DOE/EA-1030

Environmental Assessment

Characterization of Stored Defense Production Spent Nuclear Fuel and Associated Materials at Hanford Site, Richland, Washington

U.S. Department of Energy
Richland, Washington

March 1995

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GLOSSARY OF TERMS

ACTIVITY

Activity is a measure of quantity of a radioactive substance. The SI unit of measure is the becquerel (Bq) which is equal to the amount of substance from which one disintegration (nuclear transformation) per second is obtained. The common unit of activity is the curie (Ci) which is equal to 37 billion disintegrations per second - that number of disintegrations is approximately the disintegration rate of one gram (0.04 oz) of radium from which the original definition came. One Ci equals 3.7×10^{10} Bq.

While activity gives a measure of rate of radioactive decays of a substance, if used alone it may be misleading. The half-life of the substance, or the time it takes for one half of the activity to have disappeared is also important. For example one unit of activity of cesium-137 (half-life about 30 years) will have diminished to about 1% of the initial amount in 200 years, whereas one unit of activity of iodine-129 (half-life about 16 million years), for all practical purposes, will not have diminished at all.

BECQUEREL See Activity.

CRITICALITY

Criticality typically refers to a condition where masses of fissile material have exceeded the size, geometry and neutron moderation to result in a spontaneous self-sustaining nuclear chain reaction in which there is an exact balance between production and loss of neutrons in the absence of extraneous sources. The result is emission of radiation and release of considerable quantities of fission products. The event is not explosive in the usual sense, however dose rates near a criticality event can be very high to lethal. Extraordinary precautions are taken to assure that the conditions for accidental criticality do not exist.

CURIE See Activity.

DEFENSE PRODUCTION SPENT NUCLEAR FUEL

Defense production spent nuclear fuel is nuclear fuel that has been irradiated in a nuclear reactor for production of special nuclear material, principally plutonium-239 to be used in national defense programs, that has been removed from the reactor, but has not been reprocessed for recovery of uranium and plutonium.

DIFFERENTIAL SCANNING CALORIMETRY

Calorimetry consists of techniques used to determine the enthalpy, internal energy, specific heat, and heating value of a system. Differential Scanning Calorimetry is one type of apparatus that can be used to perform these measurements. A sample of known weight is placed within the calorimeter, and is reacted or combusted in a known atmosphere. The heat released by the reaction can be precisely measured and related to the thermodynamic properties listed above.

DOSE, RADIATION

In terms of public health and safety, radiation dose is a measure of the amount of ionizing radiation absorbed by the body or body tissue. The unit of absorbed dose in SI units is the gray (Gy) and is equal to the deposition of one joule of energy per kilogram of tissue and in common units is the rad which is equal to the deposition of 100 ergs per gram of tissue.

Various forms of radiation have different impacts on tissues and different tissues have different responses in terms of overall impact on the body. The source of radiation may originate outside the body, or inside the body as a result of inhalation, ingestion, absorption, or injection. Absorbed dose by itself is generally not sufficient as a measure of detriment or impact. As a consequence a total effective dose equivalent has been defined to take into account these differences and which yields a single risk-based value. As used in this EA the total effective dose equivalent includes the 50-year committed dose from radionuclides internal to the body and the radiation dose received from external sources. The special name of the unit of total effective dose equivalent is the sievert (Sv) in SI units and the rem in common units. One Sv equals 100 rem. (The fundamental units of effective dose equivalent are such that one sievert is equal to one joule of energy per kilogram of absorbing medium.)

Typically, dose is calculated for a "Maximally Exposed Individual" and for populations of interest. The Maximally Exposed Individual is that hypothetical individual who by virtue of food consumption patterns, place of residence, *et cetera*. that would tend to maximize the individual's dose for a given release of radionuclides to air, water or ground. Population doses are based on doses to individuals under more typical dietary and other assumptions. The doses for various subgroups (the product of the number of individuals each receiving the same dose and that dose) are added together to obtain the collective dose to the population. Population dose is reported in person-Sv (person-rem).

FISSILE MATERIAL

Fissile material is that material capable of undergoing fission by slow neutrons, e.g., uranium-235 and plutonium-239.

HEPA FILTER

A HEPA filter is a high efficiency particulate air filter. Typically a HEPA filter will remove 99.95+% of airborne particulates per stage of filter. These filters are often used in series to obtain greater removal of radioactive material from air.

MASS SPECTROMETRY

Mass spectrometry is an analytical technique used to determine the mass number per unit charge of elements contained in a gas sample. This is particularly useful for quantitatively determining reaction products resulting from chemical reactions.

METALLOGRAPH

A technique of recording images using photographic equipment in conjunction with optical or electron microscopes to investigate microstructural features of materials.

MT

A combining form commonly spoken as metric ton in place of the SI unit, tonne and is equivalent to 1.102 tons.

MTU

Metric tons of uranium. Commonly used when referring to the mass of un-irradiated nuclear fuel.

MTHM

Metric tons of heavy metal. Commonly used when referring to irradiated nuclear fuel where the mass of uranium and plutonium constitutes the bulk of the mass as compared to fission and activation products and fuel assembly parts.

PASSIVATION

Passivation is a technique to preclude degradation (corrosion) of a surface by providing a barrier layer over the surface to protect it from the environment. The barrier may be in the form of an oxide, alloy or metallic coating.

POINT-RISK ESTIMATE

Point-risk estimate is a measure of detriment (adverse impact) that takes into account the consequences of an accident, if it were to happen, and the likelihood (estimated recurrence frequency) of the accident occurring. It is most useful when used as a means of comparison among activities. For example, if an accident were to occur in which it was calculated that 50 latent cancer fatalities (LCFs) were to occur in the Hanford environs and the likelihood of the accident occurring was once in 10,000 years, the point risk estimate for that accident would be 0.005 LCFs/yr. That could be compared to the point-risk estimate from natural background radiation, which using the same dose-LCFs conversion factors, which would be 50 LCFs/yr in the same population. Typically, point-risk estimates are expressed on an annual basis, however, they may also be used over any specified time period.

SPENT NUCLEAR FUEL

Spent nuclear fuel is fuel that has served its purpose or is no longer able to sustain a fission reaction. In plutonium production reactors the fuel is "spent" when the optimum amount of plutonium-239 has been produced for the particular fuel. In commercial nuclear power reactors the fuel is "spent" when the growth of fission products in the fuel poisons the fuel to where it will not sustain the fission reaction.

THERMO-GRAVIMETRIC ANALYSIS

Thermo-gravimetric analysis is a technique used to measure the kinetics (or rate) of a reaction process. The technique employs an experimental apparatus consisting of a highly sensitive balance coupled with a controlled-atmosphere furnace. A sample to be studied will often be suspended below the balance and allowed to hang within the controlled-atmosphere furnace. The sample is then reacted with a selected atmosphere under selected temperature conditions. The change in sample weight as a function of time is recorded. The resulting weight versus time curve, coupled with physical examinations used to determine the reaction products, can be used to identify the reaction mechanism. This technique is useful for determining the types of conditions which will produce corrosion and how fast those corrosion processes will proceed in metals.

UNITS OF MEASUREMENT

The principal units of measurement used in this EA are the so called SI units, a metric system, accepted by the International Organization for Standardization as the legal standard at a meeting in Elsinore, Denmark in 1966. SI is the abbreviation for Systême Internationale d'Unités. In that system most all units are made up of combinations of six basic units, of which length in meters, mass in kilograms, and time in seconds are of importance in this EA. An example of a combination unit is that for energy for which the name of the unit is the joule [kilogram x (meters per second per second) x meters].

Numbers that are very small or very large are often expressed in exponential notation. For example the number 0.000034 may be expressed as 3.4×10^{-5} and 65,000 may be expressed as 6.5×10^{4}. Multiples or sub-multiples of the basic units are also used. A list of multiples and sub-multiples used in this EA are as follows:

Name	Symbol	Multiply by:	
milli	m	0.001	or 1×10^{-3}
kilo	k	1,000	or 1×10^{3}
mega	M	1,000,000	or 1×10^{6}
giga	G	1,000,000,000	or 1×10^{9}
tera	T	1,000,000,000,000	or 1×10^{12}

For example, the unit of mass is the kilogram [the standard of which is a lump of platinum iridium kept at the International Bureau of Weights and Measures at Sêvres, France (near Paris)]. Thus, the tonne (symbol for which is "t" - also called a metric ton), is one megagram (Mg), 1×10^{3} kilograms (kg), or 1×10^{6} grams (gm).

In this EA values given in SI units are followed by values given in common units in parentheses.

WATT

The watt is the name for a unit of power, or the rate of using energy. One watt is equal to the energy consumption rate of one joule per second.

X-RAY DIFFRACTION

X-ray diffraction is a tool for the investigation of the fine structure of matter. The technique is most frequently used to determine the crystallographic structure of a chemical compound or material. Every chemical material has a unique structure which will diffract x-rays in a particular manner. Over the course of time, extensive libraries of structures have been cataloged, and today the process of identifying unknown compounds can be conducted by computers which match measured x-ray diffraction patterns to the libraries of known compounds.

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
Bq	becquerel
CFR	Code of Federal Regulations
Ci	curie
cm	centimeter
CNS	Chem-Nuclear Systems, Inc.
CY	calendar year
DOE	U. S. Department of Energy
DOH	Washington State Department of Health
DOT	U. S. Department of Transportation

EIS	environmental impact statement
FONSI	finding of no significant impact
ft	feet (or foot depending on context)
ft^3	cubic feet
kg	kilogram
km	kilometer
km^2	square kilometer
LCF	latent cancer fatality
LEU	low-enriched uranium
LLW	low-level (radioactive) waste
LWR	light-water reactor
m	meter
m^3	cubic meter
mrem	milli-rem (1/1000 rem)
MTU	metric tons of uranium
mSv	milli-sievert (1/1000 sievert)
NEPA	National Environmental Policy Act of 1969
NRC	U. S. Nuclear Regulatory Commission
PNL	Pacific Northwest Laboratory
PTL	Postirradiation Testing Laboratory
PUREX	plutonium and uranium recovery through extraction
rem	common unit of dose equivalent, effective dose equivalent, committed dose equivalent, total effective dose equivalent, and total organ dose equivalent
RL	Richland Operations Office (DOE)
RLW	radioactive liquid waste
RLWS	radioactive liquid waste sewer
s	second
SERF	Special Environmental Radiometallurgy Facility
SI	Systêm Internationale d'Unitês (International System of Units)
SNF	spent nuclear fuel
SNFM	spent nuclear fuel materials
SPR	single-pass (once-through cooling) reactor; includes all Hanford production reactors except N-Reactor
Sv	sievert: SI unit of dose equivalent, effective dose equivalent, committed dose equivalent, total effective dose equivalent, and total organ dose equivalent
TRU	transuranic
WAC	Washington State Administrative Code
WHC	Westinghouse Hanford Company
yr	year

EXECUTIVE SUMMARY

There are about 2,100 tonnes (2,300 tons) of defense production spent nuclear fuel stored in the 100-K Area Basins located along the south shore of the Columbia River in the northern part of the Hanford Site. Some of the fuel which has been in storage for a number of years is in poor condition and continues to deteriorate. The basins also contain fuel fragments and radioactively contaminated sludge.

The DOE needs to characterize defense production spent nuclear fuel and associated materials stored on the Hanford Site. In order to satisfy that need, the Department of Energy (DOE) proposes to select, collect and transport samples of spent nuclear fuel and associated materials to the 327 Building for characterization. As a result of that characterization, modes of interim storage can be determined that would be compatible with the material in its present state and alternative treatment processes could be developed to permit a broader selection of storage modes.

For planning purposes it was assumed that 100 round-trips from the 100-K Area to the 300 Area [about 45 km (28 miles) distant] would be made over a five-year period. Although up to 500 kg (1,100 pounds) of spent nuclear fuel may be shipped per year, the maximum amount in the 300 Area at any one time would be limited to 250 kg (550 pounds) - a quantity smaller than that for which criticality concerns might arise [280 kg (610 pounds)]. Materials not used in the analyses would be returned to the basins for storage.

No alternative processes that would accomplish the purpose and satisfy the stated need were identified. No other suitable characterization facilities were identified on the Hanford Site. New construction of on-site or off-site laboratories were not considered reasonable. Implementing the no-action alternative would not satisfy the purpose and need for the proposed action.

Environmental impacts of the proposed action were determined to be limited principally to radiation exposure of workers, which, however, were found to be small. No health effects among workers or the general public would be expected under routine operations. Under one postulated accident having an estimated frequency of occurrence of on the order of once in ten thousand to once in a million years, one latent cancer fatality was calculated to occur among the general public, if the accident occurred during the growing season. Depending on food crop usage, the point-risk estimate for latent cancer fatalities for this accident would range from zero to 0.0001 per year. For perspective the point-risk estimate for latent cancer fatalities among the same population from natural background radiation is 50 per year.

Implementation of the proposed action would not result in any impacts on cultural resources, threatened, endangered and candidate species, air or water quality, socioeconomic conditions, or waste management.

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ENVIRONMENTAL ASSESSMENT (EA)

FOR

CHARACTERIZATION

OF STORED

DEFENSE PRODUCTION SPENT NUCLEAR FUEL AND ASSOCIATED MATERIALS

AT

HANFORD SITE, RICHLAND, WASHINGTON

1.0 PURPOSE OF AND NEED FOR AGENCY ACTION

The Department of Energy (DOE) needs to characterize defense production spent nuclear fuel and associated materials (SNFM)[a] stored on the Hanford Site. That characterization would establish a basis for determining the types of interim-storage[b] modes that would be compatible with the SNFM in its present condition and the kind and extent of processing, if any, the SNFM might require to make it compatible with alternative storage modes. Additionally, information obtained as a part of the proposed action would be expected to support future decisions on ultimate disposition of the SNFM.

The need for characterization arises because 1) some fuel, if it were to become bare and dry, might auto-ignite releasing radioactive material to the atmosphere, thus, auto ignition conditions need to be determined; 2) the condition of material in canisters in 105-KW Basin is unknown, but it may contain some uranium hydride, a reactive corrosion product; and 3) proceeding with either wet or dry storage concepts for SNFM in the 100-K Basins without the technical basis provided by characterization would not be prudent in terms of safety and environmental protection.

(a) Spent nuclear fuel and associated materials, or spent nuclear fuel materials (SNFM), is used to collectively refer to the spent nuclear fuel, associated sludges, gases, liquids, fuel assembly and/or canister parts, and any other related materials.

(b) For purposes of analysis interim storage for forty years is assumed.

2.0 BACKGROUND

Currently 1,150 MTU[a] (1,270 tons) of irradiated N-Reactor fuel are stored in 3,666 open canisters in the 105-KE Basin and 958 MTU (1,060 tons) of N-Reactor fuel are stored in 3,815 sealed canisters in the 105-KW Basin in the 100-K Area of the Hanford Site (Figure 1). Each basin also contains a small amount of irradiated Single-Pass Reactor (SPR) fuel [0.1 MTU (0.1 tons) in 105-KW Basin and 0.4 MTU (0.4 tons) in 105-KE Basin]. In addition there are 2.9 MTU (3.2 tons) of SPR and 0.5 MTU (0.6 tons) of N-Reactor fuel stored in the PUREX plant in the 200 East Area. The N-Reactor fuel was discharged from the reactor between 8 and 25 years ago. Most of the SPR fuel is residual material from the 105-KE and -KW reactors and is over 20 years old. The total stored spent defense production nuclear fuel (SNF) amounts to about 2,110 MTU (2,320 tons).

An estimated 12% (visual inspection) of the fuel elements have cladding damage as a result of discharge and subsequent handling operations and 90% of the canisters (maximum of 14 elements per canister) are estimated to contain at least one damaged fuel element (Bergsman 1994). In addition, some fuel has been damaged as a result of corrosion during storage.

In 1992 encapsulation of the fuel in 105-KE Basin and repackaging, where necessary, of fuel stored in canisters in the 105-KW Basin was proposed. The potential environmental consequences of these encapsulation and repackaging activities were analyzed and reported in *Environmental Assessment of 105-KE and 105-KW Basins Fuel Encapsulation and Repackaging, 100-K Area, Hanford Site, Richland, Washington, DOE/EA-0535 (DOE 1992a)*, and a finding of no significant impact (FONSI) was approved by the U. S. Department of Energy (DOE) in June 1992. At that time return of the fuel to water-basin storage was planned, however, consideration is now being given to alternative storage concepts.

Current plans call for preparation of a site-specific environmental impact statement (EIS) on interim storage of irradiated fuel at the Hanford Site [The Hanford Site is included as an alternative spent nuclear fuel (SNF) storage site in the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environment Impact Statement* (DOE 1994a)]. The outcome of this proposed action would support the analyses in the Hanford Site SNF EIS in that the research proposed would establish the technical basis for alternative storage concepts.

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[a] Metric tons of uranium before irradiation (MTU). Masses of uranium after irradiation amounted to 1143.7 t (1258 tons) and 951.8 t (1,047 tons), respectively (Bergsman 1994).

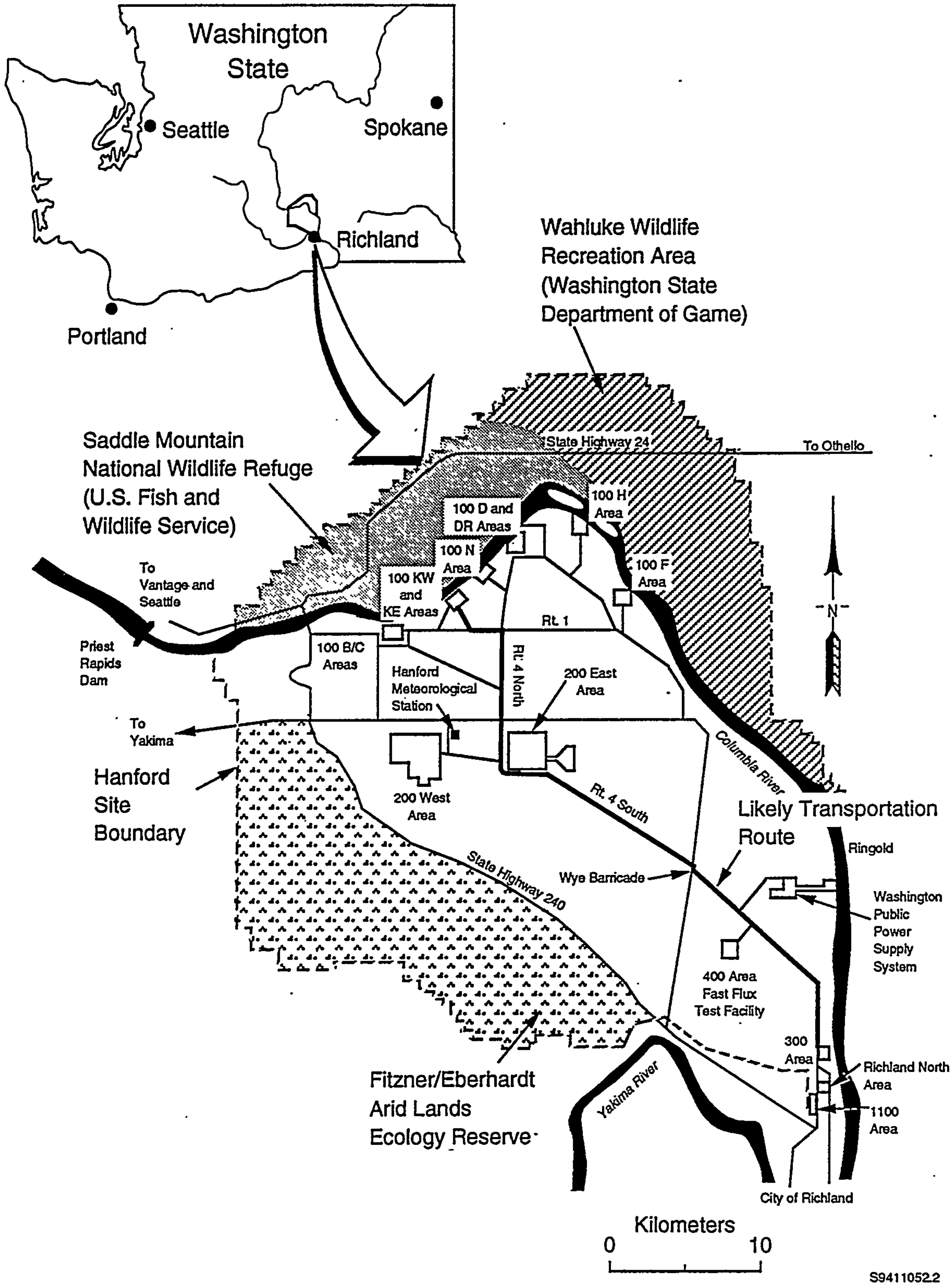

Figure 1. The Hanford Site and Likely Transportation Route

3.0 PROPOSED ACTION

The proposed action would include: 1) visual inspection of basin contents, including use of video equipment, e.g., borescope examinations; 2) assessment of the condition of canisters, e.g., ultrasonic liquid level detection in sealed canisters in 105-KW Basin; 3) selection and collection of samples of SNFM stored in the 105-KE, 105-KW Basins, and possibly in the PUREX plant; 4) transport of the samples to the Postirradiation Testing Laboratory (PTL) in the 327 Building in the 300 Area of the Hanford Site; 5) physical and chemical characterization of the samples; 6) development of a range of SNFM conditioning processes, as necessary to support decisions on 40-year storage; 7) and return of unused portions of samples to the 105-KE or 105-KW Basins.

Samples would be collected and transported to the 327 Building by the Hanford Site Operations and Engineering Contractor. Sample characterization would be performed by Pacific Northwest Laboratory (PNL) staff principally in the 327 Building with some analyses subsequently performed in the 325 and 326 Buildings and possibly in the 324 Building. Some analyses of portions of samples may be performed by the Hanford Site Operations and Engineering Contractor in the 222-S Building in the 200 West Area. The locations of the 105-KE and 105-KW Basins in the 100-K Area, a schematic of the 100-K Basins layout, and a cutaway representation of a 100-K Basin are shown in Figures 2, 3, and 4, respectively. The locations of the PUREX plant in 200-East Area, and the 327, 326, 325, and 324 Buildings in the 300 Area are shown in Figures 5 and 6, respectively. The arrangement of the various hotcells within the 327 Building are shown in Figure 7.

3.1 Details of SNF, Transportation, and Facilities Associated with the Proposed Action

Details regarding the SNF, activities at the storage locations, transportation of samples, the characterization facilities and activities proposed to be conducted at those facilities are described in the following subsections.

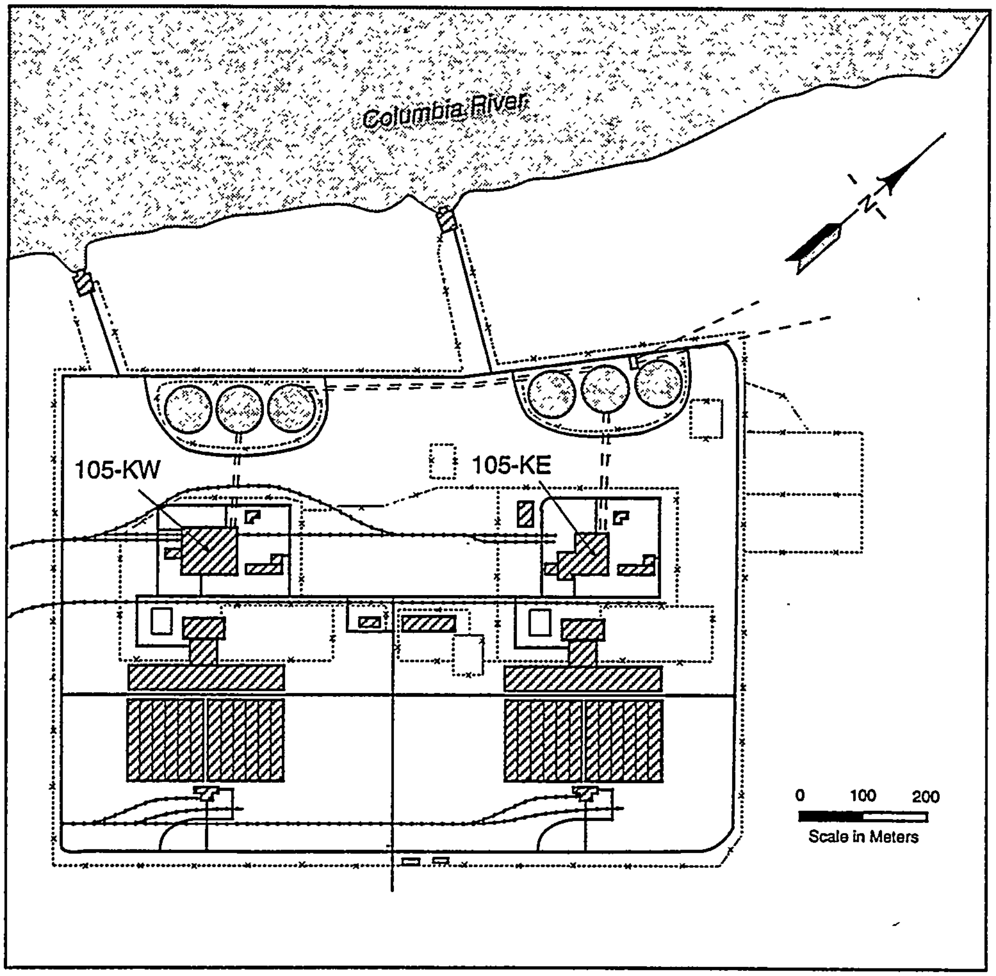

Figure 2. Location of 105-KE and 105-KW Storage Basins within 100-K Area

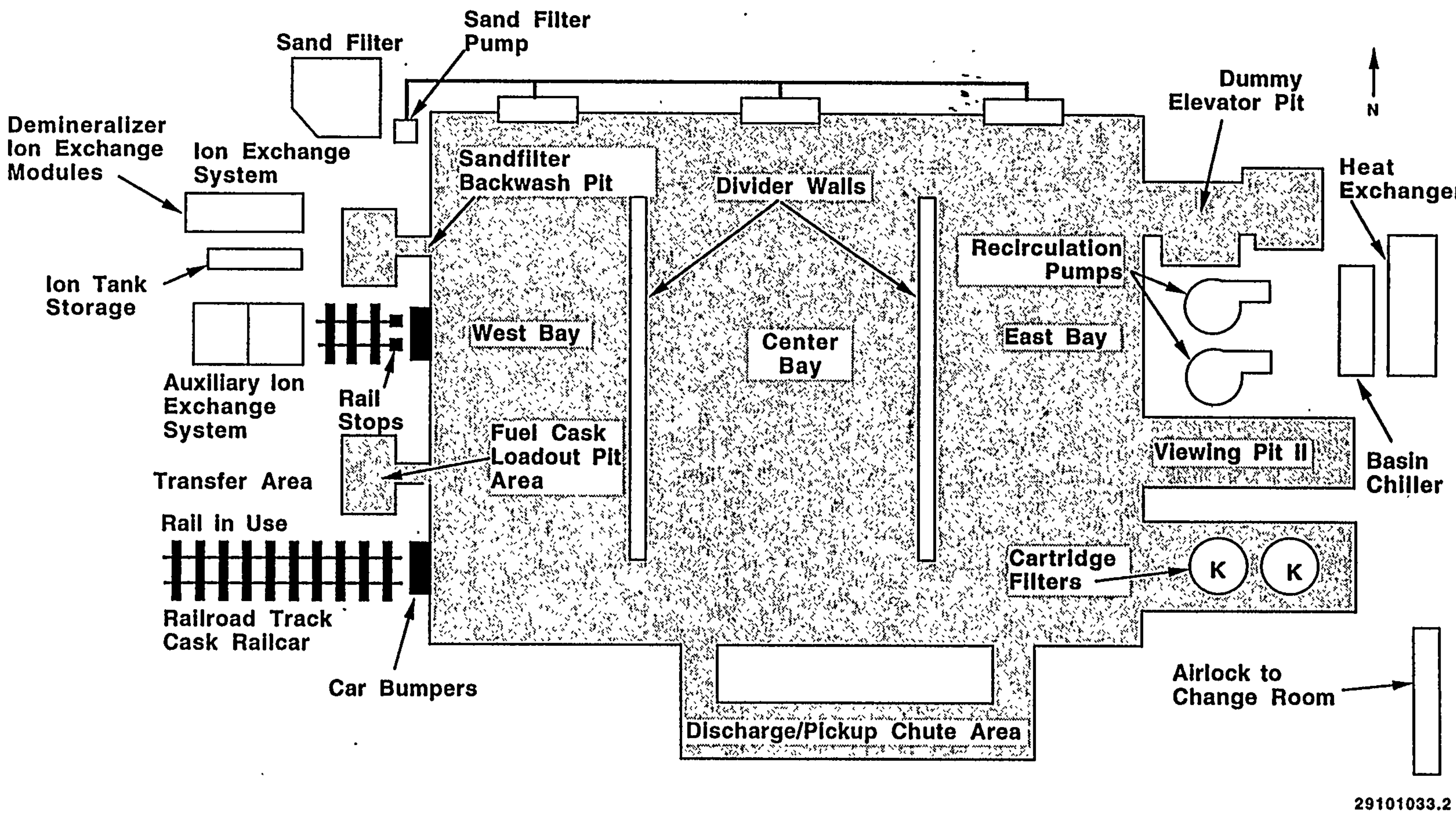

Figure 3. Schematic Drawing of 100-K Basin Layout

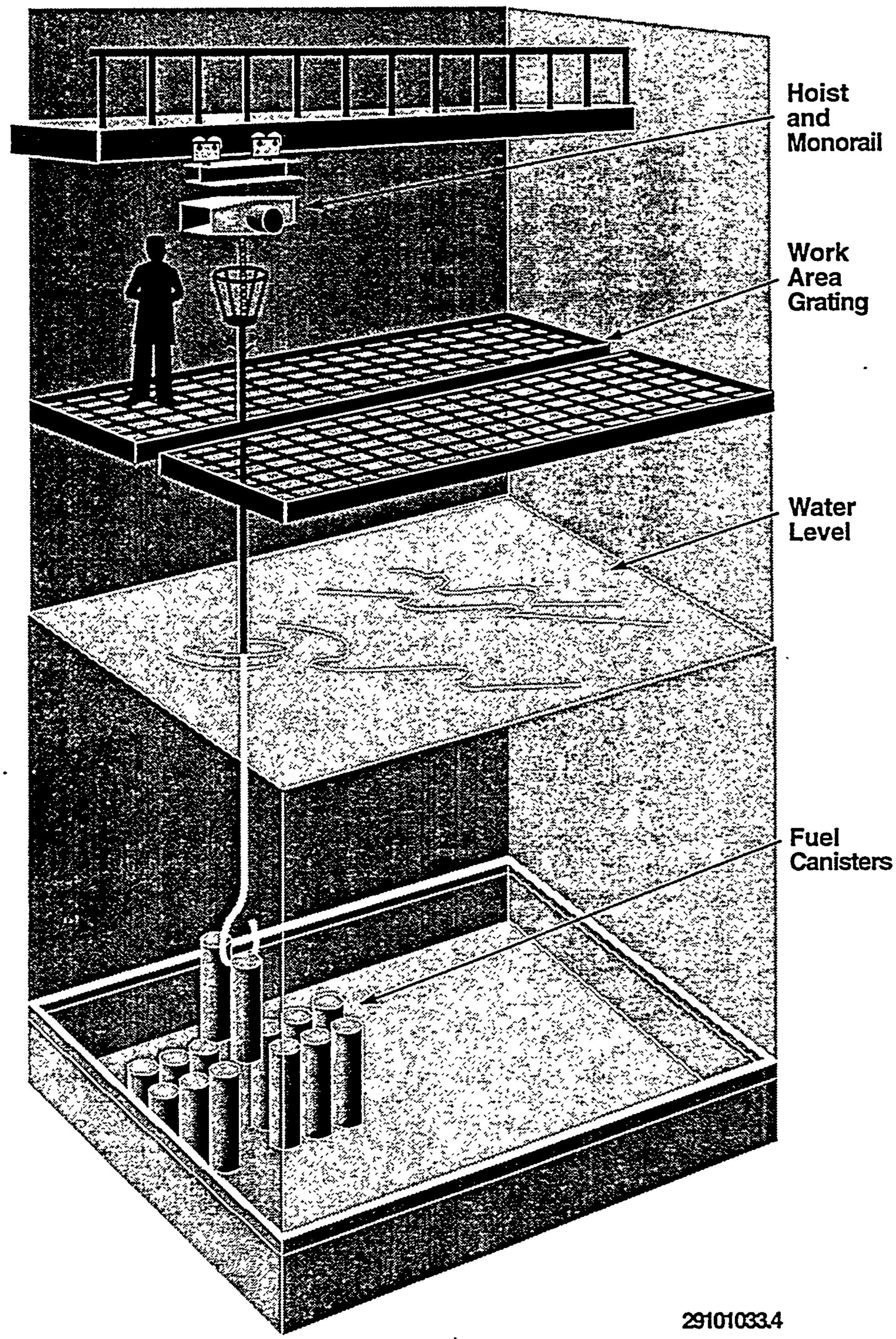

Figure 4. Cutaway Representation of a 100-K Basin

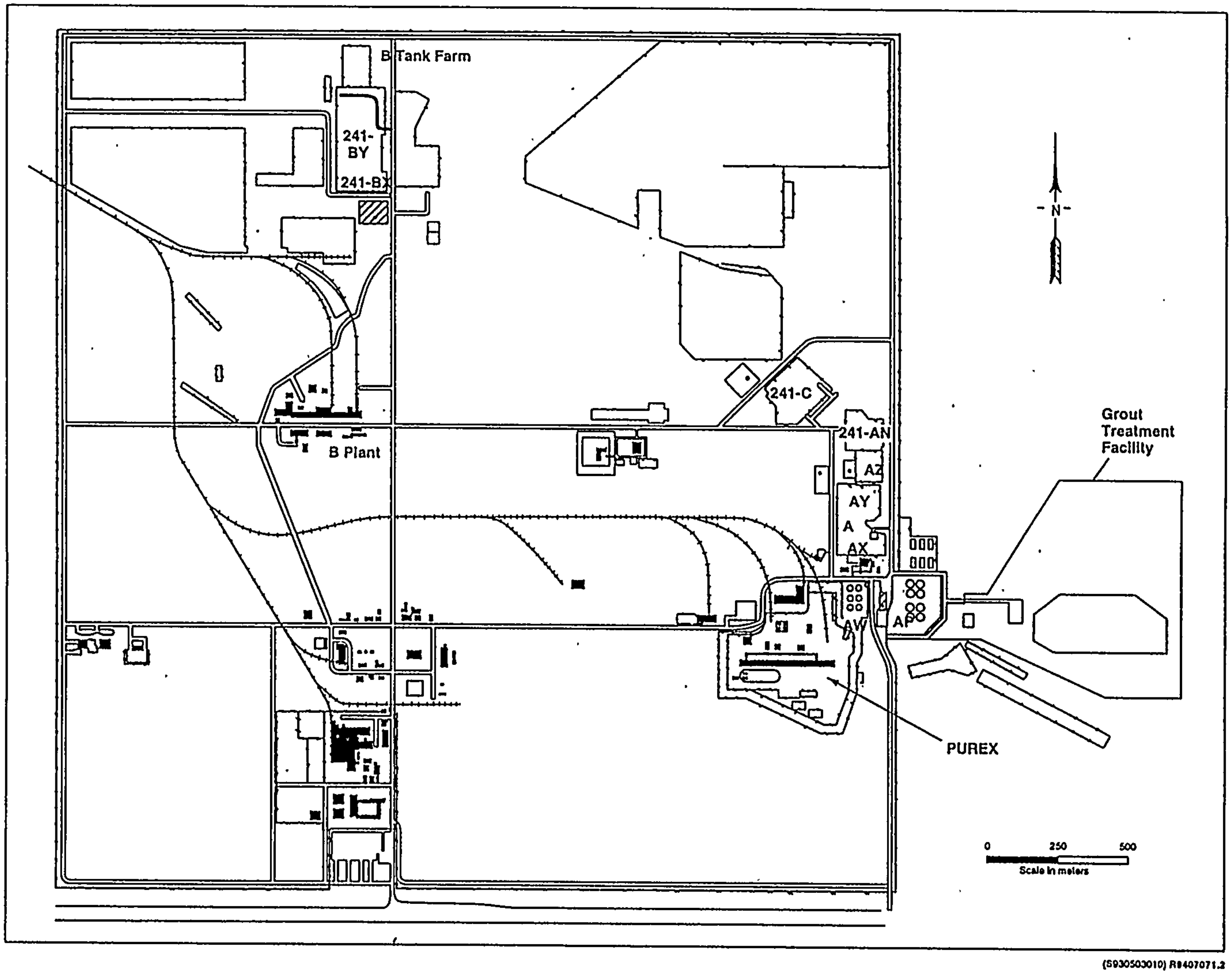

Figure 5. Location of the PUREX Plant Within the 200-East Area

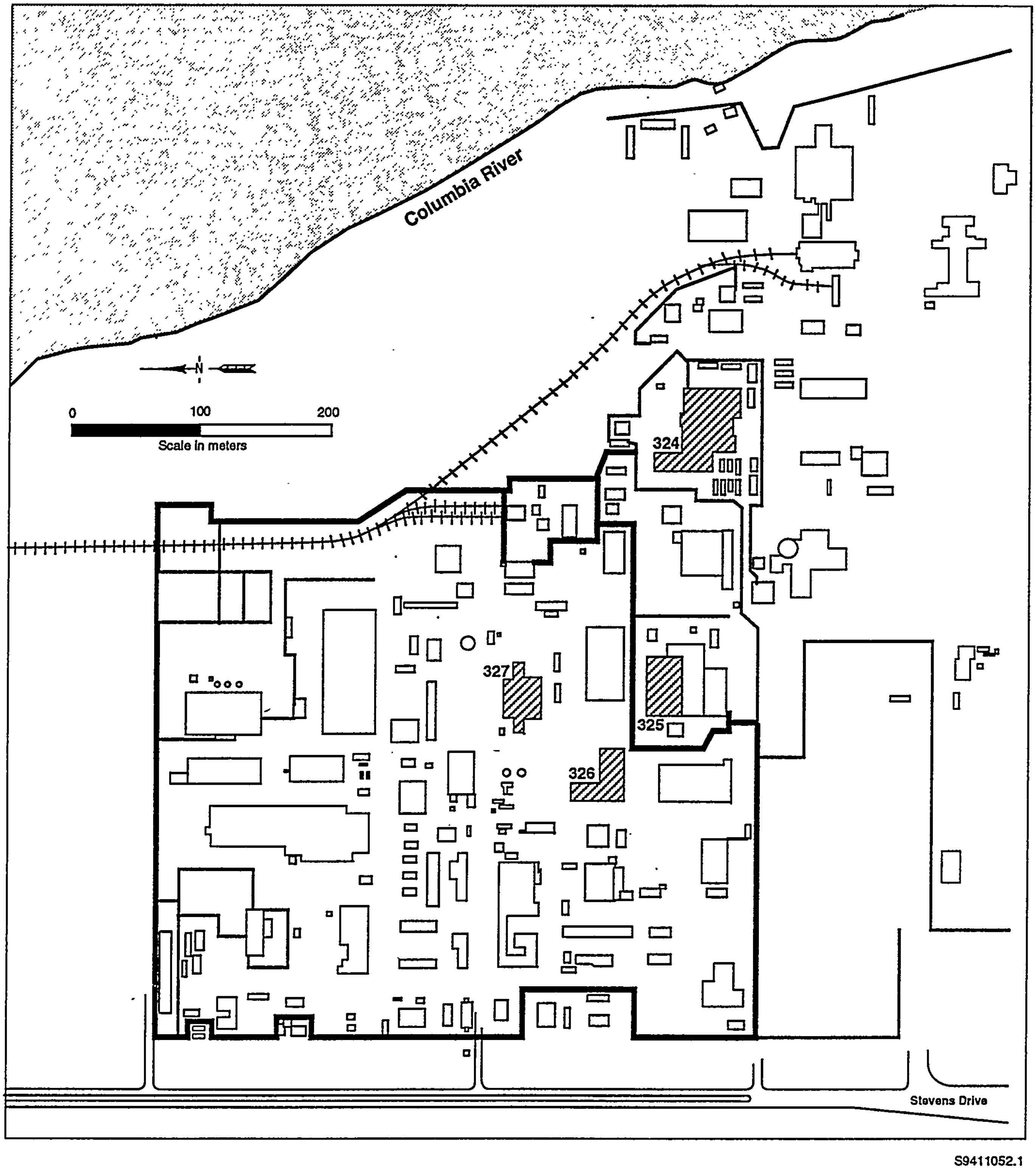

Figure 6. Location of the 327, 324, 325, and 326 Buildings in the 300-Area

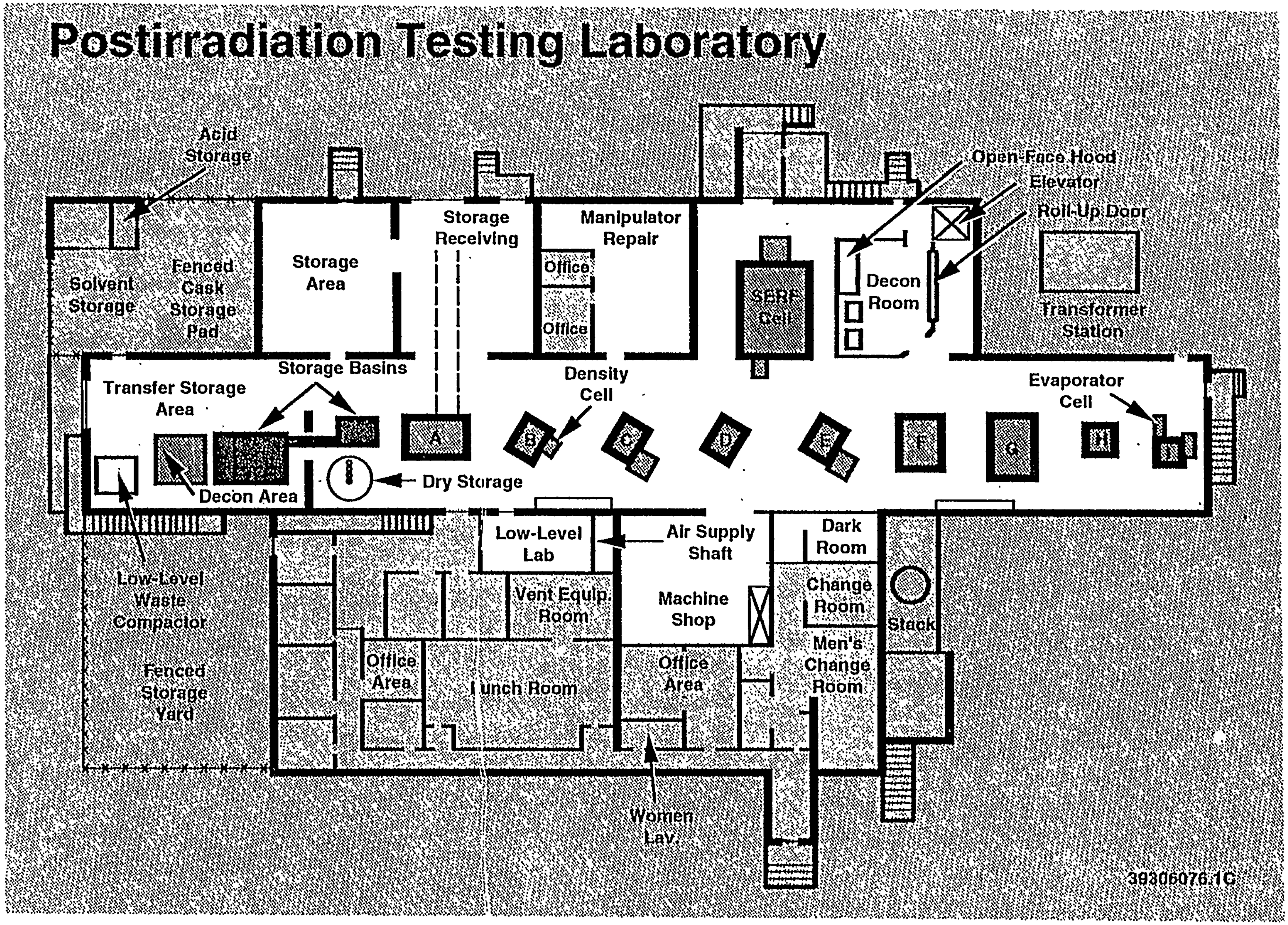

Figure 7. Schematic Drawing of Postirradiation Testing Laboratory (327 Bldg.)

3.1.1 Representative Isotopic Inventory of N-Reactor Spent Fuel

A representative isotopic inventory of one 23.5-kg N-Reactor irradiated fuel-assembly would typically range (depending on fuel type and age) approximately as follows:

Nuclide	Mass kg (lb)	Activity GBq (Ci)
U-238	23.2 (51.2)	0.3 (0.008)
U-235	0.17 - 0.24 (0.38 - 0.53)	0.1 - 0.2 (0.004 - 0.005)
Pu-239	0.03 - 0.05 (0.07 - 0.1)	70 - 100 (2 - 3)
Cs-137	0.0008 - 0.003 (0.002 - 0.007)	2,400 - 10,000 (65 - 280)
Sr-90	0.0005 - 0.002 (0.001 - 0.004)	2,400 - 8,100 (64 - 220)

The initial enrichment of uranium-235 in this fuel was only a few percent by weight and would thus be characterized as low-enriched uranium (LEU) fuel.

The decay heat of one such assembly ranges from about 1 to 3 watts.

3.1.2 Activities at SNFM Storage Locations Associated with the Proposed Action

A typical sequence of activities associated with selecting and collecting SNFM samples and making them ready for shipment to the 327 characterization laboratories are described in the following sub-sections. Actual activities would vary with the specific conditions encountered.

3.1.2.1 105-KE Basin

Sample Selection

Fuel sample selection in the 105-KE Basin would be initiated using a database that contains a mapping of the fuel canisters together with known conditions. Visual examination and use of video equipment would also be used in sample selection. Once selected the fuel sample would be moved underwater to the loadout pit for the next operation. Selection and collection of other SNFM samples from canisters or from the floor of the basins would be accomplished in substantially the same way, although a different containerization for the samples may be employed.

Sample Preparation

The fuel that is selected for shipment would be loaded into a Single Fuel Element Canister, [a cylindrical container nominally 10 cm (4 inches) in diameter and 70 cm (28 inches) long] sealed and then monitored for pressure increases to ensure that hydrogen generation rates are within shipping limitations. Once the in-place testing is complete, a new, vented, lid would be installed on the Single Fuel Element Canister.

Other types of SNFM samples would be prepared for shipment in much the same way as that described for fuel samples. Canisters may be fabricated specifically for these other samples of SNFM.

Cask Preparation

The outside surfaces of the cask would likely be coated with a material, such as strippable paint, to limit surface contamination and to facilitate decontamination after the cask is removed from the basin.

Cask Loading

Once the cask has been prepared and the Single Fuel Element Canister(s) are ready to be loaded into the cask (i.e., hydrogen generation tests are completed) the following steps would typically be taken:

1) The cask would be placed into the loadout pit and loaded with Single Fuel Element Canisters which would contain the SNFM sample(s).

2) The cask cavity would be rinsed to remove loose particulate contamination, e.g., using a fresh-water source under water, then the cask lid would be put in place, and the cask removed from the water and allowed to drain.

3) The cask lid would then be sealed, and cask surfaces would be decontaminated, as necessary, to meet specifications for shipping.

4) The cask would now be ready for loading onto a cask-shipping truck and shipment to the 327 facility.

3.1.2.2 105-KW Basin

The process of preparing the fuel for shipment in the 105-KW basin would be very similar to that of the 105-KE basin, however, gas and liquid sampling of the canisters might be included. Anticipated major differences in the above procedures are as follows:

1) Lids on 105-KW canisters would be removed and reinstalled underwater.

2) Because the concentrations of contaminants in 105-KW basin water are less (most are much less) than ten percent of those in 105-KE basin water, it is anticipated that less decontamination would be necessary.

3.1.2.3 PUREX Plant SNF

SNF located in PUREX plant would not be expected to be sampled during this campaign. The PUREX plant SNF was included in the inventory to accommodate the possibility that this fuel might be transferred to the 100-K Basins and then sampled later for characterization. Movement of SNF from the PUREX plant is the subject of another National Environmental Policy Act (NEPA) review (Wagoner 1994).

3.1.3 SNFM Transport

It is presently anticipated that about 500 kg (1,100 pounds) of fuel would need to be transported annually, for up to five years, between the 100-K Basins and the 300 Area for characterization. This would amount to about 20 round trips of 90 km (56 miles) each per year. However, depending on the conditions found and the information gathered, it may be necessary to obtain additional samples, or to run the campaign for a longer time. In any case, portions of the samples transported to PNL would be removed for characterization and the balance returned to the basins. No more than 250 kg (550 pounds) of SNFM would be kept in the 300 Area at any one time.

Packaging and transport of SNFM samples would be conducted by the Hanford Site Operations and Engineering Contractor according to *Packaging Design Criteria for the N-Reactor/Single-Pass Reactor Fuel Characterization Shipments* (Stevens 1994a) and *N Reactor/Single Pass Reactor Fuel Characterization Shipments Safety Evaluation for Packaging* (Stevens 1994b). The SNFM samples would be transported via a Chem-Nuclear Systems, Inc. CNS 1-13G cask, or equivalent. The CNS 1-13G cask consists of a stainless steel encased, lead shielded cask with a double walled, carbon steel shipping overpack. The cask cavity is 1.4 m (54 inches) high by 0.67 m (26.5 inches) in diameter and overall the cask weighs about 15 tonnes (16 tons). The casks would be shipped one per truck over Hanford Site roads.

The CNS-1-13G cask has been licensed by the Nuclear Regulatory Commission (NRC) for enclosed and sealed oxide and metal SNF with up to 500 grams (1.1 pounds) of uranium-235-equivalent fissile inventory, however the license does not include consideration of breached or damaged SNF with direct access of the fuel to the cask cavity. Damaged SNF or SNFM would be placed in additional vented cans to help assure containment (Stevens 1994b).

The most probable transportation route would be on Hanford roads beginning at 100-K Area, Route 1, Route 4-North and Route 4-South, and ending at the 300 Area, as shown on Figure 1 (route used in transportation impact analysis). Of this route about 15 km (9.4 miles) along Route 4-South from the Wye Barricade to the 300 Area, are accessible to, but are not frequented by the general public. Since the cask is not licensed for transport of damaged fuel on public roads, Route 4-South (WYE Barricade to 300 Area) would be closed to public access during shipment of damaged SNFM samples (representing only a few of the bounding number of 20 shipments per year) consistent with Department of Transportation (49 CFR 172, 173, 174, and 397) regulations and DOE Order 5480.3. To minimize inconvenience to others using this route, shipments necessitating road closures would be made at times of minimal traffic.

Documentation of safety analyses, as required by DOE regulations to ensure adequacy of the shipping package, has been prepared and approved (Stevens 1994a, Stevens 1994b).

3.1.4 Postirradiation Testing Laboratory (PTL)

The Postirradiation Testing Laboratory in the 327 Building provides shielded, ventilated, and specially equipped laboratories for physical and metallurgical examination and testing of irradiated fuels, concentrated fission products, and structural materials, and has been in operation since 1953. The facility has been and continues to be used for examining irradiated and non-irradiated fuel. The irradiated fuels examined in this facility include oxide, metal, carbide and nitride-based fuels. Specifically, N-Reactor fuel, SPR fuel, and Light Water Reactor (LWR) fuels (from commercial power reactors) have been examined; N-Reactor fuels as recently as 1988, and examinations of LWR fuel for the Yucca Mountain Site Characterization Project are ongoing.

The 327 Building (Figure 7) is a single-story structure with a partial basement. Maximum dimensions are about 66 m (220 feet) long by 43 m (140 feet) wide by 10 m (33 feet) tall and the building is roughly cruciform in shape. The building framework is welded steel with exterior walls of fluted steel insulated panels. The primary operating area is on the main floor and includes 11 hotcells, two small shielded cells, two small water basins, the area around the cells (the canyon), and the bays connected to the canyon in which auxiliary operations are performed.

A large overhead door provides access to the truck loading and unloading receiving bay at the west end of the building. There a 13.5 tonne (14.8 ton) bridge crane and an 18 tonne (20 ton) bridge crane are used to transfer casks containing radioactive materials from the receiving area to the cells or between the cells, and for general lifting and transfer service in the canyon. The receiving operations for the SNFM for the proposed action would involve:

1) Removing the overpack from the CNS 1-13G cask outside of the facility. The cask would be surveyed for radioactive contamination prior to entry into the building and decontaminated, if necessary.

2) Backing the tractor-trailer (truck) into the receiving bay and unloading the cask from the trailer.

3) Lowering the cask into the small storage basin.

4) Opening the cask underwater in the storage basin.

5) Removing the sample canisters which contain the SNFM from the cask.

6) Replacing the cask lid and removing the cask from the basin.

7) Performing exit radiological surveys, and reloading the cask on the trailer for return to the Operating and Engineering Contractor.

The small water basin is intended to be the staging area for the SNFM prior to performing characterization activities in the PTL hotcells.

There are nine air-atmosphere hotcells in the PTL. Cells A through I are shop-fabricated from high-density cast iron. The base, walls, and top cover are fitted together by a groove-dowel, lock-together design. The shielded cells rest on a reinforced concrete floor. If direct access is required, a wall may be removed to permit maintenance or to make changes in process or handling equipment.

Most operations in the hotcells are performed with manipulators. Services and viewing ports that are accessed by interchangeable plugs and that lock in place by expanding retaining rings are spaced symmetrically about the iron cell-walls.

Characterization activities would begin in A-Cell[a]. A-Cell is connected to the small water storage basin by a loading chute. A cable can be extended down the chute and affixed to the bail on a Single Fuel Element Canister. The Single Fuel Element Canister can then be pulled up into the cell for unloading. Once opened, the SNFM would be extracted for visual examination in A-Cell. Following visual examination, samples to be sent to other cells would be loaded into a transfer cask (a small cask designed specifically for cell-to-cell transfers), and moved to the F-Cell for the next stage in the characterization activities.

F-Cell would be used to perform sample sectioning and preparation. F-Cell has been used for characterizing N-Reactor fuel elements in past operations, and is equipped with a milling machine and lathe which would be used for sample cutting. Should the SNFM exhibit pyrophoric behavior, a cover box would be fabricated to allow the use of inert atmospheres during sample preparation. Once the samples have been reduced to a size appropriate to the specific analysis to be performed, selected portions would be transported to other hotcells for further examination. The residual materials would be returned to A-Cell for placement in containers and returned to the storage pool prior to return shipment to the 100-K Basins.

E-Cell is intended for use in performing metallographic examination of the fuel. At this time the cell is equipped with additional sample preparation equipment, microscopes, and a metallograph. The use of other hotcells is not anticipated at this time, but is not precluded.

Some samples would be reduced in size to permit handling in radiation glove boxes. Some of the characterization activities to be conducted in glove boxes include additional microscopic analyses, radio-analysis (liquid scintillation analysis), and thermodynamic/kinetic process determination. There is a

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[a] Although specific cells are cited, other cells may be used for a given function depending on the needs of characterization and circumstances at the time.

possibility that some of the SNFM samples might be handled in radiation fume hoods (of which there are two in the PTL), but use of these is not anticipated at this time.

The PTL also has a Special Environmental Radiometallurgy Facility or SERF Cell which provides an examination and storage facility with a nitrogen atmosphere for specimens that may be affected by air. The facility consists of an upper operating area and a lower storage area. A detachable shielded enclosure at the north end, with access to the operating cell, houses a remote metallograph for photomicrography, microhardness testing, and sample viewing at high magnification. Two airlocks provide access for entry or removal of test materials, supplies, equipment, and waste without compromising the integrity of the cell atmosphere. Operating equipment is designed to be located entirely within the cell, and operations are performed with manipulators. This cell may not be used initially for the SNFM characterization activities because the manipulators have limited weight capacity and the cell is highly contaminated from FFTF fuel examinations. However, due to the unique features of the SERF cell, later usage is not precluded.

3.1.4.1 Proposed Characterization Activities

Examinations of the intact SNFM would include:

- Optical examinations of cross-sections of the fuel prepared using saws and mounting/polishing equipment in the hotcell to measure such parameters as hydride content and orientation and matrix integrity

- Thermo-gravimetric analysis of fuel pieces to measure type and rate of corrosion

- Differential scanning calorimetry tests to determine thermal properties

- Mass spectroscopy on gaseous species released from the SNFM samples to identify isotopes and obtain thermo-dynamic and kinetic release data

- X-ray diffraction on solid samples to identify phases in the material

Hotcell and analytical laboratory examinations of SNF sludge samples would include:

- Sludge settling tests

- Density and particle size measurements

- Dewatering/dehydration tests

- Compositional analysis

Additional analyses may be identified and would be performed as necessary to meet the objectives of the proposed action.

3.1.4.2 Development of Conditioning Processes

The range of conditioning process to be examined would depend on the evolving characterization efforts and are not presently defined. It is expected that conditioning processes would include drying, passivation, and various levels of bulk chemical processing including conversion to oxides for interim storage pending decisions on ultimate disposition and possibly separation of nuclides for alternative disposition (resources to storage and wastes to interim storage pending ultimate disposal).

3.1.4.3 Chemicals to Be Used in Characterization and Development Activities

The project activities would use several chemicals in the characterization of SNF and development of conditioning processes. Based on experience, chemicals expected to be used by the project are listed in Table 1; as the research evolves others may also be used as well. Quantities of chemicals are anticipated to be less than the Reportable Quantities listed in title 40 Code of Federal Regulations (CFR), Parts 117, 302 and 355.

3.1.5 Return of Unused Portions of Samples to 100-K Basins

SNFM samples which are not consumed during the characterization process would be returned to the 100-K Basins for storage (see Section 6.8 Waste management and Disposal). The operational sequence utilized for this activity would be essentially the reverse of the shipping operation described in Section 3.1.2. Small amounts of SNFM may be returned in containers capable of being loaded directly into storage canisters rather than in Single Fuel Element Canisters.

3.2 Criticality Considerations

Actions taken to prevent criticality accidents at storage locations and the characterization facilities are described in the following subsections.

3.2.1 Storage Locations

Currently, stringent controls are in place to prevent criticality events in the 100-K Basins (DOE 1992a). The prevention of accidental formation of critical masses in the basins is based primarily on confining the fuel in critically safe geometry. Further the control is based on a double contingency criterion, which states that at least two unlikely, independent, and concurrent changes in process conditions must occur before a critical configuration is possible. These controls would also apply to the fuel sampling activity in the basins.

3.2.2 Characterization Facilities

The limitation of 250 kg (550 pounds) of SNFM at any one time in the 300 Area would be below the criticality safety limit of 280 kg (610 pounds) developed for storage of N-Reactor fuel in the 327 Building (Harms 1994). As a consequence no conditions associated with the proposed action would be expected to exist that would support a criticality event.

Table 1. Chemicals to be Used for SNFM Characterization

Chemical	Anticipated Use
epoxy resins	sample embedding compounds
isopropyl alcohol	sample cleaning
ethyl alcohol	sample cleaning
methyl alcohol	sample cleaning
glycerin	sample cleaning
diamond paste (kerosene/paraffin base)	sample polishing
aluminum oxide	sample polishing
magnesium oxide	sample polishing
hydrogen peroxide	sample etching
nitric acid	sample etching and/or dissolution studies
hydrofluoric acid	sample etching
oxalic acid (10% solution)	sample etching
chromic acid (2% solution)	sample etching
sulfuric acid	sample etching

4.0 ALTERNATIVES TO PROPOSED ACTION

Alternative Processes

There appear to be no alternative processes to characterization that would provide the required knowledge of the condition of the SNFM and satisfy the need, as stated. However, there is a strategy, that under certain circumstances, could obviate the need for the proposed action.

If N-Reactor fuel were to be removed from the 100-K basins as is, placed in PUREX plant type dissolvers and processed to form oxides or otherwise stabilized for ultimate disposition, or reprocessed for recovery of uranium and plutonium or other resources, there would be essentially no need for characterization of the existing fuel.

The decision for near term processing of SNF depends on the outcome of the Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft

Environment Impact Statement (DOE 1994a) for which a Record of Decision (ROD) is scheduled for June 1995. In the event that processing was needed to implement an option selected in that ROD, a site specific EIS for such an activity at Hanford would be necessary for construction and operation of a processing facility.

While this strategy could preclude the occurrence of the minimal environmental impacts of implementing the proposed action (see Section 6), it is a strategy that is not ripe for decision, and as a consequence is not considered in detail.

Alternative Facilities

Because of the need for off-loading SNFM in water basins and for ignition protection, there are no other suitable characterization facilities at the Hanford Site. New construction of laboratories would be possible, but with a facility readily available that had been designed and used for activities such as the proposed action and the minimal impacts found, the cost and delay of new construction was determined to be unwarranted. Detailed consideration of characterization in laboratories off-site was not considered reasonable because they would offer no advantages and would unnecessarily add to transport distances.

No Action Alternative

The "no-action alternative," as prescribed by Council on Environmental Quality (CEQ) Regulations [40 CFR (Code of Federal Regulations) 1500 -1508], was assumed for purposes of this analysis to be not to conduct any characterization of N-reactor fuel.

5. AFFECTED ENVIRONMENT

The affected environment would consist of the environs of the 105-KW and 105-KE basins in the 100-K Area; the 327, 324, 325, and 326 Buildings in the 300 Area; the Purex plant and 222-S Building in the 200 Areas, and the transportation route between those three areas; and the remainder of the Hanford Site and its environs as indicated in Figure 1. The Hanford Site lies within the semi-arid [average precipitation 15 cm/yr (6 inches)] Pasco Basin of the Columbia Plateau in southeastern Washington State. The Hanford Site occupies an area of about 1450 km^2 (560 square miles) north of the confluence of the Yakima and the Columbia rivers. Historically this land, with restricted public access, provided a buffer for the smaller areas used for production of nuclear materials, research, and waste storage and disposal. Only about six percent of the land area has been disturbed and is actively used (Cushing, Ed. 1994).

Lands adjoining the Site to the west, north, and east are principally range and agricultural land. The nearest offsite residence is, or potentially could be, about 2 km (1¼ miles) east to east-southeast from the 327 building. The cities (Tri-Cities) of Richland, Kennewick (Benton County), and Pasco

(Franklin County) constitute the nearest population center and are located southeast of the Hanford Site. The population within 80 km (50 miles) of the Hanford Site is about 380,000.

The 105-KW and 105-KE basins which were constructed in the 1950s are located in the northern part of the Site near the south bank of the Columbia River. The highest flood observed on the Columbia River was the dam-unregulated flood of 1894 that reached 127 m above mean sea level (417 feet). It is estimated that the probable maximum flood [40,000 m^3/s (1.4 million ft^3/s)] would reach 129 m (423 feet). The deck of the basin is 142 m (466 feet), thus the basins would not be considered to be within the 100-year flood plain [13,000 m^3/s (0.5 million ft^3/s)] and probably not the 500-year flood[a] plain. The basins are adjacent to that stretch of the river included in the Columbia River Study (Public Law 100-605), but are not within the area defined for study.

The 200 Areas of the Hanford Site have been industrialized for over 50 years. The 200 Areas are well above the floodplain of the Columbia River [nominally 210 m (700 feet) in elevation] (DOE 1986).

The 300 Area of the Hanford Site has also been an industrialized area for over 50 years. Some of the areas surrounding these buildings are at an elevation [nominally 120 m (390 ft) in elevation] that would be marginally within the floodplain for the maximum probable flood [40,000 m^3/s (1.4 million ft^3/s)] but would not be within the 100-year floodplain [13,000 m^3/s (0.5 million ft^3/s)] and are not on any wetlands or prime or unique farmland. The buildings of interest are not within the area included in the Columbia River Study (Public Law 100-605).

Air quality in the Hanford region is well within the state and federal standards for criteria pollutants, except that short-term particulate concentrations occasionally exceed the 24-hour PM_{10} standard as a result of naturally occurring dust storms (DOE 1994a).

Several archaeological surveys have been conducted on the Hanford Site and while there are known archaeological or cultural resources outside the fenced area of the K Basins, the proposed action would take place within existing facilities and would not disturb the sites. There are no such resources known in the immediate vicinity of the 200 or 300 Area buildings of interest. Since there is no construction planned to be associated with the proposed action there would be no opportunity for discovery of cultural resources. Based on Site studies, there are no threatened, endangered or candidate species known to exist or frequent the area in the vicinity of these buildings, nor are there any critical habitats within the area of interest (Cushing, Ed. 1994).

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[a] There are no published flow rates or flood elevations specifically addressing a 500-year flood. It has been suggested, but not authoritatively established, that the 500-year flood would have flow rates somewhat less than those of the maximum probable flood.

A more complete characterization of the Hanford Site may be found in *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Cushing, Ed. 1994).

6.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

Environmental impacts associated with routine operation of the facilities and with hypothetical, but plausible, accidents are described in this section. Impacts would be primarily those that might be associated with worker exposure to radiation and releases of radioactive materials to the atmosphere from sampling and characterization activities. Extensive experience with similar activities suggests that the dose to workers would be minimal. Since there would be no construction or facility alterations there would be no impacts on threatened, endangered or candidate species, cultural resources, floodplains or wetlands.

6.1 Worker and Public Health and Safety - Routine Facility Operations/Postulated Accidents

Impacts on worker and public health and safety from routine operations and postulated accidents in storage and characterization facilities are presented in the following subsections (see Section 6.7 for environmental implications of transporting SNFM). In general, worker exposure to radiation and non-radiological substances in the workplace would be controlled by means of exposure-rate measurements, time and access limitations, and application of the principle of keeping exposures as low as reasonably achievable (ALARA).

6.1.1 Routine Facility Operations

Impacts on worker and public health and safety from routine operations of the facilities are presented in the following subsections.

6.1.1.1 100-K Basins

Based on current measurements of radiation fields (no dose reduction measures were taken into account), activities associated with retrieval and preparation for shipment of up to 20 shipments (for purposes of bounding impacts) of SNFM samples per year and unloading of returned material (again assuming 20 shipments per year) would result in a bounding collective worker dose[a] of about 0.3 person-Sv/yr (30 person-rem/yr) (Bergmann 1994)[b]. Over a

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[a] Unless specified otherwise, the word dose should be read as total effective dose equivalent, that is, the sum of the dose from sources external to the body for a given year and the 50-year committed effective dose equivalent from sources internal to the body from intakes during that year.

[b] Dose estimates were based on maximum rather than average field readings. As a consequence, actual doses would likely be less than reported. Changes in procedures based on ALARA reviews of specific tasks may also result in a dose substantially smaller than that reported here.

campaign period of 5 years the total collective worker dose would amount to about 1.5 person-Sv (150 person-rem). Using a conversion factor of 0.04 latent cancer fatalities (LCFs) per person-Sv (0.0004 LCFs per person-rem) (ICRP 1991), no latent cancer fatalities (0.06 LCFs) would be expected to result from this aspect of the proposed action.

It may be noted that workers are subject to routine radiation exposure from many of the operations within the K-Basins area. The radiation exposure resulting from the proposed action would be cumulative with exposures received from other actions. The radiation exposure of each operations worker is administratively controlled to no more than 0.02 Sv/yr (2 rem/yr) with a worker monitoring program which provides hold points starting at a cumulative exposure to any worker at 0.005 Sv (0.5 rem). Such controls assure that under normal operating conditions individual workers will not be exposed to levels approaching the DOE limit of 0.05 Sv/yr (5 rem/yr) as prescribed in 10 CFR 835.

The dose to the hypothetical offsite maximally exposed individual from particulate releases from the KE and KW basins would not likely be greater than the offsite dose in 1984, the year when the segregation activity (segregating fuel by plutonium-240 content) was performed. Those doses were 3.2×10^{-6} mSv (3.2×10^{-4} mrem) and 1.7×10^{-7} mSv (1.7×10^{-5} mrem) respectively (DOE 1992a). These doses would not add significantly to those reported in the *Hanford Site Environmental Report 1993* (Dirkes *et al* 1994), where the potential dose to the hypothetical offsite maximally exposed individual during CY 1993 from Hanford Site operations was 0.0003 mSv (0.03 mrem). The potential dose to the local population of 380,000 persons from 1993 operations was 0.004 person-Sv (0.4 person-rem). Using a conversion factor of 0.05 LCFs per person-Sv (0.0005 LCFs per person-rem) (ICRP 1991)[a], no latent cancer fatalities (0.0002 LCFs) would be expected to result. For perspective, the national average dose from natural background radiation is 3 mSv/yr (300 mrem/yr) (NCRP 1987), which for the population of interest would result in about 1,000 person-Sv/yr (100,000 person-rem/yr) equating to about 50 latent cancer fatalities per year.

Small quantities of hazardous materials (e.g., cleaning agents) which may be generated during this aspect of the proposed action would be managed and disposed of in accordance with applicable federal and state regulations. Radioactive material, radioactively-contaminated equipment, and radioactive mixed wastes would be appropriately packaged, stored, and disposed of at existing facilities on the Hanford Site. No impact on waste receiving facilities or capacities would be expected. No offsite impacts would be expected.

[a] The conversion factor from dose to latent cancer fatalities for the general public is somewhat higher than that for workers because of different age distributions in the two groups (ICRP 1991).

It is anticipated that routine sampling operations would not provide additional exposure of workers to toxic or noxious vapors. Noise levels would be comparable to existing conditions in the 100-K Basins. No offsite impacts would be expected.

6.1.1.2 Characterization Laboratories

The average dose among the 10 workers expected to be involved with the characterization activities would be about 0.005 Sv/yr (0.5 rem/yr), with no individual worker being permitted (administrative control level) to receive more than 0.02 Sv/yr (2 rem/yr). Using the conversion factor of 0.04 LCFs per person-Sv (0.0004 LCFs per person-rem), the maximum probability of contracting a radiation related latent cancer fatality for an individual receiving the average annual dose each year for the 5-year campaign would be 0.001.

The collective dose to workers would be about 0.05 person-Sv (5 person-rem per year), or a total of 0.25 person-Sv (25 person-rem) for a 5-year campaign. Using a conversion factor of 0.04 LCFs per person-Sv (0.0004 LCFs per person-rem) no latent cancer fatalities (0.01 LCFs) would be expected to result from these operations.

Exhaust air streams from the laboratory hotcells and fume hoods are presently passed through two sets of HEPA filters and continuously sampled before release to the atmosphere via the building stack and would continue to be so filtered and sampled during fuel characterization. The 327 Building stack is considered a potentially major source of release of radionuclides to the atmosphere in that the potential exists to exceed 0.001 mSv/yr (0.1 mrem/yr) to the maximally exposed off-site individual (based on Part H, 40 CFR 61 requirements). In 1993, the last year for which data have been published for the 327 Building Stack, the dose to the maximally exposed off-site individual was 3.9×10^{-8} mSv (3.9×10^{-6} mrem) associated with a release of about 370 Bq (1×10^{-8} Ci) of alpha emitters and 37,000 Bq (1×10^{-6} Ci) of fission products (DOE 1994b). Using a dose to latent cancer fatality conversion factor of 0.05 LCFs per person-Sv (0.0005 LCFs per person-rem), the maximum individual probability of a latent cancer fatality would be about 2×10^{-12}[(a)].

6.1.2 Accident Conditions

Impacts on worker and public health and safety from accident conditions during operations are presented in the following subsections.

Although the safety record for operations at Hanford is generally good, Emergency Response Plans have been established to prepare for and mitigate the consequences of potential emergencies (DOE 1992b). These plans were prepared in accordance with DOE Orders and other federal, state, and local regulations. The plans describe actions that will be taken to evaluate the severity of a potential emergency and the steps necessary to notify and coordinate the

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[(a)] For perspective, the probability of a solar flare large enough to deliver ground level cosmic ray doses lethal to most any organism at high geomagnetic latitudes on earth is on the order of 1×10^{-8} per year (O'Brien 1978).

activities of other agencies having emergency response functions in the surrounding communities. They also specify levels at which the hazard to workers and the public are of sufficient concern that protective action should be taken. The Site holds regularly scheduled exercises to ensure that individuals with responsibilities in emergency planning are properly trained in the procedures that have been implemented to mitigate the consequences of potential accidents and other events. These plans and procedures are considered to adequately encompass emergency response for the activities described for the proposed action.

6.1.2.1 100-K Basins

Onsite Workers and Public

The following postulated accident for the 105-KE and 105-KW Basins is considered to be the bounding accident[a] for fuel sampling and preparation for shipment. The accident scenario was adapted from an accident described by Smith (1991). In this accident a cask is dropped and overturned in the fuel transfer area, with fuel elements spilling out of the cask, within the basin building, but away from the basin. The amount of fuel assumed to be exposed amounts to 40 kg (88 lbs), the amount assumed for each shipment (based on cask limitation on fissile material). This amount of fuel represents about 4% of that given in Smith (1991). The frequency of this accident is estimated as 10^{-4} to 10^{-6} per year. The analysis assumes 10-year-old fuel (12% of plutonium content is plutonium-240). The source term is calculated by multiplying the inventory at risk by the release fraction. The calculation of the release fractions assumes the fuel heats but does not melt. Also, site evacuation is assumed, giving a two-hour time for calculation of the onsite release factor. The offsite release factor was calculated using an eight-hour release time. The calculated release quantity was 3 grams (0.1 ounce) for onsite exposure and 12 grams (0.4 ounces) for offsite exposure, resulting in the calculated doses given in Table 2 (4% of values in Table A-2 in DOE 1994a). No latent cancer fatalities would be expected (maximum value - 0.3 LCFs) among non-involved workers and the general public as a result of this accident.

Involved Worker

A cask drop involving fuel elements falling out of the cask would most likely be observed by the workers, or the workers would be alerted by area radiation alarms and/or the radiation monitor in attendance to a change in radiation intensity. In accordance with procedures, the assumed three involved workers would be using personal protective equipment as prescribed in a Radiological Work Permit, but typically would not be wearing respiratory protection. The workers would immediately evacuate the area to reduce their exposure to direct

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[a] Although other accidents might occur, discussion of bounding accidents, that is, those that would be expected to have the largest consequences yet be reasonably plausible as to occurrence, provides an envelope of consequences for accident conditions.

Table 2. Consequences of 105-KE Basin cask drop accident.

	Individual Impacts - Onsite and Offsite			
	Onsite Worker	Public Access Location	Individual Resident	
			All Pathways	Without Ingestion
Dose (Sv)	1.4×10^{-3}	1.1×10^{-3}	5.8×10^{-4}	2.1×10^{-4}
(rem)	1.4×10^{-1}	1.1×10^{-1}	5.8×10^{-2}	2.1×10^{-2}
Latent Cancer Fatalities, (LCFs)	None (5.8×10^{-5})	None (5.3×10^{-5})	None (2.9×10^{-5})	None (1.1×10^{-5})

	Collective Impacts to Population within 80 km			
	50 percent E/Q[a]		95 percent E/Q	
	All Pathways	Without Ingestion	All Pathways	Without Ingestion
Dose (person-Sv)	0.33	0.14	5.8	2.5
(person-rem)	33	14	580	250
Latent Cancer Fatalities, (LCFs)	None (1.6×10^{-2})	None (7.4×10^{-3})	None (2.8×10^{-1})	None (1.3×10^{-1})

a. The term E/Q refers to the time - integrated air concentration at the receptor location for an acute release. It is analogous to the X/Q dispersion parameter used for a chronic release scenario.

radiation (by increasing their distance from the source), for which their clothing provides no protection. Once at a distance, they would move upwind of the postulated airborne release before beginning recovery and decontamination procedures. At the time of spill the fuel is assumed to be wet and no inhalation of radionuclides by workers takes place. Assuming that the workers are initially 1 m (3 ft) from the spilled fuel and take 2 minutes to evacuate, their external exposure from the cesium-137 contained in the fuel would amount to about 0.06 Sv (6 rem). The maximum probability of such an individual contracting a fatal cancer from such a dose would amount to about 0.002. The collective worker dose for such a scenario would be about 0.18 person-Sv (18 person-rem), and no latent cancer fatalities (0.007 LCFs) would be predicted. Note that consequences of this accident are highly dependent on assumptions of distance from the spilled fuel and the amount of time to evacuate the scene of the accident.

Uranium Hydride Issue

The potential has been identified for formation of elevated levels of uranium hydride in SNF in sealed storage where the uranium metal is in contact with water. Uranium hydride is very reactive and could trigger rapid oxidation of metal fuel when sealed canisters of SNF are opened in air-equilibrated water. Such sealed canisters are stored in 105-KW Basin. Under laboratory conditions uranium hydride is pyrophoric in air, but not in water. The extent to which uranium hydride might be a safety problem in prolonged storage is uncertain, because the documentation base on actual pyrophoric events associated with fuel storage is spotty and inconclusive (MACTEC 1994).

An analysis using ultra conservative assumptions (all of the metallic uranium has been transformed into 20% uranium hydride and 80% uranium oxide) suggests that the consequences of rapid oxidation in a canister of SNF in water would be on the order of 10% of the consequences of the bounding analysis presented above (Weber 1994).

6.1.2.2 Characterization Laboratories - Existing Conditions

Onsite Workers and Public

The postulated bounding accident for activities in the 327 Building under existing conditions is expected to be that of mechanical damage and subsequent fire of reactive fuel within a hotcell as described in "Postirradiation Testing Laboratory (327 Building) Safety Analysis Report (SAR)," HEDL-TC-1009, Westinghouse Hanford Company (WHC). For this accident it was assumed that mechanical damage would immediately release gaseous fission products. The subsequent fire would cause total reaction of reactive fuel forms. Fission products would be released to the atmosphere from the fuel through the ventilation system which includes both HEPA and activated charcoal filtration. This accident is not related to fuel introduced into the 327 Building as a result of characterization activities.

The calculated dose to a nearby, but not involved, worker (100 m distant) was 0.2 mSv (20 mrem) from which the maximum probability of fatal cancer would amount to 8 X 10^{-6}. The dose to the maximally exposed individual in the general population was calculated to be 25 mSv (2,500 mrem), principally from the ingestion pathway, from which the maximum probability of latent cancer fatality would be 1.2 X 10^{-3}. The collective population dose within 80 km (50 miles), if no restrictions on food crops were imposed, was calculated to be 43 person-Sv (4,300 person-rem) from which two latent cancer fatalities would be inferred. If restrictions were placed on the use of food crops, or if the accident occurred outside of the growing season, no latent cancer fatalities would be inferred. The frequency of such an accident was estimated to be between 1 X 10^{-4} to 1 X 10^{-6} per year. On that basis, the point-risk estimate for latent cancer fatality induction would range from zero to 0.0002 per year depending on crop interdiction or time of occurrence. For perspective the point-risk estimate for latent cancer fatality induction from natural background radiation amounts to 50 per year.

Involved Workers

Since the release in this accident is confined to the ventilation system with release to the atmosphere, radiological consequences with respect to involved workers would not be anticipated.

6.1.2.3 Characterization Laboratories - Proposed Activities

Onsite Workers and Public

The postulated bounding accident for characterization activities in the 327 Building is taken to be that of mechanical damage and subsequent fire of the maximum inventory of N-fuel proposed to be held in the 327 Building at any one time. The bounding analysis was based on the radionuclide inventory contained in 10-year old 16% plutonium-240 Mark IA fuel and on 95% meteorological conditions[a]. It was further assumed that the accident takes place near time of harvest during autumn. As in the accident under existing conditions, it was assumed that mechanical damage would immediately release gaseous fission products. The subsequent fire would cause total reaction of reactive fuel forms. Fission products would be released to the atmosphere from the fuel through the ventilation system which includes both HEPA and activated charcoal filtration. If this accident were to occur, the consequences would be in addition to those described in Section 6.1.2.2 for existing conditions. Consequences of this accident are presented in Table 3.

As may be noted in Table 3, the calculated dose to the nearby, but not involved, worker (100 m distant) was 0.3 mSv (30 mrem) from which the maximum probability of fatal cancer would amount to about 1 X 10^{-5}. The dose to the maximally exposed individual in the general population was calculated to be 9 mSv (900 mrem), principally from the ingestion pathway. The maximum probability of a latent cancer fatality from such a dose would be about 5 X 10^{-4}. The collective population dose within 80 km (50 miles), if no

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[a] "95% meteorological conditions" implies that, for a given release, atmospheric dispersion conditions resulting in higher concentrations of pollutants at a given location would occur only 5% of the time.

Table 3. Consequences of Bounding N-Fuel Sample Fire

	Worker	Public	
		Individual	Collective
Dose (Sv)	3.0×10^{-4}	9.0×10^{-3}	15 (person-sieverts)
(rem)	3.0×10^{-2}	9.0×10^{-1}	1,500 (person-rem)
Latent Cancer Fatalities (LCFs)	None (1×10^{-5})	None (5.0×10^{-4})	0 to 1

restrictions on food crops were imposed, was calculated to be 15 person-Sv (1,500 person-rem) from which one latent cancer fatality would be inferred. If restrictions were placed on the use of food crops, or if the accident did not occur during the growing season, no latent cancer fatalities would be inferred. The frequency of such an accident was assumed to be the same as for existing conditions, or between 1×10^{-4} and 1×10^{-6} per year. On that basis, the point-risk estimate would range from zero to 0.0001 depending on crop interdiction or time of occurrence. Again, for perspective, the point-risk estimate for fatal cancer induction from natural background radiation amounts to 50 per year.

Involved Workers

As under existing conditions, the release in this accident would be confined to the ventilation system with release to the atmosphere and no radiological consequences with respect to involved workers would be anticipated.

6.2 Air Quality

100-K Basins

No significant increases in particulate emissions from the basins would be expected.

Characterization Facilities

Very small releases of nitrogen oxides would be expected from burning experiments and from dissolution of SNFM in the laboratory. Releases would not approach limits prescribed by State of Washington regulations [Washington Administrative Code (WAC) 173-470-030, -100].

Permitting

Discussions regarding activities associated with the proposed action were held with the Washington State Department of Health (DOH) at a DOH/DOE/WHC/PNL routine monthly meeting. DOH determined that the discussions were sufficient to approve the activity and that the meeting minutes would serve as DOH's approval for the proposed activities (Stites 1994a, 1994b).

6.3 Water Quality

There would be no pollutants released to surface water or groundwater during normal operations associated with the proposed action, hence there would be no impacts on surface water or groundwater quality.

6.4 Ecological Systems and Threatened, Endangered and Candidate Species

In the absence of any construction of structures, releases of effluents to surface water or ground, and minor releases of pollutants to the atmosphere there would be minimal impacts associated with the proposed action on local ecosystems and no impacts on threatened, endangered, or candidate species or their habitat.

6.5 Cultural Resources

In the absence of known cultural resources within the areas in which the proposed action would be carried out and the lack of opportunity, via earth moving in new construction, for discovery of unknown resources, there would be no implications of impacts on cultural resources associated with the proposed action.

6.6 Socioeconomics

Since staff in the existing work force would perform the activities in the proposed action, there would be no basis for occurrence of socioeconomic impacts associated with the proposed action.

6.7 Transportation

Impacts resulting from transport of SNFM in the proposed action are discussed in the following subsections. For purposes of bounding transportation impacts 20 round-trip shipments per year for five years were assumed which amounts to a total SNFM transport distance of about 9,000 km (6,000 miles).

6.7.1 Incident-free Transportation

The RADTRAN 4 computer code was applied to calculate doses to workers and the public from routine transport of SNFM between the 100-K Basins and the 327 Building (Daling and Harris 1994). The collective dose to truck crews of two workers per truck amounted to about 1.5×10^{-4} person-Sv/yr (0.015 person-rem/yr) for all shipments or 0.0008 person-Sv (0.08 person-rem) for the entire campaign. The collective dose to the public was calculated to about 6×10^{-5} person-Sv/yr (0.006 person-rem/yr) or 0.0003 person-Sv (0.03 person-rem) for the entire campaign. No latent cancer fatalities (3×10^{-5} to 2×10^{-5} LCFs) would be expected from such doses.

6.7.2 Transportation Accidents

The RADTRAN 4 computer code was also used to calculate impacts of transportation accidents involving round-trip SNFM shipments between 100-K Basins and the 327 Building (Daling and Harris 1994). The impacts are presented in terms of probabilistically-weighted consequences of transportation accidents. That is, the impacts are the product of the probability and consequences of an accident and have been integrated over all of the accidents.

The population dose from the maximum credible accident[a] (Daling and Harris 1994), having a frequency of approximately one in a million per year, was calculated to be about 2.1 x 10^{-5} person-Sv (0.0021 person-rem) . No latent cancer fatalities (1 x 10^{-6} LCFs) would be expected from this accident. The maximum offsite individual dose from this accident was calculated to be 5.4 x 10^{-6} mSv (5.4 X 10^{-4} millirem). The maximum probability that this individual would contract a fatal cancer from this exposure level would be about 3 X 10^{-10}.

The total probabilistically-weighted impact of transportation accidents involving 100 SNFM round-trip shipments was calculated to be about 2 x 10^{-11} person-Sv (2 X 10^{-9} person-rem). No radiation related latent cancer fatalities (1 X 10^{-12} LCFs) would be expected from transportation accidents associated with the proposed action.

Injuries and fatalities not involving radioactive material were also investigated (Daling and Harris 1994). Risk factors employed in this EA were adopted from Daling and Harris (1994) and were:

Fatalities: 1.5 X 10^{-8} fatalities per km (2.4 x 10^{-8} fatalities per mile) for workers and 5.3 X 10^{-8} fatalities per km (8.5 x 10^{-8} fatalities per mile) for the general public.

Injuries: 2.8 X 10^{-8} injuries per km (4.5 x 10^{-8} injuries per mile) for workers and 8.0 X 10^{-7} injuries per km (1.3 x 10^{-6} injuries per mile) for the general public.

For the 100 round-trip shipments of 90 km (56 miles) each that would result from implementing the proposed action, no injuries or fatalities among workers or the public would be expected.

---

[a] The maximum credible accident is developed from the maximum credible release of radionuclides rather than from what could cause the release. Typically, however, the maximum credible accident is assumed to involve collision of the transport vehicle followed by an intense fire the combination of which pressurizes the cask to failure.

6.8 Waste Management and Disposal

The SNFM sampling and characterization project activities would be conducted in accordance with the Hanford Site Waste Minimization and Pollution Prevention Awareness Program Plan (DOE/RL-91-31) which would further reduce the minimal impacts of waste generation.

100-K Basins

Hazardous materials (e.g., solvents, glycols, asbestos) which may be generated would be managed and reused, recycled, or disposed of in accordance with applicable federal and state regulations. Radioactive material, radioactively-contaminated equipment, and radioactive mixed wastes would be appropriately packaged, stored, and disposed of at existing facilities on the Hanford Site. None of the materials would be anticipated to be generated in substantial quantities when compared to the annual amount routinely generated throughout the Hanford Site. For example, during CY 1992, about 24,000 m^3 (approximately 840,000 ft^3) of low-level nonindustrial waste was received for disposal and/or storage in the 200 Areas (Anderson and Hagel 1993). This may be compared with the total amount of solid waste generated in the 100-K Area in 1992 of approximately 36 m^3 (1,300 ft^3). The quantity of wastes generated in the proposed action would not add significantly to the quantities routinely generated at the K-Basins.

Characterization Facilities

Laboratory waste streams associated with the proposed action would consist of low-level waste (LLW), radioactive liquid waste (RLW), contact-handled transuranic (TRU) waste, and residual SNFM. The waste streams would consist of materials such as examined fuel samples, cutting wastes, polishing disks, and other solid wastes, such as hood-gloves. Although uncertain, the volume of these wastes would not likely exceed 10 m^3 (350 ft^3). Liquid wastes would be generated from fuel-cutting fluids, saw coolants, polishing compounds and sludge samples, and are expected to be disposed of using the Radioactive Liquid Waste Sewer (RLWS). Including flushing requirements for use of the line, the project expects to dispose of approximately 10,000 liters (2,600 gallons) of liquid waste. Saw cuttings, abrasive wheels, cutting blades, and other sample preparation consumables would be managed as transuranic (TRU) waste, the volume of which would not likely exceed 2 m^3 (70 ft^3). Unused portions of fuel samples remaining after characterization would be placed in suitable containers and returned for storage in either the 105-KE or 105-KW Basin pending disposition with other K-Basin materials. Remaining characterization wastes would be disposed of in approved on-site low-level waste burial grounds in the 200 Areas; only sanitary waste would be sent to the 300 Area sanitary sewer system.

Wastes generated in the proposed action would have a negligible effect on Site capacity for disposing of these wastes. A plan titled *Waste Management Plan for Hanford Spent Nuclear Fuel Characterization Activities*, generated jointly by PNL and WHC (Chastain and Spinks 1994), was written to ensure the disposition of all wastes generated as part of this action. This document requires that PNL perform a "life-cycle" analysis on each characterization activity to ensure that the wastes generated by the activity have a pre-approved disposition pathway. Adherence to the requirements of this document would ensure that no wastes would be generated for which disposal could not be provided.

At the conclusion of the characterization research the laboratories would be restored to a condition usable for other projects having similar radiological protection requirements.

6.9 Environmental Justice

With respect to Executive Order 12898 regarding environmental justice, distributions of minority and low income population groups have been identified for the Hanford Site (DOE 1994c). The analysis in this EA disclosed no impacts on public health and the environment and socioeconomics to be associated with the proposed action, therefore there would be no disproportionate impacts on any subgroups of the public including minority and low-income populations.

7.0 IMPLICATIONS OF THE NO-ACTION ALTERNATIVE

If the No-Action Alternative were implemented, characterization of 105-KE Basin and 105-KW Basin SNFM would not be performed and therefore the impacts discussed in Section 6 would not occur. Encapsulation and packaging of SNF in 105-KE Basin for continued water basin storage could proceed, however the need might remain for some quantification of hydrogen generation rates, if fuel were to be shipped over large distances, and for the potential for uranium hydride formation as may occur in SNF. Technical support for continued wet or dry storage concepts for interim or long-term storage and for future decisions on ultimate disposition of SNFM would not be developed.

8.0 CUMULATIVE IMPACTS

In recent years radiation dose among workers at the 100-K Basins has averaged about 0.22 person-Sv/yr (22 person-rem/yr) (Holloman and Motzco 1992, 1993). Routine handling of SNFM and characterization activities would result in a collective worker dose of up to 0.35 person-Sv/yr (35 person-rem/yr) which would amount to 17 percent of the most recently reported annual collective Hanford worker dose of about 2.1 person-Sv (210 person-rem) (Lyon 1994). For the five-year campaign, the proposed action would add less than 9% to the estimated collective dose of 20 person-Sv (2,000 person-rem) attributable to SNF management since Hanford start-up (Bergsman 1993) and less than 0.2% to the 1945-1985 collective Hanford-worker dose of 861 person-Sv (86,100 person-rem) (Gilbert 1993).

There would be no measurable addition to the calculated collective population dose of about 0.004 person-Sv/yr (0.4 person-rem/yr) (Dirkes *et al* 1994) due to other activities associated with the Hanford Site and no latent cancer fatalities (0.0002 LCFs) would be expected. For perspective, the collective population dose from natural background is approximately 1,000 person-Sv/yr

(100,000 person-rem/yr) would imply 50 cancer fatalities per year in this population from all sources of natural background radiation.

Releases of pollutants to the atmosphere from the proposed action when added to existing site emissions would not cause the State of Washington air quality limits to be approached by overall Site releases.

9.0 APPLICABLE ENVIRONMENTAL REGULATIONS AND PERMIT REQUIREMENTS

It is DOE's policy to conduct its operations in compliance with the letter and spirit of applicable environmental statutes, regulations, and standards (DOE Order 5400.1). SNFM sampling, transport, and characterization would meet the requirements of all applicable environmental laws, regulations and permits.

Activities that would be undertaken in the proposed action and that would involve releases to the atmosphere have been approved by the Washington State Department of Health (see Section 6.2).

10.0 LIST OF AGENCIES AND TRIBES CONSULTED

The National Park Service, the States of Washington and Oregon, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Wanapum, and the Nez Perce Tribe were provided with draft copies of this EA for their review and comment. Comments received from the National Park Service and the States of Washington and Oregon (Appendix A) were considered in preparing the final EA. The applicability of existing air quality permits for the proposed action was discussed with the Washington State Department of Health.

The opportunity to comment was provided to and comments were received from the Yakama Indian Nation on a directly related DOE planning document for characterization of Hanford's spent nuclear fuel (Jim 1994).

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Appendix A

Pre-approval Comments and Responses

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
DOE/EA-1030

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 Characterization of Stored Defense Production Spent Nuclear Fuel and Associated Materials at Hanford Site, Richland, Washington* (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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195-TPA-140

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

February 23, 1995

Mr. Paul F. X. Dunigan, Jr.
U.S. Department of Energy
P.O. Box 550
Richland, WA 99352

Dear Mr. Dunigan:

Thank you for the opportunity to comment on the Environmental Assessment for Characterization of Stored Defense Production Spent Nuclear Fuel and Associated Materials at Hanford Site, Richland, Washington. We reviewed the EAR and have the following comments.

I. Executive Summary

The 300 Area at the Hanford Site historically has been used in research and development (R&D) projects and programs sponsored by the U. S. Department of Energy (USDOE), and performed by Pacific Northwest Laboratories (PNL) since the mid-1960's. As such, the emphasis has been on research and development rather than waste management. The result has been that a quality R&D characterization program that includes waste management has not been implemented. Recent examples of poor waste management practices at the 300 Area include the high-level vault tanks/B-cell in the 324 building[1] and a discharging waste drum containing legacy waste in the 331 building[2].

The USDOE must include a discussion with more detailed information beyond what is provided in Section 6.8 as to how waste will be managed in the 300 Area, which is generated from this activity. The discussion should include: 1) A corrective action plan for PNL to change the cultural thinking about waste management for these types of facilities and activities; 2) a complete commitment of funding and path forward for ultimate disposition of excess and residual sample material for the entire planned duration of this activity, and 3) a commitment by USDOE to make these fundamental changes in waste management at their research facilities.

---

1 Hanford Federal Facility Agreement and Consent Order, Dispute Resolution Committee Agreement, February 7, 1995, 324 Building.

2 Unusual Occurrence Report #RL--PNL-PNLBOPER-1995-0002, Dated January 11, 1995.

II. **Section 3.1.3.** (SNFM Transport) This Section should mention compliance with 49 CFR 172, 173 and 177 and related regulations. If the intent is to comply with "equivalent" USDOE Orders, then the orders must be referenced and equivalency established.

It is not entirely clear whether closure of Route-4 South is proposed during all shipments of SNF samples, or only when casks contain materials that exceed license specifications. Also, it is not clear whether the intent is to close the entire route to all traffic, or the publicly accessible portion (south of Wye Barricade) only. In either case, there is no assessment of impacts on other Site activities such as the operations of WNP 2, or other facilities whose workers and suppliers would be affected by closures as many as 20 times each year.

II. **4.0. Alternative to Proposed Action**

Additional information or discussion is needed to support the statement, " . . . there appears to be no alternative characterization processes that would accomplish the purpose and satisfy the need, as stated." Assuming that an analysis went into that assumption, presenting that information in this document would clarify and support the conclusion for the reader.

III. **6.1. Worker and Public Health and Safety**

The Environmental Assessment goes into sufficient detail to describe probability of transportation accidents, but fails to mention or discuss the difference between what USDOE considers an incident verses an accident. For example, the plutonium inhalation at the Plutonium Finishing Plant was considered an incident. Nevertheless, people were exposed. If possible, please describe the anticipated incidents from this activity.

Section 6.1.1. says: "Impacts on worker and public health and safety from transportation and routine operations of the facilities are presented in the following subsections." However, impacts from transportation are not treated at all in **Section 6.1.**

Section 6.6. should be revised to include effects of up to 20 road closures annually.

IV. **6.7.2. Transportation** (Transportation Accidents) should explicitly provide the following information:

a. A description of the "maximum credible accident."
b. Basis for non-radioactive fatality and injury risk factors. What accident rate data were used? Based on what types of highway, traffic densities, etc.?
c. Assumptions about vehicle inspection and driver qualification underlying accident probability assumptions.

The document needs to address the adequacy of, or required additions to, on-site and off-site emergency response capabilities in light of additional fuel handling at the storage locations, the laboratories, and in transport.

Section 6.1.1.1. At the top of page 22, in the first line, latent cancer fatalities are calculated at the rate of 0.0004 LCFs per person-rem. Two paragraphs later they are calculated at the rate of 0.0005 LCFs per person-rem. This occurs again on page 23 in Section 6.1.1.2. It appears the rate of 0.0005 LCFs per person-rem is only used when computing effect to the general population. The author should either discuss the significance of dose to workers compared to dose to the general population which leads to use of a different factor for effect, or make all calculations using the same effect factor.

Section 6.1.1.2. On page 23, near the end of the second full paragraph, the author has incorrectly converted "3.9×10^{-8} Sv" to "3.9×10^{-6} mrem." This should be corrected as the effect is three orders of magnitude.

IV. Permitting

Discussion is lacking as to why permitting is or is not required, related to waste management.

If you have questions, please call Mr. Ron Effland with our Nuclear Waste Program at (360) 407-7134.

Sincerely,

Jeff Breckel, Manager
Outreach, Policy, and Support Section

JB:RE:dr

RESPONSES TO COMMENTS ON N-FUELS CHARACTERIZATION EA

Washington Department of Ecology

Comment:

I-1) A corrective action plan for PNL to change the cultural thinking about waste management for these types of facilities and activities needs to be discussed.

Response:

PNL has recently added a new Directorate of Environmental Safety and Health and is aggressively addressing improvements in the cultural thinking about waste management and its potential impact on the environment. No change made to the EA.

Comment:

I-2) A complete commitment of funding and path forward for ultimate disposition of excess and residual sample material for the entire planned duration of the activity needs to be discussed.

Response:

The EA was modified on page 32 to indicate that materials returned to the K-Basins would be for storage pending decisions on the disposition of K-Basin materials in general. Wastes specific to characterization activities would not remain in the 300 Area, but would be disposed of in the 200 Areas. Authorization for SNFM samples shipment to the 327 Building will not be approved by DOE-RL and PNL-Safeguards and Security until the waste disposal pathway is established.

Comment:

I-3) A commitment by USDOE to make these fundamental changes in waste management at their research facilities needs to be addressed.

Response:

The response to I-2 wherein characterization wastes are removed from the 300 Area should satisfy the intent of the suggested commitment.

Comment:

II. Section 3.1.3-1) Mention of 49 CFR 172 et seq and related regulations should be mentioned. If the intent is to comply with "equivalent" USDOE Orders, then the orders must be referenced and equivalency established.

Response:

Applicable parts of 49 CFR have been added to the EA on page 14. It is intended that shipment of damaged SNFM be NRC-equivalent, including security escort (front and rear) and to be administratively constrained with respect to vehicle speeds.

Comment:

II. Section 3.1.3-2) Not clear if Route-4 South will be closed for all shipments, nor are impacts on others, such as WNP-2 operations discussed.

Response:

EA clarified at page 14 to note road closed only for damaged fuel transport which is expected to be a small number of the shipments. Also committed to avoiding peak traffic times to minimize inconvenience of others using the road.

Comment:

II. 4.0) Additional information or discussion is needed to support the statement, "...there appears to be no alternative characterization process that would accomplish the purpose and satisfy the need, as stated."

Response:

The wording of the EA on page 19 was changed to clarify that there appear to be no other processes than characterization to satisfy the need. That is taken to be self evident. In addition the fuels reprocessing alternative that would obviate the need for characterization was added to the EA.

Comment:

III. 6.1) EA fails to differentiate between accidents and incidents. Describe anticipated incidents from proposed activity.

Response:

The EA process typically addresses bounding accidents and as a consequence does not specify all accidents nor would it describe events of lesser consequence that might be categorized as incidents. No change made to the EA.

Comment:

III. Section 6.1.1.) States that impacts from transportation are discussed in this section when they are not.

Response:

The words "transportation and" have been removed from the EA at page 21. Transportation impacts are discussed in Section 6.7.

Comment:

III. Section 6.6.) Effects of up to 20 road closures per year should be addressed.

Response:

Included with earlier response on page 14 of EA.

Comment:

IV. 6.7.2a) A description of the "maximum credible accident" is needed.

Response:

A brief statement regarding the maximum credible accident has been added as a footnote on page 30 of the EA.

Comment:

IV. 6.7.2.b) Provide basis for non-radioactive fatality and injury risk factors.

Response:

The EA was revised at page 30 to emphasize that the factors were from Daling and Harris (1994).

Comment:

IV. 6.7.2c-1) Provide assumptions about vehicle inspection and driver qualification underlying accident probability assumptions.

Response:

Transportation accidents per unit distance are based on actual experience in the trucking industry and do not take into account vehicle inspection and driver qualification in arriving at the rates.

Comment:

IV. 6.7.2c-2) The EA needs to address emergency response capabilities in light of additional fuel handling at storage locations, laboratories and in transport.

Response:

A paragraph has been added to the EA at page 24 briefly describing emergency response at Hanford.

Comment:

IV. Section 6.1.1.1) Reason for two factors relating dose to latent cancer fatalities needs to be explained.

Response:

A reference and an explanatory footnote has been added to the EA on page 23.

Comment:

IV. Section 6.1.1.2) Units conversion is off by 3 orders of magnitude.

Response:

The proper units conversion has been made and now appears on page 24 of the EA.

Comment:

IV. Permitting) Discussion is lacking as to why permitting is or is not required related to waste management.

Response:

Permitting is necessary for waste disposal sites, but not for individual shipments.

Oregon

DEPARTMENT OF ENERGY

February 15, 1995

Mr. Paul F. Dunigan, Jr.
NEPA Compliance Officer
U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99352-0550

Dear Mr. Dunigan:

We have reviewed the proposed "Environmental Assessment for Characterization of Stored Defense Production Spent Nuclear Fuel and Associated Materials at the Hanford Site, Richland, Washington" (DOE/EA-1030), dated February, 1995.

We agree with both the need and scope of this Environmental Assessment. Correction of the fuel storage at the K-Basins is a high priority issue for Oregon. Both the Oregon Department of Energy and the Oregon Hanford Waste Board have publicly stated their support.

The chemical condition of this fuel is not well known. Significant amounts of uranium hydride may have formed, especially in the sealed storage of the K-West Basin. It is essential for the success of the fuel relocation effort that more data on the chemical and pyrophoric character of the fuels be determined.

We are concerned that the exposure estimates for the incident scenarios may be low. Estimating the potential risks from a pyrophoric metal fire is very difficult. We suggest you extend the analysis of such possibilities, and focus additional effort on upgrading the Lab facilities to better handle such a fire.

Sincerely,

Mary Lou Blazek

Mary-Lou Blazek
Oregon Department of Energy

John A. Kitzhaber
Governor

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RESPONSES TO COMMENTS ON N-FUELS CHARACTERIZATION EA

Oregon Department of Energy

Comment:

One comment was received which dealt with a concern that accident scenarios involving pyrophoric metal fires in the laboratory might yield low exposure estimates.

Response:

Jian-Shun Shuen, RL and Iral Nelson, PNL discussed the comment with Dirk Dunning, ODoE, author of the comment and when apprised that we had done a bounding analysis, his concerns appeared to be satisfied. He noted that we should assure that the bounding nature of the accident was stated. The applicable scenarios are identified as bounding. At first usage (page 24), a footnote was added to the EA to inform the reader of the meaning of a bounding accident.

Finding of No Significant Impact

U. S. Department of Energy
Finding of No Significant Impact

Characterization
of
Stored Spent Nuclear Fuel and Associated Materials
at
Hanford Site, Richland, Washington

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-1030, on sampling stored spent nuclear fuel and associated materials in the 105-KW and -KE basins and the PUREX plant, transport of the fuel to the 300 Area, and physical and chemical characterization of the fuel, principally in the 327 Building in the 300 Area of the Hanford Site. Based on the analyses in the EA, and considering preapproval comments from the States of Washington and Oregon, 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 (NEPA) of 1969 (42 U.S.C. 4321 et seq.). Therefore, the preparation of an environmental impact statement is not required.

ADDRESSES FOR FURTHER INFORMATION:

Single copies of EA (DOE/EA-1030) and further information about the proposed project are available from:

Ms. Elizabeth D. Sellers, Director
Nuclear Materials Division
U. S. Department of Energy
Richland Operations Office
MSIN S7-41
P.O. Box 550
Richland, WA 99352
Phone: (509) 376-7465

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 leave a message at (800) 472-2756

PURPOSE AND NEED: DOE needs to characterize defense production spent nuclear fuel and associated materials stored on the Hanford Site. The need for characterization arises because some fuel, if it became dry, might auto-ignite releasing radioactive material, or the fuel might contain reactive corrosion products such as uranium hydride. Characterization would establish a basis for determining the types of future interim storage that would be compatible with the fuel and material in its present condition and the kind and extent of conditioning, if any, required for alternate storage modes.

PROPOSED ACTION: The proposed action which the EA addresses is to obtain samples of spent nuclear fuel and associated materials stored in the 100-K Basins; transport the samples by truck in commercially available NRC licensed casks to the 327 Building in the 300 Area; subject the samples to physical and chemical characterization; develop a range of alternative fuel conditioning technologies based on the characterization results; return unused sample portions to storage in the 100-K Basins; and dispose of characterization wastes in approved disposal sites in the 200 Areas.

ALTERNATIVES: No alternative to characterization in the existing fuel examination facilities on the Hanford Site was identified that would satisfy the purpose and need. Alternative existing facilities on the Hanford Site were considered, but since they were limited in their capacity to receive fuel and perform the needed analyses, they were not analyzed in detail. Construction of new facilities was not considered reasonable due to the additional costs and delay needed for new construction, and the existence of suitable facilities. Use of off-site laboratories was not considered reasonable because of the transportation distances. The "No-Action" Alternative was considered to be not performing any characterization of fuel.

ENVIRONMENTAL IMPACTS: Because the proposed action is to be performed by the current work force in existing facilities and using existing transportation routes, environmental impacts would be limited principally to radiation exposure of workers, which, however, are expected to be small. No health effects among workers or the general public would be expected during routine operations. No impacts related to socioeconomics, cultural resources, air or water quality, and threatened or endangered species were identified.

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. While distributions of minority and low-income populations have been identified for the Hanford Site, the analysis in this EA disclosed no high and adverse health or environmental impacts resulting from implementation of the proposed action. Therefore no disproportionate impacts are expected to any minority or low income populations.

Cumulative Impacts. The proposed action is not expected to contribute substantially to the overall cumulative impacts from operations on the Hanford Site. For example, there would be no measurable addition to the calculated collective population dose of about 0.004 person-Sv/yr (0.4 person-rem/yr) due to other activities on the Hanford Site and no latent cancer fatalities (0.0002 LCFs) would be expected.

Impacts from Postulated Accidents. Postulated accidents were examined related to operations in the KE and KW Fuel Storage Basins, transportation, and the 300 Area laboratories. In all the postulated accidents but one, no latent cancer fatalities were expected. However, under the postulated bounding accident for characterization activities in the 327 Building, having an estimated frequency of occurrence of about once in ten thousand years to once in a million years, one latent cancer fatality was calculated to occur among the general public within 80 km (50 miles). Depending on the season of occurrence and/or crop usage restrictions following the accident, no latent fatal cancers would be expected. For perspective the estimate for latent cancer fatalities among the same population from natural background radiation is 50 per year.

DETERMINATION: Based on the analysis in the EA (DOE/EA-1030), and considering preapproval comments from the States of Washington and Oregon, I conclude that the proposed sampling, transporting, and characterizing stored spent nuclear fuel and associated materials, and development of conditioning processes to support future consideration of alternative storage methods for storage of spent nuclear fuel at the Hanford Site does not constitute a major federal action significantly affecting the human environment within the meaning of NEPA. Therefore, an Environmental Impact Statement for the proposed action is not required.

Issued in Richland, Washington, this 13th day of March 1995.

John D. Wagoner
Manager
Richland Operations Office