5.0 Environmental Impacts of the Proposed Action

5.1 Impacts from Construction Activities

5.1.1 Air Impacts

Under normal construction activities, no airborne emissions of radioactive or hazardous materials are expected. However there is a potential for an airborne emission if a radiation area is unexpectedly disturbed during construction of the proposed retrieval facilities, storage facilities, infrastructure upgrades, and administrative facilities. However, the likelihood of any potential release is minimal because of the radiation administrative controls in place during the construction activities. Radiological field work would be performed in compliance with ALARA principles, applicable state and federal regulations, and DOE Orders and guidelines. Under normal conditions, air emissions would be within construction air permit requirements. In the event that radioactive contamination is encountered work would stop and more detailed monitoring would be done. Any contaminated area caused by a potential release above permit requirements would be cleaned up as a routine operation on site.

Exhaust gases and minor amounts of heat would be discharged to the atmosphere from the construction equipment. Ambient noise levels would be increased in the immediate vicinity during construction, but would be a temporary condition.

Particulate releases to the atmosphere, typical of all construction projects, would be limited to dust generated for short periods as a result of project construction activities. Dust control measures, such as spraying the ground with water or a soil fixative, would be implemented as needed during these activities to mitigate blowing dust.

Administrative safety procedures would be enforced to maintain safety in the workplace and prevent occupational accidents. Construction activities would comply with OSHA safety requirements.

5.1.2 Water Impacts

No liquid discharges to the environment would be expected during construction, except for the water that would be sprayed on the ground during construction to control dust. No detrimental impact is expected to the groundwater in the 200 West Area, which is approximately 70 meters (230 feet) below the surface (Kasza et al. 1991).

5.1.3 Waste Management Impacts

Miscellaneous small quantities of nonradioactive and nonhazardous construction scrap materials would be generated by the proposed activities. This waste would be disposed of in accordance with all applicable federal and state regulations, and DOE Orders and guidelines.

All waste would be disposed of in the existing Hanford Site central landfill or other approved disposal site. Any waste disposed of offsite would be taken to an appropriately permitted facility.

If contaminated soil is encountered (e.g., wind may blow contaminated soil into the non-radioactive zone), this contaminated soil would be properly characterized for disposal in accordance with all applicable federal and state regulations, and DOE Orders and guidelines. The volume of contaminated soil that may be encountered is not known, but potential waste volume for disposal is expected to be minimal because the construction area is expected to be free of contaminated soil. Any soil contamination designated as LLW would be disposed of at the Hanford Site's LLW burial grounds. Mixed waste would be stored onsite in a RCRA- permitted storage facility until shipment to an approved RCRA permitted TSD facility.

5.1.4 Land Impacts

The total land area involved in this proposed action is about 18.6 hectares (46 acres) in comparison to the approximate 777 hectares (1,920 acres) that make up the 200 West Area and represents about 1.5 percent of the land in the 200 West Area. Site clearing to remove sagebrush and other vegetation and grading of the sites would be required during construction of proposed buildings, access roads, and drainfields.

5.1.5 Noise Impacts

Equipment used during construction would temporarily increase ambient noise levels. Any noise level increase would not be expected to have any detrimental impact to neighboring office workers. Construction workers would wear appropriate hearing protection during operation of the construction equipment.

5.1.6 Radiological Impacts

Any work in radiation controlled areas would be performed in compliance with ALARA principles, applicable state and federal regulations, and DOE Orders and guidelines. The potential radiation received by workers during the performance of the action would be administratively controlled below DOE limits established in 10 CFR Part 835, *Occupational Radiation Protection* and the HSRCM (DOE 1994). Those limits require that individual radiation exposure be controlled below an annual EDE of a maximum of 5 rem per year. However, contractor administrative controls further impose an administrative control level on an individual's radiation exposure to 500 mrem per year. These controls assure that, under normal conditions, workers would not be exposed to radiation levels approaching the DOE limit.

5.1.6.1 Construction of Retrieval Facilities

Radioactive soil is not anticipated to be encountered during construction because there is about four feet of clean soil overburden covering the waste drums and the surface area is designated as a non-radioactive zone. Because the construction activities would occur in a non-radioactive area, no radioactive airborne emissions are expected.

Although contact with contaminated soil is not expected, it could be encountered during construction activities. If so, a radiation control zone would be established around the contaminated area. Workers, wearing proper protective equipment, would enter the zoned area and cleanup the contaminated area. The contaminated soil would be properly characterized and either stored or disposed of on the Hanford Site.

5.1.6.2 Construction of Storage Facilities

The radiological conditions and work practices associated with the construction of the Storage Facility are similar to that described for construction of the Retrieval facilities in Section 5.1.6.1 with the exception that known waste containers are not located beneath the construction area. Construction activities would occur in a non-radioactive surface area with no access restrictions. This would not pose any unusual health risks to the construction workers.

Although contact with contaminated soil is not expected, it could be encountered during construction activities. If so, a radiation control zone would be established around the contaminated area. Workers, wearing proper protective equipment, would enter the zoned area and clean up the contaminated area. The contaminated soil would be properly characterized and either stored or disposed of on the Hanford Site.

5.1.7 Consumption of Nonrenewable Resources

Construction materials, such as concrete, steel, and petroleum, represent a relatively small long-term commitment of nonrenewable resources. A total of approximately 17,600 cubic meters (23,000 cubic yards) of concrete and 299,000 kilograms (330 tons) of steel would be used in construction of the Retrieval and Storage Facility actions, and approximately 250,000 liters (66,000 gallons) of petroleum products would be consumed.

5.1.8 Effect on Sensitive Areas

The proposed Retrieval activities and the Storage Facility activities would be located in the 200 West Area of the Hanford Site. A CRR specific to the site of the proposed action has been completed by PNL. During the cultural review, the historic White Bluffs Road was identified as being within the proposed complex. No other archaeological sites or isolates were recorded during the survey (Appendix B).

The historic White Bluffs Road is eligible for listing on the National Register of Historic Places. However, the State Historic Preservation Officer has determined that the segment of the road located within the 200 West Area is a non-contributing section and is not considered to be a historic property. No other sensitive areas, such as wetlands, floodplains, archaeological, sole source aquifers, or structures of historical significance, are known to be located in the vicinity of the proposed action. In the event that any cultural materials may be encountered during work activities, work would halt until a PNL archaeologist could assess the significance of the find.

The proposed action would be located on the 200 Area Plateau. Land disturbance would be limited to the 200 West Area. It would not be located in the 100- or 500-year floodplain of the Columbia River or Cold Creek. There is no evidence of the existence of any wetlands in the area.

A Biological Review of the area (Appendix A) indicated that the loggerhead shrike (federal candidate level 2 and state candidate) and the sage sparrow (state candidate) were observed in the area. Although the northern sagebrush lizard was not observed in the area of the proposed action, the loss of sagebrush could impact this species that relies on the shrub-steppe habitat. No other species listed (or candidate for listing) as threatened or endangered would be impacted by the proposed action. Project construction schedules would be adjusted to minimize impact on these species by avoiding site clearing and preparation activities during the nesting season (March through July). No other restrictions were recommended from the biological review. After the nesting period, the shrub-steppe habitat would be destroyed in the area of the proposed buildings, access roads, and parking lots. Of the approximately 18.6 hectares (46 acres) covered by the total proposed project, an estimated 14.6 hectares (36 acres) of state designated priority shrub-steppe habitat would be destroyed by the project construction. The first phase of the proposed action would remove an estimated 11.4 hectares (28 acres) and an additional 3.2 hectares (8 acres) could be removed by a future expansion. Similar shrub-steppe habitat exists elsewhere on the Hanford Site, although the habitat is shrinking in size.

A short-term impact on plant and animal life within or near the proposed action during construction is anticipated, as well as a possible long-term, detrimental impact to the loggerhead shrike and sage sparrow because of the destruction of nesting habitat. In order to minimize impacts of lost shrub-steppe habitat, DOE would mitigate the removal of priority shrub-steppe habitat as discussed below and in Section 2.5.

A Hanford sitewide mitigation program is being developed by RL in cooperation with the Washington Department of Fish and Wildlife, the USFWS, and the indian tribes. The development of the program is in a formative stage, with concepts and procedures for agreements being the initial focus. As part of this effort, a draft sitewide mitigation strategy is being prepared.

The following are key components of the mitigation strategy:

- Avoidance and minimization of impact through siting
- Salvage and transplant

- Restoration of temporarily disturbed habitat
- Compensation for lost habitat.

Each of the components of the sitewide mitigation strategy as they apply to the proposed action is discussed in the following paragraphs.

Measures to avoid and minimize impacts have been applied to the extent feasible. The anticipated loss of mature sagebrush habitat has been reduced substantially by a change in project scope. The original scope of the project included a footprint of approximately 36 hectares (89 Acres), of which 20 hectares (50 acres) of priority habitat would have been destroyed. Since then, the scope of the project has been significantly changed to reduce the habitat loss. The new proposed footprint is only 18.6 ha (46 acres) and only 14.6 ha (36 acres) are priority habitat within the 36 hectare (89 acre) footprint encompassed by the previously surveyed cultural resource and biological reviews (Appendix A and B). Part of the impact to habitat would also be delayed by the phased approach to construction of the Storage Facility. It may be possible to change the siting for the Phase 2 buildings to a previously disturbed area and avoid the potential habitat removal from the second phase construction.

Restoration of temporarily disturbed habitat would not be considered for the proposed action because the habitat that would be disturbed during construction would be effectively removed from the ecosystem during the full life of operations.

DOE would compensate for priority habitat loss in accordance with the Sitewide Mitigation Strategy when it is approved.. If a sitewide mitigation program is not adopted in a timely fashion (by no later than July 1996), the Solid Waste Operations Complex (SWOC) would then develop a stand-alone program for mitigating the loss of mature sagebrush habitat. The concepts would apply the key elements of the draft Sitewide Mitigation Strategy.

The first phase of the proposed action would remove an estimated 11.4 hectares (28 acres) of mature habitat. At the ratio of 3:1, 34 hectares (84 acres) would be remediated as compensation. Under a potential future phase of Project W-112, 3.2 hectares (8 acres) of habitat may be destroyed and 9.6 hectares (24 acres) would be remediated in the appropriate area. Sagebrush plants of appropriate size could be salvaged from the Phase 1 and Phase 2 areas and transplanted. RL is currently evaluating the possibility of siting the Box and Ignitable Storage Buildings in a previously disturbed area directly east of the three Long Term Storage Buildings to reduce the potential habitat loss by 3.2 hectares (8 acres).

5.2 Impacts of Retrieval Operations

5.2.1 Normal Retrieval Operations

Workers would wear protective clothing and the work area would be continuously monitored for radiation levels during normal retrieval operations. The retrieval activities would be performed in compliance with ALARA principles, applicable state and federal

regulations, and DOE Orders and guidelines. The contractor administrative control level for worker exposure is a maximum of 500 mrem per year which is lower than those DOE limits established in 10 CFR Part 835, *Occupational Radiation Protection* and the HSRCM. These controls assure that, under normal conditions, workers would not be exposed to radiation levels approaching the DOE limit of 5 rem per year (HSRCM 1994). When x-raying waste drums, the drums are moved into a fully shielded vault area. During x-ray operation, workers are protected by this shielding. In addition, designed safety features would prohibit x-ray operation until the vault area is clear of workers.

Implementation of work practices for the directly involved worker would mitigate potential health impacts. Radiation work permits that specify the radiological condition and any radiological zone entry requirements would be required. Workers are required to have appropriate training, wear appropriate personal protective equipment, adhere to ALARA principles, and follow established administrative controls.

Workers would be exposed to a direct radiation source during the retrieval activities. Preliminary design includes measures to provide shielding to workers and minimize exposure. Based on early dose uptake calculations, it is estimated that the average annual dose to a retrieval worker is about 0.3 rem. Over an estimated three year retrieval activity, a projected group of 14 retrieval workers would receive a dose consequence of 12.6 person-rem. Potential radiological risks to workers would be minimized by job safety planning and adherence to established ALARA principles and industrial health and safety procedures. Applying the International Commission on Radiological Protection (ICRP) nominal cancer fatality coefficient for low dose, low dose-rate whole body irradiation of approximately 4×10^{-4} latent cancer fatality (LCF) per person-rem EDE (See Section 5.2.2), the health effect to this directly involved worker group is 0.005 LCF.

A leaking waste container could be found during retrieval operations. Because of the protective covering and the relative dry climate (about 15 to 18 centimeters (6 to 7 inches) annual precipitation), no leaching of soil contaminants to groundwater would be expected to have occurred. The contamination is expected to be localized. The contaminated area would be cleaned up with no adverse impact expected to underlying groundwater about 70 meters (230 feet) below the surface (Kasza et al. 1991).

Under normal retrieval operations, potential exposure to chemical hazards is low. After the soil overburden is removed off the drum module the area is pre-monitored for detectable indication of potential chemical exposure to workers. If the monitoring indicates a chemical hazard presence, workers would wear appropriate protective clothing for the particular chemical hazard.

Equipment used during retrieval operations would temporarily increase ambient noise levels.

5.2.2 Postulated Accident - Abnormal Retrieval Operations

A Preliminary Safety Evaluation (PSE) evaluated postulated radiological accidents during the proposed Retrieval operations, and calculated the radiological EDE in person-rem (WHC 1991b). The postulated accident that generated the largest dose consequence was a drum explosion before installing vents on the container. The explosion is postulated to occur as a result of hydrogen buildup, in unvented containers, that eventually reaches an explosive concentration with oxygen. The explosion ignites the waste material, and contaminated material is released by fire. The amount of TRU waste in the exploded drum is assumed to be the highest TRU-loaded drum in the trench area nearest the Plutonium Finishing Plant (PFP). An estimated 0.0414 plutonium equivalent curie is released. As noted in the PSE, this postulated accident has an annual probability occurrence of 2.3×10^{-6} (about two times every one million years) and is considered an extremely unlikely event, but is developed here to quantify impacts.

Radiological dose consequences to onsite and offsite populations were calculated for this postulated accident using the Hanford Site standard dosimetry GENII computer code (Napier et al. 1988). This code analyzes environmental releases resulting from acute or chronic releases to the air, water, or soil. Sixteen compass sectors are analyzed. The code utilizes Hanford Site-specific meteorological data, and models atmospheric dispersion between the release point and the receptor as a straight-line Gaussian plume with no terrain effects. The GENII atmospheric dispersion model becomes increasingly inaccurate at close distances, and is therefore not used at distances less than 100 meters (328 feet) from the release point.

The ICRP has determined that the nominal cancer fatality coefficient for low dose, low dose-rate whole body irradiation is approximately 4×10^{-4} LCF per person-rem EDE for a worker population, and approximately 5×10^{-4} LCF per person-rem EDE for a population of all ages (ICRP 1991). Health effects in terms of LCFs are calculated by multiplying the calculated radiological dose by the ICRP coefficient (WHC 1993c).

Under a postulated accident condition, the onsite and offsite health effects in terms of projected LCFs are calculated for the directly involved worker, the onsite maximum exposed individual (MEI), the offsite MEI, and the maximum exposed onsite and offsite populations. The MEI is defined as a hypothetical individual receiving the highest dose from the release and represents the upperbounding dose consequence.

Population data from the 1990 census is used in defining the total population surrounding the radiological release point. The total offsite population is considered to be the general public, and is assumed to extend from the Hanford Site boundary to a circle having an 80-kilometer (50-mile) radius from the release point. This population totals 375,860.

Health effects from a postulated accident are based upon calculated GENII dose consequences without the trench enclosure structure. The purpose of the enclosure structure is purely for weather protection. However, the all weather enclosure could serve to mitigate dose consequences to workers and the general public in the unlikely event of a postulated accident.

The calculated dose consequences are based on a 50-year time duration after exposure and a 95-percent meteorology factor whereby a condition of atmospheric dispersion is exceeded 95-percent of the year in a given sector. This represents a very conservative approach to projecting health effects (WHC 1993c). When combined with the annual accident probability of 2.3×10^{-6}, the risk to the onsite and offsite MEI, to the directly involved workers, and to the onsite and offsite populations of becoming a LCF is substantially reduced. As noted earlier, the postulated exploding drum accident has an annual probability occurrence of 2.3×10^{-6}, and is considered to be an extremely unlikely event. Table 2 represents a summary of the calculated dose consequences and associated health effect in terms of LCFs:

Onsite Health Effects

The onsite MEI is a hypothetical individual receiving the highest dose from the postulated accident. This MEI is located 100 meters (328 feet) from the release point and represents the upperbounding dose consequence which is greater than any dose consequence to any other individual in the onsite population. The calculated dose consequence is 18 rem and, applying the ICRP coefficient, a projected 0.0072 LCFs would occur. Because this is less than one fatality, no LCF would be expected. The 0.0072 LCF means that the onsite MEI has a chance of about 1 in 140 of becoming a LCF.

The population health effects caused by a radioactive release depend on the population distribution around the release point, as well as site-specific meteorology. For the postulated trench accident, the maximum dose to the onsite population was to those located east of Trench 4C-T04, towards the PFP.

The onsite population is assumed to extend from a minimum of 100 meters (328 feet) from the release point to the Hanford Site boundary, and consists of DOE employees, DOE contractor employees, other contractor personnel, and supervised visitors on the Hanford Site. This population group is not directly involved in the proposed drum removal activity, but would receive the largest dose consequence of 14,900 person-rem in the event of a postulated accident. Applying the ICRP coefficient of 4×10^{-4} LCF/person-rem, the health effect to this onsite population group is calculated to be 6.0 LCF. The 6.0 LCF means that an average member of the exposed onsite population of 3,488 has a chance of about 1 in 580 of becoming a LCF should the postulated accident occur.

The analysis of onsite population dose consequences considers an unmitigated release and exposure, and does not take credit for the *Hanford Emergency Response Plan* (DOE-RL 1994) prepared and implemented in accordance with DOE Order 5500.3A, and *Planning and Preparedness for Operational Emergencies* (DOE 1992), which would minimize the risk of exposure. Emergency signals would warn the onsite population if the postulated accident occurred. An emergency communication network exists on the Hanford Site to inform the onsite population of emergency actions to be taken. Training for emergency situations on the Hanford Site is routine in nature and would reduce potential onsite population dose consequences and projected LCFs.

For directly involved workers within 100 meters (328 feet) of the release point, the GENII computer code used to evaluate atmospheric dispersion and dilution of the release is unreliable. This, combined with the fact that radiological dose consequences to these workers are primarily dependent on where workers are located at the time of release (e.g., upwind or downwind), prohibits the making of an accurate quantification of the dose consequences. However, a rough estimate of dose consequences can be made using International Atomic Energy Agency (IAEA) guidance (IAEA 1990), which indicates that all other things being equal, reducing the distance between the worker and the release point by an order of magnitude results in a factor of 30 increase in worker dose. In this case, the GENII computer code calculated the MEI 100 meters (328 feet) from the release point would receive a dose of 18 rem EDE. Using the IAEA guidance, a directly involved worker 10 meters (33 feet) away from the release point would receive a dose of roughly 540 rem EDE (IAEA 1990).

In the event of a postulated accident, this EA assumes that five directly involved workers are 10 meters (33 feet) from the exploding drum and would receive a total of 2,700 person-rem. Each worker is assumed to be equally exposed and would receive an acute whole body dose of 540 rem EDE. This level of exposure could be a potentially lethal radiation dose to a worker. The worker would experience nausea and vomiting within two to four hours and lasting for less than 24 hours. The worker's blood system would be damaged because of the radiation and up to 90 percent of the workers would require hospitalization for treatment (blood transfusion, antibiotics, and rest) for a period of 60 to 90 days. The incidence of death would range from zero to eighty percent and would occur within three weeks to two months (Shleien, B., et al, 1984). Assuming the worker receives medical treatment and survives the acute dose, damage to other body organs (i.e., eyes, bone marrow, lungs, thyroid) may have occurred that could effect the workers health later in life.

Retrieval workers would be wearing proper personnel protective equipment when working in a radiation area and work practices would adhere to ALARA principles. Additional engineered controls would be in place to provide protective shielding to minimize worker exposure. Because of the shielding design, the acute whole body dose of 540 rem EDE would be considerably reduced. As stated in Section 5.2.2, the annual probability of a retrieval accident is about two times every one million years and is an extremely unlikely event. The likelihood of a worker receiving a dose consequence of 540 rem EDE is very remote.

This EA does not analyze the potential impact to the five directly involved worker 10 meters (33 feet) of an exploding drum. Depending upon where the worker is standing and what protection may exist between the worker and the drum, potential fatalities could occur. In addition, any other individuals within 100 meters (328 feet) of the exploding drum could be fatally injured. Any other individuals who may happen to be within this 100 meters but not directly involved in the drum retrieval could, likewise, be a fatally injured depending on location.

Offsite Health Effects

The offsite MEI is a hypothetical individual receiving the highest dose from the postulated accident. The calculated dose is 0.077 rem and represents the upperbounding dose consequence. This dose consequence is greater than any dose consequence to any other individual in the offsite population. Applying the ICRP coefficient of 5×10^{-4} LCF/person-rem, a projected 0.0000385 LCFs would occur. Because the calculated LCF is much less than 1, no LCF would be expected. The offsite MEI, located in the west-northwest sector of Trench 4C-T04, would have a chance of about 1 in 26,000 of becoming a LCF.

The greatest exposure to the offsite population, should the accident occur, is received by a population of 102,538. This population group would receive 152 person-rem. Applying the ICRP coefficient of 5×10^{-4} LCF/person-rem, the health effect to this offsite population group is calculated to be 0.076 LCF. The calculated LCF is less than one and, therefore, a LCF would not be expected. The 0.076 LCF means that an average member of the exposed offsite population of 102,538 has a chance of about 1 in 1.3 million becoming a LCF should the postulated accident occur. When the annual accident probability of 2.3×10^{-6} is considered, risk to the offsite population and MEI of becoming a LCF is reduced substantially. No adverse health effects are expected.

The potential offsite radiation dose consequence over a 50-year time period is related to the extent of external exposure to or the intake of radionuclides released from a postulated accident. For both the offsite MEI and offsite population receptors, the primary pathway of radionuclides taken into the body is by inhalation resulting from an exposure in a radioactive plume.

Table 2 - Summary of Normal and Abnormal LCFs - Retrieval Actions

RECEPTOR (w/population size)	DOSE CONSEQUENCE	LCFs
Normal retrieval actions (14)	12.6 person-rem CDE	0.005
MEI - Onsite (1)	18 rem EDE	0.0072
MEI - Offsite (1)	0.077 rem EDE	0.0000385
Exposed Onsite Population (3,488)	14,900 person-rem CDE	6.0
Exposed Offsite Population (102,538)	152 person-rem CDE	0.076

5.3 Impacts of Storage Facility Operations

5.3.1 Normal Storage Operations

No liquid effluents, other than the sanitary waste from the planned septic and drainfield systems, would be discharged from the proposed facilities. The sanitary effluents would be nonhazardous and nonradioactive, and would not be a RCRA regulated waste. The sanitary sewer systems would be designed and constructed to operate in conformance with current state and local county regulations, and liquid discharges would occur routinely during operations. The sanitary sewer system would be reviewed and approved by the DOH.

If the planned sanitary sewer system were utilized to full capacity of 43,000 cubic meters (approximately 11 million gallons) per year, there could be a 1.5 percent increase in the total nonradioactive effluent of all Hanford Site operations being discharged to the soil column. Little, if any, mounding at the watertable would result. Any impact to local groundwater flow direction, or potential contaminant plume is predicted to be minimal (Tyler 1993).

Workers are required to have appropriate training, wear appropriate personal protective equipment, adhere to ALARA principles, and follow established administrative controls. No adverse noise impact is expected during normal storage operations.

For this EA, approximately 12 directly involved workers would be engaged in Storage Facility activities. This would include a mixture of plant craft disciplines (i.e., equipment operators, electricians, laborers, radiation monitoring, etc) and supervisory personnel. These 12 workers would be exposed to a direct radiation source. Preliminary engineering design features include provisions for shielding to minimize worker exposure. Based on early dose uptake calculations, it is estimated that the average annual dose to a storage worker is about 0.3 rem. Over a three year storage activity, the projected worker group of 12 storage workers would receive a dose consequence of 11.0 person-rem. Applying the ICRP nominal cancer fatality coefficient of approximately 4×10^{-4} LCF per person-rem EDE (See Section 5.2.2), the health effect to this directly involved worker group is 0.004 LCF.

5.3.2 Abnormal Operations - Postulated Accident

A separate PSE evaluated postulated radiological accidents during the Storage Facility operations and calculated the collective radiological EDE in person-rem (WHC 1991c). Unlike the postulated accident of the Retrieval operations, the postulated accident for the Storage Facility that would generate the largest dose consequence is an earthquake followed by a fire. Under this accident scenario, a radioactive airborne release could occur from the Storage Facility to the environment because of breached waste containers. This would release an estimated 0.172 plutonium equivalent curies and 15.9 curies of mixed fission products.

The annual probability of the postulated accident for the Storage Facility was determined to be 1 x 10^{-3} (once every one thousand years). In the event of an earthquake, the waste drums are assumed to fall, rupture, and ignite. The following fire is assumed to consume the combustible waste and an airborne release occurs. Using the Hanford Site standard dosimetry GENII computer code (Napier et al. 1988), radiological dose consequences to onsite and offsite populations were calculated for the postulated earthquake and fire accident at the Storage Facility (WHC 1993d). The GENII atmospheric dispersion model becomes increasingly inaccurate at close distances, and is therefore not used at distances less than 100 meters (328 feet) from the release point.

As noted in Section 5.2.2, health effects in terms of LCFs are calculated by multiplying the calculated radiological dose by the ICRP coefficient (ICRP 1991).

Onsite Health Effects

The onsite MEI is a hypothetical individual located 100 meters (328 feet) from the release point and receives the highest dose from the postulated accident. This dose to the MEI represents the upperbounding dose consequence and is greater than any dose received by any other individual in the onsite population. The calculated dose consequence is 2.13 rem and, applying the ICRP coefficient of 4 x 10^{-4}, a projected 0.00085 LCFs would occur. Because this is less than one fatality, no LCF would be expected. The 0.00085 LCF means that the onsite MEI has a chance of about 1 in 1,200 of becoming a LCF.

The GENII computer code model determined that the maximum dose to the onsite population would occur southeast of the Storage Facility, towards the PFP. This sector has an estimated population of 3,861 and would receive a dose consequence of 1,520 person-rem. The calculated health effect using the ICRP coefficient of 4 x 10^{-4} is 0.6 LCF. Because this calculated health effect is less than one, it is unlikely there would be a fatality in the onsite population group. The 0.6 LCF means that an average member in the exposed onsite population of 3,861 has a chance of about 1 in 6,430 of becoming a LCF should the postulated accident occur.

As described earlier, directly involved workers within 100 meters (328 feet) of the release point, the GENII computer code used to evaluate atmospheric dispersion and dilution of the release becomes increasingly inaccurate. Similar to that approach discussed in Section 5.2.3.1 for estimating a dose consequence to the directly involved worker, a rough estimate of dose consequences can be made using IAEA guidance. For the postulated Storage Facility accident, the GENII computer code calculated the MEI 100 meters (328 feet) from the release point would receive a dose of 2.13 rem EDE. Using the IAEA guidance, a directly involved worker 10 meters (33 feet) away from the release point would receive a dose of 64 rem EDE (IAEA 1990). In the event of a postulated accident, four workers are assumed to be 10 meters (33 feet) from the ruptured waste container would receive a total of 256 person-rem. Applying the ICRP coefficient for workers of 4 x 10^{-4} LCF/person-rem, the projected LCF is 0.102 or a chance of about 1 in 40 of becoming a LCF.

The analysis for dose consequences for the onsite population and MEI considers an unmitigated release and exposure to radiation. The Hanford Site's emergency preparedness plan, prepared and implemented in accordance with DOE Order 5500.3A (DOE 1992), would reduce any impact because of emergency sirens and evacuation procedures. The onsite population receives routine training in responding to emergency actions. Dose consequences and projected LCFs are expected to be less than calculated because of the mitigation measures. In addition when consideration is given for the annual accident probability of 1×10^{-3}, risk to the onsite population and MEI of becoming a LCF is substantially reduced.

Offsite Health Effects

The offsite MEI is a hypothetical individual located at the Hanford Site boundary and receives the highest dose from the postulated accident. This MEI represents the upperbounding dose consequence which is greater than any other individual would receive in the offsite population group. The calculated dose consequence is 0.26 rem and, applying the ICRP coefficient of 5×10^{-4}, a projected 0.00013 LCFs would occur. Because this is much less than one fatality, no LCF would be expected. The 0.00013 LCF means that the offsite MEI has a chance of about 1 in 7,700 of becoming a LCF.

In the event of the postulated accident, the largest offsite dose would occur to the population of 102,538 located in the sector west of the Storage Facility. Refer to Section 5.2.2.1 for discussion of offsite population and method of analysis. This exposed population would receive a dose consequence of 654 person-rem. Applying the ICRP coefficient of 5×10^{-4} LCF/person-rem, the health effect to this offsite population group is calculated to be 0.33 LCF. The calculated LCF is less than one and a LCF would not be expected. The 0.33 LCF means that an average member of the exposed offsite population of 102,538 has a chance of about 1 in 311,000 of becoming a LCF should the postulated accident occur. When the annual accident probability of 1×10^{-3} is considered, risk to the offsite population and MEI of becoming a LCF is reduced substantially. No adverse health effects are expected.

The potential offsite radiation dose consequence over a 50-year time period is related to the extent of external exposure to or the intake of radionuclides released from a postulated accident. For both the offsite MEI and offsite population receptors, the primary pathway of radionuclides taken into the body is by inhalation resulting from an exposure in a radioactive plume.

Table 3 - Summary of Normal and Abnormal LCFs - Storage Operations

RECEPTOR (w/population size)	DOSE CONSEQUENCE	LCFs
Normal storage operations (12)	11 person-rem CDE	0.004
MEI - Onsite (1)	2.13 rem EDE	0.00085
MEI - Offsite (1)	0.26 rem EDE	0.00013
Exposed Onsite Population (3,861)	1,520 person-rem CDE	0.6
Exposed Offsite Population (102,538)	654 person-rem CDE	0.33

5.4 Nonradioactive Hazardous Waste Impacts

Some of the hazardous wastes identified from storage records are asbestos; metals (beryllium, barium, cadmium, copper, lead, mercury, sodium, lithium, and zirconium); sodium hydroxide, nitric acid, and other corrosives; and organics (antifreeze, stripcoat, trichlorethylene and other solvents, polychlorinated biphenyl, tributyl phosphate, carbon tetrachloride, hydraulic fluid, and oils) (WHC 1991b, WHC 1991c).

5.4.1 Hazardous Waste - Construction and Normal Retrieval/Storage Conditions

During Retrieval and Storage Facility construction activities, small amounts of hazardous waste (e.g., cleaning agents, petroleum products), are expected to be generated. These generated wastes would be disposed of in accordance with applicable federal and state regulations.

Under normal retrieval and storage conditions, workers would not be exposed to hazardous waste components in a waste container. However, in the event a waste container is encountered that exhibits leakage, a small temporary greenhouse would be constructed around the contaminated area within the portable weather enclosure building. Trained workers equipped with proper protective clothing would initiate cleanup of the contaminated area. After waste cleanup, the containers would be moved to approved storage facilities on the Hanford Site.

5.4.2 Hazardous Waste - Abnormal Retrieval/Storage Conditions

The waste containers to be retrieved from Trench 4C-T04 would be stored in the Storage Facility in accordance with RCRA and WAC 173-303 regulations. In the event of a postulated retrieval or storage accident of a container release followed by a fire, a hazardous chemical airborne release could occur. An analysis of hazardous chemical exposures to onsite and offsite receptors was evaluated in the PSEs (WHC 1991b, WHC 1991c). Average exposures were calculated for onsite and offsite populations, divided by the threshold limit value (TLV) and presented as a ratio of concentration to the TLV. The TLV is the time-weighted average concentration to which the receptors may be repeatedly exposed without adverse effects. The calculated toxic consequences from a postulated accident followed by fire are noted below in Table 4.

Table 4 - Toxic Consequences from a Postulated Retrieval Accident

Toxic material	Onsite Average Exposure (mg/cubic meter)	Offsite Average Exposure (mg/cubic meter)	TLV (mg/cubic meter)	Ratio of Concentration to TLV	
				Onsite	Offsite
Mercury	0.0000344	0.0000000198	0.05	0.000688	0.000000396
Cadmium	0.0000344	0.0000000198	0.01	0.00344	0.00000198
Barium	0.0000344	0.0000000198	0.5	0.0000688	0.00000004
PCB	0.0205	0.0000118	0.5	0.041	0.0000236
Ca_2ClPO_4 [1]	0.00327	0.00000188	2.0	0.00164	0.00000094

[1] Limits are based on CaO, a combustion product in air for Ca_2ClPO_4 (Phosgene). The decomposition product of carbon tetrachloride is recognized as a toxic substance because when the carbon tetrachloride is heated to decomposition; it emits toxic fumes of phosgene gas.

The TLV for phosgene given off from heating carbon tetrachloride (Ccl_4), is similar to that of CaO.

The ratio of concentration to the TLV for onsite and offsite indicates that the exposure to toxic materials for these population groups is well below the TLV (Sax and Lewis 1989). No adverse health effect would be anticipated from exposure to hazardous chemicals as a result of the proposed action.

5.5 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. Minority (especially Hispanic) populations and low income populations are present near the Hanford Site (PNL 1994). DOE is in the process of developing official guidance on the implementation of the Executive Order. The analysis in this EA (Sections 5.0) indicates that there would be minimal impacts to both the offsite population and potential workforce by implementing the proposed action, under both routine and accident conditions. Because the entire proposed action would occur on the Hanford Site and the offsite environmental impacts from the proposed action analyzed in this EA are expected to be minimal, it is not expected that there would be any disproportionate impacts to any minority or low-income portion of the community.

5.6 Socioeconomic Impacts

The DOE and its contractors dominate the local employment picture with almost one-quarter of the total nonagricultural jobs in Benton and Franklin counties. Ninety-three percent of Hanford employees reside in the Benton and Franklin county areas. Therefore, work activities on the Hanford Site plays an important role in the socioeconomics of the Tri-Cities (Richland, Pasco, and Kennewick) and other parts of Benton and Franklin counties (DOE 1995). Other surrounding counties would be impacted to a lesser degree.

Construction of the proposed Retrieval and Storage Facility would create a temporary increase of approximately 100 construction workers from local labor halls. Initially, about 100 (of the planned 400) administrative and operations personnel would be located in the SWOC as a result of the proposed action. Primarily, these personnel would be relocated from various offices around the Hanford Site. No substantial change is expected in the number of Hanford Site employees as a result of the proposed action. There would be no discernible impact to employment levels within Benton and Franklin counties.

5.7 Cumulative Impacts

Existing and planned projects nearby the location of the proposed action area were reviewed to determine cumulative impacts that could result from initiating the proposed retrieval action, waste storage activities, the infrastructure upgrades, and the CWSC. Existing areas near the site of the proposed action that contribute to the cumulative impact include the following:

- Waste Receiving And Processing (WRAP) Facility - WRAP 1; presently under construction

- Central Waste Complex; an existing RCRA permitted storage area
- Low-level Burial Grounds; management of Hanford's solid waste
- Tank Farm activities; management of Hanford's waste storage tanks
- T-Plant; existing facility for decontamination services
- U-Plant and the Reduction Oxidation (REDOX) Plant; retired processing facilities
- 222-S Analytical Lab; existing laboratory services
- Plutonium Finishing Plant; in process of residual plutonium cleanup
- Environmental Restoration and Disposal Facility; permitted Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) waste disposal facility under construction
- Environmental Restoration activities; management of inactive facilities, burial sites, cribs, etc.

5.7.1 Cumulative Impacts - Air (Radioactive)

The offsite population received about 0.3 person-rem via air and water pathways from 200 Area operations in 1993 whereas Hanford Site workers involved in the proposed action would perform similar tasks around other waste management activities. The calculated radiation exposure to these workers under normal conditions is very small. The average annual dose rate for 1993 in the 200 Areas was 130 mrem per year (PNL 1994) and well below the natural background radiation of about 300 mrem per year. The proposed action is not expected to alter calculated radiological air doses.

5.7.2 Cumulative Impacts - Water

The proposed action would not discharge any radioactive liquid effluent to the ground and, therefore, not incrementally add to Hanford Site radioactive liquid effluent discharges to the ground.

Nonradioactive liquid effluents would be discharged to the ground because of the planned septic sewer systems in the 200 Areas of the Hanford Site. In the 200 Areas, a total of 2,180,000 cubic meters (576 million gallons) of nonradioactive effluents were discharged to the ground in CY 1991 (PNL 1992). Assuming the sewer system operates at full design capacity, during a seven-day work week, the proposed action would add approximately 43,000 cubic meters (11 million gallons) in one year to nonradioactive liquid effluents producing a total annual discharge for the Hanford Site of about 2,223,000 cubic meters (588 million gallons) to the ground. Due to the lateral spreading and relatively small discharge

rates, there may be little discernable mounding, if any at the water table. The hydraulic impact to local groundwater flow direction is likely minimal and movement of any underground contaminated plumes is not expected. Although the discharge from this proposed action would incrementally add to the amount of nonradioactive effluents being discharged on the Hanford Site, the proposed septic system would not be expected to impact the groundwater (Tyler 1993).

5.7.3 Cumulative Impacts - Land

The proposed Retrieval actions and Storage Facility actions would occur on the 200 West Area of the Hanford Site. Approximately 18.6 hectares (46 acres) of the total 777 hectares (1,920 acres) in the 200 West Area would be impacted. This is about 1.5 percent of the land area in the 200 West Area. The retrieval activities would occur on previously disturbed areas, while the proposed Storage Facility would be constructed on relatively undeveloped land. The proposed action is compatible with the planned 200 West Area land uses.

Because the proposed Storage Facility would occur on undisturbed land, there would be an incremental loss of shrub-steppe habitat for the loggerhead shrike, sage sparrow and northern sagebrush lizard. An estimated 14.6 hectares (36 acres) of priority shrub-steppe habitat would be lost. Other projects completed, under way, or planned for the future on the Hanford Site involve loss of priority habitat (Including the Environmental Restoration Disposal Facility, 240 Access Road, Cross Site Transfer, 200 Area Sanitary Sewer System). Cumulative loss of priority habitat on the Hanford Site could exceed 405 hectares (1,000 acres). An overall Hanford Site Strategy for mitigation for lost priority habitat is currently being developed. Specific mitigation for habitat loss from this proposed action is discussed in Sections 2.5 and 5.1.8.

5.7.4 Cumulative Impacts - Socioeconomics.

Uncertainties exist with regard to Hanford Site budgets. The current trend is for work force reduction whereby DOE is projecting about 4,800 jobs will be eliminated by the end of fiscal year 1995. Additional budget reductions could occur in fiscal years 1997 and 1998 that would necessitate further workforce reductions. As stated in Section 5.6, employment on the Hanford Site plays an important socioeconomic role in the region since 93 percent of Hanford employees reside in the Benton and Franklin county areas. Therefore, the current downward trend in Hanford's workforce would be expected to have an impact on the local community.

Although the retrieval and storage activities would contribute slightly to the Hanford Site employment growth, the increase of about 100 in construction workers would be temporary and the assigned administrative and operations personnel would be re-located from other onsite offices. No cumulative impact would be expected to the local economy from undertaking the proposed action.