventual treatment and disposal The No-Action Alternative would involve removing only that volume of waste associated with routine S&M

Volumes of waste removed from the N Reactor facilities would be the same under both the Proposed Action and Alternative 1 and would involve removing essentially all hazardous substances that could be designated as wastes from the N Reactor facilities Volumes of waste generated under the No-Action Alternative would be substantially lower, consisting of chemicals and contaminated materials typically generated or removed during routine S&M Table 5-1 summarizes waste volumes for the alternatives

The volume of liquid effluent discharged would be 5,300,000 L (1,400,000 gal) and would be the same under the Proposed Action and Alternative 1 Under the Proposed Action, the liquid would be discharged to the soil in the 200 Area, and under Alternative 1, the liquid would be discharged to the Columbia River in the 100-N Area

5.1.3 Socioeconomic

Socioeconomic impacts are defined to include the impacts on employment, population, housing, and transportation to communities near the 100-N Area The primary socioeconomic study area is the Tri-Cities area, including the communities of Richland and Kennewick in Benton County and Pasco in Franklin County

During the deactivation phase of the Proposed Action and Alternative 1, an average staff of approximately 194 people would be required This would be an increase of about 144 people over current S&M requirements for the N Reactor facilities However, most of the necessary people with appropriate skills are already employed at the Hanford Site and, as necessary, could be deployed to the deactivation project The 144 people are approximately 0 9% of the Hanford Site workforce of approximately 16,000 employees Following deactivation, approximately 3 people would be required for routine S&M Any other staffing requirements would be intermittent Staffing requirements would shift to D&D, so this decrease would not necessarily represent a loss of employment Social and economic impacts cannot be quantified at this time because of uncertainties associated with the future Hanford Site budgets

Approximately 50 people would be required to implement the No-Action Alternative These people are already employed at the N Reactor and performing the activities of the No-Action Alternative, so this alternative would not impact current staffing levels, nor would a socioeconomic impact be expected

5.1.4 Ecological and Cultural Resources Impacts

Biological reviews of the N Reactor facilities were conducted in 1993 and 1994 (PNL 1994c, PNL 1994d) PNL (1994c) identified vegetation as sparse and consisting primarily of Russian thistle and cheatgrass Of the species encountered, none were listed as endangered or threatened, or candidates for such listing by Washington State or the federal government, or species listed as monitor species by the Washington State government The review noted that a wide variety of avian species nest on the ground or on buildings in the 100-N Area, and recommended that deactivation activities be scheduled to minimize disturbance of the avian species during the nesting season (April to June) Given this, is was anticipated that no destruction of migratory birds, their eggs, or nests should result from the proposed deactivation activities A subsequent review (PNL 1994d) was conducted during nesting season and confirmed this finding

Cultural resource reviews conducted in 1994 (PNL 1994a, PNL 1994b, provided in Appendix D) did not identify known archeological resources in or around the N Reactor facilities However, workers would be instructed to watch for cultural materials (e g , bones, artifacts) during any earth-disturbing activities Should any such cultural materials be encountered, work would stop until such time as a qualified archaeologist has been notified, and the site properly assessed The reviews also determined that, overall, the scope of work contemplated as part of deactivation would have no effect on any aspects of the buildings that would make them eligible for the National Register (PNL 1994a) The first review stated that two buildings had already been identified as eligible for the National Register (PNL 1994a), but a subsequent review (PNL 1994b) found that the buildings were not eligible (PNL 1994b) The Washington State Department of Community Development Office of Archeology and Historic Preservation concurred with the assessment that the Proposed Action would not impact eligibility for the National Register (Griffith 1994, provided in Appendix D)

5.1.5 Cost Impacts

The current annual cost for S&M of the N Reactor facilities is approximately $8 million Under the No-Action alternative, it is likely that this cost would increase over time as the facilities continue to age and require increasing levels of maintenance to maintain safety and prevent the release of hazardous substances To account for this, the baseline cost of S&M is assumed to increase by $5 million beginning in 1996, $1 million beginning in 2001, and $2 million beginning in 2006 (Duncan 1995) In addition, costs are assumed to escalate at a rate of 3% each year because of inflation Total costs of the No-Action Alternative are as follows (Duncan 1995)

S&M (1995-1997)	$ 26 million
S&M (1998-2018)	$ 301 million
Total (No Action):	**$ 327 million**

The cost of the Proposed Action and Alternative 1 would be about equal They include both the cost of deactivation itself and the cost of S&M during and following deactivation For cost evaluation purposes, it was assumed that the cost for S&M during deactivation would be the same as for the No-Action Alternative The cost of S&M would drop to $2 million following deactivation

Total costs of the Proposed Action or Alternative 1, assuming an escalation rate of 3% (for inflation), are as follows (Duncan 1995)

Deactivation (1995-1997)	\$ 60 million
S&M (1995-1997)	\$ 26 million
S&M (1998-2018)	\$ 87 million
Total:	**\$ 173 million**

An analysis of costs in terms of nonrenewable resources is not provided The quantity of nonrenewable resources that would be committed to deactivation would be the same whether these activities are completed over the next 3 years, as under the Proposed Action or Alternative 1, or deferred to some time in the future prior to D&D, per the no-action alternative

5.1.6 Cumulative Impacts

Ongoing and future activities at the Hanford Site include environmental cleanup, waste management, research and development, and technology development Activities that would be expected to occur in the 100-N Area during the same time as the Proposed Action include characterization of waste sites, remediation of soil and groundwater, and D&D of facilities The cumulative impacts of the other activities in the 100-N Area and at the Hanford Site are summarized as follows

5.1.6.1 Radiological Exposure. No activities outside of the 100-N Area are expected to contribute directly to the exposure of N Reactor facility workers, due to the distance between Hanford areas The nearest operational areas are in the 100-K Area, where spent nuclear fuel is currently stored in basins, and the 100-D Area, where initial soil and groundwater remediation efforts are underway Both areas are about 2 km (1 2 mi) from the 100-N Area and no impacts on other Hanford Site workers from these areas have been identified Current activities in the 100-N Area include characterization of soil, groundwater, and waste sites and implementation of an expedited response action near the river to remediate groundwater No increases in normal background exposure levels in the 100-N Area are expected from these activities The average background exposure rate in the 100-Area in 1993, as measured by thermoluminicant dosimeter monitoring location, was 197 mrem for the year (DOE-RL 1994c) This is a 24-hour-a-day, 365-days-a-year exposure, and does not reflect the exposure to an individual worker

Members of the public are potentially exposed to low levels of radiation from airborne and liquid effluent releases from a variety of Hanford Site operations The dose to the MEI in 1993 from all Hanford Site operations was 0 03 mrem, and the dose to the offsite population was 0 4 person-rem (Dirkes et al 1994)

The dose to the offsite MEI from all 100 Area operations in 1993 was 8×10^{-4} mrem, and the population dose was 0 004 person-rem (Dirkes et al 1994) The only exposure to the offsite population from the Proposed Action or Alternative 1 would be from airborne emissions during the deactivation phase of the action These emissions would add about 0 0004 mrem/yr to the MEI, and 0 01 person-rem/yr to the population dose

5.1.6.2 Volumes of Radioactive and Dangerous Wastes and Liquid Effluents Many activities at the Hanford Site result in the generation of radioactive and dangerous wastes and the discharge of liquid effluents The Proposed Action and Alternative 1 would add an incremental amount to those wastes and effluents as follows

- The total volume of radioactive waste reviewed for disposal, or storage in the 200 Areas in 1993 was 13,000 m^3 (460,000 ft) (Anderson 1994) The proposed Action and Alternative 1 would add 1,200 m^3 (42,000 ft^3) to the total waste receipts a over 3-year period

- The Hanford Site (excluding PNL) generated 700,800 kg (1,540,000 lb) of dangerous waste in 1993 (DOE-RL 1994d) The total mass of dangerous waste generated as a result of the Proposed Action and Alternative 1 would be as much as 364,000 kg (800,000 lbs) of dangerous waste over a 3-year period, or an average of 121,000 kg (264,000 lbs) of dangerous waste each year

- Total discharges of radioactive liquid effluents to the soil from the Hanford Site operations in 1993 were 5,600,000,000 L (1,500,000,000 gal) (WHC 1994) (This volume does not include sanitary waste discharges) Approximately 5,300,000 L (1,400,000 gal) of liquid effluents would be discharged into the soil from the Proposed Action, or about 0 1% of the 1993 total Discharges of radioactive effluents to the Columbia River from 100 Area operations in 1993 totaled 920,000,000 L (240,000,000 gal) (WHC 1994), excluding groundwater seepage to the river at N Springs Discharges of radioactive effluents to the river resulting from Alternative 1 would total about 5,300,000 L (1,400,000 gal), or 0.5% of the total 1993 discharge

The projected volumes of waste would have no cumulative impact on the storage capacity of the Hanford Site

5.6.1.3 Socioeconomic Impacts. The number of people directly involved with the deactivation activities of the Proposed Action or Alternative 1 is a small fraction of the current employment (about 16,000) for all Hanford Site operations The projected impacts on staffing would have no cumulative impact on the socioeconomic of the region around the Hanford Site

5.1.7 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires that federal agencies 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 The proposed actions would occur within the boundary of the Hanford Site Any potential impacts associated with the proposed actions would affect only onsite employees It is not expected that there would be any disproportionate adverse effects to low-income or minority populations in the surrounding communities

5.2 Comparison of Alternatives

This section compares the environmental impacts of the No-Action Alternative and Alternative 1 to those of the Proposed Action

5.2.1 *No-Action Alternative*

The No-Action Alternative continues routine S&M operations and does not proceed with deactivation

The advantages of the No-Action Alternative are as follows

- In the near-term workers would receive lower radiation exposures Only exposure required for continuing the current level of operations would be incurred versus the exposure incurred in deactivating facilities under the Proposed Action
- The volumes of radioactive waste removed would be much lower than quantities removed under the Proposed Action
- The volumes of dangerous waste removed would be much lower than quantities removed under the Proposed Action

The disadvantages of the No-Action Alternative are as follows

- It would not achieve the purpose, described in Section 1 0, of reducing the potential for environmental release from N Reactor facilities and reducing S&M cost
- It would reduce the potential for reuse, recycling, or disposal of materials from the N Reactor facilities
- It would require continued operational costs (estimated at approximately $13,000,000 per year) to perform S&M of facilities no longer needed by the government
- In addition to the exposure and costs incurred, performing long-term S&M with the facilities in their current condition, deactivation, and the attendant exposure, waste generation, and costs, would eventually be required to D&D the N Reactor facilities

5.2.2 Alternative 1

Alternative 1 allows for the completion of all activities necessary for the deactivation of the affected N Reactor Facilities Contaminated water would be treated at the 100-N Area to meet discharge limits prior to discharge to the Columbia River.

The advantages of Alternative 1 are that onsite transportation of radioactive wastes would be reduced, and the deactivation schedule would not be dependent on the ETF permitting and operations schedule

The disadvantage of Alternative 1 is there would be a tritium effluent discharge to the Columbia River above the drinking water standard (Breckel 1994)

Table 5-1 Summary of Impacts by Alternative (2 sheets)

Impact	No Action Alternative	Alternative 1	Proposed Action
Time frame	24 years	24 Years	24 Years
Exposure			
N Reactor personnel (work force)	120 person-rem cumulative, no health effects expected	199 person-rem cumulative No health effects expected	199 person-rem cumulative No health effects expected
Other Hanford Site personnel (individual)	Current levels, no health effects expected	Current levels plus an additional 10 mrem/yr or less No health effects expected	Current levels plus an additional 10 mrem/yr No health effects expected
Offsite population (individual)	Current levels, no health effects expected	Current levels plus < 0 0023 mrem/yr < 0 0069 mrem total No health effects expected	Current levels plus <0 0023 mrem/yr <0 0069 mrem total No health effects expected
Offsite population (population)	Current levels, no health effects expected	Current levels plus 0 025 person-rem 0 075 person-rem total No health effects expected	Current levels plus 0 025 person-rem 0 075 person-rem total No health effects expected
Waste			
Radioactive, low-level (solid)	105 m^3 (3,700 ft^3)	1,200 m^3 (43,000 ft^3)	1,200 m^3 (43,000 ft^3)
Radioactive, low-level (liquid)	None	5,300,000 L (1,400,000 gal)	5,300,000 L (1,400,000 gal)
Radioactive, mixed (solid)	8 m^3 (300 ft^3)	40 m^3 (1,400 ft^3)	40 m^3 (1,400 ft^3)
Radioactive, mixed (liquid)	None	65,000 L (17,000 gal)	65,000 L (17,000 gal)

Table 5-1 Summary of Impacts by Alternative (2 sheets)

Impact	No Action Alternative	Alternative 1	Proposed Action
Waste (cont)			
Radioactive, mixed (petroleum)	None	47,000 L (12,000 gal)	47,000 L (12,000 gal)
Radioactive potential TRU (7,100 nCi/g)	None	2 m^3 (70 ft^3) solid, or 75,700 L (20,000 gal) as a slurry	2 m^3 (70 ft^3) solid, or 75,700 L (20,000 gal) as a slurry
Dangerous (solid)	13 m^3 (450 ft^3)	58 m^3 (2,000 ft^3)	58 m^3 (2,000 ft^3)
Dangerous (liquid)	64,000 L (17,000 gal)	250,000 L (66,000 gal)	250,000 L (66,000 gal)
Dangerous (petroleum)	None	103,000 L (27,000 gal)	103,000 L (27,000 gal)
Dangerous (Compressed gas)	None	115 kg (252 lb)	115 kg (252 lb)
Liquid Effluents	None	5,300,000 L (1,400,000 gal) to the Columbia River	5,300,000 L (1,400,000 gal) to soil
Socioeconomic	50 Workers (1995-2018)	194 workers (1995-1997) 3 workers (1998-2018)	194 workers (1995-1997) 3 workers (1998-2018)
Ecological/Cultural Resources	No impacts identified	No impacts identified	No impacts identified
Cost	$327 million	$173 million	$173 million

6.0 ACCIDENT EVALUATION

Accident scenarios that could result in a radiological release to the environment were reviewed No conditions were identified that would result in a fire No chemical or radiological conditions were identified that could reasonably result in an explosion or the bulk release of hazardous chemicals or radionuclides The derailment of a rail car or cars during transport of the 105-N Fuel Storage Basin radioactive sediment was considered The probability of a radioactive transportation rail accident at the Hanford Site has been estimated based on national rail statistics and factored for the special controlled conditions (WHC 1993) The roll-over accident frequency is estimated to be 4 2 x 10^{-9} per mile traveled at the Hanford Site, or once every 20,000,000 shipments of 19 3 km (12 mi) (WHC 1993) The probability of this accident occurring for the proposed shipment would not be credible and therefore, it was not evaluated further

The accident with the maximum potential impact was determined to be a release of radiologically-contaminated water from the 105-N Fuel Storage Basin. This scenario is based on a similar release of contaminated water from the 100-KE Fuel Storage Basin The K Basin release was the result of the failure of a construction joint in the basin. Similar joints do not occur in the 105-N Fuel Storage Basin, but the fact that a basin release has previously occurred on the Hanford Site makes this event reasonably foreseeable A probability for the event was not calculated

This accident could occur under any of the three alternatives However, the probability would be higher under the No Action Alternative because water is stored in the basin for a longer period of time The water release could involve a release that is either contained within the N Reactor building or that escapes to the environment Both cases were evaluated in terms of their impacts to the environment, onsite personnel, and offsite population

6.1 CASE 1 - RELEASE TO THE ENVIRONMENT

In Case 1, it is assumed that all of the water in the basin is released to the Columbia River over a period of 90 days The mechanism by which the water reaches the river is not considered here While it is not considered probable for such a release to occur, it is evaluated here to develop the extreme risk analysis This hypothetical release could only occur if (1) the basin develops a leak of 1900 L/hr (500 gal/hr), (2) if the water is preferentially directed towards the river, (3) if the contaminants in the water are not absorbed or physically held up by surrounding soils, and (4) if no corrective action is taken to stop the leak At the end of 90 days, all 5,300,00 L (1,400,000 gal) of contaminated water would have been released

The offsite radiation dose resulting from this hypothetical liquid release from the basin was calculated by the Hanford Site standard computer model GENII (Napier et al 1988), results are provided in Table 6-1 The model determines what the maximum exposure will be to an individual living at the closest public inhabited area from the discharge point and assumes that the diet of the exposed individual consists of 100% home grown food and that the water supply is untreated and comes directly from the river. This individual is considered to be the MEI The maximum radiation doses from specific radionuclides would total 4 x 10^{-4} person-rem EDE to the MEI from this hypothetical release This impact to the MEI is 10 times less than the EPA allowable drinking water standard of 4 mrem/yr (40 CFR 143) Using a health effects conversion factor of 500 LCF per million person-rem

EDE (ICRP 1991), the probability of this offsite individual dying of cancer from this release would be approximately 2 x 10^{-7} (1 in 5,000,000)

The basin water is used to shield workers from exposure to radioactive sediments In the event of a loss of water and if the basin cannot be repaired, an alternate shielding mechanism would be required This could include adding a solid material such as sand The dose to the maximally exposed worker would be subject to administrative control and would not exceed 2000 mrem/yr

6.2 CASE 2 - RELEASE WITHIN N REACTOR BUILDING

Case 2 assumes that the water released from the basin is confined within the 105-N Building, which houses the 105-N Fuel Storage Basin Several mechanisms can be postulated for water accidentally draining out of the basins The most likely failure event would be damage or improperly positioned basin drain valves The event is assumed to occur instantaneously, and without corrective action

Because of the configuration of the 105-N Building, the water released would be confined within either the basin or within the lift station sump The total volume of the basin water, 5,300,000 L (1,400,000 gal) would not be released into the building due to the equalization of water depths within the building

Particulate airborne contamination resulting from basin water that leaked would remain within the ventilation envelope of the 105-N Building ventilation system where air is collected and filtered prior to being exhausted from the facility No quantifiable offsite radiological consequences were identified for this case No radiological dose consequences were analyzed for the remediation activities associated with this accident scenario The dose to the maximally exposed worker would be subject to administrative control and would not exceed 2000 mrem/yr

6.3 EFFECT OF ALTERNATIVES ON ACCIDENT SCENARIOS

The No-Action Alternative would leave radiologically-contaminated water in the 105-N Fuel Storage Basin until such time as deactivation is implemented Both the Proposed Action and Alternative 1 activities would remove the water from the 105-N Fuel Storage Basin during the next 3 years and would thus mitigate the possibility of a liquid release to environment

Table 6-1 Offsite Dose Impacts from a 90-Day Release of 105-N Fuel Storage Basin Water at 500 Gallons per Hour

Radionuclide	**Curies per Day**	**Curies Total over 90 Days**	**MEI Offsite Dose (mrem)**[a]
Plutonium-239/240	1 8 x 10^{-5}	1 6 x 10^{3}	9 7 x 10^{-6}
Strontium-90	5 5 x 10^{2}	5 0 x 10^{0}	3 0 x 10^{2}
Cesium-137	1 1 x 10^{2}	9 9 x 10^{1}	3 2 x 10^{1}
Tritium	6 4 x 10^{1}	5 8 x 10^{1}	3 8 x 10^{-5}
Cobalt-60[b]	7 5 x 10^{-2}	6 8 x 10^{0}	1 6 x 10^{-2}
TOTAL	--	--	3 7 x 10^{-1}

Source Gano 1993
[a]EPA drinking water standard is 4 mrem/yr
[b]Cobalt-60 concentration as of 03/05/93

7.0 PERMITS REQUIRED

The Notification of Construction permit approvals for radioactive air emissions resulting from deactivation activities at the 105-N Fuel Storage Basin have been received from the Washington State Department of Health (DOH) (Conklin 1994) and the EPA (McCormick 1994)

All permits for radioactive air emissions resulting from deactivation activities at other N Reactor facilities will be obtained as necessary prior to initiating the activity

8.0 AGENCIES CONSULTED

The Proposed Action would occur within 0 40 km (0 25 mi) of the Columbia River, the distance that defines the Hanford Reach corridor The U S Department of the Interior, National Park Service was consulted to ensure that the Proposed Action would be consistent with the purposes for which the Hanford Reach is being considered for protection under the *Hanford Reach Act* (Public Law 100-605) We have no serious concerns with the proposed action provided that all reasonable care is taken to avoid contamination and other impacts to the proposed White Bluffs National Wildlife Refuge and Columbia National Wild and Scenic River

Ecology, EPA, and DOH personnel were included in value engineering studies to optimize the activities of the Proposed Action The studies focused on methods to reduce worker exposure, waste generation, and environmental releases during the Proposed Action

A draft of this document was sent to Washington State and Oregon State, the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Pierce Tribe, Wanapum, and the National Park Service and other interested parties on December 22, 1994, for preapproval review Written comments were received from Ecology, Confederated Tribes and Bands of the Yakama Nation, and the National Park Service The comments and responses are found in Appendix G No other written comments were received in response to the draft document

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APPENDIX A

DOSE RATE FOR FUEL SPACER SILOS

Bechtel

50 Beale Street
San Francisco, CA 94105-1895
Mailing address P.O. Box 193965
San Francisco, CA 94119 3965

February 21, 1995

Garth M Duncan
Project Engineer
BHI

Dear Garth

The following summarizes radiological aspects of some N Reactor deactivation activities

We have evaluated representative container and shipping configurations for reactor fuel spacer disposal to estimate container contact and transportation driver doses

For a 500 cubic foot nominal concrete box or grouted steel cylinder filled with spacers, the contact dose rate would be between 800 and 1,000 mrem/hr Assuming a 20 ft distance between the box and the driver, about 2.5 inches of lead would be required to limit the dose rate to the driver to less than 2 mrem/hr. For a grouted silo, about 16 inches of 150 pcf grout would be required to limit the dose rate to the driver to less than 2 mrem/hr

Actual values for these parameters will be determined once final container and transportation configurations and the specific shielding method are decided

Based on contact dose rate readings of 6 rem/hr in the center of the silos, the volume and mass of the spacers in the silos provided by the project, and ^{60}Co as the sole isotope as reported by Westinghouse, we estimate the total activity in the two silos at between 270 and 340 Ci giving a median value of 305 Ci

Please fell free to contact me if there are any questions

Sincerely,

A R Larson
Engineering Specialist

Bechtel National, Inc. *Systems Engineers-Constructors*

APPENDIX B

DOSE CALCULATION FOR HANFORD SITE WORKERS

THIS APPENDIX PROVIDES THE DOCUMENTATION OF THE 0.8 PERSON-REM EXPOSURE THE N REACTOR WORKERS WOULD RECEIVE FROM INHALATION OF AIRBORNE EMISSIONS RESULTING FROM THE PROPOSED ACTION

Science Applications International Corporation
An Employee-Owned Company

January 21, 1994 94-0021.WAC

Mr. Gary Wells
Westinghouse Hanford Company
P.O. Box 1970
MSIN H6-26
Richland, WA 99352

SUBJECT: N REACTOR STABILIZATION ENVIRONMENTAL ASSESSMENT BACK-UP MATERIAL

Dear Gary:

Attached is Revision 2 of the letter report we originally produced for dose calculations for the subject EA. This revision is based on the change in estimated volume for the sludge, from 12 m^3 to 2 m^3, and the change in total exposure hours from 83,000 to 34,500 (provided by N Reactor Management in early December). The method of calculation was not changed, and as expected there is a significant reduction in the internal dose. The external dose (192.6 Person-rem) is from the latest version (Rev. 4) of the N Reactor Closure Plan.

This report will most probably have to be cleared, as we reference it in the EA as the basis for an internal dose of 0.8 Person-rem over the project life.

If I can be of further service or provide any additional information, please contact me at the SAIC Richland Office at 943-3133.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Warren A. Cohen
Senior Environmental Engineer

William Herrington
Senior Radiological Engineer

WAC/drs

Enclosure

cc: Ralph Gamara - WHC
Project File/LB

1845 Terminal Drive, Richland, Washington 99352 • (509) 943-3133 • FAX (509) 943-5121
Other SAIC Offices: Albuquerque, Boston, Colorado Springs, Dayton, Falls Church, Huntsville, Las Vegas, Los Angeles, McLean, Oak Ridge, Orlando, Palo Alto, Seattle, Tucson

N REACTOR BASIN STABILIZATION CALCULATIONS FOR MAXIMUM ANNUAL AND COLLECTIVE DOSE Revision 2

Calculations were performed to assess the internal dose to workers from stabilization of the N Reactor Basin. These calculations considered the committed effective dose equivalent (CEDE) to workers via the inhalation pathway. Previous calculations estimated the effective dose equivalent for external exposure.

Inhalation Model and Assumptions

The assumed release scenario for the worker dose calculations was conservative in its assumptions and relied on Westinghouse Hanford referenced data when possible. The release and exposure scenario consisted of a radioactively contaminated sludge volume (2 cubic meters) (WHC, 1994) uniformly mixed into the current maximum Basin aqueous volume (4,088,000 liters) (WHC, 1994), and made airborne according to previously established resuspension models. (R. Borkowski, 1986). Standard respiratory protection was assumed in the calculations and workers were exposed up to a maximum of 2000 hours per year to obtain the maximum annual CEDE calculations. Collective CEDE to the worker population was based on total worker hour exposure for Tasks 1.0 to 11.0 for the Westinghouse N-Basin Task Plan (WHC, 1993), as verbally revised by the N Reactor Managment staff, Dec 9, 1993 to a total of 34,500 hours of exposure over the 4 year project time frame.

The nuclide inventory of the sludge used in the calculations was based on the scaling factors developed by Devanney (Devanney, 1988) and sludge concentrations for ^{60}Co and ^{137}Cs, and sludge density (1.1 g/cc) from Subrahmanyam (Subrahmanyam, 1987). This inventory includes ^{241}Am, ^{10}Be, $^{144}Ce/Pr$, ^{242}Cm, ^{57}Co, ^{60}Co, ^{134}Cs, ^{137}Cs, ^{14}C, ^{154}Eu, ^{3}H, ^{54}Mn, ^{59}Ni, ^{63}Ni, ^{238}Pu, $^{239/240}Pu$, ^{125}Sb, ^{89}Sr, ^{90}Sr, ^{234}U, ^{235}U, ^{238}U, and ^{65}Zn.

A resuspension factor of 1×10^{-6} was assumed in transporting contaminants from the aqueous basin water to the air above the basin. This factor was based on a low-agitating water surface with basin water near ambient room temperature, and with minimum air flow across the surface (R. Borkowski, 1986). Ranges of resuspension factors are from 1×10^{-3} for highly agitated or boiling liquids resulting from severe light water reactor accidents to 1×10^{-8} for simple evaporation from stable waste solutions. It is assumed that minimizing of surface water agitation will be incorporated in the WHC Radiation Work Permit or in the ALARA program.

A respiratory protection factor of 1×10^{4} was assumed because it is the standard value listed in the Westinghouse Safety Manual (WHC, 1991) for SCBA or supplied air respiratory protection. For these calculations, it is also assumed that an air turnover rate in the Basin containment shell was present and sufficient to prevent concentrating of the airborne radioactive materials released.

Calculation Methods

Table I shows the calculations of the maximum annual CEDE (for a worker exposed for a 2000 hour work year) and the collective CEDE (total CEDE to the worker population over the time period required to complete the Basin stabilization).

For each of the 25 nuclides analyzed, the nuclide concentration was calculated based on the specific nuclide scaling factors described by Devanney (Devanney, 1990), and the sampled activity of ^{60}Co and ^{137}Cs (Subrahmanyam, 1988). The activity was decayed to 1989 and then the specific scaling factors were applied. This resulted in two values (one based on the ^{60}Co scaling factor and one based on the ^{137}Cs scaling factor) being calculated for each of the twenty five nuclides. The most conservative result for each radionuclide was carried forward in the calculations. The nuclide concentration was multiplied by a total sludge mass, yielding the total activity. Each activity was decayed to 1994 and then mixed into the total Basin aqueous volume of 4.088×10^9 ml to give the worst case (maximally dispersed) nuclide concentration.

Each Basin aqueous nuclide concentration was multiplied by a resuspension factor of 1×10^{-6} (R. Borkowski, 1986) to provide the airborne concentration above the Basin. This concentration was then divided by the respiratory protection factor of 1×10^4 (WHC, 1991) to give an effective airborne concentration breathed by the worker.

Workers exposed to an airborne concentration of 100 percent of the Derived Air Concentration (DAC) (DOE, 1988) for 2000 hours per year would receive an annual CEDE of 5 rem. Determination of the CEDE for the N Basin Stabilization was therefore made by multiplying 5 rem by the ratio of the Effective Airborne Concentration to the DAC. Collective doses were similarly calculated using the CEDE and the ratio of the total workhours (34,500) to the yearly individual work hours (2000) as the exposure time.

The results of the calculations shown in Table 1 are as follows:

Committed Effective Dose Equivalent	Collective Dose for 34,500 hours
4.4E-02 mrem/exposure hr	7.56E-01 person-rem

Table II shows the calculations for average exposure hour limits based on the total workhours (34,500) planned over the 4 year period and the total collective dose equivalent (external plus internal) limited by the DOE contractor personnel exposure limit of 500 mrem/year. This does not indicate that the maximum short term exposure for a specific task will not exceed DOE contractor personnel exposure limits.

Collective External Dose	192.6 Person-rem (WHC,1994)
Collective Internal (committed Dose)	0.8 Person-rem
Total Collective Dose over project time span	193.4 Person-rem

REFERENCES

Borkowski, R. et al, *Resuspension of Fission Products During Severe Accidents in Light Water Reactors.* Laboratoriuim fur Aerosolphysik und Filtertechnik, 1986.

Department of Energy. *Radiation Protection for Occupational Workers.* DOE 5480.11. 1988.

Devanney, J.A., *Chactenzation of Radioactive Waste at 100N.* WHC-SD-NR-RPT-005, Rev 0. 1990.

Subrahmanyam, V.B, *Hanford Production Reactor Fuel Storage Basin Sediment Characterization and Processing for Disposal.* WHC-SD-CP-TI-135, Rev 0/ Rev 1, 1988.

Westinghouse Hanford Company. *Radiation Protection. WHC-CM-4-10*, Rev I. 1991.

Westinghouse Hanford Company. *N-Reactor Wastewater Management Alternative Study.* WHC-SD-NR-ES-015, Rev 0. 1992.

Westinghouse Hanford Company *N-Basin Task Plan*, 1993.

Westinghouse Hanford Company. *N Reactor Deactivation Program Plan*, WHC-SP-0615, Rev 4, 1994.

TABLE I
Maximum Annual (CEDE) and Collective Dose Calculations
N Reactor Basin Stabilization

Revised Jan 18, 1994 - for volume of 70 cu ft = 2 cu meters and Total exposure hours of 34,500

Activity corrected to 1988	
Co-60	Cs-137
1.02E+01	6.54E-01

Scaling Factors Co-60 LMA	Scaling Factors Cs-137 LMA	Radionuclide	1988 Activity Co-60 (uCi/g)	1988 Activity Cs-137 (uCi/g)	1988 Activity (uCi/g)	1988 Activity 2 cu meters (uCi)	Half Life (years)	1994 Activity for (uCi)	1994 N Basin 4.086 E6 liters (uCi/cc)	Assumed Resuspension	1994 Airborne Near Basin (uCi/cc)	Assumed Respiratory Factor	Breathed 1994 Concentration (uCi/cc)	Derived Air Concentration (uCi/cc)	Committed Effective Dose Equivalent (rem)	Collective Dose for 34500 hours (person-rem)
8.65E-03	5.76E-02	Am-241	8.81E-02	3.19E-02	8.81E-02	1.60E+05	4.32E+02	1.59E+05	3.89E-05	1.00E-06	3.89E-11	1.00E-04	3.89E-15	2.00E-12	8.72E-03	1.68E-01
1.60E-05	1.90E-05	Be-10	1.63E-04	1.05E-05	1.63E-04	2.98E+02	1.60E+06	2.98E+02	7.25E-08	1.00E-06	7.25E-14	1.00E-04	7.25E-18	6.00E-09	6.04E-09	1.04E-07
8.92E-02	3.69E-01	Ce/Pr-144	8.09E-01	1.89E-01	8.09E-01	1.85E+06	7.78E-01	1.92E+04	4.71E-06	1.00E-06	4.71E-12	1.00E-04	4.71E-16	6.00E-09	3.92E-07	6.77E-06
2.60E-05	7.41E-04	Cm-242	2.05E-04	4.10E-04	4.10E-04	7.46E+02	4.46E-01	3.13E-01	7.66E-11	1.00E-06	7.66E-17	1.00E-04	7.66E-21	1.00E-10	3.83E-10	6.61E-09
1.50E-04	8.92E-04	Cm-243/244	1.53E-03	6.49E-04	1.53E-03	2.78E+03	2.85E+01	2.46E+03	6.02E-07	1.00E-06	6.02E-13	1.00E-04	6.02E-17	3.00E-12	1.00E-04	1.73E-03
6.03E-03	3.82E-01	Co-57	6.12E-02	2.12E-01	2.12E-01	3.85E+05	7.42E-01	3.69E+03	8.79E-07	1.00E-06	8.79E-13	1.00E-04	8.79E-17	3.00E-07	1.47E-09	2.53E-08
	8.65E+00	Co-60	NA	NA	1.02E+01	1.85E+07	5.27E+00	9.59E+06	2.35E-03	1.00E-06	2.35E-09	1.00E-04	2.35E-13	1.00E-08	1.17E-04	2.02E-03
1.94E-01	4.34E-03	Cs-134	1.98E+00	2.40E-03	1.98E+00	3.59E+06	2.06E+00	8.68E+05	1.83E-04	1.00E-06	1.83E-10	1.00E-04	1.83E-14	4.00E-08	2.04E-06	3.52E-05
1.51E-01		Cs-137	NA	NA	0.00E+00	0.00E+00	3.00E+01	0.00E+00	0.00E+00	1.00E-06	0.00E+00	1.00E-04	0.00E+00	7.00E-08	0.00E+00	0.00E+00
2.35E-04	1.96E-03	C-14	2.39E-03	1.09E-03	2.39E-03	4.35E+03	5.73E+03	4.35E+03	1.06E-06	1.00E-06	1.06E-12	1.00E-04	1.06E-16	1.00E-06	5.32E-10	9.18E-09
2.40E-02	6.37E-03	Eu-154	2.44E-01	2.87E-03	2.44E-01	4.44E+05	8.60E+00	3.00E+05	7.33E-05	1.00E-06	7.33E-11	1.00E-04	7.33E-15	8.00E-09	4.66E-06	7.81E-05
5.54E-03	4.83E-02	H-3	5.64E-02	2.56E-02	5.64E-02	1.03E+05	1.24E+01	7.75E+04	1.90E-05	1.00E-06	1.90E-11	1.00E-04	1.90E-15	2.00E-05	4.74E-10	8.17E-09
8.45E-02	5.81E-01	Mn-54	8.61E-01	3.11E-01	8.61E-01	1.56E+06	8.56E-01	2.72E+04	6.66E-06	1.00E-06	6.66E-12	1.00E-04	6.66E-16	3.00E-07	1.11E-08	1.92E-07
3.18E-04	2.84E-03	Ni 59	3.24E-03	1.57E-03	3.24E-03	5.89E+03	7.50E+04	5.89E+03	1.44E-06	1.00E-06	1.44E-12	1.00E-04	1.44E-16	8.00E-07	9.00E-10	1.55E-08
2.38E-01	3.09E-01	Ni-63	2.42E+00	1.71E-01	2.42E+00	4.41E+06	9.60E+01	4.25E+06	1.04E-03	1.00E-06	1.04E-09	1.00E-04	1.04E-13	3.00E-07	1.73E-06	2.99E-05
3.23E-03	2.14E-02	Pu 238	3.29E-02	1.19E-02	3.29E-02	5.98E+04	8.77E+01	5.75E+04	1.41E-05	1.00E-06	1.41E-11	1.00E-04	1.41E-15	3.00E-12	2.34E-03	4.04E-02
1.94E-02	1.29E-01	Pu 239/240	1.98E-01	7.14E-02	1.98E-01	3.59E+05	2.41E+04	3.59E+05	8.79E-05	1.00E-06	8.79E-11	1.00E-04	8.79E-15	2.00E-12	2.20E-02	3.79E-01
5.36E-01	3.65E+00	Pu-241	5.46E+00	1.07E+00	5.46E+00	9.93E+06	1.44E+01	7.80E+06	1.91E-03	1.00E-06	1.91E-09	1.00E-04	1.91E-13	1.00E-10	9.54E-03	1.65E-01
1.65E-02	2.42E-01	Sb-125	1.68E-01	1.34E-01	1.68E-01	3.06E+05	2.77E+00	8.74E+04	2.14E-05	1.00E-06	2.14E-11	1.00E-04	2.14E-15	2.00E-07	5.35E-09	9.22E-08
1.67E-02	1.08E-01	Sr-89	1.70E-01	6.98E-02	1.70E-01	3.09E+05	1.38E-01	4.02E-06	9.83E-16	1.00E-06	9.83E-22	1.00E-04	9.83E-26	8.00E-09	8.19E-18	1.41E-16
4.02E-02	2.67E-01	Sr-90	4.09E-01	1.46E-01	4.09E-01	7.44E+05	2.91E+01	6.61E+05	1.62E-04	1.00E-06	1.62E-10	1.00E-04	1.62E-14	2.00E-09	4.04E-05	6.97E-04
2.74E-05	3.80E-04	U-234	2.79E-04	1.99E-04	2.79E-04	5.07E+02	2.45E+05	5.07E+02	1.24E-07	1.00E-06	1.24E-13	1.00E-04	1.24E-17	2.00E-11	3.10E-06	5.35E-05
8.27E-06	6.92E-05	U-235	8.42E-05	3.83E-05	8.42E-05	1.53E+02	7.04E+08	1.53E+02	3.75E-08	1.00E-06	3.75E-14	1.00E-04	3.75E-18	2.00E-11	9.37E-07	1.62E-05
4.73E-05	3.94E-04	U 238	4.82E-04	2.18E-04	4.82E-04	8.76E+02	4.47E+09	8.76E+02	2.14E-07	1.00E-06	2.14E-13	1.00E-04	2.14E-17	2.00E-11	5.36E-06	9.24E-05
2.40E-02	1.34E+00	Zn-65	2.44E-01	7.42E-01	7.42E-01	1.35E+06	6.68E-01	7.82E+03	1.84E-06	1.00E-06	1.84E-12	1.00E-04	1.84E-16	1.00E-07	9.19E-09	1.59E-07
														Total	4.38E-02	7.56E-01
															2.2E-02	mrem/hr

Table II -Average Exposure Hours

The interal dose (inhalation) will be limited by the collective external dose, (192.6 person-rems over 34,500 workhours in 4 years).

Total hours worked over 4 years		**34500**	
Collective External dose over 4 years	**192.6**		**person-rem**
Collective Internal dose over 4 years	**0.8**		**person-rem**
Total Collective dose over 4 years		**193.4**	**person-rem**
Average Collective dose per year		**48.35**	**person-rem**
Maximally Exposed Individual (Admistrative Controls		**500**	**mrem/year**
Average number of personnel required assuming all personnel are maximally exposed		**97**	

APPENDIX C

BIOLOGICAL REVIEW

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, Washington 99352
Telephone (509) 376-5345

January 4, 1994

Mr. G. Wells
Westinghouse Hanford Company
H6-26
Richland, WA 99352

Dear Mr. Wells,

BIOLOGICAL REVIEW OF THE N REACTOR STABILIZATION, #93-WHC-007

This letter summarizes the biological review for the N Reactor Stabilization. The biological survey for the above-referenced project was conducted on June 14 and June 16, 1993 by C. A. Brandt, N. A. Cadoret, and B. L. Tiller. The pedestrian survey focused on plant and animal species protected under the Endangered Species Act, candidates for such protection, and plant and animal species listed as threatened, endangered, candidate, or monitor by the State of Washington.

The subject area is located within the 100-N Area perimeter fence and is a highly disturbed industrial site. Substrate on the subject area consists primarily of pavement and packed gravel that is herbicided annually. Vegetation on the site is sparse and consists largely of Russian thistle (*Salsola kali*) and cheatgrass (*Bromus tectorum*), alien annual weeds.

Of the species encountered, none are listed as endangered or threatened, or candidates for such listing by the Washington State or federal governments, or species listed as monitor species by the Washington State government. Consequently, no adverse impacts to such species would occur from the proposed action.

A wide variety of avian species nest on the ground, in shrubby vegetation, or on buildings in the 100-N Area. Stabilization of the N Reactor facilities will include several 4' x 6' excavations (pers. comm., January 3, 1993) that could disturb nests of ground-nesting birds or species that nest in shrubs or trees. There will be no structural modifications of the exterior of any buildings in the 100-N Area (pers. comm., December 13, 1993), precluding destruction of nests or killing of birds on buildings.

Battelle

Mr. G. Wells
January 4, 1994
Page 2

We recommend excavation be undertaken, where possible, outside the nesting season, which extends from April to June, 1994. Additional surveys of the 100-N Area will be undertaken this spring to determine use of the area by nesting birds in 1994. If any species of concern are found as a result of this upcoming survey, we will notify you. Otherwise, no destruction of migratory birds, their eggs, or nests should result from the proposed stabilization activities.

Sincerely,

C A Brandt

C. A. Brandt, Ph.D.
Senior Research Scientist
Environmental Sciences Department

CAB: jmb

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P O Box 999
Richland, Washington 99352
Telephone (509) 376-5345

November 17, 1994

Linda Mihalik
CH2M Hill-Hanford, Inc.
P O. Box 1510, MSIN H4-79
Richland, WA 99352

Dear Ms Mihalik

BIOLOGICAL REVIEW OF THE N REACTOR STABILIZATION PROJECT, 100 N Area, #93-WHC-007 (Update)

Project Description

- an update to letter 93-WHC-007 dated January 4, 1994 concerning the determination of use of the project area by nesting migratory bird species

Objectives.

- to identify plant and animal species protected under the Endangered Species Act (ESA), candidates for such protection, and species listed as threatened, endangered, candidate, sensitive, or monitor by the state of Washington, and species protected under the Migratory Bird Treaty Act,
- to evaluate the potential impacts of disturbance on priority habitats and protected plant and animal species identified in the survey

Methods:

- pedestrian and ocular reconnaissance of the proposed site was conducted by R. Zufelt, C McKinnon, C Duberstein, and G Fortner on May 19 and June 17, 1994

Results and Conclusions:

- no plant and animal species protected under the ESA, candidates for such protection, or species listed by the Washington state government were observed in the vicinity of the proposed site,
- vegetative habitat near or on the site consists primarily of cheatgrass (*Bromus tectorum*) and Russian thistle (*Salsola kali*),
- no migratory bird species were observed nesting in the vicinity of the proposed site,
- no adverse impacts to species of concern are expected to occur from the proposed action

Sincerely,

JM Thomas for CAB

CA Brandt, Ph D
Project Manager
Ecological Compliance Assessment

CAB glf

APPENDIX D

CULTURAL RESOURCES REVIEWS

Battelle

Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, Washington 99352
Telephone (509) 372-1791

January 26, 1994

No Known Affected Historic Properties

Mr. G. T. Wells
Westinghouse Hanford Company
Restoration and Remediation
P. O. Box 1970/H6-26
Richland, WA 99352

Dear Gary:

CULTURAL RESOURCES REVIEW OF THE N REACTOR STABILIZATION PROJECT - CORRECTION. HCRC #94-100-012.

In response to your request received December 13, 1993, staff of the Hanford Cultural Resources Laboratory (HCRL) conducted a cultural resources review of the subject project and sent a letter to you dated January 4, 1994. The letter stated that the HCRL staff found the 1100N and 1101N Buildings to be eligible for the National Register of Historic Places (NRHP). However, upon further evaluation, the HCRL finds that these two facilities are not eligible for the NRHP due to their lack of structural integrity and minor role in the Manhattan era.

As stated in the January 4 letter, the other facilities within the N Reactor complex have not yet been evaluated for the NRHP. However, if they are found to be eligible for inclusion on the NRHP in the future, the current project will have no effect on any aspects of the buildings that would make them eligible.

As stated in the previous letter, the HCRL staff finds that there are no known cultural resources or affected historic properties within the proposed project area. The workers, however, must be directed to watch for cultural materials (e.g., bones, artifacts) during excavations. If any are encountered, work in the vicinity of the discovery must stop until an HCRL archaeologist has been notified, assessed the significance of the find, and, if necessary, arranged for mitigation of the impacts to the find. Please notify us if any changes to project location or scope are anticipated.

A copy of this letter has been sent to Charles Pasternak, DOE, Richland Operations Office, as official documentation. If you have any questions, please call me at 372-1791. Please use the HCRC# above for any future correspondence concerning this project.

Very truly yours,

M. E. Crist
M. E. Crist
Technical Specialist
Cultural Resources Project

Concurrence: M. K. Wright
M. K. Wright, Scientist
Cultural Resources Project

cc: C. R. Pasternak, RL (2)
File/LB

Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P O Box 999
Richland, Washington 99352
Telephone (509) 372-1791

January 4, 1994

No Known Affected Historic Properties

Mr. G. T. Wells
Westinghouse Hanford Company
Restoration and Remediation
P. O. Box 1970/H6-26
Richland, WA 99352

Dear Gary:

CULTURAL RESOURCES REVIEW OF THE N REACTOR STABILIZATION PROJECT. HCRC #94-100-012.

In response to your request received December 13, 1993, staff of the Hanford Cultural Resources Laboratory (HCRL) conducted a cultural resources review of the subject project, located in the 100N Area of the Hanford Site. According to the information that you supplied, the project entails deactivating and stabilizing the facilities inside the 100N fenced area. The work includes removing all contaminated and hazardous materials from the facilities, patching or replacing damaged roofs, securing windows and doors, sealing pipes, and capping and isolating utilities. Some excavation is required to work on utilities; the estimated excavation depth will be four to six feet.

Our literature and records review shows that of the facilities in the 100N complex, only two, the 1100N and 1101N Buildings, have been found to be eligible for the National Register of Historic Places (NRHP). If other facilities are found to be eligible for inclusion on the NRHP in the future, the current project will have no effect on any aspects of the buildings that would make them eligible. The only work that could affect the structural integrity or exterior appearance of the facilities is patching and repairing roofs and sealing entrances; however, the roof repairs and replacements will be completed in a similar style and with similar appearing materials as the current roofing, and the windows will be sealed with plywood and the doors locked with padlocks.

Our review also shows that part of the project area is located within 400 meters of the Columbia River and is therefore in a culturally sensitive location. However, because the area has been highly disturbed by the original installation of the utilities and by nearby building and road construction, it is very unlikely that any subsurface archaeological materials exist within the area of potential effect of the project. Monitoring by an archaeologist is not necessary.

It is the finding of the HCRL staff that there are no known cultural resources or affected historic properties within the proposed project area. The workers, however, must be directed to watch for cultural materials (e.g., bones, artifacts) during excavations. If any are encountered, work in the vicinity of the discovery must stop until an HCRL archaeologist has been notified, assessed the significance of the find, and, if necessary, arranged for mitigation of the impacts to the find. This is a Class III case, defined as a project which involves new construction in a disturbed, low-sensitivity area, and a Class VI case, a project that involves the demolition or alteration of existing structures Please notify us if any changes to project location or scope are anticipated.

Battelle

Mr. Gary Wells
January 4, 1993
Page 2

A copy of this letter has been sent to Charles Pasternak, DOE, Richland Operations Office, as official documentation. If you have any questions, please call me at 372-1791. Please use the HCRC# above for any future correspondence concerning this project.

Very truly yours,

M. E. Crist
Technical Specialist
Cultural Resources Project

Concurrence: D. Harvey, Scientist
Cultural Resources Project

cc: C. R. Pasternak, RL (2)
File/LB

STATE OF WASHINGTON

DEPARTMENT OF COMMUNITY DEVELOPMENT

OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION

111 21st Avenue S.W • P.O. Box 48343 • Olympia, Washington 98504-8343 • (206) 753-4011 • SCAN 234-4011

March 2, 1994

Mr. Charles R. Pasternak, Manager
Cultural Resources Program
Department of Energy
Richland Field Office
Post Office Box 550
Richland, WA 99352

Log: 021794-04-DOE
Re: N-Reactor Stabilization Project

Dear Mr. Pasternak: Charles

The Washington State Office of Archaeology and Historic Preservation (OAHP) is in receipt of your letter and documentation regarding the above referenced action at the Hanford Site. From your letter, I understand that the Department of Energy proposes to remove contaminated and hazardous materials from the facilities, patching and replacing damaged roofs, securing windows and doors, sealing pipes, and capping and isolating utilities.

In response, OAHP has reviewed the documentation regarding this action. Also, our recent visit to Hanford left OAHP staff with an initial impression that the N-Reactor may be eligible for listing in the National Register of Historic Places. Although further documentation is needed before we arrive at a formal opinion, N-Reactor appears to be significant in illustrating advanced technological and scientific processes pioneered at the Hanford Site.

However, in the interim, we concur with your opinion that the proposed work for this action will have "no effect" upon characteristics of the property which would make it eligible for National Register listing. The proposed work does not appear to change character defining features of the property nor to be actions which are irreversible. However, should the scope of this work change significantly, we recommend contacting OAHP for further consultation

RECEIVED

MAR 7 1994

LANDLORD AND FACILITIES MANAGEMENT BRANCH

Mr. Pasternak
March 2, 1994
Page Two

Also, we concur with your opinion that because of the highly disturbed nature of surrounding ground surfaces, it is highly unlikely that subsurface archaeological resources will be located as a result of excavation work. However, in the unlikely event that archaeological resources are found during such work, OAHP should be contacted immediately.

Charles, thank you for the opportunity to comment on this action. Should you have any questions, please feel free to contact me at (206) 753-9116.

Sincerely,

Greg Griffith

Gregory A. Griffith
Comprehensive Planning Specialist

GAG:lms
Enclosures

cc: David Harvey
Mona Wright

Department of Energy
Richland Operations Office
P O Box 550
Richland Washington 99352

RECEIVED
FEB 16 1994
Historic Preservation

FEB 11 394

Ms. Mary M. Thompson
State Historic Preservation Officer
Office of Archaeology and
Historic Preservation
Department of Community Development
111 West 21st Avenue, KL-11
Olympia, Washington 98504-5411

Dear Ms. Thompson:

N-REACTOR STABILIZATION PROJECT

The U S. Department of Energy, Richland Operations Office (RL) is preparing for the deactivation and stabilization of the N-Reactor at the Hanford Site. This proposal includes removing all contaminated and hazardous materials from the facilities, patching or replacing damaged roofs, securing windows and doors, sealing pipes, and capping and isolating utilities. Some excavation is required to work on utilities.

Only two buildings in the N-Reactor area have been evaluated for eligibility to the National Register of Historic Places (Register), neither of which were found to be eligible. Your office concurred with these findings in January, 1994. If other facilities in the complex are found to be eligible for inclusion to the Register in the future, we believe the current project will have no effect on the aspects of the buildings that make them eligible The only work that could affect the structural integrity or exterior appearance of the facilities is patching and repairing roofs and sealing entrances. However, the roof repairs and replacements will be completed in a similar style and with similar appearing materials as the current roofing, and the windows will be sealed with plywood and the doors locked with padlocks

Our review also shows that part of the project area is located within 400 meters of the Columbia River and is, therefore, in a culturally sensitive location. However, because the area has been highly disturbed by the original installation of the utilities and nearby building and road construction, it is very unlikely that any subsurface archaeological materials exist within the area of potential effect of the project

In accordance with CFR 36, 800.4, RL has made a good faith effort to identify historic properties at this proposed location that would be affected by this project and commence the eligibility evaluation of these properties to the Register We believe that no historic properties eligible for the Register will be affected by this undertaking

Ms. Mary M. Thompson -2-

If any archaeological or additional historical resources are discovered during project activities, work will be halted and your office consulted immediately Your office will also be consulted if the scope of the project is modified. Therefore, in accordance with CFR 36, 800.4(d), we are providing documentation supporting these findings to your office.

Your signature below will acknowledge receipt of our notification. Please return a signed copy for our records. If you have any questions or are in need of additional information I can be contacted at (509) 376-6354.

Sincerely,

Charles R. Pasternak, Manager
Cultural Resources Program
Site Infrastructure Division

SID:CRP

Office of Archaeology
and Historic Preservation

Enclosure: HCRC #94-100-012

cc w/encl:
J. Van Pelt, CTUIR

cc w/o encl:
G. V. Last, PNL
M. K. Wright, PNL
D. W. Harvey, PNL
R. C. Phillips, PNL
R. H. Engelmann, WHC

APPENDIX E

SUPPORTING INFORMATION, DEACTIVATION ACTIVITIES

 009483

Environmental Restoration Contractor ***ERC Team***

Interoffice Memorandum

Job No. 22192
Written Response Required NO
CCN N/A
OU N/A
TSD N/A
ERA N/A
Subject Code 6800

TO L A Mihalik H4-79

COPIES See Below

DATE. February 16, 1995

FROM G. M Duncan/ GM Duncan
Project Engineer/N Deactivation
X5-54/373-7385

SUBJECT **N DEACTIVATION INPUT FOR THE ENVIRONMENTAL ASSESSMENT**

Last June, John Walsh of the project advised that the peak number of personnel required to perform N Reactor Deactivation is estimated to be 194. This is based on the 1994 N Reactor Subproject Baseline Summary adjusted for specific estimates of craft personnel The "No Action" alternative, i e , maintain personnel and environmental compliance only is expected to be 50 personnel John also advised that N Basin sediment would be consolidated in the North Cask Pit, characterized then shipped by rail tanker to the 204 AR Tank Farm Tankcar Unloading Facility in the 200 East Area The basin water pumped to the cask pit with the sediment would also be transported with the sediment It was anticipated that there would be 20,000 gallons of slurry utilizing three tank cars Dose rates at contact on the rail cars is expected to be 500 mRem/hr

Information on the 107N building and cost summary information provided informally to you in October is attached

GMD mar

Attachment N Reactor Subproject

Copies
E T Coenenberg H6-07, w/a
L R Curry H4-85, w/a
M E. Greenidge X5-54, w/a
J L Walsh X5-50, w/a

009483

N Reactor Subproject

Deactivation Cost Summary

($ IN 000'S)

	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 98–00	Total FY94–97	Total FY93–00
Program Management	76 0	990 0	1,499 0	1,533 0	1,567.0	0 0	5,589 0	5,665 0
Deactivation Planning and Execution	17,790 0	17,666 0	24,634 0	26,334 0	24,870 0	15,132.0	93,504 0	126,426 0
Facility Compliance	15,159 0	10,965 0	10,973 0	11,326 0	10,264 0	14,936 0	43,528 0	73,623 0
Building and System Deactivation	91 0	939.0	4,529 0	3,929 0	4,015 0	0 0	13,412 0	13,503 0
N Basin Deactivation	0 0	2,590 0	5,877 0	7,924 0	6,521 0	0 0	22,912 0	22,912 0
HGP Deactivation (Contaminated Facilities Only)	0 0	132 0	760 0	61 0	63 0	196 0	1,016 0	1,212 0
Waste Handling	1,462 0	1,680.0	1,845 0	1,887 0	1,929 0	0 0	7,341 0	8,803 0
Waste Disposal	782 0	868 0	613 0	1,168 0	2,039 0	0 0	4,688 0	5,470 0
SAS/Patrol	295 0	492 0	38 0	39 0	40 0	0 0	609 0	904 0
Regulatory Response	1,857 0	2,804.0	1,378 0	986 0	3,153 0	1,174 0	8,321.0	11,352 0
Total Program	19,723 0	21,460 0	27,511 0	28,853 0	29,590 0	16,306 0	107,414 0	143,443 0

-94

95-97

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EA Input on the 107-N Building

Facility Description

The 107-N Building, located outside and west of the 105-N Building, provided cooling, filtering and demineralization of the 105-N Fuel Storage Basin water. The building is a 47' x 69' x 48' reinforced concrete structure housing a process control room, personnel change area for donning protective clothing, a drumming room, sand filters, ion exchange tanks, a backwash/settling tank, a regeneration tank, heat exchangers, ventilation equipment and miscellaneous pumps. The 107-N Water Treatment facility was operated between and 1984 and 1989.

Process piping is fiberglass reinforced epoxy resin pipe with a glass mat reinforced epoxy resin liner on the Basin water side, and stainless steel on the waste side. The facility is provided with its own HEPA-filtered ventilation system. Tanks are vented to the building sump which vents to the HEPA filters. There are two test wells between the 107-N Building and the Columbia River.

Virtually all of the 107-N Building is contaminated, totaling approximately 38,000 ft^2. Although recent, detailed surveys are not readily available, historic data identified general area exposure rates less than 5 mR/hr. Local area exposure rates inside tank cubicles are higher: 100 - 200 mR/hr on the upper levels of the sandfilters, and as high as 35 R/hr in contact with the bottom of the Backwash/Settling Tank.

The endpoint of the stabilization process for the 107-N Building includes draining all process fluids, removing ion exchange resins, removing sand filter media and removing enough of the radioactivity within process systems to require no exterior radiological posting or control.

Although the preferred stabilization technique has not been determined, this facility is an excellent candidate for a chemical decontamination process. The stabilization process is expected to generate 342 ft^3 of low-level waste, 127 ft^3 of mixed waste, which includes 0.5 ft^3 of contaminated lead and 7 ft^3 of contaminated batteries. The chemical decontamination process will generate an additional 150 ft^3 of spent ion exchange resins. This work is expected to require less than 5 man-rem to complete.

N Reactor SubProject
Surveillance and Maintenance
w/ Deactivation

		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1UN111 Program Mangement	$	~~2465~~	*	*	250	250	250	250	250	250	250	250	250
1UN211 Facility Compliance		~~6775~~	*	*	1,750	1,750	1,750	2,250	2,250	2,250	2,250	2,250	2,750
1UN212 Waste Handling		~~2,980~~	*	*	–	–	–	–	–	–	–	–	–
1UN311 Deactivation		~~6,625~~	*	*	–	–	–	–	–	–	–	–	–
1UN421 N Basin Cleanup		~~4,235~~	*	*	–	–	–	–	–	–	–	–	–
Total (1995 dollars)	$	~~23,080~~ 8K	* 8.5K	*8.5	2,000	2,000	2,000	2,500	2,500	2,500	2,500	2,500	3,000
Escalation (3%)		–	– 255	– 255	185	250	320	485	575	665	765	860	1,150
Total	$	~~23,080~~ 8000	– 8,755	– 9020	2,185	2,250	2,320	2,985	3,075	3,165	3,265	3,360	4,150

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1UN111 Program Mangement	$	250	250	250	250	250	250	250	250	250	250	250	250
1UN211 Facility Compliance		2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750	2,750
1UN212 Waste Handling		–	–	–	–	–	–	–	–	–	–	–	–
1UN311 Deactivation		–	–	–	–	–	–	–	–	–	–	–	–
1UN421 N Basin Cleanup		–	–	–	–	–	–	–	–	–	–	–	–
Total (1995 dollars)	$	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Escalation (3%)		1,275	1,405	1,540	1,675	1,815	1,960	2,105	2,260	2,420	2,580	2,750	2,920
Total	$	4,275	4,405	4,540	4,675	4,815	4,960	5,105	5,260	5,420	5,580	5,750	5,920

$113M

General
- Assumes escalation rate of 3% per year
- Does not iclude cost to support facilities used by other Environmental Restoration programs
- Revised Deactivation program costs have not been prepared. Assumes only that program will be complete by 9/30/97

1UN111 Program Mangement
- Assumes minimal coverage –
- Program management and project controls (2FTE – 200K(FY95))
- Procurement/craft training/misc support (50K(FY95))

1UN311 Deactivation
... complete 9/30/97

1UN211 Facility Compliance
- Electricity/Electrical Maintenance, Sewer, Water and other utilities (400K(FY95))
- Operator support/Supervision for routine patrols (3 FTE's – 300K(FY95))
- Maintenance and Repairs (avg of 5K per building per year or 5x140 = 700K(FY95))
- Environmental Monitoring and Surveillance at same level as FY 1995 (350K(FY95))
- Adds $ 500K beginning in FY 2001 for added facility maintenance for extended surveillance
- Adds $ 1 Million beginning in FY 2006 for added facility maintenance for extended surveillance

1UN212 Waste Handling
- Assumes no additional waste disposal requirements during Surveillance and Maintenance period

1UN421 N Basin Cleanup
- Assumes Basin Cleanup is complete 9/30/97

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N Reactor SubProject
No Action Option

		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1UN111 Program Mangement	$	600	600	600	600	600	600	600	600	600	600	600	600
1UN211 Facility Compliance		6,700	7,200	7,200	7,200	7,200	7,200	7,700	7,700	7,700	7,700	7,700	8,700
1UN212 Waste Handling		700	700	700	700	700	700	700	700	700	700	700	700
1UN311 Deactivation		–	–	–	–	–	–	–	–	–	–	–	–
1UN421 N Basin Cleanup		–	–	–	–	–	–	–	–	–	–	–	–
Total (1995 dollars)	$	8,000	8,500	8,500	8,500	8,500	8,500	9,000	9,000	9,000	9,000	9,000	10,000
Escalation (3%)		–	255	520	790	1,065	1,355	1,745	2,070	2,400	1,745	3,095	3,840
Total	$	8,000	8,755	9,020	9,290	9,565	9,855	10,745	11,070	11,400	10,745	12,095	13,840

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1UN111 Program Mangement	$	600	600	600	600	600	600	600	600	600	600	600	600
1UN211 Facility Compliance		8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700
1UN212 Waste Handling		700	700	700	700	700	700	700	700	700	700	700	700
1UN311 Deactivation		–	–	–	–	–	–	–	–	–	–	–	–
1UN421 N Basin Cleanup		–	–	–	–	–	–	–	–	–	–	–	–
Total (1995 dollars)	$	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Escalation (3%)		4,260	4,685	5,125	5,580	6,050	6,530	7,025	7,535	8,060	8,605	9,160	9,735
Total	$	14,260	14,685	15,125	15,580	16,050	16,530	17,025	17,535	18,060	18,605	19,160	19,735

General
+ Assumes escalation rate of 3% per year
+ Does not iclude costs to support 100 N Area facilities used by other Environmental Restoration programs

1UN111 Program Mangement
+ Assumes minimal coverage –
+ Program management and project controls (3 FTE – $ 300K (FY95))
+ Purchasing support (2 FTE – $ 200K(FY95))
+ Craft Training/misc support ($ 100K(FY95))

1UN311 Deactivation
+ Assumes no deactivation

1UN211 Facility Compliance
+ Assumes FY 1995 Facility Compliance level
+ Certain maintenance, operations and utility costs related to ho..sing costs for other programs ($ 500K) is offset by costs for QA support, work control, etc currently covered in the Deactivation budget in FY 1995
+ Adds $ 500K beginning in FY1996 for added facility maintenance for extended surveillance
+ Adds $ 1 Million beginning in FY2001 for added facility maintenance for extended surveillance
+ Adds $ 2 Million beginning in FY2006 for added facility maintenance for extended surveillance

1UN212 Waste Handling
+ Assumes 25% of FY 1995 level of support for Waste Handling and Disposal requirements as primary efforts are currently related to Deactivation wastes

1UN421 N Basin Cleanup
+ Assumes no deactivation

43

009483

013809

Environmental Restoration Contractor **ERC Team**

Interoffice Memorandum

By

Job No. 22192
Written Response Required NO
CCN N/A
OU N/A
TSD N/A
ERA N/A
Subject Code 5850

TO L. A. Mihalik H4-79

DATE April 17, 1995

COPIES E. T. Coenenberg H4-79
G. M. Duncan X5-54
D. L. Schilperoort X8-29

FROM J. L. Walsh
Project Controls
X5-50/373-1408

SUBJECT **SURVEILLANCE AND MAINTENANCE RADIATION EXPOSURE**

Per your request, radiation exposure for N Reactor personnel during a surveillance and maintenance only period, i.e., No Action Alternative, is expected to be about 5 0 REM. This is based on actual recorded data for CY 1992 when N Reactor was shutdown, but in a standby period awaiting DOE guidance for initiation of deactivation activities. For all work at N Reactor, 8475 mrem was recorded in the Westinghouse Radiation Area Management (WRAM) computer system, but for calculation purposes you may use 5.0 REM This data was derived from "pencil" dosimeter readings for all personnel who worked in a radiation zone during the year

Should you have any questions please call me on 373-1408.

JLW:mar

APPENDIX F

CRITICALITY ENGINEERING ANALYSIS

NOV 04 1991

ENGINEERING DATA TRANSMITTAL

1 EDT 134522

2 To (Receiving Organization) Process Safety Support	3 From (Originating Organization) Criticality Engineering Analysis	4 Related EDT No N/A — DOE/EA-0984 Redline Draft Rev 0
Prog/Dept/Div 29210	6 Cog/Proj Engr SJ Altschuler	7 Purchase Order No N/A
5 Originator Remarks: CSER 90-003: Classification of the 100-N Basin with Fuel Removed as a Limited Control Facility		9 Equip/Component No N/A
		10 System Bldg Facility 100-N Basin
		12 Major Assm Dwg No N/A
11 Receiver Remarks		13 Permit/Permit Application No
		14 Required Response Date

15 DATA TRANSMITTED

(A) Item No	(B) Document/Drawing No	(C) Sheet No	(D) Rev No	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-SQA-CSA ~~20025~~ 20325		0	CSER 90-003: Classification of the 100-N Basin with Fuel Removed as a Limited Control Facility	2	1,2		

16 KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 see MRP 5 43 and EP-1 7	1 Approval 2 Release 3 Information 4 Review 5 Post-Review 6 Dist (Receipt Acknow Required)	1 Approved 2 Approved w/comment 3 Disapproved w comment 4 Reviewed no/comment 5 Reviewed w/comment 6 Receipt acknowledged

17 SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

(G) Reason	(H) Disp	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp
1	1	Cog/Proj Eng	[signature]	9/11/91	R3-01						
1	1	Cog/Proj Eng Mgr	[signature]	9/11/91	R3-01						
1	1	QA	[signature]	10/22/91	X1-80						
1	1	Safety	R.V. Skinner	9-17-91	S6-05						
1	1	Peer Review CA Rogers	C A Rogers	9/11/91	R3-01						

18	19	20	21 DOE APPROVAL (if required)
[signature] 9/11/91 Signature of EDT Originator Date	[signature] 10/3/91 Authorized Representative for Receiving Organization Date	[signature] 10/29/91 Cognizant/Project Engineer's Manager Date	Ltr No ☐ Approved ☐ Approved w/comments ☐ Disapproved w/commen

BD-7400-172 (2.

References

1. Memo, W. D. Wittekind to P. A. Worden, "Evaluation of N Reactor Basin Criticality With No Fuel In It", p.4-5, February 20, 1990.

2. V. B. Subrahmanyan, "Hanford Production Reactor Fuel Storage Basin Sediment - Characterization and Processing for Disposal", SD-CP-TI-135, Revision 1, Appendix C, October 13, 1988.

3. W. D. Wittekind, op. cit., Appendix C.

4. Op. cit., Appendix D.

5. Op. cit., p.9

√6. Memo, W. D. Wittekind to P. A. Worden, "N Basin Sludge Quantity Calculation", March 14, 1990.

7. Memo, P. A. Worden to R. A. Cox, "N Basin Plutonium Content at Specified Confidence Levels", April 5, 1990.

8. R. D. Carter, G. R. Kiel, and K. R. Ridgeway, "Criticality Handbook," 3 Volumes, ARH-600, June 1968, Atlantic Richfield Hanford Co.

Reviewer's Comments

An independent review was performed by C. A. Rogers who makes the following comments:

To accurately determine the reactivity of the basin sludge, the most relevant information is the total fissile fraction (^{235}U and ^{239}Pu combined) in the constituent heavy metal. One expects both of these isotopes to be uniformly distributed throughout the sludge, as described above. Since ^{235}U and ^{238}U can not be chemically separated, criticality is only possible if the Pu concentration is increased several orders of magnitude with all of the Pu brought into a relatively small volume. No known natural process can do this. In addition, even if deliberately planned, it would not be possible with credible means to achieving a critical configuration within the N-Basin starting from the conditions described. This reviewer therefore concurs with the conclusion of this evaluation.

CSER 90-003

CLASSIFICATION OF THE 100-N BASIN WITH FUEL REMOVED AS A LIMITED CONTROL FACILITY

Prepared by: ______________ Date: 9/11/91
Engineer, Criticality Engineering Analysis

Reviewed by: ______________ Date: 9/11/91
Engineer, Criticality Engineering Analysis

Approved by: ______________ Date: 9/11/91
Manager, Criticality Engineering Analysis

Approved by: ______________ Date: 9-25-91
Manager, Nuclear Facility Safety

Conclusion and Summary

This Criticality Safety Engineering Report (CSER) allows the 100-N Basin with all fuel removed to be classified as a Limited Control facility. After consideration of the fissile material in the sludge remaining in the 100-N Basin, it is concluded that the concentration and enrichment are sufficiently low that criticality is not possible for any changes in moderation or shape. Therefore, the 100-N Basin with all fuel removed may be classified as a LIMITED CONTROL FACILITY.

System Description

The enrichment of the uranium in the sludge has been estimated to be less than 1.00 weight percent U-235 by several methods. The enrichment calculated from 100-N Basin material flow composition is less than 0.93, 0.95, and 0.99 weight percent U-235 at confidence levels of 90, 95, and 99.5 percent. The uranium enrichment calculated from measurements made during reprocessing of this material at PUREX give values of less than 0.88 weight percent U-235 at a confidence level of 99.5 percent.[1] Measurements of isotopic concentrations in the sludge are consistent with the burnup used in the previous two methods.

It is felt that these estimates of enrichment are biased high for two reasons and that the actual value is lower. The higher burnup elements are more likely to corrode and contribute to the sludge and the lower burnup fuel elements with higher remaining enrichments have already been reprocessed.

Subrahmanyan[2] reports in 1988 that the 100-N Basin contains sludge estimated to weigh two metric tons if dry. From the Pu-239 and Pu-240 activity, Wittekind[3] calculates that there is less than 109 and 146 grams of plutonium in the sludge at confidence levels of 95 and 99.5 percent, respectively. The highest quantity of plutonium ever dissolved in the water of the 100-N Basin at any one time is estimated to be 29 grams. The quantity of plutonium expected in solution based upon values for liquid discharged to the crib in 1989 is estimated to be less than 4 grams at a confidence level of 99.5 percent.[4] The total plutonium in the N Basin is 111.6 and 149.2 grams at the 95 and 99.5 percent confidence levels, respectively, based on the assumption of 2.0 metric tons of dry sludge.[5]

Applying statistical analysis to the determination of the amount of sludge gives values of no more than 1.68, 5.29, and 7.79 metric tons at 50, 95, and 99.5 percent confidence levels, respectively.[6] The estimate for total plutonium in the sludge given in the previous paragraph, 146.0 grams is at a confidence level slightly larger than 50 percent. Adjusting for the amounts of sludge, these values become 287.5 and 568.7 grams at 95 and 99.5 percent confidence levels, respectively.[7] The grand total of all plutonium in N Basin, both in the sludge or in solution becomes 572 grams at the 99.5 percent confidence level.

Method of Analysis and Results

According to LA-10860-MS, Figure 24 and ARH-600,[8] III.B.2-7, the minimum enrichment at which a uranium-water solution could become critical is 1.03 wt% U-235. The enrichment for the uranium in the sludge is less than this. Change of shape, or the amount of water, or increase of size will not cause criticality.

The minimum critical mass of 520 grams of plutonium with no Pu-240 when optimally moderated and reflected with water (ARH-600, III.A.9(100)-4). For 3 percent Pu-240, the minimum critical mass increases to 600 grams (ARH-600, III.9(97)-4). Dilution with uranium will increase the critical mass considerably to at least several kilograms due to absorption in the U-238.

The 100-N Basins are unable to achieve a critical condition unless additional fissile material is provided because the concentration of fissile isotopes is sufficiently low. Adding the 572 grams of plutonium to the uranium will increase the enrichment of fissile material by less than 0.01 percent. No mechanism exists to spontaneously concentrate the U-235. Selective precipitation of the plutonium would not cause criticality as there is less than the minimum critical mass required. Even to approach criticality would require the formation of a sphere of optimum size and concentration using all the plutonium in the N Basin without the presence of uranium which would have to be precipitated first.

The 100-N Basins should, therefore, be classified as a LIMITED CONTROL FACILITY. In order for this classification to be maintained the following controls are required:

No fissile material should be added.
Sludge removal activity should be reviewed and approved by Criticality Engineering Analysis to ensure that there is no mechanism to concentrate fissile material.

APPENDIX G

PRE-APPROVAL COMMENT LETTERS

Confederated Tribes and Bands of the Yakama Indian Nation

DOE/EA-0984

Established by the Treaty of June 9 1855

January 23, 1995

Mr. John Wagoner, Manager
Richland Field Office
Department of Energy
P.O. Box 550 A7-50
Richland, WA 99352

Dear Mr. Wagoner:

Subject. ENVIRONMENTAL ASSESSMENT (EA) FOR THE DEACTIVATION OF THE N REACTOR FACILITIES, COMMENTS ON--

The Yakama Nation has reviewed the proposed Environmental Assessment for the deactivation of the N Reactor Facilities and has notable concerns over the proposed action to send 1,400,000 gallons of radiologically contaminated water from the 105-N Fuel Storage Basin and 1300-N Emergency Dump Basin to the 200 Area Effluent Treatment Facility for treatment and subsequent discharge to the soil column.

The Department of Energy has previously stated that the 200 Area Effluent Treatment Facility does not have the capability for removing or attenuating the tritium levels in influent streams. The proposed action predicts effluent concentrations for tritium of 35,800,000 pCi/L, a value translating into the discharge of 190 Curies to the soil column. This concentration exceeds the drinking water standard for tritium of 20,000 pCi/L by over three orders of magnitude. The resultant injury to the groundwater resource associated with this discharge is unwarranted and reflects an apparent disregard to preserve the Yakama Nation's right to use these resources. It is the Yakima Nation's position that discharge concentrations exceeding the allowable ground water levels are unacceptable. Furthermore, discharge of contaminants to the soil column violates DOE's own Order 5400.5., a commitment by the Department of Energy to disallow cleanup actions that continue to injure the surrounding environment.

The Yakama Nation has suggested a number of alternatives to tritium discharge involving industrial reusage, as well as continued storage of the waste stream until it has decayed to drinking water standards or until adequate separation technology is developed. Consideration of reuse and storage alternatives are notably absent in the subject Environmental Assessment. In view of the basin's high tritium concentrations, reuse/recycling options should be elevated above wastewaters currently being considered for treatment at ETF with markedly lower radiolytic concentrations. We propose that confinement of tritiated water from tanks and storage basins in surface storage facilities that already exist, such as, the now defunct empty grout vaults or the spare liquid effluent retention facility (LERF), would help avoid injury to the aquifer and related resources.

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Post Office Box 151, Fort Road Toppenish WA 98948 (509) 865-5121

John Wagoner
Page 2

We have previously indicated to DOE that decisions stemming from the NEPA processes should clearly establish the residual injury to natural resources and the damages associated with the alternative actions considered by the process. Such NEPA decisions regarding waste management and remediation alternative actions must assure that such actions do not infringe upon Treaty rights nor violate other laws regarding Yakama Nation member rights or culture.

The subject EA fails to address the resource damages associated with the proposed action. The Yakama Nation urges the Department of Energy to reconsider this action and offer forward a preferable alternative that will avoid impacts to the resources we are committed to protect.

Sincerely,

Russell Jim, Manager
Environmental Restoration/Waste Management Program
Yakama Indian Nation

cc: K. Clarke, DOE/RL
M. Riveland, WA Ecol.
T. Grumbly, DOE/EM
T. O'Toole, DOE/EH
Washington Gov. M. Lowry
U. S. Senator P. Murray
DNFSB
EPA Administrator, Washington, D.C.
Dennis Faulk, USEPA, Richland

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Department of Energy
Richland Operations Office
P O Box 550
Richland, Washington 99352

APR 14 1995

Mr. Russell Jim
Confederated Tribes and Bands
of the Yakama Indian Nation
P.O. Box 151
Toppenish, Washington 98948

Dear Mr. Jim:

ENVIRONMENTAL ASSESSMENT (EA) FOR THE DEACTIVATION OF THE N REACTOR FACILITIES

This letter is in response to a Confederated Tribes and Bands of the Yakama Indian Nation (YIN) letter to Mr. John Wagoner from Mr. Russell Jim "Environmental Assessment (EA) for the Deactivation of the N Reactor Facilities, Comments on --," dated January 23, 1995. In the YIN letter concerns were expressed regarding the proposed action to send radioactively contaminated water from N Reactor Facilities to the 200 Area Effluent Treatment Facility (ETF) for treatment and subsequent discharge to the subsurface, the lack of consideration of reuse and storage alternatives, and compliance with DOE Order 5400.5.

The disposition of the liquid effluent from the N Reactor Facilities via the 200 Area ETF was evaluated against other alternatives and was determined to be the most cost effective and protective of human health. Other alternatives considered included reuse, storage and radioactive decay, evaporation, and discharge to the river.

The ETF will be permitted for the discharge of the effluent. The National Environmental Policy Act and State Environmental Policy Act processes have been completed via the "Hanford Environmental Compliance Environmental Assessment" (HEC-EA) and the "Washington Department of Ecology Supplemental Analysis of the 200 Area Effluent Treatment Facility (Project C-018)."

Treatment of the water from the N Reactor Facilities at the ETF will be consistent with the ETF operations described in the HEC-EA and the supplemental analysis. The activity of tritium in the ETF effluent will be maintained below 24,000,000 pCi/L. The total tritium in the N Reactor water will be about 190 curies, which is approximately six percent of the anticipated total tritium discharge from the ETF during its operating life.

Other alternatives considered in the N Reactor Deactivation EA include the following:

- Recycle/reuse: No reasonable and cost-effective opportunities for recycle or reuse of the N Reactor water in planned programs were identified. However, there will continue to be active consideration of reuse opportunities, such as tank sluicing, as new programs are planned.

- Storage: Current activity levels of tritium would require a storage period of about 130 years to decay the tritium to the drinking water standard, and this long-term storage was not deemed practicable or cost-effective. The Liquid Effluent Retention Facility in the 100-N Area was

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not designed for continuous or long-term storage. Furthermore, it has not been maintained during the past eight years and its integrity could not be assured.

- Evaporation: The evaporation alternative was considered less desirable because tritium can be dispersed directly into the atmosphere which has the potential for public exposure. The air pathway (inhalation) is considered a direct exposure pathway to the body because air is variable in direction and unrestricted in dispersion of all pathways. By comparison, subsurface discharge and groundwater containment offer a greater ability to restrict public exposure.

The discharge to the river option was considered feasible, and was evaluated as an alternative in the EA. Discharging the effluent to the river would require a National Pollutant Discharge Elimination System permit. Because tritium levels in the effluent discharge to the river would be above the drinking water standard, the permit would require a large mixing zone in the river. Based on "As Low As Reasonably Achievable" (ALARA), the direct exposure was also considered a greater potential impact to the public. Therefore, this alternative was not selected.

The U.S. Department of Energy (DOE), Richland Operations Office (RL), in consultation with DOE-Headquarters, has determined that the proposed action is compliant with DOE Order 5400.5. This order requires that facilities and operations be designed and operated such that liquid effluent discharges are driven by the DOE ALARA policy and objective to minimize contamination in the environment to the extent practicable. The order also adopts the "best available technology" (BAT) as the appropriate level of treatment for liquid wastes containing radioactive contaminants.

Technical and economic considerations are included in determining BAT, and BAT treatment is provided to protect groundwater and prevent radionuclide buildup in the soil. In regard to BAT for tritium, DOE Order 5400.5 section II.3.e. (2) "Tritium Control" states that there is no practicable technology available for removing tritium from dilute waste streams. It also states that tritium decay in transit in confined groundwater (i.e., confined from the public use) may be an acceptable alternative to direct release to the atmosphere or to surface waters. As previously stated, the ETF has incorporated BAT and has been accepted by the state and RL.

If you want to discuss this matter further or require additional information, please contact me at (509) 376-6667 or Mr. Paul M. Pak at (509) 376-4798.

Sincerely,

Paul F. X. Dunigan, Jr.

Paul F. X. Dunigan, Jr.
NEPA Compliance Officer

RSD:PMP

cc: F. R. Cook, YIN
J. D. Wagoner, RL

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47600 • Olympia, Washington 98504-7600
(206) 407-6000 • TDD Only (Hearing Impaired) (206) 407-6006

January 20, 1995

Mr. Paul F. X. Dunigan, Jr.
U. S. Dept of Energy
PO Box 550
Richland WA 99352

Dear Mr. Dunigan:

Thank you for the opportunity to comment on the environmental assessment for the Deactivation of the N Reactor Facilities (#DOE/EA-0984). We reviewed the environmental checklist and have the following comments.

A shoreline permit will be required if the proposed project is located, or disturbance will occur within 200 feet of the ordinary high water mark of the Columbia River.

If you have any questions, please call Mr. Mike Maher with our Shorelands Program at (509) 625-5185.

Sincerely,

Rebecca J. Inman

Rebecca J. Inman
Environmental Review Section

RI:
94-9584

cc: Mike Maher, ERO
Heidi Renz, ERO

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Department of Energy
Richland Operations Office
P O Box 550
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Ms. Rebecca J. Inman
State of Washington
Department of Ecology
Environmental Review Section
P.O. Box 47600
Olympia, Washington 98504-7600

Dear Ms. Inman:

ENVIRONMENTAL ASSESSMENT FOR THE DEACTIVATION OF THE N REACTOR FACILITIES

This letter is in reference to your letter to me dated January 20, 1995, in which you commented that "A shoreline permit will be required if the proposed project is located, or disturbance will occur within 200 feet of the ordinary high water mark of the Columbia River."

In response to your comment, the proposed project is located greater than 200 feet from the ordinary high water mark of the Columbia River. Additionally, according to Washington Administrative Code 173-19-080, the Shoreline Management Act shall not be applicable to activities of federal agencies on lands owned in fee by the Federal Government. The U.S. Department of Energy has ownership of the shoreline at the 100-N Area.

If you want to discuss this matter further or require additional information, please contact me at (509) 376-6667 or Mr. Paul M. Pak at (509) 376-4798.

Sincerely,

Paul F. X. Dunigan, Jr.

Paul F. X. Dunigan, Jr.
Nepa Compliance Officer

RSD:PMP

United States Department of the Interior

NATIONAL PARK SERVICE
Pacific Northwest Region
909 First Avenue
Seattle, Washington 98104-1060

IN REPLY REFER TO

L7619(PNR-RP)
Columbia River, WA-W&S

JAN 27 1995

Paul Dunigan
United States Department of Energy
Mail Stop IN A5-15
Post Office Box 550
Richland, Washington 99352

Dear Mr Dunigan

We have reviewed the *Draft Environmental Assessment for the Deactivation of the N Reactor Facilities* (EA) and believe that the EA is adequate We have no serious concerns with the proposed action, provided that all reasonable care is taken to avoid contamination and other impacts to the proposed White Bluffs National Wildlife Refuge and Columbia National Wild and Scenic River

Thank you for the opportunity to provide comments on the EA. If you have any questions regarding this letter, please contact Dan Haas at (206) 220-4120

Sincerely,

Richard L Winters

Richard L Winters
Associate Regional Director
Recreation Planning and Professional Services

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DEACTIVATION OF THE N REACTOR FACILITIES

HANFORD SITE, RICHLAND, WASHINGTON

U.S. DEPARTMENT OF ENERGY

FINDING OF NO SIGNIFICANT IMPACT

MAY 1995

AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact

SUMMARY: The U.S. Department of Energy (DOE) has prepared an Environmental Assessment (EA), DOE/EA-0984, to assess environmental impacts associated with the deactivation of the N Reactor, and activities to support this work at the Hanford Site, Richland, Washington. The N Reactor operated from 1963 until 1987 in a plutonium production mission. The N Reactor is located in the 100 N Area of DOE's Hanford Site near the City of Richland, Washington. Alternatives considered in the review process included: the No Action alternative; the preferred alternative to deactivate the reactor and thereafter to perform surveillance and maintenance pending future decommissioning decisions; and an alternative addressing discharge of contaminated water to the Columbia River after treatment, instead of to the Effluent Treatment Facility in the 200 East Area as in the preferred alternative.

Based on the analysis in the EA, and considering preapproval comments from the National Park Service, the State of Washington, and the Yakama Indian Nation, 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:

Ms. Julie K. Erickson, Director
River Sites Restoration Division
U.S. Department of Energy
Richland Operations Office
P. O. Box 550
Richland, Washington 99352
(509) 376-3603

For further information regarding the DOE NEPA process, contact:

Ms. Carol M. Borgstrom, Director
Office of NEPA Oversight
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-4600 or (800) 472-2756

PURPOSE AND NEED: DOE needs to place the N Reactor facilities in a condition that enhances worker safety and environmental protection, and reduces the cost of surveillance and maintenance.

BACKGROUND: The N Reactor was the last plutonium reactor constructed and operated at the Hanford Site. It operated from December 1963 until December 1987, when it was placed in standdown status for an extensive maintenance and safety enhancement program. In 1988, DOE ordered N Reactor be placed in cold standby status, which was achieved by October 1990. In July 1991, after evaluating national defense needs, the DOE decided to cease preservation of N Reactor, and to proceed with activities leading to eventual decommissioning.

PROPOSED ACTION: The proposed action is to deactivate the facilities to remove conditions that present a potential threat to human health and the environment and to reduce future surveillance and maintenance requirements. The action will include surveillance and maintenance after deactivation. Deactivation will take about three years and involve about 80 facilities. Surveillance and maintenance will continue until N Reactor and its ancillary facilities are all decommissioned.

Specific actions include: existing equipment would be restarted to support deactivation activities; equipment fluids, hazardous substances and unattached equipment and materials would be removed and characterized, packaged, and transported to the 200 Areas for use, recycling, storage or disposal as waste; basins and tanks would be drained, and contaminated water and residuals would be removed and transported to the 200 Areas for disposal; the 105-N Fuel Storage Basin would be inspected for irradiated fuel fragments, which would be removed, packaged and stored in the basin awaiting future decisions regarding interim storage; contaminated water from the 105-N Fuel Storage Basin and the Emergency Dump Basin would be removed, pretreated as necessary in a facility specially constructed in the 100-N Area, then transported to the permitted Effluent Treatment Facility in the 200 East Area for additional treatment and disposal to the soil; contaminated sediment, hardware, pieces of lithium targets, and irradiated fuel spacers would be removed, packaged as necessary, and transported to the 200 Areas for storage or disposal; radiation zones would be decontaminated and removed or stabilized to fix loose contaminants; support systems such as heating, ventillation, and air conditioning, water and monitors that are not required for future environmental compliance or personnel safety would be de-energized; structural repairs would be made as necessary for future surveillance and maintenance needs; building penetrations would be sealed to prevent entry of animals, and personnel access controls would be installed; and routine maintenance, including inspections, and vermin and weed control would continue.

ALTERNATIVES CONSIDERED: The EA discussed a contaminated waste water disposal alternative, as well as the No Action Alternative.

No-Action Alternative. This alternative would leave the N Reactor facilities in their current condition. Current levels of surveillance and maintenance would be performed to minimize the potential for environmental release, protect workers, and assure compliance with applicable regulations. Electrical distribution, fire protection, sewer, water, telephone, and other communications needed to support active facilities would remain active. Contaminated materials would remain in place.

Discharge to the Columbia River. This alternative would involve performing all activities described in the proposed action with the exception of the method of disposal of the contaminated water. Rather than treating the water at the 200 Area Effluent Treatment Facility, the water would be treated at the 100-N Area and discharged to the Columbia River.

ENVIRONMENTAL IMPACTS: Routine conduct of the proposed action would not result in any significant increase in Hanford Site emissions and effluents. Before beginning the proposed activity, appropriate procedures and administrative controls would be in place to maintain exposure to workers and other onsite personnel to within requirements established by DOE Orders and as low as reasonably achievable principles. Minor additional radiation exposure to either onsite personnel or offsite individuals would be expected from the proposed action. The whole body collective effective dose equivalent (CEDE) to N Reactor and transportation work force would be approximately 199 person-rem over the duration of Proposed Action. Based on a work force of 194 during the deactivation phase the average worker would receive an effective dose equivalent (EDE) of 1 person-rem. The estimated probability of the worker dying from cancer induced by such radiation doses is approximately 4×10^{-4} (1 in 2,500). The projected offsite popuation dose would be about 0.025 person-rem. The probability of any member of the offsite population having a cancer death due to radiation exposure from the Proposed Action would be 1.3×10^{-5}, or one chance in 80,000.

The proposed action would result in the generation of hazardous materials and hazardous, mixed and radioactive wastes. These would be removed, and would be managed and reused, recycled, or disposed of in accordance with applicable regulations.

The 100 N Area is a developed, highly disturbed area. Most activities will take place within existing buildings. No sensitive or critical plant or animal habitat would be affected.

Socioeconomic Impacts

Under either the Proposed Action or the Discharge to the Columbia River alternative, the N Reactor facilities deactivation would require about 194 workers, about 144 more than are currently employed performing surveillance and maintenance. It is expected most of these additional workers are already employed on the Hanford Site, or would be available from the labor pool in the Tri-Cities. As deactivation progresses, the staffing levels would be reduced, to a final total of about 3 to perform surveillance and maintenance. This increase and reduction represent about 0.8% of the 1994 Hanford Site workforce. Social and economic impacts cannot be quantified at this time because of the ongoing reductions in the Hanford work force and uncertainty about future Hanford budgets.

The No Action alternative would not change current staffing levels, therefore, no socioeconomic impacts are expected.

Cumulative Impacts

The proposed action is not expected to contribute substantially to the overall cumulative impacts from operations on the Hanford Site. Standard Operating Procedures will provide sufficient personnel protection such that exposure to radiological and chemical materials will be kept below DOE guidelines. Deactivation operations will not significantly increase the amount of radioactivity released from total Hanford operations. The wastes generated from the proposed action would not add substantially to waste generation rates at the Hanford Site and would be stored or disposed in existing facilities.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that Federal agencies 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. This proposed action would occur within the Hanford Site boundaries. As discussed in the EA, no health effects are expected. With the exception of socioeconomic impacts which are unknown, it is not expected that there would be any disproportionate adverse effects to low-income or minority populations in the surrounding community.

Impacts From Postulated Accidents

In addition to environmental impacts that were postulated from routine operations, the EA discussed a range of reasonably foreseeable accident scenarios that could lead to environmental impacts. Scenarios were related to a release of water from the 105-N Fuel Storage Basin either as a release to the Columbia River, or contained in the 105-N Building.

In the case in which the basin water would be released to the Columbia River, it was assumed that the release would occur over a period of 90 days. No probability for this accident was calculated, however, since a basin release has previously occurred on the Hanford Site makes this event reasonably forseeable. The radiation doses from specific radionuclides would total 4×10^{-4} person-rem EDE to the maximally exposed offsite individual. This is 10 times less than the EPA drinking water standard of 4 mrem/yr. Using a health effects conversion factor of 500 latent cancer fatalities (LCF) per million person-rem, the probability of this individual dying of cancer due to this release would be approximately 2×10^{-7} (1 in 5,000,000).

In the case in which the basin water release would be confined within the 105-N Building, no offsite radiological dose consequences were evaluated, because the water would remain within the building, and particulate airborne contamination would remain within the ventilation envelope of the building where the air is collected and filtered prior to being exhausted from the facility.

DETERMINATION: Based on the analysis in the EA, and after considering the preapproval comments of the National Park Service, the State of Washington, and the Yakama Indian Nation, I conclude that the proposed deactivation of the N Reactor facilities at the Hanford Site does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, an EIS for the proposed action is not required.

Issued at Richland, Washington, this 1st day of May, 1995.

John D. Wagoner
Manager
Richland Operations Office