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APPENDIX D Naval Spent Nuclear Fuel Management Part A

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Programmatic Spent Nuclear
Fuel Management
and
Idaho National Engineering Laboratory
Environmental Restoration and
Waste Management Programs
Environmental Impact Statement
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Appendix D
Naval Spent Nuclear Fuel Management
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Appendix D
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Department of Energy
Programmatic Spent Nuclear Fuel Management
and
Idaho National Engineering Laboratory
Environmental Restoration and
Waste Management Programs
Environmental Impact Statement
Naval Spent Nuclear Fuel Management

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SUMMARY

INTRODUCTION

Volume 1 to the Department of Energy's Programmatic Spent Nuclear Fuel Managem Idaho National Engineering Laboratory Environmental Management Programs Environment Statement evaluates a range of alternatives for managing naval spent nuclear fuel e removed from U.S. Navy nuclear-powered vessels and prototype reactors through the y Environmental Impact Statement (EIS) considers a range of alternatives for examinin naval spent nuclear fuel, including alternatives that terminate examination and inv the refueling or defueling site. The EIS covers the potential environmental impact alternative, as well as cost impacts and impacts to the Naval Nuclear Propulsion Pr

This Appendix covers aspects of the alternatives that involve managing naval s fuel at four naval shipyards and the Naval Nuclear Propulsion Program Kesselring Si Milton, New York. This Appendix also covers the impacts of alternatives that invol naval spent nuclear fuel at the Expended Core Facility in Idaho and the potential i constructing and operating an inspection facility at any of the Department of Energ considered in the EIS. This Appendix also considers the impacts of the alternative spent nuclear fuel examinations at Puget Sound Naval Shipyard. This Appendix does impacts associated with storing naval spent nuclear fuel after it has been inspecte DOE facilities. These impacts are addressed in separate appendices for each DOE si

BACKGROUND

The Naval Nuclear Propulsion Program is a joint U.S. Navy and DOE program resp for all matters pertaining to naval nuclear propulsion. The Program is responsible propulsion plants aboard over 120 nuclear-powered warships powered by over 140 nava for nuclear propulsion work performed at six naval shipyards and two private shipya spent nuclear fuel from ships is ending at two of those shipyards as a result of re base closures, and nuclear propulsion work at one of the private shipyards has not spent nuclear fuel for more than 15 years. The Program is also responsible for two owned, contractor-operated laboratories, two moored training ships, three land-base reactors, and the Expended Core Facility located at the Naval Reactors Facility. T Facility is located at the Idaho National Engineering Laboratory (INEL).

NAVAL SPENT NUCLEAR FUEL MANAGEMENT

Naval spent nuclear fuel is the fuel removed from naval nuclear propulsion pla is designed to meet the demanding requirements needed to support long-term operatio

To meet these requirements, it is designed to withstand battle shock and to retain as to minimize radiation dose to the ships' operating personnel who must live and w proximity to the reactor. Even after decades of service, the spent nuclear fuel re high integrity.

For nearly 40 years, naval spent nuclear fuel has been shipped by rail in shie containers from naval shipyards and prototypes to the Expended Core Facility in Ida removed from the shipping containers and placed into water pools at the Expended Co fuel is examined for specific characteristics and for abnormalities. Selected fuel detailed examination. Naval fuel examinations provide assurance that operations of can continue without restriction. These examinations have significantly contribute lives and continued safe performance of current naval reactor designs. This work h substantial reduction in the amount of spent nuclear fuel generated by the Naval Nu Program.

DESCRIPTION OF ALTERNATIVES

The EIS considers five general alternatives for spent nuclear fuel management. alternatives are described in Chapter 3 of Volume 1. Naval spent nuclear fuel woul under each of these general alternatives as follows.

No Action

Naval reactors would be refueled and defueled as planned. Naval spent nuclear stored in transport casks at the Navy or DOE facility where defueling was conducted generated from ships at Newport News Shipbuilding would be transferred to Norfolk N Shipyard.) No further spent nuclear fuel examination would be conducted. This alt require a phase-in period while additional containers are procured for spent nuclea During an approximately 3-year period, spent nuclear fuel would be transported in s containers to the Expended Core Facility in Idaho. The containers would be unloade support additional refuelings and defuelings.

Decentralization

For naval spent nuclear fuel, three options are considered. Each option would phase-in period while facilities are developed. The length of the phase-in period option and mode of storage selected. During the phase-in period, spent nuclear fue transported in shipping containers to the Expended Core Facility in Idaho. The con unloaded and used to support additional refuelings and defuelings.

a. Store naval spent nuclear fuel at the Navy or DOE facility where defueling (Fuel generated from ships at Newport News Shipbuilding would be transferred to Nor Shipyard.) At each storage location, dry storage in shipping containers and dry ca storage in a water pool facility are considered.

b. Modify the existing water pool facility at Puget Sound Naval Shipyard to c maximum practical amount of naval spent nuclear fuel examinations at that site. St nuclear fuel at the Navy or DOE facility where defueling is conducted. (Fuel gener Newport News Shipbuilding would be transferred to Norfolk Naval Shipyard.) At each location, dry storage in shipping containers and dry casks as well as wet storage i facility are considered.

c. Ship naval spent nuclear fuel to the Expended Core Facility for examinatio the fuel after examination to the Navy or DOE facility where defueling is conducted from ships at Newport News Shipbuilding would be transferred to Norfolk Naval Shipy storage location, dry storage in shipping containers and dry casks as well as wet s pool facility are considered.

1992/1993 Planning Basis

The historic practice of transporting all spent nuclear fuel removed from nava Expended Core Facility in Idaho for examination would resume. Following examinatio be transferred to DOE for management at the Idaho Chemical Processing Plant pending disposition.

Regionalization

The overall Regionalization alternative includes two options. The first optio managing spent nuclear fuel at three DOE sites (Hanford Site, the INEL, and the Sav Site) based on fuel type. Under this option, the historical practice of transporti removed from naval reactors to the Expended Core Facility in Idaho for examination Following examination, fuel would be transferred to DOE for management at the Idaho Processing Plant pending final disposition.

The second overall option involves managing spent nuclear fuel at a Western Re and an Eastern Regional Site, based primarily on the originating location of the fu option, naval fuel would be allocated to one site, either the western or the easter examination and storage. This Appendix evaluates the potential impacts of examinin nuclear fuel at all of the potential sites.

Centralization

The Centralization alternative would collect all of the DOE's current and futu fuel at one DOE site. The Hanford Site, the INEL, the Nevada Test Site, the Oak Ri and the Savannah River Site have been considered as candidates for this single site selected, then naval spent nuclear fuel would be examined at the Expended Core Faci be stored at the Idaho Chemical Processing Plant. If a site other than INEL were s Expended Core Facility would be shut down and a new or modified facility for examin additional storage facilities would be constructed at the selected site.

SITES CONSIDERED FOR NAVAL SPENT NUCLEAR FUEL MANAGEMENT

Naval Shipyards and Prototypes - The EIS evaluates four naval shipyards, Puget Shipyard at Bremerton, Washington; Norfolk Naval Shipyard at Portsmouth, Virginia; Naval Shipyard at Kittery, Maine; and Pearl Harbor Naval Shipyard at Pearl Harbor, management of naval spent nuclear fuel only. The EIS also evaluates the Kenneth A. Prototype Site at West Milton, New York. The four shipyard locations are industria located near harbor areas. The Kesselring Site is a 3900-acre facility located in of New York State in a wooded rural environment.

Idaho National Engineering Laboratory - This is the location of the Naval Reac which is also the present location of the Expended Core Facility. It is located in and occupies about 890 square miles of desert. The Idaho National Engineering Labo presently used for industrial and support operations associated with energy researc management activities, grazing, recreational uses, and environmental research. It urban areas and occupies a controlled federal reservation which is largely undistur state.

Savannah River Site - The Savannah River Site in South Carolina is the locatio Department of Energy's weapons production sites. The P, K, and L Reactors at this produced plutonium and tritium in support of the nation's nuclear weapons program. River Site is located in the eastern United States and is in a heavily wooded envir returning to a more natural state from its previous agricultural uses. It is 310 s

Hanford Site - The Hanford Site in the State of Washington is the location of Department of Energy's weapons production sites. The N-Reactor at this site was us through the years for the production of plutonium in support of the nation's nuclea program. The Hanford Site is in the western United States on open, vacant desert l square miles in area which is largely undisturbed from its original state.

Oak Ridge Reservation - The Oak Ridge Reservation in Tennessee is the location the Department of Energy's facilities which was primarily used to support the natio weapons program. The Y-12 Plant at this location was used for processing highly en for fuel elements used in the Savannah River reactors. The Oak Ridge Reservation i eastern United States and is in a heavily wooded environment. It is 55 square mile consists of three industrialized areas separated by undeveloped forest land.

Nevada Test Site - The Nevada Test Site in Nevada has been a location for perf nuclear weapons testing. This site has been used by the DOE for activities in supp nuclear weapons program. The Nevada Test Site is in the western United States and open, vacant desert land. It is 1350 square miles in area.

ANALYSES

This EIS evaluates the potential environmental impact of each alternative, inc construction of new facilities and management operations at those facilities (trans handling, examination, and storage of naval spent nuclear fuel). In general, accid on accidents which have the probability to occur at least once every 10 million yea accidents considered includes those resulting from human errors or mechanical failu crashes into storage facilities and improper spent nuclear fuel handling, as well a such as earthquakes and tornadoes. Both radiological and non-radiological impacts The cumulative impacts of spent nuclear fuel management and other operations at the also been evaluated.

RESULTS AND COMPARISON OF ALTERNATIVES

Implementation of some of the alternatives would require construction or modif facilities for storage of naval spent nuclear fuel at naval sites or a replacement Facility at a DOE site. The locations for any new facilities would be selected fro available on existing federally owned property, so no additional land would be with use at any site. The only exception to this might occur if the Barnwell Nuclear Fu Savannah River were to be purchased and removed from the public domain. New facili would be chosen to avoid impacts on the cultural, archaeological, aesthetic, or sce area and to ensure that the rights or interests of Native American or Native Hawaii not be infringed. No site listed in the National Register of Historic Places would Ecologically sensitive areas, such as those in the vicinity of any threatened or en would be avoided. Construction activities associated with any naval spent nuclear examination facility would comply with all applicable laws and regulations, using e procedures for preserving air and water quality and previously unknown archaeologic artifacts encountered and for minimizing such impacts as noise and disturbance or d habitat.

No new naval spent nuclear fuel storage or examination facility would release radioactive or hazardous material to the environment. In 40 years of receipt, tran handling, and examination of naval spent nuclear fuel, the Naval Nuclear Propulsion never had a release of radioactivity that has had a significant effect on the envir operations that would be performed and the controls that would be in place, the imp ecological, or geological resources of any naval facility considered would be negli Furthermore, experience has shown that since naval spent nuclear fuel management is industrial activity, its contributions to noise and traffic would be inconsequentia would generally be within the capabilities of the candidate sites. The Hanford Sit Site are possible exceptions to this because they are already operating at or near capacities and may require additional capacity to accommodate a new Expended Core F

In the unlikely event of any accident involving naval spent nuclear fuel, it i more than 210 acres of land would be affected for the most severe case, and in the analyzed, smaller areas of land would be affected. The affected area would require tamination

and during this cleanup, access controls would have to be established. However, du land area affected, it is judged that these restrictions would only be temporary an issues such as economics, treaty rights, tribal resources, ecology, and land use wo limited in time. The remediation actions would be simpler in rural areas than in u provided that prudent controls and remediation operations were promptly implemented land and buildings could be recovered in either case. As demonstrated in the accid appendix, the human health effects would not be large and the effects on wildlife a would also not be large, partly due to the relatively small area affected and partl limited effects of the accident.

The radiological and non-radiological impacts of all the alternatives consider small. After consideration of the full range of environmental impacts and other ef with the management of naval spent nuclear fuel, it is judged that for all of the a considered, the impacts on the ecology, cultural and aesthetic values, air and wate geology, and such areas as noise, traffic, and utilities, normally associated with would be so small and differ so little among alternatives for naval spent nuclear f be of little assistance in differentiating among the alterna-

tives.
The areas of impact which are of special interest to the public or which provi distinct contrasts among the alternatives are public health, socioeconomics, cost, Nuclear Propulsion Program mission.

Public Health Impacts

A primary concern for most people is the risk to the public from exposure to r radioactive material for each of the alternatives. The exposure could be a result or an accident. A practical method often used to characterize the public risk resu actions such as these is to estimate the number of prompt fatalities or cancer fata result.

The analyses in this EIS show that there would be no prompt fatalities from th exposure associated with accidents (or normal operations) for any of the alternativ that there would be no latent cancer fatalities under any of the alternatives. How Action and Decentralization alternatives, under which naval spent nuclear fuel woul naval shipyard, the risks to a member of the public would be higher than for other

Figure S-1 provides an overall comparison of the alternatives in terms of the increase in the number of cancer fatalities that might occur in the general populat operation for each alternative. It is important to emphasize that these cancer fat results rather than actual expected fatalities. This is because the expected numbe during normal operations is so small as to be indistinguishable relative to the lar deaths expected from naturally occurring conditions and other man-made effects not spent nuclear fuel operations. This is not meant to trivialize the importance of r cancer fatalities but, rather, is meant to put the issue in perspective. In all th of years of facility operation and transportation of naval spent nuclear fuel would single additional fatal cancer might be expected to occur. To provide some perspec occurring radioactive materials in fertilizer used to produce food crops contribute millirem per year to an average American's exposure to radiation. Using the same c method used to determine the cancer fatality risk for the Naval Nuclear Propulsion

Figure S-1. Risk from normal operations by alternative (fatal cancers to the gene

alternatives, the exposures from consuming food grown with fertilizer result in 125 fatalities annually in the United States.

The most severe risks for a facility accident were determined to be from an ai into a dry storage container at the Pearl Harbor Naval Shipyard. This accident was result in 26 cancer fatalities and had a probability of occurring about once every accident has been calculated to produce a risk of less than 0.0003 additional cance The risks from all other accidents associated with examination or storage of naval were much less than this. In general, the risks from facility accidents tended to Action and Decentralization alternatives, because for these alternatives fuel would which are located close to large population centers. For transportation accidents, varied with the distances to be traveled, being least for the No Action and the Dec Examination alternatives which would involve transportation over short distances to near where the fuel is removed from reactors.

Socioeconomic and Cost Impacts

The socioeconomic impacts of implementing each of the alternatives would diffe and are summarized in Table S-1. The primary socioeconomic impact of the alternati would be on employment. Nation-wide employment levels would not vary significantly alternatives for managing naval spent nuclear fuel and therefore do not provide a b among the alternatives. The maximum impact on local employment levels would be cau alternatives requiring development of new naval spent nuclear fuel examination capa facility other than INEL while terminating these activities at INEL. Continuing cu transporting naval spent nuclear fuel to the Expended Core Facility at INEL for exa by transfer to the DOE for storage would result in the minimum disruption of employ

As shown in Figure S-2, there are large differences in the costs associated wi alternatives. These costs include the costs that would be incurred from constructi and containers, naval spent nuclear fuel transportation, and facility operation. I are associated with those alternatives that support examination of naval spent nucl existing facilities and those alternatives that terminate or severely curtail spent

examination. The higher costs are associated with those alternatives that require new Expended Core Facility and those alternatives that use shipping containers for
Table S-1. Summary of potential socioeconomic impacts.

Alternative	Long-term Impacts at INEL	Long-term Impacts at Other Sites
1. No Action	Lose 500 jobs	Add 50-100 jobs at naval sites
2. Decentralization		
- No Examination	Lose 500 jobs	Add 50-200 jobs at naval sites
- Limited Examination	Lose 500 jobs	Add 110-260 jobs at naval sites
- Full Examination	No change	Add 50-200 jobs at naval sites
3. 1992/1993 Planning Basis	No change	No change
4/5. Regionalization or Centralization		
- Idaho National Engineering Laboratory	No change	No change
- Hanford Site	Lose 500 jobs	Add 500 permanent jobs and some construction jobs at Hanford
- Savannah River Site	Lose 500 jobs	Add 500 permanent jobs and some construction jobs at Savannah River
- Nevada Test Site	Lose 500 jobs	Add 500 permanent jobs and some construction jobs at NTS
- Oak Ridge Reservation	Lose 500 jobs	Add 500 permanent jobs and some construction jobs at ORR

Figure S-2. Summary of costs by alternative (facility and transportation costs ov

Two important components of Naval Nuclear Propulsion Program operations are th management of naval spent nuclear fuel and support of the Navy's fleet of nuclear-p Based on the analyses in this EIS, all alternatives considered would allow safe sto nuclear fuel until a permanent repository becomes available. However, some of the would not provide equal levels of Fleet support. Alternatives which limit or termi nuclear fuel examination would severely impact ongoing research and development wor spent nuclear fuel examination results are used to confirm the adequacy of design f material performance, and confirm or adjust computer predictions of fuel performanc information contributes to the design and manufacturing of new naval reactor cores operation of nuclear-powered warships. Of the alternatives allowing full examinati Hanford Site, Savannah River Site, Oak Ridge Reservation, or Nevada Test Site, exam INEL would have the smallest mission impact due to the presence of existing facilit for performing this work, and the presence of a highly skilled work force, all of w be relocated or reassembled if a new examination site were selected.

CONCLUSION - PREFERRED ALTERNATIVE

The Navy's preferred alternative for the management of naval spent nuclear fue continue the historic, technically sound and safe practice of conducting refueling nuclear-powered warships and prototypes as planned, transporting naval spent nuclea Expended Core Facility at INEL for full inspection and examination, and transferrin nuclear fuel to the DOE facility for storage pending availability of a method for p disposition. This preferred alternative is based on consideration of environmental cost, and mission impacts of each alternative.

The analyses contained in this EIS demonstrate that the environmental impacts implementing any of the alternatives would be very small for normal operations and conditions. The analysis results do not provide a basis to distinguish among the a of these areas. The socioeconomic impacts of the alternatives also do not provide distinguish among the alternatives.

The Navy's preferred alternative is, therefore, based on impacts to the Navy's

cost. Alternatives that limit or terminate naval spent nuclear fuel examination wo Fleet support and the development of new naval reactors. Primarily because of the infrastructure, examination followed by storage at INEL would best support the Nava Propulsion Program mission and would be the least cost alternative allowing for ful naval spent nuclear fuel.

The alternatives which involve the Navy's preferred alternative are: 1992/199 Basis alternative and the Regionalization and Centralization alternatives that incl Expended Core Facility at INEL.

1. INTRODUCTION

This appendix describes the alternatives which have been evaluated for the exa storage of spent nuclear fuel from U. S. naval nuclear shipboard and prototype reac fuel is removed during reactor refuelings and defuelings at naval and commercial sh prototype sites. The alternatives include a range of options for managing naval sp year 2035. The options for spent fuel examination include ceasing all examinations limited amount of fuel at a naval shipyard, and performing a full range of examinat facility (Idaho National Engineering Laboratory) or at another Department of Energy The options for naval spent fuel storage include storage at the refueling and defue cases, it is necessary to move the fuel to the closest acceptable Navy shipyard), s facility, or storage at another DOE facility. Spent fuel transportation aspects wi examination and storage alternatives selected.

Naval spent fuel examination, whether at a naval or DOE site, will remain the of the Naval Nuclear Propulsion Program. This appendix therefore addresses the env impacts of naval spent fuel examination. This appendix also addresses the environm long-term storage of spent fuel at naval shipyards and prototype sites. The enviro long-term spent fuel storage at DOE facilities are addressed in the Environmental I appendices applicable to those sites.

2. BACKGROUND

2.1 NAVAL NUCLEAR PROPULSION PROGRAM OVERVIEW

The Naval Nuclear Propulsion Program is a joint Navy/Department of Energy (DOE organization responsible for all matters pertaining to naval nuclear propulsion pur Executive Order 12344, enacted as permanent law by Public Law 98-525 (42 USC 7158). Program is responsible for:

a. The nuclear propulsion plants aboard over 120 warships powered by over 140 reactors.
b. Moored Training Ships located in Charleston, South Carolina used for naval propulsion plant operator training.
c. Nuclear propulsion work performed at eight shipyards (six public and two p
d. Two DOE government-owned, contractor-operated laboratories devoted solely nuclear propulsion research, development, and design work.
e. Three land-based prototype naval reactors used for research and developmen training of naval nuclear propulsion plant operators.
f. The Expended Core Facility, located at the Naval Reactors Facility which i Idaho National Engineering Laboratory.

More detailed discussion is available in the references listed in Section 2.6 Duncan 1990; Hewlett and Duncan 1974).

2.2 HISTORY AND MISSION OF THE PROGRAM

In 1946, at the conclusion of World War II, Congress passed the Atomic Energy established the Atomic Energy Commission (AEC) to succeed the wartime Manhattan Pro gave it the sole responsibility for developing atomic energy. At that time, Captai Rickover was assigned to the Navy Bureau of Ships, the organization responsible for design. Captain Rickover recognized the military implications of successfully harn power for submarine propulsion, and that it would be necessary for the Navy to work

to develop such a program. By 1949, Captain Rickover had forged an arrangement bet and the Navy that led to the formation of the Naval Nuclear Propulsion Program. In nuclear submarine USS NAUTILUS put to sea and demonstrated the basis for all subseq nuclear-powered warship propulsion designs. In the 1970's, government restructurin AEC part of the Naval Nuclear Propulsion Program from the AEC (which was disestabli became the Department of Energy. Although the Naval Nuclear Propulsion Program gre scope over the years, it retained its dual responsibilities within the Department o Department of the Navy, and its basic organization, responsibilities, and technical remained much as when it was first established.

By eliminating altogether the need for oxygen for propulsion, nuclear power of drive a submerged submarine without the need to resurface frequently. In addition, offered a way to drive a submerged submarine at high speed without concern for fuel

Nuclear propulsion, though originally developed for submarines, significantly military capability of surface ships. Nuclear propulsion provides virtually unlimi endurance without dependence on tankers and their escorts. Moreover, the space nor for propulsion fuel in oil-fired ships can be used for weapons and aircraft fuel in ships.

Naval fuel is designed to meet the very stringent operational requirements for propulsion reactors. Because of its military design, it will maintain its integrit far less demanding conditions encountered during land-based storage. Naval fuel is operate in a high-temperature and high-pressure environment for many years. Curren capable of over 20 years of successful operation. Measurements of the corrosion ra naval fuel designs have shown that naval spent nuclear fuel could be safely stored longer than the 40 years considered in this Environmental Impact Statement (EIS) in air used for storage. Naval fuel uses highly corrosion-resistant materials for fue can withstand high-intensity radiation and harsh environments. As a result, the fu and has very high integrity. The fuel is designed, built, and tested to ensure tha will contain and hold the radioactive fission products. Naval fuel totally contain within the fuel - there is no fission product release from the fuel in normal opera nuclear reactor core contains a large quantity of fission products, it is essential the nuclear fuel in order to minimize radiation exposure to a ship's crew. Naval f rugged. It can withstand combat shock loads which are well in excess of 10 times t for which commercial nuclear power plant fuel is designed. It routinely operates w in power level since naval ships must be able to change speed quickly in operationa fuel consists of solid components which are non-explosive, non-flammable, and non-c ruggedness of naval fuel is demonstrated by the fact that two nuclear-powered ships in the 1960's, and subsequent environmental monitoring shows no release of fission fuel despite the catastrophic nature of the loss of the ships (NNPP 1994a). Also, fuel examined after 28 years of storage in a water pool exhibited no detectable det Although spent nuclear fuel is highly radioactive, it is not regarded as "waste"; i handling procedures, shielding, and other measures to isolate it from people and th

The integrity of naval nuclear fuel is due in part to a long-standing program spent fuel after it has been removed from prototype reactor plants and operating sh examinations have been conducted at the Idaho National Engineering Laboratory (INEL beginning of the Naval Nuclear Propulsion Program. Construction and early operatio INEL Expended Core Facility (ECF) occurred between 1957 and 1962. The original bui contained a water pool and nine shielded cells connected to the water pool by a tra examination requirements changed, the ECF underwent several expansion programs.

The first and second expansions, in 1962 and 1963, were prompted by the initia irradiated test specimen examinations at ECF. In the 1970's, the third expansion o addition of new, larger hot cells. The fourth expansion (1979-1987) included the e ECF building and water pools for the addition of the Breeding Nondestructive Assay addition was for the receipt and examination of the Light Water Breeder Reactor nuc following its operation in the former PWR Shippingport Atomic Power Station. The w has continued at or near capacity, receiving, handling, and examining spent fuel fr plants.

The examinations of naval spent nuclear fuel are essential to meeting the goal Nuclear Propulsion Program. The primary goals that are supported by examinations a

- Continued safety of naval reactors
- The design of new reactors having extended lifetimes
- Improvements in nuclear fuel performance
- Demonstration of satisfactory operation of existing naval reactors by prov confirmation of their proper design and allowing maximum depletion of thei
- Validation of design models for new core types.

The goal of the extended lifetime reactor design is to have the reactor core l the ship. Such a design would eliminate the need to refuel the reactor during its would also reduce the cost of fueling the ship, and would increase the time that su in active service rather than being refueled.

This EIS assumes that the extended-lifetime goal is partially achieved. Based technology, the EIS assumes that each of the three SEAWOLF submarines will need to once during the period to the year 2035. Based on anticipated developments support from the examinations of naval spent nuclear fuel, this EIS also assumes that each Submarine Class will not need to be refueled during the period to 2035.

If the examinations of naval spent nuclear fuel are terminated and the goal of core is not achieved, more naval spent nuclear fuel will be created than is otherwi number of shipments of naval spent nuclear fuel during the period from 1995 to 2035 from about 580 to about 630 and the corresponding amount of naval spent nuclear fue from 65 metric tons of heavy metal (MTHM) to about 70 metric tons of heavy metal.

Similarly, the goals for safety, improved fuel performance, and satisfactory o reactors will depend on continuing the examinations of naval spent nuclear fuel.

2.3 REGULATORY FRAMEWORK

The Naval Nuclear Propulsion Program includes activities conducted by both the and the Department of Energy. Executive Order 12344, enacted as permanent law by P 98-525, and the Atomic Energy Act of 1954 establish the responsibility and authorit of the Naval Nuclear Propulsion Program (who is also the Deputy Assistant Secretary Reactors within the Department of Energy) for all facilities and activities that co These executive and legislative actions establish that the Director is responsible pertaining to naval nuclear propulsion, including direction and oversight of enviro health matters for all program facilities and activities.

The federal permits, licenses, and other entitlements listed below may need to implement the alternative selected. Existing federal permits, licenses, and entitl modified as required. Applicable state and local permits, licenses, and entitlemen or modified, as necessary.

- National Pollutant Discharge Elimination System (NPDES) Permit as required Federal Water Pollution Control Act (FWPCA), 33 U.S.C. - 1251 et seq.
- NPDES General Permit for Stormwater Discharges from Construction Sites as by the FWPCA, 33 U.S.C. - 1251 et seq.
- Permit to emit hazardous air pollutants (radionuclides) under the Clean Ai 42 U.S.C. - 7401 et seq., as amended by the Clean Air Act Amendments of 19
- Department of Energy Certificate of Compliance for Radioactive Materials P accordance with the Atomic Energy Act (AEA), 42 U.S.C. - 2011 et. seq.

2.4 NAVAL SPENT NUCLEAR FUEL

2.4.1 Summary of Naval Spent Nuclear Fuel Operations

For approximately 40 years, naval spent nuclear fuel has been shipped by rail Reactors Facility at the INEL, where it is removed from the shielded shipping conta into the water pools at the ECF. All spent fuel received at the ECF is visually ex for evidence of any unusual condition such as unexpected corrosion, unexpected wear defects. After the fuel assembly structural components have been removed, the inte assembly is examined for the conditions discussed above. In addition, the assembly distortions from irradiation, heat, or the fission process which could interfere wi distribution of primary coolant and consequent heat removal. The inspection also c flow obstructions due to foreign material or excessive corrosion product buildup. percent of the spent naval reactor cores are given more detailed examinations for s confirming the adequacy of new design features, exploring materials performance con obtaining detailed information to confirm or adjust computer predictions of neutron transfer, or hydraulic flow and distortion. These detailed examinations may includ determine corrosion film thicknesses, dimensional measurements to determine fuel as distortion, and radiochemical analysis to determine core depletions, as well as oth discussed below, the examination program is essential in supporting the Navy's cont operation of naval reactors and design of new, improved fuel having a longer lifeti

Examination of all spent naval fuel is essential to the mission of the Navy fo to provide data on current reactor performance, to validate models used to predict performance, and to support research to improve reactor design.

Naval fuel examinations provide real data on reactor cores installed in ships operating in the fleet. This information is essential to validate calculational mo Through the years, the Naval Nuclear Propulsion Program has built a substantial tec from examinations of earlier reactor core types. The Program predicts the performa core types with calculational models supported by this database. Essentially no in on core types that will form the backbone of the nuclear fleet for the foreseeable submarines, LOS ANGELES class submarines, and NIMITZ class aircraft carriers). Dat reactor core types are necessary to validate basic assumptions of current models, p variability which exists between individual cores and within a single core, and ide unanticipated effects of operation that have not been evaluated or accounted for in

Confidence in the validity of engineering models is essential for assurance th can continue without restriction. Since reactors operating in the fleet are not ta their design during peacetime operations, the Program requires a technically sound continuing to conclude that we have a robust design. Prototype reactors cannot by this information, as their operation is not identical to that of a warship. The fa satisfactorily with no indication of a problem during a normal shipboard lifetime d that the core would have been acceptable under the worst case conditions for which The examination of spent nuclear fuel from each core provides the assurance needed unexpected technical issues not evaluated and addressed in the models that would af unrestricted operation.

Data from examinations also contribute significantly to improvements in reacto Improvements in calculational models and analyses have enabled the Program to incre lifetime and the performance of reactor cores. For example, the reactor cores inst USS NAUTILUS in the 1950's operated for 2 years. Current reactor cores are designe 20 years, a significant technical accomplishment unique to naval fuel. The Navy is develop a life-of-the-ship (30-year) core for the New Attack Submarine which is sti stages. This core will further reduce the amount of spent fuel generated in the lo will not require refueling during their lifetime. Continuing data from current cor if this effort is to succeed.

In the final analysis, examination of naval spent nuclear fuel absorbs conside In a time of extremely tight budgets, the Navy would not be performing such examina they were judged to be necessary to support the conduct of technical work. Examina the last 37 years have played a key role in achieving over 4500 reactor-years of sa operations, having nuclear-powered warships steam over 100,000,000 miles, and incre lifetimes from 2 years to over 20 years. The record shows there is no reason for r technical basis upon which safe naval reactor design and operation are founded, and includes, as a key cornerstone, the examination of naval spent nuclear fuel.

A limited quantity of naval fuel is retained following examination for referen study. After examination, most spent fuel is loaded into shielded containers and t DOE's Idaho Chemical Processing Plant (ICPP) at the INEL for storage. The transpor spent nuclear fuel from shipyards and prototypes is described in Attachment A. The handling at ECF of the spent fuel from naval reactors is described in Attachment B.

The Naval Nuclear Propulsion Program evaluates small samples of both fuel and materials for possible use in naval reactor systems. The samples are irradiated at Reactor Area and then examined at ECF. A typical sample undergoes several cycles o and examination over several months or years.

The basic process for managing naval spent nuclear fuel starts with the spent reactor plant loaded in a container. There are many stringent control steps in the are necessary to ensure the safety and health of the workers, the public, and the e controls have been established by the conservative philosophy of the Naval Nuclear Program and, as a minimum, meet the applicable regulations of federal and state age cies. Those
controls will also apply to any and all of the alternatives that are being consider management of naval spent nuclear fuel.

Historically, the main steps that have been used for many years for managing s consist of the following:

Step 1. The process starts with spent fuel that has been removed from the reactor shielded shipping container at a prototype site or shipyard authorized to reactor refuelings or defuelings.

Step 2. The loaded shipping container is transported by rail to the ECF at the INE

Step 3. The spent fuel is received at ECF.

Step 4. The spent fuel is separated from structural material and examined in the E
Step 5. The spent fuel is transferred, in a shielded container, to the ICPP.

At the ICPP, naval spent nuclear fuel is stored in water pools to shield worke radiation. Naval nuclear fuel is designed to operate for decades in high-temperatu substantial corrosion. This means that it can be stored in the cool water in stora very little corrosion for centuries because the rate of corrosion, which is very sl temperatures inside naval reactors, decreases rapidly as the temperature of the wat decreases. Experience at the Expended Core Facility and the Idaho Chemical Process shown that naval spent nuclear fuel has not degraded during many years in water poo

2.4.2 Facilities Related to Naval Spent Nuclear Fuel

The shipyards that perform the refueling and defueling operations are also res shipping the naval spent nuclear fuel to the facility where structural material is examinations are conducted. Since 1957, these operations have been conducted at th After the specified operations and examinations are complete, ECF is responsible fo spent fuel to ICPP, the storage location.

The operations at the shipyards for removing the spent fuel from the ship requ special, heavily shielded equipment to remove the spent fuel from the reactor to th container (which is also heavily shielded) while protecting the workers from the ra spent fuel. The shipping containers are designed and tested to transport the spent protecting the workers and any nearby persons from the radiation of the spent fuel. spent fuel is unloaded from the shipping containers with special, heavily shielded protect the workers from radiation. The spent fuel is removed from the transfer ca pool where the depth of the water is sufficient to shield the workers from the radi spent fuel modules. The subsequent machining operations and examinations of the spe performed in the water pool under the required depth of water, or in a heavily shie certain operations and examinations can be performed safely. After the work on the completed, the spent fuel is loaded into a shielded transfer cask (under water) for location, such as the ICPP. These are the main pieces of special equipment and fac required to perform the necessary operations with naval spent nuclear fuel. There pieces of equipment and apparatus that are also used along with the main equipment necessary work safely and efficiently.

2.5 PLANNED REDUCTIONS IN THE NUMBER OF NUCLEAR-

POWERED NAVAL VESSELS

Following the successful operation of the USS NAUTILUS in 1954, the number of powered submarines and surface ships in the U.S. Navy grew steadily until it reache over 150 ships in 1987. Report NT-94-2 provides a graph of the total number of nuc vessels in the U.S. Navy over the years since the beginning of the Naval Nuclear Pr (NNPP 1994b). Since 1988, the number of nuclear-powered vessels in the U.S. Navy h The Navy has been able to accomplish its mission with fewer ships, partly because t crews became more capable over the years and partly because the development of long reactor cores makes it possible for nuclear-powered ships to spend more time on dut shipyards being refueled. A major factor in the reduction in the number of nuclear is that, since the end of the Cold War, the Navy has embarked on a program to reduc warships in its fleet. With the Navy downsizing from a fleet of almost 600 warship over 300, the number of nuclear-powered warships is also diminishing. The actual s nuclear-powered fleet by the year 2000 is expected to be between 80 and 90 vessels 95 and 110 reactors (since surface ships have two or more reactors).

Figure 2-1 shows the peak number of nuclear-powered naval vessels in 1987 and of nuclear-powered ships in the fleet for each of the next 10 years under current p planned reduction reflects the most recent changes in the mission of the U.S. Navy, effects of the end of the Cold War. Under this plan, the number of nuclear-powered will be reduced by the end of the next 10 years to approximately one-half the numbe The Navy is moving ahead with this plan, but it should be remembered that such plan the future if Congress alters the Navy's mission in the light of world developments

This plan for reducing the number of nuclear-powered naval vessels was used in development of environmental impacts in this Environmental Impact Statement (EIS). the planned reduction in the number of ships in future years is incorporated into a associated with examination or storage of naval spent nuclear fuel reported in this

timing and number of naval spent nuclear fuel shipments used in the calculation of
with transportation are based on this plan.

Figure 2-1. Total number of nuclear-powered ships in the United States Navy. 2.6 REFERENCES

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3. ALTERNATIVES

This section describes the alternatives which were evaluated for the managemen nuclear fuel removed during reactor refuelings and defuelings at naval and commerci the prototype sites. Since Chapter 3 of Volume 1 provides a complete description o Energy's alternatives for all types of spent nuclear fuel under its cognizance, the are limited to aspects of the alternatives related to naval spent nuclear fuel.

1. No Action: Spent fuel from naval reactors at naval shipyards and prototype si in shielded containers at facilities close to the refueling and defueling site spent fuel examinations.

2. Decentralization: There are three different variations to this alternative. No Action alternative except that additional spent fuel storage options would second variation, a limited amount of spent fuel would be examined in detail a Shipyard to provide information on nuclear fuel performance. This limited amo be stored at the examination site and the remainder would be stored at or near defueling sites. In the third variation, all spent fuel would be shipped to t Engineering Laboratory (INEL) Expended Core Facility (ECF) and examined as it past, then returned for storage to facilities at or near the refueling and def ECF improvements, including the dry cell expansion (Attachment B), would be co

3. 1992/1993 Planning Basis: Spent fuel would continue to be received, examined, INEL as it has been in past years. All planned ECF improvements, including th expansion (Attachment B), would be completed.

4. Regionalization: Current and future naval spent nuclear fuel would be receive stored at the Hanford Site, INEL, the Savannah River Site, the Nevada Test Sit Reservation. If INEL were the site selected for Regionalization of naval spen this alternative would be essentially the same as the 1992/1993 Planning Basis
5. Centralization: Current and future spent fuel would be collected and stored a Energy (DOE) site. Examination and storage facilities would be constructed, a examinations would be performed at that one site. There would be no differenc Regionalization and the Centralization alternatives for naval spent nuclear fu

This section also describes other alternatives which were considered and then detailed analysis.

3.1 NO ACTION

This alternative is restricted to the minimum actions deemed necessary for con secure handling and storage of naval spent nuclear fuel. It is important to note t status quo condition. Naval reactors would be refueled and defueled as planned. N

would be stored in shipping containers at a Navy or DOE facility. These shipping c modified and recertified as discussed in Section D.1.2.1 of Attachment D. No furth fuel examination would be conducted and research and development activities associa of the spent fuel would not be performed. The Expended Core Facility at INEL would

Under this alternative, the transportation of naval spent nuclear fuel to INEL about 3 years, during which additional shipping containers would be purchased and a naval sites to serve as storage locations would be completed (see Section 3.8). Th reactors at naval shipyards or active prototype sites would be stored at a naval sh most instances where it was removed from the reactor during servicing. The spent f from the reactors and placed directly into shipping containers for storage without Newport News Shipbuilding, a private shipyard located in Newport News, Virginia, do defueling work for the Navy. Spent fuel removed from ships refueled or defueled at Shipbuilding would be transported to the nearest naval site, Norfolk Naval Shipyard Virginia. Norfolk Naval Shipyard is about 10 miles (about 250 miles by rail) from Shipbuilding. The spent fuel would be stored in such a way that it would be protec intruders and that workers, the public, and the environment would be protected. Th storage until the DOE is prepared to take receipt of the fuel.

Since no additional spent fuel examinations would be performed at ECF, the wor examination of test specimens irradiated in the Advanced Test Reactor at INEL would another site at INEL. The selected site might require modifications to accommodate

If this alternative and its minimum actions were selected, it would be necessa certify approximately 500 additional shipping containers and to construct the assoc the naval sites to be able to store the spent fuel from all of the nuclear-powered or defueled until the time that a permanent disposal facility becomes operational. time when containers would not yet be available, naval spent nuclear fuel would be containers to the Expended Core Facility at INEL. These containers would be unloa support additional refuelings and defuelings.

A major result of this and any other alternative which precludes detailed exam spent nuclear fuel is that the further development of improved nuclear fuel for U.S hindered. Examination of spent fuel provides useful information on the performance system designs. Without a continuing flow of such information, eventually confiden naval nuclear fuel to perform satisfactorily under design conditions would decrease also important in developing improvements in future fuel designs.

In this context, an alternative which would leave the spent nuclear fuel onboa warships was considered. Under such an alternative, refueling and defueling operat the nuclear-powered warships would be retired in place at piers at Navy facilities. 3.6.3 of this Appendix, it was determined that this approach to a "no action" alter involve many actions, including a large expansion of pier space, with the resultant increased number of naval personnel assigned to monitoring the retired nuclear-powe reduction in work force at several shipyards, and a reduction in the number of oper warships beyond that planned. Consequently, it was concluded that this could not b action" alternative and a more appropriate, and feasible, approach for the No Actio as a basis for this Environmental Impact Statement.

Attachment D contains a more detailed description of storing naval spent nucle its removal location.

3.2 DECENTRALIZATION

Under this alternative, DOE would maintain existing naval spent nuclear fuel i and new naval spent nuclear fuel would be stored at or near the sites where it was Three different variations of this Decentralization alternative have been considere variations are similar to the No Action alternative with regard to their location a storage of spent nuclear fuel. At each storage location under all three options, s containers, dry storage casks, and wet storage in water pools has been considered. require a transition period while facilities are developed (see Section 3.8).

3.2.1 Store Naval Spent Nuclear Fuel at or Close to Locations Where

Removed Without Examination

Similar to the No Action alternative, this alternative would include storage o reactors at naval shipyards or active prototype sites close to the locations where refueling or defueling. The spent fuel would be placed directly into storage witho

tion. Storage would be in water pools, dry casks, or shipping containers. The spen from damage or intruders, and workers, the public, and the environment would be pro would remain in storage until a permanent disposal site became available.

No further naval spent nuclear fuel examination would be conducted. Without t program, further development of improved nuclear fuel for U.S. Navy ships would be spent nuclear fuel examination provides useful information on the performance of ex designs. A continuing flow of such information is needed to prevent confidence in nuclear fuel to perform satisfactorily under design conditions from decreasing over examination of naval spent nuclear fuel is also important in developing improvement addition, the work associated with examination of irradiated test specimens, which development of advanced designs, would no longer be performed at the Expended Core and would have to be relocated to other facilities at INEL. The Expended Core Faci shut down.

The environmental effects associated with this alternative would be determined choice among water pool, dry storage casks, or shipping container storage. The shi be mobile storage casks, which could also be used for shipping. Like the other opt alternative, a transition period would be required during which it would be necessa and certify enough shipping containers or dry storage casks to store the spent fuel ships being refueled or defueled or to design, construct, and certify water pools f sites. During this transition period, naval spent nuclear fuel would continue to b Core Facility at INEL where the shipping containers would be unloaded and used to s refuelings and defuelings.

Attachment D contains a more detailed description of storing naval spent nucle its removal location.

3.2.2 Examine a Limited Amount of Naval Spent Nuclear Fuel in the

Puget Sound Naval Shipyard Water Pit Facility and Store All
Naval Spent Nuclear Fuel at Navy Facilities

Under this alternative, the existing water pool facility at Puget Sound Naval built to support the refueling of nuclear-powered aircraft carriers, would be modif maximum amount of naval spent nuclear fuel examinations practical at that site. Th this alternative and the one described in the preceding section is that only a smal fuel could be examined to provide information on nuclear fuel performance for use i improved nuclear fuel.

The only existing facility available within the Naval Nuclear Propulsion Progr facility at ECF, which could be used to examine spent fuel from naval reactors is t Puget Sound Naval Shipyard at Bremerton, Washington. However, the use of this faci dimensional examinations of high-priority spent fuel assemblies would require remov installed aircraft-carrier refueling equipment. As a result, Puget Sound would no capability to refuel nuclear-powered aircraft carriers. This facility has no shiel destructive examinations of spent fuel. Although this alternative would provide a examination and analysis of spent fuel, the ability to sustain further development reactors needed to ensure the safety and performance superiority of U.S. Navy ships Continuous performance of naval spent nuclear fuel examinations at Puget Sound Nava preclude the performance of aircraft-carrier refuelings at Puget Sound because the no longer be available.

The limited amount of spent fuel examined in the modified facility and all nav removed from reactors at Puget Sound Naval Shipyard would be stored at that shipyar fuel removed at other naval shipyards or active prototype sites would be stored at location where it was removed during refueling or defueling. The limited amount of would be transported from the originating site to Puget Sound Naval Shipyard in the currently used for naval spent nuclear fuel.

Like the other options under this alternative, a transition period would be re of facilities utilizing shipping containers, dry storage casks, or water pools for During this transition period, naval spent nuclear fuel and test specimens would co the Expended Core Facility at INEL where the shipping containers would be unloaded additional refuelings and defuelings.

Under this option, the Expended Core Facility at INEL would be shut down after transition period. The examination of irradiated test specimens would be performed No Action alternative (Section 3.1).

Attachment D contains a more detailed description of the examination and stora nuclear fuel for this alternative. The transportation of fuel to be inspected at P

is described in Attachment A.

3.2.3 Examine All Naval Spent Nuclear Fuel at the INEL and Return to

Naval Facilities for Storage

Under this option, all naval spent nuclear fuel would be shipped to the Expend the INEL for examination. After examination, this fuel would be returned to a nav long-term storage near the location where the fuel was removed from a reactor. The fuel under this alternative would be performed at the INEL Expended Core Facility a past years. As with other options under this alternative, the naval spent nuclear shipping containers, dry storage casks, or water pools. All planned improvements t Facility, including the dry cell expansion, would be completed.

The receipt, examination, and preparation for storage for this alternative wou described in more detail in Attachment B, and the storage would be the same as that Attachment D for shipyard and prototype storage. Transportation of the spent fuel in the same manner as described in Attachment A.

3.3 1992/1993 PLANNING BASIS

The practice of transporting spent nuclear fuel removed from naval reactors to Facility in Idaho for examination would be resumed. Following examination, the spe be transferred to DOE for management at the Idaho Chemical Processing Plant pending All planned improvements in fuel examination capability for naval spent nuclear fue the ECF dry cell expansion, would be completed. Operation of an ECF Dry Cell Facil supporting analysis and the assumptions of this Environmental Impact Statement.

The shipment of naval spent nuclear fuel from shipyards and prototypes to INEL Attachment A, and receipt and handling at INEL of the spent fuel from naval reactor prototypes is described in Attachment B. Attachment B also includes a description Facility.

3.4 REGIONALIZATION

Two options have been considered under this alternative. Under the first Regi considered, DOE would manage all spent nuclear fuel at the Hanford, INEL, and Savan allocating each type of spent nuclear fuel to one of these sites according to its c type of cladding. Under the second option, spent nuclear fuel under DOE cognizance at one DOE site in the eastern portion of the United States and one DOE site in the United States, with all spent nuclear fuel assigned to one of these two sites on th origin. The eastern site would be either the Savannah River Site or the Oak Ridge western site would be the Hanford Site, INEL, or the Nevada Test Site. The Expende INEL would be shut down in all cases where INEL would not be used for naval spent n examination and storage.

3.4.1 Regionalization Using Storage at Three Sites (Hanford, INEL,

and Savannah River)

This option under the Regionalization alternative would result in all naval sp managed at the INEL in the same manner as the 1992/1993 Planning Basis alternative nuclear fuel has similar characteristics and would be managed at a single site. Un Zircaloy-clad fuel would be managed at the INEL and since naval fuel is Zircaloy-cl assigned to INEL. The practice of transporting spent nuclear fuel removed from nav Expended Core Facility in Idaho for examination would be resumed. Following examin would be transferred to DOE for management at the Idaho Chemical Processing Plant p disposition. All planned improvements in fuel examination capability for naval spe would be completed.

3.4.2 Regionalization Using Storage at Only Two Sites

Under this option, DOE would collect all spent nuclear fuel at one existing la eastern United States (either the Oak Ridge Reservation or the Savannah River Site) large DOE site in the western part of the country (either the Hanford Site, INEL, o Spent nuclear fuel would be collected at one or the other of these two sites, based Only one of the two locations would be used for examination and storage of naval sp this option, but the impacts of managing naval spent nuclear fuel at all of the pos evaluated because the site for naval spent nuclear fuel has not been chosen.

A new naval spent nuclear fuel examination facility would have to be construct selected if it were other than INEL, and the Expended Core Facility at INEL would b new facility would have capabilities equivalent to those of the existing Expended C and would support all examinations and experimental work required for the developme The new examination facility would be operated by the Naval Nuclear Propulsion Prog

Naval spent nuclear fuel would be removed from naval reactors and transported examination facility, as described in Attachment A. The fuel would be unloaded and water pools and shielded cells constructed for this purpose, in a manner similar to Attachment B. After completion of all examination work, the naval spent nuclear fu transferred to storage facilities operated by the DOE at the same site. None of th this alternative, other than INEL, currently has facilities adequate to store the a involved in this option. Therefore, the DOE would have to construct new storage fa spent nuclear fuel, including naval spent nuclear fuel, if this option were selecte

It should be understood that the Navy would operate only one facility for exam spent nuclear fuel, and all naval spent nuclear fuel examined during the period cov Environmental Impact Statement would be stored at the same DOE site where the exami performed. Therefore, there are no differences for management of naval spent nucle Regionalization alternative and the Centralization alternative (described in the ne site.

3.5 CENTRALIZATION

As implied by its name, this alternative would collect all current and future fuel at one DOE site. The sites analyzed include the Hanford Site, INEL, the Savan Ridge Reservation (ORR), and the Nevada Test Site (NTS). As in the Regionalization Navy would operate a facility for examination of naval spent nuclear fuel at only o naval spent nuclear fuel examined during the period evaluated would be stored at th was examined, so there are no differences between the Regionalization alternative a alternative for management of naval spent nuclear fuel.

If INEL were chosen as the DOE site for centralized long-term storage of naval the Expended Core Facility would continue to operate. After examination at the Exp naval spent nuclear fuel would be transferred to the Idaho Chemical Processing Plan need to modify the Expended Core Facility since it is a safe, modern facility provi needed for naval spent nuclear fuel examinations. However, any planned facility ch improved or additional fuel handling and examination capability, such as the ECF Dr be completed.

If a DOE site other than INEL were chosen for the centralized long-term spent facility, then the Expended Core Facility at INEL would be closed. A new naval spe examination facility would need to be constructed at the selected site, or an exist be modified to perform the needed examinations of naval spent nuclear fuel. This f capabilities equivalent to those of the existing Expended Core Facility at INEL. S nuclear fuel storage facilities would have to be constructed at the selected site s facilities at other sites suitable for storage of spent nuclear fuel from INEL.

Adjacent to the Savannah River Site is the site of the Barnwell Nuclear Fuel P owned facility is not being used currently. It could be purchased at an undetermin Savannah River Site, and subsequently modified to provide capabilities equivalent t Expended Core Facility. Similarly, at Hanford there exists the Fuels and Materials (FMEF) that could be modified to provide capabilities equivalent to those at the Ex It is expected that the modifications to either of these two facilities would cost a new Expended Core Facility.

Shipments of naval spent nuclear fuel to the Expended Core Facility in Idaho w the first 3 years of the time required to construct a new naval spent nuclear fuel selected location (see Section 3.8). All naval spent nuclear fuel would be transfe after the new facilities were placed into operation.

The receipt, handling, and storage of naval spent nuclear fuel for this altern

Attachments B and E, and transportation of the spent fuel is described in Attachmen

3.6 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS

Several other alternatives were considered in addition to those described abov other alternatives were not analyzed to the same depth as those described above. T the reasons for not analyzing them in detail are discussed in this section.

3.6.1 Use Other Combinations of Sites for Examination and Storage

of Naval Spent Nuclear Fuel

Some variations of alternatives can be conceived in which spent fuel would be site at which it was removed from a reactor to some other facility for examination storage and subsequently shipped to another facility for storage. Evaluating all s tions for examination, treatment, and storage as separate alternatives would be com number of alternatives which could result. Furthermore, detailed treatment of such alternatives would complicate the evaluation of environmental effects.

However, it is not necessary to consider each of these combinations individual processes involved and the possible environmental effects generally can be represen the effects of alternatives already discussed. For example, the impacts of examini site other than INEL followed by shipment back to a shipyard for storage would be e those for examination of fuel under the alternative of examination and storage of t DOE site, described in Section 3.5, except for transportation. Continuing the exam storing the naval spent nuclear fuel at a shipyard as part of such an alternative w for storing spent fuel at the shipyard without inspection, described in Section 3.2 shipping the fuel back and forth between the DOE site and a shipyard for such an ap approximately double the effects of shipment to the DOE site for inspection and sto sites are involved but a second trip would be required to return the fuel from the storage site.

In a similar fashion, the effects of other possible combinations of inspection be deduced from combinations of the alternatives discussed in earlier sections. In cation and confusion, these alternative combinations were not explicitly analyzed i

3.6.2 Examine or Store Spent Nuclear Fuel from Naval Reactors in

Foreign Facilities

It would be physically possible to examine and store spent nuclear fuel from n foreign countries. The naval spent nuclear fuel could be shipped safely to a forei storage could be established. However, the characteristics of naval fuel are class requirements of the Atomic Energy Act of 1954, as amended. Such characteristics in geometry, what requirements govern its design, how it is manufactured, and how it o reactor. These characteristics can be deduced from physical nondestructive examina from more intrusive means of inspection.

Information classified under the Atomic Energy Act may not be provided to fore or foreign interests unless the President determines that such access is in the def States, a government-to-government agreement allowing such access is reached, and p review is afforded to ensure acceptance by the legislative branch.

Characteristics of long-lived U.S. naval fuel, which constitutes virtually all nuclear fuel evaluated in this Environmental Impact Statement, have never been prov country. It has been long-standing U.S. policy not to provide such information and currently in existence with any foreign country providing for such access.

U.S. naval fuel also utilizes highly enriched uranium suitable for use in nucl spent nuclear fuel remains highly enriched even after it has completed use in a nav Nuclear Non-Proliferation Act, implementing requirements of the Treaty for the Non-Nuclear Weapons, imposes severe restrictions on the transfer of such material to fo restrictions are in addition to those arising from the classified nature of the fue

Foreign nations provide no unique capabilities or advantages for examination o spent nuclear fuel. In fact, only four other countries (the United Kingdom, France Republic of China) build and operate nuclear-powered warships, and none has naval r the long-lived performance characteristics of U.S. naval reactor fuel. Thus, U.S. examination of such long-lived fuel are unique and special.

There are also technical and environmental reasons why processing of naval spe foreign facilities is unreasonable. As is discussed in this Environmental Impact S nuclear fuel is not expected to require any processing or stabilization - it will l emplacement in a geologic repository owing to its inherent structural strength and necessary by its military application. Processing naval spent nuclear fuel is more or DOE fuel for those same reasons, and doing such reprocessing abroad would result highly enriched uranium in a foreign country, creating concerns over non-proliferat safeguards.

Based on these considerations, the alternative of processing or storing naval foreign countries is not a reasonable alternative, and thus was eliminated from det

3.6.3 Do Not Remove Naval Spent Nuclear Fuel from

Nuclear-powered Ships

Nuclear-powered warships represent about 40 percent of the Navy's major combat the Navy fleet is based on ensuring that the Navy has sufficient ships in active se the country's defense commitments, as established by Congress and the President.

It is physically possible to retain spent fuel in the reactors in nuclear-powe ships at shipyards until a decision on the ultimate disposition of spent nuclear fu ships for which refueling was planned unavailable for further service. However, th result in these ships being unavailable once their currently installed reactor fuel life. This is impractical because the ships would have to be replaced (a process t many years and in most instances requires ships that have not been designed) or the to operate without the full complement of ships required to execute national polici submarine fleet is nuclear-powered, including the fleet of ballistic missile submar least vulnerable part of the nation's strategic deterrent, and our attack submarine ballistic submarines as well as play a crucial role in littoral warfare, failure to result in a unilateral decrease in the nation's strategic deterrent.

Also of particular importance in this regard is the commencement of refueling aircraft carriers which form the backbone of the Navy's fleet. Of twelve operating Class, with three more under construction to replace older, conventionally powered retirement. Refueling of the USS NIMITZ is scheduled to begin in 1998, but refueli already underway for this first-of-a-kind effort. These preparations entail emptyi nuclear fuel from the earlier refueling of the USS ENTERPRISE and defueling of the BEACH. This spent nuclear fuel is at Newport News Shipbuilding and Drydock Co. in facility which is required for the NIMITZ Class refuelings. Once the facility is e reconfigured for use, including refurbishment, maintenance, and extensive training

If the facility cannot be emptied, the USS NIMITZ and subsequent NIMITZ Class DWIGHT D. EISENHOWER, USS CARL VINSON, USS THEODORE ROOSEVELT, US ABRAHAM LINCOLN, are scheduled for refueling in succession after the US NIMITZ could not be refueled the fleet at the time they would be required for service. In effect, the Navy woul fewer carriers than would be needed to fulfill national security requirements. Thes include maintaining continued forward presence in peacetime (which is essential to deter aggression, encourage global stability, and promote interoperability with our response. National security requirements also include ability to field forces suff simultaneous regional conflicts (such as Operation Desert Storm), as well as operat such as Somalia and Haiti. The national security need to ensure that the USS NIMIT returned to service in the fleet on schedule was certified by the Secretary of Defe accepted by the Governor of Idaho in January 1995, when he allowed shipment of nava from the Newport News Shipbuilding and Drydock Co. to continue. Additional shipmen required after the Record of Decision is issued on this EIS in June 1995 to complet by late 1995.

Additionally, implementing this alternative would require extensive modificati shipyards, including increasing the number of piers and the availability of waterfr ships at their moorings. Other shipyard facilities also might have to be modified the use of waterfront space to moor the numbers of ships involved during the 40-yea construction of piers and other needed facilities would cause impacts on the waterf could affect the local ecology. For example, dredging would be required along with spoils; such activities have been an environmental concern at several Navy facilit

While this method for storing naval spent nuclear fuel would cause some increa activities, in the long run it would result in the idling of skilled workers as the and work schedules were disrupted by the loss of ship servicing work. Mooring the removing the naval spent nuclear fuel would also utilize highly trained Navy nuclea

unproductive task of watching over shutdown ships. The resources dedicated to prov moorings would produce no improvements in a shipyard's ability to perform its missi decrease its capabilities. The radiological effects on the environment or people i negligible as long as the nuclear-powered vessels and propulsion plants were mainta procedures and discipline used for operating ships, since the environmental effects nuclear-powered vessels are well documented and known to be negligible.

Separately, the costs of maintaining the ships with spent nuclear fuel remaini Navy operating procedures and providing the additional piers and waterfront service be large. The costs of this approach would be high both for ships which are to be ships which would normally be refueled and returned to duty. One cost would result assign qualified nuclear operators to monitor vessels awaiting refueling or defueli which are being decommissioned at the end of their life, the primary cost of this a cost to maintain qualified nuclear operators, shipboard equipment, and associated s including security, to ensure nuclear and radiological safety for the workers and t more expensive than removal of the spent fuel for storage.

Thus, in summary, this alternative would be costly and would involve extensive would have an effect on the environment due to construction activities. This alter permit continued service of many Navy ships and only postpone decisions on a satisf location. As a result of these considerations, this alternative was eliminated fro

3.7 COMPARISON OF ALTERNATIVES

This section provides a comparison of the alternatives as they relate to the a under the Naval Nuclear Propulsion Program (NNPP). The comparison focuses on those projected to have the most significant impacts. As discussed in Sections 5.1 throu projected for most impact categories are very small or nonexistent. Such impact ca use, cultural resources, aesthetic and scenic resources, geology, water resources, noise, utilities and energy, waste management, and irreversible and irretrievable c Consequently, the impacts in these areas provide no basis for distinguish-ing among alternatives.

It is important to note that in the No Action alternative and in two of the op ization alternative, examination of naval spent nuclear fuel would cease or be seri important scientific information would be lost. Beyond this issue, the principal d alternatives occur in the categories of occupational and public health and safety (operations and accidents for facility operations and transportation operations), cu socioeconomics. Even in these areas, the overall impacts and the differences are s few unavoidable adverse effects that remain after the years of experience have been operations and the necessary mitigative measures have been applied.

DOE has adopted two quantitative safety goals to limit the risks of fatalities nuclear operations. The goals are:

- The risk to an average individual in the vicinity of a DOE nuclear facility that might result from accidents should not exceed one-tenth of one percent sum of prompt fatalities resulting from other accidents to which members of are generally exposed.

- The risk to the population in the area of a DOE nuclear facility for cancer result from operations should not exceed one-tenth of one percent (0.1%) of cancer fatality risks resulting from all other causes.

A comparison of the calculated risks associated with each of the Naval Nuclear Program alternatives indicates that the implementation of any of these alternatives the DOE facility safety goals.

3.7.1 Summary of Impacts

The most salient of the environmental impacts are summarized below. These imp presented under two categories:

- Human Health Impacts
- Other Impacts.

3.7.1.1 Human Health Impacts. Table 3-1 provides an overall comparison of the alternatives. This

comparison is presented in terms of the increase in the number of cancer fatalities general population for any given year after an alternative has been implemented and level of operation. This increase in the risk of developing fatal cancers is broke risk increase is associated with normal operations, the highest risk facility accid operations. For example, it is calculated that for the 1992/1993 Planning Basis al spent nuclear fuel would continue to be received, examined, and prepared for storag there would be:

- an increase of about 0.0000009 cancer fatalities per year for the general p INEL (i.e., about one additional cancer fatality nationwide in 1,000,000 ye 116,000 people who live within a 50-mile radius of INEL) due to normal ECF

- an increase of 0.000026 cancer fatalities per year for the general populati transportation routes due to normal transportation of naval spent nuclear f shipyards to the ECF.

- an increase of 0.00000017 cancer fatalities per year for the general popul facility accident with the highest risk (in this case it would be the accid water pool used for examination and storage of naval spent nuclear fuel).

Table 3-1. Risk (fatal cancers to the general population per year) by alte

Alternative	Normal Operations Risk Storage at NNPP Sites	Examination	Transportation Incident-Free Risk
1. No Action	2.2 x 10-5	N/A	4.3 x 10-6
2. Decentralization			
- No Exam	2.2 x 10-5	N/A	4.3 x 10-6
- Dry Storage	3.4 x 10-4	N/A	4.3 x 10-6
- Water Pool Storage			
- Limited Exam	2.2 x 10-5	6.5 x 10-5	1.1 x 10-5
	2.7 x 10-4	6.5 x 10-5	1.1 x 10-5
- Dry Storage			
- Water Pool Storage			
	2.2 x 10-5	8.5 x 10-7	4.1 x 10-5
- Full Exam	3.4 x 10-4	8.5 x 10-7	4.1 x 10-5
- Dry Storage			
- Water Pool Storage			
3. 1992/1993 Planning Basis(1)		8.5 x 10-7	2.6 x 10-5
4/5. Regionalization or Centralization(1)(2)			
	-	8.5 x 10-7	2.6 x 10-5
- INEL	-	4.0 x 10-6	6.0 x 10-5
- Hanford	-	1.8 x 10-5	1.5 x 10-4
- S. River	-	9.0 x 10-8	7.5 x 10-5
- NTS	-	5.0 x 10-5	1.4 x 10-4
- ORR			

(1) For alternatives 3, 4, and 5, the risk due to storage of naval spent nuclear fu this evaluation. It is included in the evaluation of the individual DOE sites.

(2) Both the Regionalization and Centralization alternatives would locate an ECF at sites. For this reason, the risk is the same for these alternatives.

(3) Some of the alternatives would involve a limited number of shipments by sea fro Sound. Even though the probability of a severe accident involving a shipboard radioactivity would be less than 10(-7) per year, the risk of such an accident discussed in Attachment F, Section F.1.4.4. The risk of such an accident has b x 10(-6) per year.

- an increase of 0.000001 cancer fatalities per year for the general populatio

transportation accidents.

Table 3-1 shows that the cancer risks due to Naval Nuclear Propulsion Program ac the alternatives are small. In all of these cases, thousands of years of repetitio would be required before a single additional fatal cancer would occur. Risk is def probability of occurrence of an event leading to radiation exposure and the level o radiation in terms of the increased number of fatal cancers that would result. A d points in the development of an estimate of cancer fatalities is provided below; mo of the parameters, analyses, and results are provided in Attachments A and F.

The increased number of fatal cancers is based on the calculated increase in exp would be seen by the general public as a result of each of the alternatives. The a a member of the population in the U.S. from background radiation is approximately 0 millirem). The average annual collective exposure to all of the population in the radiation is approximately 69 million person-rem. When people are exposed to addit number of additional radiation-induced cancer and other health effects needs to be estimate for radiation-induced cancer can be briefly summarized as follows:

- In a typical group of 10,000 persons who do not work with radioactive mate about 2000 (20 percent) will normally die of cancer.

- If each of the 10,000 persons received an additional 1 rem of radiation ex person-rem) in their lifetime, then an estimated 5 additional cancer death might occur.

- Therefore, the likelihood of a person contracting fatal cancer during thei increased nominally from 20 percent to 20.05 percent by exposure to 1 addi radiation.

The "factor" for such a person to contract a fatal cancer, considering all pos expressed as 0.0005 fatal cancers per rem of exposure. This is mathematically equi cancers from 10,000 person-rem of collective exposure to a large group of persons.

Further, a collective exposure of 10,000 person-rem would be expected to produ approximately 7.3 health detriments due to non-fatal and fatal cancers and severe g are two of the factors for the health detriments that may result from exposure to a results in this section are given in terms of fatal cancers. The total number of h 7.3/5.0 or 1.46 times these values.

The number of detrimental health effects which might result from exposure of a people to low levels of radiation has been the subject of debate for many years. T effects performed in this Environmental Impact Statement use the relation recommend International Commission on Radiological Protection because it is well-documented a the council. It also is widely accepted by the scientific community as representin produces estimates of health effects that will not be exceeded. However, there are exposure to low levels of radiation produces more health effects than would be esti International Commission on Radiological Protection relation. On the other hand, a researchers believe that the International Commission on Radiological Protection re number of detrimental health effects produced by low levels of radiation. In fact, from the levels of radiation resulting from routine naval spent nuclear fuel manage excluded (CIRRPC 1992). Clearly, using a relation developed by one or the other of produce a larger or smaller estimate of the number of health effects than the value statement. All of the results of analyses of normal operations and hypothetical ac include the calculated exposure in addition to the number of health effects in orde calculations using any relation between radiation exposure and health effects judge

The risks associated with all of the alternatives are low compared to the risk life. The risks of normal operations may be placed in perspective by considering o encountered risks. For example, the average American is exposed to approximately 0 from the radioactivity released from combustion of fossil fuels (NCRP 1987), which risk of an average individual dying from cancer of about 1 chance in 50,000. As a naturally occurring radioactive materials in fertilizer used to produce food crops millirem per year to an average American's exposure to radiation (NCRP 1987). This death from cancer between 1 chance in 12,500 and 1 chance in 25,000.

A frame of reference for the risks from accidents associated with spent nuclea alternatives can be developed by comparing them to the risks of death from other ac example, the risk of death in a motor vehicle accident is about 1 chance in 80 (NSC risk of death for the average American from fires is approximately 1 chance in 500 from accidental poisoning is about 1 chance in 1000 (NNPP 1994b).

It must be remembered that no member of the public will receive as much as one of a rem from 40 years of the normal operations associated with any of the alternat Examining the results shown in the tables of radiation exposures (Attachments A and principal source of the difference in the exposures associated with radiation and r released from normal operations and from hypothetical accidents for the alternative people who live in the vicinity of the alternative sites and where they live relati When the emissions from the sources are essentially the same, the resulting impacts size of the surrounding population, on the way the population is distributed around distances and directions from the particular facility, and on the characteristics o

3.7.1.2 Other Impacts. The principal impact in the employment portion of the socioeconomics

category is the number of jobs created by the construction and operation of a new (The magnitude of the effect is relatively small in populations of the sizes under c those people who benefit either directly or indirectly from the jobs. The creation negative impacts: the jobs may be created at a distant location, or the jobs creat small but adverse effect on the local community in terms of additional people and a additional public services.

The cost of operating and constructing new facilities or modifying existing on necessary capabilities for handling and storing spent fuel is an important economic the site affected and the alternative under consideration, the cost may be as much construction and 40 years of operation.

In the unlikely event of a serious accident involving naval spent nuclear fuel only about 210 acres of land would be affected for the most severe case (this is de Attachment F), and in the other accidents analyzed, smaller areas of land would be area would require decontamination, and during this cleanup access controls would h However, due to the limited land area affected, it is judged that these restriction and the impact on issues such as economics, treaty rights, tribal resources, ecolog relatively small and limited in time. The remediation actions would be simpler in areas; however, provided that prudent controls and remediation operations were prom the affected land and buildings could be recovered in either case. As demonstrated in Attachments A and F and summarized above, the human health effects are not large wildlife and other biota would also not be large, partly due to the limited area af

Examination of naval spent nuclear fuel and irradiated test specimens has been ECF at INEL since 1957. This program has made and continues to make important cont safety, cost, and operational performance of naval nuclear propulsion plants. Howe alternative and two of the Decentralization alternatives would result in substantia program. The Centralization, Regionalization, 1992/1993 Planning Basis, and the De Examination alternatives would maintain the needed examination capability.

The safety of operating naval reactor plants has benefitted directly from the programs. The result has been the construction of rugged reactor cores that are mo conditions (such as corrosion, high temperatures, and intense radiation) without re products. The Naval Nuclear Propulsion Program's commitment to improved safety con by two major issues:

- Protection of the Environment - In more than 40 years of operating and mai in very demanding conditions, the Naval Nuclear Propulsion Program has nev a reactor accident, criticality accident, or a release of radioactivity th effect on the environment.

- Personnel Safety - The importance of ensuring the integrity of the fuel is fact that the sailors onboard the ships live in very close proximity to an hours a day. Any release of radioactivity from the fuel into the reactor increase the radiation exposure of the ship's crew.

Since the inception of the Naval Nuclear Propulsion Program, the useful lifeti has been extended by more than a factor of 10. The examination programs at ECF pla making this improvement possible. As a result of the extended reactor lifetimes, b refueling costs and spent nuclear fuel storage costs have been saved. In addition, permit the ships to spend a larger fraction of their lifetime on sea duty rather th saving costs by reducing the number of ships required. Further reductions in nucle costs are being pursued through improvements in many areas of nuclear fuel systems.

The improvements in nuclear fuel performance that have been developed in part knowledge gained from the examination program have contributed to improved ship ope characteristics. Major improvements have been made in power density, maneuverabili

simplicity. These improvements translate into important tactical advantages for ou this advantage with ever improving technologies elsewhere in the world is vitally i our sailors and to protecting our national interests.

In the final analysis, the most important differences are:

- The transfer of jobs associated with the Expended Core Facility among the considered for locating the examination facility, or the outright loss of

- The costs if new facilities are required.

- The loss or maintenance of naval spent nuclear fuel examination capability

Sections 3.7.2, 3.7.3, and 3.7.4 provide additional summary information on the impact.

3.7.2 Impacts Due to Normal Operations

During normal operations, there are public impacts due to direct radiation or radioactive materials to the environment. These impacts are presented in the form fatalities due to exposure to the small amounts of radiation involved or radioactiv important to emphasize that these cancer fatalities are calculated results rather t fatalities. This is because the expected number of such fatalities during normal o be unmeasurable and indistinguishable relative to the larger number of such deaths occurring conditions and other man-made effects not related to naval spent fuel ope meant to trivialize the importance of radiation-induced cancer fatalities but, rath in perspective.

Table 3-2 presents a summary comparison of the calculational prediction of the cancers per year that might be expected due to normal operations within each of the consideration for naval spent nuclear fuel handling. This table provides the calcu population. The impacts to selected individuals including workers are provided in Table 3-2 reflects the two possibilities (water pool and dry storage) for storing n **the Navy sites.** In the case of dry storage at Navy sites, the impact from normal o calculated levels of direct radiation from storage casks at the shipyards. The env were used to calculate the water pool values in the table are based on measured rel Expended Core Facility at the INEL. Also, the way in which direct radiation or env impact the population would be a function of the population distribution and the me present at the release location. To account for these differences, actual data on meteorology for the various specific sites were used. The data in Table 3-2 are fo future when the situation has stabilized at each location (that is, capabilities co for the stated alternative have been achieved and are in operation at a facility at

All alternatives have some estimated number of fatalities, albeit a very small estimated number of cancer fatalities is associated with the 1992/1993 Planning Bas INEL, and Centralization - INEL alternatives. The largest single estimate for the fatalities is only 0.00038 per year for the Decentralization - Full Examination alt view this is that if this alternative is selected and operations continue for

Table 3-2. Fatal cancers per year to the general population from normal operations

Alternative	INEL	Puget Sound	Pearl Harbor	Portsmouth	Nor
1. No Action	-	1.2 x 10-6	9.3 x 10-9	2.3 x 10-7	2.1 5
2. Decentraliza-tion					
- No Exam - Dry Storage - Water Pool Storage	- - - -	1.2 x 10-6 6.5 x 10-5	9.3 x 10-9 7.0 x 10-5	2.3 x 10-7 2.3 x 10-5	2.1 5 1.4 4
- Limited Exam		6.6 x 10-5	9.3 x 10-9	2.3 x 10-7	2.1 5

- Dry Storage	8.5 x 10-7	6.5 x 10-5	7.0 x 10-5	2.3 x 10-5	1.4 4
- Water Pool Storage	8.5 x 10-7				
- Full Exam		1.2 x 10-6	9.3 x 10-9	2.3 x 10-7	2.1 5
- Dry Storage		6.5 x 10-5	7.0 x 10-5	2.3 x 10-5	1.4 4
- Water Pool Storage					

Alternative	INEL	Hanford	Savannah River	NTS	ORR
3. 1992/1993 Planning Basis	8.5 x 10-7	-	-	-	-
4/5. Regionalization or Centralization					
- INEL	8.5 x 10-7	-	-	-	-
- Hanford	-	4.0 x 10-6	-	-	-
- S. River	-	-	1.8 x 10-5	-	-
- NTS	-	-	-	9.0 x 10-8	-
- ORR	-	-	-	-	5.0 5

10,000 years, between three and four extra cancer fatalities might be expected in that entire time period due to normal operations.

3.7.3 Impacts Due to the Most Severe Accidents

Accidents may occur during operation of naval spent nuclear fuel handling and st during transportation of naval spent nuclear fuel. Specific accidents considered t other reasonably foreseeable accidents were analyzed to determine their potential i population. For sites with spent fuel storage in water pools, the facility acciden water pool or an accidental criticality since these produced the greatest consequen spent fuel storage, the facility accident analyzed was an airplane crash if its pro 1 x 10-7 per year (1 chance in 10 million per year); otherwise, a wind-driven missi analyzed. Details of analyses of foreseeable accidents which might occur during fu are described in Attachment F. Details of the transportation accident analyses are A.

In Table 3-3, the potential impacts of facility and transportation accidents wit consequences are expressed in terms of fatal cancers per accident. These are calcu relation that 0.0005 cancer fatalities could occur for each person-rem of exposure population. The impacts are based on hypothetical occurrences of the accidents and low probabilities of the accidents actually occurring. For each alternative, the m facility or transportation accident is listed rather than a total of the individual that only one severe accident would occur at one time.

For facility accidents, the greatest potential impact is associated with dry spe Pearl Harbor Naval Shipyard. This is due to an airplane crash into a dry storage c transportation accidents, the risks vary with the distances to be traveled, being l the Decentralization - No Examination alternatives which involve only minimal trans storage.

Table 3-4 lists the most severe risks (probability of occurrence times the numbe facility accidents in terms of potential cancer fatalities per year.

Table 3-3. Most severe consequences (fatal cancers to the general population) from

Alternative	INEL(1)	Puget Sound(2)	Pearl Harbor(3)	Por
1. No Action*	-	0.017	26	9.0
2. Decentralization				

- No Exam	-	0.-	26	9.0
- Dry Storage	-	017	1.1	0.3
- Water Pool Storage		0.51		
	-		26	9.0
	-	0.017	1.1	0.3
- Limited Exam		0.51		
- Dry Storage	0.017		26	9.0
- Water Pool Storage	0.017	0.0-17 0.51	1.1	0.3
- Full Exam				
- Dry Storage				
- Water Pool Storage				
Alternative	INEL(1)	Hanford	Savannah	NTS
3. 1992/1993 Planning Basis	0.017	-	-	-
4/5. Regionalization or Centralization	0.017	-	-	-
	-	0.047	-	-
- INEL	-	-	4.8	-
- Hanford	-	-	-	0.1
- S. River	-	-	-	-
- NTS				
- ORR				

\+ Based on accidents with a probability of occurrence of 1 x 10-7 or greater.
* Dry storage is the only option considered under the No Action alternative.
(1) The most severe accident is a drained water pool.
(2) The most severe accident involving storage or examination in a water pool
For the dry storage alternatives, the most severe accident is mechanical d
The limited exam - dry storage option at Puget Sound also includes examina
shown for this option are due to accidents occurring during dry storage op
(3) The most severe accident is from a plane crash for dry storage and a drain
(4) The most severe accident is from a plane crash.
(5) Some of the alternatives would involve a limited number of shipments by se
Even though the probability of a severe accident involving a shipboard fir
less than 10-7 per year, the risk of such an accident has been calculated
Section F.1.4.4. The most severe consequences of such an accident have be

Table 3-4. Most severe risk to the general population fr

Alternative	INEL(1)	Puget Sound(2)	Pearl Harbor(3)	Portsmouth(3)
1. No Action	-	1.7 x 10-7	2.6 x 10-4	9.0 x 10-7
2. Decentralization				
- No Exam	-	1.7 x	2.6 x 10-4	9.0 x 10-7
- Dry Storage	-	10-7	1.1 x 10-5	3.4 x 10-6
- Water Pool Storage		5.1 x 10-6		
	-		2.6 x 10-4	9.0 x 10-7
	-		1.1 x 10-5	3.4 x 10-6
- Limited Exam		1.7 x 10-7		
- Dry Storage	1.7 x 10-7	5.1 x 10-6	2.6 x 10-4	9.0 x 10-7
- Water Pool Storage	1.7 x 10-7		1.1 x 10-5	3.4 x 10-6
- Full Exam		1.7 x 10-7		
- Dry Storage		5.1 x		

- Water Pool Storage		10-6		

Alternative	INEL(1)	Hanford(1)	Savannah River(4)	NTS(4)
3. 1992/1993 Planning Basis	1.7 x 10-7	-	-	-
4/5. Regionalization or Centralization				
	1.7 x	-	-	-
- INEL	10-7	4.7 x	-	-
- Hanford	-	10-7	9.6 x 10-6	-
- S. River	-	-	-	7.2 x 10-8
- NTS	-	-	-	-
- ORR	-	-		

* Dry storage is the only option considered under the No Action alternative.
(1) The most severe accident is from a drained water pool.
(2) The most severe accident involving storage or examination in a water pool i For the dry storage alternatives, the most severe accident is mechanical da missile. The limited exam - dry storage option at Puget Sound also include pool; the risks shown for this option are due to accidents occurring during
(3) The most severe accident is from a plane crash for dry storage and a draine pool storage.
(4) The most severe accident is from a plane crash.

3.7.4 Cumulative, Socioeconomic, and Cost Impacts

A summary of the estimated cumulative impacts from the radiological operations each of the alternatives evaluated in detail is presented in Table 3-5. It is base of operation by 1995 for any given alternative. The impacts are expressed as fatal population within 80 kilometers (50 miles) and apply to the reasonably foreseeable period ranging from 1995 to 2035. The impacts were based on annual results for nor multiplied by 40. The impacts due to both wet and dry storage are presented. For storage at Navy shipyards and prototypes, the sum over all the Navy sites was used comparison for the same amount of fuel. The total for each alternative was then ca the fatal cancers for transportation, receipt and examination operations, and stora the impacts for all alternatives would be negligible.

The historical impact of transportation and ECF operations for the period rang 1995 was calculated to be about 0.001 fatal cancers. This is the total number of f estimated among the several million people along transportation routes coupled with located within 50 miles of INEL. This estimate was based on the calculated inciden results from Attachment A, and the calculated results of normal operations and stor The calculated results from Attachment F were adjusted from an annual basis (1995) by multiplying by 38 years and by a factor of 1.7 to take into consideration the va ships and operations. No extra factor was applied to the estimates of the historic impact to account for the vulnerabilities that might be associated with facility or naval spent nuclear fuel is very strong and has very high integrity (Section 2.2), has disclosed no important vulnerability. The factor of 1.7 represents the ratio o radiation exposures received by all military and civilian personnel in the Naval Nu Program during the historical period (NNPP 1994a). In the case of the Limited Exam the analysis includes both the material shipped to Puget Sound for examination and material stored there and at other sites from defuelings without examination.

Table 3-6 presents the cumulative impact from the radiological operations to a maximally exposed worker and a hypothetical maximally exposed individual at the sit impacts are presented in terms of the likelihood of fatal cancer for the affected i

Table 3-5. Summary of cumulative impacts (fatal cancers to the general population)

	Fatal Cancers (1995-2035)1			
Alternative	Transport2	Exam Operations3	Storage3 (Dry) [Wet]	Total (Dry) [Wet]
1. No Action	1.7 x 10-4	0	(9.0 x 10-4)**	(0.0011)**
2. Decentralization				
- No Exam	1.7 x 10-4	0	(9.0 x 10-4)	(0.0011)

			[0.014]	[0.014]
- Limited Exam	4.2 x 10-4	0.0026	(9.0 x 10-4)	(0.0039)
			[0.011]	[0.014]
- Full Exam	0.0017	3.4 x 10-5	(9.0 x 10-4)	(0.0026)
			[0.014]	[0.015]
3. 1992/1993 Planning Basis	0.0011	3.4 x 10-5	*	0.0011
4/5. Regionalization or Centralization				
- INEL	0.0011	3.4 x 10-5	*	0.0011
- Hanford	0.0024	1.6 x 10-4	*	0.0026
- Hanford/FMEF	0.0024	1.6 x 10-4	*	0.0026
- S. River	0.0060	7.2 x 10-4	*	0.0067
- S. River/Barnwell Plant	0.0060	7.2 x 10-4	*	0.0067
- Nevada Test Site	0.0030	3.6 x 10-6	*	0.0030
- Oak Ridge Reservation	0.0055	0.0020	*	0.0075

Notes:
1 Fatal cancers for 1958-1995 were calculated to be about 0.001 for transport and E ons.
Fatal cancers were calculated at 5.0 x 10-4 fatal cancers per person-rem.
2 Values from Attachment A.
3 Values from Attachment F.
*DOE storage, not NNPP.
**There is no wet storage under the No Action alternative.

Table 3-6. Likelihood of fatal cancer from cumulative radiation dose.

	Maximally Exposed Worker		Maximally Exposed Individual	
	Total Radiation Dose (rem)	Likelihood of Fatal Cancer	Total Radiation Dose (rem)	Likelihood of Fatal Cancer
1. No Action	4.7	0.0019	0.12	6.0 x 10-5
2. Decentralization				
- No Exam	4.7	0.0019	0.12	6.0 x 10-5
- Limited Exam	4.7	0.0019	0.12	6.0 x 10-5
- Full Exam	4.7	0.0019	0.12	6.0 x 10-5
3. 1992/1993 Planning Basis	3.4	0.0014	1.0 x 10-5	5.0 x 10-9
4/5. Regionalization or Centralization				
- INEL	3.4	0.0014	1.0 x 10-5	5.0 x 10-9
- Hanford	3.4	0.0014	9.6 x 10-6	4.8 x 10-9
- Hanford/FMEF	3.4	0.0014	1.8 x 10-5	9.0 x 10-9
- S. River	3.4	0.0014	1.9 x 10-5	9.5 x 10-9
- S. River/Barnwell Plant	3.4	0.0014	1.5 x 10-4	7.5 x 10-8
- Nevada Test Site	3.4	0.0014	1.4 x 10-5	6.8 x 10-9
- Oak Ridge Reservation	3.4	0.0014	0.0040	2.0 x 10-6

values were determined based on a projected 40-year exposure at the location of the The radiological doses for workers represent the largest average dose from the part in an alternative. The average radiation dose for workers was selected by using th shipyard or DOE site radiation exposure summaries (NNPP 1994b; NNPP 1994c). The ra for maximum off-site individuals are the largest values calculated for a person loc closest to any facility involved under an alternative. These doses are based on th individuals presented in Attachment F.

Employment impacts were determined from the nature of each alternative based o at INEL. Table 3-7 presents a summary of potential socioeconomic impacts at each o each of the alternatives evaluated in detail. The results indicate that as many as several hundred shorter-term construction jobs might be lost or gained at an affect alternative selected.

Cost impacts were estimated from the nature of each alternative based on exper **Table 3-8 presents a summary of the cost impacts for each of the alternatives evalu**

summary provides the costs which would be incurred from construction as well as tra operation costs over the next 40 years. In all alternatives, there would be large billion. For three of the alternatives involving continued operation of the ECF at Planning Basis, Regionalization at INEL, and Centralization at INEL), there would b construction cost impact; however, the cost of continued ECF operation for an addit be $2.6 billion. The cost values considered in preparing Table 3-8 include facilit ranging from zero for alternatives involving no new facilities to a high of $800 mi a new facility with full examination capability. The transportation costs depend o logistics and range from a low of $10 million to a high of $110 million. Fuel stor from a low of zero for those alternatives utilizing water pool storage to a high of containers on railcars for the No Action alternative. Also included are operating ranging up to $2.6 billion for the various alternatives, and Idaho ECF shutdown cos in which the present ECF is shut down.

Table 3-7. Summary of potential socioeconomic impacts.

	Impacts Associated with the Affected Sit			
Alternative	INEL	Hanford	Savannah River	Nevada Test Site
1. No Action	Lose 500 jobs	No change	No change	No change
2. Decentralization				
- No Exam	Lose 500 jobs	No change	No change	No change
- Limited Exam at Puget	Lose 500 jobs	No change	No change	No change
- Full Exam	No change -200 jobs	No change	No change	No change
3. 1992/1993 Planning Basis	No change	No change	No change	No change
4/5. Regionalization or				
- INEL	No change	No change	No change	No change
- Hanford	Lose 500 jobs	Gain 500 perm. jobs and some const. jobs	No change	No change
- S. River	Lose 500 jobs	No change	Gain 500 perm. jobs and some const. jobs	No change
- Nevada Test Site	Lose 500 jobs	No change	No change	Gain 500 perm. jobs and some const. jobs
- Oak Ridge Reservation	Lose 500 jobs	No change	No change	No change

Table 3-8. Summary of cost impacts over 40 years.

	Cost ($ Billions)
No Action	3.6
Decentralization	

- No Exam	1.5 - 3.4*
- Limited Exam	1.8 - 3.7*
- Full Exam	3.8 - 5.7*
1992/1993 Planning Basis	2.6
Regionalization or Centralization	
- INEL	2.6
- Hanford	3.4
- Savannah River	3.5
- Nevada Test Site	3.5
- Oak Ridge Reservation	3.5

* The cost varies under this alternative depending on the mode of storage. The mos options are those that use shipping containers for storage; the least expensive options are those that use immobile dry storage containers.

The largest cost ($3.8 to $5.7 billion) would be needed for new storage faciliti addition to the ECF operational costs under the Decentralization - Full Examination Approximately $0.8 billion would be needed for the construction of new receipt, han examination facilities at the alternative site if a Regionalization or Centralizati INEL were selected, thereby resulting in a cost of $3.5 billion over 40 years of op than $800 million would be needed for modifications to existing facilities if eithe Hanford or Savannah River were selected. Also, if the alternative involving the Ba Plant at Savannah River were selected, additional funds would be needed to buy the as to modify it to meet the Program needs.

A hidden cost associated with the No Action alternative and two of the Decentr alternatives is the loss or major reduction in the capability to examine naval spen examinations of naval spent nuclear fuel at the Expended Core Facility at INEL have 1957. The examinations are a critical aspect of the Naval Nuclear Propulsion Progr fuel research and development program. The information derived from the examinatio engineering data on nuclear reactor environments, material behavior, and design per contribute to the Naval Nuclear Propulsion Program in two very significant ways.

First, this information is used to support the design of new reactors having e example, such examinations have contributed to extending the life of naval fuel fro reactor core in USS NAUTILUS to over 20 years for the latest nuclear-powered warshi goal is to develop naval nuclear fuel that lasts the life of the ship; this would m be needed. Longer-lived fuel allows fewer refuelings, saves money in the costs of work on ships, makes ships available for longer periods of service, and creates les Second, information from these examinations has supported the operation of existing providing confirmation of proper design and allowing the fuel they contain to be us possible time.

Thus, the examinations of naval spent nuclear fuel are an integral part of the nuclear safety of the Naval Nuclear Propulsion Program. In over 4500 reactor-years than 300 refuelings and defuelings of naval reactors, there has never been a nuclea criticality accident, or any release of radioactivity that has had a significant ef Preventing release of radioactivity from the fuel is extremely important to the saf who operate the nuclear-powered warships since they must live aboard ship in close reactor 24 hours a day.

While it is difficult to quantify the benefits of an outstanding safety record yields an understandable economic gain. The gain is in a reduction in the number o must be procured and in the number of refuelings. Another gain is the increased on nuclear-powered warships which is reflected in a decreased number of ships required by achieving life-of-the-ship fuel and thus eliminating the need for any refuelings approximately $5 billion will accrue for a force structure of less than 100 ships. ment in life from 2 years to 20 years has already avoided the need to perform 15 re ship and reduced that to a single refueling.

3.8 TRANSITION PERIOD

A transition period would be required before any of the alternatives considere nuclear fuel management could be fully implemented, except for those which would re practice of shipping naval spent nuclear fuel to the Expended Core Facility at INEL to the Idaho Chemical Processing Plant for storage. This transition period would b necessary additional funding and to build the necessary facilities and equipment.

For example, if the Record of Decision were to identify that the alternative o

Savannah River had been selected, a new Expended Core Facility would have to be fun Savannah River Site before shipments of naval spent nuclear fuel from shipyards cou Savannah River. Similarly, if the No Action alternative were selected, additional would have to be built since the available shipping containers for naval spent nucl and waiting at the shipyards in June 1995.

Impacts of all alternatives evaluated for naval spent nuclear fuel management impacts of combinations of alternatives would also be low. The Environmental Impac on impacts at the time of full implementation in order to simplify the discussion a for the impacts. By doing so, it assures that impacts greater than those analyzed alternative were used for a small fraction of the 40-year period followed by a shif the remainder of the 40 years. This section discusses a transition period which is rapid but practical shift from the situation in June 1995 to full implementation of selected in the Record of Decision. This transition period would be about the same alternative.

It is expected that the transition period would consist of 3 years of shipment the shipyards or prototypes to ECF at INEL beginning with issue of the Record of De and include approximately 80 total shipments. This would result in shipping to INE had been filled and at the shipyards at that time. Many of the containers would th and returned to the shipyard where they would be reloaded. During this 3-year peri containers would make a second trip to ECF at INEL for unloading after being return After these 3 years of shipments, no further shipments to INEL would be made, and t Facility at INEL would be shut down. The shipping containers would then be refille years, but kept at the shipyards or shipped to the location of the new examination

If an alternative which does not continue storage of naval spent nuclear fuel selected, procurement and contract actions to implement the course of action select Decision would be initiated during these two 3-year periods. In accordance with th selected in the Record of Decision, additional shipping containers or immobile dry built or construction of water pools would be initiated at shipyards or a new ECF a started. It is assumed that these procurements or construction would have proceede shift to the selected option would be in full swing at this time.

3.9 PREFERRED ALTERNATIVE FOR NAVAL SPENT NUCLEAR FUEL

The specific elements discussed in each category of environmental impacts have determine the Navy's preferred alternative for managing naval spent nuclear fuel un disposition become available. The costs and mission impacts have also been conside preferred alternative.

Environmental Impacts: This Environmental Impact Statement (EIS) documents th environmental impacts of each alternative for naval spent nuclear fuel management. environmental impacts under normal operations and hypothetical accident conditions water quality and wetlands, air quality, land use, and public health. This EIS con accident initiators, such as natural hazards, transportation, and fuel handling.

The analyses demonstrate that the environmental impacts of implementing any of would be very small for both normal operations and accident conditions. All altern radiological impacts well below established DOE safety performance goals (SEN-35-91 one percent of the risk of fatal cancers from all sources (including natural causes of the alternatives in non-radiological areas would also be extremely small. The a provide a basis to distinguish among the alternatives in most of these areas.

Socioeconomic Impacts: The socioeconomic impact of implementing each of the a would differ somewhat. The primary determinant of socioeconomic impact of the alte is employment. Total nation-wide employment levels would not vary significantly am managing naval spent nuclear fuel, and therefore do not seem to provide a basis to alternatives. The maximum impact on existing employment levels would arise from al development of new naval spent nuclear fuel examination capability at a DOE facilit while terminating these activities at INEL. Resuming current practices of transpor fuel to the ECF at INEL for examination followed by transfer to the DOE for storage minimum disruption of employment levels.

Mission Impacts: Two important components of Naval Nuclear Propulsion Program are the safe management of naval spent nuclear fuel and support of the Navy's fleet warships. Based on the analyses in this EIS, all alternatives considered would all spent nuclear fuel until permanent disposition. However, some of the alternatives levels of Fleet support. Alternatives which limit or terminate naval spent nuclear severely impact ongoing research and development work. Naval spent nuclear fuel ex

used to confirm the adequacy of design features, explore material performance, and computer predictions of fuel performance. This information contributes to design a new naval reactor cores as well as understanding of operating ships. Each spent na own unique manufacturing and operating history. Consequently, examination of each provides an opportunity to obtain new information relevant to reactor core performa Section 2.4.1 of this Appendix, the technical feedback obtained through this examin essential to extending the lifetime of naval reactor cores and assuring their opera important to understand that because of their long service lives, the first of the used in LOS ANGELES Class submarines are just now being removed from operating reac becoming available for examination. The first cores from NIMITZ Class aircraft car submarines have yet to be removed. These cores are the basis for all of the curren the starting point for new designs. Of the alternatives allowing full examination Savannah River Site, Oak Ridge Reservation, or Nevada Test Site, examination at the the smallest mission impact due to the presence of existing facilities and equipmen work, and the presence of a highly skilled work force, all of which would need to b reassembled if a new examination site were selected.

Cost Impacts: There are large differences in the costs associated with all al additional costs would be associated with continuing the historic practice of shipp fuel to INEL for examination, followed by transfer to the DOE for storage pending p Alternatives involving developing facilities for storage of naval spent nuclear fue developing examination facilities at a DOE site other than INEL would involve billi additional costs, relative to historic practices, without any discernible improveme environmental impacts.

Based on the analyses presented in this EIS, the Navy prefers an alternative w historic, technically sound, and safe practice of conducting refueling and defuelin warships and prototypes as planned, transporting naval spent nuclear fuel to the Ex the INEL for full inspection and examination, and transferring naval spent nuclear storage at that site. As summarized above, this preferred alternative avoids disru development work, minimizes disruption to existing employment levels and infrastruc lowest cost, and does not involve appreciable environmental impact. This preferred accommodated under the 1992/1993 Planning Basis, Regionalization, or Centralization

3.10 REFERENCES

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4. AFFECTED ENVIRONMENT

4.1 NAVY AND PROTOTYPE SITES FOR NAVAL SPENT NUCLEAR

FUEL

4.1.1 PUGET SOUND NAVAL SHIPYARD: BREMERTON,

WASHINGTON

4.1.1.1 Overview

The Puget Sound region lies in the northwest corner of Washington State as sho 4.1.1-1. The region is defined by the Olympic Mountain Range to the west and the C Mountain Range to the east. The lowlands contrast dramatically with the mountains, with numerous channels, bays, and inlets on the inland sea that is Puget Sou Naval Shipyard is located inside the city limits of Bremerton, Washington at 47y 33 and 122y 38' 8" west longitude. Bremerton is located in Kitsap County on the Sincl Puget Sound west of Seattle and about 20 air miles northwest of Tacoma. Topography area is characterized by rolling hills with an elevation range from sea level to +2 sea level (msl) in West Bremerton and ranging up to y300 feet above msl in East Bre east of Port Washington Narrows). The predominant native vegetation in the area ar cedar, and hemlock. Within a distance of 25 to 40 miles in a westerly direction fr Olympic Mountains rise to elevations of 4,000 to 7,000 feet. The higher peaks are ered with snow most of the year and there are several glaciers on Mount Olympus (el easterly direction and within a distance of 60 miles, the Cascade Range rises to av 5,000 to 7,000 feet with snowcapped peaks in excess of 10,000 feet.

Puget Sound Naval Shipyard is the largest activity of the Bremerton Naval Com also includes the Fleet and Industrial Supply Center, Puget Sound and Naval Sea Sys Detachment, and Planning and Engineering for Repair/Alteration of Aircraft Carriers activities include Naval Inactive Ship Maintenance Facility, Naval Reserve Center, Printing Service. Figure 4.1.1-2 provides a shipyard vicinity map, and Figure 4.1. Puget Sound Naval Shipyard.

4.1.1.2 Land Use

Kitsap County has historically been a semi-rural county. Roughly 80 to 85 per County's total area is either forest, farmland, or undeveloped. The city of Bremer surrounding vicinity is the largest population and economic center in the county an lower percentage of agriculture and undeveloped land. Most development in Kitsap C clustered around the commercial nodes of Bremerton, Port Orchard, Bainbridge Island Poulsbo, Silverdale, and Gorst, and near the shorelines.

The second largest land use category is residential, which is further broken medium density housing. More land area is devoted to single-family (low density) r multi-family (medium density) development in this area.

Other land use delineations are parks and open space; commercial, which inclu mining; and much of the Navy buildings. The nearby land uses are typical of an are moderate intensity. The area contains residential, commercial, industrial, educati recreational facilities. The local waters support recreational and commercial acti regularly scheduled ferry traffic.

Bremerton Naval Complex includes a total of approximately 1,347 acres consist and submerged lands. Puget Sound Naval Shipyard has 327 acres of upland and is hig Puget Sound Naval Shipyard also owns about 338 acres of submerged tidelands. The w dock area is the high-security portion of the shipyard where most production takes production shops, administration, and some public works and supply functions. The the shipyard is the military support area which provides services to military perso housing, retail goods and services, recreation, counseling, dental care, and other The industrial support area in the southwestern portion of the shipyard includes se homeported ships and inactive fleet, the power plant, warehouses, steel yard, publi

Figure 4.1.1-1. Location of Puget Sound Naval Shipyard within Washington. Figure 4.1.1-2. Puget Sound Naval Shipyard vicinity map. Figure 4.1.1-3. Puget Sound Naval Shipyard site map.

4.1.1.3 Socioeconomics

Bremerton is the largest city within Kitsap County. The major population cen

County other than Bremerton include Port Orchard, Poulsbo, Silverdale, Bainbridge I Kingston. Kitsap County also has two reservations: the Port Madison Indian Reserv by the Suquamish Tribe, and the Port Gamble Indian Reservation governed by the S'Kl

The region surrounding the shipyard, within 50 miles, contains a population o 3 million. Figure 4.1.1-4 provides a population distribution rose centered on the covering a 50-mile radius. During 1989, Kitsap County ranked 7th as the most popul the state (Washington SESD 1990). According to the 1990 census, Kitsap County was growing county in the state with a 28.9% growth rate for the decade for a total pop 189,731. The most recent estimate (April 1992), puts Kitsap's population at 205,60 Regional Planning Council projects the number of inhabitants to reach 280,985 by th increase of 48.10% over the 1990 figure.

Kitsap County's economy is largely affected by the federal government. Gover Kitsap County's largest employment sector, with the federal government having the g As of 1993, Puget Sound Naval Shipyard was the largest employer in the county, empl 10,200 civilian personnel. In 1990, the government sector's share of county employ approximately 45 percent. The retail trade and services sectors are the county's n employers. Many of the service industries, such as the growing number of engineeri management firms, directly or indirectly support the military. By 1989, the servic for 21 percent of employment in the county and the retail trade sector accounted fo (Navy 1991a).

The majority of the labor force that would be employed at the shipyard for co operation of the naval spent nuclear fuel area would be expected to reside within a the shipyard. The calculated total population, labor force, and employment within base year (1995) are presented in Table 4.1.1-1. Projections of employment and pop years beyond 1995 have not been presented because, as discussed in Section 5, the n additional jobs that might be created at the shipyard under any alternative could b

Table 4.1.1-1. Regional employment factors at Puget Sound Naval Shipyard.

Regional Employment	Regional Labor Force	Regional Population
492,900	527,000	979,070

There are seven port districts in the county. The Port of Bremerton is the l Bremerton and Port Orchard within its boundaries. The Port of Bremerton owns Breme Airport, Olympic View Industrial Park, marinas in downtown Bremerton and Port Orcha First Street Dock in Bremerton. Kitsap County is governed by a Board of Commission divided into three districts. Bremerton is split between the three districts. Reg responsibility of the Kitsap Regional Planning Council, and the Puget Sound Regiona Council, which is made up of elected officials from King, Kitsap, Pierce, and Snoho cities, and from the Indian tribal councils. Land use outside the shipyard is regu Bremerton Comprehensive Plan and Zoning Ordinance. The Bremerton Area Council of Neighborhoods is made up of nine neighborhoods. The group was established to encou age citizen participation in Bremerton city planning (Navy 1991a).

Agencies responsible for environmental protection are the U.S. Army Corps of U.S. Coast Guard, the Environmental Protection Agency (EPA), and the United States Wildlife Service (USFWS). The Washington State Department of Ecology and the city are responsible for the Coastal Zone Management Plan. The Department of Natural Re jurisdiction over marine lands management, and the Department of Fisheries and Depa protect wildlife resources. Washington's system of freeways, highways, and ferries responsibility of the Washington State Department of Transportation. Historic pres for the state are administered by the Office of Archaeology and Historic Preservation.

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the Puget Sound Naval Shipyard, the population data provided in Figure 4.1.1-4.

Figure 4.1.1-4. 50-mile population distribution around Puget Sound Naval Shipyar

average within the 50-mile radius by more than 20 percentage points and populations more than 50 percent minority members. These populations have been identified foll approach developed by the Environmental Protection Agency which, for purposes of en justice evaluation, defines minority communities as those which have percentages of

than the average in the region analyzed (EPA 1994).

Figure 4.1.1-6 shows the locations of populations which have more than 25 per members living in poverty, reflecting a common definition of low-income communities The U. S. Census Bureau characterizes persons in poverty as those whose income is l "statistical poverty threshold." For the 1990 census, this threshold was based on $12,500 per household.

4.1.1.4 Cultural Resources

Until the mid 1880s, Kitsap County was inhabited by several Native American tr Salish language group who lived on the shores of Puget Sound. For about 100 years, settlement of the Suquamish Tribe lay along the west shore of Agate Passage.

Congressional funding in 1891 led to the purchase of 190 acres of land on Sin the construction of a dry dock, repair, and overhaul base for the U.S. Navy. This the Puget Sound Naval Station.

No prehistoric archaeological sites have been identified at the Puget Sound N yard. In addition, no submerged cultural resources have been recorded in the immedi shipyard. There are no Native American properties or ceremonial sites in the areas nuclear fuel would be stored.

There is one National Historic Landmark and four National Registered Historic within the shipyard. The east industrial portion of the shipyard was designated as Landmark in 1992 as a part of the "World War II in the Pacific" group and contains dry docks, and equipment that were used in World War II warship repairs. The four

Figure 4.1.1-5. Minority population distribution within 50 miles of the Puget So

Figure 4.1.1-6. Low-income population distribution within 50 miles of the Puget

Districts are: Officer's Row, Old Puget Sound Radio Station, Old Naval Hospital, a Marine Reservation.

4.1.1.5 Aesthetic and Scenic Resources

The Puget Sound region offers a striking contrast in terrain, with mountains; hills; flat-topped ridges; and plateaus. These areas are separated by numerous cha lakes, and valleys. The shoreline along the county is characterized by moderate to cliffs. The county has large areas of farmlands and forest.

The city of Bremerton and the Puget Sound Naval Shipyard are urbanized areas. shipyard has an industrialized character along the shoreline, with parking areas, d warehouses, and ship traffic along Sinclair Inlet. The upland section of the shipy housing, recreational facilities, and retail businesses. Chainlink fences mark the The area within the shipyard where the naval spent nuclear fuel would be stored has sensitivity since the area is an industrial site.

4.1.1.6 Geology

4.1.1.6.1 General Geology.

The Kitsap Peninsula consists of several geological phenomena which have occurred over the past 60 million years. The upper layers of rock are g by hard, dense, fine-grained lava with an accumulation of several thousand feet (in marine sedimentary rocks above the lava flows. Uplifting of the Cascade and Olympi ranges caused the Kitsap Peninsula and other Puget Trough lowlands to become sites sedimentary materials washed down from the surrounding ranges. More recently, glac as erosion, have been responsible for carving the low, hilly, rolling topography of (Navy 1991a). The following geological discussion was obtained from "Site Inspecti Sound Naval Shipyard" (URS 1992).

Puget Sound Naval Shipyard is within the Puget Sound Lowland between the Olym Mountains and the older Cascade Mountains to the east. Before the glaciation which 1.7 to 2.2 million years ago, the Puget Sound Lowland probably contained a large ri draining to the north and west into what is now the Strait of Juan de Fuca. Glacia Sound Lowland produced the arms and embayments of Puget Sound.

4.1.1.6.2 Geologic Resources.

Geological materials found in Puget Sound include hard, dense
volcanic rock formed up to 63 to 65 million years ago, and fragmented sedimentary r
unconsolidated sediments deposited by glaciers up to 1.7 to 2.2 million years ago.
separate glacial advances and accompanying periods between glaciers have been hypot
Puget Sound Lowland. Soil layers deposited by glaciers are generally coarse sand a
silt from lakes, and low-permeability deposits left by glaciers. The soils from th
glaciers are generally fine-grained silts and sands deposited by rivers or lakes, i
of sand and gravel.

Most of the geologic material in Kitsap County is glacial deposits. The Kits
the remnant of a plain formed from the debris deposited by glaciers. Volcanic bed
the south end of Sinclair Inlet and at Gold Mountain south and west of Bremerton.
bedrock outcrops on the south end of Bainbridge Island and at the adjacent tip of t
Bremerton.

Kitsap County has four basic soil types: soils underlain by cemented hard-pa
bedrock substrate; soils with permeable, distinctly stratified sublayers which are
internal drainage; the organic soils represented by small, widely scattered areas o
soils having little or no agricultural or building potential. Typical landforms in
mountainous land, steep broken land, coastal beaches, and tidal marshes.

The natural topography of the shipyard has been altered substantially from it
condition. Portions of the upland areas of the complex were cut to fill marshes an
The resulting fill material was predominantly a silty, gravelly sand with occasiona
and clays. The surface of the filled areas is a solid layer of earth. The remaini
soils vary from dense deposits from glaciers to soft bay mud and peat. The upland
packed clay soil with low permeability. (URS 1992)

There are no economic geologic resources at the shipyard.

4.1.1.6.3 Seismic and Volcanic Hazards.

Seismic risk related to structural damage may be
represented in the United States by a relative scale of 0 through 4, with Zone 0 no
encounter damage and Zone 4 expected to encounter the greatest seismic risk. The P
Naval Shipyard is located in Zone 3. (UBC 1991) The Uniform Building Code seismic
provides a means for a comparable assessment of the seismic hazard between the alte
the Record of Decision identifies this site for the interim storage of naval spent
seismic evaluation would be conducted. More detailed information regarding the des
considerations for storage of naval spent nuclear fuel at the shipyard is provided

There have been approximately 200 earthquakes in the Pacific Northwest since
which caused little or no damage. The most recent earthquakes of high magnitude in
near Olympia (approximately 40 miles from Bremerton) in 1949 (moment magnitude 7.1)
Seattle in 1965 (moment magnitude 6.5). There has recently been speculation by som
that earthquakes in the Puget Sound area might produce moment magnitudes as high as
On the other hand, some seismologists believe that earthquakes with moment magnitud
7.0 are unlikely in this region. There is also some disagreement at present on the
movements that might occur in this area.

There is no known fault line within 3000 feet of the Bremerton Naval Complex;
two known fault traces have been identified in Kitsap County. The Kingston-Bothell
northern portion of the county, and the Seattle-Bremerton trace, located a few mile
Bremerton. There has been no known surface faulting in conjunction with earthquake
shipyard region.

Potential hazards from volcanism are minimal and limited to wind-borne volcan
the distance of the shipyard from the Cascade vents and the configuration of the in
topography exclude other volcanic hazards. Only ash from a "large" or "very large"
reach the shipyard. The 1980 eruption of Mount St. Helens, Washington, approximate
south of the shipyard, resulted in a very slight coating of ash at the shipyard.

The potential hazard from large waves generated by volcanoes or earthquakes i
The system of straits and inlets surrounding Puget Sound provides a natural barrier
Sound Area, which effectively dampens the propagation of distantly generated large
of a local large wave generated by seismic events occurring that would affect the s
however, seismologists have found evidence of a large, shallow focus earthquake nea
1300 years ago. This earthquake was most likely in excess of moment magnitude 7.
a shallow focus earthquake such as this were to occur beneath Puget Sound, a tsunam
which might cause flooding in the Puget Sound area. Because the largest earthquake

area are deep seated (more than 60 kilometers (37 miles)), and no major surface rup have occurred, the hazard of generation of a large wave by a local earthquake is mi potential for landslide-generated waves is controlled by the geologic conditions; h development of an earthquake-induced landslide of sufficient size to create a large expected.

A more detailed description of the regional geology and seismicity is documen Design Study - Water Pit Facility, Puget Sound Naval Shipyard, Bremerton, Washingto (Navy 1978).

4.1.1.7 Air Resources

4.1.1.7.1 Climate and Meteorology.

The general meteorological conditions of the Puget Sound area are typical of a marine climate, since the prevailing air currents at all elev Pacific Ocean. The relatively cool summers, mild winters, and wetness characterist climate are enhanced by the presence of Puget Sound. The area tends toward damp, c conditions much of the year. The Cascade Range to the east serves as a partial bar temperature extremes of the continental climate of eastern Washington.

The normal annual precipitation near Bremerton is 38.33 inches. The rainy se from October to March and accounts for more than 75 percent of the yearly precipita

The mean annual temperature is 51.4yF. Normally, January is the month with t average temperature of 39yF and July is the month with the highest average temperature of 64.5yF.

The average annual mean wind speed at the Seattle-Tacoma Airport is 9.0 miles (mph), with a recorded maximum speed of 1-minute duration of 49 mph. Prevailing winds are from the southwest.

The mean annual relative humidity at the Seattle-Tacoma Airport at 4:00 a.m. percent, decreasing to 62 percent by 4:00 p.m. There is an average of 43.4 days pe reduces visibility to 0.25 mile or less. The mean annual percent of possible sunsh The month with the greatest mean percent of possible sunshine is July with 65 perce with the least is December with 21 percent (Navy 1991a).

4.1.1.7.2 Air Quality.

An area can be designated by the Environmental Protection Agency as having air quality that is better than defined by the National Ambient Air Quality (attainment) or as exceeding one or more of those standards (nonattainment for one pollutants). The Code of Federal Regulations, Title 40, Part 81, states that the A Region for the shipyard is better than national standards for total suspended parti SO2. The area has no specific classification for ozone, carbon monoxide, and NO2. Class I Area is the Olympic National Park, approximately 24 kilometers (15 miles) f

4.1.1.7.3 Existing Radiological Conditions.

Radiological facilities at all naval shipyards are designed to ensure that there are no uncontrolled discharges of radioactivity in ai Radiological controls are exercised to preclude exposure of working personnel to ai activity exceeding federal limits. Air exhausted from radiological work facilities high-efficiency particulate air filters and monitored during discharges. The annua radioactivity emissions from the shipyards do not result in any measurable radiatio general public. Calculations of site radioactive airborne emissions for 1992 have described in Attachment F. These calculations have shown that emissions of radionu shipyard result in an effective dose equivalent of less than 0.1 mrem per year to a general public.

4.1.1.8 Water Resources

4.1.1.8.1 Surface Water.

Numerous freshwater sources are found in Kitsap County, with numerous lakes dotting the county's landscape. Kitsap Lake, in west Bremerton, is at 238 acres. Lakes and reservoirs are used for recreation and other public uses. of Bremerton comes from surface and groundwater supplies.

Freshwaters in the Bremerton area are monitored by the Washington State Depar Ecology. Puget Sound Naval Shipyard has no important surface freshwaters.

Sinclair Inlet is located in Puget Sound. It is a narrow body of marine wate 1.1 miles wide at its widest point and approximately 3.5 miles long. A majority of Sinclair Inlet has been developed. The dominant feature is the shipyard, lying on The city of Port Orchard borders the southern shore. Localized areas of Sinclair I chemicals as a result of historic urban and industrial activities. Contaminants of polychlorinated biphenyls (PCBs); polycyclic aromatic hydrocarbons (PAH); and toxic chromium and mercury (PTI 1990). Fish taken from these localized areas show elevat concentrations of PCBs, mercury, and chromium.

Puget Sound tides are of the twice-daily, mixed type with two unequal highs a lows per day. Tides in the inlet are similar to those in Seattle, the primary refe principal forces that produce currents in Sinclair Inlet are tidal. Generally, wea direction moving water in and out of the inlet. The flushing capacity of the inlet freshwater input (Navy 1991a).

Based on Flood Insurance Rate Map (FIRM) COMMUNITY-PANEL No. 530093 0015 and topographical maps, the Puget Sound Naval Shipyard is not in the 100 or 500 year fl

4.1.1.8.2 Groundwater.

Groundwater is generally found within 100 feet of the ground surface in sand and gravel layers caused by material from receding glaciers. The rate of grou in Kitsap County is estimated to be approximately 12 inches annually, equating to a 0.5 million gallons per day per square mile. The nature of the geology in the area in almost any location can tap a number of aquifers at different depths. The quali groundwater near Bremerton is good. Groundwater is used for approximately 35 perce public water supply for Bremerton. Groundwater at Puget Sound Naval Shipyard is po salinity caused by intrusion from Sinclair Inlet. (Navy 1991a).

4.1.1.8.3 Existing Radiological Conditions.

The normal activities associated with current naval nuclear operations at all naval shipyards do not result in the intentional discharg liquid effluent. However, there were occasions, primarily in the early 1960's, whe levels of radioactivity were discharged with liquid effluent. In all cases, efflue than permitted under the then current limits imposed by state and federal agencies.

The United States Environmental Protection Agency Office of Radiation Program performed monitoring of the water, plant life, aquatic life, and sediment in the vi Sound Naval Shipyard. The purpose of the survey was to determine if operations rel Navy nuclear warship activities resulted in releases of radionuclides which could c significant population exposure or contamination of the environment. "Radiological Facilities on Puget Sound" (Lloyd and Blanchard 1989) discusses the most recent Env Protection Agency monitoring data. Pertinent conclusions are as follows:

1. "A trace amount of cobalt-60 (0.04 pCi/g+/-0.01 pCi/g) was detected in one sample at PSNS. All other radioactivity detected in the 80 sediment sampl to naturally occurring radionuclides or fallout from past nuclear weapons Chernobyl reactor accident in 1986."
2. "Results of core sampling did not indicate any previous deposit of cobalt- sediment."
3. "Water samples contained no detectable levels of radioactivity other than ring naturally."
4. "External gamma-ray measurements did not detect any increased radiation ex the public above natural background levels."
5. "Based on the current radiological surveys, shipyard and nuclear-powered w operations have resulted in no increases in radioactivity that would resul population exposure or contamination of the environment."

Environmental monitoring is conducted by the shipyard. The results of this m program corroborate the Environmental Protection Agency's conclusions.

4.1.1.9 Ecological Resources

4.1.1.9.1 Terrestrial Ecology.

Vegetation and wildlife on Puget Sound Naval Shipyard are limited to "open spaces," noncontiguous, undeveloped areas which comprise approxima of the entire Bremerton Naval Complex (Navy 1991a). Most of these areas have been disturbed and are currently landscaped with native and ornamental trees and shrubs.

Tree species include Douglas fir (Pseudotsuga menziesii), vine maple (Acer ci leaf maple (Acer macrophyllum), western red cedar (Thuja plicata), madrone (Arbutus western hemlock (Tsuga heterophylla). There are various types of thick underbrush salal (Gaultheria shallon), sword fern (Polystichum sp.), Oregon grape (Berberis ne rhododendron (Rhododendron spp.) (Navy 1986).

Because of its location on the Pacific flyway, Puget Sound exhibits a diverse an influx of seasonal migrants. Many of the migrants, particularly waterfowl, rema in the sound because of the mild climate, abundance of bays and coves, and the avai Due to the extensive industrial nature of the shipyard, its resident bird community "urban species." Resident bird species include Stellar's jay (Cyanocitta stelleri) vulgaris), flicker (Colaptes spp.), American crow (Corvus brachyrhynchos), black-ca (Parus atricapillus), goldfinch (Spinus tristis), pigeon (Columba fasciata), robin golden-crowned kinglet (Regulus satrapa), evening grosbeak (Hesperiphona vespertina ring-necked pheasant (Phasianus colchicus) (Navy 1986). In addition, numerous glau gulls (Larus glaucescens) inhabit the waterfront areas.

Although abundant mammal populations originally existed in the Puget Sound ar current populations of mammals at the shipyard are extremely limited. The only mam reported at the shipyard are gray squirrels (Sciurus griseus), mice, and shrews (Na

With few exceptions, reptiles and amphibians are not particularly abundant in area. The lack of suitable habitat restricts the population of reptiles and amphib garter snakes, salamanders, newts, and frogs (Navy 1990a).

No environmental concerns associated with vegetation or wildlife have been id shipyard.

4.1.1.9.2 Wetlands.

There are no freshwater wetlands on the shipyard. There are no streams, rivers, ponds, or lakes located on the shipyard (Navy 1986). The majority of the s developed and covered with an impervious surface. The shipyard does own 338 acres (deep-water tidal property) along the waterfront.

4.1.1.9.3 Aquatic Ecology.

Salt marsh and brackish marsh communities formerly existed along much of the shoreline of Puget Sound. For a number of years, these areas were perc wastelands and thousands of acres were diked, drained, and reclaimed.

The original landform of the shipyard has been greatly altered to accommodate development. Projects have increased the usable land by filling in the marsh area corner and by extending the shoreline with quaywalls and landfill. The shoreside o consists primarily of riprap, concrete bulkheads, and old wooden piers. Marine veg shipyard shoreline consists primarily of sea lettuce (Ulva lactuca), rockweed (Fuch debris of algae that have been dislodged from their subtidal moorings and carried i no waterfront areas at the shipyard that have clam beds, eelgrass, kelp beds, or si (Navy 1986).

Resident fish populations inhabiting the shipyard intertidal shoreline includ (Cottidae), surf perch (Embiotocidae), and flatfish (Pleuronectidae). Migratory fi Pacific salmon (Oncorhynchus spp.), sea-run cutthroat trout (Oncorhynchus clarki), (Microgadus proximus), Pacific cod (Gadus macrocephalus), Pacific herring (Clupea h pallasii), rockfish (Sebastes spp.), and two or three species of migratory smelt (O (Navy 1986). There is near-shore migration of juvenile salmon and other fish speci March 15 to June 15. Herring mill in the vicinity of the shipyard from January 20

(Navy 1991a). No recreational or commercial fishing is allowed within the confines

4.1.1.9.4 Endangered and Threatened Species.

As required under Section 7 of the Endangered
Species Act of 1973, the responsible agency of a major federal action must conduct assessment to identify any endangered or threatened species which are likely to be action. The United States Fish and Wildlife Service had previously provided a list threatened species that may be in the Bremerton area (Navy 1991a). The list includ the bald eagle (Haliaeetus leucocephalus). Wintering bald eagles may occur in the from about October 31 through March 31.

Bald eagles are regularly seen along most of the inland waters of Puget Sound active during the day and feed on a variety of animals (preferring fish or waterfow They nest and rest most often in conifers, choosing large, open-crowned trees near (Navy 1991a). Eagles are capable of tolerating a certain amount of intrusion and c they tend to seek privacy for rearing their young.

Although no eagles have been reported nesting on the shipyard, there are seve within 1 mile of the shipyard (Navy 1991a). Trees suitable for perching and roosti non-industrialized area at the shipyard, but not near the waterfront. Bald eagles Sinclair Inlet anywhere and at any time. It is not likely that eagles feed on fish a regular basis because of the high level of human activity and the variability of Eagles in this area feed primarily on seagulls and other birds (Navy 1991a).

Marine mammals are afforded full federal protection under the Marine Mammal P tion
Act of 1972. Pinnipeds (seals and sea lions) and cetaceans (whales, dolphins, and regularly or occasionally are found in central Puget Sound include the Pacific harb vitulina), California sea lion (Zalophus californianus), killer whale (Ordinus orca (Phocoenoides dalli), and harbor porpoise (Phocoena phocoena) (Navy 1991a).

The National Marine Fisheries Service had previously provided a list of endan threatened species under its jurisdiction that may occur in Puget Sound waters in s Programmatic Environmental Impact Statement Fast Combat Support Ship (AOE-6 Class) Coast Homeporting Program" (Navy 1991a). The list included two endangered mammals, whale (Eschrichtius robustus) and the humpback whale (Megaptera novaeangliae); one mammal, the Steller sea lion (Eumetopias jubatus); and one endangered turtle, the l turtle (Dermochelys coriacea).

None of the sensitive, threatened, or endangered species are represented in t the shipyard (Navy 1991a).

4.1.1.10 Noise

Puget Sound Naval Shipyard is an existing industrial-type environment characte from truck and auto traffic; ship loading cranes and related diesel-powered equipme continuously operating transmission lines for steam, fuel, water, and related compr and other liquids. In addition, new construction of buildings, reconstruction and activities for streets, buildings, parking lots, and ships all contribute to an ind Primary noise sources are located along the naval shore support facilities (piers a land-side facilities) and are dampened to the residential areas by the hills adjace area.

4.1.1.11 Traffic and Transportation

Primary regional land access to the Seattle/Tacoma/Bremerton area is achieved interstate highways, I-90 and I-5.
Major transportation corridors in Kitsap County are based upon a
network of state routes. The county's municipalities and population centers are ac Routes (SR) 104, 303, 304, 305, and 308. The major thoroughfare in south Kitsap Co which runs south from Bremerton to Tacoma and connects with I-5 in Tacoma.

Bremerton's primary access routes include SR 3, which is a major north-south that travels through western Bremerton; SR 303, which originates within Bremerton a Avenue and continues through eastern Bremerton to Silverdale; SR 304, which travels Bremerton as Callow Avenue, Burwell Street, and Washington Avenue; Kitsap Way, whic 6th Street within the city; 11th Street, which provides local east-west circulation

Montgomery, and Naval avenues, which provide local north-south circulation. The pr Bremerton Connector is a road-widening project that will improve accessibility to d Bremerton from SR 3 and SR 16.

Kitsap Transit provides transportation service to various areas of Kitsap Cou population centers, ferry docks, and other activity centers, through a Public Trans In addition, tours and charters are available locally through Cascade Trailways whi twice daily scheduled run to Tacoma. Taxi service is also available throughout the area.

Bremerton National Airport, used for general aviation, is the largest of thre in Kitsap County and is located near SR 3 south of Bremerton. The other two airfie are Port Orchard Airport and Apex Airpark near Silverdale.

Two ferry systems provide services to the Bremerton area. The Washington Sta System provides numerous daily runs from Bremerton, Kingston, Bainbridge Island, an to the Seattle area. There is also a state ferry run in the northern part of the c Kingston to Edmonds, Washington, north of Seattle. In addition to the cross sound by the Washington State Ferry System, Horluck Transportation Company runs a passeng service connecting downtown Port Orchard to Bremerton.

Burlington Northern Railroad provides scheduled and on-demand freight rail se number of locations in the southern and central portions of Kitsap County. A Navy- from Shelton, Washington, provides additional rail service to the shipyard and Bang Submarine Base.

Naval spent nuclear fuel has been removed from Navy nuclear-powered ships and to the Idaho National Engineering Laboratory Expended Core Facility (ECF) for exami evaluation as a routine part of their operating cycle. Starting in 1962, the naval originating at Pearl Harbor Naval Shipyard was transported by ocean vessel to Puget Shipyard for subsequent rail shipment to ECF. From 1962 to the present, a total of nuclear fuel shipments have been made from Pearl Harbor Naval Shipyard to Puget Sou Shipyard, then on to ECF. In 1966, Puget Sound Naval Shipyard began removing naval nuclear fuel from Navy nuclear-powered ships and transporting it by rail to ECF. F present, a total of 115 shipments of naval spent nuclear fuel originating at Puget Shipyard have been made to ECF. Attachment A provides a list of the spent nuclear made to date by year and by originating shipyard. Attachment A also contains detai of the shipping containers used for naval spent nuclear fuel shipments from shipyar

Puget Sound Naval Shipyard has 23 miles of railroad tracks, 8 piers, 4 moorin large dry docks.

4.1.1.12 Occupational and Public Health and Safety

4.1.1.12.1 Occupational Radiological Health and Safety. The Navy has well established and

effective Occupational Safety, Health, and Occupational Medicine programs at all of regard to radiological aspects of these programs, the Naval Nuclear Propulsion Prog reduce to as low as reasonably achievable the external exposure to personnel from i associated with naval nuclear propulsion plants. These stringent controls on minim radiation exposure have been successful. No civilian or military personnel at Navy exceeded the federal accumulated radiation exposure limit which allows 5 rem exposu of age beyond age 18. Since 1967, no person has exceeded the federal limit which a 3 rem per quarter year and since 1980, no one has received more than 2 rem per year associated with naval nuclear propulsion plants. The average occupational exposure monitored at all shipyards is 0.26 rem per year. The average lifetime accumulated from radiation associated with naval nuclear propulsion plants for all shipyard per monitored is 1.2 rem. (NNPP 1994a) This corresponds to the likelihood of a cancer 2083.

The Navy's policy on occupational exposure from internal radioactivity is to exposure to personnel from internal radioactivity. The limits invoked to achieve t one-tenth of the levels allowed by federal regulations for radiation workers. As a policy, no civilian or military personnel at shipyards have ever received more than federal annual occupational exposure limit from internal radiation exposure caused associated with naval nuclear propulsion plants.

For work operations involving the potential for spreading radioactive contami ments are used to prevent personnel contamination or generation of airborne radioac controls for contamination are so strict that precautions sometimes have had to be tracking contamination from fallout and natural sources into radiological areas bec

tion control limits used in these areas were well below the levels of fallout and n occurring outside in the general public areas. A basic requirement of contaminatio monitoring all personnel leaving any area where radioactive contamination could pos Workers are trained to survey themselves (i.e., frisk), and their performance is ch radiological control personnel. Frisking of the entire body is required, normally held survey instruments. Major work facilities are equipped with portable monitors in lieu of hand-held friskers. These stringent controls to protect the workers and contamination have proven effective in the past.

In 1991, researchers from Johns Hopkins University, Baltimore, Maryland, comp comprehensive epidemiological study of the health of workers at the six naval shipy private shipyards that service the Navy's nuclear-powered ships (Matanoski 1991). study evaluated a population of 70,730 civilian workers over a period from 1957, be first overhaul of the first nuclear-powered submarine, USS NAUTILUS, through 1981, whether there was an excess risk of leukemia or other cancers associated with expos of gamma radiation.

The Johns Hopkins study found no evidence to conclude that the health of peop work on U.S. naval nuclear-powered ships has been adversely affected by exposure to radiation incidental to this work. Additional studies are planned to investigate t update the shipyard study with data beyond 1981.

The radiation exposure during normal operations at each shipyard for workers radiation levels monitored is determined based on the annual radiation exposure of worker for all shipyards based on Naval Nuclear Propulsion Program Report NT-94-2 (The total number of shipyard personnel monitored for radiation exposure associated Nuclear Propulsion Program has been about 164,000.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e transportation workers for all historical shipments is 16.6 person-rem, which stati to 0.0066 cancer fatalities. The maximum exposed individual (MEI) is a transportat the workers are closer to the shipment for a longer time than any member of the gen Under the limiting assumption that the same worker is associated with every shipmen historical period, this person would receive a total exposure of 7.5 rem over the a 40-year period, or about 0.19 rem per year, which is within DOE standards for occup exposed individuals. The radiation exposures to workers correspond to much less th cancer, which means that it is unlikely that there have been any past health impact historical shipments of naval spent nuclear fuel over the entire history of such sh

4.1.1.12.2 Occupational Non-radiological Health and Safety.

The shipyard has an occupational health/preventive medicine unit and a branch clinic (industrial dispen by Naval Hospital Bremerton. Personnel may also be taken to Harrison Memorial Hosp needed.

The shipyard maintains two fire stations with approximately 50 personnel. Th fire department that is fully equipped for structural and industrial firefighting a spill response.

The shipyard has a security force of approximately 177 personnel providing la services, emergency services, security clearances, and parking and traffic control Naval Complex.

In the non-radiological Occupational Safety, Health, and Occupational Medicin Navy complies with the Occupational Safety and Health Administration regulations. is to maintain a safe and healthful work environment at all naval facilities. Due of work at these facilities, there is a potential for certain employees to be expos chemical hazards. These employees are routinely monitored during work and receive surveillance for physical hazards such as exposure to high noise levels or heat str employees are monitored for their exposure to chemical hazards such as organic solv asbestos, etc., and where appropriate are placed into medical surveillance programs for these chemical hazards.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact due to the historical shipment of naval spent nuclear fuel over the entire h

shipments.

4.1.1.12.3 Public Radiological Health and Safety.

In order to quantify the exposures resulting
from normal shipyard radiological releases to the general public, detailed analyses
based on very conservative estimates of radioisotopic releases since releases began
provides detailed annual release values used in the analyses.
The GENII computer code (Napier et al. 1988) was used to calculate exposures
beings due to the estimated radionuclide releases from normal operations at the shi
A person on the shipyard boundary at the location where the largest exposures
received was used as the hypothetical maximally exposed off-site individual (MOI) f
releases of radioactive material from stored fuel. The population data used to cal
exposures were taken from 1990 census data provided by the U.S. Census Bureau. Met
were obtained as described in Attachment F.
The hypothetical exposures calculated in Attachment F for the period 1995 thr
adjusted from an annual basis (1995) to the historical basis by multiplying by 38 y
of 1.7 to take into consideration variations in the number of ships and operations.
The calculated accumulated exposures through 1995 to the general population w
of the site (about 3 million people) are 1.3 person-rem. To provide perspective, t
received due to natural radiation sources through 1995 are approximately 34 million
based on 0.3 rem per person per year.
The results of environmental monitoring as described in Naval Nuclear Propuls
Report NT-94-1 show that Naval Nuclear Propulsion Program activities had no disting
on normal background radiation levels at site perimeters (NNPP 1994b).
Attachment A provides a discussion of the calculation of past health impacts
all transportation of naval spent nuclear fuel and test specimens. The radiation e
general population for all historical shipments is 1.95 person-rem, which statistic
0.00098 cancer fatalities.
All of the radiation exposures to the general population correspond to much l
incident cancer, which means that it is unlikely that there has been any past healt
public due to all historical shipments of naval spent nuclear fuel over the entire
shipments.

4.1.1.12.4 Public Non-radiological Health and Safety.

Kitsap County has two hospitals,
Harrison Memorial Hospital in East Bremerton and the Naval Hospital Bremerton.
Fire protection in Kitsap County is administered by local fire departments an
The Bremerton Fire Department has three stations. Police protection services in Ki
provided by the County Sheriff's Office, the city of Bremerton, and other local jur
mutual aid.
Attachment A provides a discussion of the calculation of past health impacts
all transportation of naval spent nuclear fuel and test specimens. Approximately 0
estimated as a result of non-radiological sources (vehicle emissions) associated wi
shipments of spent nuclear fuel. This number includes both the workers and the gen
Since this number is much less than one, it is unlikely that there has been any non
impact to the public due to all historical shipments of naval spent nuclear fuel ov
of such shipments.

4.1.1.13 Utilities and Energy

Public water systems supply the majority of Kitsap County's water requirement
Wells are
the primary source of water for outlying areas. The Bremerton watershed, located i
Mountain area, is the largest single source for the city of Bremerton. A dam on th
provides the water storage reservoir. Freshwater is received at the shipyard from
Bremerton public water supply. A saltwater system is used at the piers and dry doc
firefighting, flushing, and cooling of ship systems. Refer to Section 4.1.1.8 for
water resources.
The Bonneville Power Administration and the Puget Sound Power and Light Compa
provide electrical service to Kitsap County. Rates for electrical power are relati

close proximity of hydroelectric facilities. The shipyard steam plant provides eme service, as well as steam.

A limited industrial natural gas distribution system exists in the east end o majority of the military support area in the west end of the shipyard has been conv gas. Natural gas is used industrially, since most of the buildings are heated by s shop, foundry, and pipe shops are the largest users of gas. The only natural gas s industrial area is in the foundry (Navy 1991a).

Shipyard freshwater usage is approximately 676 million gallons annually.

Electricity usage is about 247,000 megawatt hours annually.

4.1.1.14 Materials and Waste Management

All of Bremerton's sewage is treated by the Bremerton Wastewater Utility at th Water Treatment Plant, located at the intersection of State Routes 3 and 304.
This plant was
completed in 1985 to provide secondary treatment. Navy ships produce sewage which to the city of Bremerton's Water Treatment Plant. Berthed ships generally have on- discharge their sewage into the piers' sewage lines. In some cases, portable pumps and pressurize.

Most of the solid waste produced by the shipyard is hauled by a private contr privately owned Olympic View landfill. Miscellaneous acid and alkaline cleaning so (concentrated liquid) is collected, stored on base, and eventually shipped to hazar storage and disposal facilities. Solid and liquid chemical wastes are collected, c packaged, and labeled at the shipyard, then turned over to a contractor for disposa Manchester Fuel Department provides for the collection and recycling of oily wastes bilge waters (Navy 1991a).

Solid radioactive waste materials are packaged in strong, tight containers, s necessary, and shipped to burial sites licensed by the U.S. Nuclear Regulatory Comm under agreement with the U.S. Nuclear Regulatory Commission. Shipyards and other s are not permitted to dispose of radioactive solid wastes by burial on their own sit approximately 851 cubic yards of routine low-level radioactive waste containing 59 shipped from the shipyard for burial.

Waste which is both radioactive and chemically hazardous is regulated under b Energy Act and the Resource Conservation and Recovery Act (RCRA) as "mixed waste." Naval Nuclear Propulsion Program, concerted efforts are taken to avoid commingling chemically hazardous substances so as to minimize the potential for generation of m example, these efforts include avoiding the use of acetone solvents, lead-based pai in disposal containers, and chemical paint removers. Radioactive wastes, including chemically hazardous substances, are handled in accordance with long-standing Progr requirements. Such handling includes solidification to immobilize the radioactivit radioactive and chemically hazardous substances, removal of liquids from solids, an techniques. A determination is then made as to whether the resulting waste is haza of Program efforts to avoid the use of chemically hazardous substances in radiologi activities typically generate only a few hundred cubic feet of mixed waste each yea amount of mixed waste, along with limited amounts of mixed waste from Program work prior to 1987, will be stored pending the licensing of commercial treatment and dis

Since the complex contains so much pavement, surface drainage is required. A storm sewer system exists, which is separate from the sanitary sewer system. The s discharges runoff into Sinclair Inlet through 15 outfalls (Navy 1991a).

4.1.2 NORFOLK NAVAL SHIPYARD: PORTSMOUTH, VIRGINIA

4.1.2.1 Overview

Norfolk Naval Shipyard is located in the Tidewater region of Virginia as shown 4.1.2-1. The shipyard is contiguous with the city of Portsmouth at 36y 49' 5" nort 17' 38" west longitude. The shipyard consists of over 1,200 acres and includes ove tive, industrial, and support structures and 4 miles of shoreline. Figure 4.1.2-2 map, and Figure 4.1.2-3 provides the site map for the Norfolk Naval Shipyard. For Figures 4.1.2-4 and 4.1.2-5 show the location and vicinity of Newport News Shipbuil areas are within 15 miles of the shipyard: Portsmouth, Chesapeake, Norfolk, Virgin Hampton and Newport News, and Suffolk. The cities of Portsmouth to the immediate w

Chesapeake to the south, and Norfolk to the north and east surround the shipyard. Norfolk is separated from the shipyard proper by the Southern Branch of the Elizabe east and by the confluence of the Southern, Eastern, and Western Branches of the El the north.

4.1.2.2 Land Use

Over 95 percent of the land area within the boundaries of the shipyard is cove structures or paved with concrete and asphalt. The shipyard is divided internally industrial area and a non-industrial area. All of the piers, dry docks, and work f ing naval nuclear propulsion plant work are within the controlled industrial area.

The surrounding six city areas are a mix of urban, suburban, light industrial with the land areas dissected by the numerous rivers, creeks, bays, and wetlands.

Portsmouth is predominantly urban and suburban. The two main industries are and the Portsmouth Marine Terminals, which are cargo shipping terminals operated by International Terminals. There are few undeveloped tracts of land in Portsmouth.

Figure 4.1.2-1. Location of Norfolk Naval Shipyard within Virginia. Figure 4.1

Elizabeth River. Downtown Norfolk is about 2.5 miles north-northeast of the shipya financial, cultural, and educational hub of the Southside area. Norfolk is primari suburban with light industrial centers scattered throughout the city. The Norfolk commercial shipyards, coal terminals, various piers for bulk cargo such as gypsum a and the Norfolk Naval Base. Like Portsmouth, Norfolk has few undeveloped tracts of

The Chesapeake corporate limit adjoins the Norfolk corporate limit just south St. Helena Annex and the Portsmouth corporate limit mid-stream of the Southern Bran Elizabeth River due east of the shipyard. The majority of the shipyard industrial river from Chesapeake. The land area immediately along the riverfront is industria terminals, and manufacturing. Chesapeake is a mixture of suburban and rural areas. Branch Area adjoins Portsmouth and is primarily suburban with large tracts of undev currently used for crops to the south and west. Greenbriar adjoins Norfolk and is commercial hub of Chesapeake. Great Bridge adjoins Virginia Beach and is primarily commercial corridors and regional shopping areas. The southern part of Chesapeake contains the Great Dismal Swamp and is rural with isolated residential areas scatte region.

Virginia Beach is not contiguous with any shipyard property but is within 15 Beach adjoins Norfolk and Chesapeake on their eastern borders and fronts the Atlant Cape Henry to the North Carolina state line. The area between the ocean front reso Norfolk city line has undergone explosive growth over the past 20 years. The area residential with several commercial corridors connecting various parts of the city. Line" divides the southern agricultural rural area from the developed areas in the Virginia Beach. This line has moved south in steps over the years in response to i for further development.

Hampton and Newport News are adjoining cities lying on a peninsula formed by and York rivers. Newport News Shipbuilding and port facilities for coal and contai the major industries. Although within 15 miles, the peninsula cities have historic from the southside cities economically and demographically as well as politically. changing with the opening of the bridge-tunnel connecting western Tidewater with th Inclusion of the peninsula cities into the Regional Standard Metropolitan Statistic regions demographically. Land use is primarily suburban with several major commerc dissecting and connecting the two cities. A downtown area of Newport News sits at peninsula separated from the James River waterfront by coal terminals and the Newpo Shipbuilding facilities. The limited agricultural land is being rapidly supplanted residential and commercial development.

Suffolk is the westernmost of the southside cities. Suffolk is predominantly substantial land area under cultivation with peanuts, soybeans, and produce vegetab crops. Residential areas are scattered but are becoming more numerous as land in P Western Branch Area of Chesapeake is developed.

4.1.2.3 Socioeconomics

The shipyard is centrally located in relation to the six city population cente Tidewater region. At the time of the 1990 census, approximately 1.5 million person 50-mile radius of the shipyard. The six-city metropolitan area houses most of this 4.1.2-6 provides a population distribution rose showing the population density and

principal centers within 50 miles of the shipyard. Population data are based on th

As of 1993, Norfolk Naval Shipyard employed approximately 8,500 civilian pers number of military personnel at the shipyard is typically between 2,000 and 3,000 a times up to approximately 15,000.

The majority of the labor force that would be employed at the shipyard for co operation of the naval spent nuclear fuel area would be expected to reside within a the shipyard. The total calculated population, labor force, and employment within base year (1995) are presented in Table 4.1.2-1. Projections of employment and pop years beyond 1995 have not been presented because, as discussed in Section 5, the n additional jobs that might be created at the shipyard under any alternative could b

Figure 4.1.2-6. 50-mile population distribution around Norfolk Naval Shipyard. T

Regional Employment	Regional Labor Force	Regional Population
498,000	533,000	1,138,400

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the Norfolk Naval Shipyard, con population data provided in Figure 4.1.2-6.

Figure 4.1.2-7 shows the locations of populations which have more than 50 per members within the 50-mile radius. Minorities make up approximately 33 percent of population in this area. These populations have been identified following an appro the Environmental Protection Agency which, for purposes of environmental justice ev minority communities as those which have percentages of minorities greater than the region analyzed (EPA 1994).

Figure 4.1.2-8 shows the locations of populations which have more than 25 per members living in poverty, reflecting a common definition of low-income communities The U. S. Census Bureau characterizes persons in poverty as those whose income is l "statistical poverty threshold." For the 1990 census, this threshold was based on $12,500 per household.

4.1.2.4 Cultural Resources

Founded November 1, 1767 under the British flag, the shipyard pre-dates the Un Navy Department by 30 years. The first drydocking in the western hemi-sphere occurred at the

Figure 4.1.2-7. Minority population distribution within 50 miles of the Norfolk

shipyard has been greatly expanded. Beginning in 1963, the yard was authorized to Nuclear Propulsion Program work.

The Naval Shipyard Museum located at the foot of High Street in downtown Port contains many historical photographs and drawings, valuable artifacts, and archives the 226-year history of the shipyard and its close ties to the city of Portsmouth. to the public and to researchers.

No prehistoric archaeological sites have been identified at the Norfolk Naval addition, no submerged cultural resources have been recorded in the immediate vicin shipyard. There are no Native American properties or ceremonial sites in the areas nuclear fuel would be stored. In the area where naval spent nuclear fuel would be no historic sites that are potentially eligible or listed on the National Register (NPS 1991). Due to the historic nature of the shipyard, there might be areas of ar interest. In the past, artifacts from the early shipbuilding era have been uncover tion excavation.

4.1.2.5 Aesthetic and Scenic Resources

The lower Chesapeake Bay - Hampton Roads region is a flat coastal plain with m topographic relief. The numerous bays, rivers, and creeks that dissect the region various wetlands consisting of saltwater marshes, bogs, and swamps. The unique eco wetlands provides habitat for numerous indigenous and migratory species of aquatic wildlife. Area beaches fronting the Atlantic Ocean from Cape Henry southward and a

Chesapeake Bay westward from Cape Henry provide both scenic and recreational opport area residents and visitors.

The shipyard is centrally located in a highly developed urban area and has an character. The area within the shipyard where the naval spent nuclear fuel would b visual sensitivity since the area is an industrial site. The original character of extensively modified in the 300 years that western man has occupied the area.

4.1.2.6 Geology

4.1.2.6.1 General Geology (Coch 1971).

The coastal plain is characterized by a series of marine transgressions with extended periods of non-marine erosion and deposition of river the surface down to a depth of about 120 feet, the most recent sediments of the Col occur. Underlying the Columbia Group is the Yorktown Formation (deposits of fine s shells), which, at the location of the shipyard, is about 100 feet thick. The Calv thickness of about 345 feet, underlays the Yorktown Formation.

The Calvert Formation consists of usually consolidated greenish-brown clays, silicon-based clays over a basic layer of coarse sand. The Calvert clays form an i hard-packed barrier which limits the vertical migration of shallow groundwater. Th isolates the Columbia and Yorktown regional aquifers from deeper lying aquifers con permeable formations underlying the Calvert. Extensive studies of the Coastal Plai sponsored by the Virginia Division of Mineral Resources have been conducted and pub various bulletins and reports (Teifke and Onuschak 1973; Coch 1971).

4.1.2.6.2 Geologic Resources.

There are no unique or economic geological resources in the shipyard region. (Teifke and Onuschak 1973; Coch 1971)

4.1.2.6.3 Seismic and Volcanic Hazards.

Seismic risk related to structural damage may be represented in the United States by a relative scale of 0 through 4, with Zone 0 no encounter damage and Zone 4 expected to encounter the greatest seismic risk. The N Shipyard is located in Zone 1. (UBC 1991) No volcanic hazards exist. The Uniform seismic classification provides a means for a comparable assessment of the seismic alternate sites. If the Record of Decision identifies this site for the interim st fuel, then a detailed seismic evaluation would be conducted. More detailed informa design basis considerations for storage of naval spent nuclear fuel at the shipyard Attachment D.

4.1.2.7 Air Resources

4.1.2.7.1 Climate and Meteorology.

The Tidewater area is nearly surrounded by water with Chesapeake Bay to the north, Hampton Roads to the west, and the Atlantic Ocean to t area contains numerous bays and is traversed by several rivers and creeks. The cli is essentially marine. The land is level and low with an average elevation of 13 f

Based on the 1951 through 1980 period, the average first occurrence of 32 deg is November 17 and the average last occurrence is March 23. Temperatures of above are infrequent and below zero temperatures are almost nonexistent. The proximity t water modifies the invading air masses. Summer winds are predominantly from the so southwest, pulling large amounts of moisture up from the Gulf of Mexico. During th months, afternoon thunderstorms due to daytime heating of the near surface air are Large areas of high pressure frequently stall just east of the southern coast. The can lead to extended periods of hot, humid weather with very little precipitation o thunderstorms. Thunderstorms occasionally spawn isolated tornadic activity through Although locally destructive, the tornados move through the area rapidly along with

Precipitation is distributed fairly evenly throughout the year and totals abo average. Snowfall is usually light and is frequently gone within 24 hours. Large occur but are infrequent. July and August are generally the wettest months due to while November and December are the dryest. Average monthly precipitation is 3.5 i weather can begin as early as March but more frequently occurs in April. This is a period between winter and summer weather patterns. During the spring, summer-like snow, and cold-humid weather can and frequently do occur during the same week. Mil the fall usually extends through Thanksgiving.

Winter climate is primarily determined by the latitude of the upper level jet steers eastwardly moving arctic air masses. Usually, winters are mild with alterna and warm weather. Winter rains are frequent due to the frontal boundaries formed f storm cells to the north and moisture-laden Gulf air moved into the area by a high- the south. North to northeast winds predominate during the winter months. Northea affect the Atlantic Coast from the Carolinas northward. Strong northeast winds and cause localized flooding of low-lying areas. Since the Chesapeake Bay is shallow, wind can move large amounts of water from the north end of the bay southward. When water level is combined with a high tide, flooding occurs. Added to this is the he poor drainage due to the low elevation. High tide levels 6 to 8 feet above normal during major northeast winds along with major beach erosion from Cape Henry to Cape

4.1.2.7.2 Air Quality.

An area can be designated by the Environmental Protection Agency as having air quality that is better than defined by the National Ambient Air Quality (attainment) or as exceeding one or more of those standards (nonattainment for one pollutants). The Code of Federal Regulations, Title 40, Part 81, states that the A Region, in which the shipyard is located, is in marginal nonattainment for ozone an national standards for total suspended particulate matter and SO2. The area has no tion for carbon monoxide and NO2. The nearest Class I Area is the Swanquarter Nati Area, approximately 161 kilometers (100 miles) from the shipyard.

4.1.2.7.3 Existing Radiological Conditions.

Radiological facilities at all naval shipyards are designed to ensure that there are no uncontrolled discharges of radioactivity in ai Radiological controls are exercised to preclude exposure of working personnel to ai activity exceeding federal limits. Air exhausted from radiological work facilities high-efficiency particulate air filters and monitored during discharges. The annua radioactivity emissions from the shipyards do not result in any measurable radiatio general public. Calculations of site radioactive airborne emissions for 1992 have described in Attachment F. These calculations have shown that emissions of radionu shipyard result in an effective dose equivalent of less than 0.1 mrem per year to a general public.

4.1.2.8 Water Resources

4.1.2.8.1 Surface Water.

Hampton Roads is a relatively wide body of water formed by the confluence of the James, Elizabeth, and Nansemond Rivers. It connects on the east Chesapeake Bay. The natural depth of the main part of Hampton Roads ranges from 20 however, the harbor shoals to less than 10 feet toward shore. Two channels are mai of 40 feet by dredging. The currents in Hampton Roads are influenced considerably have a velocity of 0.5 m/sec.

The Elizabeth River is the most downriver tributary of the James River. The system is comprised of a main stem, running from Sewell's Point and Craney Island t Pinner Points, plus four tributary arms: the Lafayette River and the Eastern, West Branches.

Deep navigation channels are maintained from Hampton Roads up the main stem a Southern Branch of the Elizabeth River. Project depths decrease from 45 feet at th between the Norfolk Naval Shipyard and Newton Creek. The channels in the Eastern a Branch and Lafayette River are maintained at 25 feet, 14 feet, and 8 feet, respecti

The Southern Branch of the Elizabeth River is an estuarine body of water in w action brings about a mixing of salt and fresh water. This portion of the river is heavily sediment-laden body of water. The movement of the water is affected by the the channel and the influence of tidal action.

Located along the river banks and in the surrounding territory are extensive naval bases and docking facilities, pleasant exurbs and yacht clubs, dry docks and shipping terminals, the commercial centers of Norfolk and Portsmouth, relatively qu and the Great Dismal Swamp.

Neither the Southern Branch of the Elizabeth River, nor the Hampton Roads Har commercially. Within these waterbodies, it has been established by the Virginia De Health that it shall be unlawful for any person, firm, or corporation to take shell condemned areas for any reason.

Norfolk Naval Shipyard is located on the Southern Branch of the Elizabeth Riv industrialized area of the city of Portsmouth, Virginia, 8 miles upstream from the James and Elizabeth Rivers. The Southern Branch is a deep-water river which provid heavy industry (i.e., ship repairs, gas and oil distribution, etc.) in the vicinity addition, the Southern Branch is a major north-south part of the Army Corp of Engin Waterway System.

The Southern Branch is brackish and is not a source of drinking water. The S of the Elizabeth River-Naval Shipyard waterbody extends from Jones and Paradise Cre Downtown Tunnel (Route 264). Shellfish condemnations impact 429 acres. This conde due to historical sediment toxic contamination, and the potential for pollutants of bacteria (Virginia WCB 1992a). Sixteen industrial facilities discharge to the Sout Elizabeth River main stem and tributaries. Surveys of finfish in the Elizabeth Riv Southern Branch) show obvious signs of stress and/or disease, especially among thos to the contaminated bottom sediments. Many fish have external lesions, fin erosion and cataracts.

The bottom sediments of the Elizabeth River are highly contaminated with a va organic and inorganic compounds at several locations (Virginia WCB 1992a). The maj contamination problems occur in the highly industrialized Southern Branch. Of part among the synthetic organic compounds found in the Southern Branch of the Elizabeth polynuclear aromatic hydrocarbons (PAH's). They are long-lived, and many are mutag carcinogenic. PAH's are found in a variety of sources including creosote, coal tar fly and bottom ash from coal-fired boilers, roofing tar, asphalt oil, petroleum oil diesel soot, and wood stove soot. One source of this class of compounds in the Eli been attributed to the wood-preserving facilities, which have been in operation alo Branch since the early 1900's.

The James River-Hampton Roads waterbody encompasses the James River mainstem tributaries from Old Point Comfort to Willoughby Spit (northern border) to the west Island (eastern border), west to Barrel Point (southern border), and north to Boat River, and Mill Creek. Shellfish condemnations impact 17,281 acres (Virginia WCB 1 condemnation is due to historical toxic contamination, and the potential for fecal pollution. This portion of the James River mainstem receives additional discharges at least half of which are seafood preparation waste discharges.

Surrounding the Nansemond River watershed are seven lakes (Lake Kilby, Lake C Lake Meade, Speights Run Lake, Lake Prince, Lake Burnt Mills, and Western Branch Re which are used as public water supply sources for the surrounding cities. Lake Tay city of Norfolk, is the closest lake and is approximately 7 miles from Norfolk Nava other lakes are approximately 20 miles to the west of the shipyard.

The Flood Insurance Rate Map (FIRM COMMUNITY-PANEL No. 515529 0060 B) shows that most of the Norfolk Naval Shipyard, including the location considered for the naval spent nuclear fuel, is in the 100-year floodplain. However, the location con spent nuclear fuel is not in a high-hazard area (as defined by Title 10, Part 1022 Federal Regulations for floodplains) which is an area where frequent flooding occur

4.1.2.8.2 Groundwater.

Shallow groundwater underlies the whole region. Designated as the Columbia aquifer, it is composed primarily of sediments that were deposited up to 1 years ago as channel fill and river or ocean terraces. The aquifer is composed of sand, silt, and clay and is unconfined throughout the region. The saturated thickn aquifer is about 80 feet in the Tidewater area.

A consolidated layer of silty clay underlies the water table and separates it Formation. In general, water flow within the Columbia aquifer is from the topograp

topographic lows. This flow distribution is modified locally by the pumping of wel borrow pits, and by the upper contours of the Yorktown Formation. As a result, the wells can vary drastically in only a few hundred yards.

Underlying the Columbia aquifer are seven distinct aquifers that originate ea and progressively deepen as they proceed eastward. The names of the aquifers and t depths at the location of the shipyard are shown in Table 4.1.2-2.

The material confining the individual aquifers thickens from west to east so leakage between aquifers due to gravity or artesian pressure differentials decrease Yorktown-Eastover aquifer is both confined and unconfined, depending on location, a fine to coarse sand interbedded with clay, shell, and sandy clay. The formation th 100 feet in the vicinity of the shipyard. Where the aquifer is unconfined, it is a recharge to both the water table aquifer and to underlying confined flow systems.

Table 4.1.2-2. Aquifers that underlie the Columbia aquifer.

Aquifer	Depth Below Sea Level (ft)
Yorktown - Eastover	Sea Level
Chickahominy - Piney Point	200
Aquia	400
Brightseat	500
Upper Potomac	750
Middle Potomac	900
Lower Potomac	>1500

Artesian pressure existing in the confined portions of the Yorktown aquifer c vertical leakage from the Yorktown aquifer into the water table aquifer. In the vi shipyard, the thickness of the confining layer is about 80 feet. The confining lay blue-gray to green-gray clay interbedded with massive silty clay, fine sand, and ch fragments.

The Yorktown aquifer is a major source of domestic, commercial, and light ind Yields are reported to range from 20 to 250 gallons per minute. This aquifer is th drinking and domestic consumption water for those localities within the region not municipal water systems. The groundwater aquifers have been extensively monitored published in numerous papers, bulletins, and reports (Siudyla et al. 1981; USGS 199 quality is monitored by several state agencies and boards with annual reports submi and Congress (Virginia WCB 1992b).

Since the underlying layers slope downward from west to east, the flow of gro vicinity of the shipyard generally trends from west to east, with localized modific described.

Rivers and creeks bound the shipyard on the immediate east and south. The co Southern, Eastern, and Western Branches of the Elizabeth River occurs about 1.5 mil shipyard. These stream beds are below sea level and thus intercept the water table

Where an aquifer is interfaced with surface streams or impoundments, the net aquifer is toward the surface water. In the case of the shipyard, the water table on three sides (N, E, S) by a surface stream. This confines any contaminant infilt aquifer to the area of and immediately adjacent to the shipyard property. With a n to gravity, any contaminant infiltrating from the shipyard area would percolate thr into the water table under the shipyard and be intercepted by bounding surface wate

4.1.2.8.3 Existing Radiological Conditions.

The normal activities associated with current naval nuclear operations at all naval shipyards do not result in the intentional discharg liquid effluent. However, there were occasions, primarily in the early 1960's, whe levels of radioactivity were discharged with liquid effluent. In all cases, efflue than permitted under the then current limits imposed by state and federal agencies.

The United States Environmental Protection Agency Office of Radiation Program performed monitoring of the water, plant life, aquatic life, and sediment in the vi Naval Shipyard. The purpose of the survey was to determine if operations related t nuclear warship activities resulted in releases of radionuclides which could contri population exposure or contamination of the environment. "Radiological Surveys of Naval Station, the Norfolk Naval Shipyard, and Newport News Shipbuilding" (Sensinta Blanchard 1988) discusses the most recent Environmental Protection Agency monitorin Pertinent conclusions are as follows:

1. "The trace amounts of cobalt-60 measured in the harbor sediments are signi than observed during the 1968 survey and exist about 5 inches beneath the

sediment, indicating that no detectable cobalt-60 has been deposited in th since the 1968 survey.
2. In addition to cobalt-60, only radionuclides of natural origin plus trace cesium-137 from previous nuclear weapons testing were detected in any of t sediment samples.
3. No tritium or gamma-ray emitters, other than those occurring naturally, we harbor water, or samples of sediment, water, and vegetation collected from
4. Drinking water samples contained no detectable levels of radioactivity oth occurring naturally.
5. The shoreline gamma-ray surveys failed to detect any elevated exposure lev one location where the levels are attributed to the naturally occurring ra exist in granite rock.
6. The levels and locations of radioactivity identified and the limited media found show that operations related to nuclear-powered warship activities r discernible adverse effects on public health or the environment."

Environmental monitoring is conducted by the shipyard. The results of this m program corroborate the Environmental Protection Agency's conclusions.

4.1.2.9 Ecological Resources

4.1.2.9.1 Terrestrial Ecology.

The shipyard area is highly developed and its surface is about 95% covered with impervious materials. The few green areas are outside the control area and have been extensively graded. Landscaping consists primarily of turf gras trees. The oldest growth areas are in the vicinity of the Shipyard Commander's res Park. Appendix B of the "Land Management Plan for Norfolk Naval Shipyard" (NFEC 19 those plants known to or likely to occur on the shipyard or its annexes.

The shipyard bird population consists of urban species commonly found in sout Virginia. These species include pigeons, jays, robins, finches, chickadees, starli blackbirds, grackles, cowbirds, chimney swifts, martins, mocking birds, cardinals, terns, and several species of gulls. There are few mammals that inhabit the shipya populations are limited. Squirrels and other rodents common to developed areas are

The shipyard offers little refuge for reptiles and amphibians. Non-poisonous and the occasional black snake are found in vegetated areas and in warehouse struct newts, salamanders, and other semi-aquatic reptiles can be found in wet areas where and habitat exists. Sightings are infrequent due to the dispersed habitat location number of suitable sites.

The Tidewater area is part of the Mid-Atlantic flyway. Migratory species pas area or over-winter in the numerous bays, sounds, creeks, and wetlands that occur i During migratory periods and over the winter, more than a hundred species of water observed in the region. Since there is no suitable habitat or forage areas on the appearance of migrating species is rare.

4.1.2.9.2 Wetlands.

There are no freshwater wetlands on the main shipyard site where naval spent nuclear fuel would be stored. The majority of the shipyard is developed and impervious surface. National Wetlands Inventory Maps (DOI 1986) show a number of e wetlands along the banks of Paradise, Blows, and St. Juliens Creeks. There are no wetlands along the western shoreline of the Southern Branch from its mouth to Parad (Silberhorn and Dewing 1989). The total wetland area along Paradise Creek is, acco reference, about 422 acres.

Blows Creek wetlands occur along the Southern Branch and encompass about 2.54 St. Juliens Creek tidal marshes are subdivided into eight locations and total about (Silberhorn and Dewing 1991).

4.1.2.9.3 Aquatic Ecology.

The majority of the shipyard property is located on land that has been filled to raise its elevation above the level of the river. The shipyard shor concrete bulkheads and finger piers built on concrete pilings. Wooden wharfs and q

replaced over the years with concrete structures. Marine vegetation along the ship limited to red and green algae. As reported in Section 4.1.2.8.1, the marine life Branch is limited due to the pollution in the river from sewage treatment plants an industries. There is no commercial fishing and only limited sport fishing in the S the contiguous shipyard waters, there is no fishing due to a security buffer zone a heavy traffic along the river.

Estuarine wetland ecology is principally vegetative and consists of Saltmarsh Reed grass. The abundance of Reed grass in these areas is indicative of disturbed been filled or are impacted by overloads of upland sediment.

Herring gulls, several species of terns, brown pelicans, egrets, herons, corm migratory bird species common along the Atlantic flyway take refuge in or feed on r marshland environments and biota.

The waters adjoining the shipyard are frequently dredged to maintain the dept piers, at the entrance to dry docks, and in the turning basin. The periodic remova limits the habitat of benthic organisms common in other parts of the lower bay and

4.1.2.9.4 Endangered and Threatened Species.

There are no critical habitats as defined in
50CFR424.02 within the 15-mile tidal influence area. Several federally designated endangered (E) species have been identified as existing in the vicinity. The exact habitats could not be located; however, surveys of the area have not identified any property. The U.S. Fish and Wildlife Service lists the following species as endang in the South Hampton Roads area from Suffolk eastward (DOI 1990).

1. Loggerhead turtle (T)
2. Bald eagle (E)
3. Peregrine falcon (E)
4. Piping plover (T)
5. Red-cockaded woodpecker (E)
6. Eastern cougar (E)
7. Dismal Swamp southeastern shrew (T)
8. Northeastern beach tiger beetle (T)

No state rare, threatened, or endangered species exist within the 15-mile tid (Buhlmann and Ludwig 1992).

There are no marine mammals that are routinely found within the lower Chesape its tributaries. Manatees and Atlantic Bottlenose dolphins occasionally appear in Hampton Roads; however, their presence is transient. Stranding and grounding of po whales and dolphins as well as carcasses of dead animals occasionally appear along from Virginia's Eastern Shore to the North Carolina Outer Banks but sightings of wh or near the ocean shore are rare.

Various oceanic turtles may nest along the sandy beaches surrounding the Ches and Outer Banks. The highly developed regions along the Elizabeth River do not pro nesting sites for these marine reptiles.

4.1.2.10 Noise

Norfolk Naval Shipyard is an existing industrial-type environment characteriz truck and auto traffic; yard cranes and related internal combustion engine powered operating transmission lines for steam, air, and water along with associated pumps The eastern shoreline of the Southern Branch contains private shipyards, manufactur bulk material handling and storage terminals. These activities, along with Norfolk add to the ambient noise levels of the river corridor.

Intervening structures and distance separate adjacent residential areas to th immediately west of the shipyard from the waterfront ship repair activities and thu generated by those activities.

4.1.2.11 Traffic and Transportation

Within the city of Portsmouth, three main corridors, High Street, Portsmouth George Washington Highway serve as access to suburban commercial and residential ar
The
Downtown and Midtown tunnels link Portsmouth and Norfolk and join via connecting ar

regional interstate highway network consisting of I-64, I-262, I-464, and I-664. I Hampton Roads while I-664 crosses the lower James River linking the southside citie News and Hampton on the peninsula. The bridge-tunnels allow the unimpeded flow of commercial ships and warships through Hampton Roads.

Tidewater Regional Transit provides bus services throughout Portsmouth and No limited public transportation is available in Chesapeake and Virginia Beach.

The Norfolk International Airport provides commercial scheduled passenger and service to major connecting hubs. Most private and general aviation not operating International operate from airports in Chesapeake, Suffolk, and Virginia Beach.

A passenger ferry across the Elizabeth River connects the Portsmouth downtown Waterside Berths on the Norfolk side. This ferry service is primarily designed for recreational passengers rather than commuter service.

Norfolk Southern and CSX corporations operate extensive networks of rail tran freight and bulk cargo. Norfolk and Newport News are the nation's largest terminal and, along with Portsmouth, have a large capacity for containerized and bulk cargos by CSX and Norfolk Southern subsidiaries serve the shipyard at the north and south and St. Juliens Creek annexes.

Naval spent nuclear fuel has been removed from Navy nuclear-powered ships and to the Idaho National Engineering Laboratory Expended Core Facility (ECF) for exami evaluation as a routine part of their operating cycle. Naval spent nuclear fuel sh Naval Shipyard to ECF were initiated in 1965. Since that time, 10 shipments of nav fuel originating at Norfolk Naval Shipyard have been made to ECF. The naval spent shipped by rail. Attachment A provides a list of these shipments made to date by y A also contains detailed descriptions of the shipping containers used for naval spe shipments from shipyards.

Norfolk Naval Shipyard has 30 miles of paved roads, 19 miles of railroad trac docks.

4.1.2.12 Occupational and Public Health and Safety

4.1.2.12.1 Occupational Radiological Health and Safety. The Navy has well established and

effective Occupational Safety, Health, and Occupational Medicine programs at all of regard to radiological aspects of these programs, the Naval Nuclear Propulsion Prog reduce to as low as reasonably achievable the external exposure to personnel from i associated with naval nuclear propulsion plants. These stringent controls on minim radiation exposure have been successful. No civilian or military personnel at Navy exceeded the federal accumulated radiation exposure limit which allows 5 rem exposu of age beyond age 18. Since 1967, no person has exceeded the federal limit which a 3 rem per quarter year and since 1980, no one has received more than 2 rem per year associated with naval nuclear propulsion plants. The average occupational exposure monitored at all shipyards is 0.26 rem per year. The average lifetime accumulated from radiation associated with naval nuclear propulsion plants for all shipyard per monitored is 1.2 rem. (NNPP 1994a) This corresponds to the likelihood of a cancer 2083.

The Navy's policy on occupational exposure from internal radioactivity is to exposure to personnel from internal radioactivity. The limits invoked to achieve t one-tenth of the levels allowed by federal regulations for radiation workers. As a policy, no civilian or military personnel at shipyards have ever received more than federal annual occupational exposure limit from internal radiation exposure caused associated with naval nuclear propulsion plants.

For work operations involving the potential for spreading radioactive contami ments are used to prevent personnel contamination or generation of airborne radioac controls for contamination are so strict that precautions sometimes have had to be tracking contamination from fallout and natural sources into radiological areas bec tion control limits used in these areas were well below the levels of fallout and n occurring outside in the general public areas. A basic requirement of contaminatio monitoring all personnel leaving any area where radioactive contamination could pos Workers are trained to survey themselves (i.e., frisk), and their performance is ch cal control personnel. Frisking of the entire body is required, normally using sen survey instruments. Major work facilities are equipped with portable monitors, whi of hand-held friskers. These stringent controls to protect the workers and the pub tion have proven effective in the past.

In 1991, researchers from Johns Hopkins University, Baltimore, Maryland, comp comprehensive epidemiological study of the health of workers at the six naval shipy private shipyards that service the Navy's nuclear-powered ships (Matanoski 1991). study evaluated a population of 70,730 civilian workers over a period from 1957, be first overhaul of the first nuclear-powered submarine, USS NAUTILUS, through 1981, whether there was an excess risk of leukemia or other cancers associated with expos of gamma radiation.

The Johns Hopkins study found no evidence to conclude that the health of peop work on U.S. naval nuclear-powered ships has been adversely affected by exposure to radiation incidental to this work. Additional studies are planned to investigate t tions and update the shipyard study with data beyond 1981.

The radiation exposure during normal operations at each shipyard for workers radiation levels monitored is determined based on the annual radiation exposure of worker for all shipyards based on Naval Nuclear Propulsion Program Report NT-94-2 (The total number of shipyard personnel monitored for radiation exposure associated Nuclear Propulsion Program has been about 164,000.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e tation workers for all historical shipments is 16.6 person-rem, which statistically 0.0066 cancer fatalities. The maximum exposed individual (MEI) is a transportation the workers are closer to the shipment for a longer time than any member of the gen Under the limiting assumption that the same worker is associated with every shipmen historical period, this person would receive a total exposure of 7.5 rem over the a 40-year period, or about 0.19 rem per year, which is within DOE standards for occup exposed individuals. The radiation exposures to workers correspond to much less th cancer, which means that it is unlikely that there have been any past health impact historical shipments of naval spent nuclear fuel over the entire history of such sh

4.1.2.12.2 Occupational Non-radiological Health and Safety.

In the non-radiological
Occupational Safety, Health, and Occupational Medicine area, the Navy complies with tional Safety and Health Administration Regulations. The Navy policy is to maintai healthful work environment at all naval facilities. Due to the varied nature of wo there is a potential for certain employees to be exposed to physical and chemical h employees are routinely monitored during work and receive medical surveillance for such as exposure to high noise levels or heat stress. In addition, employees are m exposure to chemical hazards such as organic solvents, lead, asbestos, etc., and wh placed into medical surveillance programs for these chemical hazards.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact due to the historical shipment of naval spent nuclear fuel over the entire h shipments.

The shipyard has an occupational health/preventive medicine unit and a branch (industrial dispensary). Personnel may also be taken to Portsmouth Naval Hospital General Hospital as needed.

The shipyard maintains two fire stations with approximately 60 personnel. Th ment is fully equipped for structural and industrial firefighting and hazardous mat

The shipyard security force has approximately 100 personnel providing law enf services, emergency services, security clearances, and parking and traffic control Naval Shipyard Complex.

Relative to social services, military personnel receive assistance through va Portsmouth Naval Hospital and the Navy's Morale Welfare and Recreation Department.

4.1.2.12.3 Public Radiological Health and Safety.

In order to quantify the exposures resulting
from normal shipyard radiological releases to the general public, detailed analyses based on conservative estimates of radioisotopic releases since releases began. At detailed annual release values used in the analyses.

The GENII computer code (Napier et al. 1988) was used to calculate exposures beings due to the estimated radionuclide releases from normal operations at the shi

A person on the shipyard boundary at the location where the largest exposures received was used as the hypothetical maximally exposed off-site individual (MOI) f releases of radioactive material from stored fuel. The population data used to cal exposures were taken from 1990 census data provided by the U.S. Census Bureau. Met were obtained as described in Attachment F.

The hypothetical exposures calculated in Attachment F for the period 1995 thr adjusted from an annual basis (1995) to the historical basis by multiplying by 38 y of 1.7 to take into consideration variations in the number of ships and operations.

The calculated accumulated exposures through 1995 to the general population w of the site (about 1.5 million people) are 3.9 person-rem. To provide perspective, received due to natural radiation sources through 1995 are approximately 18 million based on 0.3 rem per person per year.

The results of environmental monitoring as described in Naval Nuclear Propuls Report NT-94-1 show that Naval Nuclear Propulsion Program activities had no disting on normal background radiation levels at site perimeters (NNPP 1994b).

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e general population for all historical shipments is 1.95 person-rem, which statistic 0.00098 cancer fatalities.

All of the radiation exposures to the general population correspond to much l incident cancer, which means that it is unlikely that there has been any past healt public due to all historical shipments of naval spent nuclear fuel over the entire shipments.

4.1.2.12.4 Public Non-radiological Health and Safety.

Portsmouth has three hospitals:
Portsmouth General Hospital, Maryview Hospital, and Portsmouth Naval Hospital.

Fire protection in Portsmouth is administered by local fire departments and f Portsmouth Fire Department has nine stations. Police protection services are provi Portsmouth.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact to the public due to all historical shipments of naval spent nuclear fuel ov of such shipments.

4.1.2.13 Utilities and Energy

The shipyard purchases all of its water from the city of Portsmouth.
Section 4.1.2.8.1
describes the sources of public water supplies for the region. A saltwater system and dry docks for cooling supplies to ship systems and for fire and flushing mains.

Shipyard and ship sewage effluents are discharged to the Hampton Roads sanita mains via the Portsmouth sewer system. Sewage treatment plants along the Southern lower James River receive and treat sewage from surrounding cities.

Electricity is purchased from Virginia Power Company transmission grids and i from the Refuse Derived Fuel Plant located just south of the shipyard and operated ern Public Service Authority. During periods of low demand, the Refuse Derived Fue electricity to Virginia Power. The Refuse Derived Fuel Plant also provides yard st and space heating.

Natural gas serves six buildings within the shipyard. Industrial uses includ tempering furnaces, various ovens and torches, laboratory burners, and cooking appl cafeteria. This gas is purchased from Commonwealth Gas Company which serves the Po area.

Shipyard freshwater usage is approximately 823 million gallons annually.

Electricity usage is about 20,000 megawatt hours annually.

4.1.2.14 Materials and Waste Management

Solid waste generated by the shipyard is collected by a private contractor. Metals are
segregated on-site in specially marked dumpsters to be recycled by the Defense Mark
Reutilization Office. Solid burnable waste is transferred to the Southeastern Publ
where it is either compacted into fuel blocks for use in the Refuse Derived Fuel Pl
at a regional landfill located in Suffolk. Once turned over, the Southeastern Publ
determines the final disposition depending on the regional waste volume inventory a
adjacent to the shipyard.

The Refuse Derived Fuel Plant provides electricity and steam to the shipyard
power to the Virginia Power grid when excess capacity exists.

Liquid chemical wastes are collected, characterized, packaged, and labeled by
then turned over to a licensed contractor for disposal.

Solid radioactive waste materials are packaged in strong, tight containers, s
necessary, and shipped to burial sites licensed by the U.S. Nuclear Regulatory Comm
under agreement with the U.S. Nuclear Regulatory Commission. Shipyards and other s
are not permitted to dispose of radioactive solid wastes by burial on their own sit
approximately 1333 cubic yards of routine low-level radioactive waste containing 15
shipped from the shipyard for burial.

Waste which is both radioactive and chemically hazardous is regulated under b
Energy Act and the Resource Conservation and Recovery Act (RCRA) as "mixed waste."
Naval Nuclear Propulsion Program, concerted efforts are taken to avoid commingling
chemically hazardous substances so as to minimize the potential for generation of m
example, these efforts include avoiding the use of acetone solvents, lead-based pai
in disposal containers, and chemical paint removers. Radioactive wastes, including
chemically hazardous substances, are handled in accordance with long-standing Progr
requirements. Such handling includes solidification to immobilize the radioactivit
radioactive and chemically hazardous substances, removal of liquids from solids, an
techniques. A determination is then made as to whether the resulting waste is haza
of Program efforts to avoid the use of chemically hazardous substances in radiologi
activities typically generate only a few hundred cubic feet of mixed waste each yea
amount of mixed waste, along with limited amounts of mixed waste from Program work
prior to 1987, will be stored pending the licensing of commercial treatment and disposal facilities.

An extensive storm drain system exists on the shipyard to remove the runoff f
tion. Outfalls empty into the Southern Branch, Paradise Creek, and St. Juliens Cre
outfalls serving the shipyard property have been mapped and located.

4.1.3 PORTSMOUTH NAVAL SHIPYARD: KITTERY, MAINE

4.1.3.1 Overview

Portsmouth Naval Shipyard is located in York County, in the southeast corner
shown on Figure 4.1.3-1. The Portsmouth Naval Shipyard is located in Portsmouth Ha
estuary of the Piscataqua River. This river flows between the states of Maine and
The shipyard is located on Seavey Island near the mouth of the river and is separat
Portsmouth, New Hampshire, by the main channel of the Piscataqua River and from Kit
by a back channel. Access to the shipyard is provided by two bridges from the Kitt

4.1.3-2 provides a shipyard site map.

Seavey Island has an area of 278 acres. The center reference point on the is
70y44'22" longitude and 43y04'56" latitude. The Portsmouth Harbor and its tributar
extensively for fishing, lobstering, and recreational boating. The port of Portsmo
importing salt and petroleum products, as well as exporting a variety of products,
lumber.

4.1.3.2 Land Use

At the mouth of the Piscataqua River, several creeks and the river converge a Atlantic Ocean. The shipyard has been developed over time by filling in between fi and building a rock causeway to the approximately 5-acre undeveloped Clarks Island.

To the north, across the back channel, is the predominantly low-density resid of Kittery, Maine. Kittery's land along the river and back channel is virtually al residential use. The exceptions are two commercial areas located on Badgers Island intersection of Routes 103 and 236 and several public use areas consisting of playg The main commercial land use area is located along Route 1 and the Route 1 bypass. Kittery's land further north is undeveloped due to natural constraints. The develo primarily designated for low-density residential use.

Figure 4.1.3-1. Location of Portsmouth Naval Shipyard within New Hampshire and M

Castle in the state of New Hampshire. Portsmouth's waterfront is nearly fully deve played an important role in the growth and prosperity of Portsmouth since it was se Strawberry Banke in 1623. Today there are areas of commercial, industrial, residen public/semi-public land use along the river.

Further inland, Portsmouth has large undeveloped land areas. Development on land is constrained by wetlands and other natural factors; however, there still rem to accommodate future development.

Directly south of the shipyard is a large body of estuarine water containing islands. These islands are either undeveloped or have low-density housing.

The town of New Castle is predominantly developed with housing and is the loc Coast Guard Station. Other land uses on the island town include commercial, public land.

4.1.3.3 Socioeconomics

Portsmouth Naval Shipyard is located in the small town of Kittery, Maine, a r England that consists predominantly of small rural towns.

Portsmouth, New Hampshire is the closest urban municipality to the shipyard. population of about 22,300, it is also the largest municipality in the area. Other within the area include Sanford and Biddeford in Maine and Rochester and Dover in N They have populations of approximately 20,500, 20,700, 26,600, and 25,000, respecti Maine has a population of about 64,400. This major southern Maine urban center is miles north of the shipyard. Also, the city of Boston, Massachusetts, with a popul 574,300, is located approximately 50 miles south of the shipyard. Figure 4.1.3-3 p population distribution rose centered on the shipyard and covering a 50-mile radius

Figure 4.1.3-3. 50-mile population distribution around Portsmouth Naval Shipyard

On the Maine side of the Piscataqua River, the increase in population in York Count 1990 was 24,848 which was a 17.8% increase. On the New Hampshire side of the river municipalities within Rockingham County gained in population through the 1980 to 19 There was a gain of 55,500 people or about a 29.2% increase.

Portsmouth Naval Shipyard is located within the "seacoast region" which is de job centers. Each center includes the smaller communities adjacent to them.

The seacoast region is made up of the Portsmouth, Exeter-Epping, Hampton, Dov worth, and Rochester centers in New Hampshire and the Kittery and Biddeford centers

Historically, the economy of the seacoast region has been based on manufactur shoes, and marine vessels were for many years the most important products of the re Shipbuilding and ship repair, primarily at Portsmouth Naval Shipyard, have maintain role in the economy. Textiles and shoe manufacturing have declined over the past 3 been supplemented in part by plastics, electronics, and metals industries. The wag employers are low relative to those paid at the shipyard. On balance, the seacoast experienced consistent declines in manufacturing employment in recent years.

Non-manufacturing employment, especially in the trade and service sectors, is The Hampton, Portsmouth, Kittery, and Biddeford job centers have experienced econom vacation resorts. Communities close to Massachusetts such as Hampton and Exeter-Ep grown as part of the Boston metropolitan area.

The city of Portsmouth is the seacoast region's trade and cultural center and tion market for points in northern New England.

The generally healthy state of Portsmouth's economy is reflected by its excel situation. As of July 1993, the unemployment rate was just 3.4% compared to the na of 6.9%. The civilian labor force in the Portsmouth labor market area numbered 14, 1993.

The majority of the labor force that would be employed at the shipyard for co operation of the naval spent nuclear fuel area would be expected to reside within a the shipyard. The calculated total population, labor force, and employment within base year (1995) are presented in Table 4.1.3-1. Projections of employment and pop years beyond 1995 have not been presented because, as discussed in Section 5, the n additional jobs that might be created at the shipyard under any alternative could b

Table 4.1.3-1. Regional employment factors at Portsmouth Naval Shipyard.

Regional Employment	Regional Labor Force	Regional Population
115,230	121,550	258,900

Portsmouth has the distinction of being the only natural deep-water harbor be and Portland, making it a major factor in New England seaborne commerce. Modern ye facilities, an established Foreign Trade Zone, and reliable container ship service

The chief commodities transported through the port are petroleum products whi over 90 percent of the marine commerce shipped. Large quantities of limestone (gyp are also received. The chief products shipped out of Portsmouth are petroleum prod scrap. Commercial fishing in the area represents a multi-million dollar industry.

As of 1994, the region's largest employer, with approximately 4900 employees, Portsmouth Naval Shipyard. The shipyard is the largest employer in the states of M Hampshire. The 1993 payroll amounted to $228 million.

Other contributing factors to the region's economic development include Pease Authority in Newington, the University of New Hampshire in Durham, and the New Hamp Vocational/Technical College in Stratham.

The Kittery-York labor market area in York County had 86,165 people in the ci force as of July 1993 and an unemployment rate of 2.3% for July 1993. The majority labor force was employed in non-farm related jobs including manufacturing, transpor utilities, wholesale and retail trade, finances, services, and government.

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the Portsmouth Naval Shipyard, the population data provided in Figure 4.1.3-3.

Figure 4.1.3-4 shows the locations of populations in which minority membershi average within the 50-mile radius by more than 20 percentage points and populations more than 50 percent minority members. These populations have been identified foll approach developed by the Environmental Protection Agency which, for purposes of en justice evaluation, defines minority communities as those which have percentages of than the average in the region analyzed (EPA 1994).

Figure 4.1.3-5 shows the locations of populations which have more than 25 per members living in poverty, reflecting a common definition of low-income communities The U. S. Census Bureau characterizes persons in poverty as those whose income is l "statistical poverty threshold." For the 1990 census, this threshold was based on $12,500 per household.

4.1.3.4 Cultural Resources

The Portsmouth-Kittery area has been part of the country's history since its v Many structures and sites from the late seventeenth, eighteenth, and nineteenth cen survived within the framework of new development over the years, especially in the Portsmouth. Considered as a group, these preserved structures and sites constitute cultural, and educational resource, and a heritage with increasing value to future Portsmouth-Kittery vicinity.

Figure 4.1.3-4. Minority population distribution within 50 miles of the Portsmou

On November 17, 1977, the National Park Service, Department of the Interior, Portsmouth Naval Shipyard Historic District on the National Register of Historic Pl includes 54 acres of land, and 59 buildings and structures. The shipyard qualified Status because of its shipbuilding and repair function throughout the history of th unique industrial site, and its historical and architecturally interesting building colonial period to the present day, this shipbuilding and repair site served first,

government, later, the revolutionary colonies, and finally, the United States throu steam, and atomic power. Portsmouth Naval Shipyard represents one of the country's complete industrial operations. (Navy 1993a)

There are no known cultural resources in the area of the site where naval spe would be stored. Due to the historic nature of the shipyard, there might be areas interest. In the past, artifacts from the early shipbuilding era have been uncover construction excavation.

4.1.3.5 Aesthetic and Scenic Resources

The majority of the 303 acres (278 acres on the shipyard, 25 in Admiralty Vil up the Portsmouth Naval Shipyard is considered industrial use land. Although there figures on the breakdown of land classifications, it is estimated that over 75% of by either buildings or pavement. The area within the shipyard where naval spent nu be stored has low visual sensitivity since the area is an industrial site. Improve shipyard include the parade grounds, athletic fields and various lawns dispersed th improved grounds include several small picnic areas on the shipyard, the Jamaica Is Recreation area, and the isolated grassy areas on the fringe of the streets and sid areas of unimproved grounds (includes all other unpaved acreage not classified as i improved) include the two freshwater ponds and the small beach front on what was on Island. Because Admiralty Village is a housing facility, what little open space re development was utilized for recreational purposes (e.g., tennis courts) or landsca aesthetic value.

4.1.3.6 Geology

4.1.3.6.1 General Geology.

Portsmouth Naval Shipyard is located on Seavey Island in the Seaboard Lowland Section of the New England Province. This section has a low, undu topography with low hills that are either bedrock with a light veneer of rocks or s glaciers, or marine clay.

The general area near Portsmouth Naval Shipyard is relatively flat, rising gr foothills of the White Mountains and dissected by numerous streams and rivers that example, carved gorges 20 to 100 feet deep in the granite hills of the Mount Agamen area. What remains of the mountain range in the southern and western portions of t scattered and isolated, high, smooth, weathered rock hills.

The thickness of the overburden of loose materials varies from 0 to 200 feet with 80% of the area having less than 50 feet depth to bedrock. A predominant char soil in the area is the presence of the groundwater table near or at the surface.

4.1.3.6.2 Geologic Resources.

The physical geography of the general area near the Portsmouth Naval Shipyard is characterized by bedrock prominences surrounded by and dissected stream courses of the Piscataqua River. Seavey Island, itself a rock knob, is one bedrock outcrops. The bedrock of Seavey Island is almost entirely the Kittery form grained, lime-silicate material consisting of chalky sandstone formed under heat an siltstone, and gray sandstone shale from approximately 400 million years ago. (Nav

There are no economic geologic resources at the shipyard.

4.1.3.6.3 Seismic and Volcanic Hazards.

Seismic risk related to structural damage may be represented in the United States by a relative scale of 0 through 4, with Zone 0 no encounter damage and Zone 4 expected to encounter the greatest seismic risk. The s located in Zone 2A according to the "Uniform Building Code" (UBC 1991). No volcani exist. The Uniform Building Code seismic classification provides a means for a com assessment of the seismic hazard between the alternate sites. If the Record of Dec site for the interim storage of naval spent fuel, then a detailed seismic evaluatio More detailed information regarding the design basis considerations for storage of

fuel at the shipyard is provided in Attachment D.

Numerous small faults are to be seen in all rock units of the region. Quanti abundance appears to be related to the brittleness of the rock containing them. Mo displacement of a few inches or feet. Only one was deemed to be sufficiently impor the geologic map. This is the Portsmouth fault which forms the Rye-Kittery contact approximately 9 miles. There are so few outcrops of the fault zone, and these are attempt was made to calculate the fault displacement. It is not known if the fault Piscataqua River and into Southeastern Maine. (Navy 1993b)

4.1.3.7 Air Resources

4.1.3.7.1 Climate and Meteorology.

The overall climate in the Portsmouth region is characterized as variable. Weather conditions can change dramatically over short interva alternating frontal systems on a day-to-day basis, widely ranging daily and annual overall differences between the same seasons in different years.

Although this region is situated in the path of the prevailing westerly winds experiences a variety of air changes over the course of a year. These include: col from the north, warm land air from the Gulf states, and cool, damp air from the Atl the combinations of, or switches between, these conditions that generally cause the characteristic weather.

Weather conditions, especially temperature, in the Portsmouth general area ar its maritime setting. The average daily temperature ranges from 80yF in July to 13 February. Temperatures can fluctuate outside this range, but they are not usually

Precipitation is fairly evenly distributed over the year, with 2.7 to 4.6 inc month for a 42.6-inch annual total. On the average, there are about 130 days each than a trace of precipitation. Most summer precipitation results from showers and, thunderstorms. Winter precipitation is generally associated with stormy conditions masses moving up along the coast.

The cool Atlantic waters can produce extensive advection fog when warmer mois carried over the cool water. With any persistent eastern component in the wind dir often lies just offshore during the summer can reach the coastline. This situation the summer by local sea breezes. All months of the year have a fairly consistent o Localized and continuous fog was observed at the former Pease Air Force Base an ave the time and was dense enough to restrict visibility to 1.2 miles (2 kilometers) or the time.

The predominant direction the wind blows from for the Portsmouth Harbor area combination of the western, southwestern, and southern sectors for a combined total time. Differences in wind characteristics occur on a seasonal basis with west-nort dominating in the winter, and southwest-southeast winds increasing in frequency dur summer.

The wind speed averages 8.8 miles per hour in the Portsmouth Harbor area. Sp than 40 miles per hour, however, can occur any time of the year. During the winter speeds are normally caused by the northeast winds moving down the coast, while duri high winds are more often associated with thunderstorms of squall lines moving thro (Navy 1991b)

4.1.3.7.2 Air Quality.

A Reasonably Available Control Technology analysis was conducted in response to Maine Department of Environmental Protection (DEP) regulations requirin Available Control Technology for Volatile Organic Compound (VOC) emission sources, Portsmouth Naval Shipyard, which are located in ozone nonattainment areas. The Rea Available Control Technology analysis was conducted for point and fugitive sources emissions at the shipyard.

The shipyard is a large industrial complex that emits VOC emissions from a va sources located throughout the site. Many of the sources of VOC are small and repr losses of emissions. VOC emissions from these operations are best controlled throu implementation of good housekeeping practices.

It has been determined that current VOC operations at the shipyard meet Reaso Available Control Technology. Continuation of current practices will ensure that V

from the shipyard are maintained at or below Reasonably Available Control Technolog (Navy 1991b)

An area can be designated by the Environmental Protection Agency as having ai is better than defined by the National Ambient Air Quality Standards (attainment) o or more of those standards (nonattainment for one or more pollutants). The Code of Regulations, Title 40, Part 81, states that the Air Quality Control Region for the moderate nonattainment for ozone and is better than national standards for total su matter and SO2. The area has no specific classification for carbon monoxide and NO Class I Area to the shipyard is at the Presidential Range - Dry River Wilderness Ar 120 kilometers (75 miles) from the shipyard.

4.1.3.7.3 Existing Radiological Conditions Radiological facilities at all naval shipyards are

designed to ensure that there are no uncontrolled discharges of radioactivity in ai Radiological controls are exercised to preclude exposure of working personnel to ai exceeding federal limits. Air exhausted from radiological work facilities is passe high-efficiency particulate air filters and monitored during discharges. The annua radioactivity emissions from the shipyards do not result in any measurable radiatio general public. Calculations of site radioactive airborne emissions for 1992 have described in Attachment F. These calculations have shown that emissions of radionu shipyard result in an effective dose equivalent of less than 0.1 mrem per year to a general public.

4.1.3.8 Water Resources

4.1.3.8.1 Surface Water.

A large portion of York County's surface runoff from precipitation is drained by coastal basins reaching a short distance inland from the coast. The sys drainage channels used by runoff waters, varying from very small brooks to larger r are in a southeasterly direction towards the Atlantic Ocean, but tributaries natura directions into the larger channels. The remainder of the area is drained by large basins that reach further inland. The Saco River basin and the Piscataqua-Salmon F are the largest drainage systems, the Mousam and Kennebunk Rivers being considerabl each of these drainage basins, surface water is held in swamps, ponds and lakes, bo man-made, and by dams for storage, water supply, and development of power.

The largest quantities of surface runoff occur during March, April, and May w occurring in August and September. On the average, runoff is approximately 22 inch inches annual precipitation. The combination of spring rains and snow melt not onl increase stream flow, but also tend to replenish groundwater supplies.

The Piscataqua River, formed by the confluence of the Cocheco River and the S River, flows southeasterly for 13 miles until it enters the ocean at Portsmouth Har miles of the river is tidal. The river is one of the fastest flowing tidal waterwa port in the northeastern United States. Due to abrupt channel changes and the stre ebb currents, hazardous cross-currents and eddies are found in the main channel pas east of Pierce and New Castle Island. The average current velocity at full strengt varies from about 2.6 to 4.0 knots, whereas in the back channels, the velocity vari to 2 knots.

The tide at Portsmouth occurs twice daily. The average tidal range from Port is 8.4 feet. The average mean spring range is 9.7 feet and the average mean tide l

New Hampshire and Maine have an agreement to maintain acceptable water qualit Piscataqua River and both states regulate their effluent discharges into the river. designated by the state of New Hampshire as a Class B segment and by the state of M SB-1. New Hampshire Class B waters are acceptable for bathing, other recreational habitat, and public water supply after adequate treatment. Maine Class SB-1 waters all clean water usages including water contact recreation, fishing, shellfish harve propagation, and fish and wildlife habitat. (Navy 1984)

The Flood Insurance Rate Map (FIRM COMMUNITY-PANEL No. 230171 0008D) shows that the Portsmouth Naval Shipyard is not in a 100 or 500 year floodplain.

4.1.3.8.2 Groundwater.

Groundwater reserves constitute an important natural resource and are especially important to the more populated communities in the area. The majority o supply in the area is taken from lakes and rivers, with groundwater providing the r requirements.

As much as 35% of the total area of York County is underlain by soils which a adapted to storage and yield of groundwater, but this figure is based only on surfa localities, marine clays overlie deeper gravels and may represent excellent future favorable groundwater soils are measured to adequate depths, it is quite probable t groundwater yield areas will shrink to a few percent of the total land areas. (Nav

4.1.3.8.3 Existing Radiological Conditions.

The normal activities associated with current naval nuclear operations at all naval shipyards do not result in the intentional discharg liquid effluent. However, there were occasions, primarily in the early 1960's, whe levels of radioactivity were discharged with liquid effluent. In all cases, efflue than permitted under the then current limits imposed by state and federal agencies.

The United States Environmental Protection Agency Office of Radiation Program performed monitoring of the water, plant life, aquatic life, and sediment in the vi Naval Shipyard. The purpose of the survey was to determine if operations related t nuclear warship activities resulted in releases of radionuclides which could contri population exposure or contamination of the environment. "Radiological Survey of P Shipyard, Kittery, Maine and Environs" (Semler 1991) discusses the most recent Envi Protection Agency monitoring data. Pertinent conclusions are as follows:

1. "No trace of Co-60 was detected in any samples at Portsmouth Naval Shipyar radioactivity detected in the 40 sediment samples is attributed to natural radionuclides or fallout from past nuclear weapons testing.
2. Results of core sampling did not indicate any previous deposit of Co-60 in
3. The water samples contained no detectable levels of radioactivity.
4. All radioactivity detected in the biota samples is attributed to naturally radionuclides or fallout.
5. External gamma ray measurements did not detect any increased radiation exp public above natural background levels.
6. Based on the survey, it was concluded that current practices regarding nuc warship operations have resulted in no increases in radioactivity that wou major exposure or contamination of the environment."

Environmental monitoring is conducted by the shipyard. The results of this m program corroborate the Environmental Protection Agency's conclusions.

4.1.3.9 Ecological Resources

4.1.3.9.1 Terrestrial Ecology.

Portsmouth Naval Shipyard is an isolated land mass that has been highly developed. There is almost no remaining natural habitat in the shipyard are exception being Clarks Island and the surrounding estuary. Even these areas are no activities on the shipyard and nearby industry.

The estuary around the shipyard could be classified as an intertidal river sy supports a subtidal estuary community. The shoreline is characterized by steep, ro lying marshlands. The shipyard mass would probably be classified as a rock outcrop characterized by sparse vegetation of low-lying shrubs and herbs with scattered tre would be classified as an acidic shoreline outcrop.

The vegetation of the shipyard is made up primarily of trees, shrubs, and gra been planted for landscaping purposes. No naturally occurring species remain at th Clarks Island has remained undeveloped, there is much greater diversity. It suppor herbaceous and shrub species including rushes, skunk cabbage, jewelweed, spike gras azalea, bittersweet, witch hazel, and dogwood. Several lowland tree species are al island, including red maple, sycamore, willow, and poplar.

The fringe marshes along the shore of Admiralty Village and along portions of are dominated by two species, cord grass (Spartina alterniflora) and salt hay (Spar perennial grasses are year-round producers of vital organic matter that is distribu

food chain or deposited in the marsh as part of the underlying peat marsh.

Another important plant species present within the Piscataqua River and abund shipyard is Zostera marina, commonly called eel grass. This submerged marine flowe vital to the health and productivity of the estuary. It provides habitat essential species such as crabs, fin fish, geese, and ducks. Eel grass beds are also preferr lobsters. Other valuable functions of eel grass beds include: sediment trapping, and water filtration. This filtration ability also causes eel grass beds to be sus resulting from excessive wastewater and fertilizer nutrients. Thus, eel grass is e of the estuary and can also serve as an indicator of unhealthy conditions.

The limited amount of vegetation and the highly industrialized nature of the severely limit the availability of suitable habitat for most terrestrial species. mammals on the shipyard, primarily those species that tend to live in close associa including: mice, squirrels, raccoons, and rabbits. There are white-tailed deer an vicinity of the shipyard. However, there are no known resident species of deer or shipyard. The Navy's 1993 "Natural Resources Management Plan for Portsmouth Naval contains a complete listing of all mammals and reptiles found in the southeastern M Hampshire region (Navy 1993b).

One notable ecological feature of the shipyard is its avian population. Bird abundant in the region during the months of April and September, coinciding with th seasons. The most common species in the area are the herring gull, American black doublecrested commorant, great blue heron, and American crow. The most abundant wi species are Canada geese, greater scaup, bufflehead, and common goldeye. Sea birds the most abundant, and the year-round species include herring gulls and great black The commom tern can also be found in large numbers during the late spring and summe have also been known to frequent the area and there is one known nesting pair in th Estuary vicinity. Appendix V. . of the Navy's Natural Resources Management Plan c complete list of bird species common to the coastal region (Navy 1993b).

Clarks Island serves as a safe haven for a multitude of birds. It is an opti migratory species in that it has rocky shore, a small beach area, and an inland are wood and low-lying vegetation. It would not be unreasonable to expect that during and fall, Clarks Island would be utilized by a variety of songbird species along wi coastal species mentioned above. (Navy 1993b)

4.1.3.9.2 Wetlands.

There are a few isolated marine wetlands in the vicinity of the shipyard and a small freshwater wetland on the shipyard. There are two freshwater ponds on the of the base, which have been characterized as palustrine, unconsolidated bottom, an flooded. There is a small area on the banks of the larger pond which is characteri scrub shrub, broadleaf deciduous wetland. There are also two very minute areas sou freshwater ponds which have been characterized as palustrine emergent, persistent, wetlands. Two areas of estuarine wetlands are noted. Along the northeast shorelin classified as intertidal, unconsolidated shore, mud bottom, and regularly flooded. classification has been given to the northern shoreline of Clarks Island. Finally, of Clarks Island and on the southwestern corner of the shipyard, there are areas of aquatic bed, algal, regularly flooded wetlands. It should be noted that these dete based on stereoscopic analysis of aerial photographs and cannot be considered compl without ground truthing. (Navy 1993b)

Because natural drainage systems are limited, the shipyard has developed an e water collection system and a drainage system to control flooding of the freshwater collection system eventually drains into the Piscataqua River, as does surface runo

4.1.3.9.3 Aquatic Ecology.

The waters surrounding the Portsmouth Naval Shipyard support a vast amount of marine life, from mammals to benthic organisms. Although the larger species, like whales and dolphin, are not common to the estuarine waters of the Pis harbor seals can be seen throughout the Great Bay region in winter and spring. The supports a number of commercially and recreationally important fin fish including s flounder, Atlantic silversides, alewives, and striped bass. A more complete list c Appendix V. . of the Navy's Natural Resources Management Plan (Navy 1993b).

These fish species rely heavily on a healthy benthic invertebrate population Substrate type has a major impact on the number and variety of species that will be

particular area. The areas around the shipyard that have a rocky bottom will be po epibenthic organisms. Sandy or muddy bottoms can support both epibenthic and infau Some of the more common shellfish species include lobster, softshell clams, and blu more detailed list of benthic infauna can be found in Appendix V. . of the Navy's Management Plan (Navy 1993b).

The freshwater ponds on the shipyard also serve as a source of aquatic specie healthy benthic community within this ecosystem as well, including a variety of pol There is an abundance of vegetation in and around the ponds, which provides habitat fish. The most abundant fish species at this time is the smallmouth bass (Micropte which were stocked at one time. (Navy 1993b)

4.1.3.9.4 Endangered and Threatened Species.

In the coastal area from Portland, Maine to Portsmouth, New Hampshire, the threatened or endangered species include the Piping Tern, Bald Eagle, Peregrine Falcon, Shortnose Sturgeon, and several species of whal turtles.

Appendix V. . of the Navy's Natural Resources Management Plan (Navy 1993b) i list of the threatened and endangered species of southeastern Maine and New Hampshi and New Hampshire officials were consulted and have determined that there is no evi that any threatened or endangered species reside on the Portsmouth Naval Shipyard. mammals are afforded full federal protection under the Marine Mammal Protection Act (Navy 1993b).

4.1.3.10 Noise

Portsmouth Naval Shipyard is an existing industrial-type environment character from truck and auto traffic; ship loading cranes and related diesel-powered equipme continuously operating transmission lines for steam, fuel, water, and related compr and other liquids. In addition, new construction of buildings, reconstruction and activities for streets, buildings, parking lots, and ships all contribute to a perv environment.

4.1.3.11 Traffic and Transportation

The Kittery-Portsmouth area is very accessible to vehicular traffic due to th Interstate 95.
The major cities of Boston, Massachusetts and Portland, Maine are approximately one hour away. U.S. Route 1, a primary road, runs parallel to I-95 in a north-south di provides good access to the local communities along the seacoast. Because of the s on an island in the Piscataqua River, access is restricted to two federally owned b provide access directly to the shipyard's northern boundary from residential street Kittery. The majority of installation oriented traffic traverses five local second Avenue, Wenworth Street, and Shapleigh, Whipple, and Rogers Roads. Walker Avenue i primary access route to Bridge 1 and Whipple Road provides direct access to Bridge shipyard generated traffic is funneled from the two major highways, I-95 and U.S. R the local roadways and over the bridges.

Daily rail service, freight only, is provided to Portsmouth Naval Shipyard by Maine Railroad. The railroad connects Portsmouth with Manchester, New Hampshire; P Maine; and Boston, Massachusetts. Rail passenger service is available via AMTRAK c Boston.

Limited air service is provided at small airports at Eliot and Sanford, Maine and Rochester, New Hampshire. Pease Airport provides the opportunity for commuter Logan Airport in Boston, Massachusetts and to other cities. In addition, Portsmout hour travel time by car from major airports at Boston, Massachusetts and Portland,

The Portsmouth Harbor, about 3 nautical miles from deep water of the Atlantic accessible year round via the Piscataqua River channel. The river channel is 35 fe mean low water and 400 feet wide. There are about 500 vessel trips each way throug each year. About 150 of these trips involve ships with drafts greater than 18 feet trips are made by tankers. A Coast Guard Station is located at New Castle near the (Navy 1984)

Naval spent nuclear fuel has been removed from Navy nuclear-powered ships and

to the Idaho National Engineering Laboratory Expended Core Facility (ECF) for exami evaluation as a routine part of their operating cycle. Naval spent nuclear fuel sh Portsmouth Naval Shipyard to ECF were initiated in 1959. Since that time, 43 shipm spent nuclear fuel originating at Portsmouth Naval Shipyard have been made to ECF. spent nuclear fuel was shipped by rail. Attachment A provides a list of these ship by year. Attachment A also contains detailed descriptions of the shipping containe spent nuclear fuel shipments from shipyards.

4.1.3.12 Occupational and Public Health and Safety

4.1.3.12.1 Occupational Radiological Health and Safety. Portsmouth Naval Shipyard and the

Admiralty Village housing area are physically located in York County, Kittery, Main government-owned land. The U.S. Government provides its own police and fire protec shipyard, while Kittery provides police and fire protection for the Admiralty Villa (Navy 1984)

The Navy has well established and effective Occupational Safety, Health, and Medicine programs at all of its shipyards. In regard to radiological aspects of th Naval Nuclear Propulsion Program policy is to reduce to as low as reasonably achiev exposure to personnel from ionizing radiation associated with naval nuclear propuls stringent controls on minimizing occupational radiation exposure have been successf military personnel at Navy sites have ever exceeded the federal accumulated radiati which allows 5 rem exposure for each year of age beyond age 18. Since 1967, no per exceeded the federal limit which allows up to 3 rem per quarter year and since 1980 received more than 2 rem per year from radiation associated with naval nuclear prop The average occupational exposure of each person monitored at all shipyards is 0.26 The average lifetime accumulated radiation exposure from radiation associated with propulsion plants for all shipyard personnel who were monitored is 1.2 rem. (NNPP 1 corresponds to the likelihood of a cancer fatality of 1 in 2083.

The Navy's policy on occupational exposure from internal radioactivity is to exposure to personnel from internal radioactivity. The limits invoked to achieve t one-tenth of the levels allowed by federal regulations for radiation workers. As a policy, no civilian or military personnel at shipyards have ever received more than federal annual occupational exposure limit from internal radiation exposure caused associated with naval nuclear propulsion plants.

For work operations involving the potential for spreading radioactive contami ments are used to prevent personnel contamination or generation of airborne radioac controls for contamination are so strict that precautions sometimes have had to be tracking contamination from fallout and natural sources into radiological areas bec contamination control limits used in these areas were well below the levels of fall contamination occurring outside in the general public areas. A basic requirement o control is monitoring all personnel leaving any area where radioactive contaminatio occur. Workers are trained to survey themselves (i.e., frisk), and their performan radiological control personnel. Frisking of the entire body is required, normally held survey instruments. Major work facilities are equipped with portable monitors in lieu of hand-held friskers. These stringent controls to protect the workers and contamination have proven effective in the past.

In 1991, researchers from Johns Hopkins University, Baltimore, Maryland, comp comprehensive epidemiological study of the health of workers at the six naval shipy private shipyards that service the Navy's nuclear-powered ships (Matanoski 1991). study evaluated a population of 70,730 civilian workers over a period from 1957, be first overhaul of the first nuclear-powered submarine, USS NAUTILUS, through 1981, whether there was an excess risk of leukemia or other cancers associated with expos of gamma radiation.

The Johns Hopkins study found no evidence to conclude that the health of peop work on U.S. naval nuclear-powered ships has been adversely affected by exposure to radiation incidental to this work. Additional studies are planned to investigate t update the shipyard study with data beyond 1981.

The radiation exposure during normal operations at each shipyard for workers radiation levels monitored is determined based on the annual radiation exposure of worker for all shipyards based on Naval Nuclear Propulsion Program Report NT-94-2 (The total number of shipyard personnel monitored for radiation exposure associated Nuclear Propulsion Program has been about 164,000.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e transportation workers for all historical shipments is 16.6 person-rem, which stati to 0.0066 cancer fatalities. The maximum exposed individual (MEI) is a transportat since the workers are closer to the shipment for a longer time than any member of t Under the limiting assumption that the same worker is associated with every shipmen historical period, this person would receive a total exposure of 7.5 rem over the a 40-year period, or about 0.19 rem per year, which is within DOE standards for occup exposed individuals. The radiation exposures to workers correspond to much less th cancer, which means that it is unlikely that there have been any past health impact historical shipments of naval spent nuclear fuel over the entire history of such sh

4.1.3.12.2 Occupational Non-radiological Health and Safety.

In the non-radiological Occupational Safety, Health, and Occupational Medicine area, the Navy complies with Occupational Safety and Health Administration Regulations. The Navy policy is to m and healthful work environment at all Navy facilities. Due to the varied nature of facilities, there is a potential for certain employees to be exposed to physical an These employees are routinely monitored during work and receive medical surveillanc hazards such as exposure to high noise levels or heat stress. In addition, employe their exposure to chemical hazards such as organic solvents, lead, asbestos, etc., ate are placed into medical surveillance programs for these chemical hazards.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact due to the historical shipment of naval spent nuclear fuel over the entire h shipments.

4.1.3.12.3 Public Radiological Health and Safety.

In order to quantify the exposures resulting from normal shipyard radiological releases to the general public, detailed analyses based on very conservative estimates of radioisotopic releases since releases began provides detailed annual release values used in the analyses.

The GENII computer code (Napier et al. 1988) was used to calculate exposures beings due to the estimated radionuclide releases from normal operations at the shi

A person on the shipyard boundary at the location where the largest exposures received was used as the hypothetical maximally exposed off-site individual (MOI) f releases of radioactive material from stored fuel. The population data used to cal exposures were taken from 1990 census data provided by the U.S. Census Bureau. Met were obtained as described in Attachment F.

The hypothetical exposures calculated in Attachment F for the period 1995 thr adjusted from an annual basis (1995) to the historical basis by multiplying by 38 y of 1.7 to take into consideration variations in the number of ships and operations.

The calculated accumulated exposures through 1995 to the general population w of the site (about 2.4 million people) are 0.65 person-rem. To provide perspective received due to natural radiation sources through 1995 are approximately 28 million based on 0.3 rem per person per year.

The results of environmental monitoring as described in Naval Nuclear Propuls Report NT-94-1 show that Naval Nuclear Propulsion Program activities had no disting on normal background radiation levels at site perimeters (NNPP 1994b).

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e general population for all historical shipments is 1.95 person-rem, which statistic 0.00098 cancer fatalities.

All of the radiation exposures to the general population correspond to much l incident cancer, which means that it is unlikely that there has been any past healt public due to all historical shipments of naval spent nuclear fuel over the entire shipments.

4.1.3.12.4 Public Non-radiological Health and Safety.

The Naval Medical Clinic located on
the shipyard is used by Navy personnel and dependents for their general medical car
Medical problems that require treatment not available at the clinic are taken care
located in York, Maine and Portsmouth, New Hampshire. (Navy 1984)

Attachment A provides a discussion of the calculation of past health impacts
all transportation of naval spent nuclear fuel and test specimens. Approximately 0
estimated as a result of non-radiological sources (vehicle emissions) associated wi
shipments of spent nuclear fuel. This number includes both the workers and the gen
Since this number is much less than one, it is unlikely that there has been any non
impact to the public due to all historical shipments of naval spent nuclear fuel ov
of such shipments.

4.1.3.13 Utilities and Energy

Portsmouth Naval Shipyard has its own Security, Fire, Public Works, and Suppl
departments.
Portsmouth Naval Shipyard obtains its electricity from Central Maine Power, but has
central power plant capable of producing all of the required steam and electricity.
furnished by the town of Kittery, Maine. (Navy 1984)

The 1993 electrical power usage at Portsmouth Naval Shipyard was 76,262 megaw
The water usage at the shipyard was approximately 668 million gallons for 1993.

4.1.3.14 Materials and Waste Management

The shipyard's sewage is pumped to the town of Kittery's sewage treatment syst

Disposition of solid waste is as follows: 58% is recycled, 38% is burned for energ
Maine Energy Recovery Incinerator, and 4% is landfilled at licensed off-site facili
waste is collected and shipped for off-site licensed treatment/disposal. Container
is collected, consolidated, characterized, and labeled at the shipyard's state-lice
Storage Facility prior to manifesting to off-site licensed treatment/disposal/energ
Oily waste is presently contracted for off-site disposal; however, an oily waste tr
been installed and should be on line in the near future. The effluent from treatme
discharged to the sewer, and the separated waste oil will be sold through the Defen
Agency.

Solid radioactive waste materials are packaged in strong, tight containers, s
necessary, and shipped to burial sites licensed by the U.S. Nuclear Regulatory Comm
under agreement with the U.S. Nuclear Regulatory Commission. Shipyards and other s
are not permitted to dispose of radioactive solid wastes by burial on their own sit
approximately 74 cubic yards of routine low-level radioactive waste containing 2 cu
from Portsmouth Naval Shipyard for burial.

Waste which is both radioactive and chemically hazardous is regulated under b
Energy Act and the Resource Conservation and Recovery Act (RCRA) as "mixed waste."
Naval Nuclear Propulsion Program, concerted efforts are taken to avoid combining r
chemically hazardous substances so as to minimize the potential for generation of m
example, these efforts include avoiding the use of acetone solvents, lead-based pai
in disposal containers, and chemical paint removers. Radioactive wastes, including
chemically hazardous substances, are handled in accordance with long-standing Progr
requirements. Such handling includes solidification to immobilize the radioactivit
radioactive and chemically hazardous substances, removal of liquids from solids, an
techniques. A determination is then made as to whether the resulting waste is haza
of Program efforts to avoid the use of chemically hazardous substances in radiologi
activities typically generate only a few hundred cubic feet of mixed waste each yea
amount of mixed waste, along with limited amounts of mixed waste from Program work
prior to 1987, will be stored pending the licensing of commercial treatment and dis

4.1.4 PEARL HARBOR NAVAL SHIPYARD: PEARL HARBOR, HAWAII

4.1.4.1 Overview

The Pearl Harbor Naval Shipyard is located in the Southeast Loch of Pearl Har Hawaii (Figures 4.1.4-1 and 4.1.4-2). This shipyard consists of approximately 350 of Oahu is the third largest (593 square miles) in the State of Hawaii and is the p the Hawaiian Islands. The 1990 Oahu population of approximately 820,000 residents 75% of the state's total, and the City and County of Honolulu are the fastest growi state, with the highest population densities. Honolulu is the state capital, large business and government.

Pearl Harbor is a principal harbor for U.S. Navy activities and is the base o for the mid-Pacific. Figure 4.1.4-3 provides a Pearl Harbor site map. Its water s 8 square miles and its docks accommodate all classes of Navy vessels up to the larg carriers. Ship maintenance and repairs are performed for all types of vessels in P Shipyard's dry docks and docking areas. All of the docks are located in the Southe the exception of Dry Dock 4 which is adjacent to the Pearl Harbor main channel. (N

4.1.4.2 Land Use

There are six major land use activities at Pearl Harbor. Commander Naval Bas (NAVBASE) hosts various operational commands that include the Headquarters for the and the Headquarters of the Third Fleet.

Pearl Harbor Naval Shipyard provides the maintenance and repair services note Naval Supply Center provides fuel, ammunition, other supplies, and storage. The ot use activities are for: the Submarine Base; the Public Works Center; and the U.S. Ship Maintenance Detachment.

Land use is designated as urban by the State of Hawaii, and military by the C of Honolulu. As can be seen in Figure 4.1.4-2, the Pearl Harbor Naval Shipyard is

Figure 4.1.4-1. Location of Pearl Harbor Naval Shipyard in Hawaii. Figure 4.1.

the remaining three quadrants. Other activities commonly occurring in the Pearl Ha commercial fishing, tourism, and recreational facilities, along with a few retail c (Navy 1990b)

4.1.4.3 Socioeconomics

Oahu has experienced a high rate of economic growth over the past decade due in the Pacific, which benefits both military defense and visitor industries. These surpassed the two historical bases of the Hawaiian economy, which are pineapple and tion and production.

Oahu's visitor industry continues to prosper. Visitor arrivals to the state Department of Business and Economic Development to reach 7.8 million visitors by 20 capturing approximately half of the visitors. This would represent a visitor growt about 3.4 percent compounded annually.

Defense expenditures cushion Oahu's economy from the seasonal and cyclical fl tourism. The military is also a primary source of highly skilled employment opport civilians. Pearl Harbor has the largest concentration of Department of Defense emp state, with about 7,700 shore-based Navy personnel and 10,900 civilians, for a tota naval base. In 1993, shipyard employment accounted for about 5,000 of the total. distribution within 50 miles of Pearl Harbor Naval Shipyard is shown in Figure 4.1.

Unemployment figures in the state and for the island of Oahu are among the lo nation. Oahu is at a 2.3 percent unemployment level as of October 1989, reflecting economy that prevailed in the latter half of the 1980s. With the outlook favorable expansion, job growth is currently expected to equal or better the 2 to 3 percent h increase in Oahu's work force. (Navy 1990b)

Figure 4.1.4-4. Population distribution within 50 miles of Pearl Harbor Naval Sh

operation of the naval spent nuclear fuel area would be expected to reside on the i calculated total population, labor force, and employment within this region for the are presented in Table 4.1.4-1. Projections of employment and population for the y have not been presented because, as discussed in Section 5, the number of additiona be created at the shipyard under any alternative could be small.

Table 4.1.4-1. Regional employment factors at Pearl Harbor Naval Shipyard.

Regional Employment	Regional Labor Force	Regional Population

393,260	407,530	812,190

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the Pearl Harbor Naval Shipyard with the population data provided in Figure 4.1.4-4.

Figure 4.1.4-5 shows the locations of populations which have more than 50 per members within the 50-mile radius. Minorities make up approximately 55 percent of population in this area. These populations have been identified following an appro the Environmental Protection Agency which, for purposes of environmental justice ev minority communities as those which have percentages of minorities greater than the region analyzed (EPA 1994).

Figure 4.1.4-6 shows the locations of populations which have more than 25 per members living in poverty, reflecting a common definition of low-income communities The U. S. Census Bureau characterizes persons in poverty as those whose income is l

Figure 4.1.4-5. Minority population distribution within 50 miles of the Pearl Ha

Figure 4.1.4-6. Low-income population distribution within 50 miles of the Pearl

"statistical poverty threshold." For the 1990 census, this threshold was based on $12,500 per household.

4.1.4.4 Cultural Resources

Pearl Harbor has been the site of several important historical events and cha noted for its role in the Pacific Theatre Defense during World War II. Physical si Pearl Harbor have been designated as historically significant, including several ba the December 7, 1941 Japanese bombing of Pearl Harbor, as well as sites where plane Naval Base Pearl Harbor was designated as a National Historic Landmark in 1964, and was listed on the National Register of Historic Places.

The Pearl Harbor area has been heavily modified over the past 70 years. This extensive changes that were intended to stabilize the marshy shorelines. Most surf pre-military occupation has long since been obliterated. Due to the historic natur there might be areas of archaeological interest. However, there are no archaeologi within the boundary of the shipyard. Many native Hawaiian cultural resources exist Islands. There are three Hawaiian fish ponds located outside the boundary, in West Loch, that have been recommended for preservation. (Navy 1990b)

4.1.4.5 Aesthetic and Scenic Resources

The Pearl Harbor viewshed is dominated by the sweeping mountain to sea vistas of nearshore areas on Oahu. The City and County of Honolulu's Coastal View Study (that the "flat terrain and the built up military facilities surrounding Pearl Harbo public viewing opportunities into this bay." (Navy 1990b) The shipyard area, itse setting. The area within the shipyard where naval spent nuclear fuel would be stor sensitivity since the area is an industrial site.

4.1.4.6 Geology

4.1.4.6.1 General Geology.

Oahu's topography consists of two parallel mountain ranges running in a northwest to southeast direction, separated by a plateau. A large, relatively borders the plateau at the south. The Pearl Harbor Naval Complex, for the most par coastal plain.

Land near the waterfront areas is very flat, rising slightly inland from Kame There are moderate slopes which exist around the rim of the Makalapa Crater.

4.1.4.6.2 Geologic Resources.

There are several different soil associations within the Pearl Harbor basin. The majority of the U.S. Navy lands surrounding Pearl Harbor are com Lualualei - Fill Land - Ewa Soil Association. This association consists of well-dr and moderate fine textured soils on fans and in drainage ways on the southern and w plains of Oahu. The soils are formed from sediment deposited by streams, and are n moderately sloping. This soil association makes up about 14 percent of the island

Pearl Harbor estuary occurs on the coastal sedimentary plain of southern Oahu consists of three lochs which join to form a single channel entrance. Streams, spr water flow into the harbor; the estuary was formed by freshwater flows that have er plain and retarded coral growth. Since their initial formation, the lochs have bee change, erosion, and silt. The west side of the harbor is composed mostly of limes known as the Ewa Plain. The east side of the harbor consists mainly of compacted v Hard, dense volcanic rock forms the bulk of the rock material to the north. Marine sediments occur around the perimeter of the harbor. (Navy 1990b)

Much of the land area in Pearl Harbor is fill land created by dredge spoils s major dredging effort took place between 1940 and 1943, when dredged material was p Waipio Peninsula and adjacent to Kuahua Island (now Kuahua Peninsula). This landfi present shoreline configuration. (Navy 1990b) There are no economic geologic reso shipyard.

4.1.4.6.3 Seismic and Volcanic Hazards.

Seismic risk related to structural damage may be represented in the United States by a relative scale of 0 through 4, with Zone 0 no encounter damage and Zone 4 expected to encounter the greatest seismic risk. The P Naval Shipyard is located in Zone 1. (UBC 1991) Except for the island of Hawaii i Hawaiian Islands are not a highly seismic area. Even on Hawaii, most of the earthq volcanic origin and do little or no damage, although a few have been quite severe. Building Code seismic classification provides a means for a comparable assessment o hazard between the alternate sites. If the Record of Decision identifies this site of naval spent fuel, then a detailed seismic evaluation would be conducted. More d regarding the design basis considerations for storage of naval spent nuclear fuel a provided in Attachment D.

From review of Tsunami Wave Runup Heights in Hawaii by Harold G. Loomis, Hawa Institute of Geophysics, University of Hawaii, May 1976, past inundation levels fro by seismic events have been about 3 feet above Mean Sea Level (msl). In addition, from the U.S. Army Engineering Division, Pacific Ocean, dated 10 January 1986 indic seismically induced wave elevations for the 10-year, 100-year, and 500-year event t feet, and 3.8 feet, respectively, for adjacent coastal areas. (Navy 1990b)

Pearl Harbor is fully protected from ocean waves and swells. Waves propagati 15,000-foot entrance channel are completely reduced. The normal tides in Hawaii oc with pronounced daily inequalities. Maximum high, or spring tides, reach 2.5 feet water level rise is caused by four components: astronomical tides, rise from atmos reduction (pressure setup), wind setup, and wave setup. Based on information obtai Naval Western Oceanography Center, maximum hurricane storm water level rise from se the worst conditions foreseeable would be approximately 12 feet above the existing maximum total storm water level rise would be approximately 14.5 feet above msl. U maximum foreseeable conditions, any material stored in the dry dock area of Pearl H Shipyard, which is about 8 feet above msl, could be flooded to a level of about 6.5

In September 1992, the worst storm in Pacific history, Hurricane Iniki, hit K sustained 145-mile-per-hour winds and gusts to 175 miles per hour. Oahu, 80 miles received comparatively minor damage to that experienced on Kauai. The last hurrica state prior to Iniki was Iwa in 1982 but it did not cause nearly as much damage.

The Hawaiian Islands were formed by volcanic eruptions; however, the only act area is on the island of Hawaii. There are no volcanic hazards on the island of Oa Dalrymple 1973).

4.1.4.7 Air Resources

4.1.4.7.1 Climate and Meteorology.

With the exception of minor differences in temperature and rainfall at Red Hill and Camp Stover, all of the activities at Pearl Harbor lie wit zone and are subject to the same weather conditions.

The predominant winds are the northeast tradewinds, which prevail most of the particularly from February to November. Thus, the predominant winds would carry an contaminant from the shipyard to the unpopulated ocean region adjacent to Pearl Har At certain times of the year, south to southwest winds and mild offshore breezes ca Winds with speeds up to 49 miles per hour may occasionally strike from the north or rarely reach gale velocities. The south winds are usually accompanied by wet tropi frequent heavy showers. During the summer months, periods of no wind occur occasio not persist for more than a day or two. During the winter months, winds tend to be with longer periods of light and variable winds, and occurrences of strong southerl associated with weather fronts and storms.

The rainfall at Pearl Harbor is light and generally inadequate to sustain law vegetation for at least nine months of the year. Very heavy precipitation may occa times of southerly winds, and this may cause local flooding because of the nature o relatively low elevation. The mean annual rainfall for the naval base is between 2 dependent upon the incidence of the occasional heavy southerly rains mentioned prev topography and meteorology of Oahu are responsible for the unusual annual rainfall Figure 4.1.4-2.

Temperatures vary by season as well as daily in the Pearl Harbor region. Hig 89yF are not uncommon during mid-afternoon in summer. Night temperatures during th season fall between 72yF and 76yF. During the winter and early spring, daytime hig between 76yF and 78yF, and nighttime lows may fall to the low 60's or high 50's. T generally caused by a shallow blanket of cold air that pours down from the mountain over the lowlands during periods of low-velocity tradewinds. The low temperatures invariably accompanied by a heavy dewfall which is not normal to the region.

4.1.4.7.2 Air Quality.

An area can be designated by the Environmental Protection Agency as having air quality that is better than defined by the National Ambient Air Quality ment) or as exceeding one or more of those standards (nonattainment for one or more The Code of Federal Regulations, Title 40, Part 81, states that the Air Quality Con shipyard is better than national standards for total suspended particulate matter a no specific classification for ozone, carbon monoxide, and NO2.

Air quality on Oahu is primarily affected by the prevalence of the northeast prevail approximately 80 percent of the year, particularly from February to Novembe monitoring of the naval base area conducted in 1989 showed that there was no NAAQS Thus, air quality was in attainment with federal standards. The state standards, w restrictive in many cases than federal requirements, were exceeded only at intersec traffic during peak rush hours. (Navy 1990b) The nearest Class I Area is Haleakal 188 kilometers (117 miles) from the shipyard.

4.1.4.7.3 Existing Radiological Conditions.

Radiological facilities at all naval shipyards are designed to ensure that there are no uncontrolled discharges of radioactivity in ai Radiological controls are exercised to preclude exposure of working personnel to ai radioactivity exceeding federal limits. Air exhausted from radiological work facil through high-efficiency particulate air filters and monitored during discharges. T radioactivity emissions from the shipyards do not result in any measurable radiatio general public. Calculations of site radioactive airborne emissions for 1992 have described in Attachment F. These calculations have shown that emissions of radionu shipyard result in an effective dose equivalent of less than 0.1 mrem per year to a general public.

4.1.4.8 Water Resources

4.1.4.8.1 Surface Water.

Pearl Harbor receives surface runoff from seven watersheds. The Waikele Watershed (54 square miles) is the largest of the seven, comprising nearly Pearl Harbor Basin. It is drained primarily by Waikele Stream, which discharges th sediment load of any of the Pearl Harbor Basin streams.

The Waiawa Watershed (24.6 square miles) consists of forest, agricultural, an is drained by Waiawa Stream and its tributaries into Middle Loch. The Waimalu Wate square miles) is drained by the Waimano, Waimalu, and Kalauao Streams, which discha East Loch of Pearl Harbor. The watershed is primarily undeveloped forest land with urban areas on the coastal plain and lower slopes. The Aiea and Halawa Watersheds the Aiea and Halawa Streams, respectively, which discharge into East Loch. They ar nature to the Waimalu Watershed. Honouliuli Stream drains the Honouliuli Watershed intermittently into West Loch. The watershed consists primarily of agricultural an Only 20 percent of the Ewa Beach Watershed drains into Pearl Harbor. Sediment disc Pearl Harbor from the flat lowland area adjacent to West Loch are negligible.

Of the eight streams discharging into Pearl Harbor, two are intermittent: Ho and Aiea Stream. The remaining are perennial streams (Waikele, Waiawa, Waimano, Wa Kalauao, and Halawa), which have their headwaters in the high rainfall area of the All streams drain the forested and agricultural lands and pass through urban areas Pearl Harbor. Some flooding occurs along the major streams throughout much of the a major problem on the Naval Complex, affecting only a narrow strip of land along A (Navy 1990b)

An assessment in 1988 by the State of Hawaii, Department of Health indicated Harbor's large drainage basin in central Oahu and the abundant rainfall in headwate streams that flow into the harbor are major contributors to the harbor's role as a nonpoint runoff from agricultural, urban, and military sources. Violations of wate were noted for nitrogen, phosphorus, turbidity, and fecal coliforms in the harbor w (Navy 1990b)

The Flood Insurance Rate Map (FIRM) COMMUNITY-PANEL No. 150001 0110 C shows that the floodplain is "undetermined" for the Pearl Harbor Naval Shipyard. Based o and topographical maps of areas approximately 3 miles away, the conceptual interim is in the 100-year floodplain. However, based on experience, the location consider nuclear fuel is not in a high-hazard area (as defined by Title 10, Part 1022 of The Regulations for floodplains) which is an area where frequent flooding occurs.

4.1.4.8.2 Groundwater.

The major source of potable water on Oahu is dependent on a hydrologic cycle that starts with evaporation of water from the ocean, condensation rain, and the capture of that rain by the Koolau Mountains. A portion of the rainw down into the porous ground to become groundwater. The groundwater is a limited re in three types of groundwater bodies, or aquifers: major basal aquifers, which con floating on heavier seawater sealed from the ocean by layers of dense, hard volcani aquifers in which rainfall is caught behind impermeable dikes at high elevations; a standing on impermeable beds of volcanic ash, thus creating springs. Naval Base Pe receives most of its water from the Koolau Aquifer and a small portion from the Wai which are basal aquifers located in south central Oahu, partially within the Pearl Management Area (PHWMA). As of 1990, the military had an allocation of 28.125 mill per day (mgd) from the PHWMA, of which 22.670 mgd was authorized for the Navy. Ove of this allocation was not used in 1988. Approximately 3 mgd of this unused alloca to the Navy. The quality of groundwater from the above aquifers is good. (Navy 19

4.1.4.8.3 Existing Radiological Conditions.

The normal activities associated with current naval nuclear operations at all naval shipyards do not result in the intentional discharg liquid effluent. However, there were occasions, primarily in the early 1960's, whe levels of radioactivity were discharged with liquid effluent. In all cases, efflue than permitted under the then current limits imposed by state and federal agencies.

The United States Environmental Protection Agency Office of Radiation Program

performed monitoring of the water, plant life, aquatic life, and sediment in the vi Harbor Naval Shipyard. The purpose of the survey was to determine if operations re Navy nuclear warship activities resulted in releases of radionuclides which could c significant population exposure or contamination of the environment. "Radiological Pearl Harbor Naval Shipyard and Environs" (Callis 1987) is the most recent Environm Agency report which discusses data taken in 1985. Pertinent conclusions from this follows:

1. "Neither harbor water nor drinking water from surrounding areas contain de cobalt-60 or tritium radioactivity.
2. Very small quantities of cobalt-60 were found in sediment and in two aquat samples from the harbor. No cobalt-60 was found in any of the aquatic lif
3. The levels of cobalt-60 in the harbor sediment have decreased significantl surveys of 1966 and 1968 and are consistent with those expected from the r decay of the amounts found in the 1966 and 1968 surveys.
4. The current practice of restricting the release of radioactive material in the minimum practical has been effective and should allow the cobalt-60 ra remaining in harbor sediment to continue to decrease.
5. The levels and locations of radioactivity identified and the limited media found show that operations related to nuclear-powered warship activities r release of radionuclides having adverse effects on public health or the en

Environmental monitoring is conducted by the shipyard. The results of this m program corroborate the Environmental Protection Agency's conclusion.

4.1.4.9 Ecological Resources

4.1.4.9.1 Terrestrial Ecology.

Because the Pearl Harbor area has been disturbed extensively and for such a long period of time, the vegetation is dominated by introduced or alien consists of maintained landscaped specimens or, on unmaintained areas, mangrove thi scrub. The few native taxa which occur on these unmaintained areas such as 'uhaloa indica) and 'ilima (Sida fallax) occur throughout the Hawaiian Islands and the Paci environmental habitats. No plants considered threatened or endangered occur on thi

Fauna in the Pearl Harbor area is also typically urban. In general, various cats and dogs, rodents, and exotic bird species are found in the area. No endemic recorded during the course of the field surveys completed in 1989. (Navy 1990b)

4.1.4.9.2 Wetlands.

There are several wetland areas at Pearl Harbor identified in the East Loch, Middle Loch, and West Loch, as well as an area on the Waipio Peninsula. There is a Harbor National Wildlife Refuge. These are habitats for endangered species of bird Hawaiian Coot and Hawaiian Stilt. A cooperative agreement established between the the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Department of Land and Natural Resources, protects these wetlands. (Navy 1990b)

4.1.4.9.3 Aquatic Ecology.

Most of the Pearl Harbor marine community structure is characterized by four zones: sand-rubble zone, algal-mud zone, channel wall zone, and chann zone. Sedimentation is the major factor determining the constituents of the Pearl community. Hence, stony corals, which are especially sensitive to high sediment lo been observed. Predominant biota include the sea cucumber (Ophiodesoma spectabilis commonly found in areas of high organic particulate input; benthic (bottom dwelling Sabellid (feather duster) worms; Serpulid worm tubes; and various benthic shrimps a (Navy 1990b)

4.1.4.9.4 Endangered and Threatened Species.

Most of the land at Pearl Harbor Naval Shipyard has been urbanized, and the present vegetation consists almost exclusively

plant species. Consequently, no federally or state listed threatened or endangered habitats are known to exist within the confines of Pearl Harbor Naval Shipyard. Be been greatly disturbed and the native vegetation completely eliminated, there is li terrestrial habitat of any consequence. Small tracts of weedy fields and isolated secondary vegetation within the station's boundaries provide limited habitat for in birds and rodents. Some migratory birds as well as endemic and indigenous waterfow occasionally frequent the shoreline areas of Pearl Harbor Naval Shipyard, but none residents of the activity. The mangrove stands and associated shoreline habitats a variety of fish and wildlife and aid in shoreline stabilization and erosion control

Marine mammals are afforded full Federal protection under the Marine Mammal P Act of 1972. As noted above, there are wetland areas in the Pearl Harbor Complex t National Wildlife Refuge and provide habitats for endangered species of birds, prin Hawaiian Coot (Fulica americana alai) and Hawaiian Stilt [Himantopus mexicanus (=hi knudseni].

4.1.4.10 Noise

Noise sensitive locations in the Pearl Harbor area have been identified as th Memorial, U.S.S. Arizona Memorial Visitor Center, U.S.S. Bowfin Park, Marina Restau Richardson Recreation Center, and existing or planned residential areas of Ford Isl measurements were taken at these locations on December 5, 1989; previous measuremen taken at some of these locations. All appear to meet state and federal noise stand Pearl Harbor Naval Shipyard is an existing industrial environment characterized by and auto traffic, ship loading cranes and related diesel-powered equipment, and con operating transmission lines for steam, fuel, water, and related compressors for th liquids. In addition, new construction of buildings, reconstruction and rehabilita streets, buildings, parking lots, and ships all contribute to the noise associated environment. (Navy 1990b)

4.1.4.11 Traffic and Transportation

The main portion of traffic into and out of the base is an aggregate of commu work, residential related traffic, and service traffic related to the business of t Kamehameha

Highway is the primary access route to the base from the Ewa/Pearl City/central Oah Both Kamehameha Highway and Interstate Highway H-1 provide access to the Naval Base Honolulu direction. (Navy 1990b)

The Honolulu International Airport provides scheduled passenger and cargo air major connecting hubs. In addition, Hickam Air Force Base services the military.

Naval spent nuclear fuel has been removed from Navy nuclear-powered ships and to the Idaho National Engineering Laboratory Expended Core Facility (ECF) for exami evaluation as a routine part of their operating cycle. Naval spent nuclear fuel sh Harbor Naval Shipyard to ECF were initiated in 1962. Since that time, 20 shipments nuclear fuel originating at Pearl Harbor Naval Shipyard have been made to ECF. The nuclear fuel containers were transported by ship to the Puget Sound Naval Shipyard containers were then transported to ECF by rail. Attachment A provides a list of t made to date by year. Attachment A also contains detailed descriptions of the ship used for naval spent nuclear fuel shipments from shipyards.

Traffic circulation related to Naval Base Pearl Harbor is determined by the w residential populations of the base, by the geometry of the existing roadways and i the access gates into the base.

4.1.4.12 Occupational and Public Health and Safety

4.1.4.12.1 Occupational Radiological Health and Safety. The Navy has well established and

effective Occupational Safety, Health, and Occupational Medicine programs at all of yards. In regard to radiological aspects of these programs, the Naval Nuclear Prop reduce to as low as reasonably achievable the external exposure to personnel from i associated with naval nuclear propulsion plants. These stringent controls on minim radiation exposure have been successful. No civilian or military personnel at Navy exceeded the federal accumulated radiation exposure limit which allows 5 rem exposu

of age beyond age 18. Since 1967, no person has exceeded the federal limit which a 3 rem per quarter year and since 1980, no one has received more than 2 rem per year associated with naval nuclear propulsion plants. The average occupational exposure monitored at all shipyards is 0.26 rem per year. The average lifetime accumulated from radiation associated with naval nuclear propulsion plants for all shipyard per monitored is 1.2 rem. (NNPP 1994a) This corresponds to the likelihood of a cancer 2083.

The Navy's policy on occupational exposure from internal radioactivity is to exposure to personnel from internal radioactivity. The limits invoked to achieve t one-tenth of the levels allowed by federal regulations for radiation workers. As a policy, no civilian or military personnel at shipyards have ever received more than federal annual occupational exposure limit from internal radiation exposure caused associated with naval nuclear propulsion plants.

For work operations involving the potential for spreading radioactive contami ments are used to prevent personnel contamination or generation of airborne radioac controls for contamination are so strict that precautions sometimes have had to be tracking contamination from fallout and natural sources into radiological areas bec contamination control limits used in these areas were well below the levels of fall contamination occurring outside in the general public areas. A basic requirement o control is monitoring all personnel leaving any area where radioactive contaminatio occur. Workers are trained to survey themselves (i.e., frisk), and their performan radiological control personnel. Frisking of the entire body is required, normally held survey instruments. Major work facilities are equipped with portable monitors in lieu of hand-held friskers. These stringent controls to protect the workers and contamination have proven effective in the past.

In 1991, researchers from Johns Hopkins University, Baltimore, Maryland, comp comprehensive epidemiological study of the health of workers at the six naval shipy private shipyards that service the Navy's nuclear-powered ships (Matanoski 1991). study evaluated a population of 70,730 civilian workers over a period from 1957, be first overhaul of the first nuclear-powered submarine, USS NAUTILUS, through 1981, whether there was an excess risk of leukemia or other cancers associated with expos of gamma radiation.

The Johns Hopkins study found no evidence to conclude that the health of peop work on U.S. naval nuclear-powered ships has been adversely affected by exposure to radiation incidental to this work. Additional studies are planned to investigate t update the shipyard study with data beyond 1981.

The radiation exposure during normal operations at each shipyard for workers radiation levels monitored is determined based on the annual radiation exposure of worker for all shipyards based on Naval Nuclear Propulsion Program Report NT-94-2 (The total number of shipyard personnel monitored for radiation exposure associated Nuclear Propulsion Program has been about 164,000.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e transportation workers for all historical shipments is 16.6 person-rem, which stati to 0.0066 cancer fatalities. The maximum exposed individual (MEI) is a transportat the workers are closer to the shipment for a longer time than any member of the gen Under the limiting assumption that the same worker is associated with every shipmen historical period, this person would receive a total exposure of 7.5 rem over the a 40-year period, or about 0.19 rem per year, which is within DOE standards for occup exposed individuals. The radiation exposures to workers correspond to much less th cancer, which means that it is unlikely that there have been any past health impact historical shipments of naval spent nuclear fuel over the entire history of such sh

4.1.4.12.2 Occupational Non-radiological Health and Safety.

In the non-radiological Occupational Safety, Health, and Occupational Medicine area, the Navy complies with tional Safety and Health Administration Regulations. The Navy's policy is to maint healthful work environment at all naval facilities. Due to the varied nature of wo there is a potential for certain employees to be exposed to physical and chemical h employees are routinely monitored during work and receive medical surveillance for such as exposure to high noise levels or heat stress. In addition, employees are m exposure to chemical hazards such as organic solvents, lead, asbestos, etc., and wh placed into medical surveillance programs for these chemical hazards.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact due to the historical shipment of naval spent nuclear fuel over the entire h shipments.

4.1.4.12.3 Public Radiological Health and Safety.

In order to quantify the exposures resulting from normal shipyard radiological releases to the general public, detailed analyses based on very conservative estimates of radioisotopic releases from 1961 through 19 Attachment F provides detailed annual release values used in the analyses.

The GENII computer code (Napier et al. 1988) was used to calculate exposures beings due to the estimated radionuclide releases from normal operations at the shi

A person on the shipyard boundary at the location where the largest exposures received was used as the hypothetical maximally exposed off-site individual (MOI) f releases of radioactive material from stored fuel. The population data used to cal exposures were taken from 1990 census data provided by the U.S. Census Bureau. Met were obtained as described in Attachment F.

The hypothetical exposures calculated in Attachment F for the period 1995 thr adjusted from an annual basis (1995) to the historical basis by multiplying by 38 y of 1.7 to take into consideration variations in the number of ships and operations.

The calculated accumulated exposures through 1995 to the general population w of the site (about 0.8 million people) are 1.9 person-rem. To provide perspective, received due to natural radiation sources through 1995 are approximately 9.3 millio based on 0.3 rem per person per year.

The results of environmental monitoring as described in Naval Nuclear Propuls Report NT-94-1 show that Naval Nuclear Propulsion Program activities had no disting on normal background radiation levels at site perimeters (NNPP 1994b).

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e general population for all historical shipments is 1.95 person-rem, which statistic 0.00098 cancer fatalities.

All of the radiation exposures to the general population correspond to much l incident cancer, which means that it is unlikely that there has been any past healt public due to all historical shipments of naval spent nuclear fuel over the entire shipments.

4.1.4.12.4 Public Non-radiological Health and Safety.

The military is responsible for providing health care services for its personnel and dependents. Navy families rec and out-patient care at Tripler Army Medical Center. Services are also provided at and dispensaries. Active-duty personnel are required to use military health care f addition, military dependents have the option of going to private providers and bei reimbursed for the cost.

The Oahu Civil Defense Agency is responsible for developing, preparing, and a implementation of civil defense plans and programs to protect the safety, health, a residents during disasters and emergency situations. However, responsibility for m and dependents on the base rests with the Navy.

Fire protection within Naval Base Pearl Harbor is provided by the Federal Fir A Mutual Aid Pact between the federal (military) fire departments and the Honolulu affords dual coverage in times of emergencies.

Naval Base Pearl Harbor is under federal jurisdiction; therefore, federal aut normally responsible for providing all needed police service. The City and County Police Department, however, is responsible for traffic control in areas around the police station is located in Pearl City. (Navy 1990b)

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen

Since this number is much less than one, it is unlikely that there has been any non impact to the public due to all historical shipments of naval spent nuclear fuel ov of such shipments.

4.1.4.13 Utilities and Energy

4.1.4.13.1 Water Consumption. Naval Base Pearl Harbor receives most of its water from the

Koolau Aquifer and a small portion from the Waianae Aquifer, which are basal aquife south central Oahu, partially within the Pearl Harbor Water Management Area (PHWMA) 1989, a Water Management Plan for the PHWMA was proposed by the Commission on Water Resource Management (CWRM) to preserve and manage the Koolau and Waianae basal aqui the Schofield high-level aquifer. One important portion of the Water Management Pl that the sustainable yield for the PHWMA be revised downward from the then current gallons of water per day (mgd) to 195 mgd. The purpose of the revision was to elim shrinkage of the aquifer in the PHWMA from over-withdrawal. Actual use in 1989 tot mgd, of which the military portion was about 13 percent. The major water users in the Board of Water Supply (87.5 mgd) and the Oahu Sugar Company (78.6 mgd). In the plan, water allocation to the military is not decreased. The stated management pol is that "total allocation of authorized use will not at any time exceed sustainable the military had an allocation of 28.125 mgd from the PHWMA, of which 22.670 mgd wa authorized for the Navy. Of the total allocation to the U.S. Navy, Koolau Aquifer 20.333 mgd, and Waianae Basal Aquifer provides 2.337 mgd. (Navy 1990b)

4.1.4.13.2 Electricity Consumption.

The electrical power service for the Pearl Harbor Naval Complex is provided by the Hawaiian Electric Company. The Hawaiian Electric Compan grid on the island of Oahu consists of three power plants with a total capacity of plants in planning or under construction totaling 390 MW. The peak island demand i approximately 1,090 MW.

The power plants are located at Kahe, Waiau, and downtown Honolulu and are in connected via 138-kV transmission and 46-kV sub-transmission circuits. The Pearl H Complex is served via three 46-kV feeders, each from a separate 80-MVA transformer Makalapa substation, which is part of the island's 138-kV grid. The feeders serve Electric Company substations located on the base (Puuloa and Kuahua), which step th to 11.5 kV, and serve two normally separated 11.5-kV networks.

One of the 46-kV feeders serves only the Puuloa substation. The second serve Kuahua substation. The third serves both substations. Any one feeder has the capa entire Pearl Harbor load or approximately 57 MVA. In addition to the three feeders Makalapa substation, there are two alternate 46-kV circuits, one a dedicated spare, power plant.

The Puuloa substation consists of two 20/33-MVA transformers located in the P Naval Shipyard area and serves the Pearl Harbor Naval Shipyard, Naval Station Pearl Ford Island. The Kuahua substation consists of two 15/20-MVA transformers located Submarine Base Pearl Harbor area and serves the Submarine Base Pearl Harbor and Nav Center Pearl Harbor areas.

4.1.4.13.3 Fuel Consumption.

One major type of energy use is vehicular fuel consumption. No estimates are available to differentiate vehicle fuel use at Pearl Harbor from othe system consumed 152,088 gallons of diesel fuel in 1988. An occupancy rate of 1.5 p vehicle was used, so the ratio of fuel consumed per person per trip was 0.144 gallo person crossing. The second major source of energy consumption originates in build analysis of building energy use is based on standards for energy consumption per un building floor area by type of building and the geographical location.

4.1.4.13.4 Wastewater Systems and Discharges.

Sewage at the Pearl Harbor Naval Complex

is collected and treated in several separate systems. Most of the sewage generated shore activities and family housing areas receives secondary treatment at Navy-oper treatment plants. The largest volume is treated at the Fort Kamehameha Sewage Trea which serves the Naval Station Pearl Harbor, Pearl Harbor Naval Shipyard, Naval Sup Pearl Harbor Complexes, Camp Smith, Navy and Air Force housing areas, Hickam Air Fo and other adjacent military areas.

4.1.4.13.5 Energy Conservation.

To minimize the use of fossils fuels and conserve energy, the military has adopted conservation criteria for new construction and major renovatio policies used under the conservation criteria focus on meeting design energy target square foot/per year (Btu/sf/yr). Guidelines are provided for ventilation, insulat cycle cost of structures. (Navy 1990b)

4.1.4.14 Materials and Waste Management

The City and County of Honolulu's HPOWER (Honolulu Program of Waste Energy Recovery) "garbage-to-energy" facility at Campbell Industrial Park is currently in burning roughly 1,500 to 1,800 tons per day, which is most of the combustible rubbi the island of Oahu.

Approximately 20 percent (by weight) of the refuse handled by the HPOWER facility is reduced to ash and other residue which requires landfill disposal.

There are two city and county landfills: the Kapaa Landfill in Kailua (Windw the Waimanalo Gulch Landfill in Nanakuli (Leeward Oahu). The Kapaa Landfill has re capacity, and plans are underway to locate a new site in Windward Oahu. The Nanaku which opened in September 1989, is programmed for 1,000 tons per day for seven to e According to the city, the facility should be able to accommodate projected needs f and maybe longer. (Navy 1990b)

Solid radioactive waste materials are packaged in strong, tight containers, s necessary, and shipped to burial sites licensed by the U.S. Nuclear Regulatory Comm under agreement with the U.S. Nuclear Regulatory Commission. Shipyards and other s are not permitted to dispose of radioactive solid wastes by burial on their own sit approximately 110 cubic yards of routine low-level radioactive waste containing a t were shipped from the shipyard for burial.

Waste which is both radioactive and chemically hazardous is regulated under b Energy Act and the Resource Conservation and Recovery Act as "mixed waste." Within Nuclear Propulsion Program, concerted efforts are taken to avoid commingling radioa chemically hazardous substances so as to minimize the potential for generation of m example, these efforts include avoiding the use of acetone solvents, lead-based pai in disposal containers, and chemical paint removers. Radioactive wastes, including chemically hazardous substances, are handled in accordance with long-standing Progr requirements. Such handling includes solidification to immobilize the radioactivit radioactive and chemically hazardous substances, removal of liquids from solids, an techniques. A determination is then made as to whether the resulting waste is haza of Program efforts to avoid the use of chemically hazardous substances in radiologi activities typically generate only a few hundred cubic feet of mixed waste each yea amount of mixed waste, along with limited amounts of mixed waste from Program work prior to 1987, will be stored pending the licensing of commercial treatment and dis

4.1.5 KENNETH A. KESSELRING SITE: WEST MILTON, NEW YORK

4.1.5.1 Overview

The Kenneth A. Kesselring Site of the Knolls Atomic Power Laboratory (KAPL) i the mid-eastern sector of New York State as shown on Figure 4.1.5-1. The Site is l Milton in Saratoga County, New York at 43y2'28" north latitude and 73y57'13" west l United States Government owned reservation consists of over 3900 acres centered abo north of the city of Schenectady and about 8 miles west of Saratoga Springs. The S operating naval nuclear propulsion prototype plants and support facilities. The Si prototype plant that is in the process of being permanently shut down; one of the

plants is currently scheduled to be shut down in 1996. All the operating facilitie secure area near the center of the reservation (see Figure 4.1.5-2). A more detail site is provided in Figure 4.1.5-3.

4.1.5.2 Land Use

All the land within the Site perimeter is owned by the Department of Energy (are no permanent residents within this area. The surrounding region, within 50 mil contains a population of about 1,150,000 as obtained from the 1990 census.

Most of the land surrounding the Site is either wooded or is used for farming residential areas. Both dairy farms and agricultural farms are located in the imme reservation.

The West Milton area is located within the undulating transition zone between Highlands and the Hudson-Mohawk Lowlands physiographic provinces. The area is char a series of irregular northwest-southwest trending topographic steps that descend f southeasterly towards the lowlands.

Figure 4.1.5-1. Kesselring Site vicinity map. Figure 4.1.5-2. Kesselring Site sea level. The Glowegee Creek, its various tributaries, and the Crook Brook drain The developed portion of the reservation, which contains the prototype plants, cons mately 50 acres (see Figure 4.1.5-2). The terrain surrounding the Site forms a pa bottom diameter of about 2000 feet and a maximum height of 150 feet. The Site is e flat-lying with ground elevations ranging from 480 to 490 feet. The western half o surrounded by elliptical hills approximately 600 feet in elevation. Drainage from to the Glowegee Creek.

4.1.5.3 Socioeconomics

As of 1993, the Kesselring Site employed about 1,450 civilian workers, and ab naval personnel worked at the Site.

The only industry within 4 miles of the Site is the Cottrell Paper Company, l City Falls, about 3 miles from the Site.

The region surrounding the Site, within 50 miles, contains a population of ab obtained from the 1990 census. Figure 4.1.5-4 provides a population distribution r the Site and lists the total population within concentric rings covering a 50-mile

The majority of the labor force that would be employed at the Site for constr operation of the naval spent nuclear fuel area would be expected to reside within a the Site. The calculated total population, labor force, and employment within this year (1995) are presented in Table 4.1.5-1. Projections of employment and populati beyond 1995 have not been presented because, as discussed in Section 5, the number jobs that might be created at the Site under any alternative could be small.

Table 4.1.5-1. Regional employment factors at the Kesselring Site.

Regional Employment	Regional Labor Force	Regional Population
165,830	176,600	373,970

Figure 4.1.5-4. 50-mile population distribution around the Kesselring Site. Exec Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the Kesselring Site, consistent population data provided in Figure 4.1.5-4.

Figure 4.1.5-5 shows the locations of populations in which minority membershi average within the 50-mile radius by more than 20 percentage points and populations more than 50 percent minority members. These populations have been identified foll approach developed by the Environmental Protection Agency which, for purposes of en justice evaluation, defines minority communities as those which have percentages of than the average in the region analyzed (EPA 1994).

Figure 4.1.5-6 shows the locations of populations which have more than 25 per members living in poverty, reflecting a common definition of low-income communities The U. S. Census Bureau characterizes persons in poverty as those whose income is l "statistical poverty threshold." For the 1990 census, this threshold was based on

$12,500 per household.

4.1.5.4 Cultural Resources

Historically, the Kesselring Site reservation was used for agricultural purpo farmhouse foundations, grove sites, stone walls, and land fences exist on the Kesse there are no known archaeological, cultural, or Native American sites in the secure Kesselring Site (USAEC 1972). There are no historic structures on the Site that ar eligible for or are listed on the National Register of Historic Places (NPS 1991).

Figure 4.1.5-5. Minority population distribution within 50 miles of the Kesselring Site. Figure 4.1.5-6. Low-income population distribution within 50 miles of the Kesselring Site. **4.1.5.5 Aesthetic and Scenic Resources**

The Kesselring Site is located in an area of moderately undulating topography edge of the Hudson-Mohawk Lowlands. Most of the Site facilities including the prot plants are located within a fenced security area. This security area and adjacent located near the center of the Government reservation. (UE&C 1973) Since the bala reservation consists of wooded lands, there is very little public viewing opportuni facilities from the boundaries of the Government reservation. The area within the region where naval spent nuclear fuel would be stored has low visual sensitivity si industrial site.

4.1.5.6 Geology

4.1.5.6.1 General Geology.

In 1973, a Site evaluation and foundation engineering investiga-
tion
were conducted for the Kesselring Site (UE&C 1973) to establish suitable parameters and design of the S8G prototype structures. A prior evaluation of the Site was con Modifications and Addition to Reactor Facilities. In both investigations, the loca geology and seismicity of the West Milton area were examined through a literature s subsurface investigation, and a geophysical survey involving refraction and cross-h measurements. Major soil boring, sampling, and laboratory testing for the S8G Site reported in various documents (UE&C 1973; EDCE 1974a; EDCE 1974b). Additional bori information and a geophysical field investigation performed for the Modifications a Reactor Facilities project were also utilized in the S8G Site evaluation. A 1974 S evaluation was also conducted and a report issued (DGC 1974).

4.1.5.6.2 Geologic Resources.

At Kesselring, unconsolidated materials, primarily of glacial
origin, overlie bedrock. The thickness of these materials or overburden sequence i from 0 to several hundred feet. The overburden sequence, in ascending order, consi kinds of depositional units: glacier debris, lake, and ice-contact/outwash deposit glaciers overlie much of the bedrock and form the elliptical hills (drumlins) throu reservation. The glacier deposits are a dense and poorly sorted mixture of clay, s and boulders. Thinly stratified lake clay and silt deposits are mapped over the re southeastern quadrant. The ice-contact/outwash deposits mostly consist of stratifi gravels. The ice contact/outwash deposits, characterized by low clay and silt cont aquifer potential than the silt-and-clay-rich glacier and lake deposits.

Bedrock geology is also variable at the reservation and consists of crystalli Sandstone, Galway Formation (dolomites and sandstones), Gailor Dolomite, Trenton/Am Lowville Limestones, and Canajoharie Shale. The Canajoharie Shale underlies the ma reservation. This black shale generally is considered a poor aquifer and its prod on the presence or absence of fractures. Also, its water may contain naturally occ sulfide.

At the Site, approximately 20 to 30 feet of overburden deposits overlie the C These deposits consist of layers of deposits from glaciers and lakes. Locally, the been altered as the result of facility construction. Generally, groundwater exists below the ground surface. Groundwater flows easterly, toward the nearby Glowegee C

There are no economic geologic resources at the Site.

4.1.5.6.3 Seismic and Volcanic Hazards.

In 1973, a seismicity evaluation of the Kesselring Site
was conducted (UE&C 1973). An additional investigation was conducted in 1981 (EDCE
The following is a summary of their findings.

Three branch faults exist in the vicinity of the Site: The West Galway, the
the Rock City Falls faults. These branch faults are the lines of demarcation betwe
bedrock formations in the immediate area. The East Galway branch lies approximatel
northwest of the Site and is believed to be the predominant influence on the earthq
Site facilities. The two Galway faults are end branches of the Hoffman's Ferry fau

Seismic risk related to structural damage may be represented in the United St
scale of 0 through 4, with Zone 0 not expected to encounter damage and Zone 4 expec
encounter the greatest seismic risk. The Site is located in Zone 2A according to t
Building Code" (UBC 1991). The Uniform Building Code seismic classification provid
a comparable assessment of the seismic hazard between the alternate sites. If the
identifies this site for the interim storage of naval spent fuel, then a detailed s
be conducted. More detailed information regarding the design basis considerations
naval spent nuclear fuel at the Site is provided in Attachment D.

Data accumulated indicate that the maximum intensity earthquake for the regio
100-mile radius of the Site had a value of VII. The most recent earthquake of that
at Lake George, New York, on April 30, 1931. It is postulated that this event had
point where the Rock City Falls fault meets the Hoffman's Ferry fault. Since the W
East Galway branch faults are extensions of the Hoffman's Ferry fault, an earthquak
intensity might occur anywhere along the East Galway fault within the lifetime of t

Several earthquakes having an intensity VIII or greater have occurred at dist
100 miles from the Site. However, due to attenuation effects, the ground motion at
associated with these earthquakes has not been greater than that equivalent to an i
most recent event occurred in 1983 at Newcomb, New York (about 75 miles northwest o
and was of intensity VI.

Details regarding the seismic characteristics of the area and the design base
evaluations performed for the Kesselring Site are provided in the "Site Geology Eva
S8G for Kesselring Site" (UE&C 1973) and in "Geotechnical Site Investigation, Kesse
Milton, New York" (EDCE 1981).

There are no volcanic hazards in the vicinity of the Site.

4.1.5.7 Air Resources

4.1.5.7.1 Climate and Meteorology.

The east-central part of New York State, in which the West
Milton area is located, is situated at the northern end of the Hudson River Valley
ly 150 miles inland from the Atlantic coastline and about 200 miles south of the Ca
The climate of the region is primarily continental in character, but is subjected t
by the Atlantic Ocean. The moderating effect on temperatures is more pronounced du
months than in winter when outbursts of cold air sweep down from Canada. In the wa
temperatures rise rapidly in the daytime, but also fall rapidly after sunset so tha
relatively cool. Occasionally, there are extended periods of oppressive heat up to
duration.

During the winter months, winds are generally from the west or northwest. Du
warmer months, the winds are from the south. Wind velocities are moderate, and gen
less than 10 mph. Destructive winds (i.e., winds in excess of 80 mph) occur infreq
tornadoes are rare. Tornadoes are rare in the region served by the Albany, New Yor
station.

The mean monthly temperature of the region is about 50yF. Daily extremes can
-30yF in the winter months to 100yF in the summer. On an annual basis, the mean da
humidity values range from 50 to 80 percent. During the summer months, relative hu
frequently approach 100 percent during the night.

Total yearly precipitation averages about 36 inches. The average yearly snow
inches and the maximum snowfall in 24 hours is about 22 inches. On the average, a
about 3 feet can be expected.

For weather reporting purposes, the West Milton area of northeastern New York in the National Weather Service Zone Forecast for Saratoga County. The principal w location is at the Albany, New York airport. Its elevation is 275 feet above mean of the proximity of West Milton to Albany, temperature data for the Site should dif Albany data. The two locations are generally within one or two degrees of each oth Milton tending to have lower temperatures.

4.1.5.7.2 Air Quality.

The principal sources of industrial gaseous effluents from the Kesselring Site are two 21-million, one 30-million, and one 110-million Btu/hr steam generatin number 2 fuel oil that is used to fire all of the boilers contains less than 0.5 we Combustion gases from the boilers are released through three elevated exhaust stack such as ozalid reproduction, carpenter shops, welding hoods, paint shop, and indust processes constitute other permitted point sources of airborne effluents. All poin conform to the applicable state and federal clean air standards. Sulfur emitted fr monitored via analysis of fuel sulfur content and reported to the Environmental Pro (EPA) on a quarterly basis in compliance with the EPA's New Source Performance Stan Code of Federal Regulations, Title 40, Part 60. Sulfur emissions from the boilers EPA's New Source Performance Standards emission standard for stationary combustion All other industrial emission sources at the Kesselring Site do not require monitor the current New York State permits due to the very low levels of the emissions.

An area can be designated by the Environmental Protection Agency as having ai is better than defined by the National Ambient Air Quality Standards (attainment) o or more of those standards (nonattainment for one or more pollutants). The Code of Regulations, Title 40, Part 81, states that the Air Quality Control Region for this nonattainment for ozone and is better than national standards for total suspended p and SO2. The area has no specific classification for carbon monoxide and NO2.

The nearest Class I area is at Lye Brook Wilderness, Suarderland, Vermont, wh miles from the Site.

4.1.5.7.3 Existing Radiological Conditions.

Radiological facilities at the Kesselring Site are designed to ensure that there are no discharges of radioactivity in airborne exhaus prescribed operational limits. Radiological controls are exercised to preclude exp personnel to airborne radioactivity exceeding federal limits. Air exhausted from r facilities is passed through high-efficiency particulate air filters and monitored es. The annual airborne radioactive emissions from Kesselring Site do not result i exposure to the general public. As described in the "Knolls Atomic Power Laborator Monitoring Report for Calendar Year 1992" (KAPL 1992), the estimated 1992 radiation off-site individuals attributed to radioactive air emissions from Kesselring Site o than 1 percent of the Environmental Protection Agency standards given in Subpart H (CFR 1989). In order to quantify the risk of normal (non-accident) Kesselring Site airborne releases to the general public, detailed analyses were performed based on tive estimates of radioisotopic releases in the exhaust air. In 1992, the airborne the Kesselring Site totaled about 2 curies (KAPL 1992).

4.1.5.7.4 Existing Non-radiological Conditions.

New York State emission standards for all permitted emission sources at the Kesselring Site, with the exception of the site b in the individual permits for these sources. State regulations provide specific gu of emissions require a permit. Compliance with the operating permit is the respons permit holder under the condition that all planned changes in operating permit cond review and approval by the New York State Department of Environmental Conservation In addition, all operating permits are reviewed and renewed at least every 5 years.

Stationary combustion sources such as the Site's boilers are not specifically NYSDEC, but fall under the federal New Source Performance Standards in The Code of Regulations, Title 40, Part 60. Compliance with these standards is accomplished by number 2 fuel oil certified by the vendor that it contains less than 0.5 percent su documenting fuel use and sulfur content are provided to the EPA Region II office on

basis.

4.1.5.8 Water Resources

The hydrology information contained herein was extracted from two independent One was performed by the U. S. Geological Survey in November 1951. The second surv performed in 1955. Additional hydrological surveys were performed in 1975 (Moody 1 DGC 1975), and 1985 and 1986 (DGC 1986).

4.1.5.8.1 Surface Water.

Most of the Site is drained by the Glowegee Creek, which meanders through rolling farmlands and woodlands to a junction with Kayaderosseras Creek at approximately 1 mile east of West Milton. The quality of the water in Kayaderosser Glowegee Creek is satisfactory for public water supply and most industrial purposes Glowegee Creek is not used for these purposes. The average stream flow measured at Coast and Geodetic Survey gaging station 0.5 mile downstream of the Site is 41 cfs. elevation for Glowegee Creek is approximately 580 feet above mean sea level at the the Site to about 380 feet above mean sea level at its junction with the Kayadeross area and natural surface storage in the basin are small, but the soils and the unco below the soils can hold a considerable volume of groundwater. A number of perenni in the area. There are no records indicating flooding of the Site.

The Kayaderosseras Creek empties into Saratoga Lake and ultimately, by way of into the Hudson River. Kayaderosseras Creek rises in the Kayaderosseras Range on t edge of the Adirondack Mountains. The basin above West Milton ranges approximately elevation and contains a sizeable aggregate area of swamps.

The Flood Insurance Rate Map (FIRM COMMUNITY-PANEL No. 360 722 B) shows that the Kesselring Site is not in a 100 or 500 year floodplain.

4.1.5.8.2 Groundwater.

At the Site, the overburden sequence, consisting of glacier and lake deposits, and the underlying Canajoharie Shale generally form poor aquifer systems. Milton area, neither of these systems are designated as sole source aquifers by the primary/principal aquifers by New York State.

The dense glacial deposits and fine-grained lake deposits have characteristic permeabilities in comparison to ice-contact/outwash deposits. Historically, both t deposits produce very low volumes of groundwater. At the Site, shallow water table that the groundwater gradient is low. This low gradient combined with the low perm glacial deposits indicates that the groundwater flow rate is very low, on the order Also, water table mapping indicates that the Glowegee Creek, approximately 200 to 1 the operating facilities boundary, forms an aquifer boundary.

The source of potable water is a well field, located on the far eastern side composed of six wells which draw water from both deep and shallow aquifers. Monito groundwater from the Site service water well field has shown that all chemical cons are within the New York State drinking water standards (KAPL 1992). This well fiel adjacent to the Kayaderosseras Creek, is underlain by two sand and gravel aquifers. aquifer exists under water-table conditions and extends to a depth of approximately ground surface. The lowermost aquifer exists under artesian head pressure with the surface rising several feet above the static water-table surface. The depth of the approximately 55 to 100 feet below the ground surface. Recharge to the water-table simultaneous water withdrawal comes primarily from the Kayaderosseras Creek, and to degree from Crook Brook. (DGC 1986)

There are 19 monitoring wells within the operating area. These recently inst used to provide depth-to-groundwater information, related water table mapping, and assessment. Test borings on the reservation have generally showed the water table 10 feet of the ground surface. The test boring data also indicate that the configu table is, for the most part, a replica of the configuration of the surface topograp elevation and somewhat softened in relief.

4.1.5.8.3 Existing Radiological Conditions.

The liquid effluent environmental monitoring
program at the Kesselring Site consists of radiological monitoring of the Glowegee
aquatic life, and sediment in the vicinity of the Site to confirm that the general
by operations at the Site. There is no detectable radioactivity present in the Glo
sediment due to Site operations (KAPL 1992). The concentrations of chemical consti
effluent from the Kesselring Site resulted in no adverse effect on the quality of G
aquatic life. This is substantiated by results of fish and aquatic life surveys th
existence of a diverse and healthy aquatic community in the creek water. Only natu
radionuclides were detected in the Glowegee Creek water samples. The results of an
collected from Glowegee Creek show no radioactivity attributable to Site operations

Currently, Kesselring Site does not discharge radioactive liquid effluent to
ment. Since the beginning of prototype operations, the release of radioactivity int
been small (about 15 curies) and has had no measurable effect on the natural backgr
in the sediment. Over 98 percent of the radioactivity discharged to the creek was
traces of other radionuclides such as cobalt-60, iron-55, nickel-63, and antimony-1
The amount of tritium released was greatly decreased when water reuse was started b
plants. In addition, the average concentration of tritium discharged to Glowegee C
1000 times lower than allowed by federal regulations. In over three decades of ope
been no measurable impact from Kesselring Site operations on the environment or adv
the community or the public.

4.1.5.9 Ecological Resources

4.1.5.9.1 Terrestrial Ecology.

The conceptual location where naval spent nuclear fuel would be
stored is illustrated in Attachment D. This location is within an existing industr
surrounded by buildings and paved areas. The industrial nature of the Site and the
has already been disturbed from its natural state by earlier activities mean that p
sensitive to disturbance by human activities would not be expected to be present.

4.1.5.9.2 Wetlands.

There are 13 areas located on the Kesselring Site classified as either Class II
or III wetlands in accordance with the New York State Department of Environmental C
(NYCRR 1987). Current operations which include the secured area of the Site, parki
field, and pumphouse area do not impact the listed wetlands. Access and perimeter
listed wetlands at four locations (within 100 feet); however, construction of these
all current regulatory requirements.

4.1.5.9.3 Aquatic Ecology.

In accordance with the Environmental Statement for the S8G
Prototype, Kesselring Site, West Milton, New York (USAEC 1972), an expanded chemica
biological monitoring program was initiated in Glowegee Creek early in 1975. An im
this monitoring program is an annual fish survey in Glowegee Creek upstream and dow
Site discharges because Glowegee Creek is classified as a Class "C" trout stream by
These surveys conducted by the New York State Department of Environmental Conservat
environmental consultants from the Knolls Atomic Power Laboratory indicate that sto
stream merely supplements the fish population that is removed by fishermen. The se
Glowegee Creek above the Site, although not stocked, contains a population of nativ
maintained by natural spawning of the fish.

4.1.5.9.4 Endangered and Threatened Species.

There are several endangered and threatened
species listed by the New York State Department of Environmental Conservation locat
Saratoga County area. The endangered species are the karner blue butterfly, bald e
peregrine falcon, and the threatened species is the red-shouldered hawk. To date,

direct observations of these species documented on the Kesselring Site.

4.1.5.10 Noise

Plant operations and maintenance at the Kesselring Site generate noise equival industrial activity.

4.1.5.11 Traffic and Transportation

Two corridors, the Hudson-Champlain, 10 to 17 miles to the east, and the Moha 10 to 17 miles to the south and southwest, contain the major transportation systems industrial complexes in the vicinity of the Site.
The Cottrell Paper Company, located in Rock City
Falls, 3 miles from the Site, is the only industry within a 5-mile radius.

Except for their use by Kesselring Site employees, the secondary routes bound auxiliary commuting and delivery routes for small products and produce. State Rout to the north, State Route 147 runs 4 miles to the west, and State Route 67 runs 4 m State Route 50, 6 miles east, running from Saratoga Springs to Scotia, carries the amount of truck and bus traffic. The majority of through traffic uses either Inter route U.S. Highway 9, in the Hudson-Champlain corridor, 10 miles to the east.

Two lines of the Delaware and Hudson Railroad cross the region within 10 mile The main north-south line runs through Ballston Spa, just over 5 miles to the east, runs just over 5 miles to the northeast into the central Adirondack area.

Commercial barge traffic occurs on the New York State Barge Canal, 12 miles s the Site at its closest point, and on the less used Champlain Division, 17 miles ea

Saratoga County has the nearest airport, 4-1/2 miles east of the Site, follow and Albany airports, approximately 15 and 20 miles to the south-southeast. Data fu traffic representatives for the three area airports indicate that regular flight pa commercial, and private aircraft, large and small, do not pass within a 5-mile radi Only the instrument approach to the Saratoga County Airport, designated by the Fede Administration (FAA), has the potential for overflying the Site.

Albany County Airport, 22 miles south-southeast of the Site, is the nearest a scheduled flights by commercial jet aircraft. Schenectady County Airport, 15 miles is an auxiliary field with a low volume of traffic relative to size. No air carrie service out of Schenectady. The bulk of the airport's traffic is corporate and pri majority of the balance being military aircraft of the 109th New York Air National

Naval spent nuclear fuel has been removed from the prototypes and transported National Engineering Laboratory Expended Core Facility (ECF) for examination and ev matter of routine. Naval spent nuclear fuel shipments from the Kesselring Site to in 1961. Since that time, 21 shipments of naval spent nuclear fuel originating at have been made to ECF. The shipping containers were transported by heavy-lift tran nearby commercial rail line where the containers were then transported by rail. At provides a list of these shipments made to date by year. Attachment A also contain descriptions of the shipping containers used for naval spent nuclear fuel shipments

The Site exclusion area boundary, which is the boundary of the Site, defines area. No activities unrelated to plant operation are permitted within the exclusio fenced-in security area containing the operating facilities (centered within the ex boundary) is permitted only through one permanent gate facility which is manned by on a 24-hour-per-day basis.

No public roads, highways, railways, or navigable waterways traverse the excl

4.1.5.12 Occupational and Public Health and Safety

4.1.5.12.1 Occupational Radiological Health and Safety. The Navy has well established and

effective Occupational Safety, Health, and Occupational Medicine programs at all of regard to radiological aspects of these programs, the Naval Nuclear Propulsion Prog reduce to as low as reasonably achievable the external exposure to personnel from i associated with naval nuclear propulsion plants. These stringent controls on minim radiation exposure have been successful. No personnel at the Naval Reactors Depart facilities have ever exceeded the applicable federal annual radiation exposure limi was 15 rem per year in 1958 and is currently 5 rem per year. No one has exceeded t

limit of 5 rem per year since this limit was established in 1967 and since 1980, no more than 2 rem per year from radiation associated with naval nuclear propulsion pl average occupational exposure of each person monitored at Naval Reactors DOE facili per year. The average lifetime accumulated radiation exposure from radiation assoc Naval Nuclear Propulsion Program for the 141,000 personnel who have been monitored Naval Reactors facilities is about 0.35 rem (NNPP 1994c). This corresponds to the cancer fatality of 1 in 7142.

Naval Reactors policy on occupational exposure from ingested or inhaled radio prevent significant radiation exposure to personnel from internal radioactivity. T achieve this objective are one-tenth of the levels allowed by federal regulations f Since 1972 as a result of this policy, no one has received more than one-tenth the occupational exposure limit from internal radiation exposure caused by radioactivit work at the DOE Naval Reactors facilities.

For work operations involving the potential for spreading radioactive contami containments are used to prevent personnel contamination or generation of airborne The controls for contamination are so strict that precautions sometimes have had to prevent tracking contamination from fallout and natural sources into radiological a contamination control limits used in these areas were well below the levels of fall contamination occurring outside in the general public areas. A basic requirement o control is monitoring all personnel leaving any area where radioactive contaminatio occur. Workers are trained to survey themselves (i.e., frisk), and their performan radiological control personnel. Frisking of the entire body is required, normally held survey instruments. Major work facilities are equipped with portable monitors in lieu of hand-held friskers. These stringent controls to protect the workers and contamination have proven effective in the past.

In 1991, researchers from Johns Hopkins University, Baltimore, Maryland, comp ed a very comprehensive epidemiological study of the health of workers at the six n private shipyards that service the Navy's nuclear-powered ships (Matanoski 1991). dent study evaluated a population of 70,730 civilian workers over a period from 195 first overhaul of the first nuclear-powered submarine, USS NAUTILUS, through 1981, whether there was an excess risk of leukemia or other cancers associated with expos of gamma radiation. This study is also of particular relevance to workers at the N prototypes because the type of radioactivity, level of exposure, and method of radi ical controls at these shipyards are similar to the Naval Reactors prototypes.

The Johns Hopkins study found no evidence to conclude that the health of peop work on U.S. naval nuclear-powered ships has been adversely affected by exposure to radiation incidental to this work. The average annual radiation exposure for these about two times higher than the exposure received by personnel assigned to Naval Re propulsion prototype sites. Additional studies are planned to investigate the obse the shipyard study with data beyond 1981.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e tation workers for all historical shipments is 16.6 person-rem, which statistically 0.0066 cancer fatalities. The maximum exposed individual (MEI) is a transportation the workers are closer to the shipment for a longer time than any member of the gen Under the limiting assumption that the same worker is associated with every shipmen historical period, this person would receive a total exposure of 7.5 rem over the a 40-year period, or about 0.19 rem per year, which is within DOE standards for occup exposed individuals. The radiation exposures to workers correspond to much less th cancer, which means that it is unlikely that there have been any past health impact historical shipments of naval spent nuclear fuel over the entire history of such sh

4.1.5.12.2 Occupational Non-radiological Health and Safety.

In the non-radiological
Occupational Safety, Health and Occupational Medicine area, the Navy complies with tional Safety and Health Administration Regulations. The Navy's policy is to maint healthful work environment at all naval facilities. Engineered systems and adminis the primary means employed for minimizing potential employee exposure to occupation exposures cannot be controlled with engineering or administrative controls, persona equipment is used to provide additional protection. Due to the varied nature of wo facilities, there is a potential for certain employees to be exposed to physical an These employees are routinely monitored during work and receive medical surveillanc hazards such as exposure to high noise levels or heat stress. In addition, employe

their exposure to chemical hazards such as organic solvents, lead, asbestos, etc., ate are placed into medical surveillance programs for these chemical hazards.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact due to the historical shipment of naval spent nuclear fuel over the entire h shipments.

4.1.5.12.3 Public Radiological Health and Safety.

The effluent and environmental monitoring results show that the radioactivity in liquid and gaseous effluents from 1992 opera Kesselring Site had no measurable effect on background radioactivity levels. There exposures from Site operations to off-site individuals were too small to be measure calculated using conservative methods. In accordance with the "Knolls Atomic Power Environmental Monitoring Report for Calendar Year 1992" (KAPL 1992), the following were determined: (1) the radiation exposure to the maximally exposed individual in Site was less than 0.1 mrem, (2) the average exposure to members of the public resi 80-kilometer (50-mile) radius assessment area surrounding the Site was less than 0. (3) the collective exposure to the population residing within 50 miles of the Site person-rem.

The hypothetical exposures calculated in Attachment F for the period 1995 thr adjusted from an annual basis (1995) to the historical basis by multiplying by 40 y the period of site operations) and by a factor of 1.7 to take into consideration va of prototypes and operations.

The calculated accumulated exposures through 1995 to the general population w of the site (about 1.15 million people) are 3.9 person-rem. To provide perspective received due to natural radiation sources through 1995 are approximately 14 million based on 0.3 rem per person per year.

The results show that the estimated exposures were less than 0.1 percent of t the radiation protection standards listed in DOE Order 5400.5 (DOE 1993), and that exposure to the population residing within 80 kilometers (50 miles) of the Site was percent of the natural background radiation exposure to the population. In additio exposures were less than 1 percent of that permitted by the numerical guide listed Appendix I (CFR 1986) for whole-body exposure, demonstrating that exposures are as reasonably achievable. The exposure attributed to radioactive air emissions was le the EPA standard given in 40CFR61 (CFR 1989).

The collective radiation exposure to the public along travel routes from Kess shipments of radioactive materials during 1992 was calculated using data given by t "Final Environmental Statement of the Transportation of Material by Air and Other M 1977). Based on the type and number of shipments made, the collective annual radia the public along the transportation routes, including transportation workers, was a 1 person-rem. This is less than 0.001 percent of the exposure received by the same natural background radiation.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e general population for all historical shipments is 1.95 person-rem, which statistic 0.00098 cancer fatalities.

All of the radiation exposures to the general population correspond to much l incident cancer, which means that it is unlikely that there has been any past healt public due to all historical shipments of naval spent nuclear fuel over the entire shipments.

4.1.5.12.4 Public Non-radiological Health and Safety.

Liquid effluents from the Kesselring Site are derived from several sources: Site boiler blowdown, sewage treatment plan blowdown and overflow, retention basin discharges, storm water, and site service co Liquid effluents from the Kesselring Site enter Glowegee Creek through two surface (discharges 001 and 002), a submerged drain line from the sewage treatment plant (d and a storm water runoff (discharge 004).

With the exception of the sewage treatment plant, intermittent cooling tower once-through cooling systems that operate continuously, all effluents are released of effluent concentrations is achieved by the analysis of liquid collected from the systems and from the collection tanks prior to each release from the batch systems.

A series of gates are located in discharge channels 001, 002, and the lagoon means to contain effluent if concentrations should ever exceed applicable discharge addition, continuous pH and temperature monitoring systems are installed in dischar 002, and the lagoon. These systems automatically control the discharge gates and p there is ever an out-of-specification pH or temperature level. Periodic samples co effluent channels are analyzed for chemical constituents, and demonstrate complianc New York State Department of Environmental Conservation State Pollutant Discharge E System permit.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact to the public due to all historical shipments of naval spent nuclear fuel ov of such shipments.

4.1.5.13 Utilities and Energy

4.1.5.13.1 Water Consumption. The Site Service Water System provides the Kesselring Site

with water for operations, fire protection, sanitary, and potable use. The Site us million gallons of well water per year. The Site is supplied by two pressurized ma located at the well field. Main and backup chlorination facilities are located at locations. Five loops, on site, comprise the central distribution system which is up to 3,800 gallons per minute. Surge capacity for fire fighting and peak usage is elevated head tanks with a combined capacity of 500,000 gallons.

4.1.5.13.2 Electricity Consumption.

The Kesselring Site is provided with two separate off-site commercial electrical power sources from the Niagara Mohawk Power Company. One sou 115-kv Transmission Line No. 1 that runs between Spier Falls, New York and Rotterda York. This line is approximately 40 miles long and is tapped at approximately the m service to the Site. The overhead line from the 115-kv tap on Line No. 1 to the Si long. The second physically independent commercial source feeding the Site is a 3 transmission line supplied from a radial system fed from Ballston Spa, New York. T is approximately 9.6 miles long. The Site uses 47 thousand megawatt-hours of elect security, building lighting, and prototype plant support.

4.1.5.13.3 Fuel Consumption.

There is no natural gas used on the Kesselring Site. Number 2 fuel oil is used to fire four Site steam generating boilers for Site heating for wh consumption averages 640,000 gallons.

4.1.5.13.4 Wastewater Systems and Discharges.

The sewage treatment facility for the Kesselring Site is a third-level treatment facility utilizing the extended aeration activated sludge and chemical precipitation of phosphorus followed by sand filtrati meets all federal and New York State standards for sewage treatment. Discharges ar conformance with the terms of a New York State Pollutant Discharge Elimination perm sludge is stored in a holding tank and is periodically removed by a licensed subcon at a state-approved, off-site disposal area. The treatment plant is automatic and ed. Routine analysis and adjustments are made daily. Approximately 9.125 million g processed by the Site Sewage Treatment Facility each year.

4.1.5.13.5 Energy Consumption.

The following energy conservation initiatives for the Kesselring Site are scheduled for completion between now and the year 2000:

(1) The shutdown of one prototype plant.
(2) The conversion from fuel oil to natural gas for operating the Site steam
(3) Replacing the existing building lights and windows with modern, more ener systems.
(4) Major building renovations including energy conservation upgrades to vari tion and testing facilities.

4.1.5.14 Materials and Waste Management

Operation of the Kesselring Site results in the generation of various types of materials that require detailed procedures for handling, packaging, transportation, disposal at a government-operated burial site.
Radioactive materials that do not require disposal are handled and transferred in accordance with detailed material control and accountabi Internal reviews are made prior to the shipment of any radioactive materials from t that the material is properly identified, surveyed, and packaged in accordance with local requirements.

Low-level radioactive solid waste material that requires disposal includes fi resin, rags, paper, and plastic. The volume of waste contaminated with radioactivi and shipped is minimized through the use of special work procedures that limit the that becomes contaminated during work on radioactive systems and reactor components compressible wastes are compacted in order to further reduce the volume of waste to Radioactive liquids are solidified prior to shipment. All radioactive wastes are p applicable regulations of the Department of Transportation given in 49CFR, Parts 17 177-178 (CFR 1985). The waste packages also comply with all applicable requirement the DOE, and the burial sites. All shipments of low-level radioactive solid wastes authorized common carriers to government-owned burial sites located outside of New During 1992, approximately 215 cubic meters (281 cubic yards) of routine low-level containing 987 curies were shipped from the Site for burial.

Site operations produce a variety of industrial waste products including sewa sludge and effluent, once-through cooling water, chemical wastes, boiler exhaust ga such products typical of a large laboratory facility. All such waste products are dance with various permits as required by federal and state laws. Chemically hazar controlled and disposed of in accordance with the requirements of the Resource Cons Recovery Act (RCRA) in accordance with a permit held by the Site and administered b State.

All hazardous wastes are transported off-site for disposal at permitted, comm available, facilities. No treatment (with the exception of exempt simple treatment neutralization) or disposal occurs at the Kesselring Site. In 1992, the Kesselring approximately 15 tons of various hazardous wastes for off-site disposal. In accord the Site has prepared a hazardous waste minimization plan. The plan requires speci identify and minimize waste-producing operations, compare minimization efforts year demonstrate progress, and establish waste minimization goals. This is accomplished of strict procurement procedures, substitution of non-hazardous materials where pra similar measures.

Waste which is both radioactive and chemically hazardous is regulated under b Energy Act and the RCRA as "mixed waste." Within the Naval Nuclear Propulsion Prog concerted efforts are taken to avoid commingling radioactive and chemically hazardo as to minimize the potential for generation of mixed waste. For example, these eff avoiding the use of acetone solvents, lead-based paints, lead shielding in disposal chemical paint removers. Radioactive wastes, including those containing chemically substances, are handled in accordance with long-standing Program radiological requi handling includes solidification to immobilize the radioactivity, separation of the chemically hazardous substances, removal of liquids from solids, and other simple t determination is then made as to whether the resulting waste is hazardous. As a re efforts to avoid the use of chemically hazardous substances in radiological work, P typically generate only a few hundred cubic feet of mixed waste each year. This sm mixed waste, along with limited amounts of mixed waste from Program work conducted

1987, will be stored pending the licensing of commercial treatment and disposal fac

Sanitary wastewater is processed at a conventional extended aeration treatmen southeast corner of the fenced security area. The treatment train consists of equi large solids, aeration tanks in which air is bubbled through the waste to provide m sludge to reduce biochemical oxygen demand, and a clarifier for the separation of l The treatment plant is effective in reducing biochemical oxygen demand and suspende 90 percent in the effluent. Discharges are controlled in conformance with the term State Pollutant Discharge Elimination System permit held by the Kesselring Site. A accumulated sludge is removed from the plant by a New York State licensed subcontra disposed of at an approved off-site disposal facility also licensed by New York Sta

Non-hazardous wastes are reused and recycled or disposed of off-site. Sanita as cafeteria waste, scrap paper, and the like are also disposed of at a licensed of hazardous wastes are being buried in the landfill. Most metal solid waste is accum a scrap salvage vendor.

4.2 IDAHO NATIONAL ENGINEERING LABORATORY

4.2.1 Overview

There are three naval reactor prototype plants at the Idaho National Engineer (INEL) at the Naval Reactors Facility (NRF). These plants contain nuclear reactor have reached the end of their usefulness and are being placed in layup and safe sto Dismantlement of each of the prototype plants will be accomplished in the future; h specific time has yet been set for this work. Appropriate documentation under the Environmental Policy Act (NEPA) will be prepared for prototype dismantlement when a proposal for these actions has been developed.

Also located at the Naval Reactors Facility is the Expended Core Facility (EC naval spent nuclear fuel has been shipped for examination since 1957. After examin the spent nuclear fuel is transferred to the Idaho Chemical Processing Plant, also storage. This section provides a brief summary of the INEL affected environment. description of the affected environment at the INEL is provided in Volume 1, Append Volume 2, Section 4. The reader should refer to the applicable sections therein fo information.

4.2.2 Land Use

The INEL site (which has been designated a National Environmental Research Pa approximately 2300 square kilometers (about 890 square miles) of dry, cool desert i Idaho. Land at the INEL site is currently used for industrial and support operatio energy research and waste management activities, grazing, infrastructure, recreatio environmental research. Only about 2 percent of the land is used for facilities an access to most facility areas is restricted. Land surrounding the INEL site is pri grazing, mineral and energy production, wildlife management, range land, and recrea

4.2.3 Socioeconomics

INEL plays a substantial role in the regional economy. For fiscal year 1990, employed approximately 11,100 personnel, or nearly 12 percent of the total regional The population directly supported by INEL employment was approximately 38,000 perso percent of the total regional population. Over 97 percent of INEL employees reside influence affected by the INEL. The INEL region of influence includes the seven co surrounding and including the INEL: Bingham, Bonneville, Butte, Clark, Jefferson, Madison counties. Employment in this region experienced an annual average growth r approximately 1.3 percent from 1980 to 1991 while the population growth in the same 1980 and 1990 was about 0.6 percent per year. Volume 1, Appendix B provides a comp description of the affected environment at the INEL in this category.

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ

a deleterious environmental impact determined to be unacceptable or above generally
A disproportionately high impact refers to an impact (or risk of an impact) in a lo
minority community that significantly exceeds that on the larger community. Data a
U. S. Census of 1990 have been used to develop information on the locations of mino
income populations within approximately 50 miles of the INEL, and are provided in A
this volume of the Environmental Impact Statement. These data were developed in a
ensures that they are consistent with the data on the total population provided in

4.2.4 Cultural Resources

Approximately 4 percent of the INEL has been surveyed for archaeological reso
1500 sites have been identified; however, none are currently on the National Regist
Places, but may be placed there after formal evaluation. One structure on the INEL
research and development, the Experimental Breeder Reactor I, is on the National Re
Places and is a National Historic Landmark while a number of other reactors and ass
are eligible for inclusion. The entire INEL site is culturally important to Native
they believe the land is sacred. Further information on cultural resources at INEL
Volume 1, Appendix B, Section 4.4 and in Volume 2, Section 4.4.2.

4.2.5 Aesthetic and Scenic Resources

The INEL site is bordered on the north and west by the Bitterroot, Lemhi, and
mountain ranges. Volcanic buttes near the southern boundary of the INEL can be see
locations on the site. Most of the area within the INEL site consists of open, und
Although many of the site facilities are visible to the public, most facilities are
from public roads. The reader should refer to the detailed description of the affe
this category at the INEL in Volume 1, Appendix B.

4.2.6 Geology

The INEL site is located on the Eastern Snake River Plain which extends in a
the Idaho-Oregon border in the west to the Yellowstone Plateau in the east. The re
within the site are sand, gravel, and pumice.

The Eastern Snake River Plain has low seismicity but is surrounded by an area
seismicity. A summary of the seismicity at the ECF site is provided in Attachment

Volcanic hazards at the INEL site have a low probability of occurrence. Volc
in the INEL area consist of possible recurrence of silicic volcanism, silicic dome
basaltic eruptions. Of these three volcanic hazards, basaltic eruptions have been
the highest expectation of occurrence. The potential for basaltic volcanism that c
less than 10-5 per year. The reason that the risk from volcanic hazards at ECF is
facility is more than 9 miles north of the highest potential source of basaltic eru
viscous nature of basaltic lava flows, they are very slow moving and can be diverte
as that on the INEL. The potential for silicic volcanism impacting ECF is negligib
center of silicic volcanism is now located under Yellowstone National Park which is
east of ECF. Several small silicic domes were emplaced in the vicinity of INEL in
million years. These silicic domes are about 17 miles south of the Expended Core F
have minimal impact on the site. (Rizzo 1994)

4.2.7 Air Resources

The Eastern Snake River Plain climate exhibits low relative humidity, wide da
swings, and large variations in annual precipitation. The average seasonal tempera
site range from -7.3 degrees C (18.8 degrees F) in winter to 18.2 degrees C (64.8 d
summer. Annual precipitation is light, averaging 22.1 centimeters (8.7 inches). T
snowfall is 70.1 centimeters (27.6 inches). Other than thunderstorms, severe weath

The air quality on the INEL site and off-site is generally good and within ap
guidelines. Details of the non-radiological air quality and the radiological air q
Appendix B of Volume 1.

4.2.8 Water Resources

Surface water features near the INEL site are the Big Lost River, Little Lost Creek, and on-site man-made ponds. Water in the rivers does not exceed the applica water quality standards. The potential for flooding has been assessed. Details on plains can be found in Appendix B and Volume 2.

Groundwater in the area is contained in the Snake River Plain Aquifer. Subsu quality is affected by natural water chemistry and contaminants originating at the discharges to unlined ponds and deep wells have introduced radionuclides, non-radio inorganic salts, and organic compounds into the subsurface water. For a complete d affected environment in this category, the reader should refer to Volume 1, Appendi

4.2.9 Ecological Resources

Vegetation on the INEL site is primarily shrub-steppe vegetation, with sagebr dominant plant. The INEL supports animal communities typical of shrub-steppe veget habitats. Over 270 vertebrate species have been observed on the site. A more thor the topic of ecological resources at the INEL is provided in Volume 1, Appendix B. therein is a description of the threatened and endangered species which include the peregrine falcon.

4.2.10 Noise

The major sources of noise at the INEL occur primarily in developed operation include various facilities, equipment, and machines. Existing INEL-related noises the public are those from transporting people and materials to and from the INEL an facilities via buses, trucks, private vehicles, helicopters, and freight trains. I business travel of INEL personnel via commercial air transport represent an appreci such travel in and out of regional airports.

4.2.11 Traffic and Transportation

The INEL is surrounded by a system of interstate highways, U.S. highways, st railroads, and airports. The regional railroads include main and branch Union Paci Southeastern Idaho. The two major airports in Idaho Falls and Pocatello provide pa service.

The INEL transportation infrastructure consists of an on-site road system and There are about 140 kilometers (87 miles) of paved roads, of which 29 kilometers (considered service roads and are closed to the public. The Union Pacific Railroad southern portion of the INEL and provides rail service to the site. Rail shipments commodities, spent nuclear fuel, and radioactive materials.

4.2.12 Occupational and Public Health and Safety

4.2.12.1 Occupational Radiological Health and Safety. Radiation exposures to workers at

ECF in recent years have averaged approximately 100 millirem per year, compared to 5000 millirem per year specified by The Code of Federal Regulations, Title 10, Part radiation exposure to workers at ECF makes up about 30% of the occupational exposur experienced by workers at NRF. Approximately 280 workers at ECF work in radiologic are monitored for occupational radiation exposure. The average lifetime accumulate exposure from radiation associated with naval nuclear propulsion plants for the 141 who have been monitored at the DOE Naval Reactors facilities including ECF, is abou (NNPP 1994c). This corresponds to the likelihood of a cancer fatality of 1 in 7142

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e transportation workers for all historical shipments is 16.6 person-rem, which stati to 0.0066 cancer fatalities. The maximum exposed individual (MEI) is a transportat the workers are closer to the shipment for a longer time than any member of the gen Under the limiting assumption that the same worker is associated with every shipmen historical period, this person would receive a total exposure of 7.5 rem over the a

40-year period, or about 0.19 rem per year, which is within Department of Energy (D for occupationally exposed individuals. The radiation exposures to workers corresp than one incident cancer, which means that it is unlikely that there have been any due to all historical shipments of naval spent nuclear fuel over the entire history

4.2.12.2 Occupational Non-radiological Health and Safety. In the non-radiological

Occupational Safety, Health, and Occupational Medicine area, the Navy complies with Occupational Safety and Health Administration Regulations. The Navy's policy is to and healthful work environment at all naval facilities. Due to the varied nature o facilities, there is a potential for certain employees to be exposed to physical an These employees are routinely monitored during work and receive medical surveillanc hazards such as exposure to high noise levels or heat stress. In addition, employe their exposure to chemical hazards such as organic solvents, lead, asbestos, etc., appropriate are placed into medical surveillance programs for these chemical hazard

Operations at ECF have resulted in fewer than 210 days of work lost to injuri years between 1987 and 1993 out of 736 total lost days of work at NRF during that p Recordable injuries at ECF represented about 12 percent of the total number of such during the same period.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. Approximately 0 estimated as a result of non-radiological sources (vehicle emissions) associated wi shipments of spent nuclear fuel. This number includes both the workers and the gen Since this number is much less than one, it is unlikely that there has been any non impact due to the historical shipment of naval spent nuclear fuel over the entire h shipments.

Limited quantities of some materials classified as hazardous chemicals are ha but the precautions used during the work prevent exposure of the workers to these m

4.2.12.3 Public Radiological Health and Safety. The Naval Reactors Facility has from its

beginning monitored potential sources of releases of radioactivity to the environme site in liquid and airborne effluents. Releases of water containing low levels of various disposal basins, leaching pits, and retention basins were made principally 1960s. This practice was discontinued in 1979 and the residual activity in the soi is estimated to be approximately 150 curies, consisting primarily of cesium-137, st cobalt-60. The Naval Reactors Facility maintains a program to monitor these areas assurance that they continue to not present a hazard to the public. Operations at ECF, have had no effect on the groundwater of the Snake River Plain Aquifer. Monit aquifer on the NRF site indicates radioactivity is at or near natural background le comprehensive INEL site radiation monitoring program (Hoff et al. 1992) shows that exposure to persons off-site as a result of all NRF operations is too small to be m

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. The radiation e general population for all historical shipments is 1.95 person-rem, which statistic 0.00098 cancer fatalities. The maximum exposed individual (MEI) is a transportatio these workers are closer to the shipment for a longer time than any member of the g The maximum exposure to an individual of the general population is 0.062 rem over t historical period, which statistically corresponds to 0.000031 cancer fatalities.

4.2.12.4 Public Non-radiological Health and Safety. Since operations began, NRF has

monitored site water and air released from operations at the site to ensure that th requirements of applicable federal and state environmental standards. Results of a monitoring confirm that the operation of NRF has no discernible impact on the envir (WECNRF 1993). Operations at NRF have not caused degradation of the quality of the of the Snake River Plain Aquifer. Monitoring results indicate no detectable toxic or laboratory chemicals in the groundwater in the vicinity of NRF. Low levels of s chloride (like table salt) used to soften site water and nitrates (which leaked thr sewage lagoon liners) and discharges to the industrial waste ditch are detectable i vicinity of NRF at levels below the applicable drinking water standards. No consti groundwater exceeds applicable drinking water standards.

Attachment A provides a discussion of the calculation of past health impacts all transportation of naval spent nuclear fuel and test specimens. As stated in Se unlikely that there has been any non-radiological health impact to the public due t shipments of naval spent nuclear fuel over the entire history of such shipments.

4.2.13 Utilities and Energy

The following discussion briefly describes the current utility and energy usa more detailed information, refer to Volume 1, Appendix B.

Commercial electrical power is supplied to the INEL site by the Idaho Power C water supply for INEL is provided by a system of wells, pumps, and storage tanks wh administered by the DOE. Because of the distance between site facility areas, the systems for each facility are independent of each other. Wastewater systems at mos areas consist primarily of septic tanks and drain fields, although two areas also h treatment facilities. The fuels consumed at the site (fuel oil, gasoline, diesel, liquid petroleum gas) are transported to the site by various distributors for stora

4.2.14 Materials and Waste Management

The following discussion briefly describes the current waste disposal practic For more detailed information, refer to Volume 1, Appendix B.

High-level waste is currently in storage at the INEL Idaho Chemical Processin waste is blended and then treated by calcination to produce a granular calcine soli

Transuranic waste is kept in retrievable storage at the Radioactive Waste Man Complex. Although there is no currently available disposal facility, all transuran intended to ultimately be retrieved, repackaged, certified, and shipped to the Wast Plant for final disposal.

Low-level waste has been stored and disposed of at the Radioactive Waste Mana Complex. Most low-level waste is reduced in volume before disposal through inciner compaction, and sizing at the Waste Experimental Reduction Facility; however, this been curtailed since 1991 awaiting an operating permit from the State of Idaho. Lo awaiting treatment is stored on asphalt/concrete pads at the Waste Experimental Red and in radioactive waste storage containers at the generating facilities.

Most of the mixed low-level waste currently stored at the INEL is alpha-conta level mixed waste shipped to the INEL for storage and treatment from off-site gener only low-level mixed waste from INEL contractors is accepted at INEL for treatment All low-level mixed waste generated at INEL is stored at interim storage facilities systems become available or operational.

Hazardous waste generated at the INEL is not treated or permanently stored at is collected and temporarily stored at the Hazardous Waste Storage Facility, or at accumulation areas, and shipped off-site to permitted treatment, storage, or dispos

The industrial/commercial solid waste generated at the INEL is disposed of in Landfill Complex located at the Central Facilities Area. Waste segregation takes p facility so recyclable materials do not enter the solid waste stream.

4.3 SAVANNAH RIVER SITE

4.3.1 Overview

As mentioned previously, naval spent nuclear fuel has been shipped to the Expe Facility (ECF) at the Idaho National Engineering Laboratory (INEL) for examination One of the alternatives under consideration is to create a facility similar to ECF DOE-owned Savannah River Site (SRS) in South Carolina. A detailed description of t at the SRS is provided in Volume 1, Appendix C. This section provides a summary of highlights from Volume 1, Appendix C. Therefore, specific source references for in contained in this section are omitted here but can be found in Volume 1, Appendix C

Two sites have been identified as possible locations for the construction of Expended Core Facility. One location for the Savannah River ECF is just to the eas geographic center of the complex (see Site A on Figure 4.3-1). The other location unused Barnwell Nuclear Fuel Plant located just outside of the eastern boundary of

complex. In either case, a separate security area would be established specificall Savannah River ECF, with all access controlled by the Naval Reactors Program as has the case at the INEL-ECF.

4.3.2 Land Use

The SRS (which has been designated a National Environmental Research Park) oc area of approximately 800 square kilometers (310 square miles) in western South Car generally rural area about 40 kilometers (25 miles) southeast of Augusta, Georgia. Savannah River Site can be grouped into three major categories: forest/undeveloped, and developed facilities. Land use bordering SRS is primarily forest and agricultu large amount of open water and non-forested wetlands along the Savannah River Valle does not contain any public recreation facilities and only about 5 percent of the l constructed facilities.

Figure 4.3-1. Candidate sites for an Expended Core Facility. 4.3.3 Socioeconomics

Approximately 90 percent of the SRS work force lives within the region of infl by the SRS. The SRS region of influence includes Aiken, Allendale, Bamberg, and Ba Counties in South Carolina, and Columbia and Richmond Counties in Georgia. Employm region experienced an annual average growth rate of approximately 5 percent between Over this same time period, the labor force in the six-county region of influence g 39 percent. Personal income in the region of influence is about $7 billion. Popul of influence increased 13 percent from 376,058 in 1980 to 425,607 in 1990. Appendi Volume 1 provides a complete description of the affected environment at the SRS in

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the SRS, and are provided in Ap this volume of the Environmental Impact Statement. These data were developed in a ensures that they are consistent with the data on the total population provided in

4.3.4 Cultural Resources

Cultural resources on the SRS can be summarized by stating that approximately the SRS area has been examined by the South Carolina Institute of Archaeology, Univ Carolina, in consultation with the South Carolina State Historic Preservation Offic 850 archaeological sites have been identified. These range in age from Clovis Pale farms. Most structures were demolished during initial establishment of the SRS. A Volume 1 provides a complete description of the affected environment at the SRS in

4.3.5 Aesthetic and Scenic Resources

The dominant aesthetic setting in the vicinity of the SRS consists mainly of a and forest, with some limited residential and industrial areas. Because of the dis boundary, the rolling terrain, normally hazy atmospheric conditions, and heavy vege facilities are not generally visible from off the Site. The land on the SRS is hea developed areas occupy only approximately 5 percent of the total land area.

4.3.6 Geology

The SRS is on the Upper Atlantic Coastal Plain of South Carolina, which consi approximately 200 to 400 meters of sands, clays, and limestones formed millions of sediments are underlain by sandstones of Triassic age and older metamorphic and ign

There are no known capable faults as defined by the Nuclear Regulatory Commis regulatory guidelines in the SRS region. Therefore, earthquakes capable of produci damage are not likely in the vicinity of SRS. Two notable earthquakes have occurre kilometers (200 miles) of the SRS. The first was a major earthquake in 1886 center Charleston area with an estimated Richter magnitude of 6.8. The second earthquake County, South Carolina, earthquake of 1913, which had an estimated Richter magnitud occurred about 160 kilometers (100 miles) from the SRS. Two earthquakes have occur SRS during recent years. One on June 8, 1985, with a local magnitude of 2.6, and t August 5, 1988, with a local magnitude of 2.0. Appendix C of Volume 1 provides a c description of the affected environment at the SRS in this category.

4.3.7 Air Resources

The annual average temperature at the SRS is 17.8 degrees C (64 degrees F); m averages range from 7.2 degrees C (45 degrees F) in January to 27.2 degrees C (81 d July. Relative humidity readings taken four times per day range from 36 percent in percent in August. The average annual precipitation at the SRS is approximately 12 inches). Precipitation distribution is fairly even throughout the year, with the h the summer and the lowest in autumn. Winter storms in the SRS area occasionally br gusty surface winds with speeds as high as 32 meters per second (72 miles per hour)

The SRS is in a Class II area in attainment with National Ambient Air Quality (NAAQS) for pollutants, which include sulfur dioxide, nitrogen oxides, particulate ozone (as volatile compounds), and carbon monoxide. The SRS has demonstrated its c the South Carolina Department of Health and Environmental Control regulation R.61-6 8, "Toxic Air Pollutants," which regulates the emission of 257 toxic substances. A Volume 1 provides a more detailed description of the affected environment in this c

4.3.8 Water Resources

The Savannah River bounds the SRS on its southern border for about 32 kilomet (20 miles), approximately 260 kilometers (160 miles) from the Atlantic Ocean. At t River flow averages about 283 cubic meters (10,000 cubic feet) per second. Five pr to the Savannah River are on the SRS: Upper Three Runs Creek, Four Mile Branch Cree Branch Creek, Steel Creek, and Lower Three Runs Creek. Neither of the sites identi Savannah River ECF is located on the 100-year floodplain. Further discussion on th SRS as well as the 100-year floodplain is available in Volume 1, Appendix C. Appro Carolina Bays are scattered across the SRS. Carolina Bays are naturally occurring that often hold water. The quality of the water in the Savannah River and the SRS that on April 24, 1992, the South Carolina Department of Health and Environmental C the classification of these waterways from "Class B waters" to "Freshwaters." This more stringent set of water quality standards.

Excellent quality groundwater is abundant in this region of South Carolina fr aquifers. The main source of recharge to the groundwater is rainfall and the direc vadose zone is predominantly downward. In general, the vadose zone thickness range approximately 40 meters (130 feet) in the northernmost part of the SRS to 0 meter w table intersects wetlands, streams, or creeks. The groundwater beneath 5 to 10 per has been contaminated by industrial solvents, metals, tritium, or other constituent on the Site. Appendix C of Volume 1 provides a complete description of the affecte the SRS in this category.

4.3.9 Ecological Resources

At the time of acquisition by the U.S. Government, the SRS was approximately forested and one-third cropland and pasture. At present, more than 90 percent is f extensive forest management program is conducted by the Savannah River Forest Stati an important contributor to the biodiversity of Georgia and South Carolina. Caroli Savannah River Swamp, and several relatively intact longleaf pine-wiregrass communi important contributions to the diversity of biota of the SRS and of the entire regi

The removal of all human inhabitants in 1951 and the restoration of forest co have provided the wildlife associated with the wetlands of the Savannah River and t sand hills of coastal South Carolina found on the SRS with excellent wildlife habit

thorough treatment of the topic of ecological resources at the SRS is provided in V C. Also presented therein is a description of threatened, endangered, and candidat species known to occur or that might occur on the SRS.

4.3.10 Noise

The major noise sources at SRS occur primarily in developed operational areas various facilities, equipment, and machines (e.g., cooling towers, transformers, en boilers, steam vents, paging systems, construction and materials-handling equipment Major noise sources outside the operational areas consist primarily of vehicles and tions. Existing SRS-related noise sources of importance to the public are those re transportation of people and materials to and from the Site. These sources include vehicles, helicopters, and freight trains. In addition, a portion of the air cargo using commercial air transport through the airports at Augusta, Georgia, and Columb Carolina, are attributable to SRS operations. Appendix C of Volume 1 provides a co description of the affected environment at the SRS in this category.

4.3.11 Traffic and Transportation

The SRS is surrounded by a system of interstate highways, U.S. highways, stat and railroads. The regional transportation networks service the four South Carolin Georgia counties that generate about 90 percent of SRS commuter traffic.

The SRS transportation infrastructure consists of more than 230 kilometers (1 primary roads, 1,931 kilometers (1,200 miles) of unpaved secondary roads, and 103 k miles) of railroad track. These roads and railroads provide connections among the facilities and to off-site transportation linkages.

4.3.12 Occupational and Public Health and Safety

The sources of radiation exposure to individuals consist of natural backgroun cosmic, terrestrial, and internal body sources; radiation from medical diagnostic a practices; and radiation from man-made sources, including consumer products, indust and nuclear facilities. Programs are in place at the Savannah River Site to protec radiological and non-radiological hazards. These programs help to maintain the dos below the regulatory dose limit of 5 rem/year and the DOE Administrative Control Le 2 rem/year. Appendix C of Volume 1 provides a complete description of the affected the SRS in this category.

4.3.13 Utilities and Energy

The principal source of water for SRS facilities is the Savannah River, with supplemented by groundwater wells. The Savannah River Site has its own electric-ge although it purchases much of the power it uses from the South Carolina Electric an

4.3.14 Materials and Waste Management

The SRS generates high-level radioactive waste, transuranic waste, low-level waste, hazardous waste, mixed waste, and sanitary waste. DOE treats and stores was from on-site operations at the SRS in waste management facilities. This includes a 20,000 cubic meters (700,000 cubic feet) of low-level waste generated annually. SR low-level waste for disposal on the site in accordance with the waste category and surface dose rate.

Mixed low-level waste contains low-level radioactive materials and hazardous SRS mixed waste program consists primarily of providing safe storage until treatmen facilities are available. Appendix C of Volume 1 provides a complete description o environment for this category.

4.4 HANFORD SITE

4.4.1 Overview

As mentioned previously, naval spent nuclear fuel has been shipped to the Exp Facility (ECF) at the Idaho National Engineering Laboratory (INEL) for examination alternative under consideration to performing spent naval nuclear fuel inspections to construct a facility providing similar capabilities at the Hanford Site. Two op an alternate ECF at the Hanford Site are to: (1) construct a new ECF between the 2 West Areas adjacent to the proposed spent nuclear fuel storage facility, or (2) mod unused Fuels and Materials Examination Facility (FMEF), located in the 400 Area, to operations (see Figure 4.4-1).

This section provides a brief summary of the affected environment at Hanford. discussion of the Hanford Site affected environment is contained in Volume 1, Appen reader should refer to the applicable sections therein for additional information.

4.4.2 Land Use

The Hanford Site (which has been designated a National Environmental Research encompasses approximately 1450 square kilometers (560 square miles) and includes se Department of Energy (DOE) operational areas. Most of the site is open, vacant lan 6 percent of the land occupied by constructed facilities. Land uses in the surroun urban and industrial development, irrigated and dry-land farming, and grazing.

The Hanford Site includes some land-use resources that Native Americans have interest in, regarding the Treaty of 1855. DOE is assisting them in this effort. in Volume 1, Appendix A.

Figure 4.4-1. Hanford Site map. 4.4.3 Socioeconomics

The Hanford Site plays a dominant role in the socioeconomics of the Tri-Citie Pasco, and Kennewick) and other parts of Benton and Franklin counties. Approximate people live within an 80-kilometer (50-mile) radius of the site. The agricultural represents a sizeable part of the local economy. Any major changes in Hanford acti potentially most affect the Tri-Cities and other areas of Benton and Franklin count particular, but generally the 10 counties surrounding the Hanford Site, constitute of influence (Volume 1, Appendix A).

Hanford employment accounted for nearly one-quarter of the total non-agricult Benton and Franklin counties in 1991. Approximately 93 percent of the direct emplo Hanford consists of residents of Benton and Franklin counties; approximately 81 per Tri-Cities area. Population in the two counties increased by about 4 percent from

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the Hanford Site, and are provi A to this volume of the Environmental Impact Statement. These data were developed which ensures that they are consistent with the data on the total population provid

4.4.4 Cultural Resources

The Hanford Site is rich in cultural resources. It contains numerous, well-p archaeological sites representing both the prehistoric and historical periods and i homeland by many Native American people. Two single sites and seven archaeological included in the National Register of Historic Places. Management of Hanford's cult follows the Hanford Cultural Management Plan and is conducted by the Hanford Cultur Laboratory of Pacific Northwest Laboratory. DOE is assisting Native Americans who an interest in renewing their use of some Hanford land-use resources, in accordance

of 1855. Details are provided in Volume 1, Appendix A.

4.4.5 Aesthetic and Scenic Resources

The land in the vicinity of the Hanford Site is generally flat. Rattlesnake western boundary of the Site, and Gable Mountain and Gable Butte are the highest la the Site. Both the Columbia River, flowing across the northern part of the Site an eastern boundary, and the spring-blooming desert flowers provide a source of visual people. The White Bluffs, steep bluffs above the northern boundary of the river in striking feature of the landscape.

4.4.6 Geology

The Hanford Site is located within the central part of the Pasco Basin of the Plateau. Its surface features were formed by catastrophic floods and have undergon tion since, with the exception of more recently formed sand dunes. The elevation o from about 105 meters (345 feet) above mean sea level in the southeast corner to ab (803 feet) in the northwest. Much of the Hanford Site is underlain by sand, gravel deposits which could have economic value. The major geologic units and a descripti be found in Volume 1, Appendix A.

Seismicity of the Columbia Plateau is relatively low when compared to other r Pacific Northwest. There are several major volcanoes in the Cascade Range west of Site. The nearest is Mount Adams which is about 165 kilometers (102 miles) from th most active volcano is Mount St. Helens which is about 220 kilometers (136 miles) w from Hanford.

4.4.7 Air Resources

The Hanford Site is located in a semi-arid region where the climate is mild a occasional periods of high winds. The summers are generally hot and dry; the winte cool and mild. Average monthly temperatures at the Hanford Site range from -1.5 de (29.3 degrees F) in January to 24.7 degrees C (76.5 degrees F) in July. The annual humidity is 54 percent and is usually highest in winter (approximately 75 percent) summer (about 35 percent). The Cascade Mountains west of the Hanford Site greatly local climate by acting as a natural barrier to Pacific Ocean storm systems. This Site's relatively low average annual precipitation of 16 centimeters (6.3 inches). serves as a source of cold air drainage which has a considerable effect on the wind Hanford Site.

Air quality is within federal standards. Details of the non-radiological air radiological air quality are provided in Appendix A of Volume 1.

Information on severe weather, precipitation extremes, and air dispersion/sta characteristics is provided in Volume 1, Appendix A for the Hanford Site. The sour ical information used in analytical calculations is provided in Attachment F.

4.4.8 Water Resources

The major surface water features near the Hanford Site are the Columbia and Y The Columbia River flows through the northern part of the Site at an average annual about 3400 cubic meters per second (120,000 cubic feet per second). The Yakima Riv low annual flow rate compared to the Columbia River, flows along the southern porti Hanford Site at an average annual rate of 104 cubic meters per second (3673 cubic f The Hanford ECF site or the modified FMEF site would not be affected by a 500-year Columbia River. Details are provided in Volume 1, Appendix A.

The State of Washington Department of Ecology classifies the Columbia River a (excellent) from the Grand Coulee Dam, past the Hanford Site, to the mouth of the r Pacific Ocean. The Hanford Reach of the Columbia River is the last free-flowing po in the United States. Radiological monitoring shows low levels of radionuclides in River. Hydrogen-3 (tritium), iodine-129, and uranium are found in slightly higher downstream of the Hanford Site than upstream, but are well below concentration guid lished by the DOE and the U.S. Environmental Protection Agency (EPA) drinking water

Groundwater quality on the Hanford Site has been affected by defense-related produce nuclear materials. While most of the Site does not have contaminated groun underlying areas of the Site do have elevated levels of both radiological and non-r The liquid effluents, discharged into the ground, have carried with them certain ra and chemicals which move through the soil column at varying rates, eventually enter water forming plumes of contamination. Groundwater monitoring is conducted on an a Results indicate that concentrations of various radionuclides in some wells in or n exceeded drinking water standards. Tritium continues to slowly migrate with the gr where it enters the Columbia River. Nitrate concentrations also exceeded drinking various locations around the Hanford Site. More information on groundwater quality Volume 1, Appendix A.

4.4.9 Ecological Resources

The Hanford Site is a relatively large, undisturbed area of shrub-steppe vege contains numerous plant and animal species adapted to the region's semi-arid enviro vegetation at the Hanford Site consists of 10 major kinds of plant communities, wit dominant plant on fields. More than 300 species of insects, 12 species of amphibia and about 39 species of mammals are found on the Hanford Site. The horned-lark and meadowlark are the most abundant nesting birds. A more thorough treatment of the t ecological resources at the Hanford Site is provided in Volume 1, Appendix A. Also therein is a description of threatened and endangered species. These include four six species of birds, and one species each of mammals and insects.

4.4.10 Noise

Hanford measurements of the propagation of noise have been concerned primaril occupational noise at work sites. Environmental noise levels have not been extensi because of the remoteness of most Hanford activities. Most industrial facilities o are located far enough away from the site boundary that noise levels at the boundar measurable or are barely distinguishable from background noise levels. Some field well drilling and sampling, have the potential for producing noise in the field apa permanent facilities that could be disruptive to wildlife.

4.4.11 Traffic and Transportation

The area is serviced by a system of interstate highways and state roads. Per material shipments are transported by road. Bulk materials or large items are ship transportation is used to move irradiated fuel and certain high-level radioactive s transport equipment and materials.

Hanford's on-site road network consists of rural arterial routes. Only 65 of paved roads at Hanford are accessible to the public. On-site rail transport is pro railroad owned and operated by the DOE. This line connects just south of the Yakim Union Pacific, which in turn interchanges with the Washington Central and Burlingto Railroads at Kennewick. The Hanford Site infrequently uses the Port of Benton dock Columbia River for off-loading large shipments. Overland trailers are then used to shipments to the Site.

4.4.12 Occupational and Public Health and Safety

Programs are in place at the Hanford Site to protect workers from radiologica radiological hazards. In 1989, about 9000 individuals were monitored at the Hanfor 6000 received a measurable radiation dose equivalent to an average annual dose of 0 person. This is well below the regulatory dose limit of 5 rem per year and the DOE control level of 2 rem per year.

Doses and exposures to the public from airborne releases at the Hanford Site and reported annually. It is calculated that the maximally exposed off-site indivi exposure of 0.02 millirem per year of radioactive emissions, while the average expo would be 0.002 millirem per year.

4.4.13 Utilities and Energy

The principal source of water in the Tri-Cities and at the Hanford Site is th Electrical power for the Hanford Site is purchased wholesale from the Bonneville Po Administration, a federal power marketing agency. Hydropower, and to a lesser exte nuclear power, are used to generate the region's electricity.

4.4.14 Materials and Waste Management

The Hanford Site contains several waste areas associated with nuclear defense materials. These areas are scheduled for remediation in accordance with the Hanfor Agreement and Consent Order.

The following discussion briefly describes the current waste disposal practic Site. For more detailed information, and information on historical waste disposal Volume 1, Appendix A.

Wastes at the Hanford Site are generated by both facility operations and envi restoration activities. Non-dangerous solid waste is disposed of at the Solid Wast the 200 Area. The existing capacity of this landfill will be expended by the mid t Newly generated non-radioactive hazardous waste is shipped off-site for treatment, recovery, and/or disposal.

Low-level mixed waste contains low-level radioactive materials and hazardous wastes are either stored until technology is modified or verified to allow treatmen through an evaporator. Solid low-level radioactive waste is placed in unlined, sha 200 Area Low-Level Waste Burial Grounds. Hanford also receives low-level waste fro generators for disposal. High-level wastes are being stored in single-shell and do a treatment facility is constructed to allow treatment and disposal of the waste.

Transuranic waste is stored in above-ground storage facilities in the Hanford Complex and Transuranic Waste Storage and Assay Facility. This waste is planned to the Waste Isolation Pilot Plant in New Mexico for final disposal.

4.5 OAK RIDGE RESERVATION

4.5.1 Overview

As mentioned previously, naval spent nuclear fuel has been shipped to the Expe Facility (ECF) at the Idaho National Engineering Laboratory (INEL) for examination alternative to continuing naval spent nuclear fuel operations at the ECF at INEL is facility providing similar capabilities at the Oak Ridge Reservation (ORR). The ne sited near the K-25 Site which is located on the western portion of the ORR (see Fi separate security area would be established specifically to enclose the ECF at ORR, controlled by the Naval Reactors Program as has always been the case at the ECF at

This section provides a brief summary of the affected environment at the Oak Reservation. A detailed discussion of the ORR affected environment is contained in Appendix F. The reader should refer to the applicable sections of that appendix fo information and for information source references.

4.5.2 Land Use

The ORR is located on approximately 54 square miles (140 square kilometers) o within Anderson and Roane Counties, Tennessee, with Knox and Loudon Counties to the Most of the ORR is located within the corporate limits of the city of Oak Ridge. K approximately 30 miles (48 kilometers) southeast of Oak Ridge and is the largest ci The ORR includes three intensively developed industrial areas at the Y-12 Plant, th National Laboratory (ORNL), and the K-25 Site separated by mostly undeveloped fores Surrounding land uses include residential, commercial, public, and industrial areas Ridge and rural areas characterized by residences, small farms, forest, and pasture 21 square miles (54 square kilometers) of undeveloped ORR land have been designated Environmental Research Park.

Figure 4.5-1. Oak Ridge Reservation site map. 4.5.3 Socioeconomics

Socioeconomic parameters are defined in this Environmental Impact Statement fo influence encompassing Anderson, Knox, Roane, and Loudon Counties, Tennessee. Abou percent of ORR employees presently live in this region of influence. The employmen ORR in 1990 was 17,082 persons. The 1990 population of 489,230 in the region of in expected to increase at less than 1 percent annually through the year 2004, to 538, housing stock, with a 1990 vacancy rate of 1.5 percent, is expected to grow in prop population.

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the ORR, and are provided in Ap this volume of the Environmental Impact Statement. These data were developed in a ensures that they are consistent with the data on the total population provided in

4.5.4 Cultural Resources

A cultural resources survey conducted in 1975 did not identify any cultural re proposed Oak Ridge ECF site. Therefore, no prehistoric or historic resources are e located on the proposed Oak Ridge ECF site. There are no known Native American res proposed site of the Oak Ridge ECF. Further discussion is provided in Appendix F o

4.5.5 Aesthetic and Scenic Resources

The view on and near the ORR consists mainly of rural land. Views are limited terrain, forest cover, and frequent haziness. The three main developed areas at th ORNL, and K-25 Site have low vulnerability to visual impacts (visual sensitivity); lands range from low to moderate visual sensitivity.

4.5.6 Geology

The ORR lies within the western portion of the Valley and Ridge Province, nea with the Cumberland Plateau. The Valley and Ridge Province is characterized by num ridges and valleys which extend northeast-southwest. Local geology is characterize rocks of Cambrian and Ordovician age. Areas of the ORR underlain by limestones and contain sinkholes and caves ("karst" geology). Soils generally belong to the Ultis ized as moderately acidic soils that exhibit severe mineral weathering with precipi oxides. No prime or unique farmlands are located on the ORR.

From 1811 to 1975, five earthquakes or earthquake series with Modified Mercal (MMI) of V to VI have affected the ORR area. No MMI VII earthquakes have been reco ORR during this period. An MMI VII earthquake does not typically cause severe dama causes breaking of weak chimneys at the roof line, cracks in masonry, and the falli bricks, and stones. MMI VII earthquakes generally occur one order of magnitude les MMI V to VI earthquakes. Seismic records indicate that the ORR is located in a reg seismic activity having an average of one to two earthquakes per year with seismic in bursts followed by long periods of no activity. No deformation of recent surfac detected, and seismic shocks from the surrounding, more seismically active areas ar distance from the epicenter. The ORR is located in Uniform Building Code Zone 2A.

4.5.7 Air Resources

Climate at the ORR is characterized by moderate temperatures (low daily avera

in January and high daily average of 76.6yF in July), ample precipitation (annual a inches), and frequent summer thunderstorms. Although infrequently subjected to tor did experience a tornado from a severe thunderstorm in February 1993. The tornado Plant and ended just north of Knoxville. Wind speeds along the tornado path ranged per hour (18 meters per second) to nearly 130 miles per hour (58 meters per second) the areas within the Air Quality Control Region which includes the ORR were designa attainment with respect to all National Ambient Air Quality Standards. Great Smoky National Park, a Prevention of Significant Deterioration Class I area, is located r the southeast. The estimated 50-year effective dose equivalent to any member of th airborne radiological emissions from the ORR is approximately 3.3 millirem. This l regulatory limits.

4.5.8 Water Resources

The ORR is drained by the Clinch River and its network of tributaries. The Cl tributary of the Tennessee River, extends roughly 350 miles and drains roughly 4,41 The section of the river bordering the ORR is impounded by Melton Hill Dam and is a component of the inland waterway system. The average discharge from Melton Hill Da 1963 and 1979 was 150 cubic meters (5,300 cubic feet) per second. The Clinch River source of water withdrawn to meet operational demands on the ORR. The only groundw the ORR suitable for withdrawal is found in the Knox Aquifer, but withdrawals are f abundance of surface water. Concentrations of radiological and non-radiological co applicable water standards have been observed at a number of groundwater monitoring the ORR. Such concentrations are probably a result of past waste disposal practice discharge of radioactive material to ponds and impoundments). However, data indica the contamination remains close to the source. Further discussion concerning the w ORR is provided in Appendix F of Volume 1.

4.5.9 Ecological Resources

Most undeveloped land on the ORR supports forest, including naturally establi growth forest and pine plantations that have been established on former agricultura habitats on the ORR include tailwaters, impoundments, reservoir embayments, large s perennial streams, and wetlands. Wetlands on the ORR include shallow embayments on River impoundments, narrow strips of forested wetlands along groundwater seeps and abandoned farm ponds. Twenty-five plant and animal species known to be present on listed by the Tennessee Department of Environment and Conservation as either endang threatened, or of special concern.

4.5.10 Noise

Noise from the operation of industrial facilities and equipment on the ORR is limited to the developed areas at the Y-12 Plant, ORNL, and K-25 Site. Noise from the ORR is generally limited to vehicular and rail traffic. Noise at the ORR bound indistinguishable from background noise.

4.5.11 Traffic and Transportation

Segments of some arterial roads in the vicinity of the ORR operate close to d certain times. Several arterial roads that are open to the public traverse ORR lan River is a navigable component of the inland waterway system but primarily serves o boaters. Airports in the vicinity of the ORR include the McGhee Tyson Airport in K numerous smaller private airfields.

4.5.12 Occupational and Public Health and Safety

Health impacts to the public are minimal due to administrative and design cont facilities that keep releases of radioactive or otherwise hazardous materials to th compliance with applicable regulatory standards. Occupational doses to persons wor

facilities also fall within regulatory limits. Refer to Appendix F of this volume tion in this area.

4.5.13 Utilities and Energy

The Clinch River and Melton Hill Reservoirs provide all water resources to th city of Oak Ridge through two pumping stations. The ORR uses an average of 69.3 mi (18.3 million gallons) per day. Total potable water capacity available to the ORR (40.2 million gallons) per day, obtained through the K-25 and Y-12 treatment plants is provided to the ORR by the Tennessee Valley Authority. The current ORR power de approximately 115 megawatts, while the connected capacity of ORR facilities is appr megawatts. The average usage of natural gas at the ORR in 1994 was 3.6 billion Btu compared to a contractual capacity of 7.6 billion Btu per day.

4.5.14 Materials and Waste Management

Each of the three main areas of the ORR is responsible for its own air and wa discharges and the associated treatment facilities. Non-radioactive hazardous wast by each area, typically by shipment to off-site commercial treatment or disposal en for managing radioactive wastes, radioactive mixed wastes, and sanitary and industr generally involve more than one of the areas or involve land/facilities outside the Solid sanitary and industrial wastes are disposed of on the ORR. Most radioactive are stored on-site pending future disposal actions. The Toxic Substance Control Ac located at the K-25 Site, is used to incinerate uranium-contaminated polychlorinate and other mixed wastes.

4.6 NEVADA TEST SITE

4.6.1 Overview

As mentioned previously, naval spent nuclear fuel has been shipped to the Expe Facility (ECF) at the Idaho National Engineering Laboratory (INEL) for examination Two of the alternatives under consideration result in the creation of a facility si DOE-owned Nevada Test Site (NTS) in Nevada. A detailed description of the environm NTS is provided in Volume 1, Appendix F. This section provides a summary of some o highlights from that volume. Therefore, specific source references for information section are omitted here but can be found in Volume 1, Appendix F.

A site has been identified as a possible location for the construction of a f the Nevada Test Site. The potential location for the Nevada ECF is in Area 5 in th of the NTS, adjacent to Mercury Highway and south of the NFS High Explosive Assembl (see Figure 4.6-1). A separate security area would be established specifically to enclose the Nevada Test Site ECF, with all access controlled by the Naval Reactors always been the case at the Idaho ECF. This would place the Nevada ECF in close pr location being proposed under one of the Centralization alternatives for constructi an interim spent nuclear fuel storage facility.

4.6.2 Land Use

The NTS occupies an area of approximately 3,500 square kilometers (1,350 squa southern Nevada in a remote area about 104 kilometers (65 miles) northwest of Las V The southern two-thirds of the NTS is dominated by three large valleys or basins: Y and Jackass flats. Mountain ridges and hills rise above gradually sloping stream-d enclosing these basins. The northern and northwestern sections of the NTS are domi Mesa and Ranier Mesa. The NTS does not contain any public recreation facilities an small percentage of the land is occupied by constructed facilities. The NTS is alm surrounded by other federally owned lands which buffer it from lands open to the pu

Figure 4.6-1. Candidate site for an Expended Core Facility at the Nevada Test Si

Management on the south and southwest.

4.6.3 Socioeconomics

Socioeconomic parameters defined in this Environmental Impact Statement are fo county region of influence encompassing Clark and Nye Counties, Nevada. Ninety-eig NTS employees live in Clark County (88 percent) or Nye County (10 percent). Econom have continued to improve in Southern Nevada since the mid-1980s. Economic growth accelerated relative to the national trends because of the expansion in hotel and g Appendix F of Volume 1 provides a complete description of the affected environment this category.

Executive Order 12898, "Federal Actions to Address Environmental Justice in M Populations and Low-Income Populations," requires federal agencies to identify and appropriate, disproportionately high and adverse human health or environmental effe programs and activities on minority and low-income populations. An adverse environ a deleterious environmental impact determined to be unacceptable or above generally A disproportionately high impact refers to an impact (or risk of an impact) in a lo minority community that significantly exceeds that on the larger community. Data a U. S. Census of 1990 have been used to develop information on the locations of mino income populations within approximately 50 miles of the NTS, and are provided in Ap this volume of the Environmental Impact Statement. These data were developed in a ensures that they are consistent with the data on the total population provided in

4.6.4 Cultural Resources

People have inhabited the NTS site for approximately 12,000 years. The area o was inhabited by Shoshone and Southern Paiute Native American tribes prior to Europ These tribes are known to be affiliated with sites located in the northern portions including the Pahute and Rainier Mesas. No prehistoric or historic resources are e located on the proposed site for the ECF facilities. Also, there are no areas cont are subject to Native American Treaty rights. Appendix F of Volume 1 provides a co description of the affected environment at the NTS in this category.

4.6.5 Aesthetic and Scenic Resources

The view across the NTS comprises a mixture of open desert, mountain ranges, a features. Areas on and surrounding the NTS are generally of low to moderate vulner impact (visual sensitivity). Appendix F of Volume 1 provides a more complete descr affected environment at the NTS in this category.

4.6.6 Geology

The NTS lies in the southern part of the Great Basin Section of the Basin and Physiographic Province. Local geology is characterized by sediment-filled topograp valleys surrounded by ranges composed of sedimentary rocks and compacted volcanic a Appendix F of Volume 1 provides a complete description of the affected environment this category.

4.6.7 Air Resources

The climate at lower elevations at the NTS is characterized by bright sunligh precipitation, low relative humidity, and large daily temperature ranges. Climatol change markedly at higher elevations. In Pahute Mesa at an elevation of 2,000 mete above mean sea level, the average daily maximum/minimum temperatures are 4.4yC/2.2y (40yF/28yF) in January and 26.7yC/16.7yC (80yF/62yF) in July. At Yucca Flat, at an 1,200 meters (3,920 feet) above mean sea level, the average daily maximum/minimum t are 10.6yC/-6.1yC (51yF/21yF) in January and 35.6yC/13.9y- C (96yF/57yF) in July.

The NTS is located in an attainment area for all criteria pollutants, and air region presently meets all applicable federal and Nevada regulations. For all acti the estimated effective dose equivalent to any member of the public from all airbor

emissions is approximately 0.01 millirem per year, which is well under regulatory l

4.6.8 Water Resources

Perennial surface water in the vicinity of the NTS is mostly limited to widel springs, short river reaches, and playas (seasonally inundated lakes). Intermitten bodies include ephemeral streams which briefly flow following heavy rainfall and pl contain standing water for brief periods following storms. Localized flash floods heavy rainfalls can be destructive. Aquifers underlying the NTS are generally deep and 1640 feet. Due to the scarcity of surface water, groundwater is the principal NTS activities and surrounding communities. Appendix F of Volume 1 provides a comp description of the affected environment at the NTS in the general category of water including both surface water and groundwater.

4.6.9 Ecological Resources

The NTS lies in an ecological transition area between the Mojave and Great Ba Terrestrial habitats on the NTS comprise desert scrub-shrub plant communities and a and mesa community dominated by pinion pine and juniper. Aquatic habitats and wetl NTS are limited to widely scattered springs, ephemeral stream channels, and playa l five federally and state listed threatened, endangered, or other special status spe identified on or near the NTS. Of particular concern is the federally listed (thre tortoise, which is vulnerable to physical injury from construction and human activi federally listed (endangered) Devils Hole pupfish, which is vulnerable to declining

4.6.10 Noise

Major noise sources at the NTS occur primarily in developed operational areas various facilities, equipment, and machines (e.g., cooling towers, transformers, en boilers, steam vents, paging systems, construction and materials-handling equipment aircraft operations, and testing. No NTS environmental noise survey data are avail boundary, away from most facilities, noise from most sources is barely distinguisha background noise levels.

4.6.11 Traffic and Transportation

Arterial roads in the vicinity of the NTS, including Nevada Route 375 and U.S generally support free flow of traffic. Airports in the vicinity of the NTS includ International Airport in Las Vegas and numerous smaller private airports. Addition this category can be found in Volume 1, Appendix F.

4.6.12 Occupational and Public Health and Safety

Health impacts to the public are minimal due to administrative and design con facilities that keep releases of radioactive or other hazardous materials to the en ance with applicable regulatory standards. Occupational doses to persons working a also fall within regulatory limits. Appendix F of Volume 1 provides a complete des affected environment at the NTS in this category.

4.6.13 Utilities and Energy

Water is presently supplied to NTS facilities at a rate of 6139 gallons per m wells that tap underlying groundwater (aquifers). Between 40 and 45 megawatts of e presently available to the NTS from the Nevada Power Company. Proposed expansion w capacity to approximately 200 megawatts.

4.6.14 Materials and Waste Management

Numerous surface and subsurface contamination sites from previously conducted and ancillary operations have been identified on the NTS. Non-radiological contami NTS is minimal because there have been no industrial-type production operations on

A "Mixed Waste Management Unit" is located just north of the Radioactive Wast ment Station and will be part of routine disposal operations in the near future. I waste disposal operations ceased due to Environmental Protection Agency issuance of Disposal Restrictions of the Resource Conservation and Recovery Act for the Third T Active mixed waste disposal operations will commence upon completion of a National Policy Act documentation and issuance of a State of Nevada Part B permit.

Appendix F of Volume 1 provides additional documentation on materials and was ment practices at the Nevada Test Site.

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5. ENVIRONMENTAL CONSEQUENCES

5.1 NAVY AND PROTOTYPE SITES FOR NAVAL SPENT NUCLEAR

FUEL

5.1.1 PUGET SOUND NAVAL SHIPYARD: BREMERTON,

WASHINGTON

5.1.1.1 Overview of Environmental Impacts

The following sections discuss the major differences in potential environmenta associated with the choice of alternatives that include storage of naval spent nucl inspection of high priority naval spent nuclear fuel at Puget Sound Naval Shipyard. tal consequences associated with storage of naval spent nuclear fuel at Puget Sound are based on the estimates of naval spent nuclear fuel that would be stored at Puge Shipyard through the year 2035 and current knowledge of the design features associa fuel storage systems. The review of the environmental consequences associated with tives has shown that the impact on the environment associated with these activities small. There would be no impact to the Puget Sound Naval Shipyard regional environ with any alternatives that do not involve the Puget Sound Naval Shipyard.

5.1.1.2 Land Use

Construction of a storage area at Puget Sound Naval Shipyard for temporary nav nuclear fuel storage would require a modest change in the current land in use by th description of the alternate storage containers and water pools and approximate sto provided in Attachment D. Attachment C provides a comparison of spent nuclear fuel water pools versus dry container storage. The shipyard area is already an industri there would be no impact on land use. No additional land outside the naval complex required. The alternative of storing naval spent nuclear fuel in water pools would pool facility be constructed in the vicinity of the area that is designated for dry modification of the existing water pool to provide additional space. The water poo sufficient capacity to accommodate storage of all spent nuclear fuel expected to be shipyard.

In addition to the alternative involving storage at naval facilities of spent generated in the future, the existing water pool facility would be used for the alt inspections of high priority naval spent nuclear fuel would be conducted at Puget S Shipyard. A description of the Puget Sound Naval Shipyard water pool facility and operations under the alternative of inspecting high priority spent nuclear fuel at Shipyard are also provided in Attachment D.

Native American rights and interests would not be modified by construction or associated with any of the alternatives considered.

5.1.1.3 Socioeconomics

The calculated number of direct construction and operating jobs that would be 10-year period between 1995 and 2004 for each storage alternative at the shipyard i **Table 5.1.1-1.** Since there would be no naval spent nuclear fuel storage or inspect shipyard under the 1992/1993 Planning Basis and Centralization alternatives, no add be required at the shipyard under these alternatives.

Table 5.1.1-1. Number of construction and operating jobs created at Puget Sound Na for each alternative.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	200
Railcar(1)	1	1	8	1	1	1	1	1	1	1
Immobile Containers on Pads(2)	1	1	1	1	2	6	8	8	8	8
Shipping Containers on Pads (3)	1	1	1	1	2	6	2	2	2	2
Water Pool Storage(2)	16	16	73	113	138	99	106	40	40	40
Water Pool Inspection(3)	0	0	82	123	142	60	60	60	60	60

(1) Storage mode under the No Action and Decentralization alternatives.
(2) Storage mode under the Decentralization alternative.
(3) Inspection at Puget Sound would occur under the Decentralization B alternative.

The only discernible socioeconomic consequence of storing naval spent nuclear Sound Naval Shipyard is that a relatively small number of construction workers (ran to a maximum of several hundred) would be required for construction of the storage

force would consist of skilled craftsmen and unskilled laborers. This work force w during the storage facility expansion and water pool modification and would be avai the area.

The operation of the spent fuel storage area using dry storage containers wou additional workers to secure the fuel in the storage area and to support surveillan activities. For the alternative involving storing fuel in immobile dry storage con workers would be required to handle the spent nuclear fuel when it is placed into t containers. This work force would normally only be needed when fuel is being inser containers. For the alternative involving shipping containers, fewer workers would handle and secure the containers in the storage area. The operation of a water poo alternative involving storing naval spent nuclear fuel in a water pool would requir additional workers. The operation of a water pool facility for the alternative inv spent nuclear fuel would require approximately 60 workers. The number required for shipyard and prototype site storage alternatives would be small and is expected to either within the existing shipyard work force or from the local work force. Consi Department of Defense employs approximately 10,200 civilians at the shipyard, the a workers to support the alternatives would have no discernible impact on the local s conditions of the Puget Sound Naval Shipyard site and Bremerton area.

For the alternatives where dry storage containers would be manufactured, some jobs would be created in the locations where the containers are made. The process container manufacturer is subject to federal procurement requirements and would be Record of Decision. Consequently, the specific socioeconomic impacts from containe cannot be specified. The net effect of container fabrication would be to create ad bolster the local economy of the area(s) where containers are made. It is consider selection of the contractor would depend on the alternative storage site selected, with construction of casks provide no basis for selection of a storage site.

5.1.1.4 Cultural Resources

The action considered would not affect any site that is listed on the Nationa Historic Places (NPS 1991), any known archaeological areas, or any other cultural r Therefore, there would be no impacts to cultural resources associated with the alte or inspecting naval spent nuclear fuel at this location.

None of the alternatives considered would impact known archaeological or Nati sites. Procedures which comply with all applicable laws and regulations would be i protect previously undetected archaeological and cultural sites.

5.1.1.5 Aesthetic and Scenic Resources

The naval spent nuclear fuel storage area would be located within the Puget S Shipyard and would not affect the visual quality of the area since it is compatible character of the site. Physical changes to the site resulting from the expansion o storage area would not alter this industrial setting. There are no particulate air with storage of naval spent nuclear fuel and thus no visibility impacts are expecte scenic resources in the vicinity of the shipyard would be affected by the construct the storage facility.

5.1.1.6 Geology

The expansion and operation of the naval spent nuclear fuel storage facility not expected to affect the geologic character or resources of the region. If an al selected which required the storage area to be constructed, the ground would be exc necessary to prepare the surface. This would not affect the geologic characteristi layers nor the characteristics of the aquifer or vadose zone.

5.1.1.7 Air Resources

5.1.1.7.1 Radiological Consequences.

If the alternative where naval spent fuel would be stored in dry storage containers were to be selected, no airborne radioactivity releases w

occur as a result of normal storage operations. The fuel would be contained such t barriers exist to prevent fission products from becoming airborne. These barriers spent nuclear fuel in an air-tight containment until it is moved to a permanent sto would be no airborne radioactive material released from routine operations for this The only radiation exposure would be direct radiation from the array of filled stor filled storage containers would be fenced off and shielded if necessary such that t distinguishable effect on the current radiation readings at the site perimeter.

For the alternatives where naval spent nuclear fuel would be stored in a wate alternative where fuel would be inspected in the Puget Sound Naval Shipyard water p radioactivity would be emitted beyond current emissions. The airborne releases are less than the emissions from the Idaho National Engineering Laboratory (INEL) Expen Facility (ECF) because the water pool size and the number of inspections performed at the shipyard and the shipyard would not conduct the shielded cell operations tha ECF. To conservatively estimate the radiological consequences, airborne releases b releases from 1991 are used. The radiological source term used and the detailed ca tions performed to determine expected normal releases are provided in Attachment F.

The radiation exposures to human beings due to estimated radionuclide release atmosphere plus direct radiation from the stored spent nuclear fuel at the shipyard alternative involving water pool storage and the alternative involving dry storage described in Attachment F. Postulated releases were calculated for wet storage of in a water pool plus inspection of naval spent nuclear fuel.

A person on the shipyard boundary at the location where the largest exposures received was used as the hypothetical maximally exposed off-site individual (MOI) f releases of radioactive material from the stored spent fuel. The population data u population doses were taken from 1990 census data provided by the U.S. Census Burea Meteorology data were obtained as described in Attachment F. Estimated exposures t also calculated.

The hypothetical exposures calculated are based on an exposure to the estimat effluents and the direct radiation exposure for one year from the naval spent nucle shipyard. The calculations include the external effective exposure equivalent from deposition, deposition to surface water, and air immersion pathways and the 50-year effective exposure equivalent from internal exposure through the ingestion and inha All pathways were considered for persons potentially exposed, except that the inges omitted for the workers because they do not grow their food on-site. Solubilities produce the highest calculated exposures were chosen for internal exposure factors. human dietary consumption patterns were taken from "Age Dependent Values of Dietary Assessing Human Exposures to Environmental Pollutants" (Rupp 1980). The hypothetic calculated can be converted into a risk of fatal cancer or a risk of non-fatal heal non-fatal cancers, hereditary defects) based on recommendations of the Internationa Radiological Protection (ICRP 1991).

Attachment F summarizes the calculated exposures and fatal cancers to the wor exposed off-site individual (MOI), nearest public access (NPA), and the population radioactivity and direct radiation exposure in one year for each location and stora 3.7 provides a comparison of the annual number of fatal cancers calculated for the for each location and alternative.

The number of fatal cancers calculated is so small that there would be essent cancers resulting from the storage of naval spent nuclear fuel during the time it c expected to continue to be stored. Putting this into perspective, it could be stat the population might experience a fatal cancer due to incident-free storage of nava at the Puget Sound Naval Shipyard if operations continued for 15,400 years.

5.1.1.7.2 Non-radiological Consequences.

As noted in Attachment F, no increase in non-radioactive airborne emissions would be expected to result from spent nuclear fuel examination facility operations. Storage and examination facility operations would carcinogenic toxins, criteria pollutants, or other hazardous or toxic chemicals exc dustrial cleaning agents and paint thinner may be used for housekeeping and cleanli would be the same as those already used at the shipyard. Consequently, there would no impact on ambient air quality as a result of implementing any of the alternative

If an alternative were to be selected that required a storage facility to be renovated, fugitive dust emissions would be expected to result from excavation oper quantity of dust generated would be small, consistent with typical excavation activ within local requirements for dust control.

5.1.1.8 Water Resources

5.1.1.8.1 Radiological Consequences.

Spent nuclear fuel storage and inspection operations at
the shipyard would not result in discharges of radioactivity in liquid effluents du
regardless of the alternative selected for storage or inspection of spent nuclear f
due to fallout of nuclides released to the air onto the surface water is included i
discussed in Section 5.1.1.7. The air fallout impact is so small that there would
radiation levels in the water.

Puget Sound Naval Shipyard does not reside in the 100 or 500 year floodplain.
ly, the floodplain would not be impacted by spent naval nuclear fuel storage and ex
activities at the shipyard.

5.1.1.8.2 Non-radiological Consequences.

Other than chemicals used to maintain the storage
area, no hazardous wastes would be generated by the storage of naval spent nuclear
shipyard. Any hazardous liquid effluents that may be generated at the storage area
of at an Environmental Protection Agency approved disposal site.

The only source for liquid discharges from the naval spent nuclear fuel stora
the environment consists of storm water runoff which would be consistent with the t
associated with common light industrial facilities and related activities. It can
would be no impact to the human environment due to runoff water from the naval spen
storage area.

The increased water usage associated with any alternative would be negligible
existing shipyard demand.

5.1.1.9 Ecological Resources

Construction and operation of a spent fuel storage area would not impact any
for threatened or endangered species and no major changes to the industrial environ
Therefore, no major ecological impacts to the region would result from selection of
alternatives.

The conceptual location where naval spent nuclear fuel would be stored is ill
Attachment D. This location is within an existing industrial complex and is surrou
and paved areas. The industrial nature of the shipyard and the fact that the land
disturbed from its natural state by earlier activities mean that plant or animal sp
disturbance by human activities would not be expected to be present. Therefore, th
ecological impacts associated with construction or operation of a spent nuclear fue
location. The radiological controls that are in effect at the shipyard ensure that
the vicinity of the shipyard are maintained at or near natural background. Since t
would be applied to spent nuclear fuel activities, no ecological effects due to rad
would be expected to occur.

5.1.1.10 Noise

Puget Sound Naval Shipyard is an existing industrial-type environment charact
from truck and automobile traffic; ship loading cranes and related diesel-powered e
continuously operating transmission lines for steam, fuel, water, and related pumpi
those and other liquids. No ambient noise level increases are expected to occur as
the alternatives. Therefore, no noise impacts would be expected to occur.

5.1.1.11 Traffic and Transportation

Shipments of radioactive materials in the Naval Nuclear Propulsion Program ar
be made in accordance with applicable regulations of the U.
S. Department of Transportation, U.S.
Department of Energy, and the U.S. Nuclear Regulatory Commission. The purpose of t

regulations is to ensure that shipments of radioactive material are adequately cont environment and the health and safety of the general public. These regulations are radioactive material shipments and provide requirements for the container design, c identification as applicable for the specific quantity, type, and form of radioacti shipped. Naval shipping container design requirements invoke shielding and integri and meet all regulatory requirements. They provide for testing of container design qualification of workers who construct containers, and quality control inspections ensure that the containers will meet their design requirements. A detailed descrip containers used for naval spent nuclear fuel shipments is provided in Attachment A. the impacts associated with normal and accident conditions associated with transpor spent nuclear fuel is provided in Attachment A.

5.1.1.11.1 Regional Infrastructure.

The alternatives under consideration are described in Section 3. The No Action alternative or the first variation of the Decentralization altern naval spent nuclear fuel on-site. This alternative would reduce the number of rail shipyard or prototype site compared to the past practice of transporting all naval INEL. The second variation of the Decentralization alternative would ship about 10 naval spent nuclear fuel to Puget Sound. This would have some transportation impac much as transporting all naval spent nuclear fuel off-site. The third Decentraliza all naval spent nuclear fuel to INEL, examines it, and returns it to the original s site. This alternative involves more transportation than the previous practice of spent nuclear fuel to INEL, since the naval spent nuclear fuel is not returned from original site. The 1992/1993 Planning Basis alternative, the Regionalization at IN the Centralization at INEL alternative would involve the same transportation as has the past, namely transportation to INEL and retention there. The Centralization al Hanford Site would result in more transportation impact than any of the previous al the distances and population distribution between Hanford and the shipyards and pro Centralization alternative at the Savannah River Site would result in the most tran naval spent nuclear fuel of any of the alternatives.

5.1.1.11.2 Site Infrastructure.

The alternatives associated with naval spent nuclear fuel storage and inspection at Puget Sound Naval Shipyard would create some small amount of addi highway traffic because any additional employees needed to operate the water pool f inspection or storage alternatives would need to travel to and from work. This imp be very small considering the total number of employees at the Puget Sound Naval Sh fact that the additional workers might be provided from the existing work force. S and inspection activities would increase the internal traffic in the shipyard in th the total impact on shipyard traffic would not be detectable.

5.1.1.12 Occupational and Public Health and Safety

Detailed analyses of incident-free naval spent nuclear fuel transportati and handling impacts on worker and public health are described in Attachment A (tra Attachment F (storage and inspection).
The transportation analysis results, and the storage and handling analysis are summarized separately in the following subsections.

5.1.1.12.1 Incident-free Transportation Occupational and Public Health and Safety.

The radiological and non-radiological health effects associated with the incident-free naval spent nuclear fuel and test specimens have been assessed for the general popu tion workers, and hypothetical maximum exposed individual for each alternative. As Section 3.7, it is unlikely that there will be any fatal cancers as a result of nav and test specimen shipments since the estimates are much less than one fatal cancer alternative. The details of the transportation analysis are provided in Attachment

5.1.1.12.2 Incident-free Occupational and Public Health and Safety During Naval Spent

Nuclear Fuel Storage and Handling.
The public health and safety impacts of radioactivity releases
and direct radiation from storage of naval spent nuclear fuel were analyzed as disc 5.1.1.7 and Attachment F. Attachment F summarizes the results of the analysis of r releases and direct radiation from stored naval spent nuclear fuel. This analysis exposure to the workers, maximally exposed off-site individual, and nearest public naval spent nuclear fuel would result in far less than one fatality per year. For be stated that one member of these population groups might experience a fatal cance of naval spent nuclear fuel at Puget Sound Naval Shipyard if operations continued f

Projections of the number of occupational accidents that might occur during c operation of naval spent nuclear fuel storage and examination facilities have been alternative. These projections are presented in Attachment F. Based on the result projections, it is concluded that the number of occupational fatalities and injurie construction activities and storage and examination operations would be very small tive.

No public or occupational radiological health and safety impacts would be exp from naval spent nuclear fuel storage area construction activities since the constr involve radioactive work.

Attachment F also discusses toxic chemical issues for naval spent nuclear fue storage. Attachment F concludes that there would be no additional types or volumes required at the shipyards or prototype site for naval spent nuclear fuel storage. incident-free non-radiological impact resulting from storage of naval spent nuclear shipyards or prototype site.

5.1.1.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling.
As discussed in the
preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the management of naval spent nuclear fuel at the Puget Shipyard would be small under any of the alternatives considered. For example, it single fatal cancer would occur as a result of naval spent nuclear fuel management alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the Puget Sou do not display any strongly dominant direction. Similarly, the conclusion is not a related to subsistence consumption of fish or game since environmental monitoring i this relatively small and restricted site has shown no detectable difference in the tivity present in the environment from levels in similar parts of the region.

To place the impacts on environmental justice in perspective, the risk associ naval spent nuclear fuel management operations under any of the alternatives consid less than one fatality per year for the entire population. For comparison, in 1990 approximately 510,000 cancer deaths in the United States population and there were cancer deaths among people of color in the U. S. Even if all of the impacts associ the alternatives considered for naval spent nuclear fuel management were assumed to among people of color, that group would be unlikely to experience a single addition in any year. Therefore, the cancer risk for that population from naval spent nucle would not constitute a disproportionately high and adverse impact on human health o ment. The same conclusion can be drawn for low-income groups.

5.1.1.13 Utilities and Energy

If an alternative associated with storage of spent nuclear fuel at Puget Soun

were to be selected, construction and operation of the storage area would not be ex large expenditure of utilities and energy resources.
Construction activities would require quantities of water and electricity typical of any small to medium size construction project. Op container spent fuel storage facility would likely require only minimal electricity and to support industrial equipment necessary to move spent fuel.

Alternatives associated with water pool storage and inspection would require tion, water, and electrical systems suitable for a work environment and to properly the airborne discharges to the atmosphere. The utility and energy demands and impa than that identified in Section 5.2.13 for operation of ECF (10,000 MWh per year) s pool facility at Puget is smaller and the scope of operations would be less.

The amount of utilities and energy expected to be consumed would be a small i increase in the total amount of utilities and energy used at the shipyard and would discernible environmental consequence.

5.1.1.14 Facility and Transportation Accidents

5.1.1.14.1 Facility Accidents. There has never been an accident in the history of the Naval

Nuclear Propulsion Program that resulted in a significant release of radioactivity or that resulted in radiation exposure to workers in excess of abnormal occurrence as defined by the U.S. Nuclear Regulatory Commission. A description of potential a considered and a summary of the accident analyses that were conducted with regard t and storage of naval spent nuclear fuel are contained in Attachment F.

5.1.1.14.1.1 Radiological Accidents. Section 3.7.3 provides a summary of the impacts

due to the most severe accidents considered for each site. The facility accident w potential impact at Puget Sound Naval Shipyard involves accidental drainage of the accident of this magnitude would result in less than one fatal cancer to the genera 50 years, as described in Attachment F. The likelihood of such an accident occurri which is very small. For perspective, an accident such as this would not be expect the facility operated for about 100,000 years.

5.1.1.14.1.2 Non-radiological Accidents. As discussed in detail in Attachment F, the

limiting hypothetical non-radiological accident for naval spent nuclear fuel storag shipyard or prototype location would be a diesel fuel spill and fire. A catastroph fuel storage tank that might be used for an emergency diesel generator to provide b power was postulated to occur, resulting in the spilling of the entire quantity of subsequent fire. The fire would generate the following toxic chemicals:

- Carbon monoxide
- Oxides of nitrogen (90% nitric oxide and 10% nitrogen dioxide)
- Lead
- Sulfur dioxide.

Measures would be taken to reduce the health impacts of potential releases of These measures would involve controls to protect both workers and the general publi shipyard and prototype sites have emergency planning, emergency preparedness, and e response programs in place to protect both workers and the public, and involve esta such as warning communications, fire departments, and emergency command centers.

The airborne concentrations of the combustion products listed above, resultin were calculated at the locations of the on-site individuals, an individual at the s general population within a 50-mile radius of the facility. Detailed results are p Attachment F. If the accidental fire that has been hypothesized were to actually o measures that would be in place would ensure no adverse health impacts to the gener minimal health impacts to the workers.

5.1.1.14.2 Transportation Accidents.

Shipments of radioactive materials associated with naval spent nuclear fuel have never resulted in any measurable release of radioactivity t

(NNPP 1994a). There have never been any significant accidents involving release of material during shipment since the Naval Nuclear Propulsion Program began. The eff transportation accidents during the various stages of transportation of naval spent presented in Attachment A.

The health effects associated with accidents during shipments of naval spent test specimens have been assessed for the general population and the hypothetical m individual for each alternative. As summarized in Section 3.7, it is unlikely that fatal cancers as a result of naval spent nuclear fuel and test specimen shipments s much less than one fatal cancer for each alternative. Details of the transportatio provided in Attachment A.

5.1.1.14.3 Other Impacts of Accidents.

In addition to the possible human health effects associated with facility or transportation accidents described in the preceding sec such as the impacts on socioeconomics and land use in the area and the costs of cle estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that an area ranging from about 8 acr approximately a quarter mile (for an inadvertent criticality accident) to about 110 approximately 0.9 mile (for a large airplane crashing into a dry storage container) contaminated to the point where exposure could exceed 100 millirem per year. Beyon distances, the exposure would be less than 100 millirem per year, the Nuclear Regul Commission's standard for protection of the general population from radiation. Per this area might be evacuated or otherwise experience restrictions in their daily ac period, and those who work at locations within this area might be prevented from go until measures had been taken to reduce the potential for exposure. It should be n affected area within approximately a half mile from the spent nuclear fuel facility boundaries of the federally owned site.

An accident might result in short-term restrictions on access to a relatively there would be no enduring impacts on cultural or similar resources or concerns suc American rights or interests, partially because the area involved would be small an remedial actions would be conducted in a careful, controlled manner in full complia applicable laws and regulations. The area impacted would only vary slightly among Overall, the risks are small so these considerations do not assist in distinguishin

Facility or transportation accidents associated with any of the alternatives appreciable effect on the ecology of the area, considering the potential for human the amount of land which might be affected, as described in earlier parts of this s little consensus among scientists on methods for estimating the effects of radiatio resources such as plant or animal life, but since human health effects for all the small and most plants and animals are not thought to be more sensitive to radiation beings, the small impacts on human health provide an indication that the impacts on species in the area would also be small for all alternatives considered. Similarly which might be contaminated to measurable levels by chemicals or radioactive materi hypothetical accidents would be relatively small, any effects on the ecology would areas. There are no endangered or threatened species unique to the area surroundin owned site, so an accident would not be expected to result in destruction of any sp alternatives considered. The effects of accidents related to any of the alternativ cleanup which might be performed would be localized in a small area which extends o distance beyond the boundaries of the federally owned site and thus would not be ex appreciably affect the potential for survival of any species in the area. Based on evaluation of impacts of accidents on ecological resources does not help to disting alternatives.

5.1.1.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear

Fuel Storage and Handling.

As discussed in the preceding paragraphs, the impacts on human health or the environment resulting from facility or transportation accidents assoc management of naval spent nuclear fuel at the Puget Sound Naval Shipyard would be s of the alternatives considered. For example, it is unlikely that a single addition occur as a result of naval spent nuclear fuel management activities under any alter potential impacts due to an accident for any of the alternatives considered would p risk and do not constitute a credible adverse impact on the surrounding population,

from accidents associated with the management of naval spent nuclear fuel would be particular segment of the population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is because the consequences of any accident would depend on the r conditions in effect at the time an accident occurred, and the wind directions at t Naval Shipyard are highly variable with no strongly dominant direction.

To place the impacts on environmental justice in perspective, the risk associ accidents caused by naval spent nuclear fuel management under any of the alternativ would amount to less than one additional fatality per year for the entire populatio in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.1.1.15 Waste Management

The alternative in which naval spent nuclear fuel is stored at Puget Sound Na would produce limited amounts of solid municipal waste, solid low-level radioactive hazardous wastes.

In addition, no transuranic or high-level radioactive wastes would be generated by spent nuclear fuel activities at the site under any alternative. The quantity of i generated would be small and most likely consist of industrial cleaning agents of t encountered at the site. Small quantities of sanitary wastes would result from the force but this volume would be small. The wastes produced from the storage of nava fuel would be controlled and minimized in accordance with the existing waste manage at the shipyard. The amount of additional wastes generated would be minimal compar existing baseline and would not cause any adverse impacts to public health and safe environment in the vicinity of the shipyard.

5.1.1.16 Cumulative Impacts

5.1.1.16.1 Radiological Cumulative Impacts. Spent nuclear fuel storage and examination at

Puget Sound would not result in discharges of radioactivity in liquid effluents dur operations regardless of the alternative selected. Therefore, there would be no in of radioactivity to surface or ground water as a result of normal operations for an alternatives involving the storage of spent nuclear fuel in dry storage and shippin airborne radioactivity emissions are expected, so there would be no cumulative air associated with these storage methods. Consequently, the only radiological cumulat would result from dry storage alternatives would be due to direct radiation exposur containers of spent nuclear fuel.

For alternatives involving the storage and examination at Puget Sound of nava fuel in water pools, there would be no discernible direct radiation exposure to the elements due to the shielding provided by the water in the pool. Therefore, any cu which would result from water pool storage (and examination at Puget Sound) would b to airborne emissions, and the addition of these emissions would cause an indiscern emissions in the area (see Section 5.1.1.7). Current operations at the site are in Title 40, Code of Federal Regulations, Part 61, "National Emission Standards for Ha Pollutants." Cumulative air emissions would not threaten to exceed any applicable requirement or regulation, either federal, state, or local in radiological and non-categories.

A summary of the cumulative radiological impacts is provided in the following An overview of the historical radiological impacts from naval nuclear operati Sound Naval Shipyard and from transportation of naval spent nuclear fuel is provide 4.1.1.12 and detailed analyses are provided in Attachments F and A. Prior to this nuclear fuel inspections and storage operations have been conducted only at INEL. cumulative impacts have resulted from previous naval spent nuclear fuel inspection operations at any alternate site except for INEL.

The radiological impacts associated with the alternatives where naval spent n

be inspected or stored at Puget Sound Naval Shipyard are very small and are describ 5.1.1.12, with the detailed results of analyses provided in Attachment F. In order cumulative impacts for the period between 1995 and 2035, the annual radiological im with each location and alternative were summed over 40 years. The results of this tabulated in Tables 3-5 and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the population in the vicinity of the Puget Sound Naval all of the alternatives considered would be approximately 5.30 person-rem. This me would be much less than one fatal cancer from these operations over the entire 40-y evaluated. The total exposure to a theoretical maximally exposed off-site individu shipyard boundary for the entire 40-year period would be 7.0 x 10-3 rem due to the resulting in the largest exposure. This maximally exposed off-site individual woul risk of contracting a fatal cancer during his or her lifetime due to storage of spe When existing site radiological impacts due to naval nuclear operations are added t the most limiting spent nuclear fuel alternative, the exposure to the population wo person-rem and to the maximally exposed off-site individual would be 7.6 x 10-3 rem results in much less than one fatal cancer in the population and the risk of the ma off-site individual contracting a fatal cancer during his or her lifetime is 3.8 x

The total exposure related to naval spent nuclear fuel activities to a worker working continually 100 meters from the spent nuclear fuel under the alternative re largest exposure is 0.22 rem accumulated over 40 years. That corresponds to a fata 8.8 x 10-5 during the worker's lifetime. The exposure to the same worker when exis radiological impacts due to naval nuclear operations are added to the spent nuclear 0.222 rem over 40 years which corresponds to a fatal cancer risk of 8.9 x 10-5 duri lifetime. The impacts associated with transportation of naval spent nuclear fuel f alternatives considered would be similarly low.

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

Sections 4.1.1.14 and 5.1.1.15 describe the management of low-level radioacti mixed waste at the site. The volume of low-level radioactive wastes which would be the alternatives has not been calculated. However, considering the nature of radio would be associated with spent nuclear fuel storage (and examination) activities, t level radioactive waste produced during spent nuclear fuel activities would be much percent of the current site generation rate (651 m3 per year). This additional rad not introduce any changes to the site's waste management practices. The small amou material involved would not impose any discernible additional stress on the capacit waste burial ground. Therefore, any cumulative impacts associated with the generat of additional low-level wastes would be very small.

Since no mixed, transuranic, or high-level radioactive wastes would be genera nuclear fuel activities at this site under any alternative, there would be no cumul associated with these materials.

5.1.1.16.2 Non-radiological Cumulative Impacts.

An overview of the historical non-radiologi-
cal impacts from naval nuclear operations at the Puget Sound Naval Shipyard and fro of naval spent nuclear fuel is provided in Section 4.1.1.12 and detailed analyses a Attachments F and A. Prior to this time, naval spent nuclear fuel inspections and have been conducted only at INEL. Therefore, no non-radiological cumulative impact from previous naval spent nuclear fuel inspection and storage operations at any alt for INEL.

The non-radiological impacts associated with the alternative where naval spen would be inspected or stored at Puget Sound Naval Shipyard are described in Section the detailed results of analyses provided in Attachment F. As summarized in Sectio would be no additional chemicals required at the shipyard for naval spent nuclear f therefore no non-radiological impacts from normal operations. Consequently, no cum to air quality or water resources would result since the incremental addition of ch

shipyard that might result from naval spent fuel activities would be very small. T environmental problems associated with these materials.

The non-radiological cumulative transportation impacts for the population fro nuclear fuel transportation activities since the beginning of the Naval Nuclear Pro also have been calculated. In addition, the cumulative impacts from transportation nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A. The non-impacts associated with the transportation and storage of naval spent nuclear fuel alternatives considered would be low.

No cumulative land use impacts would be expected to occur as a result of spen storage and examination at Puget Sound. The land that would be dedicated for this existing federal property and situated in an industrial setting which has already b natural state (approximately 327 acres are developed land). The conversion of this of spent nuclear fuel would not result in the need to disturb undeveloped land or f be added to the federally owned property in the foreseeable future.

From a socioeconomic perspective, the introduction of naval spent nuclear fue the site would create a small number of additional jobs and could have a very small socioeconomic impact. The site currently employs approximately 10,200 civilian per shipyard employment has been associated with spent nuclear fuel activities in the p nuclear fuel activities have not been conducted at the site. An average of approxi additional jobs might be added as a result of possible spent nuclear fuel activitie peak number of additional jobs created at the site in any given year would be appro which is associated with construction and operation of a water pool facility for st nuclear fuel and modification of the existing water pool for limited examination of that the regional labor force consists of approximately 527,000 workers, the additi added jobs under any alternative would have little or no discernible socioeconomic jobs would be filled either from within the existing site work force or from the av labor force without discernible effect. There are no foreseeable future projects p no known projects planned in the region that would cause the small number of worker naval spent nuclear fuel activities to become an important impact.

The cumulative impacts associated with non-radiological waste management are expected to be small. As stated previously, any industrial wastes generated from n fuel storage and examination at Puget Sound would be small and limited to industria of the type normally encountered at the site. The volume of municipal solid wastes wastes which would be generated is expected to be proportional to the number of add added, and this small incremental increase would not be discernible. The amount of radiological wastes generated would not introduce any changes to the site's waste m practices and would not impose any additional stress on the capacity of on-site or disposal or treatment facilities. Therefore, any cumulative impacts associated wit disposal of additional wastes would be very small. There are no current environmen associated with these types of waste.

5.1.1.17 Unavoidable Adverse Effects

There are no discernible unavoidable adverse effects associated with the impl any of the alternatives and none which would help to choose among the alternatives. The alternative
in which naval spent nuclear fuel is inspected or stored at the Puget Sound Naval S cause the public to be exposed to small amounts of radiation, described in Section would result in less than one health effect in the entire population surrounding th Similarly, continued operation of the storage facility would produce limited amount municipal waste and solid low-level radioactive waste. These amounts of waste woul any major impacts in the vicinity of the Puget Sound Naval Shipyard. There will be the ecological, cultural, geological, and aesthetic resources due to the implementa alternatives. There will also be no impact on ambient noise levels.

5.1.1.18 Irreversible and Irretrievable Commitments of Resources

The only irreversible and irretrievable commitment of resources that results tive in which naval spent nuclear fuel would be stored at the shipyard would be the would be spent by the federal government to construct the necessary facilities. The total cost of
storing spent naval nuclear fuel at the shipyards and prototype ranges from approxi

to $5.7 billion. This cost represents the total cumulative cost over the 40-year p shipyards and prototype. This cost includes construction costs of the new storage depending on the alternative selected, the operation of a limited examination facil Naval Shipyard combined with the costs associated with shutting down ECF, or the op of the INEL-ECF. The major expense in the highest cost alternatives is the procure containers. Refer to Section 3.7 for a comparison of the total cumulative costs am

5.1.2 NORFOLK NAVAL SHIPYARD: PORTSMOUTH, VIRGINIA

5.1.2.1 Overview of Environmental Impacts

The following sections discuss the major differences in potential environment associated with the choice of alternatives that include storage of naval spent nucl Naval Shipyard. The environmental consequences associated with storage of naval sp at Norfolk Naval Shipyard are based on the estimates of naval spent nuclear fuel th at Norfolk Naval Shipyard through the year 2035 and current knowledge of the design associated with spent fuel storage containers. The review of the environmental con associated with these alternatives has shown that the impact on the environment at Shipyard associated with all activities is very small. There would be no impact to Shipyard regional environment associated with any alternatives that do not involve Shipyard.

5.1.2.2 Land Use

Norfolk Naval Shipyard has identified a centrally located area within the cont area as a potential site for spent nuclear fuel storage. The site is located appro from the southern branch of the Elizabeth River. Public access to the 900 feet of site evaluated is restricted. There are no known existing adverse environmental co The area is already an industrial site; therefore, there would be no impact on land identified should be sufficient depending on the type of storage mode ultimately ch of storage containers and water pools and their approximate storage locations is pr Attachment D. Attachment C provides a comparison of spent nuclear fuel storage in versus dry container storage.

The alternative of storing naval spent nuclear fuel in water pools would requ pool facility be constructed in the vicinity of the area that is designated for dry The water pool would have sufficient capacity to accommodate storage of all spent n expected to be stored at the shipyard.

No additional land use outside the shipyard would be required.

Native American rights and interests would not be modified by construction or associated with any of the alternatives considered.

5.1.2.3 Socioeconomics

The calculated number of direct construction and operating jobs that would be 10-year period between 1995 and 2004 for each storage alternative at the shipyard i **Table 5.1.2-1.** Since there would be no naval spent nuclear fuel storage or inspect shipyard under the 1992/1993 Planning Basis and Centralization alternatives, no add be required at the shipyard under these alternatives.

Table 5.1.2-1. Number of construction and operating jobs created at Norfolk Naval for each alternative.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	200
Railcar(1)	1	1	8	1	1	1	1	1	1	1
Immobile Containers on Pads(2)	1	1	1	1	2	6	8	8	8	8
Shipping Containers on Pads (2)	1	1	1	1	2	6	2	2	2	2
Water Pools(2)	16	16	70	107	132	94	103	40	40	40

(1) Storage mode under the No Action and Decentralization alternatives.

(2) Storage mode under the Decentralization alternative.

The only discernible socioeconomic consequence of storing naval spent nuclear Norfolk Naval Shipyard is that a relatively small number of construction workers (r to a maximum of several hundred would be required for construction of the storage a force would consist of skilled craftsmen and unskilled laborers. This work force w during the storage facility construction and would be available from within the are

The operation of the spent fuel storage area using dry storage containers wou additional workers to support surveillance and monitoring activities. For the alte storing fuel in immobile dry storage containers, about 20 workers would be required spent nuclear fuel when it is placed into the storage containers. This work force be needed when fuel is being inserted into the containers. For the alternative inv containers, fewer workers would be needed to handle and secure the containers in th The operation of a water pool facility for the alternative involving storing naval a water pool would require approximately 40 additional workers. The number require shipyard and prototype site storage alternatives would be small and is expected to either within the existing shipyard work force or from the local work force. Consi Department of Defense employs approximately 8,500 civilians at the shipyard, the ad workers to support the alternatives would have no discernible impact on the local s conditions of the Norfolk Naval Shipyard site.

For the alternatives where dry storage containers would be manufactured, some jobs would be created in the locations where the containers are made. The process container manufacturer is subject to federal procurement requirements and would be Record of Decision. Consequently, the specific socioeconomic impacts from containe cannot be specified. The net effect of container fabrication would be to create ad bolster the local economy of the area(s) where containers are made. It is consider selection of the contractor would depend on the alternative storage site selected, with construction of casks provide no basis for selection of a storage site.

5.1.2.4 Cultural Resources

The action considered would not affect any site that is listed on the Nationa Historic Places (NPS 1991), any known archaeological areas, or any other cultural r Therefore, there would be no impacts to cultural resources associated with the alte naval spent nuclear fuel at this location.

None of the alternatives considered would impact known archaeological or Nati sites. Procedures which comply with all applicable laws and regulations would be i protect previously undetected archaeological and cultural sites.

5.1.2.5 Aesthetic and Scenic Resources

The naval spent nuclear fuel storage area would be located within the Norfolk which is an existing industrial setting and would not affect the visual quality of compatible with the landscape character of the site. Physical changes to the site construction of a spent nuclear fuel storage area would not alter this setting. Th air emissions associated with storage of naval spent nuclear fuel and thus no visib expected. No aesthetic or scenic resources in the vicinity of the shipyard would b construction and operation of the storage facility.

5.1.2.6 Geology

The construction and operation of the naval spent nuclear fuel storage facili Naval Shipyard is not expected to affect the geologic character or resources of the alternative were selected which required a storage facility to be constructed, the excavated as necessary to prepare the surface. This would not affect the geologica tics of the underlying layers nor the characteristics of the aquifer or vadose zone storing fuel in a water pool facility, the ground surface would need to be excavate approximately 40 feet. This excavation would not affect the geological characteris Since the Columbia aquifer is at a depth of 3 to 5 feet throughout the shipyard, th considerations make a water pool facility more difficult and expensive than an abov facility. However, if water pools were selected, all precautions necessary to prot be taken.

5.1.2.7 Air Resources

5.1.2.7.1 Radiological Consequences.

If the alternative where naval spent fuel would be stored
in dry storage containers were to be selected, no airborne radioactivity releases w occur as a result of normal storage operations. The fuel would be contained such t barriers exist to prevent fission products from becoming airborne. These barriers spent nuclear fuel in an air-tight containment until it is moved to a permanent sto would be no airborne radioactive material released from routine operations for this The only radiation exposure would be direct radiation from the array of filled stor filled storage containers would be fenced off and shielded if necessary such that t distinguishable effect on the current radiation readings at the site perimeter.

For the alternative where naval spent nuclear fuel would be stored in a water radioactivity would be emitted beyond current emissions. The airborne releases for are expected to be less than the emissions from the Idaho National Engineering Labo Expended Core Facility (ECF) because the water pool size and the number of inspecti would be smaller at the shipyard and the shipyard would not conduct the shielded ce are performed at ECF. To conservatively estimate the radiological consequences, ai based on ECF releases from 1991 are used. The radiological source term used and th calculations performed to determine expected normal releases are provided in Attach

The radiation exposures to human beings due to estimated radionuclide release atmosphere plus direct radiation from the stored spent nuclear fuel at the shipyard alternative involving water pool storage and the alternative involving dry storage described in Attachment F. Postulated releases were calculated for wet storage of in a water pool plus inspection of naval spent nuclear fuel.

A person on the shipyard boundary at the location where the largest exposures received was used as the hypothetical maximally exposed off-site individual (MOI) f releases of radioactive material from the stored spent fuel. The population data u population exposures were taken from 1990 census data provided by the U.S. Census B Meteorology data were obtained as described in Attachment F. Estimated exposures t also calculated.

The hypothetical exposures calculated are based on an exposure to the estimat effluents and the direct radiation exposure for one year from the naval spent nucle shipyard. The calculations include the external effective exposure equivalent from deposition, deposition to surface water, and air immersion pathways and the 50-year effective exposure equivalent from internal exposure through the ingestion and inha All pathways were considered for persons potentially exposed, except that the inges omitted for the workers because they do not grow their food on-site. Solubilities produce the highest calculated exposures were chosen for internal exposure factors. human dietary consumption patterns were taken from "Age Dependent Values of Dietary Assessing Human Exposures to Environmental Pollutants" (Rupp 1980). The hypothetic calculated can be converted into a risk of fatal cancer or a risk of non-fatal heal non-fatal cancers, hereditary defects) based on recommendations of the Internationa Radiological Protection (ICRP 1991).

Attachment F summarizes the calculated exposures and fatal cancers to the wor exposed off-site individual (MOI), nearest public access (NPA), and the population releases of radioactivity and direct radiation exposure in one year for each locati Section 3.7 provides a comparison of the annual number of fatal cancers calculated population for each location and alternative.

The number of fatal cancers calculated is so small that there would be essent cancers resulting from the storage of naval spent nuclear fuel during the time it c expected to continue to be stored. Putting this into perspective, it could be stat the population might experience a fatal cancer due to incident-free storage of nava at the Norfolk Naval Shipyard if operations continued for 7,100 years.

If a water pool facility would be constructed at the Norfolk Naval Shipyard a storage of spent nuclear fuel, the airborne emissions from the facility would be le identified for the Puget Sound Naval Shipyard because no spent nuclear fuel inspect beyond visual examinations would be conducted in the water pools.

5.1.2.7.2 Non-radiological Consequences.

As noted in Attachment F, no increase in non-
radioactive airborne emissions would be expected to result from spent nuclear fuel operations. Storage facility operations would not involve use of carcinogenic toxi pollutants, or other hazardous or toxic chemicals except for small quantities of in agents and paint thinner that may be used for housekeeping and cleanliness control be the same as those already used at the shipyard. Consequently, there would be no ambient air quality as a result of implementing any of the alternatives at the ship

If an alternative were to be selected that required a storage facility to be renovated, fugitive dust emissions would be expected to result from excavation oper quantity of dust generated would be small, consistent with typical excavation activ within local requirements for dust control.

5.1.2.8 Water Resources

5.1.2.8.1 Radiological Consequences.

Spent nuclear fuel storage operations at the shipyard
would not result in discharges of radioactivity in liquid effluents during routine of the particular alternative chosen for storage of spent nuclear fuel. The health of nuclides released to the air onto the surface water is included in the analysis Section 5.1.2.7. The air fallout impact is so small that there would be no disting levels in the water.

Most of the Norfolk Naval Shipyard, including the location considered for the of naval spent nuclear fuel, is in the 100-year floodplain. However, the location spent nuclear fuel is not in a high-hazard area (as defined by Title 10, Part 1022 Federal Regulations for floodplains) which is an area where frequent flooding occur majority of the shipyard is already developed and covered with impervious material, operation of a naval spent nuclear fuel storage facility at the shipyard would prod impacts on the floodplain.

Flooding in the area where shipping and immobile dry storage containers are s result in any adverse environmental consequences. These containers are completely no radioactivity would be released from the interior even if they were completely s addition, the massive nature of these containers prevents them from floating or mov flood.

Since the shipyard resides in a floodplain, the design of the facility and eq minimize the potential for flooding and damage to the facility. However, in the ev facility would be flooded, the exchange of pool water with the flood waters could o discussed in Attachment F, Section F.1.4.2.1.6.2, the radioactivity concentration i pool is below the Nuclear Regulatory Commission limits specified in Title 10, Part Federal Regulations for liquid effluent except for Co-60 which is slightly higher (storage or examination of naval spent nuclear fuel would be maintained to comparabl tions). Any release of radioactivity would have to result from the exchange of floo water. This exchange would reduce the level of radioactivity even further. Conseq environmental impacts would result from flooding of water pools at naval spent nucl sites.

5.1.2.8.2 Non-radiological Consequences.

Other than chemicals used to maintain the storage
area, no hazardous wastes would be generated by the storage of naval spent nuclear Naval Shipyard. Any hazardous liquid effluents that may be generated at the storag disposed of at an Environmental Protection Agency approved disposal site.

The only source for liquid discharges from the naval spent nuclear fuel stora the environment consists of storm water runoff which would be consistent with the t associated with common light industrial facilities and related activities. It can would be no impact to the human environment due to runoff water from the naval spen storage area.

The increased water usage under any of the alternatives would be negligible c existing shipyard demand.

5.1.2.9 Ecological Resources

There are no threatened or endangered species known to exist within the shipy major changes to the industrial environment are planned. Therefore, no major ecolo the region would result from selection of any of the alternatives.

The conceptual location where naval spent nuclear fuel would be stored is il Attachment D. This location is within an existing industrial complex and is surrou and paved areas. The industrial nature of the shipyard and the fact that the land disturbed from its natural state by earlier activities mean that plant or animal sp disturbance by human activities would not be expected to be present. Therefore, th ecological impacts associated with construction or operation of a spent nuclear fue location. The radiological controls that are in effect at the shipyard ensure that the vicinity of the shipyard are maintained at or near natural background. Since t would be applied to spent nuclear fuel activities, no ecological effects due to rad would be expected to occur.

5.1.2.10 Noise

Norfolk Naval Shipyard is an existing industrial-type environment characteriz truck and automobile traffic; ship loading cranes and related diesel-powered equipm continuously operating transmission lines for steam, fuel, water, and related pumpi those and other liquids. No ambient noise level increases are expected to occur as the alternatives. Therefore, no noise impacts would be expected to occur.

5.1.2.11 Traffic and Transportation

Shipments of radioactive materials in the Naval Nuclear Propulsion Program ar be made in accordance with applicable regulations of the U.
S. Department of Transportation, U.S.
Department of Energy, and the U.S. Nuclear Regulatory Commission. The purpose of t regulations is to ensure that shipments of radioactive material are adequately cont environment and the health and safety of the general public. These regulations are radioactive material shipments and provide requirements for the container design, c identification as applicable for the specific quantity, type, and form of radioacti shipped. Naval shipping container design requirements invoke shielding and integri and meet all regulatory requirements. They provide for testing of container design qualification of workers who construct containers, and quality control inspections ensure that the containers will meet their design requirements. A detailed descrip containers used for naval spent nuclear fuel shipments is provided in Attachment A. the impacts associated with normal and accident conditions associated with transpor spent nuclear fuel is provided in Attachment A.

5.1.2.11.1 Regional Infrastructure.

The alternatives under consideration are described in Section
3. The No Action alternative or the first variation of the Decentralization altern naval spent nuclear fuel on-site. This alternative would reduce the number of rail shipyard or prototype site compared to the past practice of transporting all naval INEL. The second variation of the Decentralization alternative would ship about 10 naval spent nuclear fuel to Puget Sound. This would have some transportation impac much as transporting all naval spent nuclear fuel off-site. The third Decentraliza all naval spent nuclear fuel to INEL, examines it, and returns it to the original s site. This alternative involves more transportation than the previous practice of spent nuclear fuel to INEL, since the naval spent nuclear fuel is not returned from original site. The 1992/1993 Planning Basis alternative, the Regionalization at IN the Centralization at INEL alternative would involve the same transportation as has the past, namely transportation to INEL and retention there. The Centralization al Hanford Site would result in more transportation impact than any of the previous al the distances and population distribution between Hanford and the shipyards and pro Centralization alternative at the Savannah River Site would result in the most tran naval spent nuclear fuel of any of the alternatives.

5.1.2.11.2 Site Infrastructure.

If the alternative of storing naval spent nuclear fuel at Norfolk
Naval Shipyard were to be selected, operation of a naval spent nuclear fuel storage
noticeably affect site highway traffic because any increase in the work force would
small incremental increase in overall traffic to and from the shipyard. Internal t
Naval Shipyard would increase in the short-term; however, the total impact on shipy
surrounding area traffic would be very small.

5.1.2.12 Occupational and Public Health and Safety

Detailed analyses of incident-free naval spent nuclear fuel transportation an
handling impacts on worker and public health are described in Attachment A (transpo
Attachment F (storage and inspection).
The transportation analysis results, and the storage and
handling analysis are summarized separately in the following subsections.

5.1.2.12.1 Incident-free Transportation Occupational and Public Health and Safety.

The
radiological and non-radiological health effects associated with the incident-free
naval spent nuclear fuel and test specimens have been assessed for the general popu
tion workers, and hypothetical maximum exposed individual for each alternative. As
Section 3.7, it is unlikely that there will be any fatal cancers as a result of nav
and test specimen shipments since the estimates are much less than one fatal cancer
alternative. The details of the transportation analysis are provided in Attachment

5.1.2.12.2 Incident-free Occupational and Public Health and Safety During Naval Spent

Nuclear Fuel Storage and Handling.
The public health and safety impacts of radioactivity releases
and direct radiation from storage of naval spent nuclear fuel were analyzed as disc
tion 5.1.2.7 and Attachment F. Attachment F summarizes the results of the analysis
releases and direct radiation from stored naval spent nuclear fuel. This analysis
exposure to the worker, maximally exposed off-site individual, and nearest public a
naval spent nuclear fuel would result in far less than one fatality per year. For
be stated that one member of these population groups might experience a fatal cance
of naval spent nuclear fuel at Norfolk Naval Shipyard if operations continued for 7

Projections of the number of occupational accidents that might occur during c
operation of naval spent nuclear fuel storage and examination facilities have been
alternative. These projections are presented in Attachment F. Based on the result
projections, it is concluded that the number of occupational fatalities and injurie
construction activities and storage and examination operations would be very small
tive.

No public or occupational radiological health and safety impacts would be exp
from naval spent nuclear fuel storage area construction activities since the constr
involve radioactive work.

Attachment F also discusses toxic chemical issues for naval spent nuclear fue
storage. Attachment F concludes that there would be no additional types or volumes
required at the shipyards or prototype site for naval spent nuclear fuel storage.
incident-free non-radiological impact resulting from storage of naval spent nuclear
shipyards or prototype site.

5.1.2.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling.
As discussed in the
preceding paragraphs, the impacts on human health or the environment resulting from
operations associated with the management of naval spent nuclear fuel at the Norfol

would be small under any of the alternatives considered. For example, it is unlike fatal cancer would occur as a result of naval spent nuclear fuel management activit alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the Norfolk N not display any strongly dominant direction. Similarly, the conclusion is not affe related to subsistence consumption of fish or game since environmental monitoring i this relatively small and restricted site has shown no detectable difference in the tivity present in the environment from levels in similar parts of the region.

To place the impacts on environmental justice in perspective, the risk associ naval spent nuclear fuel management operations under any of the alternatives consid less than one fatality per year for the entire population. For comparison, in 1990 approximately 510,000 cancer deaths in the United States population and there were cancer deaths among people of color in the U. S. Even if all of the impacts associ the alternatives considered for naval spent nuclear fuel management were assumed to among people of color, that group would be unlikely to experience a single addition in any year. Therefore, the cancer risk for that population from naval spent nucle would not constitute a disproportionately high and adverse impact on human health o ment. The same conclusion can be drawn for low-income groups.

5.1.2.13 Utilities and Energy

If an alternative associated with storage of spent nuclear fuel at Norfolk Na to be selected, construction and operation of the storage facility would not be exp large expenditure of utilities and energy resources.
Construction activities would require quantities of
water and electricity typical of any small to medium size construction project. Op container spent fuel storage facility would likely require only a small amount of e and to support industrial equipment necessary to move spent nuclear fuel. Alternat with water pool storage would require heating, ventilation, water, and electrical s work environment and to properly filter and exhaust the airborne discharges to the utility and energy demands would be less than those required to operate ECF (10,000 (Section 5.2.13) since the water pool used for spent fuel storage would be smaller operations beyond visual examinations would be conducted in the water pool.

The amount of utilities and energy expected to be consumed would be a small i increase in the total amount of utilities and energy used at the shipyard and would discernible environmental consequence.

5.1.2.14 Facility and Transportation Accidents

5.1.2.14.1 Facility Accidents. There has never been an accident in the history of the Naval

Nuclear Propulsion Program that resulted in a significant release of radioactivity or that resulted in radiation exposure to workers in excess of abnormal occurrence as defined by the U.S. Nuclear Regulatory Commission. A description of potential a considered and a summary of the accident analyses that were conducted with regards naval spent nuclear fuel are contained in Attachment F.

5.1.2.14.1.1 Radiological Accidents. Section 3.7.3 provides a summary of the impacts

due to the most severe accidents considered for each site. The facility accident w potential impact at Norfolk Naval Shipyard involves an airplane crash. An accident would result in a calculated 16 fatal cancers to the general population over 50 yea Attachment F. The likelihood of such an accident occurring is 1 x 10-6, which is v perspective, an accident such as this would not be expected to occur unless the fac about 1,000,000 years.

5.1.2.14.1.2 Non-radiological Accidents. As discussed in detail in Attachment F, the

limiting hypothetical non-radiological accident for naval spent nuclear fuel storag shipyard or prototype location would be a diesel fuel spill and fire. A catastroph fuel storage tank that might be used for an emergency diesel generator to provide b power was postulated to occur, resulting in the spilling of the entire quantity of subsequent fire. The fire would generate the following toxic chemicals:

- Carbon monoxide
- Oxides of nitrogen (90% nitric oxide and 10% nitrogen dioxide)
- Lead
- Sulfur dioxide.

Measures would be taken to reduce the health impacts of potential releases of These measures would involve controls to protect both workers and the general publi shipyard and prototype sites have emergency planning, emergency preparedness, and e response programs in place to protect both workers and the public, and involve esta such as warning communications, fire departments, and emergency command centers.

The airborne concentrations of the combustion products listed above, resultin were calculated at the locations of the on-site individuals, an individual at the s general population within a 50-mile radius of the facility. Detailed results are p Attachment F. If the accidental fire that has been hypothesized were to actually o measures that would be in place would ensure no adverse health impacts to the gener minimal health impacts to the workers.

5.1.2.14.2 Transportation Accidents.

Shipments of radioactive materials associated with naval
spent nuclear fuel have never resulted in any measurable release of radioactivity t
ment
(NNPP 1994a). There have never been any significant accidents involving release of material during shipment since the Naval Nuclear Propulsion Program began. The eff transportation accidents during the various stages of transportation of naval spent presented in Attachment A.

The health effects associated with accidents during shipments of naval spent test specimens have been assessed for the general population and the hypothetical m individual for each alternative. As summarized in Section 3.7, it is unlikely that fatal cancers as a result of naval spent nuclear fuel and test specimen shipments s much less than one fatal cancer for each alternative. Details of the transportatio provided in Attachment A.

5.1.2.14.3 Other Impacts of Accidents.

In addition to the possible human health effects
associated with facility or transportation accidents described in the preceding sec such as the impacts on socioeconomics and land use in the area and the costs of cle estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that an area ranging from about 8 acr approximately a quarter mile (for an inadvertent criticality accident) to about 110 approximately 0.9 mile (for a large airplane crashing into a dry storage container) nated to the point where exposure could exceed 100 millirem per year. Beyond these exposure would be less than 100 millirem per year, the Nuclear Regulatory Commissio for protection of the general population from radiation. Persons who live in this evacuated or otherwise experience restrictions in their daily activities for a brie who work at locations within this area might be prevented from going to their jobs been taken to reduce the potential for exposure. It should be noted that all of th about a quarter of a mile from the spent nuclear fuel facility would be inside the federally owned site.

An accident might result in short-term restrictions on access to a relatively there would be no enduring impacts on cultural or similar resources, partially beca involved would be small and partly because the remedial actions would be conducted controlled manner in full compliance with applicable laws and regulations. The are vary only slightly among the alternatives. Overall, the risks are small so these c

assist in distinguishing among alternatives.

Facility or transportation accidents associated with any of the alternatives appreciable effect on the ecology of the area, considering the potential for human the amount of land which might be affected, as described in earlier parts of this s little consensus among scientists on methods for estimating the effects of radiatio resources such as plant or animal life, but since human health effects for all the small and most plants and animals are not thought to be more sensitive to radiation beings, the small impacts on human health provide an indication that the impacts on species in the area would also be small for all alternatives considered. Similarly which might be contaminated to measurable levels by chemicals or radioactive materi hypothetical accidents would be relatively small, any effects on the ecology would areas. There are no endangered or threatened species unique to the area surroundin owned site and an accident would not be expected to result in destruction of any sp alternatives considered. The effects of accidents related to any of the alternativ cleanup which might be performed would be localized in a small area extending only beyond the boundaries of the federally owned site and would not be expected to appr threatened or endangered species in the area. Based on these considerations, evalu accidents on ecological resources does not help to distinguish among alternatives.

5.1.2.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear

Fuel Storage and Handling.

As discussed in the preceding paragraphs, the impacts on human health or the environment resulting from facility or transportation accidents assoc management of naval spent nuclear fuel at the Norfolk Naval Shipyard would be small the alternatives considered. For example, it is unlikely that a single additional occur as a result of naval spent nuclear fuel management activities under any alter potential impacts due to an accident for any of the alternatives considered would p risk and do not constitute a credible adverse impact on the surrounding population, from accidents associated with the management of naval spent nuclear fuel would be particular segment of the population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is because the consequences of any accident would depend on the r conditions in effect at the time an accident occurred, and the wind directions at t Shipyard are highly variable with no strongly dominant direction.

To place the impacts on environmental justice in perspective, the risk associ accidents caused by naval spent nuclear fuel management under any of the alternativ would amount to less than one additional fatality per year for the entire populatio in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.1.2.15 Waste Management

The alternative in which naval spent nuclear fuel is stored at Norfolk Naval produce limited amounts of solid municipal waste, solid low-level radioactive waste wastes.

In addition, no transuranic or high-level radioactive wastes would be generated by nuclear fuel activities at the site under any alternative. The quantity of industr would be small and most likely consist of industrial cleaning agents of the type no at the site. Small quantities of sanitary wastes would result from the additional volume would be small. The wastes produced from the storage of naval spent nuclear controlled and minimized in accordance with the existing waste management programs shipyard. The amount of additional wastes generated would be minimal compared to t baseline and would not cause any adverse impacts to public health and safety and th the vicinity of the shipyard.

5.1.2.16 Cumulative Impacts

5.1.2.16.1 Radiological Cumulative Impacts. Spent nuclear fuel storage at the site would not

result in discharges of radioactivity in liquid effluents during routine operations alternative selected. Therefore, there would be no incremental addition of radioac ground water as a result of normal operations for any alternative. For alternative storage of spent nuclear fuel in dry storage and shipping containers, no airborne r emissions are expected, so there would be no cumulative air quality impacts associa storage methods. Consequently, the only radiological cumulative impacts that would storage alternatives would be due to direct radiation exposure from the stored cont nuclear fuel.

For alternatives involving the storage of naval spent nuclear fuel in water p be no discernible direct radiation exposure to the public from the fuel elements du provided by the water in the pool. Therefore, any cumulative impacts which would r pool storage would be primarily due to airborne emissions, and the addition of thes cause an indiscernible change in the emissions in the area (see Section 5.1.2.7). the site are in compliance with Title 40, Code of Federal Regulations, Part 61, "Na Standards for Hazardous Air Pollutants." Cumulative air emissions would not threat applicable air quality requirement or regulation, either federal, state, or local i non-radiological categories.

A summary of the cumulative radiological impacts is provided in the following An overview of the historical radiological impacts from naval nuclear operati Norfolk Naval Shipyard and from transportation of naval spent nuclear fuel is provi

4.1.2.12 and detailed analyses are provided in Attachments F and A.

Prior to this time, naval spent nuclear fuel inspections and storage operations have been conducted only at INEL. cumulative impacts have resulted from previous naval spent nuclear fuel inspection operations at any alternate site except for INEL.

The radiological impacts associated with the alternatives where naval spent n be stored at Norfolk Naval Shipyard are very small and are described in Section 5.1 detailed results of analyses provided in Attachment F. In order to calculate cumul the period between 1995 and 2035, the annual radiological impacts associated with e alternative were summed over 40 years. The results of this summation are tabulated and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the population in the vicinity of the Norfolk Naval Shi the alternatives considered would be approximately 11.2 person-rem. This means tha much less than one fatal cancer from these operations over the entire 40-year perio total exposure to a theoretical maximally exposed off-site individual living at the for the entire 40-year period would be 0.12 rem due to the alternative resulting in exposure. This maximally exposed off-site individual would have a 6.0 x 10-5 risk fatal cancer during his or her lifetime due to storage of spent nuclear fuel. When radiological impacts due to naval nuclear operations are added to the impacts of th spent nuclear fuel alternative, the exposure to the population would be 13.6 person maximally exposed off-site individual would remain at 0.12 rem. This still results one fatal cancer in the population and the risk of the maximally exposed off-site i a fatal cancer during his or her lifetime is essentially unchanged.

The total exposure related to naval spent nuclear fuel activities to a worker working continually 100 meters from the spent nuclear fuel under the alternative re largest exposure is 0.23 rem accumulated over 40 years. That corresponds to a fata 9.2 x 10-5 during the worker's lifetime. The exposure to the same worker when exis radiological impacts due to naval nuclear operations are added to the spent nuclear 0.232 rem over 40 years which corresponds to a fatal cancer risk of 9.3 x 10-5 duri lifetime. The impacts associated with transportation of naval spent nuclear fuel f alternatives considered would be similarly low.

No contribution to cumulative impacts from accidents involving naval spent nu

been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

Sections 4.1.2.14 and 5.1.2.15 describe the management of low-level radioacti mixed waste at the site. The volume of low-level radioactive wastes which would be the alternatives has not been calculated. However, considering the nature of radio would be associated with spent nuclear fuel storage activities, the amount of low-l waste produced during spent nuclear fuel activities would be much less than 20 perc site generation rate (1019 m3 per year). This additional radioactive waste would n changes to the site's waste management practices. The small amount of additional m would not impose any discernible additional stress on the capacity of the radioacti ground. Therefore, any cumulative impacts associated with the generation and dispo low-level wastes would be very small.

Since no mixed, transuranic, or high-level radioactive wastes would be genera nuclear fuel activities at this site under any alternative, there would be no cumul associated with these materials.

5.1.2.16.2 Non-radiological Cumulative Impacts.

An overview of the historical non-radiologi-
cal impacts from naval nuclear operations at the Norfolk Naval Shipyard and from tr naval spent nuclear fuel is provided in Section 4.1.2.12 and detailed analyses are Attachments F and A. Prior to this time, naval spent nuclear fuel inspections and have been conducted only at INEL. Therefore, no non-radiological cumulative impact from previous naval spent nuclear fuel inspection and storage operations at any alt for INEL.

The non-radiological impacts associated with the alternative where naval spen would be inspected or stored at Norfolk Naval Shipyard are described in Section 5.1 detailed results of analyses provided in Attachment F. As summarized in Section 5. would be no additional chemicals required at the shipyard for naval spent nuclear f therefore no non-radiological impacts from normal operations. Consequently, no cum to air quality or water resources would result since the incremental addition of ch shipyard that might result from naval spent fuel activities would be very small. T environmental problems associated with these materials.

The non-radiological cumulative transportation impacts for the population fro nuclear fuel transportation activities since the beginning of the Naval Nuclear Pro also have been calculated. In addition, the cumulative impacts from transportation nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A. The non- impacts associated with the transportation and storage of naval spent nuclear fuel alternatives considered would be low.

No cumulative land use impacts would be expected to occur as a result of spen storage. The land that would be dedicated for this purpose is on existing federal in an industrial setting which has already been disturbed from its natural state (o developed land). The conversion of this space for storage of spent nuclear fuel wo the need to disturb undeveloped land or for additional land to be added to the fede property in the foreseeable future.

From a socioeconomic perspective, the introduction of naval spent nuclear fue the site would create a small number of additional jobs and could have a very small socioeconomic impact. The site currently employs approximately 8500 civilian perso shipyard employment has been associated with spent nuclear fuel activities in the p nuclear fuel activities have not been conducted at the site. An average of approxi additional jobs might be added as a result of possible spent nuclear fuel activitie peak number of additional jobs created at the site in any given year would be appro which is associated with construction and operation of a water pool facility for st nuclear fuel. Considering that the regional labor force consists of approximately the additional number of added jobs under any alternative would have little or no d socioeconomic impact. These jobs would be filled either from within the existing s from the available regional labor force without discernible effect. There are no f projects planned at the site and no known projects planned in the region that would number of workers involved in naval spent nuclear fuel activities to become an impo

The cumulative impacts associated with non-radiological waste management are expected to be small. As stated previously, any industrial wastes generated from n fuel storage would be small and limited to industrial cleaning agents of the type n

at the site. The volume of municipal solid wastes and sanitary wastes which would expected to be proportional to the number of additional workers added, and this sma increase would not be discernible. The amount of additional non-radiological waste not introduce any changes to the site's waste management practices and would not im additional stress on the capacity of on-site or off-site waste disposal or treatmen any cumulative impacts associated with the generation and disposal of additional wa small. There are no current environmental problems associated with these types of

5.1.2.17 Unavoidable Adverse Effects

There are no discernible unavoidable adverse effects associated with the impl any of the alternatives and none which would help to choose among the alternatives. The alternative
in which naval spent nuclear fuel is stored at the Norfolk Naval Shipyard would cau exposed to small amounts of radiation, described in Section 5.1.2.12, and would res one health effect in the entire population surrounding the shipyard. Similarly, co the storage facility would produce limited amounts of solid municipal waste and sol radioactive waste. These amounts of waste would not produce any major impacts in t the shipyard. There will be no changes to the ecological, cultural, geological, an due to the implementation of any of the alternatives. There would also be no expec ambient noise levels.

5.1.2.18 Irreversible and Irretrievable Commitments of Resources

The only irreversible and irretrievable commitment of resources that results alternative in which naval spent nuclear fuel would be stored at the Norfolk Naval the money which would be spent by the federal government to construct the necessary The
total cost of storing spent naval nuclear fuel at the shipyards and prototype range $1.5 billion to $5.7 billion. This cost represents the total cumulative cost over all of the shipyards and prototype. This cost includes construction costs of the n and, depending on the alternative selected, the operation of a limited examination Sound Naval Shipyard combined with the costs associated with shutting down ECF, or costs of the INEL-ECF. The major expense in the highest cost alternatives is the p shipping containers. Refer to Section 3.7 for a comparison of the total cumulative alternatives.

5.1.3 PORTSMOUTH NAVAL SHIPYARD: KITTERY, MAINE

5.1.3.1 Overview of Environmental Impacts

The following sections discuss the major differences in potential environment associated with the choice of alternatives that include storage of naval spent nucl Portsmouth Naval Shipyard. The environmental consequences associated with storage nuclear fuel at Portsmouth Naval Shipyard are based on the estimates of naval spent will be stored at Portsmouth Naval Shipyard through the year 2035 and current knowl design features associated with spent fuel shipping containers, immobile storage co storage systems. The review of the environmental consequences associated with each tives has shown that the associated impact on the environment is very small. There impact to the Portsmouth Naval Shipyard regional environment associated with any al do not involve the Portsmouth Naval Shipyard.

5.1.3.2 Land Use

Construction of a storage area at Portsmouth Naval Shipyard would require a m in the current land use by the shipyard. A description of the alternative storage approximate storage locations is provided in Attachment D. Attachment C provides a spent nuclear fuel storage in new water pools versus dry container storage.

The alternative of storing naval spent nuclear fuel in water pools would requ pool facility be constructed in the vicinity of the area that is designated for dry The water pool would have sufficient capacity to accommodate storage of all naval s

expected to be stored at the shipyard.

No additional land outside the shipyard would be required.

Native American rights and interests would not be modified by construction or associated with any of the alternatives considered.

5.1.3.3 Socioeconomics

The calculated number of direct construction and operating jobs that would be 10-year period between 1995 and 2004 for each storage alternative at the shipyard i **Table 5.1.3-1.** Since there would be no naval spent nuclear fuel storage or inspect shipyard under the 1992/1993 Planning Basis and Centralization alternatives, no add be required at the shipyard under these alternatives.

Table 5.1.3-1. Number of construction and operating jobs created at Portsmouth Nav for each alternative.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	200
Railcar(1)	1	1	6	1	1	1	1	1	1	1
Immobile Containers on Pads(2)	1	1	1	1	2	6(3)	4	4	4	4
Shipping Containers on Pads (2)	1	1	1	1	2	6(3)	1	1	1	1
Water Pools(2)	16	16	47	72	89	63	77	35	35	35

(1) Storage mode under the No Action and Decentralization alternatives.
(2) Storage mode under the Decentralization alternative.
(3) The construction jobs would last less than one year.

The only discernible socioeconomic consequence of storing naval spent nuclear Portsmouth Naval Shipyard is that a relatively small number of construction workers few to a maximum of several hundred would be required for construction of the area) force would consist of skilled craftsmen and unskilled laborers. This work force w during the storage facility construction and would be available from within the are

The operation of the spent fuel storage area using dry storage containers wou additional workers to secure the fuel in the storage area and to support surveillan activities. For the alternative involving storing fuel in immobile dry storage con workers would be required to handle the spent nuclear fuel when it is placed into t containers. This work force would normally only be needed when fuel is being inser containers. For the alternative involving shipping containers, fewer workers would handle and secure the containers in the storage area. The operation of a water poo alternative involving storing naval spent nuclear fuel in a water pool would requir additional workers. The number required for any of the shipyard and prototype site alternatives would be small and is expected to be supplied from either within the e work force or from the local work force. Considering that the shipyard employs app naval and civilian personnel, the addition of workers to support the alternatives w discernible impact on the local socioeconomic conditions of the Portsmouth Naval Sh

For the alternatives where dry storage containers would be manufactured, some jobs would be created in the locations where the containers are made. The process container manufacturer is subject to federal procurement requirements and would be Record of Decision. Consequently, the specific socioeconomic impacts from containe cannot be specified. The net effect of container fabrication would be to create ad bolster the local economy of the area(s) where containers are made. It is consider selection of the contractor would depend on the alternative storage site selected, with construction of casks provide no basis for selection of a storage site.

5.1.3.4 Cultural Resources

All construction contracts for the shipyard contain a clause such that if art ered, appropriate measures must be taken to ensure the safe recovery of such items. these items are then placed in the shipyard museum.

The shipyard's historic district is considered a valued cultural resource and are listed on the historic register. The implementation of storage alternatives wi that is listed on the National Register of Historic Places (NPS 1991), any known ar or any other cultural resources. Therefore, there would be no impacts to cultural

with the alternative of storing naval spent nuclear fuel at the shipyard.

None of the alternatives considered would impact known archaeological or Nati sites. Procedures which comply with all applicable laws and regulations would be i protect previously undetected archaeological and cultural sites.

5.1.3.5 Aesthetic and Scenic Resources

The naval spent nuclear fuel storage area would be located within the Portsmo Shipyard which is an existing industrial setting and would not affect the visual qu since it is compatible with the landscape character of the site. Physical changes from the construction of a naval spent nuclear fuel storage facility will not alter are no particulate air emissions associated with storage of naval spent nuclear fue visibility impacts are expected. No aesthetic or scenic resources in the vicinity be affected by the construction and operation of the storage facility.

5.1.3.6 Geology

If an alternative were to be selected which required naval spent nuclear fuel Portsmouth Naval Shipyard, the construction and operation of the naval spent nuclea facility would not be expected to affect the geologic character or resources of the storage facility construction phase, the ground would need to be excavated as neces surface. This would not affect the geological characteristics of the underlying la alternative of storing naval spent nuclear fuel in a storage pool facility, the gro to be excavated to a depth of approximately 40 feet. This excavation would not aff characteristics of the area.

5.1.3.7 Air Resources

5.1.3.7.1 Radiological Consequences.

No airborne radionuclide releases from normal operations are expected to occur as a result of the alternatives involving naval sp stored in dry storage containers. The fuel would be contained such that at least t prevent fission products from becoming airborne. These barriers would retain the s in an air-tight containment until moved to a permanent storage site and there would radioactive material released from routine operations for this method of storage. exposure would be direct radiation from the array of filled storage containers. Th containers would be fenced off and shielded if necessary such that there would be n effect on the current radiation readings at the site perimeter.

For the alternative where naval spent nuclear fuel would be stored in a water radionuclide releases are expected to be less than the emissions from the Idaho Nat Laboratory (INEL) Expended Core Facility (ECF) because the water pool size and numb inspections performed would be smaller at the shipyard and the shipyard would not c shielded cell operations that are performed at ECF. To conservatively estimate the consequences, airborne releases based on ECF releases from 1991 are used. The radi term used and the detailed calculations performed to determine expected normal rele in Attachment F.

The radiation exposures to human beings due to estimated radionuclide release atmosphere plus direct radiation from the stored spent nuclear fuel at the shipyard alternative involving water pool storage and the alternative involving dry storage described in Attachment F.

A person on the shipyard boundary at the location where the largest exposures received was used as the hypothetical maximally exposed off-site individual (MOI) f releases of radioactive material from the stored fuel. The population data used to exposures were taken from 1990 census data provided by the U.S. Census Bureau. Met were obtained as described in Attachment F. Estimated exposures to workers were al

The hypothetical exposures calculated are based on an exposure to the estimat effluents and the direct radiation exposure for one year from the fuel stored at th calculations include the external effective equivalent exposure from the ground dep to surface water, and air immersion pathways and the 50-year committed effective eq exposure from internal exposure through the ingestion and inhalation pathways. All considered for persons potentially exposed, except that the ingestion pathway was o

workers because they do not grow their food on-site. Solubilities which would prod calculated exposures were chosen for internal exposure factors. Values for human d tion patterns were taken from "Age Dependent Values of Dietary Intake for Assessing Exposures to Environmental Pollutants" (Rupp 1980). The hypothetical exposures cal converted into a risk of fatal cancer or a risk of non-fatal health detriments (e.g hereditary defects) based on the "1990 Recommendations of the International Commiss Radiological Protection" (ICRP 1991).

Attachment F summarizes the calculated exposures and fatal cancers to the wor exposed off-site individual (MOI), nearest public access (NPA), and the population radioactivity and direct radiation exposure in one year for each location and stora 3.7 provides a comparison of the annual number of fatal cancers calculated for the for each location and alternative.

The number of fatal cancers calculated is so small that there would be essent cancers resulting from the storage of naval spent nuclear fuel during the time it c expected to continue to be stored. Putting this into perspective, it could be stat the population might experience a fatal cancer due to incident-free storage of nava at the Portsmouth Naval Shipyard if operations continued for 43,500 years.

If a water pool facility would be constructed at the Portsmouth Naval Shipyar storage of naval spent nuclear fuel, the airborne emissions from the facility would identified for the Puget Sound Naval Shipyard because no naval spent nuclear fuel i operations beyond visual examination would be conducted in the water pool facility.

5.1.3.7.2 Non-radiological Consequences.

As noted in Attachment F, no increase in non-radioactive airborne emissions would be expected to result from spent nuclear fuel operations. Storage facility operations would not involve use of carcinogenic toxi pollutants, or other hazardous or toxic chemicals except that small quantities of i agents and paint thinner may be used for housekeeping and cleanliness control and t same as those already used at the shipyard. Consequently, there would be no impact quality as a result of implementing any of the alternatives at the shipyard.

If an alternative were to be selected that required a storage facility to be renovated, fugitive dust emissions would be expected to result from excavation oper quantity of dust generated would be small, consistent with typical excavation activ within local requirements for dust control.

5.1.3.8 Water Resources

5.1.3.8.1 Radiological Consequences.

Spent nuclear fuel storage at the shipyard would not result in discharges of radioactivity to liquid effluents during routine operation alternative selected for storage of spent nuclear fuel. The health effect due to f released to the air onto the surface water is included in the analysis results disc 5.1.3.7. The air fallout impact is so small that there would be no distinguishable the water.

Portsmouth Naval Shipyard does not reside in the 100 or 500 year floodplain. the floodplain would not be impacted by spent naval nuclear fuel storage and examin the shipyard.

5.1.3.8.2 Non-radiological Consequences.

Other than chemicals used to maintain the storage area, no hazardous wastes would be generated by the storage of naval spent nuclear Portsmouth Naval Shipyard. Any hazardous liquid effluents that may be generated at would be disposed of at an Environmental Protection Agency approved disposal site.

The only source for liquid discharges from the naval spent nuclear fuel stora the environment consists of storm water runoff which would be consistent with the t associated with common light industrial facilities and related activities. It can would be no impact to the human environment due to runoff water from the proposed n nuclear fuel storage area.

The increased water usage under any alternative would be negligible compared

shipyard demand.

5.1.3.9 Ecological Resources

Both Maine and New Hampshire officials were consulted and have determined tha evidence to suggest that any threatened or endangered species reside on the Portsmo Shipyard (Appendix V.B. of the Navy's Natural Resources Management Plan (Navy 1993) major changes to the industrial environment are planned. None of the alternatives areas surrounding the shipyard. Therefore, no major ecological impacts to the regi from selection of any of the alternatives.

The conceptual location where naval spent nuclear fuel would be stored is ill Attachment D. This location is within an existing industrial complex and is surrou and paved areas. The industrial nature of the shipyard and the fact that the land disturbed from its natural state by earlier activities mean that plant or animal sp disturbance by human activities would not be expected to be present. Therefore, th ecological impacts associated with construction or operation of a spent nuclear fue location. The radiological controls that are in effect at the shipyard ensure that the vicinity of the shipyard are maintained at or near natural background. Since t would be applied to spent nuclear fuel activities, no ecological effects due to rad would be expected to occur.

5.1.3.10 Noise

Portsmouth Naval Shipyard is an existing industrial-type environment character from truck and automobile traffic; ship loading cranes and related diesel-powered e continuously operating transmission lines for steam, fuel, water, and related pumpi those and other liquids. No ambient noise level increases are expected to occur as the alternatives. Therefore, no noise impacts would be expected to occur.

5.1.3.11 Traffic and Transportation

Shipments of radioactive materials in the Naval Nuclear Propulsion Program ar be made in accordance with applicable regulations of the U.
S. Department of Transportation, U.S.
Department of Energy, and the U.S. Nuclear Regulatory Commission. The purpose of t regulations is to ensure that shipments of radioactive material are adequately cont environment and the health and safety of the general public. These regulations are radioactive material shipments and provide requirements for the container design, c identification as applicable for the specific quantity, type, and form of radioacti shipped. Naval shipping container design requirements invoke shielding and integri and meet all regulatory requirements. They provide for testing of container design qualification of workers who construct containers, and quality control inspections ensure that the containers will meet their design requirements. A detailed descrip containers used for naval spent nuclear fuel shipments is provided in Attachment A. the impacts associated with normal and accident conditions associated with transpor spent nuclear fuel is provided in Attachment A.

5.1.3.11.1 Regional Infrastructure.

The alternatives under consideration are described in
Section 3. The No Action alternative or the first variation of the Decentralizatio store the spent nuclear fuel on-site. This alternative would reduce the number of the shipyard or prototype site compared to the past practice of transporting all sp INEL. The second variation of the Decentralization alternative would ship about 10 spent nuclear fuel to Puget Sound. This would have some transportation impact, but transporting all spent nuclear fuel off-site. The third Decentralization alternati nuclear fuel to INEL, examines it, and returns it to the original shipyard or proto alternative involves more transportation than the previous practice of transporting INEL, since the spent nuclear fuel is not returned from INEL to the original site. Planning Basis alternative, the Regionalization at INEL alternative, or the Central alternative would involve the same transportation as has been required in the past,

tion to INEL and retention there. The Centralization alternative at the Hanford Si more transportation impact than any of the previous alternatives, due to the distan distribution between Hanford and the shipyards and prototypes. The Centralization Savannah River Site would result in the most transportation impact of spent nuclear alternatives.

5.1.3.11.2 Site Infrastructure.

The alternative associated with naval spent nuclear fuel storage at Portsmouth Naval Shipyard would not noticeably affect site highway traffic because the work force would represent a very small incremental increase in overall traffic shipyard. There would be no noticeable change in the internal traffic in the shipy held temporarily even when it is transported off-site.

5.1.3.12 Occupational and Public Health and Safety

Detailed analyses of incident-free spent nuclear fuel transportation and stor impacts on worker and public health are described in Attachment A (transportation) (storage and inspection).
The transportation analysis results, and the storage and handling analysis are summarized separately in the following subsections.

5.1.3.12.1 Incident-free Transportation Occupational and Public Health and Safety.

The
radiological and non-radiological health effects associated with the incident-free naval spent nuclear fuel and test specimens have been assessed for the general popu tion workers, and hypothetical maximum exposed individual for each alternative. As Section 3.7, it is unlikely that there will be any fatal cancers as a result of nav and test specimen shipments since the estimates are much less than one fatal cancer alternative. The details of the transportation analysis are provided in Attachment

5.1.3.12.2 Incident-free Occupational and Public Health and Safety During Spent Nuclear

Fuel Storage and Handling.
The public health and safety impacts of radioactivity releases and direct radiation from storage of spent nuclear fuel were analyzed as discussed in S Attachment F. Attachment F summarizes the results of the analysis of radioactivity direct radiation from stored spent nuclear fuel. This analysis shows that the expo maximally exposed off-site individual, and nearest public access from stored naval would result in far less than one fatality per year. For perspective, it could be member of these population groups might experience a fatal cancer due to storage of nuclear fuel at Portsmouth Naval Shipyard if operations continued for 43,500 years.

Projections of the number of occupational accidents that might occur during c operation of naval spent nuclear fuel storage and examination facilities have been alternative. These projections are presented in Attachment F. Based on the result projections, it is concluded that the number of occupational fatalities and injurie construction activities and storage and examination operations would be very small tive.

No public or occupational radiological health and safety impacts would be exp from naval spent nuclear fuel storage area construction activities since the constr involve radioactive work.

Attachment F also discusses toxic chemical issues for spent nuclear fuel hand Attachment F concludes that there would be no additional types or volumes of chemic the shipyards or prototype site for spent nuclear fuel storage. Therefore, there i non-radiological impact resulting from storage of spent nuclear fuel at the shipyar

5.1.3.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling.

As discussed in the
preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the management of naval spent nuclear fuel at the Portsm Shipyard would be small under any of the alternatives considered. For example, it single fatal cancer would occur as a result of naval spent nuclear fuel management alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the Portsmout do not display any strongly dominant direction. Similarly, the conclusion is not a related to subsistence consumption of fish or game since environmental monitoring i this relatively small and restricted site has shown no detectable difference in the tivity present in the environment from levels in similar parts of the region.

To place the impacts on environmental justice in perspective, the risk associ naval spent nuclear fuel management operations under any of the alternatives consid less than one fatality per year for the entire population. For comparison, in 1990 approximately 510,000 cancer deaths in the United States population and there were cancer deaths among people of color in the U. S. Even if all of the impacts associ the alternatives considered for naval spent nuclear fuel management were assumed to among people of color, that group would be unlikely to experience a single addition in any year. Therefore, the cancer risk for that population from naval spent nucle would not constitute a disproportionately high and adverse impact on human health o ment. The same conclusion can be drawn for low-income groups.

5.1.3.13 Utilities and Energy

If an alternative associated with the storage of naval spent nuclear fuel at Shipyard were to be selected, construction and operation of the storage area would require a large expenditure of utilities and energy resources.
Construction activities will require
quantities of water and electricity typical of any small to medium size constructio of the dry container naval spent nuclear fuel storage facility will likely require electricity for security lighting and to support industrial equipment necessary to nuclear fuel (cranes, etc). Alternatives associated with water pool storage would ventilation, water, and electrical systems suitable for a work environment and to p exhaust the airborne discharges to the atmosphere. The utility and energy demands than those required to operate ECF (10,000 MWh per year) (Section 5.2.13) since the used for naval spent nuclear fuel storage would be smaller and no spent fuel operat examinations would be conducted in the water pool.

The amount of utilities and energy expected to be consumed would be a small i increase in the total amount of utilities and energy used at the Portsmouth Naval S not result in any discernible environmental consequence.

5.1.3.14 Facility and Transportation Accidents

5.1.3.14.1 Facility Accidents. There has never been an accident in the history of the Naval

Nuclear Propulsion Program that resulted in a significant release of radioactivity or that resulted in radiation exposure to workers in excess of abnormal occurrence as defined by the U.S. Nuclear Regulatory Commission. A description of potential a considered and a summary of the accident analyses that were conducted with regards naval spent nuclear fuel are contained in Attachment F.

5.1.3.14.1.1 Radiological Accidents. Section 3.7.3 provides a summary of the impacts

due to the most severe accidents considered for each site. The facility accident w potential impact at Portsmouth Naval Shipyard involves an airplane crash. An accid

magnitude would result in 9 fatal cancers to the general population over 50 years, Attachment F. The likelihood of an airplane crash is 1 x 10-7. The facility accid risk involves accidental drainage of the water pool. The drained water pool accide less than one fatality over 50 years, but the likelihood of occurrence is 1 x 10-5.

5.1.3.14.1.2 Non-radiological Accidents. As discussed in detail in Attachment F, the limiting

hypothetical non-radiological accident for spent nuclear fuel storage in a water po prototype location would be a diesel fuel spill and fire. A catastrophic failure o tank that might be used for an emergency diesel generator to provide backup electri postulated to occur, resulting in the spilling of the entire quantity of diesel fue quent fire.
The fire would generate the following toxic chemicals:

- Carbon monoxide
- Oxides of nitrogen (90% nitric oxide and 10% nitrogen dioxide)
- Lead
- Sulfur dioxide.

Measures would be taken to reduce the health impacts of potential releases of These measures would involve controls to protect both workers and the general publi shipyard and prototype sites have emergency planning, emergency preparedness, and e response programs in place to protect both workers and the public and involve estab such as warning communications, fire departments, and emergency command centers.

The airborne concentrations of the combustion products listed above, resultin were calculated at the locations of the on-site individuals, an individual at the s general population within a 50-mile radius of the facility. Detailed results are p ment F. If the accidental fire that has been hypothesized were to actually occur, that would be in place would ensure no adverse health impacts to the general public health impacts to the workers.

5.1.3.14.2 Transportation Accidents.

Shipments of radioactive materials associated with naval spent nuclear fuel have never resulted in any measurable release of radioactivity t (NNPP 1994a). There have never been any significant accidents involving the releas material during shipment since the Naval Nuclear Propulsion Program began. The eff transportation accidents during the various stages of transportation of naval spent presented in Attachment A.

The health effects associated with accidents during shipments of naval spent test specimens have been assessed for the general population and the hypothetical m individual for each alternative. As summarized in Section 3.7, it is unlikely that fatal cancers as a result of naval spent nuclear fuel and test specimen shipments s much less than one fatal cancer for each alternative. The details of the transport provided in Attachment A.

5.1.3.14.3 Other Impacts of Accidents.

In addition to the possible human health effects associated with facility or transportation accidents described in the preceding sec such as the impacts on socioeconomics and land use in the area and the costs of cle estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that an area ranging from about 8 acr approximately a quarter mile (for an inadvertent criticality accident) to about 110 approximately 0.9 mile (for a large airplane crashing into a dry storage container) nated to the point where exposure could exceed 100 millirem per year. Beyond these exposure would be less than 100 millirem per year, the Nuclear Regulatory Commissio for protection of the general population from radiation. Persons who live in this evacuated or otherwise experience restrictions in their daily activities for a brie who work at locations within this area might be prevented from going to their jobs been taken to reduce the potential for exposure. It should be noted that all of th about a quarter mile from the spent nuclear fuel facility would be inside the bound federally owned site.

An accident might result in short-term restrictions on access to a relatively

there would be no enduring impacts on cultural or similar resources, partially beca be small and partly because all remedial actions would be conducted in a careful, c in full compliance with applicable laws and regulations. The area impacted would v among the alternatives considered. Overall, the risks are small so these considera distinguishing among alternatives.

Facility or transportation accidents associated with any of the alternatives appreciable effect on the ecology of the area, considering the potential for human the amount of land which might be affected, as described in earlier parts of this s little consensus among scientists on methods for estimating the effects of radiatio resources such as plant or animal life, but since human health effects for all the small and most plants and animals are not thought to be more sensitive to radiation beings, the small impacts on human health provide an indication that the impacts on species in the area would also be small for all alternatives considered. Similarly which might be contaminated to measurable levels by chemicals or radioactive materi hypothetical accidents would be relatively small, any effects on the ecology would areas. There are no endangered or threatened species unique to the area surroundin owned site, so an accident would not be expected to result in destruction of any sp alternatives considered. The effects of accidents related to any of the alternativ cleanup which might be performed would be localized in a small area extending only beyond the boundaries of the federally owned site and thus would not be expected to affect the potential for survival of endangered or threatened species in southeaste Hampshire. Based on these considerations, evaluation of impacts of accidents on ec does not help to distinguish among alternatives.

5.1.3.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear

Fuel Storage and Handling.

As discussed in the preceding paragraphs, the impacts on human health or the environment resulting from facility or transportation accidents assoc management of naval spent nuclear fuel at the Portsmouth Naval Shipyard would be sm of the alternatives considered. For example, it is unlikely that a single addition occur as a result of naval spent nuclear fuel management activities under any alter potential impacts due to an accident for any of the alternatives considered would p risk and do not constitute a credible adverse impact on the surrounding population, from accidents associated with the management of naval spent nuclear fuel would be particular segment of the population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is because the consequences of any accident would depend on the r conditions in effect at the time an accident occurred, and the wind directions at t Shipyard are highly variable with no strongly dominant direction.

To place the impacts on environmental justice in perspective, the risk associ accidents caused by naval spent nuclear fuel management under any of the alternativ would amount to less than one additional fatality per year for the entire populatio in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.1.3.15 Waste Management

The alternative in which naval spent nuclear fuel is stored at Portsmouth Nav would produce limited amounts of solid municipal waste, solid low-level radioactive hazardous wastes.

In addition, no transuranic or high-level radioactive wastes would be generated by spent nuclear fuel activities at the site under any alternative. The quantity of i generated would be small and most likely consist of industrial cleaning agents of t encountered at the site. Small quantities of sanitary wastes would result from the force but this volume would be small. The wastes produced from the storage of nava fuel would be controlled and minimized in accordance with the existing waste manage at the Portsmouth Naval Shipyard. The amount of additional wastes generated would

compared to the existing baseline and would not cause any adverse impacts to public and the environment in the vicinity of the Portsmouth Naval Shipyard.

5.1.3.16 Cumulative Impacts

5.1.3.16.1 Radiological Cumulative Impacts. Spent nuclear fuel storage at the site would not

result in discharges of radioactivity in liquid effluents during routine operations alternative selected. Therefore, there would be no incremental addition of radioac ground water as a result of normal operations for any alternative. For alternative storage of spent nuclear fuel in dry storage and shipping containers, no airborne r emissions are expected, so there would be no cumulative air quality impacts associa storage methods. Consequently, the only radiological cumulative impacts that would storage alternatives would be due to direct radiation exposure from the stored cont nuclear fuel.

For alternatives involving the storage of naval spent nuclear fuel in water p be no discernible direct radiation exposure to the public from the fuel elements du provided by the water in the pool. Therefore, any cumulative impacts which would r pool storage would be primarily due to airborne emissions, and the addition of thes cause an indiscernible change in the emissions in the area (see Section 5.1.3.7). the site are in compliance with Title 40, Code of Federal Regulations, Part 61, "Na Standards for Hazardous Air Pollutants." Cumulative air emissions would not threat applicable air quality requirement or regulation, either federal, state, or local i non-radiological categories.

A summary of the cumulative radiological impacts is provided in the following An overview of the historical radiological impacts from naval nuclear operati Portsmouth Naval Shipyard and from transportation of naval spent nuclear fuel is pr 4.1.3.12 and detailed analyses are provided in Attachments F and A. Prior to this nuclear fuel inspections and storage operations have been conducted only at INEL. cumulative impacts have resulted from previous naval spent nuclear fuel inspection operations at any alternate site except for INEL.

The radiological impacts associated with the alternatives where naval spent n be stored at Portsmouth Naval Shipyard are very small and are described in Section the detailed results of analyses provided in Attachment F. In order to calculate c for the period between 1995 and 2035, the annual radiological impacts associated wi and alternative were summed over 40 years. The results of this summation are tabul 3-5 and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the population in the vicinity of the Portsmouth Naval of the alternatives considered would be approximately 1.8 person-rem. This means t be much less than one fatal cancer from these operations over the entire 40-year pe The total exposure to a theoretical maximally exposed off-site individual living at boundary for the entire 40-year period would be 2.2 x 10-3 rem due to the alternati largest exposure. This maximally exposed off-site individual would have a 1.1 x 10 contracting a fatal cancer during his or her lifetime due to storage of spent nucle existing site radiological impacts due to naval nuclear operations are added to the limiting spent nuclear fuel alternative, the exposure to the population would be 2. the maximally exposed off-site individual would be 2.5 x 10-3 rem. This still resu than one fatal cancer in the population and the risk of the maximally exposed off-s contracting a fatal cancer during his or her lifetime is 1.3 x 10-6.

The total exposure related to naval spent nuclear fuel activities to a worker working continually 100 meters from the spent nuclear fuel under the alternative re largest exposure is 0.11 rem accumulated over 40 years. That corresponds to a fata 4.4 x 10-5 during the worker's lifetime. The exposure to the same worker when exis radiological impacts due to naval nuclear operations are added to the spent nuclear essentially the same over 40 years. The impacts associated with transportation of fuel for all of the alternatives considered would be similarly low.

No contribution to cumulative impacts from accidents involving naval spent nu

been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

Sections 4.1.3.14 and 5.1.3.15 describe the management of low-level radioacti mixed waste at the site. The volume of low-level radioactive wastes which would be the alternatives has not been calculated. However, considering the nature of radio would be associated with spent nuclear fuel storage activities, the amount of low-l waste produced during spent nuclear fuel activities would be much less than 20 perc site generation rate (57 m3 per year). This additional radioactive waste would not changes to the site's waste management practices. The small amount of additional m would not impose any discernible additional stress on the capacity of the radioacti ground. Therefore, any cumulative impacts associated with the generation and dispo low-level wastes would be very small.

Since no mixed, transuranic, or high-level radioactive wastes would be genera nuclear fuel activities at this site under any alternative, there would be no cumul associated with these materials.

5.1.3.16.2 Non-radiological Cumulative Impacts.

An overview of the historical non-radiologi- cal impacts from naval nuclear operations at the Portsmouth Naval Shipyard and from of naval spent nuclear fuel is provided in Section 4.1.3.12 and detailed analyses a Attachments F and A. Prior to this time, naval spent nuclear fuel inspections and have been conducted only at INEL. Therefore, no non-radiological cumulative impact from previous naval spent nuclear fuel inspection and storage operations at any alt for INEL.

The non-radiological impacts associated with the alternative where naval spen would be inspected or stored at Portsmouth Naval Shipyard are described in Section the detailed results of analyses provided in Attachment F. As summarized in Sectio would be no additional chemicals required at the shipyard for naval spent nuclear f therefore no non-radiological impacts from normal operations. Consequently, no cum to air quality or water resources would result since the incremental addition of ch shipyard that might result from naval spent fuel activities would be very small. T environmental problems associated with these materials.

The non-radiological cumulative transportation impacts for the population fro nuclear fuel transportation activities since the beginning of the Naval Nuclear Pro also have been calculated. In addition, the cumulative impacts from transportation nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A. The non- impacts associated with the transportation and storage of naval spent nuclear fuel alternatives considered would be low.

No cumulative land use impacts would be expected to occur as a result of spen storage. The land that would be dedicated for this purpose is on existing federal in an industrial setting which has already been disturbed from its natural state (a acres are developed land). The conversion of this space for storage of spent nucle result in the need to disturb undeveloped land or for additional land to be added t owned property in the foreseeable future.

From a socioeconomic perspective, the introduction of naval spent nuclear fue the site would create a small number of additional jobs and could have a very small socioeconomic impact. The site currently employs approximately 4900 civilian perso shipyard employment has been associated with spent nuclear fuel activities in the p nuclear fuel activities have not been conducted at the site. An average of approxi additional jobs might be added as a result of possible spent nuclear fuel activitie peak number of additional jobs created at the site in any given year would be appro which is associated with construction and operation of a water pool facility for st nuclear fuel. Considering that the regional labor force consists of approximately the additional number of added jobs under any alternative would have little or no d socioeconomic impact. These jobs would be filled either from within the existing s from the available regional labor force without discernible effect. There are no f projects planned at the site and no known projects planned in the region that would number of workers involved in naval spent nuclear fuel activities to become an impo

The cumulative impacts associated with non-radiological waste management are expected to be small. As stated previously, any industrial wastes generated from n fuel storage would be small and limited to industrial cleaning agents of the type n

at the site. The volume of municipal solid wastes and sanitary wastes which would expected to be proportional to the number of additional workers added, and this sma increase would not be discernible. The amount of additional non-radiological waste not introduce any changes to the site's waste management practices and would not im additional stress on the capacity of on-site or off-site waste disposal or treatmen any cumulative impacts associated with the generation and disposal of additional wa small. There are no current environmental problems associated with these types of

5.1.3.17 Unavoidable Adverse Effects

There are no discernible unavoidable adverse effects associated with the impl any of the alternatives and none which would help to choose among the alternatives. The alternative
in which naval spent nuclear fuel is stored at the Portsmouth Naval Shipyard would to be exposed to small amounts of radiation, described in Section 5.1.3.12, and wou than one health effect in the entire population surrounding the shipyard. Similarl operation of the storage facility would produce limited amounts of solid municipal low-level radioactive waste. These amounts of waste would not produce any major im vicinity of the shipyard. There will be no changes to the ecological, cultural, ge aesthetic resources due to the implementation of any of the alternatives. There wi on ambient noise levels.

5.1.3.18 Irreversible and Irretrievable Commitments of Resources

The only irreversible and irretrievable commitment of resources that results f alternative in which naval spent nuclear fuel would be stored at the Portsmouth Nav be the money which would be spent by the federal government to construct the necess The total cost of storing spent naval nuclear fuel at the shipyards and prototype r approximately $1.5 billion to $5.7 billion. This cost represents the total cumulat 40-year period for all of the shipyards and prototype. This cost includes construc new storage facilities, and, depending on the alternative selected, the operation o examination facility at Puget Sound Naval Shipyard combined with the costs associat down ECF, or the operational costs of the INEL-ECF. The major expense in the highe alternatives is the procurement of shipping containers. Refer to Section 3.7 for a total cumulative costs among alternatives.

5.1.4 PEARL HARBOR NAVAL SHIPYARD: PEARL HARBOR, HAWAII

5.1.4.1 Overview of Environmental Impacts

The following sections discuss the major differences in potential environment associated with the choice of alternatives that include storage of naval spent nucl Harbor Naval Shipyard (hereafter referred to as Pearl Harbor). The environmental c associated with storage of naval spent nuclear fuel at Pearl Harbor are based on th spent nuclear fuel that will be stored at Pearl Harbor through the year 2035 and th knowledge of the design features associated with spent fuel storage systems. The r environmental consequences associated with these alternatives has shown that the im environment at Pearl Harbor associated with all activities is very small. There wo the environment in the vicinity of Pearl Harbor associated with any alternatives th Pearl Harbor.

5.1.4.2 Land Use

Construction of a storage area at Pearl Harbor for temporary naval spent nucl would require a modest change in the current land in use by the shipyard. A descri alternate storage containers and water pools and their approximate storage location Attachment D. Attachment C provides a comparison of naval spent nuclear fuel stora pools versus dry container storage. The area is already an industrial site; theref impact on land use.

The alternative of storing naval spent nuclear fuel in water pools would requ pool facility be constructed in the vicinity of the area that is designated for dry

The water pool would have sufficient capacity to accommodate storage of all naval s expected to be stored at the shipyard.

No additional land use outside the shipyard would be required.

Native Hawaiian rights and interests would not be modified by construction or associated with any of the alternatives considered.

5.1.4.3 Socioeconomics

The calculated number of direct construction and operating jobs that would be 10-year period between 1995 and 2004 for each storage alternative at the shipyard i **Table 5.1.4-1.** Since there would be no naval spent nuclear fuel storage or inspect shipyard under the 1992/1993 Planning Basis and Centralization alternatives, no add be required at the shipyard under these alternatives.

Table 5.1.4-1. Number of construction and operating jobs created at Pearl Harbor N for each alternative.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	200
Railcar(1)	1	1	6	1	1	1	1	1	1	1
Immobile Containers on Pads(2)	1	1	1	1	2	6(3)	4	4	4	4
Shipping Containers on Pads (2)	1	1	1	1	2	6(3)	1	1	1	1
Water Pools(2)	16	16	46	71	88	62	77	35	35	35

(1) Storage mode under the No Action and Decentralization alternatives.
(2) Storage mode under the Decentralization alternative.
(3) The construction jobs would last less than one year.

The only discernible socioeconomic consequence from the alternative of storin nuclear fuel at Pearl Harbor is that a relatively small number of construction work few to a maximum of several hundred would be required for construction of the stora work force would consist of skilled craftsmen and unskilled laborers. This work fo needed during the storage facility construction and would be provided from within t

The operation of the naval spent nuclear fuel storage area using dry storage require additional workers to secure the fuel in the storage area and to support su monitoring activities. For the alternative involving storing fuel in immobile dry about 20 workers would be required to handle the naval spent nuclear fuel when it i storage containers. This work force would normally only be needed when fuel is bei the containers. For the alternative involving shipping containers, fewer workers w handle and secure the containers in the storage area. The operation of a water poo alternative involving storing naval spent nuclear fuel in a water pool would requir additional workers. The number required for any of the shipyard and prototype site alternatives would be small and would be expected to be supplied from either within shipyard work force or the local work force. Considering that the Department of De approximately 10,900 civilians at the Pearl Harbor naval base, the addition of work alternatives would have no discernible impact on the local socioeconomic conditions Harbor site.

For the alternatives where dry storage containers would be manufactured, some jobs would be created in the locations where the containers are made. The process container manufacturer is subject to federal procurement requirements and would be Record of Decision. Consequently, the specific socioeconomic impacts from containe cannot be specified. The net effect of container fabrication would be to create ad bolster the local economy of the area(s) where containers are made. It is consider selection of the contractor would depend on the alternative storage site selected, with construction of casks provide no basis for selection of a storage site.

5.1.4.4 Cultural Resources

The action considered will not affect any site that is listed on the National Places (NPS 1991), any known archaeological areas, or any other cultural resources. there would be no impacts to cultural resources associated with the alternative of nuclear fuel at this location.

None of the alternatives considered would impact known archaeological or Nati

sites. Procedures which comply with all applicable laws and regulations would be i protect previously undetected archaeological and cultural sites.

5.1.4.5 Aesthetic and Scenic Resources

The naval spent nuclear fuel storage area would be located within the Pearl H is an existing industrial setting and would not affect the visual quality of the ar ble with the landscape character of the site. Physical changes to the Pearl Harbor storage area construction will not alter this setting. There are no particulate ai with storage of naval spent nuclear fuel and thus no visibility impacts are expecte scenic resources in the vicinity of the shipyard would be affected by the construction and operation of the storage facility.

5.1.4.6 Geology

The construction and operation of the naval spent nuclear fuel storage facili is not expected to affect the geologic character or resources of the region. If an selected which required a storage area to be constructed, the ground surface would necessary to prepare the surface. This would not affect the geological characteris ing layers nor the characteristics of the Koolou and Wainae aquifers or vadose zone alternative of storing fuel in a water pool facility, the ground surface would need depth of approximately 40 feet. This excavation would not affect the geological ch area.

5.1.4.7 Air Resources

5.1.4.7.1 Radiological Consequences.

No airborne radionuclide releases from normal operations are expected to occur as a result of naval spent nuclear fuel being stor containers. The fuel would be contained such that at least two barriers exist to p products from becoming airborne. These barriers would retain the naval spent nucle air-tight containment until it is moved to a permanent storage site and there would radioactive material released from routine operations for this method of storage. exposure would be direct radiation from the array of filled storage containers. Th containers would be fenced off and shielded if necessary such that there would be n effect on normal background radiation levels at the site perimeter.

For the alternative where naval spent nuclear fuel would be stored in a water radionuclide releases are expected to be less than the emissions from the Idaho Nat Laboratory (INEL) Expended Core Facility (ECF) because the water pool size would be naval spent nuclear fuel inspection operations beyond visual examinations would be shielded cell operations would be conducted at Pearl Harbor. To conservatively est radiological consequences, airborne releases based on ECF releases from 1991 are us radiological source term used and the detailed calculations performed to determine expected normal releases are provided in Attachment F.

The radiation exposures to human beings due to estimated radionuclide release atmosphere plus direct radiation from the stored naval spent nuclear fuel at the sh alternative involving water pool storage and the alternative involving dry storage described in Attachment F.

A person on the shipyard boundary at the location where the largest exposures received was used as the hypothetical maximally exposed off-site individual (MOI) f releases of radioactive material from the stored naval spent nuclear fuel. The pop calculate population exposures were taken from 1990 census data provided by the U.S Bureau. Meteorology data were obtained as described in Attachment F. Estimated ex workers were also calculated.

The hypothetical exposures calculated are based on an exposure to the estimat effluents and the direct radiation exposure for one year from the naval spent nucle shipyard. The calculations include the external effective equivalent exposure from deposition, deposition to surface water, and air immersion pathways and the 50-year effective equivalent exposure from internal exposure through the ingestion and inha

All pathways were considered for persons potentially exposed, except that the inges omitted for the workers because they do not grow their food on-site. Solubilities produce the highest calculated exposures were chosen for internal exposure factors. human dietary consumption patterns were taken from "Age Dependent Values of Dietary Assessing Human Exposures to Environmental Pollutants" (Rupp 1980). The hypothetic calculated can be converted into a risk of fatal cancer or a risk of non-fatal heal non-fatal cancers, hereditary defects) based on recommendations of the Internationa Radiological Protection (ICRP 1991).

Attachment F summarizes the calculated exposures and fatal cancers to the wor maximally exposed off-site individual (MOI), nearest public access (NPA), and the p releases of radioactivity and direct radiation exposure in one year for each locati Section 3.7 provides a comparison of the annual number of fatal cancers calculated population for each location and alternative.

The number of fatal cancers calculated is so small that there would be essent cancers resulting from the storage of naval spent nuclear fuel during the time it c expected to continue to be stored. Putting this into perspective, it could be stat the population might experience a fatal cancer due to incident-free storage of nava at Pearl Harbor if operations continued for 14,300 years.

5.1.4.7.2 Non-radiological Consequences.

As noted in Attachment F, no increase in non-radioactive airborne emissions would be expected to result from naval spent nuclear facility operations. Storage facility operations would not involve use of carcinog pollutants, or other hazardous or toxic chemicals except that small quantities of i agents and paint thinner may be used for housekeeping and cleanliness control and t same as those already used at the shipyard. Consequently, there would be no impact quality as a result of implementing any of the alternatives at the shipyard.

If an alternative were to be selected that required a storage facility to be renovated, fugitive dust emissions would be expected to result from excavation oper quantity of dust generated would be small, consistent with typical excavation activ within local requirements for dust control.

5.1.4.8 Water Resources

5.1.4.8.1 Radiological Consequences.

Naval spent nuclear fuel storage operations at Pearl Harbor would not result in discharges of radioactivity in liquid effluents during r regardless of the alternative selected for storage of naval spent nuclear fuel. Th fallout of nuclides released to the air onto the surface water is included in the a discussed in Section 5.1.4.7. The air fallout impact is so small that there would radiation levels in the water.

Based on FIRM and topographical maps of areas approximately three miles away, considered for the interim storage of naval spent nuclear fuel is in the 100-year f the location considered for naval spent nuclear fuel is not in a high-hazard area (10, Part 1022 of The Code of Federal Regulations for floodplains) which is an area flooding occurs. Since the majority of the shipyard is already developed and cover material, construction and operation of a naval spent nuclear fuel storage facility would produce no discernible impacts on the floodplain.

Flooding in the area where shipping and immobile dry storage containers are s result in any adverse environmental consequences. These containers are completely no radioactivity would be released from the interior even if they were completely s addition, the massive nature of these containers prevents them from floating or mov flood.

Since the shipyard resides in close proximity to a floodplain, the design of equipment would minimize the potential for flooding and damage to the facility. Ho event a water pool facility would be flooded, the exchange of pool water with the f occur. As discussed in Attachment F, Section F.1.4.2.1.6.2, the radioactivity conc ECF water pool is below the Nuclear Regulatory Commission limits specified in Title The Code of Federal Regulations for liquid effluent except for Co-60 which is sligh pools used for storage or examination of naval spent nuclear fuel would be maintain

concentrations). Any release of radioactivity would have to result from the exchan with the pool water. This exchange would reduce the level of radioactivity even fu Consequently, no adverse environmental impacts would result from flooding of water spent nuclear fuel storage sites.

5.1.4.8.2 Non-radiological Consequences.

Other than chemicals used to maintain the storage
area, no hazardous wastes would be generated by the storage of naval spent nuclear Harbor. Any hazardous liquid effluents that may be generated at the storage area w of at an Environmental Protection Agency approved disposal site.

The only source for liquid discharges from the naval spent nuclear fuel stora the environment consists of storm water runoff which would be consistent with the t associated with common light industrial facilities and related activities. It can would be no impact to the human environment due to runoff water from the naval spen storage area.

The increased water usage under any of the alternatives would be negligible c existing shipyard demand.

5.1.4.9 Ecological Resources

There are no threatened or endangered species known to exist within the Pearl shipyard and no major changes to the industrial environment are planned. Therefore ecological impacts to the region would result from selection of any of the alternat

The conceptual location where naval spent nuclear fuel would be stored is ill Attachment D. This location is within an existing industrial complex and is surrou and paved areas. The industrial nature of the shipyard and the fact that the land disturbed from its natural state by earlier activities mean that plant or animal sp disturbance by human activities would not be expected to be present. Therefore, th ecological impacts associated with construction or operation of a spent nuclear fue location. The radiological controls that are in effect at the shipyard ensure that the vicinity of the shipyard are maintained at or near natural background. Since t would be applied to spent nuclear fuel activities, no ecological effects due to rad would be expected to occur.

5.1.4.10 Noise

Pearl Harbor is an existing industrial-type environment characterized by nois automobile traffic; ship loading cranes and related diesel-powered equipment; and c operating transmission lines for steam, fuel, water, and related pumping systems fo liquids. No ambient noise level increases are expected to occur as a result of any Therefore, no noise impacts would be expected to occur.

5.1.4.11 Traffic and Transportation

Shipments of radioactive materials in the Naval Nuclear Propulsion Program ar be made in accordance with applicable regulations of the U.
S. Department of Transportation,
U.S. Department of Energy, and the U.S. Nuclear Regulatory Commission. The purpose regulations is to ensure that shipments of radioactive material are adequately cont environment and the health and safety of the general public. These regulations are radioactive material shipments and provide requirements for the container design, c identification as applicable for the specific quantity, type, and form of radioacti shipped. Naval shipping container design requirements invoke shielding and integri and meet all regulatory requirements. They provide for testing of container design qualification of workers who construct containers, and quality control inspections ensure that the containers will meet their design requirements. A detailed descrip containers used for naval spent nuclear fuel shipments is provided in Attachment A. the impacts from normal and accident conditions associated with transportation of n fuel is provided in Attachment A.

5.1.4.11.1 Regional Infrastructure.

The alternatives under consideration are described in Section 3. The No Action alternative or the first variation of the Decentralization altern naval spent nuclear fuel on-site. This alternative would reduce the number of rail shipyard or prototype site compared to the past practice of transporting all naval INEL. The second variation of the Decentralization alternative would ship about 10 naval spent nuclear fuel to Puget Sound. This would have some transportation impac much as transporting all naval spent nuclear fuel off-site. The third Decentraliza all naval spent nuclear fuel to INEL, examines it, and returns it to the original s site. This alternative involves more transportation than the previous practice of spent nuclear fuel to INEL, since the naval spent nuclear fuel is not returned from original site. The 1992/1993 Planning Basis alternative, the Regionalization at IN the Centralization at INEL alternative would involve the same transportation as has the past, namely transportation to INEL and retention there. The Centralization al Hanford Site would result in more transportation impact than any of the previous al the distances and population distribution between Hanford and the shipyards and pro Centralization alternative at the Savannah River Site would result in the most tran naval spent nuclear fuel of any of the alternatives.

5.1.4.11.2 Site Infrastructure.

The alternative associated with naval spent nuclear fuel storage at Pearl Harbor would not affect local highway traffic because any increase in the wor represent a very small incremental increase in overall traffic to and from the ship be no change in the internal traffic in the shipyard because naval spent nuclear fu temporarily even when it is transported off-site.

5.1.4.12 Occupational and Public Health and Safety

Detailed analyses of incident-free naval spent nuclear fuel transportation an handling impacts on worker and public health are described in Attachment A (transpo Attachment F (storage and inspection).
The transportation analysis results, and the storage and handling analysis are summarized separately in the following subsections.

5.1.4.12.1 Incident-free Transportation Occupational and Public Health and Safety.

The radiological and non-radiological health effects associated with the incident-free tation of naval spent nuclear fuel and test specimens have been assessed for the ge tion workers, and hypothetical maximum exposed individual for each alternative. As Section 3.7, it is unlikely that there will be any fatal cancers as a result of nav and test specimen shipments since the estimates are much less than one fatal cancer alternative. The details of the transportation analysis are provided in Attachment

5.1.4.12.2 Incident-free Occupational and Public Health and Safety During Naval Spent

Nuclear Fuel Storage and Handling.
The public health and safety impacts of radioactivity releases and direct radiation from storage of naval spent nuclear fuel were analyzed as disc Section 5.1.4.7 and Attachment F. Attachment F summarizes the results of the analy ity releases and direct radiation from stored naval spent nuclear fuel. This analy exposure to the worker, maximally exposed off-site individual, and nearest public a naval spent nuclear fuel would result in far less than one fatality per year. For be stated that one member of these population groups might experience a fatal cance of naval spent nuclear fuel at Pearl Harbor if operations continued for 14,300 year

Projections of the number of occupational accidents that might occur during c operation of naval spent nuclear fuel storage and examination facilities have been

alternative. These projections are presented in Attachment F. Based on the result projections, it is concluded that the number of occupational fatalities and injurie construction activities and storage and examination operations would be very small tive.

No public or occupational radiological health and safety impacts would be exp from naval spent nuclear fuel storage area construction activities since the constr involve radioactive work.

Attachment F also discusses toxic chemical issues for naval spent nuclear fue storage. Attachment F concludes that there would be no additional types or volumes required at the shipyards or prototype site for naval spent nuclear fuel storage. incident-free non-radiological impact resulting from storage of naval spent nuclear shipyards or prototype site.

5.1.4.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling.
As discussed in the
preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the management of naval spent nuclear fuel at the Pearl Shipyard would be small under any of the alternatives considered. For example, it single fatal cancer would occur as a result of naval spent nuclear fuel management alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred. The wind directions at Pearl Harbor are wind direction which occurs most frequently is toward the southwest, away from land areas. Similarly, the conclusion is not affected by concerns related to subsistenc or game since environmental monitoring in the vicinity of this relatively small and shown no detectable difference in the amounts of radioactivity present in the envir in similar parts of the region.

To place the impacts on environmental justice in perspective, the risk associ naval spent nuclear fuel management operations under any of the alternatives consid less than one fatality per year for the entire population. For comparison, in 1990 approximately 510,000 cancer deaths in the United States population and there were cancer deaths among people of color in the U. S. Even if all of the impacts associ the alternatives considered for naval spent nuclear fuel management were assumed to among people of color, that group would be unlikely to experience a single addition in any year. Therefore, the cancer risk for that population from naval spent nucle would not constitute a disproportionately high and adverse impact on human health o ment. The same conclusion can be drawn for low-income groups.

5.1.4.13 Utilities and Energy

If an alternative associated with the storage of naval spent nuclear fuel at to be selected, construction and operation of the storage area would not be expecte expenditure of utilities and energy resources.
Construction activities would require quantities of water
and electricity typical of any small to medium size construction project. Operatio facility would likely require only small amounts of electricity for lighting and to equipment necessary to move spent nuclear fuel (e.g., cranes). Alternatives associ pool storage would require heating, ventilation, water, and electrical systems suit environment and to properly filter and exhaust the airborne discharges to the atmos and energy demands would be less than those required to operate ECF (10,000 MWh per (Section 5.2.13) since the water pool used for spent fuel storage would be smaller operations beyond visual examinations would be conducted in the water pool.

The amount of utilities and energy expected to be consumed would be a small i increase in the total amount of utilities and energy used at the shipyard and would discernible environmental consequence.

5.1.4.14 Facility and Transportation Accidents

5.1.4.14.1 Facility Accidents. There has never been an accident in the history of the Naval

Nuclear Propulsion Program that resulted in a significant release of radioactivity or that resulted in radiation exposure to workers in excess of abnormal occurrence as defined by the U.S. Nuclear Regulatory Commission. A description of potential a considered and a summary of the accident analyses that were conducted with regards naval spent nuclear fuel is contained in Attachment F.

5.1.4.14.1.1 Radiological Accidents. Section 3.7.3 provides a summary of the impacts

due to the most severe accidents considered for each site. The facility accident w potential impact at Pearl Harbor involves an airplane crash. An accident of this m result in a calculated 26 fatal cancers to the general population over 50 years, as Attachment F. The likelihood of such an accident occurring is 1 x 10-5, which is v perspective, an accident such as this would not be expected to occur unless the fac about 100,000 years.

5.1.4.14.1.2 Non-radiological Accidents. As discussed in detail in Attachment F, the

limiting hypothetical non-radiological accident for naval spent nuclear fuel storag shipyard or prototype location would be a diesel fuel spill and fire. A catastroph fuel storage tank that might be used for an emergency diesel generator to provide b power was postulated to occur, resulting in the spilling of the entire quantity of subsequent fire. The fire would generate the following toxic chemicals:

- Carbon monoxide
- Oxides of nitrogen (90% nitric oxide and 10% nitrogen dioxide)
- Lead
- Sulfur dioxide.

Measures would be taken to reduce the health impacts of potential releases of These measures would involve controls to protect both workers and the general publi shipyard and prototype sites have emergency planning, emergency preparedness, and e response programs in place to protect both workers and the public, and involve esta such as warning communications, fire departments, and emergency command centers.

The airborne concentrations of the combustion products listed above, resultin were calculated at the locations of the on-site individuals, an individual at the s general population within a 50-mile radius of the facility. Detailed results are p Attachment F. If the accidental fire that has been hypothesized were to actually o measures that would be in place would ensure no adverse health impacts to the gener minimal health impacts to the workers.

5.1.4.14.2 Transportation Accidents.

Shipments of radioactive materials associated with naval spent nuclear fuel have never resulted in any measurable release of radioactivity t (NNPP 1994a). There have never been any significant accidents involving release of material during shipment since the Naval Nuclear Propulsion Program began. The eff transportation accidents during the various stages of transportation of naval spent presented in Attachment A.

The health effects associated with accidents during shipments of naval spent test specimens have been assessed for the general population and the hypothetical m individual for each alternative. As summarized in Section 3.7, it is unlikely that fatal cancers as a result of naval spent nuclear fuel and test specimen shipments s much less than one fatal cancer for each alternative. The details of the transport provided in Attachment A.

5.1.4.14.3 Other Impacts of Accidents.

In addition to the possible human health effects
associated with facility or transportation accidents described in the preceding sec
such as the impacts on socioeconomics and land use in the area and the costs of cle
estimated in order to develop a perspective and to evaluate potential differences a
The analyses described in Attachment F showed that an area ranging from about 8 acr
approximately a quarter mile (for an inadvertent criticality accident) to about 110
approximately 0.9 mile (for a large airplane crashing into a dry storage container)
nated to the point where exposure could exceed 100 millirem per year. Beyond these
exposure would be less than 100 millirem per year, the Nuclear Regulatory Commissio
for protection of the general population from radiation. Persons who live in this
evacuated or otherwise experience restrictions in their daily activities for a brie
who work at locations within this area might be prevented from going to their jobs
been taken to reduce the potential for exposure. It should be noted that all of th
about three-quarters of a mile from the spent nuclear fuel facility would be within
the federally owned site.

An accident might result in short-term restrictions on access to a relatively
there would be no enduring impacts on cultural or similar resources or concerns suc
Hawaiian rights or interests, partially because the area involved would be small an
remedial actions would be conducted in a careful, controlled manner in full complia
applicable laws and regulations. The area impacted would vary only slightly among
considered. Overall, the risks are small so these considerations do not assist in
alternatives.

Facility or transportation accidents associated with any of the alternatives
appreciable effect on the ecology of the area, considering the potential for human
the amount of land which might be affected, as described in earlier parts of this s
little consensus among scientists on methods for estimating the effects of radiatio
resources such as plant or animal life, but since human health effects for all the
small and most plants and animals are not thought to be more sensitive to radiation
beings, the small impacts on human health provide an indication that the impacts on
species in the area would also be small for all alternatives considered. Similarly
which might be contaminated to measurable levels by chemicals or radioactive materi
hypothetical accidents would be relatively small, any effects on the ecology would
areas. There are no endangered or threatened species unique to the area surroundin
owned site, so an accident would not be expected to result in destruction of any sp
alternatives considered. The effects of accidents related to any of the alternativ
cleanup which might be performed would be localized in a small area extending only
beyond the boundaries of the federally owned site and thus would not be expected to
affect the potential for survival of any endangered or threatened species which mig
or other habitat in the area. Based on these considerations, evaluation of impacts
ecological resources does not help to distinguish among alternatives.

5.1.4.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear

Fuel Storage and Handling.
As discussed in the preceding paragraphs, the impacts on human
health or the environment resulting from facility or transportation accidents assoc
management of naval spent nuclear fuel at the Pearl Harbor Naval Shipyard would be
of the alternatives considered. For example, it is unlikely that a single addition
occur as a result of naval spent nuclear fuel management activities under any alter
potential impacts due to an accident for any of the alternatives considered would p
risk and do not constitute a credible adverse impact on the surrounding population,
from accidents associated with the management of naval spent nuclear fuel would be
particular segment of the population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp
health or the environment is not affected by the prevailing winds or direction of s
water flow. This is because the consequences of any accident would depend on the r
conditions in effect at the time an accident occurred. The wind directions at Pear
variable, but the wind direction which occurs most frequently is toward the southwe
land and residential areas.

To place the impacts on environmental justice in perspective, the risk associ
accidents caused by naval spent nuclear fuel management under any of the alternativ
would amount to less than one additional fatality per year in the entire population

in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.1.4.15 Waste Management

The alternative in which naval spent nuclear fuel is stored at Pearl Harbor w limited amounts of solid municipal waste, solid low-level radioactive wastes, and h In addition, no transuranic or high-level radioactive wastes would be generated by activities at the site under any alternative. The quantity of industrial wastes ge and most likely consist of industrial cleaning agents of the type normally encounte Small quantities of sanitary wastes would result from the additional work force but be small. The wastes produced from the storage of naval spent nuclear fuel would b minimized in accordance with the existing waste management programs at Pearl Harbor of additional wastes generated would be minimal compared to the existing baseline a cause any adverse impacts to public health and safety and the environment in the vi Harbor.

5.1.4.16 Cumulative Impacts

5.1.4.16.1 Radiological Cumulative Impacts. Spent nuclear fuel storage at the site would not

result in discharges of radioactivity in liquid effluents during routine operations alternative selected. Therefore, there would be no incremental addition of radioac ground water as a result of normal operations for any alternative. For alternative storage of spent nuclear fuel in dry storage and shipping containers, no airborne r emissions are expected, so there would be no cumulative air quality impacts associa storage methods. Consequently, the only radiological cumulative impacts that would storage alternatives would be due to direct radiation exposure from the stored cont nuclear fuel.

For alternatives involving the storage of naval spent nuclear fuel in water p be no discernible direct radiation exposure to the public from the fuel elements du provided by the water in the pool. Therefore, any cumulative impacts which would r pool storage would be primarily due to airborne emissions, and the addition of thes cause an indiscernible change in the emissions in the area (see Section 5.1.4.7). the site are in compliance with Title 40, Code of Federal Regulations, Part 61, "Na Standards for Hazardous Air Pollutants." Cumulative air emissions would not threat applicable air quality requirement or regulation, either federal, state, or local i non-radiological categories.

A summary of the cumulative radiological impacts is provided in the following An overview of the historical radiological impacts from naval nuclear operati Harbor and from transportation of naval spent nuclear fuel is provided in Section 4 detailed analyses are provided in Attachments F and A. Prior to this time, naval s inspections and storage operations have been conducted only at INEL. Therefore, no impacts have resulted from previous naval spent nuclear fuel inspection and storage alternate site except for INEL.

The radiological impacts associated with the alternative where naval spent nu be stored at Pearl Harbor are very small and are described in Section 5.1.4.12, wit results of analyses provided in Attachment F. In order to calculate cumulative imp between 1995 and 2035, the annual radiological impacts associated with each locatio were summed over 40 years. The results of this summation are tabulated in Tables 3 Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the population in the vicinity of Pearl Harbor from all

considered would be approximately 5.6 person-rem. This means that there would be m one fatal cancer from these operations over the entire 40-year period evaluated. T a theoretical maximally exposed off-site individual living at the shipyard boundary 40-year period would be 8.0 x 10-4 rem due to the alternative resulting in the larg maximally exposed off-site individual would have a 4.0 x 10-7 risk of contracting a his or her lifetime due to storage of spent nuclear fuel. When existing site radio naval nuclear operations are added to the impacts of the most limiting spent nuclea the exposure to the population would be 6.8 person-rem and to the maximally exposed individual would be 9.2 x 10-4 rem. This still results in much less than one fatal population and the risk of the maximally exposed off-site individual contracting a his or her lifetime is 4.6 x 10-7.

The total exposure related to naval spent nuclear fuel activities to a worker working continually 100 meters from the spent nuclear fuel under the alternative re largest exposure is 8.4 x 10-2 rem accumulated over 40 years. That corresponds to of 3.4 x 10-5 during the worker's lifetime. The exposure to the same worker when e radiological impacts due to naval nuclear operations are added to the spent nuclear essentially the same. The impacts associated with transportation of naval spent nu the alternatives considered would be similarly low.

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

Sections 4.1.4.14 and 5.1.4.15 describe the management of low-level radioacti mixed waste at the site. The volume of low-level radioactive wastes which would be the alternatives has not been calculated. However, considering the nature of radio would be associated with spent nuclear fuel storage activities, the amount of low-l waste produced during spent nuclear fuel activities would be much less than 20 perc site generation rate (84 m3 per year). This additional radioactive waste would not changes to the site's waste management practices. The small amount of additional m would not impose any discernible additional stress on the capacity of the radioacti ground. Therefore, any cumulative impacts associated with the generation and dispo low-level wastes would be very small.

Since no mixed, transuranic, or high-level radioactive wastes would be genera nuclear fuel activities at this site under any alternative, there would be no cumul associated with these materials.

5.1.4.16.2 Non-radiological Cumulative Impacts.

An overview of the historical non-radiologi-
cal impacts from naval nuclear operations at Pearl Harbor and from transportation o nuclear fuel is provided in Section 4.1.4.12 and detailed analyses are provided in A. Prior to this time, naval spent nuclear fuel inspections and storage operations conducted only at INEL. Therefore, no non-radiological cumulative impacts have res previous naval spent nuclear fuel inspection and storage operations at any alternat INEL.

The non-radiological impacts associated with the alternative where naval spen would be inspected or stored at Pearl Harbor are described in Section 5.1.4.12, wit results of analyses provided in Attachment F. As summarized in Section 5.1.4.12, t additional chemicals required at the shipyard for naval spent nuclear fuel storage non-radiological impacts from normal operations. Consequently, no cumulative impac or water resources would result since the incremental addition of chemicals at the result from naval spent fuel activities would be very small. There are no current problems associated with these materials.

The non-radiological cumulative transportation impacts for the population fro nuclear fuel transportation activities since the beginning of the Naval Nuclear Pro also have been calculated. In addition, the cumulative impacts from transportation nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A. The non-impacts associated with the transportation and storage of naval spent nuclear fuel alternatives considered would be low.

No cumulative land use impacts would be expected to occur as a result of spen storage. The land that would be dedicated for this purpose is on existing federal in an industrial setting which has already been disturbed from its natural state. space for storage of spent nuclear fuel would not result in the need to disturb und

additional land to be added to the federally owned property in the foreseeable futu

From a socioeconomic perspective, the introduction of naval spent nuclear fue the site would create a small number of additional jobs and could have a very small socioeconomic impact. The site currently employs approximately 5000 civilian perso shipyard employment has been associated with spent nuclear fuel activities in the p nuclear fuel activities have not been conducted at the site. An average of approxi additional jobs might be added as a result of possible spent nuclear fuel activitie peak number of additional jobs created at the site in any given year would be appro which is associated with construction and operation of a water pool facility for st nuclear fuel. Considering that the regional labor force consists of approximately the additional number of added jobs under any alternative would have little or no d socioeconomic impact. These jobs would be filled either from within the existing s from the available regional labor force without discernible effect. There are no f projects planned at the site and no known projects planned in the region that would number of workers involved in naval spent nuclear fuel activities to become an impo

The cumulative impacts associated with non-radiological waste management are expected to be small. As stated previously, any industrial wastes generated from n fuel storage would be small and limited to industrial cleaning agents of the type n at the site. The volume of municipal solid wastes and sanitary wastes which would expected to be proportional to the number of additional workers added, and this sma increase would not be discernible. The amount of additional non-radiological waste not introduce any changes to the site's waste management practices and would not im additional stress on the capacity of on-site or off-site waste disposal or treatmen any cumulative impacts associated with the generation and disposal of additional wa small. There are no current environmental problems associated with these types of

5.1.4.17 Unavoidable Adverse Effects

There are no discernible unavoidable adverse effects associated with the impl any of the alternatives and none which would help to choose among the alternatives. The alternative
in which naval spent nuclear fuel is stored at Pearl Harbor would cause the public small amounts of radiation, described in Section 5.1.4.12, and would result in less effect in the entire population surrounding the shipyard. Similarly, continued ope facility would produce limited amounts of solid municipal waste and solid low-level These amounts of waste would not produce any major impacts in the vicinity of the s will be no changes to the ecological, cultural, geological, and aesthetic resources implementation of any of the alternatives. There would also be no expected impact levels.

5.1.4.18 Irreversible and Irretrievable Commitments of Resources

The only irreversible and irretrievable commitment of resources that results alternative in which naval spent nuclear fuel would be stored at Pearl Harbor would which would be spent by the federal government to construct the necessary facilitie The total cost
of storing spent naval nuclear fuel at the shipyards and prototype ranges from appr billion to $5.7 billion. This cost represents the total cumulative cost over the 4 the shipyards and prototype. This cost includes construction costs of the new stor depending on the alternative selected, the operation of a limited examination facil Naval Shipyard combined with the costs associated with shutting down ECF, or the op of the INEL-ECF. The major expense in the highest cost alternatives is the procure containers. Refer to Section 3.7 for a comparison of the total cumulative costs am

5.1.5 KENNETH A. KESSELRING SITE: WEST MILTON, NEW YORK

5.1.5.1 Overview of Environmental Impacts

The following sections discuss the major differences in potential environment associated with the choice of the alternatives that include storage of naval spent Kenneth A. Kesselring Site. The environmental consequences associated with the sto

spent nuclear fuel at the Kesselring Site are based on the estimates of naval spent would be stored at the Kesselring Site through the year 2035 and current knowledge features associated with spent fuel storage systems. The review of the environment associated with these alternatives has shown that the impact on the environment at associated with these activities is very small. There would be no impact to the en vicinity of the Kesselring Site associated with any alternatives that do not involv

5.1.5.2 Land Use

Construction of a storage area at the Kesselring Site for temporary storage o nuclear fuel would require little rearrangement of existing on-site facilities. Th industrial site; therefore, there would be no impact on land use. A description of containers and water pools and their approximate locations is provided in Attachmen C provides a comparison of naval spent nuclear fuel storage in water pools versus d storage.

No additional land within or outside the Kesselring Site would be required fo Native American rights and interests would not be modified by construction or associated with any of the alternatives considered.

5.1.5.3 Socioeconomics

The calculated number of direct construction and operating jobs that would be 10-year period between 1995 and 2004 for each storage alternative at the Kesselring in Table 5.1.5-1. Since there would be no naval spent nuclear fuel storage or insp the Site under the 1992/1993 Planning Basis and Centralization alternatives, no add be required at the Site under these alternatives.

Table 5.1.5-1. Number of construction and operating jobs created at the Kesselring for each alternative.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	200
Railcar(1)	1	1	6	1	1	1	1	1	1	1
Immobile Containers on Pads(2)	1	1	1	1	2	6(3)	3	3	3	3
Shipping Containers on Pads (2)	1	1	1	1	2	6(3)	1	1	1	1
Water Pools(2)	16	16	43	66	81	58	62	24	24	24

(1) Storage mode under the No Action and Decentralization alternatives.
(2) Storage mode under the Decentralization alternative.
(3) The construction jobs would last less than one year.

The only discernible socioeconomic consequence from the alternative of storin nuclear fuel at the Kesselring Site is that a relatively small number of constructi from a few to a maximum of several hundred would be required for construction of th The work force would consist of skilled craftsmen and unskilled laborers. This wor needed during the storage facility construction and would be available from within

The operation of the naval spent nuclear fuel storage area using dry storage require additional workers. Personnel are required to secure fuel in the storage a surveillance and monitoring activities associated with naval spent nuclear fuel sto the alternative involving storing fuel in immobile dry storage containers, about 20 required to handle the spent nuclear fuel when it is placed into the storage contai force would normally only be needed when fuel is being inserted into the containers alternative involving shipping containers, fewer workers would be needed to handle containers in the storage area. If the alternative of storing naval spent nuclear were selected, approximately 20 workers would be required. These workers would be supplied from either within the existing Kesselring Site work force or from the loc Considering that the Kesselring Site employs approximately 1450 workers, the additi support the alternatives would have no discernible impact on the local socioeconomi Kesselring Site.

For the alternatives where dry storage containers would be manufactured, some jobs would be created in the locations where the containers are made. The process container manufacturer is subject to federal procurement requirements and would be Record of Decision. Consequently, the specific socioeconomic impacts from containe

cannot be specified. The net effect of container fabrication would be to create ad bolster the local economy of the area(s) where containers are made. It is consider selection of the contractor would depend on the alternative storage site selected, with construction of casks provide no basis for selection of a storage site.

5.1.5.4 Cultural Resources

No site that is listed on the National Register of Historic Places (NPS 1991) archaeological areas, or any other cultural resources would be affected by the stor nuclear fuel at the Kesselring Site. Therefore, there would be no impact to cultur the alternative of storing naval spent nuclear fuel at the Kesselring Site.

None of the alternatives considered would impact known archaeological or Nati sites. Procedures which comply with all applicable laws and regulations would be i protect previously undetected archaeological and cultural sites.

5.1.5.5 Aesthetic and Scenic Resources

The naval spent nuclear fuel storage area would be located in an existing are security perimeter of the Kesselring Site which is an existing light industrial set minor changes to the Site resulting from the storage of spent fuel. No aesthetic o the vicinity of the Site or on the Site would be affected by the operation of the s existing industrial use areas would be used to store the spent fuel. The visual qu would not be affected since the storage area would be compatible with the landscape Kesselring Site. There are no particulate air emissions associated with storage of fuel and thus no visibility impacts are expected.

5.1.5.6 Geology

The operation of the naval spent nuclear fuel storage area at the Kesselring expected to affect the geologic character or resources of the region. If an altern that required a dry container storage area to be constructed, the ground would only necessary to prepare the surface. This would not affect the geological characteris ing layers nor the characteristics of an aquifer or vadose zone. For the alternati water pool facility, the ground surface would need to be excavated to a depth of ap feet. This excavation would not affect the geological characteristics of the area.

5.1.5.7 Air Resources

5.1.5.7.1 Radiological Consequences.

If the alternative where naval spent nuclear fuel would be stored in dry storage containers were to be selected, no airborne radioactivity rel expected to occur as a result of normal storage operations. The naval spent nuclea contained such that at least two barriers exist to prevent fission products from be These barriers would retain the naval spent nuclear fuel in an air-tight containmen to a permanent storage site and there would be no airborne radioactive material rel operations for this method of storage. The only radiation exposure would be direct array of filled storage containers. The filled storage containers would be fenced necessary such that there would be no distinguishable effect on the current radiati site perimeter.

For the alternative where naval spent nuclear fuel would be stored in a water radioactivity emissions are expected to be considerably less than that identified f Engineering Laboratory (INEL) Expended Core Facility (ECF) because the water pool s smaller, no naval spent nuclear fuel inspection operations beyond visual examinatio conducted, and no shielded cell operations would be conducted at the Kesselring Sit conservatively estimate the radiological consequences, airborne releases based on E 1991 are used. The radiological source term used and the detailed calculations per determine normal releases are provided in Attachment F.

The radiation exposures to human beings due to estimated radionuclide release atmosphere and direct radiation from the stored naval spent nuclear fuel at the Kes both the alternative involving water pool storage and the alternative involving dry

calculated as described in Attachment F.

A person on the Kesselring Site boundary at the location where the largest ex be received was used as the hypothetical maximally exposed off-site individual (MOI releases of radioactive material from the stored naval spent nuclear fuel. The pop calculate population doses were taken from 1990 census data provided by the U.S. Ce Meteorology data were obtained as described in Attachment F. Estimated exposures t also calculated.

The hypothetical exposures calculated are based on an exposure to the estimat effluents and the direct radiation exposure for one year from the naval spent nucle Kesselring Site. The calculations include the external effective exposure equivale deposition, deposition to surface water, and air immersion pathways and the 50-year effective exposure equivalent from internal exposure through the ingestion and inha All pathways were considered for the persons potentially exposed, except that the i was omitted for the workers at Kesselring because they do not grow their food on-si which would produce the highest calculated exposures were chosen for internal expos Values for human dietary consumption patterns were taken from "Age Dependent Values Intake for Assessing Human Exposures to Environmental Pollutants" (Rupp 1980). The exposures calculated can be converted into a risk of fatal cancer or a risk of non- detriments (e.g., non-fatal cancers, hereditary defects) based on recommendations o Commission on Radiological Protection (ICRP 1991).

Attachment F summarizes the calculated exposures and fatal cancers to the wor maximally exposed off-site individual (MOI), and the population from airborne relea ty and direct radiation exposure in one year for each location and storage mode. S a comparison of the annual number of fatal cancers calculated for the general popul location and alternative.

The number of fatal cancers calculated is so small that there would be essent cancers resulting from the storage of naval spent nuclear fuel during the time it c expected to continue to be stored. Putting this into perspective, it could be stat the population might experience a fatal cancer due to incident-free storage of nava at the Kesselring Site if operations continued for 24,400 years.

5.1.5.7.2 Non-radiological Consequences.

As noted in Attachment F, no increase in non- radioactive airborne emissions would be expected to result from naval spent nuclear operations. Storage area operations would not involve use of carcinogenic toxins, or other hazardous toxic chemicals except for small quantities of industrial cleani thinner that may be used for housekeeping and cleanliness control and these would b those already used at the Kesselring Site. Consequently, there would be no impact quality as a result of implementing any of the alternatives at the Site.

If an alternative were to be selected that required a storage facility to be renovated, fugitive dust emissions would be expected to result from excavation oper quantity of dust generated would be small, consistent with typical excavation activ within local requirements for dust control.

5.1.5.8 Water Resources

5.1.5.8.1 Radiological Consequences.

Naval spent nuclear fuel storage operations at the Kesselring Site would not result in discharges of radioactive liquid effluents duri regardless of the alternative selected for storage of naval spent nuclear fuel. Th fallout of nuclides released to the air onto the surface water is included in the a discussed in Section 5.1.5.7. The air fallout impact is so small that there would radiation levels in the water.

The Kesselring Site does not reside in the 100 or 500 year floodplain. Conse floodplain would not be impacted by spent naval nuclear fuel storage and examinatio Site.

5.1.5.8.2 Non-radiological Consequences.

Other than chemicals used to maintain the storage

area, no hazardous wastes would be generated by the storage of naval spent nuclear Kesselring Site. Any hazardous liquid effluents that may be generated at the stora disposed of at an Environmental Protection Agency approved disposal site.

The only source for liquid discharges from the naval spent nuclear fuel stora the environment consists of storm water runoff which would be consistent with the t associated with common light industrial facilities and related activities. It can would be no impact to the human environment due to runoff water from the naval spen storage area.

The increased water usage under any of the alternatives would be negligible c existing Site demand.

5.1.5.9 Ecological Resources

There are no known habitats for threatened or endangered species within the K and no major changes to the industrial environment are planned. Therefore, no ecol the region would result from selection of any of the alternatives.

The conceptual location where naval spent nuclear fuel would be stored is ill Attachment D. This location is within an existing industrial complex and is surrou and paved areas. The industrial nature of the Kesselring Site and the fact that th been disturbed from its natural state by earlier activities mean that plant or anim disturbance by human activities would not be expected to be present. Therefore, th ecological impacts associated with construction or operation of a spent nuclear fue location. The radiological controls that are in effect at the Kesselring Site ensu levels in the vicinity of the Site are maintained at or near natural background. S controls would be applied to spent nuclear fuel activities, no ecological effects d material would be expected to occur.

5.1.5.10 Noise

The Kesselring Site is an existing light industrial-type environment characte from truck and automobile traffic; diesel-powered equipment; and continuously opera lines for steam, fuel, water, and related pumping systems for these and other liqui no increase in ambient noise associated with any of the alternatives. Therefore, n would be expected to occur.

5.1.5.11 Traffic and Transportation

Shipments of radioactive materials in the Naval Nuclear Propulsion Program ar be made in accordance with applicable regulations of the U.
S. Department of Transportation,
U.S. Department of Energy, and the U.S. Nuclear Regulatory Commission. The purpose regulations is to ensure that shipments of radioactive material are adequately cont environment and the health and safety of the general public. These regulations are radioactive material shipments and provide requirements for the container design, c identification as applicable for the specific quantity, type, and form of radioacti shipped. Naval shipping container design requirements invoke shielding and integri and meet all regulatory requirements. They provide for testing of container design qualification of workers who construct containers, and quality control inspections ensure that the containers will meet their design requirements. A detailed descrip containers used for naval spent nuclear fuel shipments is provided in Attachment A. the impacts from normal and accident conditions associated with transportation of n fuel is provided in Attachment A.

5.1.5.11.1 Regional Infrastructure.

The alternatives under consideration are described in Section
3. The No Action alternative or the first variation of the Decentralization altern naval spent nuclear fuel on-site. This alternative would reduce the number of rail shipyard or prototype site compared to the past practice of transporting all naval INEL. The second variation of the Decentralization alternative would ship about 10 naval spent nuclear fuel to Puget Sound. This would have some transportation impac

much as transporting all naval spent nuclear fuel off-site. The third Decentraliza all naval spent nuclear fuel to INEL, examines it, and returns it to the original s site. This alternative involves more transportation than the previous practice of spent nuclear fuel to INEL, since the naval spent nuclear fuel is not returned from original site. The 1992/1993 Planning Basis alternative, the Regionalization at IN the Centralization at INEL alternative would involve the same transportation as has the past, namely transportation to INEL and retention there. The Centralization al Hanford Site would result in more transportation impact than any of the previous al the distances and population distribution between Hanford and the shipyards and pro Centralization alternative at the Savannah River Site would result in the most tran naval spent nuclear fuel of any of the alternatives.

5.1.5.11.2 Site Infrastructure.

The alternatives associated with storage of naval spent nuclear fuel at the Kesselring Site would have no impact on local highway traffic because a work force would represent a very small incremental increase in overall traffic to There would be no change in the internal traffic at the Kesselring Site because nav fuel is temporarily held on-site even when it is transported off-site.

5.1.5.12 Occupational and Public Health and Safety

Detailed analyses of incident-free naval spent nuclear fuel transportation an handling impacts on worker and public health are described in Attachment A (transpo Attachment F (storage and inspection).
The transportation analysis results, and the storage and handling analysis are summarized separately in the following subsections.

5.1.5.12.1 Incident-free Transportation Occupational and Public Health and Safety.

The radiological and non-radiological effects associated with the incident-free transpo nuclear fuel and test specimens have been assessed for the general population, tran and the hypothetical maximum exposed individual for each alternative. As summarize 3.7, it is unlikely that there will be any fatal cancers as a result of naval spent specimen shipments since the estimates are much less than one fatal cancer for each details of the transportation analysis are provided in Attachment A.

5.1.5.12.2 Incident-free Occupational and Public Health and Safety During Naval Spent

Nuclear Fuel Storage and Handling.
The public health and safety impacts of radioactivity releases and direct radiation from storage of naval spent nuclear fuel were analyzed as disc 5.1.5.7 and Attachment F. Attachment F summarizes the results of the analysis of r releases and direct radiation from stored naval spent nuclear fuel. This analysis exposure to the worker and maximally exposed off-site individual from stored naval would result in far less than one fatality per year. For perspective, it could be member of these population groups might experience a fatal cancer due to storage of nuclear fuel at the Kesselring Site if operations continued for 24,400 years.

Attachment F also discusses toxic chemical issues for naval spent nuclear fue storage. Attachment F concludes that there would be no additional types or volumes required at the shipyards or prototype site for naval spent nuclear fuel storage. incident-free non-radiological impact resulting from storage of naval spent nuclear shipyards or prototype site.

Projections of the number of occupational accidents that might occur during c operation of naval spent nuclear fuel storage and examination facilities have been alternative. These projections are presented in Attachment F. Based on the result projections, it is concluded that the number of occupational fatalities and injurie construction activities and storage and examination operations would be very small tive.

No public or occupational radiological health and safety impacts would be exp

from naval spent nuclear fuel storage area construction activities since the constr involve radioactive work.

5.1.5.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling. As discussed in the preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the management of naval spent nuclear fuel at the Kessel small under any of the alternatives considered. For example, it is unlikely that a would occur as a result of naval spent nuclear fuel management activities under any the potential impacts due to normal operations or accident conditions for any of th considered present no significant risk and do not constitute a credible adverse imp surrounding population, no adverse effects would be expected for any particular seg population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the Kesselrin display any strongly dominant direction. Similarly, the conclusion is not affected to subsistence consumption of fish or game since environmental monitoring in the vi relatively small and restricted site has shown no detectable difference in the amou present in the environment from levels in similar parts of the region.

To place the impacts on environmental justice in perspective, the risk associ naval spent nuclear fuel management operations under any of the alternatives consid less than one fatality per year for the entire population. For comparison, in 1990 approximately 510,000 cancer deaths in the United States population and there were cancer deaths among people of color in the U. S. Even if all of the impacts associ the alternatives considered for naval spent nuclear fuel management were assumed to among people of color, that group would be unlikely to experience a single addition in any year. Therefore, the cancer risk for that population from naval spent nucle would not constitute a disproportionately high and adverse impact on human health o ment. The same conclusion can be drawn for low-income groups.

5.1.5.13 Utilities and Energy

If an alternative associated with storage of naval spent nuclear fuel at the to be selected, construction and operation of a naval spent nuclear fuel storage fa expected to require a large expenditure of utilities and energy resources. Operation of the storage facility would likely require only a small amount of electricity for lighting and t equipment necessary to move spent nuclear fuel containers (cranes etc.). Construct would require quantities of water and electricity typical of any small to medium si project. Alternatives associated with water pool storage would require heating, ve and electrical systems suitable for a work environment and to properly filter and e discharges to the atmosphere. The utility and energy demands would be less than th operate ECF (10,000 MWh per year) (Section 5.2.13) since the water pool for naval s fuel storage would be smaller and no inspections would be performed. The amount of energy expected to be consumed as a result of dry storage would be a small incremen the total amount of utilities and energy used at the Kesselring Site and would not discernible environmental consequences.

5.1.5.14 Facility and Transportation Accidents

5.1.5.14.1 Facility Accidents. There has never been an accident in the history of the Naval

Nuclear Propulsion Program that resulted in a significant release of radioactivity or that resulted in radiation exposure to workers in excess of abnormal occurrence as defined by the U.S. Nuclear Regulatory Commission. A description of potential a considered and a summary of the accident analyses that were conducted with regards naval spent nuclear fuel are contained in Attachment F.

5.1.5.14.1.1 Radiological Accidents. Section 3.7.3 provides a summary of the impacts

due to the most severe accidents considered for each site. The facility accident w potential impact at the Kesselring Site involves an airplane crash. An accident of would result in 7.5 fatal cancers to the general population over 50 years, as descr Attachment F. The likelihood of an airplane crash is 1 x 10-7. The facility accid risk involves accidental drainage of the water pool. The drained water pool accide less than one fatality over 50 years, but the likelihood of occurrence is 1 x 10-5.

5.1.5.14.1.2 Non-radiological Accidents. As discussed in detail in Attachment F, the

limiting hypothetical non-radiological accident for naval spent nuclear fuel storag shipyard or prototype location would be a diesel fuel spill and fire. A catastroph fuel storage tank that might be used for an emergency diesel generator to provide b power was postulated to occur, resulting in the spilling of the entire quantity of subsequent fire. The fire would generate the following toxic chemicals:

- Carbon monoxide
- Oxides of nitrogen (90% nitric oxide and 10% nitrogen dioxide)
- Lead
- Sulfur dioxide.

Measures would be taken to reduce the health impacts of potential releases of These measures would involve controls to protect both workers and the general publi shipyard and prototype sites have emergency planning, emergency preparedness, and e response programs in place to protect both workers and the public, and involve esta such as warning communications, fire departments, and emergency command centers.

The airborne concentrations of the combustion products listed above, resultin were calculated at the locations of the on-site individuals, an individual at the s general population within a 50-mile radius of the facility. Detailed results are p Attachment F. If the accidental fire that has been hypothesized were to actually o measures that would be in place would ensure no adverse health impacts to the gener minimal health impacts to the workers.

5.1.5.14.2 Transportation Accidents.

Shipments of radioactive materials associated with naval spent nuclear fuel have never resulted in any measurable release of radioactivity t (NNPP 1994a). There have never been any significant accidents involving the releas material during shipment since the Naval Nuclear Propulsion Program began. The eff transportation accidents during the various stages of transportation of naval spent presented in Attachment A.

The health effects associated with accidents during shipments of naval spent test specimens have been assessed for the general population and the hypothetical m individual for each alternative. As summarized in Section 3.7, it is unlikely that fatal cancers as a result of naval spent nuclear fuel and test specimen shipments s much less than one fatal cancer for each alternative. The details of the transport provided in Attachment A.

5.1.5.14.3 Other Impacts of Accidents.

In addition to the possible human health effects associated with facility or transportation accidents described in the preceding sec such as the impacts on socioeconomics and land use in the area and the costs of cle estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that an area ranging from about 8 acr approximately a quarter mile (for an inadvertent criticality accident) to about 110 approximately 0.9 mile (for a large airplane crashing into a dry storage container) nated to the point where exposure could exceed 100 millirem per year. Beyond these exposure would be less than 100 millirem per year, the Nuclear Regulatory Commissio for protection of the general population from radiation. Persons who live in this evacuated or otherwise experience restrictions in their daily activities for a brie

who work at locations within this area might be prevented from going to their jobs been taken to reduce the potential for exposure. It should be noted that all of th about three-quarters of a mile from the spent nuclear fuel facility would be inside the Kesselring Site.

An accident might result in short-term restrictions on access to a relatively there would be no enduring impacts on cultural or similar resources or concerns suc American rights or interests, partially because the area involved would be small an remedial actions would be conducted in a careful, controlled manner in full complia applicable laws and regulations. The area would vary only slightly among the alter Overall, the risks are small so these considerations do not assist in distinguishing among alternatives.

Facility or transportation accidents associated with any of the alternatives appreciable effect on the ecology of the area, considering the potential for human the amount of land which might be affected, as described in earlier parts of this s little consensus among scientists on methods for estimating the effects of radiatio resources such as plant or animal life, but since human health effects for all the small and most plants and animals are not thought to be more sensitive to radiation beings, the small impacts on human health provide an indication that the impacts on species in the area would also be small for all alternatives considered. Similarly which might be contaminated to measurable levels by chemicals or radioactive materi hypothetical accidents would be relatively small, any effects on the ecology would areas. There are no endangered or threatened species unique to the area surroundin owned site, so an accident would not be expected to result in destruction of any sp alternatives considered. The effects of any accident related to any of the alterna which might be performed would be localized in a small area which extends only a sh beyond the boundaries of the federally owned site and thus would not be expected to affect the potential for survival of endangered or threatened species which might o other habitat in the Saratoga area. Consequently, evaluation of impacts of acciden resources does not help to distinguish among alternatives.

5.1.5.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear

Fuel Storage and Handling.

As discussed in the preceding paragraphs, the impacts on human health or the environment resulting from facility or transportation accidents assoc management of naval spent nuclear fuel at the Kesselring Site would be small under alternatives considered. For example, it is unlikely that a single additional fata as a result of naval spent nuclear fuel management activities under any alternative impacts due to an accident for any of the alternatives considered would present no do not constitute a credible adverse impact on the surrounding population, no adver accidents associated with the management of naval spent nuclear fuel would be expec particular segment of the population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is because the consequences of any accident would depend on the r conditions in effect at the time an accident occurred, and the wind directions at t highly variable with no strongly dominant direction.

To place the impacts on environmental justice in perspective, the risk associ accidents caused by naval spent nuclear fuel management under any of the alternativ would amount to less than one additional fatality per year for the entire populatio in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.1.5.15 Waste Management

The alternative in which naval spent nuclear fuel is stored at the Kesselring produce limited amounts of solid municipal waste, solid low-level radioactive waste wastes.

In addition, no transuranic or high-level radioactive wastes would be generated by

nuclear fuel activities at the Kesselring Site under any alternative. The quantity generated would be small and most likely consist of industrial cleaning agents of t encountered at the Site. Small quantities of sanitary wastes would result from the force but this volume would be small. The wastes produced from the storage of nava fuel would be controlled and minimized in accordance with the existing waste manage at the Kesselring Site. The amount of additional wastes generated would be minimal existing baseline and would not cause any adverse impacts to public health and safe environment in the vicinity of the Kesselring Site.

5.1.5.16 Cumulative Impacts

5.1.5.16.1 Radiological Cumulative Impacts. Spent nuclear fuel storage at the Kesselring Site

would not result in discharges of radioactivity in liquid effluents during routine of the alternative selected. Therefore, there would be no incremental addition of surface or ground water as a result of normal operations for any alternative. For involving the storage of spent nuclear fuel in dry storage and shipping containers, radioactivity emissions are expected, so there would be no cumulative air quality i with these storage methods. Consequently, the only radiological cumulative impacts from dry storage alternatives would be due to direct radiation exposure from the st spent nuclear fuel.

For alternatives involving the storage of naval spent nuclear fuel in water p be no discernible direct radiation exposure to the public from the fuel elements du provided by the water in the pool. Therefore, any cumulative impacts which would r pool storage would be primarily due to airborne emissions, and the addition of thes cause an indiscernible change in the emissions in the area (see Section 5.1.5.7). the site are in compliance with Title 40, Code of Federal Regulations, Part 61, "Na Standards for Hazardous Air Pollutants." Cumulative air emissions would not threat applicable air quality requirement or regulation, either federal, state, or local i non-radiological categories.

A summary of the cumulative radiological impacts is provided in the following An overview of the historical radiological impacts from naval nuclear operati Kesselring Site and from transportation of naval spent nuclear fuel is provided in detailed analyses are provided in Attachments F and A. Prior to this time, naval s inspections and storage operations have been conducted only at INEL. Therefore, no impacts have resulted from previous naval spent nuclear fuel inspection and storage alternate site except for INEL.

The radiological impacts associated with the alternatives where naval spent n be stored at the Kesselring Site are very small and are described in Section 5.1.5. results of analyses provided in Attachment F. In order to calculate cumulative imp between 1995 and 2035, the annual radiological impacts associated with each locatio were summed over 40 years. The results of this summation are tabulated in Tables 3 Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the population in the vicinity of the Kesselring Site f alternatives considered would be approximately 3.28 person-rem. This means that th much less than one fatal cancer from these operations over the entire 40-year perio total exposure to a theoretical maximally exposed off-site individual living at the for the entire 40-year period would be 2.7 x 10-4 rem due to the alternative result exposure. This maximally exposed off-site individual would have a 1.4 x 10-7 risk fatal cancer during his or her lifetime due to storage of spent nuclear fuel. When radiological impacts due to naval nuclear operations are added to the impacts of th spent nuclear fuel alternative, the exposure to the population would be 5.6 person- maximally exposed off-site individual would be 4.8 x 10-4 rem. This still results one fatal cancer in the population and the risk of the maximally exposed off-site i a fatal cancer during his or her lifetime is 2.4 x 10-7.

The total exposure related to naval spent nuclear fuel activities to a worker working continually 100 meters from the spent nuclear fuel under the alternative re

largest exposure is 2.4 x 10-2 rem accumulated over 40 years. That corresponds to of 9.6 x 10-6 during the worker's lifetime. The exposure to the same worker when e radiological impacts due to naval nuclear operations are added to the spent nuclear 2.6 x 10-2 rem over 40 years which corresponds to a fatal cancer risk of 1.1 x 10-5 worker's lifetime. The impacts associated with transportation of naval spent nucle alternatives considered would be similarly low.

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

Sections 4.1.5.14 and 5.1.5.15 describe the management of low-level radioacti mixed waste at the site. The volume of low-level radioactive wastes which would be the alternatives has not been calculated. However, considering the nature of radio would be associated with spent nuclear fuel storage activities, the amount of low-l waste produced during spent nuclear fuel activities would be much less than 20 perc site generation rate (215 m3 per year). This additional radioactive waste would no changes to the Site's waste management practices. The small amount of additional m would not impose any discernible additional stress on the capacity of the radioacti ground. Therefore, any cumulative impacts associated with the generation and dispo low-level wastes would be very small.

Since no mixed, transuranic, or high-level radioactive wastes would be genera nuclear fuel activities at the Kesselring Site under any alternative, there would b impacts associated with these materials.

5.1.5.16.2 Non-radiological Cumulative Impacts.

An overview of the historical non-radiologi-
cal impacts from naval nuclear operations at the Kesselring Site and from transport nuclear fuel is provided in Section 4.1.5.12 and detailed analyses are provided in A. Prior to this time, naval spent nuclear fuel inspections and storage operations conducted only at INEL. Therefore, no non-radiological cumulative impacts have res previous naval spent nuclear fuel inspection and storage operations at any alternat INEL.

The non-radiological impacts associated with the alternative where naval spen would be inspected or stored at the Kesselring Site are described in Section 5.1.5. detailed results of analyses provided in Attachment F. As summarized in Section 5. would be no additional chemicals required at the prototype site for naval spent nuc and therefore no non-radiological impacts from normal operations. Consequently, no impacts to air quality or water resources would result since the incremental additi the Site that might result from naval spent fuel activities would be very small. T environmental problems associated with these materials.

The non-radiological cumulative transportation impacts for the population fro nuclear fuel transportation activities since the beginning of the Naval Nuclear Pro also have been calculated. In addition, the cumulative impacts from transportation nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A. The non- impacts associated with the transportation and storage of naval spent nuclear fuel alternatives considered would be low.

No cumulative land use impacts would be expected to occur as a result of spen storage. The land that would be dedicated for this purpose is on existing federal in an industrial setting which has already been disturbed from its natural state (a developed land). The conversion of this space for storage of spent nuclear fuel wo the need to disturb undeveloped land or for additional land to be added to the fede property in the foreseeable future.

From a socioeconomic perspective, the introduction of naval spent nuclear fue the Kesselring Site would create a small number of additional jobs and could have a cumulative socioeconomic impact. The site currently employs approximately 1450 civ No site employment has been associated with spent nuclear fuel activities in the pa nuclear fuel activities have not been conducted at the site. An average of approxi additional jobs might be added as a result of possible spent nuclear fuel activitie peak number of additional jobs created at the site in any given year would be appro which is associated with construction and operation of a water pool facility for st nuclear fuel. Considering that the regional labor force consists of approximately the additional number of added jobs under any alternative would have little or no d

socioeconomic impact. These jobs would be filled either from within the existing S from the available regional labor force without discernible effect. There are no f projects planned at the Site and no known projects planned in the region that would number of workers involved in naval spent nuclear fuel activities to become an impo

The cumulative impacts associated with non-radiological waste management are expected to be small. As stated previously, any industrial wastes generated from n fuel storage would be small and limited to industrial cleaning agents of the type n at the Kesselring Site. The volume of municipal solid wastes and sanitary wastes w generated is expected to be proportional to the number of additional workers added, incremental increase would not be discernible. The amount of additional non-radiol generated would not introduce any changes to the Site's waste management practices impose any additional stress on the capacity of on-site or off-site waste disposal Therefore, any cumulative impacts associated with the generation and disposal of ad would be very small. There are no current environmental problems associated with t waste.

5.1.5.17 Unavoidable Adverse Effects

There are no discernible unavoidable adverse effects associated with the impl any of the alternatives and none which would help to choose among the alternatives. The alternative
in which naval spent nuclear fuel is stored at the Kesselring Site would cause the to small amounts of radiation, described in Section 5.1.5.12, and would result in l effect in the entire population surrounding the Kesselring Site. Similarly, contin storage facility would produce limited amounts of solid municipal waste and solid l radioactive waste. These amounts of waste would not produce any major impacts in t the Kesselring Site. There will be no changes to the ecological, cultural, geologi resources due to the implementation of any of the alternatives. There would also b impact on ambient noise levels.

5.1.5.18 Irreversible and Irretrievable Commitments of Resources

The only irreversible and irretrievable commitment of resources that results tive in which naval spent nuclear fuel would be stored at the Kesselring Site would would be spent by the federal government to construct the necessary facilities. The total cost of
storing spent naval nuclear fuel at the shipyards and prototype ranges from approxi to $5.7 billion. This cost represents the total cumulative cost over the 40-year p shipyards and prototype. This cost includes construction costs of the new storage depending on the alternative selected, the operation of a limited examination facil Naval Shipyard combined with the costs associated with shutting down ECF, or the op of the INEL-ECF. The major expense in the highest cost alternatives is the procure containers. Refer to Section 3.7 for a comparison of the total cumulative costs am

5.2 IDAHO NATIONAL ENGINEERING LABORATORY

5.2.1 Overview of Environmental Impacts

The following sections discuss the potential environmental consequences at th Engineering Laboratory (INEL) associated with the choice of alternatives for naval management at the Expended Core Facility (ECF). The environmental consequences are fact that the ECF is currently in existence and operating within the perimeter of t Facility (NRF) at INEL. Volume 1, Appendix B provides an assessment of the environ impacts at INEL resulting from the full range of spent nuclear fuel activities. Th impacts resulting from "ECF-related" activities, which are discussed below (i.e., t from the transportation, receipt, handling, and examination of naval spent nuclear impacts associated with the spent nuclear fuel operations at the Idaho Chemical Pro the storage of both naval and non-naval spent nuclear fuel and other non-naval spen operations).

Review of the environmental effects of operation of the Expended Core Facilit the receipt and examination of naval spent nuclear fuel has shown that the impact o

associated with this work is very small. The largest effect in the vicinity of INE selection of any alternative for examination of naval fuel is the economic impact o retained or lost at ECF. The differences in all other impacts in the vicinity of I alternatives are very small or non-existent.

5.2.2 Land Use

The plan for all three naval plant prototypes at NRF is that they will all be defueled, and placed in safe storage until they are decommissioned. Operations at continue or cease, depending upon the alternative selected. None of the prototype if operations cease, is planned to be decommissioned during the next 10 years; ther will not be available for other uses in the near future. Native American rights an be modified by construction or operations associated with any of the alternatives c

5.2.3 Socioeconomics

Approximately 500 engineers, technicians, clerical, and maintenance personnel in the receipt and examination of naval spent nuclear fuel at ECF or in direct supp activities. Table 5.2-1 provides a summary of the direct jobs which would be assoc ECF if an alternative is selected which closes ECF, while Table 5.2-2 provides a su direct jobs associated with the continued operation of ECF. As shown in Table 5.2- increase in workers in the first three years to handle the shipment of containers w storage at the shipyards and prototype during the preparation of this Environmental The number of workers then decreases steadily to a final caretaker work force of 10 work force in the first three years shown in Table 5.2-2 includes construction work completion of the Dry Cell Facility in addition to the operations work force increa

Table 5.2-1. Summary of direct jobs (closure of INEL-ECF).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Direct Jobs	550	550	550	500	350	100	10	10	10	10

Table 5.2-2. Summary of direct jobs (operation of INEL-ECF).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Direct Jobs	574	574	550	500	500	500	500	500	500	500

5.2.4 Cultural Resources

None of the alternatives considered would impact known archaeological or Nati sites. Procedures which comply with all applicable laws and regulations would be i protect previously undetected archaeological and cultural sites.

5.2.5 Aesthetic and Scenic Resources

The entire Naval Reactors Facility is difficult to see from any point accessi aesthetic and scenic resources in the vicinity of INEL will not be affected by the for receipt and handling of naval spent nuclear fuel at ECF. Even if NRF could be only action which would alter the landscape at NRF is the dry cell extension for sp to ECF envisioned under the 1992/1993 Planning Basis alternative and this addition ECF building would be architecturally compatible with the NRF buildings.

5.2.6 Geology

The geology in the vicinity of the INEL will not be affected by the alternati receipt and handling of naval spent nuclear fuel since no changes which could impac would occur under any of the alternatives.

5.2.7 Air Resources

Small quantities of radioactivity are contained in the air released from ECF plant operations at NRF. The annual releases from ECF total approximately 1.1 curi

primarily of 0.30 curie of krypton-85, 0.70 curie of carbon-14, 0.094 curie of trit of combined strontium-90 and yttrium-90, and 0.0000048 curie of iodine-131. These would be reduced to near zero if an alternative which ends examination of naval spe ECF were selected. This reduction will occur approximately three years after the l received.

The principal sources of non-radioactive industrial gaseous effluents are air water vapor from cooling towers, and fuel combustion products from the three steam boilers used for heating. Since the boilers are used for generating steam for heat necessary to heat and maintain the ECF building whether naval spent nuclear fuel is or not, the airborne effluents at NRF would be little affected by the alternative s

Asbestos-containing material is present at NRF, but, as a result of the well- conditions with regard to asbestos at NRF, releases will be unaffected by the alter

5.2.8 Water Resources

No radioactive liquids are discharged to the environment at NRF. Consequentl alternative selected would have no effect on releases of radioactive liquids at NRF

Since the water released to the industrial waste ditch does not include any e ECF, the discharges to the ditch would be unaffected by the choice of alternatives. produces about 25% of the total NRF sewage discharge and the ECF discharge would be approximately zero if the people currently performing spent fuel examinations in th longer employed at NRF.

No hazardous wastes are disposed of at the NRF site and all solid and liquid are transported by vendors to treatment, storage, and disposal facilities approved Environmental Protection Agency and operating under approvals or permits granted by federal regulatory agencies. The small amount of hazardous waste produced during produces no effect on the environment in the vicinity of INEL, so the alternative s no impact on water quality in this area.

Annual ECF water consumption is about 2.5 million gallons. The alternative s have no discernible effect on water usage, because the ground-water withdrawn for E small in comparison to the total INEL water consumption. ECF operation has virtual surface waters.

A flood at ECF due to overflow of any surface water within the INEL boundarie probability event. Flooding of the ECF building is possible should the Mackay Dam there is adequate time following the dam break until the flood water reaches NRF to emergency procedure preparations. For more information refer to Attachment B.

5.2.9 Ecological Resources

Ecological resources (i.e., the terrestrial ecology, wetlands, aquatic ecolog and threatened species) in the vicinity of INEL will not be affected by any alterna no additional land at the NRF site will be disturbed under any alternative.

5.2.10 Noise

The small amount of noise generated by work at ECF would cease several years alternative which stopped shipment of spent naval nuclear fuel were selected since would cease. However, since this noise cannot be discerned beyond the site boundar alternative selected would have no discernible impact on noise in the vicinity of I

The similarly small amount of noise associated with railcar movement produced shipment of the naval spent nuclear fuel from shipyards to ECF would cause the alte to have no discernible impact on railcar noise generation. This is the case becaus railcars involved each year represent a minute fraction of the rail traffic in any noise is indistinguishable from that produced by other rail traffic.

5.2.11 Traffic and Transportation

Traffic and transportation in the vicinity of INEL associated with naval spent receipt, handling, and examination would essentially cease if an alternative which operations at ECF were selected. This would cause approximately 400 truck deliveri

eliminated. The reduction in personnel at ECF associated with cessation of these a cause approximately 22 fewer buses to be needed to transport them to and from the s None of the alternatives considered would increase traffic or the need for transpor of INEL.

If the ECF operation continues at the INEL, routine shipments of naval spent would be resumed to the site in certified shipping containers. Low-level waste gen hazardous waste would continue to be moved from ECF to a disposal facility.

5.2.12 Occupational and Public Health and Safety

5.2.12.1 Occupational Health and Safety. Radiological and non-radiological impacts of ECF

operations on occupational health and safety are assessed separately in terms of ra radiological effects.

Radiation exposures to workers at ECF have averaged approximately 100 millire compared to the limit of 5000 millirem per year specified by The Code of Federal Re Title 10, Part 20. The total radiation exposure to workers at ECF makes up about 3 occupational exposure to radiation experienced by workers at NRF. Since only about ECF work in radiological areas and the health risk per worker is estimated to be ap 0.00040 occurrences of fatal cancer per rem of exposure, less than one fatal cancer 0.45 fatal cancer estimated) could be expected among all ECF workers throughout the lives due to operation of ECF for an additional 40 years. This means that radiatio health of INEL workers would be virtually unchanged by the alternative selected for naval spent nuclear fuel.

Operations at ECF have resulted in fewer than 210 days of work lost to injuri years between 1987 and 1993 out of 736 total lost days of work at NRF during that p Recordable injuries at ECF represented about 12% of the total number of such injuri the same period. Consequently, selection of an alternative which ended operation o might be expected to reduce injuries to workers at NRF by about 10% to 25% due to t work force. Operation of a replacement for ECF at another Department of Energy (DO likely result in roughly the same number of injuries to workers at that facility si at ECF is very good and similar safe working conditions could be established at the

Projections of the number of occupational accidents that might occur during c operation of naval spent nuclear fuel storage and examination facilities have been alternative. These projections are presented in Attachment F. Based on the result projections, it is concluded that the number of occupational fatalities and injurie construction activities and storage and examination operations would be very small alternative.

Limited quantities of some materials classified as hazardous chemicals are ha but the precautions used during the work prevent exposure of the workers to these m Therefore, the alternative selected would not be expected to increase or decrease t INEL workers to potentially hazardous chemicals.

5.2.12.2 Public Health and Safety. The impact of NRF operations on public health and safety

can also be assessed separately in terms of radiological and non-radiological effec

The comprehensive INEL site radiation monitoring program (Hoff et al. 1992) s radiation exposure to persons who do not work at INEL resulting from all NRF operat small to be measured. In order to provide an estimate of the effects of radiation might be caused by INEL operations, calculations have been performed of the radiolo to the member of the general public who might receive the highest exposure (called exposed individual), to nearby (collocated) workers, to a worker at ECF located app 100 meters from the release point, and to the population surrounding the Idaho Nati Laboratory. These calculations include all types of radioactive particles or gases atmosphere from the operation of all existing NRF facilities, including ECF. The c and the analysis methods are provided in more detail in Attachment F.

The calculations indicate the risks are so small that there would be essentia resulting from radioactivity released by all operations at NRF, including ECF durin reasonably be expected to operate. Putting the risk into perspective, it could be member of the population might experience a fatal cancer due to combined effects of ECF if operations continued as in the past for 260 million years.

The radiological and non-radiological health effects associated with the inci

tation of naval spent nuclear fuel and test specimens have been assessed for the ge transportation workers, and the hypothetical maximum exposed individual for each al summarized in Section 3.7, it is unlikely that there will be any health effects as nuclear fuel and test specimen shipments since the estimates are much less than one detrimental health effect for each alternative. The details of the transportation analysis are provided in Attachment A.

Results of all effluent monitoring confirm that the operation of NRF has no d on the environment from non-radiological releases (WECNRF 1993). Operations at NRF no effect on the groundwater of the Snake River Plain Aquifer, and monitoring resul detectable toxic chemicals, solvents, or laboratory chemicals in the groundwater in NRF. No constituent measured in groundwater in the vicinity of NRF exceeds applica water standards. The alternative selected for examination of naval spent nuclear f have no effect on non-radiological public health and safety in the vicinity of INEL

5.2.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling. As discussed preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the examination of naval spent nuclear fuel at the INEL under any of the alternatives considered. For example, it is unlikely that a singl occur as a result of activities associated with naval spent nuclear fuel examinatio alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the INEL do n strongly dominant direction. Similarly, the conclusion is not affected by concerns subsistence consumption of fish or game because of the very small impacts associate examination of naval spent nuclear fuel.

To place the impacts on environmental justice in perspective, the risk associ operations for naval spent nuclear fuel examination under any of the alternatives c less than one fatality per year for the entire population. For comparison, in 1990 approximately 510,000 cancer deaths in the United States population and there were cancer deaths among people of color in the U. S. Even if all of the impacts associ the alternatives considered for naval spent nuclear fuel management were assumed to among people of color, that group would be unlikely to experience a single addition in any year. Therefore, the cancer risk for that population from naval spent nucle would not constitute a disproportionately high and adverse impact on human health o environment. The same conclusion can be drawn for low-income groups.

5.2.13 Utilities and Energy

Operations at ECF currently consume approximately 10,000 MWh of electricity e However, since the ECF building and associated facilities would have to be maintain period covered by this Environmental Impact Statement whether ECF is used for naval fuel examination or not and the spent fuel examinations do not consume particularly energy, the consumption of electricity and other energy would not be appreciably af alternative selected. None of the alternatives considered would increase the consu INEL.

5.2.14 Facility and Transportation Accidents

5.2.14.1 Facility Accidents. There has never been an accident in the history of the Naval

Nuclear Propulsion Program that resulted in a significant release of radioactivity or that resulted in radiation exposure to workers in excess of normal limits on exp

F provides a description of radiological accidents which could occur during water p
handling of naval spent nuclear fuel as well as accidents involving toxic chemicals
radiological accidents analyzed for ECF included: (1) an inadvertent criticality ca
earthquake or similar event, (2) accidental loss of large amounts of water containi
material from a water pool into the ground and then into water sources, and (3) sev
spent fuel if it were dropped from a crane during handling or had a heavy object dr
probability of an accident caused by an airplane crash was calculated for ECF and w
be less than 10-7. Due to the low probability, no consequences were calculated for
Calculations of the cancer fatalities which might occur as a result of all the post
provided in Attachment F. A comparison of the accident consequences for all altern
in Section 3.7.

The most limiting of the postulated accidents at ECF was water pool drainage,
resulting in fuel overheating. The exposure to the entire population from this acc
cause 0.017 cancer fatalities over 50 years, as described in Attachment F.

The exposures to collocated workers following all accidents are well below th
DOE 5-rem standard for occupational exposure. However, exposures to the worker loc
ECF site 100 meters from the radiation release point would exceed this standard fol
resulting in an inadvertent criticality.

Effects from accidents at ECF involving toxic chemicals were evaluated in Att
Due to the amount and types of chemicals stored at ECF, toxic chemicals do not pose
public or the maximally exposed off-site individual following any of the postulated
However, following the maximum foreseeable accident analyzed (a fire transient), a
chemicals would exceed Emergency Response Planning Guideline (ERPG) values for work
For maximum off-site individuals at INEL, ERPG-1 values for the toxic chemicals are
under 50% or 95% meteorology conditions. The concentrations of toxic chemicals fol
transient as well as a summary of the analysis methods are provided in Attachment F

5.2.14.2 Transportation Accidents. The health effects associated with accidents during

shipments of naval spent nuclear fuel and test specimens have been assessed for the
and the hypothetical maximum exposed individual for each alternative. As summarize
3.7, it is unlikely that there will be any health effects as a result of naval spen
specimen shipments since the risk estimates are much less than one fatal cancer or
effect for each alternative. However, the most severe accident, with a likelihood
greater than 1 x 10-7 events per year, is estimated to result in a maximum of appro
fatalities. The details of the transportation analysis are provided in Attachment

5.2.14.3 Other Impacts of Accidents. In addition to the possible human health effects

associated with facility or transportation accidents described in the preceding sec
such as the impacts on socioeconomics and land use in the area and the costs of cle
estimated in order to develop a perspective and to evaluate potential differences a
The analyses described in Attachment F showed that for the most severe hypothetical
area of approximately 8 to 11 acres, extending about 1/4 to 1/3 mile downwind, migh
contaminated to the point where exposure could exceed 100 millirem per year. Beyon
exposures would be below 100 millirem per year, the Nuclear Regulatory Commission's
protection of the general population from radiation. Persons who work at the feder
this area might be prevented from going to their jobs until measures had been taken
potential for exposure.

The area affected by the hypothetical accidents would not extend beyond the b
INEL and, in fact, would not come close to approaching the boundaries. An accident
short-term restrictions on access to a relatively small area of the federally owned
be expected to produce enduring impacts on cultural or similar resources or concern
American rights or interests, partially because the area involved would be small an
remedial actions would be conducted in a careful, controlled manner and in full com
applicable laws and regulations. The area would vary only slightly among the alter
Overall, the risks are small so these considerations do not assist in distinguishin

Facility or transportation accidents associated with any of the alternatives
appreciable effect on the ecology of the area, considering the potential for human
the amount of land which might be affected, as described in earlier parts of this s
little consensus among scientists on methods for estimating the effects of radiatio
resources such as plant or animal life, but since human health effects for all the
small and most plants and animals are not thought to be more sensitive to radiation

beings, the small impacts on human health provide an indication that the impacts on species in the area would also be small for all alternatives considered. Similarly which might be contaminated by chemicals or radioactive material to measurable leve hypothetical accidents would be relatively small, any effects on the ecology would areas. As previously stated, there are no endangered or threatened species unique surrounding the Expended Core Facility at INEL, so an accident would not be expecte destruction of any species for any of the alternatives considered. The effects of with any of the alternatives and any cleanup which might be performed would be loca small area extending only a short distance from the Expended Core Facility and thus expected to appreciably affect the potential for survival of any species. Conseque of impacts of accidents on ecological resources does not help to distinguish among

5.2.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear Fuel

Storage and Handling. As discussed in the preceding paragraphs, the impacts on hum the environment resulting from facility or transportation accidents associated with naval spent nuclear fuel at the INEL would be small under any of the alternatives c example, it is unlikely that a single additional fatal cancer would occur as a resu nuclear fuel management activities under any alternative. Since the potential impa accident for any of the alternatives considered would present no significant risk a a credible adverse impact on the surrounding population, no adverse effects from ac with the management of naval spent nuclear fuel would be expected for any particula population, minorities and low-income groups included.

To place the impacts on environmental justice in perspective, the risk from h accidents associated with naval spent nuclear fuel examination under any of the alt would amount to less than one additional fatality per year in the entire population in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.2.15 Waste Management

All non-hazardous solid wastes that cannot be recycled or used by other gover are transported to the INEL landfills at the Central Facilities Area. Operation of contribution to these wastes other than the trash associated with the approximately work at that facility. Therefore, the impact in this area at the INEL is little af selected.

The use of hazardous materials in essential applications at ECF results in th some hazardous wastes, including photographic solutions, solutions containing heavy solvents, paint-related wastes, and laboratory wastes. All hazardous wastes are tr vendors to treatment, storage, and disposal facilities approved by the Environmenta Agency and operating under approvals or permits granted by state and federal regula and none are disposed of at INEL. When appropriate, wastes are recycled or provide federal agencies for use. The small amount of hazardous waste produced from ECF op be produced and managed in the same manner if the facility were constructed and ope alternate site, so the overall effect on the environment, including that in the vic essentially unchanged by the alternative selected.

Operations at ECF contribute approximately 425 cubic meters (15,000 cubic fee radioactive solid waste each year and this amount of solid radioactive waste would approximately 75% after about three years if an alternative which stopped naval spe examinations at INEL were selected. No high-level waste and almost no transuranic 0.0001 cubic meter per year) are generated from current operations at ECF. None of considered would increase the amount of radioactive waste at INEL resulting from na fuel examinations. The radioactive waste from ECF examinations and related operati generated and managed in a similar manner if the facility were constructed and oper alternative site. Consequently, the overall effect on the environment is essential alternative selected.

5.2.16 Cumulative Impacts

Up to this point, Section 5.2 has discussed the potential environmental conse operation of the ECF Project at INEL in terms of annual impacts (i.e., radiological health effects, accident risks, and quantities of wastes that would be generated du on the maximum annual capacity of the ECF Project. To determine the upper limit fo consequences of up to 40 years of future ECF operation (from 1995 to 2035), an eval accumulated environmental consequences and risks of operating ECF was performed.

5.2.16.1 Radiological Cumulative Impacts. Operation of the INEL-ECF does not result in

discharges of radioactive liquids; therefore, there would be no changes to the surf as a result of normal operations for any alternative. There are small quantities o air released from ECF which would contribute to the cumulative air quality impacts. alternatives where the ECF is shut down, the cumulative impacts would decrease by t ECF radioactivity releases.

The radiation exposure to the general population since the beginning of opera with naval spent nuclear fuel is less than 2 rem, which corresponds to approximatel fatality. An overview of the historical radiological impacts from naval nuclear op and from transportation of naval spent nuclear fuel is provided in Section 4.2.12 a are provided in Attachments F and A. Prior to this time, naval spent nuclear fuel storage operations have been conducted only at INEL. Therefore, no cumulative impa resulted from previous naval spent nuclear fuel inspection and storage operations a except for INEL.

The annual radiological impacts associated with the alternatives where naval would be inspected or stored at the ECF at INEL are very small and are described in with the detailed results of analyses provided in Attachment F. In order to calcul impacts for the period between 1995 and 2035, the annual radiological impacts assoc location and alternative were summed over 40 years. The results of this summation Tables 3-5 and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the general public from transportation and from the alt considered involving continued operation of the ECF at INEL would be less than 3.5 This means that there would be less than 0.0017 fatal cancers from these operations 40-year period evaluated. The exposure to the maximally exposed off-site individua be approximately 0.01 millirem from 40 years of ECF operation. The corresponding r fatality to the maximally exposed off-site individual is 5.2 x 10-9 during his or h at the ECF site located 100 meters from the facility would receive less than 3 mill of ECF operation, which corresponds to a 1.1 x 10-6 risk of fatal cancer during the Analyses of hypothetical accidents which might occur as a result of these alternati risk of cancer fatalities is small. The impacts associated with transportation of fuel for all of the alternatives considered would be similarly low.

Cumulative impacts due to radioactive waste generation are expected to be min Approximately 425 cubic meters of low-level waste are expected to be generated annu over the next 40 years. This is not expected to affect the INEL waste management p little transuranic and mixed wastes and no high-level waste are generated from ECF

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

5.2.16.2 Non-radiological Cumulative Impacts. Cumulative socioeconomic impacts associated

with continued operation of the ECF Project at the INEL are expected to be minor. currently employs approximately 11,000 people. The ECF operations work force of 50 would continue to be employed over the long term at INEL if an alternative is selec continue naval spent nuclear fuel examination at INEL. If an alternative were sele in naval fuel no longer being examined at INEL, the reduction in ECF work force wou

predicted future reductions in work force at INEL by 500 jobs. Considering that th the region of influence consists of almost 105,000 people, the 500 ECF jobs would b have only a minor impact in the INEL area.

Continued operation of the ECF Project at INEL is not expected to result in a impacts relative to cumulative non-radiological emissions. Current operations at I compliance with Title 40, Code of Federal Regulations, Part 61, "National Emission Hazardous Air Pollutants." Cumulative air emissions would not threaten to exceed a quality requirement or regulation, either federal, state, or local in radiological categories.

As discussed in Section 5.2.8, the withdrawal of groundwater for continued EC would be a small percentage of existing water withdrawals at INEL and well within t capabilities of the local water resources. ECF discharges of non-radioactive and n effluents at INEL would not affect water quality. The volume of ECF routine liquid discharged at INEL would also not discernibly increase the impact to the local ecol

Operation of the ECF has no effect on cumulative land use impacts. NRF occup 0.02% of the approximately 571,000-acre INEL site and no additional land would be d for the options in which ECF is shut down, there would be no cumulative land use im site would need to be decommissioned and decontaminated before releasing it for oth work would extend beyond the time frame of this study.

The cumulative impacts associated with non-radiological waste management are The volume of hazardous, municipal, and sanitary wastes produced by ECF has not bee however, considering the nature of the work associated with ECF and the number of w amount of hazardous, municipal, and sanitary waste produced has a small effect on t impacts associated with this waste. For those options in which ECF is shut down, t wastes on the cumulative impacts is even smaller.

5.2.17 Unavoidable Adverse Effects

Small amounts of radioactivity, described in Section 5.2.12, would be release spent fuel operations at ECF, resulting in less than one health effect in the entir surrounding INEL. The effects of these small releases, combined with the other fac Section 5.2.16, would produce no discernible cumulative effects. Similarly, contin the facility would produce limited amounts of liquid sanitary waste and solid munic solid low-level radioactive waste. These amounts of waste would not differ from th the past by operation of ECF and would not produce any major impacts in the vicinit

The most important adverse effect in the vicinity of INEL would be the loss o would occur if an alternative which shut down the Expended Core Facility were chose discussed in Section 5.2.3 above, approximately 500 people at INEL would lose their alternative were selected.

5.2.18 Irreversible and Irretrievable Commitments of Resources

There are few irreversible or irretrievable commitments of resources, other t INEL associated with the selection of any of the alternatives considered for naval The total cost of operating the INEL-ECF is approximately $2.6 billion. This cost cumulative cost over the 40-year period and includes the operations costs for ECF a construction costs for completing the Dry Cell Facility. Refer to Section 3.7 for total cumulative costs among alternatives.

In the event an alternative which resulted in ceasing operations at the Expen were selected, decommissioning and decontamination of ECF would not occur immediate the facility would be placed in a safe storage condition while the federal governme proper disposition of the facility, planned the disposition, and programmed funds t disposition. Any disposition of the facility would be conducted in accordance with and state regulations.

5.3 SAVANNAH RIVER SITE

5.3.1 Overview of Environmental Impacts

The following sections discuss the potential environmental consequences that

replacement for the Expended Core Facility (ECF) were constructed and operated at t of Energy's Savannah River Site (SRS) or if the Barnwell Nuclear Fuel Plant (hereaf the Barnwell Plant) that is adjacent to and contiguous with the SRS were operated f Both of these subalternatives will be referred to as the Savannah River ECF. The t are depicted as Site A and Site B in Figure 4.3-1. Details of receipt, handling, a naval spent nuclear fuel at the SRS and the modifications to the Barnwell Plant are Attachment E.

The environmental consequences of locating the ECF at the SRS are based on th radiological source terms for normal and accidental releases and the estimated ECF emissions, liquid effluents, and solid wastes discussed in Section 5.2. Consistent programmatic Environmental Impact Statement, the environmental effects due to norma accidental releases were evaluated primarily for Site A. Some variations in the ex individuals and workers at other SRS facilities would occur for the Barnwell Plant mental consequences of locating and operating the ECF at SRS would be similar to th at the Idaho National Engineering Laboratory (INEL), and none would be large.

5.3.2 Land Use

Construction of a Savannah River ECF Project at Site A would directly affect of land. The Savannah River ECF site considered and its adjacent environs are rela contain both pine stands and mixtures of hardwoods. Construction would not distur sensitive ecological habitats, nor would it impact wetland areas. Compared to the however, the Savannah River ECF site is considered more ecologically diverse.

The alternative location at the Barnwell Plant is approximately 6 miles from t location. Forest removal at this site has already been completed, and any addition not expected to have any effect on land use.

Native American rights and interests would not be modified by construction or associated with any of the alternatives considered.

5.3.3 Socioeconomics

The potential socioeconomic impacts associated with construction of the Savan are expected to be equal to or less than those associated with the original ECF con INEL because (1) a large movement of construction workers from other areas would no for the Savannah River ECF construction due to the availability of construction cra 70 miles of the SRS (Halliburton 1992); and (2) the six counties surrounding the SR population much larger than the INEL area, which would provide a greater capability temporary relocation of construction personnel.

Table 5.3-1 provides a summary of the direct jobs which would be required for tion and operation of the Savannah River ECF during the 10-year period immediately of Decision. The greatest number of direct jobs would occur in 1999 during the pea construction phase. Estimates of the indirect jobs created as well as the effect o included in Section 5.5.3 of Volume 1 as part of either the Regionalization or Cent SRS alternatives.

Table 5.3-1. Summary of direct jobs due to the Savannah River ECF.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Direct Jobs	20	20	476	825	1033	894	850	500	500	500

During the Savannah River ECF construction period, operations personnel would that at the end of the construction period, most of the operations workers would be fully staffed, ECF operation at the SRS would require approximately 500 people, the operating and support personnel as at the INEL-ECF. This would represent less than total SRS work force. The six-county region of influence around the SRS had a 1990 425,607 persons, or about twice that of the INEL. The larger population base assoc SRS region would also provide a greater capability to absorb any personnel moving i during the construction period; however, the larger economic base of the SRS region would also have a greater tendency to diffuse potential economic benefits compared Project at the INEL.

Given the small percentage increase in the number of jobs at the SRS attribut River ECF operation, the impacts to local government services and community infrast expected to be small. Volume 1 quantifies these effects. The economic benefits to are expected to be similar to or less than those for the INEL region as the existin the SRS region is much greater and more diverse than the INEL region (DOE 1988).

5.3.4 Cultural Resources

None of the alternatives considered would impact known historical, archaeolog American sites. Procedures which comply with all applicable laws and regulations w implemented to protect previously undetected archaeological and cultural sites.

5.3.5 Aesthetic and Scenic Resources

The construction of the Savannah River ECF at Site A would directly affect 30 As a result of its location and industrial characteristics, there is essentially no impact, since the site would not be visible to the public.

No additional land would need to be cleared if the Barnwell Plant were used f The building containing the existing water pool would need to be enlarged as part o discussed in Attachment E; however, the effect on the scenic resources would be min

5.3.6 Geology

5.3.6.1 General Geology. The local geology of the SRS region determines the locations of the

surface waters and groundwaters at the site described in "Reactor Operation Environ Information Document, Volume I, Geology, Seismology and Subsurface Hydrology" (WSRC The geology of the SRS region has not been affected by operations conducted at SRS expected to be affected by Savannah River ECF operations.

5.3.6.2 Geologic Resources. The geology of both sites considered has sufficient strength to

support construction of the ECF structures, and operation of the Savannah River ECF to affect any geologic resources.

5.3.7 Air Resources

Toxic chemicals are used in the normal operations of an ECF. The use of thes controlled to limit the exposure of workers and the public. Airborne emissions fro operations include the combustion gases from the boiler house, where fuel oil is bu steam from space heating. Emergency diesel generators, which are provided for safe periodically for test purposes and release exhaust fumes to the atmosphere. These not have any detectable environmental consequence.

The airborne releases of radioactivity for the Savannah River ECF would be th INEL-ECF described in Section 5.2. The airborne release would result in no measura on-site personnel or the general population. Details are provided in Attachment F.

5.3.8 Water Resources

5.3.8.1 Surface Water. Water required for construction of the facility would be withdrawn from

the Savannah River. The small amount of water withdrawn from the Savannah River wo negligible in comparison to the approximately 4.5 million gallons-per-minute flow n new water intake structure would be required.

Expected surface water withdrawals of 2.5 million gallons per year from the S during Savannah River ECF operations represent small incremental increases in the a currently being withdrawn by on-going SRS operations (23.2 billion gallons annually negligible withdrawal in comparison to the average flow of the Savannah River. The discharge of Savannah River ECF liquids to the Savannah River.

5.3.8.2 Groundwater. Sanitary effluents generated during construction would be treated through

either the use of chemical toilets or a wastewater treatment facility. Solid waste construction would be disposed of in the SRS sanitary landfill, which is operated i State of South Carolina guidelines. Mitigation and control measures for potential and erosion would be undertaken as part of construction activities.

Sanitary effluents generated as a result of Savannah River ECF operations wou discharged to a wastewater treatment plant. There would be no discharge of radioac liquid effluents to the ground at the Savannah River ECF site. Construction and op Savannah River ECF is not expected to have an effect on the groundwater.

5.3.9 Ecological Resources

5.3.9.1 Terrestrial Ecology. During construction, plant and animal habitats associated with pine

and hardwood vegetation communities would be lost or displaced from the constructio Additionally, construction may have short-term impacts on wildlife beyond the immed site (i.e., impact on area animals due to construction and traffic noise). Howeve affected land area is small compared to the entire SRS, the impacts on wildlife fro expected to be minor.

During construction and operation of the Savannah River ECF, all effluents an would comply with regulatory standards. Due to the level of the emissions describe F, they are not expected to have an impact on the area wildlife. Operation of the ECF should result in less noise and traffic than the construction phase, and no eff ecology are expected from Savannah River ECF operation.

5.3.9.2 Wetlands. The only wetlands located on the proposed Savannah River ECF sites are the

Carolina Bays located at Site A. Because the Carolina Bays are located on the edge site, they can be avoided during construction. Construction and operation of the S would have no discernible impacts on other wetland areas and habitats at the SRS.

5.3.9.3 Aquatic Ecology. Experience has shown that SRS operations (e.g., reactor operation) can

have an adverse effect on the receiving aquatic ecosystems (e.g., L-Lake, Steel Cre etc.). However, because there would be no discharge of radioactive or hazardous li from Savannah River ECF operation, Savannah River ECF operation is expected to have the aquatic ecology.

5.3.9.4 Endangered and Threatened Species. The endangered and threatened species are

described in Volume 1, Appendix C. The construction and operation of the Savannah not expected to have any environmental impact on the endangered and threatened spec SRS.

5.3.10 Noise

The SRS is a large area of about 800 square kilometers (310 square miles). I involving construction of a new facility were selected, the construction of the Sav would cause typical construction noises. There would be little or no noise accompa operations of the Savannah River ECF.

5.3.11 Traffic and Transportation

Traffic and transportation would increase slightly in the SRS area if an ECF and operated at the SRS. The additional traffic would mainly be due to increased c from construction workers and 500 operations workers as well as traffic from materi during the Savannah River ECF construction.

If the ECF Project were located at the SRS, routine shipments of naval spent

would be transported to the site in certified shipping containers. Low-level waste facility and transuranic waste would be moved from the facility to an SRS storage f

5.3.12 Occupational and Public Health and Safety

The health and safety assessment of normal operations at the Savannah River E on managing spent nuclear fuel for examination and storage by either of two approac handling in a water pool or in a dry cell). These are the same methods of spent nu that have been employed or seriously considered for use at the INEL-ECF. The norma impacts associated with the Savannah River ECF would be similar to those for the IN following sections describe the non-radiological and radiological impacts associate River ECF (refer to Section 5.2 for the INEL-ECF impacts).

5.3.12.1 Occupational Health and Safety. Projections of the number of occupational accidents

that might occur during construction and operation of naval spent nuclear fuel stor tion facilities have been made for each alternative. These projections are present Based on the results of these projections, it is concluded that the number of occup injuries or illnesses for construction activities and storage and examination opera small for any alternative.

During Savannah River ECF construction, workers are not expected to experienc background levels of radiation resulting from on-going SRS operations. The gamma r measured near the proposed Savannah River ECF site is similar to the radiation leve site in the SRS area (WSRC 1992). The potential exposure to a construction worker of radionuclides released to the atmosphere from existing SRS operations is estimat 1 millirem per year, which is small compared to the external exposure. The very sm received by a construction worker would be well below the naval and Department of E standard of 5000 millirem per year for occupationally related whole-body and intern

During operation of the Savannah River ECF, SRS personnel would be exposed to atmospheric emissions of radioactivity and might be exposed to potential emissions Site A is located approximately 1 mile from the nearest SRS facility, while the Bar located approximately 5 miles from the nearest facility. As shown in Attachment F, exposure would be received by these collocated workers from normal Savannah River E tions. Exposures received by Savannah River ECF radiation workers from normal oper expected to be similar to the exposures currently received by workers from ECF oper INEL, discussed in Section 5.2.12.

5.3.12.2 Public Health and Safety. The impacts of normal operation of the Savannah River ECF

would be similar to those for the INEL-ECF. Normal radiological releases to the at quantities of radioactive and hazardous wastes that would be generated would not di previously discussed for the INEL. However, the location of the project relative t SRS population and the distances to facilities that would be involved in routine sh would result in differences in potential environmental consequences. Described bel to the public associated with operation of the Savannah River ECF (refer to Section INEL-ECF impacts).

Assessment of the normal operations of the Savannah River ECF involved two op handling in a water pool and dry cell handling of fuel for examination and storage. considered, the potential annual exposures were estimated for five different types at the Savannah River ECF site located 100 meters from the release point, the hypot exposed collocated worker on the SRS site, the hypothetical maximally exposed off-s (MOI), an individual at the nearest public access (NPA), and the population within (50 miles) of the Savannah River ECF site. Three pathways were included in the ana waterborne, and direct radiation, as applicable.

The results indicate that either the water pool or the dry cell option would normal operations since the exposure is so low. The analysis shows that the exposu individuals considered (workers, collocated workers, MOI, and NPA) from Savannah Ri operations would be much less than 1 millirem per year. For perspective, it could member of the entire population might experience a fatal cancer due to Savannah Riv operations if operations continued for over 50,000 years. A description of the ana more detailed results are provided in Attachment F. The impacts from normal operat alternatives are summarized in Section 3.7.

The radiological and non-radiological health effects associated with the inci transportation of naval spent nuclear fuel and test specimens have been assessed fo population, transportation workers, and hypothetical maximum exposed individual for tive. As summarized in Section 3.7, it is unlikely that there will be any fatal ca naval spent nuclear fuel and test specimen shipments since the estimates are much l cancer for each alternative. The details of the transportation analysis are provid

5.3.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling. As discussed preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the examination of naval spent nuclear fuel at the SRS w under any of the alternatives considered. For example, it is unlikely that a singl occur as a result of activities associated with naval spent nuclear fuel examinatio alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the SRS do no strongly dominant direction. Similarly, the conclusion is not affected by concerns subsistence consumption of fish or game because of the very small impacts associate tion of naval spent nuclear fuel.

To place the impacts on environmental justice in perspective, the risk associ operations for naval spent nuclear fuel examination under any of the alternatives c less than one fatality per year for the entire population. For comparison, in 1990 mately 510,000 cancer deaths in the United States population and there were about 6 deaths among people of color in the U. S. Even if all of the impacts associated wi alternatives considered for naval spent nuclear fuel management were assumed to occ people of color, that group would be unlikely to experience a single additional can year. Therefore, the cancer risk for that population from naval spent nuclear fuel not constitute a disproportionately high and adverse impact on human health or the same conclusion can be drawn for low-income groups.

5.3.13 Utilities and Energy

Heating, ventilation, and electrical systems appropriate to the needs of the S ECF for suitable working environments and to properly filter and exhaust the airbor the atmosphere are estimated to require approximately 10,000 MWh per year for norma Emergency diesel electrical generators would provide 350 kw for life support and cr services during power outages. The amount of energy consumed would be a small frac total energy used at SRS, and no discernible environmental consequence is expected.

5.3.14 Facility and Transportation Accidents

The differences in the potential consequences and risks of accidents of a Sav compared to the INEL-ECF are related to the meteorological transport of released ma population exposure, and the distance of transport. The following sections address accident consequences and risks associated with locating an ECF at the SRS.

5.3.14.1 Facility Accidents. The accident scenarios for the Savannah River ECF are the same as

those considered for the existing ECF at the INEL. These include radiological acci occur during water pool and dry handling of spent nuclear fuel as well as accidents chemicals used at ECF. The general types of radiological accidents analyzed includ criticality, (2) water pool drainage, (3) severe mechanical damage of spent fuel, (shielding, and (5) an airplane crash into the ECF. Calculations of the cancer fata occur as a result of all the postulated accidents are provided in Attachment F. A

accident consequences for all alternatives is provided in Section 3.7.

The difference in the calculated consequences for accidents at the Savannah R compared to the INEL-ECF is that the exposure received by the entire population wou the Savannah River ECF due to the larger population within an 80-kilometer (50-mile Savannah River ECF project site. Although the exposure received would be greater a River ECF, the number of health effects which would result from any of the accident would be small. The most limiting of the postulated accidents for the Savannah Riv airplane crash into a dry cell facility. If this accident were to occur, the expos population from this accident is calculated to cause 4.8 cancer fatalities over 50 Attachment F. The risk associated with the airplane crash is 0.0000096 fatal cance

The exposures to collocated workers following all accidents are below the nav 5-rem standard for occupational exposure under 50% meteorology conditions. However the worker located at the Savannah River ECF site 100 meters from the radiation rel exceed this standard following an accident resulting in an inadvertent criticality airplane crash.

Effects from accidents at the Savannah River ECF involving toxic chemicals ar those described in Section 5.2.14 for the existing INEL-ECF. Due to the amount and chemicals stored at the ECF site, toxic chemicals do not pose a risk to the public postulated accidents. However, following the maximum foreseeable accident analyzed transient), a number of toxic chemicals would exceed Emergency Response Planning Gu (ERPG) values for workers on the Savannah River ECF site as well as for collocated the MOI under either 50% or 95% meteorology conditions, toxic chemical levels do no ERPG-2 values with the ECF at Site A and ERPG-3 values if the ECF is at the Barnwel The concentrations of toxic chemicals as well as a summary of the analysis methods Attachment F.

5.3.14.2 Transportation Accidents. The health effects associated with accidents during

shipments of naval spent nuclear fuel and test specimens have been assessed for the and hypothetical maximum exposed individual for each alternative. As summarized in is unlikely that there will be any health effects as a result of naval spent nuclea specimen shipments since the risk estimates are much less than one fatal cancer or each alternative. However, the most severe accident, with a likelihood of occurren 1 x 10-7 events per year, is estimated to result in a maximum of approximately 2 fa details of the transportation analysis are provided in Attachment A.

5.3.14.3 Other Impacts of Accidents. In addition to the possible human health effects

associated with facility or transportation accidents described in the preceding sec such as the impacts on socioeconomics and land use in the area and the costs of cle estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that for the most severe hypothetical area of between about 8 acres extending about 1/4 mile downwind (for an accidental approximately 210 acres extending about 1 1/4 mile downwind (for a large airplane c examination facility) might be contaminated to the point where exposure could appro per year. Beyond these distances, exposure would be less than 100 millirem per yea Regulatory Commission's standard for protection of the general population from radi affected by the hypothetical facility accidents would not extend beyond the boundar Savannah River Site. However, if the currently inactive Barnwell Nuclear Fuel Plan such an accident, the affected area could extend beyond the boundaries of federally Persons who live in this area might be evacuated or otherwise experience restrictio activities for a brief period, and those who work at locations within this area mig going to their jobs until measures had been taken to reduce the potential for expos

An accident might result in short-term restrictions on access to a relatively there would be no enduring impacts on cultural or similar resources or concerns suc American rights or interests, partially because the area involved would be small an remedial actions would be conducted in a careful, controlled manner in full complia applicable laws and regulations. The area impacted would vary only slightly among Overall, the risks are small so these considerations do not assist in distinguishin

Facility or transportation accidents associated with an Expended Core Facilit River Site would not have an appreciable effect on the ecology of the area, conside for human health effects and the amount of land which might be affected, as describ of this section. There is little consensus among scientists on methods for estimat

radiation on ecological resources such as plant or animal life, but since human hea the accidents analyzed are small and most plants and animals are not thought to be radiation than human beings, the small impacts on human health provide an indicatio on animal and plant species in the area would also be small for an alternative whic the Expended Core Facility to the Savannah River Site. Similarly, since the areas contaminated to measurable levels by chemicals or radioactive material during the h accidents would be relatively small, any effects on the ecology would be limited to previously stated, there are no endangered or threatened species unique to the area location considered for a replacement Expended Core Facility at the Savannah River accident would not be expected to result in destruction of any species. The effect associated with these alternatives or any cleanup which might be performed would be small area extending only a relatively short distance from the Expended Core Facili not be expected to appreciably affect the potential for survival of any endangered species in the Savannah River area. Consequently, consideration of impacts of acci help to distinguish among alternatives.

5.3.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear Fuel

Storage and Handling. As discussed in the preceding paragraphs, the impacts on hum the environment resulting from facility or transportation accidents associated with naval spent nuclear fuel at the SRS would be small under any of the alternatives co example, it is unlikely that a single additional fatal cancer would occur as a resu nuclear fuel management activities under any alternative. Since the potential impa accident for any of the alternatives considered would present no significant risk a a credible adverse impact on the surrounding population, no adverse effects from ac with the management of naval spent nuclear fuel would be expected for any particula population, minorities and low-income groups included.

To place the impacts on environmental justice in perspective, the risk from h accidents associated with naval spent nuclear fuel examination under any of the alt would amount to less than one additional fatality per year in the entire population in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.3.15 Waste Management

During Savannah River ECF operation, non-radioactive and non-hazardous solid hazardous solid waste would be generated in quantities similar to those for the INE radioactive, non-hazardous wastes would be managed in a manner identical to that fo (i.e., non-hazardous, non-radioactive solid wastes would be disposed of at a sanita Hazardous wastes would be contained at their point of generation and stored at the management practices for these wastes would produce no identifiable impact on publi safety of the environment.

Operation of the ECF at the SRS would generate the same quantities of low-lev transuranic waste, and mixed wastes as the INEL-ECF. Low-level waste generated by River ECF would be stored at the SRS. The 425 cubic meters of low-level waste gene by the ECF Project represents a small quantity when compared to the quantity of low disposed of at the SRS and would not impact planned disposal operations. No high-l be generated.

Less than 0.0001 cubic meter of transuranic waste per year is generated by cu operations at the INEL. Any transuranic waste generated by the Savannah River ECF addition to approximately 10,000 cubic meters currently held in storage at the SRS. wastes generated at the Savannah River ECF would be a very small fraction of the SR waste generated and would not impact planned SRS waste-handl-
ing operations.

Mixed wastes generated by Savannah River ECF operation would be stored at the treatment and disposal facilities are available. The amount of mixed waste generat a small quantity in relation to the quantities requiring storage or disposal from p operations.

5.3.16 Cumulative Impacts

Up to this point, Section 5.3 has discussed the potential environmental conse structing and operating the ECF Project at the SRS in terms of annual impacts (i.e. doses and health effects, accident risks, and quantities of wastes that would be ge operation) based on the maximum expected annual throughput of the ECF Project. To potential consequences for 40 years of ECF operation (from 1995 to 2035), an evalua accumulated environmental consequences and risks of constructing and operating the ECF was performed.

5.3.16.1 Radiological Cumulative Impacts. The Savannah River Site has not been used for

naval spent nuclear fuel operations in the past. Prior to this time, naval spent n and storage operations have been conducted only at INEL. Therefore, no cumulative resulted from previous naval spent nuclear fuel inspection and storage operations a except for INEL.

Operation of the Savannah River ECF will not result in discharges of radioact therefore, there would be no changes to the surface or ground water as a result of for any alternative. There will be small quantities of radioactivity in the air re would contribute to the cumulative air quality impacts.

The annual radiological impacts associated with the alternatives where naval would be inspected or stored at SRS are very small and are described in Section 5.3 detailed results of analyses provided in Attachment F. In order to calculate cumul the period between 1995 and 2035, the annual radiological impacts associated with e alternative were summed over 40 years. The results of this summation are tabulated and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar

3.7.4.

The total exposure to the general public from transportation and from Savanna operations would be less than 14 person-rem. This means that there would be less t cancers from these operations over the entire 40-year period evaluated. The exposu maximally exposed off-site individual would be less than 0.2 millirem from 40 years River ECF operation at either Site A or the Barnwell Plant. The corresponding risk fatality to the maximally exposed off-site individual is 9.6 x 10-9 at Site A and 7 Barnwell Plant during his or her lifetime. A worker at the Savannah River ECF site meters from the facility would receive less than 4 millirem over 40 years of Savann operation, which corresponds to a 1.4 x 10-6 risk of fatal cancer during the worker exposures and cancer risks are as a result of ECF operations only. The exposures a corresponding to site-wide operations (including ECF) are discussed in Volume 1, Ch Analyses of hypothetical accidents which might occur as a result of these alternati risk of cancer fatalities is small. The impacts associated with transportation of fuel for all of the alternatives considered would be similarly low.

Cumulative impacts due to radioactive waste generation are expected to be min Approximately 425 cubic meters of low-level waste are expected to be generated annu Savannah River ECF over the next 40 years. This is not expected to affect the SRS ment program. Very little transuranic waste or mixed waste and no high-level waste generated from Savannah River ECF operations.

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

5.3.16.2 Non-radiological Cumulative Impacts. Cumulative socioeconomic impacts associated

with constructing and operating the ECF Project at the SRS are expected to be minor currently employs over 20,000 people. In the past, no employment at the SRS has be with naval spent nuclear fuel operations. Savannah River ECF operations would prov employment for 500 people at the SRS and would help offset predicted future reducti work force (Halliburton 1992). The peak number of additional jobs created at the S year would be approximately 1050, which includes both construction and operations w the peak of the Savannah River ECF construction effort. Considering that the labor region of influence consists of 209,000 people, the additional number of jobs added construction and operation of the Savannah River ECF would be expected to have only socioeconomic impact in the SRS area.

Construction and operation of the ECF Project at the SRS are not expected to discernible impacts relative to cumulative non-radiological emissions. Constructio Project at either Site A or Site B is sufficiently remote and removed from the near such that concentrations of fugitive emissions from construction would be well belo standards, as discussed in Section F.4 of Attachment F. Current operations at the compliance with Title 40, Code of Federal Regulations, Part 61, "National Emission Hazardous Air Pollutants." Cumulative air emissions would not threaten to exceed a quality requirement or regulation, either federal, state, or local in radiological categories.

As discussed in Section 5.3.8, the withdrawal of surface water for ECF constr operation at the SRS would be a small percentage of existing withdrawals and well w cumulative capabilities of the respective water resources. ECF discharges of non-r non-hazardous liquid effluents at the SRS would not affect water quality. The volu liquid effluents discharged at SRS would also have no measurable impact on aquatic wetland habitat.

Minimal cumulative land use impacts would be expected to occur as a result of a new ECF. The land that would be dedicated for this purpose is on existing federa The use of this land would not result in the need for additional land to be added t owned property in the foreseeable future. The SRS occupies an area of approximatel kilometers (310 square miles) with only about 5% of the land occupied by constructe land area at the Savannah River Site has been affected by past operations involving nuclear fuel. Construction of the Savannah River ECF would affect 30 acres of land than 0.02% of the total Savannah River Site land area.

The cumulative impacts associated with non-radiological waste management are to be small. The volume of hazardous waste produced by ECF has not been calculated considering the nature of the work associated with ECF, the amount of hazardous was would have a small effect on the cumulative impacts associated with this waste. Th municipal solid wastes and sanitary wastes which would be generated is expected to the number of additional workers added, and this small incremental increase would n The amount of non-radiological wastes generated would not introduce any changes to management practices and would not impose any additional stress on the capacity of waste disposal or treatment facilities. Therefore, any cumulative impacts associat generation and disposal of additional wastes would be very small. There are no cur mental problems associated with these types of wastes.

5.3.17 Unavoidable Adverse Effects

The construction of the ECF Project at the SRS would directly impact about 30 area. An estimated 30 acres of stands of loblolly pine and mixtures of hardwoods w as part of construction activities for Site A. For the Barnwell Plant, no land wou due to the limited amount of construction required for this site. During construct and animal habitats associated with pine and hardwood vegetation communities would displaced.

Construction of the Savannah River ECF would also generate liquid effluents, emissions, and solid wastes typical of those for construction of a major industrial effluents and emissions would be below applicable environmental requirements and wo expected to result in any major adverse impacts.

During Savannah River ECF operation, non-radioactive and non-hazardous solid hazardous solid waste would be generated in quantities similar to those discussed f Non-radioactive and non-hazardous solid waste would be disposed of in the SRS sanit off-site in a commercial landfill. Hazardous wastes would be stored at the SRS in or on storage pads. The Resource Conservation and Recovery Act regulates these was

amount of hazardous waste generated by Savannah River ECF operation would be small son to the amount of hazardous waste that is generated and currently in interim sto No discernible differences from normal hazardous waste management at the SRS would this strategy.

During Savannah River ECF operation, unavoidable radiation exposures would in occupational exposures and exposures to the public from normal atmospheric emission materials that would be minimal compared to criteria contained in the Environmental Agency's 40CFR61 and DOE Order 5480.1B. Sanitary waste and service waste liquid di would be below applicable environmental standards. Solid wastes generated during o including transuranic, low-level, hazardous, and mixed wastes, would result in smal potential exposures to radioactive and hazardous materials. Freon emissions would negligible increase in the risk of skin cancer; substitutes will be used when avail

In general, the unavoidable adverse impacts would be few and limited, and non identified that would have a detectable effect on public health and safety. The di impacts between the ECF alternative at SRS and the other DOE sites (INEL, Hanford, Nevada Test Site) is not discernible.

5.3.18 Irreversible and Irretrievable Commitments of Resources

During operation of the Savannah River ECF, additional fuel oil would be burn steam for heat. The fuel is not in short supply. The water to be used for the Sav would be withdrawn from the Savannah River and would be a negligible amount. No ne intake structure would be required, and no observed impacts have resulted from prev als. Total consumption of water attributable to water pool operations and consumpt water by operating personnel represent less than one-thousandth of a percent of the average annual flow.

The total cost of locating a new ECF at Savannah River is approximately $3.5 cost represents the total cumulative costs over the 40-year period and includes con operations costs of the new ECF as well as the costs associated with shutting down Refer to Section 3.7 for a comparison of the total cumulative costs among alternati would be reduced if the Barnwell Plant were selected.

As is the case with the INEL-ECF, construction and operation of the Savannah would not require the use or consumption of scarce resources.

5.4 HANFORD SITE

5.4.1 Overview of Environmental Impacts

The following sections discuss the potential environmental consequences that facility to replace the Idaho National Engineering Laboratory Expended Core Facilit were to be constructed and operated at the Department of Energy (DOE) Hanford Site ECF). Two options exist at Hanford: build a new ECF between the 200 West and the 2 Areas, or modify the existing Fuels and Materials Examination Facility (FMEF) in th Figure 4.4-1). Details of the receipt, handling, and examination of naval spent nu Hanford and the modifications to the FMEF are described in Attachment E. A detaile the potential environmental consequences of other actions and alternatives at Hanfo Volume 1, Appendix A.

The environmental consequences of constructing and operating the Hanford ECF the same radiological source terms for normal and accidental releases and the estim emissions, liquid effluents, and solid wastes for the INEL-ECF discussed in Section

The environmental consequences for the Hanford ECF would be similar to those INEL-ECF (see Section 5.2), and none would be large.

5.4.2 Land Use

The Hanford ECF would use essentially the same land area as that which was af construction of the INEL-ECF. The structure itself would occupy approximately 5 ac total affected land area would be approximately 30 acres. The higher elevation of location relative to a Probable Maximum Flood would reduce the amount of grading an atmospheric emissions from construction activities.

The land area that would be affected at the Hanford Site has been dedicated t operations as a nuclear materials handling area. The land area affected by constru sagebrush vegetation community typical of the arid Hanford Site region. Land areas construction but not affected during operation would revert to the natural sagebrus

Native American rights and interests may be affected by construction or opera with alternatives that involve construction or modification of facilities at the Ha assisting Native Americans who have expressed an interest in renewing their use of land-use resources, in accordance with the Treaty of 1855. Details are provided in Appendix A.

5.4.3 Socioeconomics

If the Hanford ECF were to be constructed, the potential socioeconomic impacts with construction of the facility are expected to be equal to or less than those th with constructing the existing INEL-ECF because: (1) as at the INEL, a large migra tion workers into the area would not be expected for constructing the project at th to the availability of construction craft workers who were formerly involved in con the Hanford Site; and (2) the existing population base within 80 kilometers (50 mil Site is larger than that surrounding the INEL and would provide a larger capability incoming construction workers. The estimates of the social and economic requiremen operational work force expected to be employed during the construction period are s to those estimated for the INEL. Details are available in Volume 1, Appendix A.

Table 5.4-1 provides a summary of the direct jobs which would be required for tion and operation of the Hanford ECF during the 10-year period immediately after t Decision. The greatest number of direct jobs would occur in 1999 during the peak o phase. Estimates of the indirect jobs created as well as the effect on area popula Section 5.5.1 of Volume 1 as part of either the Regionalization or Centralization a alternatives.

Table 5.4-1. Summary of direct jobs due to the Hanford ECF.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Direct Jobs	20	20	476	825	1033	894	850	500	500	500

During the construction period, operations personnel would be hired so that a construction period, most of the workers required for operation and support would b When fully staffed, operation of the Hanford ECF would require approximately 500 pe number of operating and support personnel as operation of the INEL-ECF. The total force would represent about 3 percent of the Hanford Site employment. The potentia benefits to the area are expected to be similar to those for the INEL area. The be from the new jobs that would be created and the associated jobs that would become r (DOE 1986a).

With the small percentage increase in the number of jobs at the Hanford Site Hanford ECF operations, the impacts to local government services and community infr expected to be small. Volume 1 quantifies these effects. The beneficial economic region are expected to be similar to the economic benefits for the INEL region.

5.4.4 Cultural Resources

Construction at this site would neither impact any known archaeological and h disturb any known habitats for rare or endangered species. None of the alternative impact known archaeological or Native American sites. Procedures which comply with laws and regulations would be implemented to protect previously undetected archaeol cultural sites.

5.4.5 Aesthetic and Scenic Resources

The Hanford Site is in a semi-arid region of southeastern Washington. Since site was selected to become the facility for the production of plutonium for the Ma site has been devoted to research, development, and production activities. As a re location, its industrial characteristics are not readily visible to the public. Th compatible with the current industrial setting.

5.4.6 Geology

5.4.6.1 General Geology. The local geology of the Hanford region determines the locations of

the surface waters and groundwaters at the site. The geology of the Hanford region be affected by the Hanford ECF construction or operations.

5.4.6.2 Geologic Resources. Two geological resources are of particular relevance to the Hanford

Site and to its utility as a location for the Hanford ECF. The water table is loca feet beneath the site. The region between the surface and the water table is an un provides an effective barrier between the large aquifer in the groundwater below an work conducted above. No radiological or hazardous liquid effluent from the Hanfor discharged to the ground. The operation of the Hanford ECF is not expected to alte the unsaturated zone or the aquifer under the Hanford Site.

5.4.7 Air Resources

The meteorology of the Hanford region is described in Section 4.4.7. There i for the construction and operation of the Hanford ECF to have any impacts on the me region.

Consideration of general weather parameters in the Hanford region indicates a for air pollution due to frequent low rates of turbulence or mixing in the atmosphe rates of mixing in an atmospheric layer are found in thermally stable layers. Ther conditions occur at Hanford about 44 percent of the time, on the average. Neutral (moderate mixing) occur about 31 percent of the time. The highest rates of mixing unstable) occur only about 25 percent of the time.

The stagnation that results from low mixing permits an abnormally high concen pollutants to accumulate from sources within the region. This applies to ordinary smoke and other exhaust fumes from regional sources, as well as to airborne emissio and a Hanford ECF. The normal emissions from a Hanford ECF would be low enough tha increase that might be accumulated during an inversion would not have any discernib consequence. Less than 1 percent of the total calculated number of fatal cancers i (50-mile) population would be due to the normal operations of a Hanford ECF.

Some of the chemicals that are used in the normal operations of an ECF are cl chemicals. The use of these chemicals is controlled to limit the exposure of worke Airborne emissions from normal operations include the combustion gases from the boi where fuel is burned to make steam for space heating. Emergency diesel generators safety, are operated periodically for test purposes, and release exhaust fumes to t

The airborne release of radioactivity for the Hanford ECF would be the same a ECF described in Section 5.2. The airborne releases would result in no measurable site personnel or the general public. Details are provided in Attachment F.

Experience with construction activities at Hanford indicates that fugitive du the nearest point of public access and at the site boundaries would be less than th limits. Standard control techniques such as applying water to the disturbed ground limit the dust emissions at the construction site.

5.4.8 Water Resources

5.4.8.1 Surface Water. Water required for construction would be withdrawn from the Columbia

River. The amount of water withdrawn from the Columbia River would be negligible i with the 3400 cubic meters per second (120,000 cubic feet per second) annual averag the river at the Hanford Site. No new water withdrawal intake structure would be r

Expected surface water withdrawals from the Columbia River during Hanford ECF represent small incremental increases in the amount of water currently being withdr Hanford operations and represent a negligible withdrawal in comparison to the avera Columbia River. There would be no discharge of liquids from the Hanford ECF to eit Columbia or Yakima River.

5.4.8.2 Groundwater. The groundwater at the potential Hanford ECF site is several hundred feet

beneath the surface. This distance provides an ample buffer between the surface op aquifer.

There would be no discharge of radioactive or hazardous liquid effluents from ECF to the ground. The existence of contamination in the groundwater due to previo the Hanford Site is discussed in Section 4.4.8.

Sanitary effluents generated during construction would be treated through the tank and drain field. Solid non-radioactive and non-hazardous waste resulting from would be disposed of on-site at a sanitary landfill. Mitigative and control measur and fugitive dust emissions would be undertaken as required.

Sanitary effluents generated as a result of Hanford ECF operations would be d septic tank located outside of the protected-area fence. Effluent from the septic discharged to a sanitary tile field. Other liquid effluents, such as process steam be within the limits of DOE and federal standards (DOE 1986b; CFR 1991; CFR 1992a), monitored and discharged to a tile field. Liquid effluents meeting these standards would not result in contamination of groundwater resources.

5.4.9 Ecological Resources

The largest impacts would result from the Centralization alternative. It req tion and operation of the Hanford ECF. It is expected that these impacts would be to those already experienced at Hanford from the construction and operation of othe similar size and scope of operations. The expected impacts are discussed in the fo tions.

5.4.9.1 Terrestrial Ecology. Construction of the Hanford ECF would disturb approximately 30

acres of land, and would permanently occupy 5 acres of land. The remaining land wo revegetated with native grasses. There would be some adverse effect on animal popu especially the less-mobile animals that might be destroyed during land clearing, bu would move to another location. The small quantities of radioactivity that would b expected to have no effect on man, and are expected to have no effect on the terres Further discussion is provided in Volume 1, Appendix A.

5.4.9.2 Wetlands. Due to the semi-arid nature of the Hanford environment, there are few affected

wetland areas. They are found along the Columbia River and in local areas at the e where the growth of various plants is enhanced. Hanford ECF operations would not h adverse impact on these areas. Additional information is provided in Volume 1, App

5.4.9.3 Aquatic Ecology. There are no aquatic habitats at the potential site for the Hanford ECF.

Hence, there would be no impact on aquatic resources due to construction or operati ECF. Aquatic resources are discussed further in Volume 1, Appendix A. Experience Hanford operations have not adversely affected its aquatic ecology. The Hanford EC are expected to have no adverse impact.

5.4.9.4 Endangered and Threatened Species. Construction and operation of the Hanford ECF

would remove approximately 30 acres of sagebrush habitat until it was revegetated a after construction. This would impact some members of the species that nest and br Similarly, there would be some impact on vegetation and less-mobile animals, but in impacts would be local and the affected animals would be expected to relocate to an habitat on the site. Further discussion and mitigation measures are provided in Vo Appendix A.

5.4.10 Noise

The Hanford Site is a very large area, about 1450 square kilometers (560 squa

only about 6 percent of the area is occupied by constructed facilities. Other than associated with sparsely spaced industrial facilities and air, rail and road traffi detectable noise on the site. Construction of the Hanford ECF would cause typical noises during the construction period. There would be little or no noise accompany operations of the Hanford ECF.

5.4.11 Traffic and Transportation

Traffic and transportation would increase slightly in the Hanford area if an and operated at Hanford. The increased traffic would be mainly due to material shi Hanford ECF construction and additional commuter traffic from the construction work operations workers.

The Hanford ECF site would be served by railway and roads. Naval spent nucle any irradiated test specimens would be shipped by railway in shielded shipping cont shipyard, prototype, or test reactor to the Hanford ECF. There they would be exami prepared for storage at a DOE facility. Stored fuel and scrap specimens would be s would be shipped to a designated site for disposition. Solid, low-level waste from handling would be transported by roadway to a Hanford shallow land burial site.

5.4.12 Occupational and Public Health and Safety

The health and safety assessment of normal operations at the Hanford ECF is ba handling spent nuclear fuel for examination and storage by either of two approaches water pool or handling in a shielded dry cell. These are the same methods of spent handling that have been used or were seriously considered for use at the INEL-ECF.

The normal operational impacts associated with the Hanford ECF would be simil for the INEL-ECF. The following sections describe the non-radiological and radiolo associated with the Hanford ECF (refer to Section 5.2 for the INEL-ECF impacts).

5.4.12.1 Occupational Health and Safety. Projections of the number of occupational accidents

that might occur during construction and operation of naval spent nuclear fuel stor tion facilities have been made for each alternative. These projections are present Based on the results of these projections, it is concluded that the number of occup injuries or illnesses for construction activities and storage and examination opera small for any alternative.

During construction of the Hanford ECF at the Hanford Site, construction pers exposed to a slightly elevated background level of radioactivity resulting from ong operations. The maximum additional annual exposure from ongoing operations at the for a construction worker in the vicinity of the 200-East Area would be approximate if he or she spent 2000 hours per year (40 hours per week for 50 weeks per year) at annual exposure of approximately 2 to 3 millirem to a construction worker at the Ha be well below the DOE standard of 5000 millirem per year for occupational exposure.

During operation of the Hanford ECF, other Hanford personnel would be exposed atmospheric emissions of radioactivity and to potential emissions from accidents. exposure received by on-site personnel would be below the DOE standard for occupati external and internal exposure. Approximately 3000 workers are employed in the 200 within a 1.6-kilometer (1-mile) radius of the Hanford ECF site. Fewer workers are 400 Area (alternative FMEF site for the Hanford ECF). As shown in Attachment F, th effects due to exposures received by the collocated worker from normal Hanford ECF would be small. Exposures received by Hanford ECF workers are expected to be simil exposures that have been received by workers from recent ECF operations at the INEL Section 5.2.12.

5.4.12.2 Public Health and Safety. Radiological releases to the atmosphere during normal

operations and the quantities of radioactive and mixed wastes normally generated wo approximately the same as those previously discussed for the INEL. However, the lo Hanford ECF relative to the surrounding Hanford Site population and the distances t that would be involved in routine shipments of material would result in small diffe environmental consequences.

Assessment of the normal operations of the Hanford ECF involved two options: in a water pool or dry cell for examination and storage. For both options consider annual exposures were estimated for five different types of people: a worker at th located 100 meters from the release point, the hypothetical maximally exposed collo the Hanford Site, the hypothetical maximally exposed off-site individual (MOI), an nearest public access (NPA), and the population within 80 kilometers (50 miles) of site. Three pathways were included in the analysis: airborne, waterborne, and dir applicable.

The results indicate that either the water pool or the dry cell option would normal operations since the exposure is so low. The analysis shows that the exposu individuals considered (workers, collocated workers, MOI, and NPA) from Hanford ECF would be much less than 1 millirem per year. For perspective, it could be stated t the entire population might experience a fatal cancer due to Hanford ECF operations continued for over 200,000 years. A description of the analysis methods and more d are provided in Attachment F. The impacts from normal operations for all alternati summarized in Section 3.7.

The radiological and non-radiological health effects associated with the inci tation of naval spent nuclear fuel and test specimens have been assessed for the ge transportation workers, and hypothetical maximum exposed individual for each altern summarized in Section 3.7, it is unlikely that there will be any fatal cancers as a nuclear fuel and test specimen shipments since the estimates are much less than one each alternative. The details of the transportation analysis are provided in Attac

5.4.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling. As discussed preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the examination of naval spent nuclear fuel at the Hanfo small under any of the alternatives considered. For example, it is unlikely that a would occur as a result of activities associated with naval spent nuclear fuel exam alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the Hanford S any strongly dominant direction. Similarly, the conclusion is not affected by conc subsistence consumption of fish or game because of the very small impacts associate tion of naval spent nuclear fuel.

To place the impacts on environmental justice in perspective, the risk associ operations for naval spent nuclear fuel examination under any of the alternatives c less than one fatality per year for the entire population. For comparison, in 1990 mately 510,000 cancer deaths in the United States population and there were about 6 deaths among people of color in the U. S. Even if all of the impacts associated wi alternatives considered for naval spent nuclear fuel management were assumed to occ people of color, that group would be unlikely to experience a single additional can year. Therefore, the cancer risk for that population from naval spent nuclear fuel not constitute a disproportionately high and adverse impact on human health or the same conclusion can be drawn for low-income groups.

5.4.13 Utilities and Energy

Heating, ventilation, and electrical systems appropriate to the needs of the suitable working environments and to properly filter and exhaust the airborne disch atmosphere are estimated to require approximately 10,000 MWh per year for normal op Emergency diesel electrical generators would provide 350 kw for life support and cr services during power outages. The increase in electrical power needs might create additional capacity. The amount of energy consumed would be a small fraction of th used at the Hanford Site, and no discernible environmental consequence is expected.

5.4.14 Facility and Transportation Accidents

The potential consequences and risks of accidents for the Hanford ECF compared INEL-ECF are related to the meteorological transport of released material, the popu and (for the transport of naval spent nuclear fuel and any test specimens) the dist The following sections address the major potential accident consequences and risks Hanford ECF compared to the INEL-ECF.

5.4.14.1 Facility Accidents. The accident scenarios for the Hanford ECF are the same as those

considered for the existing ECF at the INEL. These include radiological accidents during water pool and dry handling of spent nuclear fuel as well as accidents invol chemicals used at ECF. The radiological accidents analyzed included: (1) an inadv caused by an earthquake or similar catastrophic event, (2) accidental loss of large containing radioactive material from a water pool into the ground and then into wat severe damage of spent fuel if it were dropped from a crane during handing or had a dropped on it. The probability of an accident caused by an airplane crash was calc Hanford ECF and was determined to be less than 10-7. Due to the low probability, n were calculated for this accident. Calculations of the cancer fatalities which mig all the postulated accidents are provided in Attachment F. A comparison of the acc es for all alternatives is provided in Section 3.7.

The difference in the calculated consequences for accidents at the Hanford EC the INEL-ECF is that the exposure received by the entire population tended to be gr Hanford ECF due to the larger population within an 80-kilometer (50-mile) radius of ECF project site. Although the exposure received was greater at the Hanford ECF, i any health effects would result from any of the accidents considered. As was the c INEL-ECF, the most limiting of the postulated accidents for the Hanford ECF was wat drainage, ultimately resulting in fuel overheating. The exposure to the entire pop accident is calculated to cause 0.047 cancer fatalities over 50 years, as described This amounts to an approximately 5-percent chance of one cancer fatality in 50 year potential accident.

The exposures to collocated workers following any accident are well below the DOE 5-rem standard for occupational exposure. However, exposures to the worker loc Hanford ECF site 100 meters from the radiation release point would exceed this stan accident resulting in an inadvertent criticality.

The effects from accidents involving the use of toxic chemicals at the Hanford similar to those described in Section 5.2.14 for the INEL-ECF. The same amount and chemicals stored and used at the INEL-ECF would be used at the Hanford ECF, so toxi would not pose a risk to the public following any of the postulated accidents. How maximum foreseeable accident analyzed (a fire transient), a number of toxic chemica the Emergency Response Planning Guideline (ERPG) values for workers on the Hanford well as collocated workers. For the maximum off-site individual (MOI), EPRG-1 valu chemicals are not exceeded under 50-percent or 95-percent meteorology conditions. concentrations of toxic chemicals following the fire transient and a summary of the are provided in Attachment F.

5.4.14.2 Transportation Accidents. The health effects associated with accidents during

shipments of naval spent nuclear fuel and test specimens have been assessed for the and hypothetical maximum exposed individual for each alternative. As summarized in is unlikely that there will be any fatal cancer as a result of naval spent nuclear shipments since the estimates are much less than one fatal cancer for each alternat most severe accident with a likelihood of occurrence greater than 1 x 10-7 events p to result in a maximum of approximately 2 cancer fatalities. The details of the tr are provided in Attachment A.

5.4.14.3 Other Impacts of Accidents. In addition to the possible human health effects

associated with facility or transportation accidents described in the preceding sec such as the impacts on socioeconomics and land use in the area and the costs of cle

estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that for the most severe hypothetical area of between about 8 acres extending about 1/4 mile downwind (for an accidental approximately 210 acres extending about 1 1/4 mile downwind (for a large airplane c examination facility) might be contaminated to the point where exposure could excee per year. Beyond these distances, the exposure would be less than 100 millirem per Nuclear Regulatory Commission's standard for protection of the general population f Persons who work at locations within this area might be prevented from going to the federally owned facilities until measures had been taken to reduce the potential fo

The area affected by the hypothetical accidents would not extend beyond the b federally owned Hanford Site. An accident might result in short-term restrictions relatively small area, but it would not be expected to produce any enduring impacts similar resources or concerns such as Native American rights or interests, partiall involved would be small and partly because all remedial actions would be conducted controlled manner in full compliance with applicable laws and regulations. The are slightly among alternatives. Overall, the risks are small so these considerations do not assist in distinguishing among alternatives.

Facility or transportation accidents associated with an Expended Core Facilit Site would not have an appreciable effect on the ecology of the area, considering t human health effects and the amount of land which might be affected, as described i this section. There is little consensus among scientists on methods for estimating radiation on ecological resources such as plant or animal life, but since human hea the accidents analyzed are small and most plants and animals are not thought to be radiation than human beings, the small impacts on human health provide an indicatio on animal and plant species in the area would also be small for an alternative whic the Expended Core Facility to the Hanford Site. Similarly, since the areas which m nated to measurable levels by chemicals or radioactive material during the hypothet would be relatively small, any effects on the ecology would be limited to small are stated, there are no endangered or threatened species unique to the area surroundin considered for a replacement Expended Core Facility at the Hanford Site, so an acci expected to result in destruction of any species. The effects of accidents related alternatives and any cleanup which might be performed would be localized in a small would not extend beyond a relatively short distance from the Expended Core Facility not be expected to appreciably affect the potential for survival of endangered or t the Hanford area. Based on these considerations, evaluation of impacts of accidents resources does not help to distinguish among alternatives.

5.4.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear Fuel

Storage and Handling. As discussed in the preceding paragraphs, the impacts on hum the environment resulting from facility or transportation accidents associated with naval spent nuclear fuel at the Hanford Site would be small under any of the altern For example, it is unlikely that a single additional fatal cancer would occur as a nuclear fuel management activities under any alternative. Since the potential impa accident for any of the alternatives considered would present no significant risk a a credible adverse impact on the surrounding population, no adverse effects from ac with the management of naval spent nuclear fuel would be expected for any particula population, minorities and low-income groups included.

To place the impacts on environmental justice in perspective, the risk from h accidents associated with naval spent nuclear fuel examination under any of the alt would amount to less than one additional fatality per year in the entire population in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.4.15 Waste Management

During Hanford ECF operations, non-radioactive and non-hazardous solid waste hazardous solid waste would be generated in quantities similar to those for the INE

wastes would be managed in a manner identical to that for the INEL-ECF (that is, no non-radioactive solid wastes would be disposed of at a sanitary landfill, and hazar be contained at their point of generation and transported off-site to an approved t and disposal facility). During normal waste management practices for these wastes, impact on public health and safety or the environment would occur.

Operation of the Hanford ECF would generate essentially the same quantities o waste, transuranic waste, and mixed wastes as discussed for the INEL. Additional i materials and waste management at Hanford is provided in Volume 1, Appendix A.

5.4.16 Cumulative Impacts

The potential environmental consequences of constructing and operating the Han discussed above in terms of annual impacts (that is, radiological exposures and hea risks, and quantities of wastes that would be generated during operation) based on operating experiences at the INEL-ECF. This section provides a discussion of the p quences of up to 40 years of operation of the Hanford ECF (from 1995 to 2035).

5.4.16.1 Radiological Cumulative Impacts. Operation of the Hanford ECF would not result in

discharges of radioactive liquids; therefore, there would be no changes to the surf as a result of normal operations for any alternative. There would be small quantit in the air released from the Hanford ECF which would contribute to the cumulative a impacts. The Hanford Site has not been used for naval spent nuclear fuel operation Prior to this time, naval spent nuclear fuel inspections and storage operations hav only at INEL. Therefore, no cumulative impacts have resulted from previous naval s inspection and storage operations at any alternate site except for INEL.

The annual radiological impacts associated with the alternatives where naval would be inspected or stored at Hanford Site are very small and are described in Se the detailed results of analyses provided in Attachment F. In order to calculate c for the period between 1995 and 2035, the annual radiological impacts associated wi and alternative were summed over 40 years. The results of this summation are tabul 3-5 and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the general public from transportation and from Hanford operations would be about 5 person-rem. This means that there would be about 0.002 from these operations over the entire 40-year period evaluated. The exposure to th exposed off-site individual would be less than 0.02 millirem from 40 years of Hanfo at either the 200 Area or the FMEF. The corresponding risk of a cancer fatality to exposed off-site individual is 4.8 x 10-9 at the 200 Area and 8.8 x 10-9 at the FME lifetime. A worker at the Hanford ECF site located 100 meters from the facility wo than 4 millirem over 40 years of Hanford ECF operation, which corresponds to a 1.4 fatal cancer during the worker's lifetime. These exposures and cancer risks are as operations only. The exposures and risks corresponding to site-wide operations (in discussed in Volume 1, Chapter 5. Analyses of hypothetical accidents which might o of these alternatives show that the risk of cancer fatalities is small. The impact transportation of naval spent nuclear fuel for all of the alternatives considered would be similarly low.

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

Cumulative impacts due to radioactive waste generation are expected to be min Approximately 425 cubic meters of low-level waste are expected to be generated annu Hanford ECF over the next 40 years. This is not expected to affect the Hanford was program. Very little transuranic waste or mixed waste and no high-level waste will from Hanford ECF operations.

5.4.16.2 Non-radiological Cumulative Impacts. The cumulative socioeconomic impacts

associated with constructing and operating the Hanford ECF are expected to be small Site currently employs over 18,000 people. In the past, no employment at the Hanfo associated with naval spent nuclear fuel operations. Hanford ECF operations would long-term employment for 500 people at the Hanford Site. The peak number of additi created at the Hanford Site in any given year would be approximately 1050, which in construction and operations workers during the peak of the Hanford ECF construction Considering that the labor force in the region of influence consists of approximate the additional number of jobs added from the construction and operation of the Hanf be expected to have only a minor socioeconomic impact in the Hanford area.

Construction and operation of the Hanford ECF are not expected to result in a from cumulative hazardous or toxic emissions. Construction would be sufficiently r nearest site boundaries such that concentrations of any fugitive construction emiss below applicable standards, as discussed in Section F.4 of Attachment F. Current o Hanford Site are in compliance with Title 40, Code of Federal Regulations, Part 61, Emission Standards for Hazardous Air Pollutants." Cumulative air emissions would n exceed any applicable air quality requirement or regulation, either federal, state, cal and non-radiological categories.

As discussed in Section 5.4.8, the withdrawal of surface water for constructi of the Hanford ECF would be a small percentage of existing withdrawals and well wit cumulative capabilities of the respective water resources. Discharges of ECF non-r non-hazardous liquid effluents to tile fields at the Hanford Site are not expected water quality (that is, either of itself or on a cumulative basis).

Minimal cumulative land use impacts would be expected to occur as a result of tion of a new ECF at Hanford. The land that would be dedicated for this purpose is federal property. The use of this land would not result in the need for additional the federally owned property in the foreseeable future. The Hanford Site occupies approximately 1450 square kilometers (560 square miles) with only about 6% of the l constructed facilities. No land area at the Hanford Site has been affected by past naval spent nuclear fuel. Construction of the Hanford ECF would affect 30 acres of less than 0.01% of the total Hanford Site land area.

The cumulative impacts associated with non-radiological waste management are small. The volume of hazardous waste produced by ECF has not been calculated; howe considering the nature of the work associated with ECF, the amount of hazardous was would have a small effect on the cumulative impacts associated with this waste. Th municipal solid wastes and sanitary wastes which would be generated is expected to the number of additional workers added, and this small incremental increase would n The amount of non-radiological wastes generated would not introduce any changes to management practices and would not impose any additional stress on the capacity of waste disposal or treatment facilities. Therefore, any cumulative impacts associat generation and disposal of additional wastes would be very small. There are no cur mental problems associated with these types of wastes.

5.4.17 Unavoidable Adverse Effects

Construction of the Hanford ECF would directly impact a total of about 120,00 meters (30 acres) of land area previously dedicated to the handling of nuclear mate approximately 400,000 square meters (100 acres) outside the protected site area for of a transmission line and tile field. During construction, plant and animal habit sagebrush vegetation community would be lost or displaced from areas not previously None of the land area outside the protected site area associated with the construct sion line and less than half of the land area within the protected site area would operation; the rest would revert to a sagebrush vegetation community through natura sion. Modification of the FMEF would have lesser impacts because the construction less extensive. Refer to Attachment E for details.

Construction of the Hanford ECF would also generate liquid effluents, atmosph and solid wastes typical of those for construction of a major industrial facility. emissions would be below applicable environmental requirements and would not be exp in any adverse impact.

During operation of the Hanford ECF, unavoidable radiation exposures would in occupational exposures and exposures to the public from normal atmospheric emission

materials that would be minimal compared to the criteria imposed by the "Environmen Health Program for Department of Energy Operations" (DOE 1986b) and the "National E Standard for Hazardous Air Pollutants" (CFR 1992b). Sanitary and service waste liq that would eventually be discharged to the soil column through tile fields would al applicable environmental standards, including radioactivity standards for drinking generated during operation, including transuranic, low-level, hazardous, and mixed result in small increases in potential exposures to radioactive and hazardous mater emissions would be controlled, but might result in a negligible increase in the ris substitutes would be used when available.

In general, the unavoidable adverse impacts would be few and limited, and non identified that would affect public health and safety.

5.4.18 Irreversible and Irretrievable Commitments of Resources

During operation of the Hanford ECF, additional fuel would be burned to supply similar to the levels experienced at the INEL-ECF. The water to be used for the H would be withdrawn from the Columbia River. The amount of water that would be with the Columbia River would be negligible. No new water withdrawal intake structure w required and no observed impacts have resulted from previous withdrawals. Total co tion of
water attributable to water pool operations and consumption of potable water by ope represent less than one-thousandth of a percent of the Columbia River average flow

The total cost of locating a new ECF at Hanford would be approximately $3.4 b cost represents the total cumulative cost over the 40-year period and includes cons operations costs of the new ECF as well as the cost associated with shutting down t the FMEF were to be modified for use as the Hanford ECF, the cost would be less. R 3.7 for a comparison of the total cumulative costs among alternatives.

Construction and operation of the Hanford ECF would not require the use or co scarce resources. Expected withdrawals of surface water and groundwater during con operation would represent small incremental increases in the amounts of water being ongoing Hanford operations.

5.5 OAK RIDGE RESERVATION

5.5.1 Overview of Environmental Impacts

The following sections discuss the potential environmental consequences that replacement for the Expended Core Facility (ECF) at the Idaho National Engineering (INEL) were constructed and operated at the Department of Energy's Oak Ridge Reserv This replacement will be referred to as Oak Ridge ECF. The new ECF would be sited Site which is located on the western portion of the ORR (see Figure 4.5-1 of Sectio

The environmental consequences of locating and operating the ECF at ORR are b same radiological source terms for normal and accidental releases and the estimated emissions, liquid effluents, and solid wastes discussed in Section 5.2 for the ECF environmental consequences of locating and operating the ECF at ORR would be simila the ECF at INEL, and none would be large.

5.5.2 Land Use

Construction of an ECF at ORR would directly affect about 30 acres of land ne highly developed K-25 Site area. Site preparation for construction would disturb a vegetation cover which primarily include oak/hickory forest land. The direct loss would be minimized to the extent practical. Following completion of construction, around the ECF would be landscaped with trees and shrubbery in a manner consistent facilities in the K-25 Site area. The affected land area is very small compared to Native American rights and interests would not be modified by construction or opera Ridge ECF.

5.5.3 Socioeconomics

The potential socioeconomic impacts associated with construction of the ECF a expected to be equal to or less than those associated with the original ECF constru because (1) a large movement of construction workers from other areas would not be Oak Ridge ECF construction due to the availability of construction craft workers in and (2) the existing population base within 80 kilometers (50 miles) of the ORR is surrounding the INEL area and would provide a greater capability to absorb the inco tion personnel.

Table 5.5-1 provides a summary of the direct jobs which would be associated w tion and operation of the Oak Ridge ECF during the 10-year period immediately follo of Decision. The greatest number of direct jobs would occur in 1999 during the pea construction phase. Estimates of the indirect jobs created as well as the effect o included in Chapter 5 of Volume 1 for Regionalization at the ORR and for Centraliza

Table 5.5-1. Summary of direct jobs due to Oak Ridge ECF construction and operatio

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Direct Jobs	20	20	476	825	1033	894	850	500	500	500

During the Oak Ridge ECF construction period, operations workers would be hir the end of the construction period, most of the 500 operations personnel would be e percentage of operations workers expected to move into the area from other areas va skill requirements. Overall, approximately 20 percent are estimated to move into t four-county region of influence around the ORR had a 1990 population of 489,230 per than twice that of the INEL.

ECF operations at the ORR would require essentially the same number of operat personnel as at the INEL. This would represent less than 3 percent of the total OR Given an average family size of 2.6 persons per household for operations personnel area, the expected population increase attributable to operations personnel would r percent of the average annual growth rate from 1980 to 1990 in the ORR's four-count influence. This percentage of population increase attributable to Oak Ridge ECF op relation to normal population increases in the ORR region might have a short-term, local government services and community infrastructures. The economic benefits to are expected to be similar to or less than those for the INEL region since the exis of the ORR region is greater and more diverse than that of the INEL region.

5.5.4 Cultural Resources

Construction or operation of the Oak Ridge ECF would not impact known archaeo Native American sites. Procedures which comply with all applicable laws and regula implemented to protect previously undetected archaeological and cultural sites.

5.5.5 Aesthetic and Scenic Resources

Construction of the Oak Ridge ECF would directly affect 30 acres of land. Th facility would be seen from Bear Creek Road as being completely surrounded by undev The forested ridges to the northwest and southeast of this area reduce its visibili owned lands, so that impacts to aesthetic and scenic resources would be minor.

5.5.6 Geology

5.5.6.1 General Geology. Although some ripping or blasting of limestone, dolomite, or quartz

layers could be necessary to construct the ECF, no unique geological features would There are no mining activities in this vicinity that could be impacted by ECF const operation. Previously disturbed areas would be regraded to accommodate the new ECF runoff from such land disturbances would be minimized by implementation of soil ero sediment control measures.

5.5.6.2 Geologic Resources. Since no extensive or unique geologic or mineral resources are

known to occur near the K-25 Site, impacts to such resources from ECF construction would not be expected.

5.5.7 Air Resources

Minor short-term emissions of fugitive dust and exhaust from heavy equipment possible during Oak Ridge ECF construction. The use of toxic chemicals during ECF operations is controlled to limit the exposure of workers and the public. Airborne normal operations would include the combustion gases from the boiler house, where f burned to make steam for space heating. Emergency diesel generators, which would b safety, would be operated periodically for test purposes and release exhaust fumes The environmental impacts of these emissions would be negligible.

The airborne releases of radioactivity for the ECF at ORR would be the same a at INEL described in Section 5.2. The airborne release would result in no measurab on-site personnel or the general population. Details are provided in Attachment F.

5.5.8 Water Resources

5.5.8.1 Surface Water. Water required for construction of the Oak Ridge ECF would be

withdrawn from the Clinch River. The small amount of water withdrawn would be negl comparison to the approximately 1.29 x 1010 liters (3.40 x 109 gallons) per day flo Hill Dam. No new water intake structure would be required.

The 2.5 million gallons per year additional surface water withdrawal from the during Oak Ridge ECF operations would represent a very small increase in the 6.93 x x 107 gallons) per day currently being withdrawn by ongoing ORR operations and repr negligible withdrawal in comparison to the average flow of the Clinch River.

Liquid discharges from the Oak Ridge ECF would be treated by a wastewater tre which would be built to service the new DOE spent nuclear fuel facilities. Dischar wastewater to area receiving waters would be in accordance with applicable National Discharge Elimination System effluent limits. These discharges would have a neglig the receiving water system. Design controls would render spills and leaks that cou surface or groundwater unlikely.

The Oak Ridge ECF would not be located within the 500-year floodplain.

5.5.8.2 Groundwater. No groundwater would be used for construction and operation of the Oak

Ridge ECF, given the plentiful surface water supplies. Therefore, no impact on gro or quantity is expected. Because there would be no direct discharge of process wat and because wastewater would be treated prior to a National Pollutant Discharge Eli System-permitted discharge to surface waters, no impacts on groundwater are expecte

5.5.9 Ecological Resources

5.5.9.1 Terrestrial Ecology. Areas of natural vegetation cover which primarily include

oak/hickory forest land would be disturbed for the Oak Ridge ECF. The loss of terr would be minimized to the extent practical. Construction and traffic noise might h minor impact on wildlife beyond the immediate construction site.

During construction and operation of the Oak Ridge ECF, all effluents and emi comply with regulatory standards and are not expected to have an impact on the area Operation of the Oak Ridge ECF should result in less noise and traffic than the con and no effects on terrestrial ecology are expected from Oak Ridge ECF operations.

5.5.9.2 Wetlands. Construction of the Oak Ridge ECF may displace forested wetlands adjacent to

tributaries of Grassy Creek flowing near the proposed site. This displacement of w accomplished in accordance with Corps of Engineers and Tennessee Water Quality Cont tration requirements.

5.5.9.3 Aquatic Ecology. Aquatic habitat would be affected by the rechanneling of tributaries to

Grassy Creek during construction of the Oak Ridge ECF. Minor increases in water wi the Clinch River and water discharged to its tributaries would not greatly affect t these water bodies. All wastewater would be discharged in compliance with National Discharge Elimination System permit limitations.

5.5.9.4 Endangered and Threatened Species. No known terrestrial or aquatic areas potentially

providing habitat to federally listed or state listed threatened or endangered spec construction area; consequently, impacts to threatened and endangered species are n a concern.

5.5.10 Noise

Noises generated on the ORR do not propagate off-site at levels that impact t population. Noise increases outside the ORR due to the Oak Ridge ECF would be limi produced by truck, car, and train traffic on roads and railroads approaching the OR increases would not be large enough to be objectionable to the communities borderin railroads.

5.5.11 Traffic and Transportation

Traffic and transportation would increase slightly in the ORR area if an ECF and operated at ORR. The additional traffic would mainly be due to increased commu construction workers and 500 operations workers as well as traffic from material sh Oak Ridge ECF construction and operation.

If the Oak Ridge ECF were established, naval spent nuclear fuel would be rout transported to the ORR in certified shipping containers. Various types of wastes g ECF would be dispositioned on-site and off-site. Following examination, most of th fuel would be transferred to the spent fuel storage location at ORR until the time geologic storage becomes available.

5.5.12 Occupational and Public Health and Safety

The health and safety assessment of normal operations at the Oak Ridge ECF wa handling and examination of naval spent nuclear fuel either in a water pool or in a are the same methods of spent nuclear fuel handling that have been employed or seri for use at the ECF at INEL. The normal operational impacts associated with the ECF be similar to those for the ECF at INEL. The following sections describe the non-r radiological impacts associated with the ECF at ORR (refer to Section 5.2 for the E impacts).

5.5.12.1 Occupational Health and Safety. Projections of the number of occupational accidents

that might occur during construction and operation of naval spent nuclear fuel stor examination facilities have been made for each alternative. These projections are Attachment F. Based on the results of these projections, it is concluded that the tional fatalities and injuries or illnesses for construction activities and storage operations would be very small for any alternative.

During Oak Ridge ECF construction, workers are not expected to experience ele background levels of radiation resulting from ongoing ORR operations. The potentia construction worker from inhalation of radionuclides released to the atmosphere fro operations is expected to be small compared to the external exposure. The exposure construction worker would be well below the naval and Department of Energy (DOE) st 5000 millirem per year for occupationally related whole-body and internal exposures

During operation of the Oak Ridge ECF, ORR personnel would be exposed to rout atmospheric emissions of radioactivity and might be exposed to potential emissions The Oak Ridge ECF site is located approximately 1 mile from the nearest ORR facilit Attachment F, no measurable exposure would be received by these collocated workers

Oak Ridge ECF operations. Exposures received by radiation workers from normal oper ECF at ORR are expected to be similar to the exposures currently received by worker operation of the ECF at INEL, discussed in Section 5.2.12.

Exposures, injuries, and potential fatalities to workers at the Oak Ridge ECF as a result of accidents during ECF operations. However, the safety record of the very good, and similar safe working conditions could be established at the new faci

5.5.12.2 Public Health and Safety. The impacts of normal operation of the ECF at ORR would

be similar to those for the ECF at INEL. Normal radiological releases to the atmos quantities of radioactive and hazardous wastes that would be generated would not di previously discussed for the INEL. However, location of the ECF relative to the su population and the distances to facilities that would be involved in routine shipme would result in differences in potential environmental consequences. Described bel to the public associated with operation of the ECF at ORR (refer to Section 5.2.12 INEL impacts).

Assessment of normal operation of the Oak Ridge ECF involved handling and exa spent fuel either in a water pool or in a dry cell. For both cases, the potential estimated for five different types of people: a worker at the Oak Ridge ECF site lo from the release point, the hypothetical maximally exposed collocated worker on the hypothetical maximally exposed off-site individual, an individual at the nearest pu population within 80 kilometers (50 miles) of the Oak Ridge ECF site. Three pathwa included in the analysis: airborne, waterborne, and direct radiation, as applicable

The results indicate that handling and examination of spent fuel either in a dry cell would be satisfactory for normal operations since the exposure is so low. that the exposure to all the individuals considered (workers, collocated workers, a individuals) from Oak Ridge ECF operations would be much less than 1 millirem per y perspective, it could be stated that one member of the entire population might expe cancer due to Oak Ridge ECF operations if operations continued for 20,000 years. A the analysis methods and more detailed results are provided in Attachment F. The i normal operations for all alternatives are summarized in Section 3.7.

The radiological and non-radiological health effects associated with the inci transportation of naval spent nuclear fuel and test specimens have been assessed fo population, transportation workers, and hypothetical maximum exposed individual for tive. As summarized in Section 3.7, it is unlikely that there will be any fatal ca naval spent nuclear fuel and test specimen shipments since the estimates are much l cancer for each alternative. The details of the transportation analysis are provid

5.5.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling. As discussed preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the examination of naval spent nuclear fuel at the ORR w under any of the alternatives considered. For example, it is unlikely that a singl occur as a result of activities associated with naval spent nuclear fuel examinatio alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the ORR do no strongly dominant direction. Similarly, the conclusion is not affected by concerns subsistence consumption of fish or game because of the very small impacts associate tion of naval spent nuclear fuel.

To place the impacts on environmental justice in perspective, the risk associ operations for naval spent nuclear fuel examination under any of the alternatives c less than one fatality per year for the entire population. For comparison, in 1990 mately 510,000 cancer deaths in the United States population and there were about 6 deaths among people of color in the U. S. Even if all of the impacts associated wi alternatives considered for naval spent nuclear fuel management were assumed to occ

people of color, that group would be unlikely to experience a single additional can year. Therefore, the cancer risk for that population from naval spent nuclear fuel not constitute a disproportionately high and adverse impact on human health or the same conclusion can be drawn for low-income groups.

5.5.13 Utilities and Energy

Heating, ventilation, and electrical systems appropriate to the needs of the O suitable working environments and to properly filter and exhaust the airborne disch atmosphere are estimated to require approximately 10,000 MWh per year for normal op Emergency diesel electrical generators would provide 350 kw for life support and cr services during power outages. The amount of energy consumed would be a small frac total energy used at ORR and no discernible environmental consequence is expected.

5.5.14 Facility and Transportation Accidents

The differences in the potential consequences and risks of accidents at the E compared to the ECF at INEL are related to the meteorological transport of released population exposure, and the distance of transport. The following sections address accident consequences and risks associated with locating an ECF at the ORR.

5.5.14.1 Facility Accidents. A number of hypothetical accidents were evaluated for the Oak

Ridge ECF. These included radiological accidents involving naval spent nuclear fue pool storage, dry storage, and dry cell operations as well as accidents involving t at ECF. Calculations of the cancer fatalities which might occur as a result of all accidents are provided in Attachment F. A comparison of the accident consequences alternatives is provided in Section 3.7.

The difference in the calculated consequences for accidents at the ECF at ORR the ECF at INEL is that the exposure received by the entire population would be gre Ridge ECF due to the larger population within an 80-kilometer (50-mile) radius of t ECF site. Although the exposure received was greater at the Oak Ridge ECF, the num effects which would result from any of the accidents considered would be small. Th of the postulated accidents for the ECF at Oak Ridge would be an airplane crash int facility. The exposure to the entire population from this accident is calculated t fatalities over 50 years, as described in Attachment F. The risk associated with t would be approximately 0.000008 fatal cancers per year.

Effects from two accidents at the ECF at Oak Ridge involving toxic chemicals in Attachment F. The first accident was a chemical spill and fire; the second was diesel fuel. Both accidents could expose the public to various toxic chemicals at exceed Emergency Response Planning Guidelines (ERPG) level 3 limits. Both accident expose workers at the Oak Ridge ECF to various toxic chemicals at concentrations wh ERPG-3 limits. In both cases, however, it is expected that actual toxic chemical e much less due to the mitigative measures that would be implemented. A summary of t methods, the toxic chemical concentrations, and a discussion of the mitigative meas chemicals are provided in Attachment F.

5.5.14.2 Transportation Accidents. The health effects associated with accidents during

shipments of naval spent nuclear fuel and test specimens have been assessed for the and hypothetical maximum exposed individual for each alternative. As summarized in is unlikely that there will be any health effects as a result of naval spent nuclea specimen shipments since the risk estimates are much less than one fatal cancer or for each alternative. However, the most severe accident, with a likelihood of occu 1 x 10-7 events per year, is estimated to result in a maximum of 2.1 fatalities. T transportation analysis are provided in Attachment A.

5.5.14.3 Other Impacts of Accidents. In addition to the possible human health effects

associated with facility or transportation accidents described in the preceding sec

such as the impacts on socioeconomics and land use in the area and the costs of cle estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that for the most severe hypothetical area of between about 8 acres extending about 1/4 mile downwind (for an accidental approximately 210 acres extending about 1 1/4 mile downwind (for a large airplane c examination facility) might be contaminated to the point where exposure could excee per year. Beyond these distances, the exposure would be less than 100 millirem per Nuclear Regulatory Commission's standard for protection of the general population f The area which might be affected by one of these hypothetical accidents could exten the boundaries of the Oak Ridge Reservation, so some people who live in the affecte evacuated or otherwise experience restrictions in their daily activities, and those locations within the affected area might be prevented from going to their jobs unti taken to reduce the potential for exposure.

An accident might result in short-term restrictions on access to a relatively would not be expected to produce any enduring impacts on cultural or similar resour such as Native American rights or interests, partially because the area involved wo partly because all remedial actions would be conducted in a careful, controlled man compliance with applicable laws and regulations. The area would vary only slightly alternatives. Overall, the risks are small so these considerations do not assist i alternatives.

Facility or transportation accidents associated with an Expended Core Facilit Ridge Reservation would not have an appreciable effect on the ecology of the area, potential for human health effects and the amount of land which might be affected, earlier parts of this section. There is little consensus among scientists on metho effects of radiation on ecological resources such as plant or animal life, but sinc for all the accidents analyzed are small and most plants and animals are not though sensitive to radiation than human beings, the small impacts on human health provide the impacts on animal and plant species in the area would also be small for an alte would relocate the Expended Core Facility to the Oak Ridge Reservation. Similarly, which might be contaminated to measurable levels by chemicals or radioactive materi hypothetical accidents would be relatively small, effects on the ecology should be areas. As previously stated, there are no endangered or threatened species unique surrounding the location considered for an Expended Core Facility at the Oak Ridge an accident would not be expected to result in destruction of any species. The eff related to any of the alternatives and any cleanup which might be performed would b within a small area which would extend only a relatively short distance from the Ex Facility and thus would not be expected to appreciably affect the potential for sur or threatened species in the vicinity. Based on these considerations, evaluation o accidents on ecological resources does not help to distinguish among alternatives.

5.5.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear Fuel

Storage and Handling. As discussed in the preceding paragraphs, the impacts on hum the environment resulting from facility or transportation accidents associated with naval spent nuclear fuel at the ORR would be small under any of the alternatives co example, it is unlikely that a single additional fatal cancer would occur as a resu nuclear fuel management activities under any alternative. Since the potential impa accident for any of the alternatives considered would present no significant risk a a credible adverse impact on the surrounding population, no adverse effects from ac with the management of naval spent nuclear fuel would be expected for any particula population, minorities and low-income groups included.

To place the impacts on environmental justice in perspective, the risk from h accidents associated with naval spent nuclear fuel examination under any of the alt would amount to less than one additional fatality per year in the entire population in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.5.15 Waste Management

During Oak Ridge ECF operations, non-radioactive and non-hazardous waste and waste would be generated in quantities similar to those for the ECF at INEL. Solid industrial wastes would be disposed of at an on-site landfill. Hazardous solid was contained at their point of generation and transported off-site to an approved disp management practices for these wastes would produce no identifiable impact on publi of the environment.

Operation of the ECF at ORR would generate the same quantities of radioactive waste, transuranic waste, and mixed wastes as the ECF at INEL. Low-level waste gen Oak Ridge ECF would be stored on-site pending a future disposal action. The 425 cu cubic yards) of low-level waste generated annually by the ECF at INEL represents a the low-level waste managed at ORR. No high-level waste would be generated.

Less than 0.0001 cubic meter of transuranic waste per year is generated by cu operations at the INEL. Any transuranic waste generated by the Oak Ridge ECF would small fraction of the transuranic waste at ORR and would not impact planned waste h Much of the newly generated and retrievably stored transuranic waste at ORR will be treated and certified for eventual disposal at the DOE Waste Isolation Pilot Projec

Any mixed waste generated by Oak Ridge ECF operations would be stored on-site future disposal action. This would represent a very small fraction of the mixed wa past and ongoing operations requiring disposition.

5.5.16 Cumulative Impacts

Up to this point, Section 5.5 has discussed the potential environmental conse structing and operating the ECF at the ORR in terms of annual impacts (i.e., radiol health effects, accident risks, and quantities of wastes that would be generated du based on the maximum expected annual workload of the ECF. To determine the potenti quences for 40 years of ECF operation (from 1995 to 2035), an evaluation of the acc environmental consequences and risks of constructing and operating the Oak Ridge EC performed.

5.5.16.1 Radiological Cumulative Impacts. Operation of the Oak Ridge ECF would not result

in discharges of radioactive liquids; therefore, there would be no changes to the s water as a result of normal ECF operations. There would be small quantities of rad air released from ECF which would contribute to the cumulative air quality impacts.

The Oak Ridge Reservation has not been used for naval spent nuclear fuel oper past. Prior to this time, naval spent nuclear fuel inspections and storage operati conducted only at INEL. Therefore, no cumulative impacts have resulted from previo nuclear fuel inspection and storage operations at any alternate site except for INE

The annual radiological impacts associated with the alternatives where naval would be inspected or stored at ORR are very small and are described in Section 5.5 detailed results of analyses provided in Attachment F. In order to calculate cumul the period between 1995 and 2035, the annual radiological impacts associated with e alternative were summed over 40 years. The results of this summation are tabulated and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure to the general public from transportation and from Oak Rid operations would be approximately 15 person-rem. This means that there might be 0. cancers from these operations over the entire 40-year period evaluated. The exposu maximally exposed off-site individual would be 4 millirem from 40 years of Oak Ridg operation. The corresponding risk of a cancer fatality to the maximally exposed of 2.0 x 10-6 during his or her lifetime. A worker at the Oak Ridge ECF site located the facility would receive less than 5 millirem over 40 years of Oak Ridge ECF oper corresponds to a 1.9 x 10-6 risk of fatal cancer during the worker's lifetime. The cancer risks are as a result of ECF operations only. The exposures and risks corre wide operations (including ECF) are discussed in Volume 1, Chapter 5. Analyses of

accidents which might occur as a result of these alternatives show that the risk of small. The impacts associated with transportation of naval spent nuclear fuel for tives considered would be similarly low.

Cumulative impacts due to radioactive waste generation are expected to be min Approximately 425 cubic meters (556 cubic yards) of low-level waste are expected to annually by the Oak Ridge ECF over the next 40 years. This is not expected to affe management program. Very little transuranic waste or mixed waste and no high-level generated from Oak Ridge ECF operations.

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

5.5.16.2 Non-radiological Cumulative Impacts. The cumulative socioeconomic impacts

associated with constructing and operating the Oak Ridge ECF are expected to be min Ridge Reservation employs over 17,000 people. In the past, no employment at the OR associated with naval spent nuclear fuel operations. Oak Ridge ECF operations woul term employment for 500 people at the ORR. The peak number of additional jobs crea in any given year would be approximately 1050, which includes both construction and workers during the peak of the Oak Ridge ECF construction effort. Considering that in the region of influence consists of over 292,000 people, the additional number o the construction and operation of the Oak Ridge ECF would be expected to have only socioeconomic impact in the Oak Ridge area.

Construction and operation of the Oak Ridge ECF are not expected to result in ible impacts relative to cumulative non-radiological emissions. Construction of th remote and removed from the nearest ORR boundaries such that concentrations of fugi from construction would be well below applicable standards, as discussed in Section ment F. Current operations at the Oak Ridge Reservation are in compliance with Tit Federal Regulations, Part 61, "National Emission Standards for Hazardous Air Pollut Cumulative air emissions would not threaten to exceed any applicable air quality re regulation, either federal, state, or local in radiological and non-radiological ca

The withdrawal of surface water for ECF construction and operation at the ORR small percentage of existing withdrawals and well within the cumulative capabilitie water resources. Discharges of ECF non-radioactive and non-hazardous liquid efflue would have no measurable impact on water quality or aquatic ecology.

Minimal cumulative land use impacts would be expected to occur as a result of tion of a new ECF. The land that would be dedicated for this purpose is on existin The use of this land would not result in the need for additional land to be added t owned property in the foreseeable future. The Oak Ridge Reservation occupies an ar approximately 140 square kilometers (54 square miles) with only about 8% of the lan the Y-12 Plant, K-25 Site, and Oak Ridge National Laboratory. No land area at the Reservation has been affected by past operations involving naval spent nuclear fuel the Oak Ridge ECF would affect 30 acres of land. This is less than 0.09% of the to Reservation land area.

The cumulative impacts associated with non-radiological waste management are to be small. The volume of hazardous waste produced by ECF has not been calculated considering the nature of the work associated with ECF, the amount of hazardous was would have a small effect on the cumulative impacts associated with this waste. Th municipal solid wastes and sanitary wastes which would be generated is expected to the number of additional workers added, and this small incremental increase would n The amount of non-radiological wastes generated would not introduce any changes to management practices and would not impose any additional stress on the capacity of waste disposal or treatment facilities. Therefore, any cumulative impacts associat generation and disposal of additional wastes would be very small. There are no cur mental problems associated with these types of wastes.

5.5.17 Unavoidable Adverse Effects

Construction of an ECF at ORR would directly affect about 30 acres of land ar preparation for construction would disturb areas of natural vegetation cover which oak/hickory forest land. The direct loss of terrestrial habitat would be minimized practical.

Construction of the Oak Ridge ECF would also generate liquid effluents, atmos emissions, and solid wastes typical of those for construction of a major industrial effluents and emissions would be below applicable environmental requirements and wo expected to result in any major adverse impacts.

During Oak Ridge ECF operations, non-radioactive and non-hazardous waste and waste would be generated in quantities similar to those discussed for the INEL. So industrial wastes would be disposed of in an ORR landfill. Hazardous wastes would their point of generation and transported off-site to an approved disposal facility hazardous waste generated by Oak Ridge ECF operations would be small in comparison amount of hazardous waste that is generated at the ORR. No discernible differences hazardous waste management at the ORR would result from this strategy.

During Oak Ridge ECF operations, unavoidable radiation exposures would includ tional exposures and exposures to the public from normal atmospheric emissions of r materials that would be small compared to criteria contained in 40CFR Part 61.92 an 5480.1B. Sanitary waste and service waste liquid discharges would be below applica standards. Solid wastes generated during operations, including transuranic, low-le and mixed wastes, would result in small increases in potential exposures to radioac

Construction and operation of the Oak Ridge ECF would not require the use or of scarce resources. Expected surface water withdrawals during construction and op represent small incremental increases in the amount of water being withdrawn by ong operations. In general, the unavoidable adverse impacts would be few and limited, been identified that would have a detectable effect on public health and safety. T impacts between the ECF alternative at ORR and the other DOE sites (INEL, Savannah Hanford, Nevada Test Site) is not discernible.

5.5.18 Irreversible and Irretrievable Commitments of Resources

During operation of the Oak Ridge ECF, additional fuel would be burned to sup heat. The fuel is not in short supply. The water to be used for the Oak Ridge ECF drawn from the Clinch River and would be a small amount. No new water intake struc required, and no observed impacts have resulted from previous withdrawals. Total c water attributable to water pool operations and consumption of potable water by ope represent less than one-thousandth of a percent of the Clinch River average annual

The total cost of locating a new ECF at Oak Ridge is approximately $3.5 billi represents the total cumulative cost over the 40-year period and includes construct costs of the new ECF as well as the cost associated with shutting down the ECF at I Section 3.7 for a comparison of the total cumulative costs among alternatives.

As is the case with the ECF at INEL, construction and operation of the ECF at not require the use or consumption of scarce resources.

5.6 NEVADA TEST SITE

5.6.1 Overview of Environmental Impacts

The following sections discuss the potential environmental consequences that replacement for the Expended Core Facility (ECF) at the Idaho National Engineering (INEL) were constructed and operated at the Department of Energy's Nevada Test Site facility will be referred to as the Nevada ECF. The affected environment for the p depicted on Figure 4.6-1, is discussed briefly in Section 4.6 and in greater detail Appendix F.

The environmental consequences of locating and operating the ECF at NTS are b same radiological source terms for normal and accidental releases and the estimated emissions, liquid effluent, and solid wastes discussed in Section 5.2 for the ECF a environmental consequences of locating and operating the Nevada ECF would be simila the ECF at INEL, and none would be large.

5.6.2 Land Use

Over 40.5 square kilometers (10,000 acres) of land exists in the area being c location for the proposed Nevada ECF. This is in the same general area being consi

proposed spent nuclear fuel storage facility discussed in Volume 1, Appendix F. Co ECF at NTS would directly affect about 30 acres of land. This would result in only reduction in the available land base of the NTS. Located next to Mercury Highway, area would support construction and maintenance of an ECF, railcar holding faciliti support facilities. The ECF facilities would be compatible with all existing and p NTS facilities. The affected land area is small compared to the entire NTS. Nativ and interests would not be modified by construction or operations associated with a alternatives considered.

5.6.3 Socioeconomics

The potential socioeconomic impacts associated with construction of the Nevad expected to be equal to or less than those associated with the original ECF constru because (1) a large movement of construction workers from other areas would not be Nevada ECF construction due to the availability of construction craft workers in th and (2) the counties surrounding the NTS have a population adequate to absorb any t relocation of construction personnel.

Table 5.6-1 provides a summary of the direct jobs which would be required for tion and operation of the Nevada ECF during the 10-year period immediately after th Decision. The greatest number of direct jobs would occur in 1999 during the peak o phase. Estimates of the indirect jobs created as well as the effect on area popula Section 5.5.6 of Volume 1 as part of either the Regionalization or Centralization a Site alternatives.

Table 5.6-1. Summary of direct jobs due to the Nevada ECF.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Direct Jobs	20	20	476	825	1033	894	850	500	500	500

During the Nevada ECF construction period, operations personnel would be hire the end of the construction period, most of the operations workers would be employe percentage of operations workers expected to move into the area from other areas va skill requirements. Overall, approximately 20 percent are estimated to move into t Las Vegas Metropolitan Service Area, which constitutes the major portion of the pop region of influence, had a 1990 population of 735,000 and an estimated population o August 1993.

The Nevada ECF operation would require essentially the same number of operati personnel (500) as at the INEL. This would represent a relatively small percentage work force. Given the 20-percent estimate for immigration and an average family si per household for operations personnel moving into the area, the expected populatio attributable to the operating personnel would be 260 persons.

Given the small percentage of population increase attributable to Nevada ECF relation to normal population increases in the NTS region, no major adverse impacts government services and community infrastructures are expected. The economic benef region are expected to be similar to those for the INEL region.

5.6.4 Cultural Resources

Construction at the site considered for the Nevada ECF would not impact any k archaeological or Native American sites. Procedures which comply with all applicab regulations would be implemented to protect previously undetected archaeological an

5.6.5 Aesthetic and Scenic Resources

The construction of the Nevada ECF would directly affect approximately 30 acr As a result of its location and industrial characteristics, there is essentially no impact since the site would not be visible to the public.

5.6.6 Geology

5.6.6.1 General Geology. The local geology of the NTS region has been impacted as a result of

past nuclear testing. This impact has been in the form of surface faulting. Becau

operation of the Nevada ECF would not produce forces near the magnitude of those pr past nuclear tests, it is highly unlikely that this activity would cause additional

5.6.6.2 Geologic Resources. Precious metals may exist in certain carbonate rocks and volcanic

or sedimentary rocks at the NTS. The Nevada ECF would not be located within a mini the site will likely remain closed to mining operations so the impact to any precio that may exist at the NTS will not change if the proposed facility is sited there.

5.6.7 Air Resources

Minor short-term emissions of fugitive dust and exhaust from heavy equipment possible during Nevada ECF construction. The use of toxic chemicals during ECF nor would be controlled such that the exposure levels of workers and the public would b Airborne emissions from normal operations would include the combustion gases from t house, where fuel would be burned to make steam for space heating. Emergency diese which would be provided for safety, would be operated periodically for test purpose exhaust fumes to the atmosphere. These emissions would not have any detectable env consequence.

The airborne releases of radioactivity for the ECF at NTS would be the same a at INEL described in Section 5.2. The airborne release would result in no measurab on-site personnel or the general population. Details of the analyses supporting th provided in Attachment F.

5.6.8 Water Resources

5.6.8.1 Surface Water. As stated in Section 4.6.8, with the exception of short periods of runoff

from spring discharges, there is no perennial surface water at the NTS. As such, t supply required to operate the Nevada ECF could not be obtained from local surface the NTS currently derives its complete water supply from the groundwater aquifers. construction and operation of the Nevada ECF would have no impact on the quantity a surface water in the area.

There are no National Pollutant Discharge Elimination System permits for the are no wastewater discharges to on-site and off-site surface waters. NTS wastewate to sewage lagoons. Therefore, all wastewaters associated with the construction and Nevada ECF would likely be discharged into the on-site lagoon system along with the wastewaters generated at the NTS. Thus, surface water quantity and quality in the not be expected to be impacted.

5.6.8.2 Groundwater. The NTS currently extracts groundwater from aquifers within two

hydrographic subbasins: Alkali Flat-Furnace Creek Ranch and Ash Meadows. These sub with their specific hydrographic areas and NTS well locations, are described in Sec 1, Appendix F. The 2.5 million gallons per year additional withdrawal of water fro required for operation of an ECF represents less than a 3-percent increase over the which water is withdrawn for use in Area 6 and less than 0.5 percent of the total N

5.6.9 Ecological Resources

5.6.9.1 Terrestrial Ecology. During construction and operation of the Nevada ECF, all effluent

and emissions would comply with regulatory standards and are not expected to have a area wildlife. Operation of the Nevada ECF should result in less noise and traffic tion phase, and no effects on terrestrial ecology are expected from Nevada ECF oper

5.6.9.2 Wetlands. National Wetland Inventory maps of the NTS have not been prepared, nor

have wetlands been delineated on the site. However, available information indicat the NTS are limited in distribution and extent. Small areas of wetlands could be p margins of the surface drainages, playas, and reservoirs on the NTS. It is expecte and operation of the Nevada ECF would have negligible impact on any wetlands.

5.6.9.3 Aquatic Ecology. Because there would be no discharge of radioactive or hazardous liquid

effluent from Nevada ECF operation, these operations are expected to have no effect ecology.

5.6.9.4 Endangered and Threatened Species. The endangered and threatened species are

described in Section 4.6.9. The desert tortoise is the only federally listed speci affected by the construction of an ECF facility. Forty-five percent of the total k habitat is located in the Yucca Mountains. The area that could be affected directl ECF are Frenchman Flat and the southern bajada of Control Point Hills.

Construction and maintenance of roads, utility and communication lines, build pipelines, sewage lagoons, and other facilities could result in harm or harassment and loss of habitat. Tortoises could become injured by falling into open trenches construction excavations and might not be able to escape. They could become submer storage ponds, wastewater lagoons, and other impoundments not fenced to exclude the

5.6.10 Noise

Noises generated on the NTS do not propagate off-site at levels that impact t population. Noise increases outside the NTS due to the Nevada ECF would be limited produced by truck, car, and train traffic on roads and railroads approaching the NT increases would not be large enough to be objectionable to the areas bordering the railroads.

5.6.11 Traffic and Transportation

Traffic and transportation would increase in the area if an ECF is constructe the NTS. The additional traffic would mainly be due to increased commuter traffic workers and 500 operations workers as well as traffic from material shipments durin ECF construction.

If the Nevada ECF were established, naval spent nuclear fuel would be routine to the site in certified shipping containers. Various types of wastes generated at dispositioned on-site and off-site. Following examination, most of the naval spent be transferred to the spent fuel storage location on the NTS until the time that pe storage becomes available.

5.6.12 Occupational and Public Health and Safety

The health and safety assessment of normal operations at the Nevada ECF was b handling and examination of spent nuclear fuel either in a water pool or in a dry c same methods of spent nuclear fuel handling that have been employed or seriously co at the ECF at INEL. The normal operational impacts associated with the Nevada ECF similar to those for the ECF at INEL. The following sections describe the non-radi radiological impacts associated with the ECF at NTS (refer to Section 5.2 for the E impacts).

5.6.12.1 Occupational Health and Safety. Projections of the number of occupational accidents

that might occur during construction and operation of naval spent nuclear fuel stor tion facilities have been made for each alternative. These projections are present Based on the results of these projections, it is concluded that the number of occup injuries or illnesses for construction activities and storage and examination opera

small for any alternative.

During Nevada ECF construction, workers are not expected to experience elevat ground levels of radiation resulting from on-going NTS operations. The gamma radia near the proposed Nevada ECF site is similar to the radiation levels measured off-s area. The potential exposure to a construction worker from inhalation of radionucl atmosphere from previous and current NTS operations is expected to be small compare external exposure. The exposure received by a construction worker would be well be and Department of Energy (DOE) standard of 5000 millirem per year for occupationall whole-body and internal exposures.

During operation of the Nevada ECF, NTS personnel would be exposed to routine atmospheric emissions of radioactivity and might be exposed to potential emissions The Nevada ECF site is located approximately 3 miles from the Radioactive Waste Man Facility, which is the nearest existing NTS facility. As shown in Attachment F, no exposure would be received by these collocated workers from normal Nevada ECF opera Exposures received by radiation workers from normal operation of the ECF at NTS are be similar to the exposures currently received by workers from normal operation of INEL, discussed in Section 5.2.12.

Exposures, injuries, and potential fatalities to workers at the Nevada ECF co a result of accidents during ECF operations. However, the safety record of the ECF good, and similar safe working conditions could be established at the new facility.

5.6.12.2 Public Health and Safety. The impacts of normal operation of the Nevada ECF would

be similar to those for the ECF at INEL. Normal radiological releases to the atmos quantities of radioactive and hazardous wastes that would be generated would not di previously discussed for the INEL. However, the location of the project relative t NTS population and the distances to facilities that would be involved in routine sh would result in differences in potential environmental consequences. Described bel to the public associated with operation of the ECF at NTS (refer to Section 5.2.12 INEL impacts).

Assessment of the normal operations of the Nevada ECF involved handling and e of spent fuel either in a water pool or in a dry cell. For both cases, the potenti were estimated for five different types of people: a worker at the Nevada ECF site from the release point, the hypothetical maximally exposed collocated worker on the hypothetical maximally exposed off-site individual, an individual at the nearest pu population within 80 kilometers (50 miles) of the Nevada ECF site. Three pathways the analysis: airborne, waterborne, and direct radiation, as applicable.

The results indicate that handling and examination of spent fuel either in a dry cell would be satisfactory for normal operations since the exposure is so low. that the exposure to all the individuals considered (workers, collocated workers, a individuals) from Nevada ECF operations would be much less than one millirem per ye perspective, it could be stated that one member of the entire population might expe cancer due to Nevada ECF operations if operations continued for over 11 million yea of the analysis methods and more detailed results are provided in Attachment F. Th from normal operations for all alternatives are summarized in Section 3.7.

The radiological and non-radiological health effects associated with the inci transportation of naval spent nuclear fuel and test specimens have been assessed fo population, transportation workers, and hypothetical maximum exposed individual for tive. As summarized in Section 3.7, it is unlikely that there will be any fatal ca naval spent nuclear fuel and test specimen shipments since the estimates are much l cancer for each alternative. The details of the transportation analysis are provid

5.6.12.3 Incident-free Occupational and Public Health and Safety Effects on Environ-

mental Justice Due to Naval Spent Nuclear Fuel Storage and Handling. As discussed preceding paragraphs, the impacts on human health or the environment resulting from operations associated with the examination of naval spent nuclear fuel at the NTS w under any of the alternatives considered. For example, it is unlikely that a singl occur as a result of activities associated with naval spent nuclear fuel examinatio alternative. Since the potential impacts due to normal operations or accident cond alternatives considered present no significant risk and do not constitute a credibl the surrounding population, no adverse effects would be expected for any particular population, minorities and low-income groups included.

The conclusion that there would be no disproportionately high and adverse imp health or the environment is not affected by the prevailing winds or direction of s water flow. This is true for normal operations because the effects of routine oper It is also true for accident conditions because the consequences of any accident wo random conditions at the time it occurred, and the wind directions at the NTS do no strongly dominant direction. Similarly, the conclusion is not affected by concerns subsistence consumption of fish or game because of the very small impacts associate tion of naval spent nuclear fuel.

To place the impacts on environmental justice in perspective, the risk associ operations for naval spent nuclear fuel examination under any of the alternatives c less than one fatality per year for the entire population. For comparison, in 1990 approximately 510,000 cancer deaths in the United States population and there were cancer deaths among people of color in the U. S. Even if all of the impacts associ the alternatives considered for naval spent nuclear fuel management were assumed to among people of color, that group would be unlikely to experience a single addition in any year. Therefore, the cancer risk for that population from naval spent nucle would not constitute a disproportionately high and adverse impact on human health o ment. The same conclusion can be drawn for low-income groups.

5.6.13 Utilities and Energy

Heating, ventilation, and electrical systems appropriate to the needs of the N suitable working environments and to properly filter and exhaust the airborne disch atmosphere are estimated to require approximately 10,000 MWh per year for normal op This would represent about a 4-percent increase in NTS electrical consumption and m transmission line upgrades. Emergency diesel electrical generators would provide 3 facility services during power outages.

5.6.14 Facility and Transportation Accidents

The differences in the potential consequences and risks of accidents at the E compared to the ECF at INEL are related to the meteorological transport of released population exposure, and the distance of transport. The following sections address accident consequences and risks associated with locating an ECF at the NTS.

5.6.14.1 Facility Accidents. A number of hypothetical accidents were evaluated for the Nevada

ECF. These included radiological accidents involving naval spent nuclear fuel duri storage, dry storage, and dry cell operations, as well as accidents involving toxic ECF. Calculations of the cancer fatalities which might occur as a result of all th are provided in Attachment F. A comparison of the accident consequences for all al provided in Section 3.7.

The difference in the calculated consequences for accidents at the Nevada ECF the ECF at INEL is that the exposure received by the entire population would be les ECF due to a different population distribution within an 80-kilometer (50-mile) rad The most limiting of the postulated accidents for the Nevada ECF would be an airpla dry cell facility. The exposure to the entire population from this accident is cal cancer fatalities over 50 years, as described in Attachment F.

The exposures to collocated workers following all accidents are well below th DOE standard of 5 rem per year for occupational exposure. However, exposures to th located at a Nevada ECF site 100 meters from the radiation release point could exce following an accident resulting in an inadvertent criticality or an airplane crash

Effects from accidents at the Nevada ECF involving toxic chemicals are simila described in Section 5.2.14 for the existing ECF at INEL. Due to the amount and ty stored at the ECF site, toxic chemicals do not pose a risk to the public following accidents. However, following the maximum foreseeable accident analyzed (a fire tr number of toxic chemicals would exceed Emergency Response Planning Guideline (ERPG) workers on the Nevada ECF site. For the maximum off-site individual, ERPG-2 values chemicals are not exceeded under either 50% meteorology or 95% meteorology conditio concentrations of toxic chemicals as well as a summary of the analysis methods are Attachment F.

5.6.14.2 Transportation Accidents. The health effects associated with accidents during

shipments of naval spent nuclear fuel and test specimens have been assessed for the and hypothetical maximum exposed individual for each alternative. As summarized in is unlikely that there will be any health effects as a result of naval spent nuclea specimen shipments since the risk estimates are much less than one fatal cancer or effect for each alternative. However, the most severe accident, with a likelihood greater than 1 x 10-7 events per year, is estimated to result in a maximum of 2.1 f details of the transportation analysis are provided in Attachment A.

5.6.14.3 Other Impacts of Accidents. In addition to the possible human health effects

associated with facility or transportation accidents described in the preceding sec such as the impacts on socioeconomics and land use in the area and the costs of cle estimated in order to develop a perspective and to evaluate potential differences a The analyses described in Attachment F showed that for the most severe hypothetical area of between about 8 acres extending about 1/4 mile downwind (for an accidental approximately 210 acres extending about 1 1/4 mile downwind (for a large airplane c examination facility) might be contaminated to the point where exposure could excee per year. Beyond these distances, the exposure would be less than 100 millirem, th Regulatory Commission's standard for protection of the general population from radi affected by the hypothetical accidents would not extend beyond the boundaries of th Site. Persons who work at locations within this area might be prevented from going the federally owned facilities until measures had been taken to reduce the potentia

An accident might result in short-term restrictions on access to a relatively would not be expected to produce any enduring impacts on cultural or similar resour such as Native American rights or interests, partially because the area involved wo partly because all remedial actions would be conducted in a careful, controlled man compliance with applicable laws and regulations. The area would vary only slightly alternatives. Overall, the risks are small so these considerations do not assist i alternatives.

Facility or transportation accidents associated with an Expended Core Facilit Test Site would not have an appreciable effect on the ecology of the area, consider for human health effects and the amount of land which might be affected, as describ of this section. There is little consensus among scientists on methods for estimat radiation on ecological resources such as plant or animal life, but since human hea the accidents analyzed are small and most plants and animals are not thought to be radiation than human beings, the small impacts on human health provide an indicatio on animal and plant species in the area would also be small for an alternative whic the Expended Core Facility to the Nevada Test Site. Similarly, since the areas whi contaminated to measurable levels by chemicals or radioactive material during the h accidents would be relatively small, effects on the ecology should be limited to sm previously stated, there are no endangered or threatened species unique to the area location considered for an Expended Core Facility at the Nevada Test Site, so an ac be expected to result in destruction of any species. The effects of accidents rela alternatives and any cleanup which might be performed would be localized within a s would extend only a relatively short distance from the relocated Expended Core Faci would not be expected to appreciably affect the survival potential of endangered or in the vicinity. Based on these considerations, evaluation of the impacts of accid resources does not help to distinguish among alternatives.

5.6.14.4 Effects of Accidents on Environmental Justice Due to Naval Spent Nuclear Fuel

Storage and Handling. As discussed in the preceding paragraphs, the impacts on hum the environment resulting from facility or transportation accidents associated with naval spent nuclear fuel at the NTS would be small under any of the alternatives co example, it is unlikely that a single additional fatal cancer would occur as a resu nuclear fuel management activities under any alternative. Since the potential impa accident for any of the alternatives considered would present no significant risk a a credible adverse impact on the surrounding population, no adverse effects from ac with the management of naval spent nuclear fuel would be expected for any particula

population, minorities and low-income groups included.

To place the impacts on environmental justice in perspective, the risk from h accidents associated with naval spent nuclear fuel examination under any of the alt would amount to less than one additional fatality per year in the entire population in 1990 there were approximately 40,000 traffic fatalities in the United States pop were about 7,400 deaths caused by traffic accidents among people of color in the U. the additional cancer deaths associated with an accident involving any of the alter for naval spent nuclear fuel management were assumed to occur only among people of group would experience less than one additional fatal cancer per year. The same co drawn for low-income groups.

5.6.15 Waste Management

During Nevada ECF operation, non-radioactive and non-hazardous solid waste an solid waste would be generated in quantities similar to those for the ECF at INEL. would be managed in a manner identical to that for the ECF at INEL (i.e., non-hazar radioactive solid wastes would be disposed of at a sanitary landfill and hazardous be contained at their point of generation and transported off-site to an approved d Waste management practices for these wastes would produce no identifiable impact on and safety of the environment.

Operation of the ECF at NTS would generate the same quantities of low-level w transuranic waste, and mixed wastes as the ECF at INEL. Low-level waste generated ECF would be disposed of at the NTS. The 425 cubic meters (556 cubic yards) of low generated annually by the ECF at INEL represents a small fraction of the low-level the NTS and would not impact planned disposal operations. No high-level waste woul

Less than 0.0001 cubic meter of transuranic waste per year is generated by cu operations at the INEL. Any transuranic waste generated by the Nevada ECF would be Nevada Test Site's transuranic waste storage cell, and would not impact planned was operations. Any mixed wastes generated by Nevada ECF operation would be stored on- future disposal action.

5.6.16 Cumulative Impacts

Up to this point, Section 5.6 has discussed the potential environmental conse structing and operating the ECF Project at the NTS in terms of annual impacts (i.e. doses and health effects, accident risks, and quantities of wastes that would be ge operations) based on the maximum expected annual workload of the ECF. To determine consequences for 40 years of ECF operation (from 1995 to 2035), an evaluation of th environmental consequences and risks of constructing and operating the Nevada ECF w

5.6.16.1 Radiological Cumulative Impacts. The Nevada Test Site has not been used for naval

spent nuclear fuel operations in the past. Prior to this time, naval spent nuclear storage operations have been conducted only at INEL. Therefore, no cumulative impa resulted from previous naval spent nuclear fuel inspection and storage operations a except for INEL.

Operation of the Nevada ECF will not result in discharges of radioactive liqu there would be no changes to the surface or ground water as a result of normal oper alternative. There will be small quantities of radioactivity in the air released f contribute to the cumulative air quality impacts.

The annual radiological impacts associated with the alternatives where naval would be inspected or stored at the NTS are very small and are described in Section detailed results of analyses provided in Attachment F. In order to calculate cumul the period between 1995 and 2035, the annual radiological impacts associated with e alternative were summed over 40 years. The results of this summation are tabulated and 3-6 of Section 3.

The cumulative transportation impacts for the population groups from naval sp transportation activities since the beginning of the Naval Nuclear Propulsion Progr calculated and are very small. In addition, the cumulative impacts from transporta nuclear fuel over the 40-year period between 1995 and 2035 for each alternative hav The detailed results of these calculations are presented in Attachment A and summar 3.7.4.

The total exposure (from operations and transportation) to the general public ECF operation would be approximately 6 person-rem. This means that there would be 3 x 10-3 fatal cancers from these operations over the entire 40-year period evaluat the maximally exposed off-site individual would be less than 1 millirem from 40 yea Site ECF operation. The corresponding risk of a cancer fatality to the maximally e individual is 6.8 x 10-9 during his or her lifetime. A worker at the Nevada Test S meters from the facility would receive less than 2 millirem over 40 years of Nevada operation, which corresponds to a 7.2 x 10-7 risk of fatal cancer during the worker exposures and cancer risks are as a result of ECF operations only. The exposures a corresponding to site-wide operations (including ECF) are discussed in Volume 1, Ch Analyses of hypothetical accidents which might occur as a result of these alternati risk of cancer fatalities is small. The impacts associated with transportation of fuel for all of the alternatives considered would be similarly low.

Cumulative impacts due to radioactive waste generation are expected to be min Approximately 425 cubic meters of low-level waste are expected to be generated annu Nevada ECF over the subject 40-year period. This is not expected to affect the NTS management program. Very little transuranic waste or mixed waste and no high-level generated from Nevada ECF operations.

No contribution to cumulative impacts from accidents involving naval spent nu been included in the analyses presented in this Environmental Impact Statement beca never been a nuclear reactor accident, criticality accident, transportation acciden radioactivity which had a significant effect on the environment.

5.6.16.2 Non-radiological Cumulative Impacts. The cumulative socioeconomic impacts

associated with constructing and operating the Nevada ECF are expected to be minor. Test Site currently employs over 8,500 people. In the past, no employment at the N associated with naval spent nuclear fuel operations. Nevada Test Site ECF operatio long-term employment for 500 people at the NTS. The peak number of additional jobs NTS in any given year would be approximately 1050, which includes both construction tions workers during the peak of the Nevada Test Site ECF construction effort. Con labor force in the region of influence is expected to reach 792,309 people by 2004, number of jobs added from the construction and operation of the Nevada Test Site EC expected to have only a minor socioeconomic impact in the NTS area.

Construction and operation of the Nevada ECF are not expected to result in an impacts relative to cumulative non-radiological emissions. Construction of the ECF remote and removed from the nearest NTS boundaries such that concentrations of fugi from construction would be well below applicable standards, as discussed in Section Attachment F. Current operations at the Nevada Test Site are in compliance with Ti Federal Regulations, Part 61, "National Emission Standards for Hazardous Air Pollut Cumulative air emissions would not threaten to exceed any applicable air quality re regulation, either federal, state, or local in radiological and non-radiological ca

Minimal cumulative land use impacts would be expected to occur as a result of tion of a new ECF. The land that would be dedicated for this purpose is on existin The use of this land would not result in the need for additional land to be added t owned property in the foreseeable future. The Nevada Test Site occupies an area of 3,500 square kilometers (1,350 square miles) of which only about 0.55% is developed at the Nevada Test Site has been affected by past operations involving naval spent Construction of the Nevada Test Site ECF would affect 30 acres of land. This is le the total Nevada Test Site land area.

The cumulative impacts associated with non-radiological waste management are to be small. The volume of hazardous waste produced by ECF has not been calculated considering the nature of the work associated with ECF, the amount of hazardous was would have a small effect on the cumulative impacts associated with this waste. Th municipal solid wastes and sanitary wastes which would be generated is expected to the number of additional workers added, and this small incremental increase would n The amount of non-radiological wastes generated would not introduce any changes to management practices and would not impose any additional stress on the capacity of waste disposal or treatment facilities. Therefore, any cumulative impacts associat generation and disposal of additional wastes would be very small. There are no cur mental problems associated with these types of wastes.

5.6.17 Unavoidable Adverse Effects

Construction of an ECF at NTS would directly affect about 30 acres of land ar loss of terrestrial habitat would be minimal.

Construction of the Nevada ECF would also generate liquid effluents, atmosphe and solid wastes typical of those for construction of a major industrial facility. emissions would be below applicable environmental requirements and would not be exp in any major adverse impacts.

During Nevada ECF operations, non-radioactive and non-hazardous solid waste a solid waste would be generated in quantities similar to those discussed for the INE and non-hazardous solid waste would be disposed of in the NTS sanitary landfill. H would be contained at their point of generation and transported off-site to an appr facility. The amount of hazardous waste generated by Nevada ECF operation would be comparison to the amount of hazardous waste that is generated and currently in inte NTS. No discernible differences from normal hazardous waste management at the NTS from this strategy.

During Nevada ECF operations, unavoidable radiation exposures would include o exposures and exposures to the public from normal atmospheric emissions of radioact that would be minimal compared to criteria contained in 40CFR Part 61.92 and DOE Or Sanitary waste and service waste liquid discharges would be below applicable enviro standards. Solid wastes generated during operations, including transuranic, low-le mixed wastes, would result in small increases in potential exposures to radioactive materials. Freon emissions would result in a negligible increase in the risk of sk will be used when available.

Construction and operation of the Nevada ECF would not require the use or con scarce resources. Expected groundwater withdrawals during construction and operati represent small incremental increases in the amount of water being withdrawn by ong operations. In general, the unavoidable adverse impacts would be few and limited, been identified that would have a detectable effect on public health and safety. T impacts between the ECF alternative at the NTS and the other DOE sites (INEL, Savan Hanford, Oak Ridge) is not discernible.

5.6.18 Irreversible and Irretrievable Commitments of Resources

During operation of the Nevada ECF, additional fuel would be burned to supply heat. The fuel is not in short supply. The water to be used for the Nevada ECF wo from the groundwater aquifers. No new water wells are expected to be required, and impacts have resulted from previous withdrawals. Total consumption of water attrib pool operations and consumption of potable water by operating personnel would repre small percentage of the supply available by aquifer recharge.

The total cost of locating a new ECF at the Nevada Test Site is approximately This cost represents the total cumulative cost over the 40-year period and includes operation costs of the new ECF as well as the cost associated with shutting down th Refer to Section 3.7 for a comparison of the total cumulative costs among alternati

As is the case with the ECF at INEL, construction and operation of the Nevada not require the use or consumption of scarce resources.

5.7 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE

ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT
OF LONG-TERM PRODUCTIVITY

Implementation of any of the alternatives for the Navy will commit and utiliz environmental resources shortly after the implementation date. In general, up to a acres of land could be committed to support naval spent nuclear fuel management act be noted however that the land at the Naval Reactors Facility at the Idaho National Laboratory is already committed to this purpose and implementation of the Preferred would not require the commitment of any additional land. The spent nuclear fuel ma activities are expected to require up to 2.5 million gallons of water per year and megawatt-hours of electrical energy per year depending on the alternative selected. throughout this Appendix, the normal operations associated with naval spent nuclear will result in some radioactive releases and releases of some toxic chemicals and o however, due to the types of operations involved and the stringent controls that wo

these releases would be extremely small and would not affect long-term productivity
Commitment of these resources is necessary to support long-term safe handling examination of naval spent nuclear fuel.

5.8 POTENTIAL MITIGATION MEASURES

As stated earlier, all of the environmental impacts associated with implement the alternatives would be small. However, measures will be taken to reduce these s lowest possible levels. Consistent with existing Naval Nuclear Propulsion Program historical practices, actions would be taken to prevent pollution, and to mitigate spent nuclear fuel management facility construction, operations and potential accid measures are summarized below; additional discussion is provided in Attachment F.

5.8.1 Pollution Prevention

Extensive environmental control programs and procedures are in place at all n order to minimize any environmental and public safety and health impacts that might radiological and non-radiological operations. A summary of some of these controls following sections.

5.8.1.1 Radiological Pollution Prevention Actions. The policy of the U.S. Navy is to reduce to

the minimum practicable the amounts of radioactivity released to the environment. implemented at shipyards and prototype sites through procedures that are consistent recommendations of the National Council on Radiation Protection and Measurements an standards issued by the U.S. Environmental Protection Agency, International Commiss Radiation Protection, International Atomic Energy Agency, National Academy of Scien Research Council, U.S. Nuclear Regulatory Commission, and U.S. Department of Energy

The principal source of radioactivity in liquid effluents is trace amounts of products from reactor plant metal surfaces in contact with reactor cooling water. radioactive fission products are normally not a consideration for waste disposal be products remain within spent nuclear fuel elements, which are not handled as waste. liquids that are generated at shipyard and prototype sites are collected in contain remove most of the radioactivity, and reused rather than intentionally discharged t

Radiological work facilities are designed to ensure that there are no appreci radioactivity in airborne exhausts. Radiological controls are exercised in radiolo to preclude exposure of workers to airborne radioactivity exceeding limits specifie of Federal Regulations, Chapter 20. These controls include performing work involvi materials inside plastic bags or glove boxes which are completely sealed off from t Air exhausted from radiological work facilities is passed through high efficiency p which remove more than 99.9 percent of all particles from air, and is monitored dur verify the effectiveness of the control measures.

Sources of radiation are controlled at shipyards and prototypes. Radiologica are designed to minimize radiation exposure to personnel who perform work in the fa ensure that exposure to personnel outside the facility is negligible. Ambient radi with sensitive devices outside the boundaries of areas where radiological work is p to confirm that radiological operations result in no measurable increase in exposur public.

Shipyards and prototypes are not permitted to dispose of radioactive waste on solid radioactive wastes are packaged in strong, tight containers, shielded as nece burial sites that are either licensed by the U.S. Nuclear Regulatory Commission or agreement with the U.S. Nuclear Regulatory Commission or are authorized for radioac disposal by the U.S. Department of Energy. The volume of waste that is generated a minimized through use of work procedures that limit the amount of material that bec ed during work on radioactive systems and reactor components. Workers periodically specifically intended to help them minimize the production of radioactive waste.

Personnel who work with radioactive materials receive specific training regar hazards associated with radioactive materials, the general and specific radiologica she might encounter, and his or her responsibility to the Navy and the public for s radioactive materials. More details regarding the scope of this training are provi Propulsion Program Reports NT-94-2 and NT-94-3 (NNPP 1994b and NNPP 1994c).

5.8.1.2 Non-radiological Pollution Prevention Actions. Naval shipyards and prototype sites

follow applicable federal, state, and local requirements for the prevention of rele cal pollutants to the environment. Procedures are in place at each location that e at the shipyard or prototype comply with environmental requirements and that the op have an adverse effect on the workers, the public, and the environment.

Shipyards and prototype sites are subject to regulation under the Clean Air A follow Environmental Protection Agency, state, and local regulations regarding air prevention. Permits are secured as required for operation of facilities which migh toxic, or hazardous air pollutants. Equipment is designed and operated in order to National Emission Standards for Hazardous Air Pollutants and National Ambient Air Q Standards for the region. Procedures are also in place at shipyard and prototype s the facilities comply with federal, state, and local requirements regarding asbesto burning, vehicle emissions, and use of ozone depleting substances. When appropriat are treated in order to achieve compliance with requirements and to ensure that the degrade ambient air quality.

Shipyard and prototype sites also must comply with the requirements of the Cl The Navy policy is to reduce or eliminate the need for wastewater treatment by mini eliminating pollutants at the source. Permits are secured as required for all poin navigable waters and corrective measures are taken to comply with the terms of thes cases where Publicly Owned Treatment Works are used for industrial wastewater disch measures are taken by the site to ensure that the discharges are in accordance with local requirements.

Each site has an active program for evaluating equipment and chemicals propos purchase to minimize or eliminate environmental, safety, and health hazards. These help to minimize the amount of hazardous waste that is generated by ensuring that t quantities of hazardous materials procured are kept to a minimum. Each site has an investigate the replacement of toxic or hazardous materials with other materials an substitutions are made in order to avoid the use of chemicals that would result in hazardous waste. The procurement program includes approval by appropriate safety a organizations at the site. Hazardous wastes and other toxic substances, such as po biphenyls, are handled and disposed of in accordance with applicable Environmental Agency, state, and local requirements. Personnel who handle hazardous materials, h and other potentially hazardous substances receive training regarding the specific materials that they are expected to handle and the methods for safely handling thos training is conducted in accordance with applicable requirements such as those mand Occupational Safety and Health Administration, the Department of Transportation, an mental Protection Agency. Non-hazardous solid wastes are handled and disposed of i with applicable federal, state, and local requirements. When practicable and econo materials are recycled or recovered.

Naval designs also consider the effects of the life-cycle of components, incl disposal. For example, stainless steel fittings are frequently used in equipment i bronze fittings, which contain lead, and which can allow lead to leach out of the m Similarly, solvents chosen for naval work in recent years have been selected to avo substances and complex organic chemicals.

Contingency plans exist at shipyard and prototype sites to respond to all acc and hazardous substance (radiological and non-radiological) releases. These plans developed in accordance with the applicable federal, state, and local requirements ensure that workers, the public, and the environment would be protected in the even release.

5.8.1.3 Prevention of Mixed Wastes. Mixing of radioactive and chemically hazardous materials

is avoided; compounding the intrinsic hazards of radioactivity with the chemical ha materials creates a complex regulatory and occupational safety and health situation execution of the work. For example, hazardous materials which could give rise to h listed under the Resource Conservation and Recovery Act (such as acetone) are precl radiological work. Other materials such as alcohol are used instead. The success in avoiding the creation of mixed radioactive and hazardous waste is reflected by t 1993, Program sites, naval shipyards, and Program DOE laboratories and prototypes p than 30 m3 of mixed waste and hold a current inventory of less than 100 m3.

5.8.2 Construction

In the event that implementation of an alternative requires construction of a location will be selected to avoid impacts on the cultural, archaeological, aesthet resources of the area and to ensure that the rights and interests of Native America Hawaiian groups are not infringed. Ecologically sensitive areas such as those in t threatened or endangered species, and sites listed in the National Register of Hist be avoided.

If upon implementation of an alternative, it is determined that construction nuclear fuel management facility would appreciably impact some resources, then acti those impacts would be taken. These actions could include, but would not be necess items such as: archaeological data collection prior to construction, education of cultural resources and unauthorized artifact collection, involvement of Native Amer Hawaiians in the selection of a mitigation strategy, and memorandums of agreement b and concerned parties. Preactivity surveys would be conducted to identify any plan that could be affected. As needed, mitigation measures and recovery plans would be agencies such as the U.S. Fish and Wildlife Services and the Corps of Engineers wou The potential for soil erosion could be reduced through methods such as control of runoff, including sediment catch basins. Fugitive dust emissions would be minimize wetting exposed soils. Traffic concerns could be controlled by widening of roads a management. Workers in the construction environment would be protected by the use and ear plugs and other safety equipment as needed.

5.8.3 Normal Operations

As has been the policy of the Naval Nuclear Propulsion Program, normal work pr any naval spent nuclear fuel management facility would be designed to minimize rele therefore mitigate the impacts on the environment. Releases as a result of normal be minimized through a variety of measures, including: closely controlling the gen contaminated waste, using total containment devices for certain work that could res release, filtering the ventilation exhaust from radiological facilities, and recycl used in contaminated systems. All radiological workers at naval facilities are tra mitigation principles and in other methods of minimizing radiation exposure. Mitig the use of toxic or hazardous materials make use of administrative controls, traini equipment to provide personnel protection and emergency response. For personnel pr controls involve safety review committees for planned activities that establish req permits and procedures, and the use of required clothing such as rubber boots, glov and eye protection that mitigate the effects associated with use of toxic or hazard Procedures may also require provisions for positioning mitigative devices such as e and emergency showers before work is allowed to commence. All of the facilities be would employ emergency response programs to mitigate impacts of potential toxic che to workers and the public.

5.8.4 Accidents

Although a serious accident involving naval spent nuclear fuel is highly unli plans are in place at all nuclear naval facilities to mitigate the impacts of a fac accident. These plans include activation of emergency control organizations throug Nuclear Propulsion Program to provide on-scene response as well as support for the response team. Realistic training exercises are conducted periodically to ensure t organizations maintain a high level of readiness, and to ensure that coordination a lines with local authorities and other federal and state agencies are effective. I designed to resist corrosion and damage due to accident conditions; this rugged con also have an important mitigative effect on the impacts of an accident involving na fuel.

Emergency response measures include provisions for immediate response to any any naval site, identification of the accident conditions, and communications with providing radiological data and recommendations for any appropriate protective acti of an accident involving radioactive or toxic materials, workers in the vicinity of promptly evacuate the immediate area. This evacuation can typically be accomplishe

of the accident and would reduce the hazard to workers.

For members of the general public residing at the site boundary and beyond, a taken to prevent the public from exceeding certain limits on exposure to radiation needed. Individuals that reside or work on site, or those that may be traversing t would be evacuated from the affected area within 2 hours. Security personnel and a officials at all locations would oversee the removal of residents, workers, and tra efficient manner. Periodic training and evaluation of the emergency response perso to ensure that correct actions are taken during an actual casualty. Therefore, exp workers, and travelers to any hazard, including the potential for ingestion and inh nation, would be limited, as much as possible. Upon stabilization of the situation remediation actions would be implemented as soon as practicable.

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