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DOE/EIS-0274

FINAL ENVIRONMENTAL IMPACT STATEMENT

Disposal of the S3G and D1G Prototype Reactor Plants

Volume 1 of 2

November 1997

Prepared by the
U. S. Department of Energy
Office of Naval Reactors

Printed on recycled paper

Affected Public: Individuals or households; Federal Government; State, Local or Tribal Gov't, SEAs or LEAs.

Annual Reporting and Recordkeeping Hour Burden:

Responses: 925,698.

Burden Hours: 943,318.

Abstract: A local educational agency must submit an application to the Department to receive Impact Aid payments under sections 8002 or 8003 of the Elementary and Secondary Education Act (ESEA), and a State requesting certification under section 8009 of the ESEA must submit data for the Secretary to determine whether the State has a qualified equalization plan and may take Impact Aid payments into consideration in allocating State aid.

[FR Doc. 97–30975 Filed 11–25–97; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF EDUCATION

President's Board of Advisors on Historically Black Colleges and Universities; Meeting

AGENCY: President's Board of Advisors on Historically Black Colleges and Universities, Department of Education.

ACTION: Notice of meeting.

SUMMARY: This notice sets forth the schedule and agenda of the meeting of the President's Board of Advisors on Historically Black Colleges and Universities. This notice also describes the functions of the Board. Notice of this meeting is required under Section 10(a)(2) of the Federal Advisory Committee Act.

DATE AND TIME: December 18, 1997 from 9:00 a.m. to 5:00 p.m.

ADDRESSES: The meeting will be held at the Sheraton City Centre Hotel located at 1143 New Hampshire Avenue, NW, Washington, DC.

FOR FURTHER INFORMATION CONTACT: Sterling Henry, White House Initiative on Historically Black Colleges and Universities, U.S. Department of Education, 600 Independence Avenue, SW, the Portals Building, Suite 605, Washington, DC 20202–5120. Telephone: (202) 708–8667.

SUPPLEMENTARY INFORMATION: The President's Board of Advisors on Historically Black Colleges and Universities was established under Executive Order 12876 of November 1, 1993. The Board is established to advise on the financial stability of Historically Black Colleges and Universities, to issue an annual report to the President on HBCU participation in Federal programs, and to advise the Secretary of Education on increasing the private sector role in strengthening HBCUs.

The meeting of the Board is open to the public. The meeting will be primarily devoted to the discussion of challenges facing historically black colleges and universities.

Records are kept of all Board procedures, and are available for public inspection at the White House Initiative on Historically Black Colleges and Universities located at 1250 Maryland Avenue, S.W., The Portals Building, Suite 605, Washington, DC, 20202, from the hours of 8:30 a.m. to 5:00 p.m.

Dated: November 19, 1997.

David A. Longanecker,

Assistant Secretary for Postsecondary Education.

[FR Doc. 97–31043 Filed 11–25–97; 8:45 am]

BILLING CODE 4000–01–M

DEPARTMENT OF ENERGY

Notice of Availability of the Final Environmental Impact Statement on the Disposal of the S3G and D1G Prototype Reactor Plants

AGENCY: Department of Energy.

ACTION: Notice of availability.

SUMMARY: The Department of Energy (DOE) Office of Naval Reactors (Naval Reactors) has published the Final Environmental Impact Statement on the Disposal of the S3G and D1G Prototype Reactor Plants. The Final Environmental Impact Statement was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969; Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500–1508); and DOE NEPA Implementing Procedures (10 CFR Part 1021). The Final Environmental Impact Statement and its supporting references are available to the public at the Saratoga Springs Public Library in Saratoga Springs and the Schenectady County Public Library in Schenectady, New York. The Final Environmental Impact Statement is also available by mail upon request.

SUPPLEMENTARY INFORMATION:

Background

The S3G and D1G Prototype reactor plants are located on the Kesselring Site near West Milton, New York, approximately 17 miles north of Schenectady. The S3G and D1G Prototype reactor plants first started operation in 1958 and 1962, respectively, and served for more than 30 years as facilities for testing reactor plant components and equipment and for training of U.S. Navy personnel. As a result of the end of the Cold War and the downsizing of the Navy, the S3G and D1G Prototype reactor plants were shut down in May 1991 and March 1996, respectively. Since then, the S3G and D1G Prototype reactor plants have been defueled and placed in a safe and stable protective storage condition. The Kesselring Site will not be released for other uses in the foreseeable future since two active prototype reactor plants continue to operate to perform training of U.S. Navy personnel and testing of naval nuclear propulsion plant equipment.

Alternatives Considered

1. Prompt Dismantlement—Preferred Alternative

The Final Environmental Impact Statement identifies prompt dismantlement as the preferred alternative. If selected, this alternative would be subject to the availability of appropriated funding. This alternative would involve the prompt dismantlement of the S3G and D1G Prototype reactor plants. All S3G and D1G Prototype reactor plant systems, components and structures would be removed from the Kesselring Site. To the extent practicable, the resulting low-level radioactive metals would be recycled at existing commercial facilities. The remaining low-level radioactive waste would be disposed of at the DOE Savannah River Site in South Carolina. The Savannah River Site currently receives low-level radioactive waste from Naval Reactors' sites in the eastern United States. Both the volume and radioactive content of the S3G and D1G Prototype reactor plant low-level waste fall within the projections of Naval Reactors' waste provided to the Savannah River Site, which are included in the *Savannah River Site Waste Management Final Environmental Impact Statement*, dated July 1995. For the purposes of providing an upper bound in transportation related risk analyses, transportation of low-level radioactive waste to the Hanford Site in Washington State is also evaluated. There are no current plans to ship low-level radioactive wastes from S3G and D1G Prototype reactor plant dismantlement activities to the Hanford Site. In the event that shipment of these wastes to Hanford Site becomes necessary, waste disposal plans and activities would comply with all applicable State and Federal statutes and regulations.

2. Deferred Dismantlement

The deferred dismantlement alternative would involve keeping the defueled S3G and D1G Prototype reactor plants in protective storage for 30 years before dismantlement. Deferring dismantlement for 30 years would allow nearly all of the cobalt-60 radioactivity to decay. Nearly all of the gamma radiation within the reactor plant comes from cobalt-60. The very small amount of longer-lived radioisotopes, such as nickel-59, would remain and would have to be addressed during dismantlement.

3. No Action

The no action alternative would involve keeping the defueled S3G and D1G Prototype reactor plants in protective storage indefinitely. Since there is some residual radioactivity with long half-lives, such as nickel-59, in the defueled reactor plant, this alternative would leave some radioactivity at the Kesselring Site indefinitely.

4. Other Alternatives Considered

The other alternatives considered include permanent on-site disposal. Such on-site disposal could involve building an entombment structure over the S3G and D1G Prototype reactor plants or developing a below-ground disposal area at the Kesselring Site. Another alternative would be to remove the S3G and D1G Prototype reactor plants as two large reactor compartment packages for offsite disposal. Each of these alternatives was considered but eliminated from detailed analysis.

Public Comments on the Draft Environmental Impact Statement

Naval Reactors held a public hearing with two sessions on the Draft Environmental Impact Statement in Milton, New York on August 13, 1997. Comments from 14 individuals and agencies were received in either oral or written statements at the hearing or in comment letters. Approximately one-third of the commenters expressed a preference for the preferred alternative, prompt dismantlement. Two commenters favored the deferred dismantlement alternative and the remaining commenters expressed no specific preference for any of the alternatives. Public comments resulted in only minor clarifications in the Final Environmental Impact Statement. Based on U.S. Environmental Protection Agency (EPA) review of the Draft Environmental Impact Statement, EPA rated the proposed project as "LO" (Lack of Objection). All of the comments and Naval Reactors" responses are included in an appendix to the Final Environmental Impact Statement.

Preferred Alternative

Naval Reactors has identified the prompt dismantlement alternative as the preferred alternative since it is consistent with the Naval Reactors' record of managing waste efficiently and minimizing its generation. Prompt dismantlement would allow Naval Reactors to utilize an experienced work force that is presently located at the Kesselring Site. Prompt dismantlement could be accomplished safely, economically, and with a high degree of certainty that the environmental impacts would be small.

Availability of Copies of the Final Environmental Impact Statement

The Final Environmental Impact Statement has been distributed to interested Federal, State, and local agencies, and to individuals who have expressed interest. Copies of the Final Environmental Impact Statement and its supporting references are available for review at the Saratoga Springs Public Library at 49 Henry Street, Saratoga Springs, NY 12866, and at the Schenectady County Public Library at 99 Clinton Street, Schenectady, NY 12301. Requests for copies of the Final Environmental Impact Statement should be directed to Mr. A. S. Baitinger, Chief West Milton Field Office, Office of Naval Reactors, U.S. Department of Energy, P.O. Box 1069, Schenectady, NY 12301; telephone (518) 884–1234.

Issued at Arlington, VA this 18th day of November 1997.

F. L. Bowman,

Admiral, U.S. Navy Director, Naval Nuclear Propulsion Program.

[FR Doc. 97–31073 Filed 11–25–97; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

Information Collection Submitted for Review and Request for Comments (FERC–511)

November 21, 1997.

AGENCY: Federal Energy Regulatory Commission.

ACTION: Notice of submission for review by the Office of Management and Budget (OMB) and request for comments.

SUMMARY: The Federal Energy Regulatory Commission (Commission) has submitted the energy information collection listed in this notice to the Office of Management and Budget (OMB) for review under provisions of Section 3507 of the Paperwork Reduction Act of 1995 (Pub. L. 104–13). Any interested person may file comments on the collection of information directly with OMB and should address a copy of those comments to the Commission as explained below. The Commission received no comments in response to an earlier **Federal Register** notice of August 21, 1997 (62 FR 44462) and has made this notation in its submission to OMB.

DATES: Comments regarding this collection of information are best assured of having their full effect if received on or before December 26, 1997.

ADDRESSES: Address comments to Office of Management and Budget, Office of Information and Regulatory Affairs, Attention: Federal Energy Regulatory Commission, Desk Officer, 726 Jackson Place, N.W., Washington, D.C. 20503. A copy of the comments should also be sent to Federal Energy Regulatory Commission, Division of Information Services, Attention: Mr. Michael Miller, 888 First Street N.E., Washington, D.C. 20426.

FOR FURTHER INFORMATION CONTACT: Michael P. Miller may be reached by telephone at (202) 208–1415, by fax at (202) 273–0873, and by e-mail at mmiller@ferc.fed.us.

SUPPLEMENTARY INFORMATION:

Description

The energy information collection submitted to OMB for review contains:

1. *Collection of Information:* FERC–511 "Application for Transfer of License."
2. *Sponsor:* Federal Energy Regulatory Commission.
3. *Control No.:* OMB No. 1902–0069. The Commission is now requesting that OMB approve a three-year extension of the current expiration date, with no changes to the existing collection. There is no change to the reporting burden. These are mandatory collection requirements.
4. *Necessity of Collection of Information:* Submission of the information is necessary to enable the Commission to carry out its responsibilities in implementing the provisions of the Federal Power Act (FPA). The information reported under Commission identifier FERC–511 is filed in accordance with Sections 4(e), and 8(FPA). Section 4(e) of the FPA authorizes the Commission to issue licenses for construction, operation and maintenance of dams, water conduits,

COVER SHEET

PROPOSED ACTION: Determine and implement a disposal strategy for the defueled S3G and D1G Prototype reactor plants.

TYPE OF STATEMENT: Final Environmental Impact Statement (DOE/EIS-0274)

RESPONSIBLE AGENCY: U.S. Department of Energy, Office of Naval Reactors

FOR FURTHER INFORMATION: For further information on this Final Environmental Impact Statement, contact:

Mr. Andrew S. Baitinger, Chief
West Milton Field Office, Office of Naval Reactors
U.S. Department of Energy
PO Box 1069
Schenectady, NY 12301-1069
Telephone (518) 884-1234

ABSTRACT: This Final Environmental Impact Statement evaluates in detail three alternatives for the disposal of the S3G and D1G Prototype reactor plants. These alternatives include: "no action," which means continuing surveillance and monitoring for an indefinite period of time; prompt dismantlement (the preferred alternative) and disposal of the S3G and D1G Prototype reactor plants; and deferred dismantlement, which allows for decay of some radioactivity prior to dismantlement and disposal. The analyses demonstrate that the environmental and socioeconomic impacts for each of the disposal alternatives would be small.

The Naval Reactors Program received written comments on the Draft Environmental Impact Statement during a 45-day public comment period lasting from July 25, 1997 to September 8, 1997. Oral comments were received during a public hearing held on August 13, 1997. This Final Environmental Impact Statement includes copies of all written and oral comments that the Naval Reactors Program received on the Draft Environmental Impact Statement. All comments were taken into consideration during preparation of this Final Environmental Impact Statement.

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SUMMARY

S.0 Introduction

> **National Environmental Policy Act :** A Federal law passed in 1969, which requires all Federal agencies to consider in their decision making processes potential environmental effects before implementing any major action, and established the Council on Environmental Quality within the Office of the President.
>
> **Alternatives:** The range of reasonable options considered in evaluating and selecting an approach to meet the need for agency action.
>
> **Environmental Impact Statement:** A detailed environmental analysis for a proposed action that could significantly affect the environment. A tool for decision making, it describes the positive and negative environmental effects of the alternatives.
>
> **Record of Decision:** A concise public record of the agency's decision, which discusses the alternative selected. The discussion will include whether all practicable means to avoid or minimize environmental harm from the selected alternative were adopted (and if not, why they were not).

The U.S. Department of Energy Office of Naval Reactors (Naval Reactors Program) is currently evaluating alternatives for the disposal of the S3G and D1G Prototype reactor plants, located at the Knolls Atomic Power Laboratory Kesselring Site (Kesselring Site) near West Milton, New York. A key element of the Naval Reactors Program's decision making process is a thorough understanding of the environmental impacts associated with each alternative. The National Environmental Policy Act requires Federal agencies to analyze the potential environmental impacts (both positive and negative) of their proposed actions to assist them in making informed decisions. In following this process, the Naval Reactors Program prepared a Draft Environmental Impact Statement to assess various alternatives and to provide necessary background, data and analyses to help decision makers and the public understand the potential environmental impacts of each alternative. Following consideration of public comments, the Naval Reactors Program prepared this Final Environmental Impact Statement. The Naval Reactors Program decision will be presented in a Record of Decision to be issued 30 days after publication of the Final Environmental Impact Statement.

The Kesselring Site is located on a Federal reservation approximately 14 kilometers (9 miles) southwest of Saratoga Springs, New York. The Federal reservation consists mostly of wooded areas. The areas surrounding the reservation are mostly rural and include a mixture of woodlands, farmlands, and small residential tracts. The Site has been operated as a reactor testing and training facility under Naval Reactors Program control since the mid-1950s and is expected to continue operating in this manner into the foreseeable future.

The S3G and D1G Prototype reactor plants were permanently shut down in May 1991 and in March 1996, respectively, reflecting the end of the Cold War and projected downsizing of the U.S. Navy fleet. All spent nuclear fuel was removed from the S3G Prototype reactor and shipped off-site in July 1994. All spent nuclear fuel was removed from the D1G Prototype reactor and shipped off-site in February 1997. The high integrity nuclear fuel represented approximately 95 percent of the radioactivity originally at the S3G and D1G Prototypes. Management of Naval spent nuclear fuel has been addressed in a separate U.S. Department of Energy evaluation, Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference 2-7). The MARF and S8G Prototype reactor plants continue to operate at the Kesselring Site to fulfill the mission of training U.S. Navy personnel and testing Naval nuclear propulsion plant equipment. Future disposal of these prototypes would be considered a major Federal action which would require preparation of a separate Environmental Impact Statement. Since there are no plans to permanently shut down the remaining operating prototypes in the foreseeable future, an evaluation of their disposal and release of the Kesselring Site and Federal reservation lands for other uses is not required at this time.

The S3G and D1G Prototype reactor plants are located within separate prototype reactor compartments at the Kesselring Site. The reactor compartments are shielded and serve as holding structures for the radioactive reactor plant systems. The S3G and D1G Prototype reactor plant systems have been inactivated (that is, defueled and placed in a safe and stable condition). However, the defueled reactor plants still contain radioactive materials such as activated metals and corrosion products, which must be managed in a way that protects public health and the environment.

The identification of a preferred alternative in this Environmental Impact Statement reflects consideration of the following factors: (1) public comments; (2) protection of human health and the environment; (3) cost; (4) technical feasibility; (5) operational efficiency; and (6) regulatory impacts. Based on these factors, the Naval Reactors Program has identified prompt dismantlement as the preferred alternative for the disposal of the S3G and D1G Prototype reactor plants for the following reasons:

- An experienced work force is currently available at the Kesselring Site.
- Eventual release of the Kesselring Site is more readily achievable since two of the four prototype reactor plants would be dismantled and disposed of.
- Prompt dismantlement has a greater degree of certainty in completing the dismantlement and disposal within predicted costs and with small environmental impacts.

The environmental impacts associated with all of the considered alternatives would be small. The Naval Reactors Program's preferred alternative would allow for the safe dismantlement, shipment, and disposal of the S3G and D1G Prototype reactor plant components.

S.1 Alternatives

This Environmental Impact Statement evaluates three alternatives in detail for disposal of the S3G and D1G Prototype reactor plants. Each of these alternatives is briefly described below; full descriptions are provided in Chapter 3.

No Action - The S3G and D1G Prototype reactor plants would be left in a defueled, safe and stable condition, and monitored for the indefinite future. This Environmental Impact Statement provides the results of evaluating only the first 30 years of caretaking for the purpose of comparison and does not include the impacts of actions after that time, such as final disposal.

Prompt Dismantlement **(Preferred Alternative)** - The S3G and D1G Prototype reactor plants would be dismantled shortly after the Record of Decision, and materials would be disposed of off-site or recycled at existing U.S. Department of Energy or commercial facilities. The project would be completed as soon as practicable, subject to available appropriated funding.

Deferred Dismantlement - The S3G and D1G Prototype reactor plants would be left in a defueled, safe and stable condition, and monitored for a period of 30 years to allow the radioactive material to decay prior to dismantlement. The Naval Reactors Program considers 30 years appropriate for the caretaking period because it would allow cobalt-60 to decay to less than 2 percent of the radioactivity levels present in each prototype reactor plant in 1997. Nearly all of the gamma radiation within the defueled S3G and D1G Prototype reactor plants comes from cobalt-60, which has a 5.27-year half-life. A longer deferment period would not provide much additional benefit. Although radiation levels would be reduced, in comparison to the prompt dismantlement alternative, this alternative would not change the amount of material to be handled as low-level radioactive waste due to the presence of long-lived radionuclides.

Alternatives Eliminated from Detailed Analysis - Three alternatives were evaluated and subsequently eliminated from further analysis. They include the one-piece reactor plant off-site disposal alternative, the entombment alternative, and the on-site disposal alternative.

The one-piece reactor plant off-site disposal alternative would involve the removal and disposal of the entire S3G and D1G Prototype reactor compartments each as one-piece units. This alternative is based on the reactor compartment disposal program currently in use for dismantling decommissioned nuclear-powered U. S. Navy warships. In that program, defueled reactor plant systems and lead shielding are left intact, and each reactor compartment is sealed as a single package. The sealed packages provide an excellent barrier to the environment, and result in low person-rem and cost. Defueled reactor compartments are packaged at the Puget Sound Naval Shipyard and are then sent by barge and special ground transport to the U.S. Department of Energy Low-level Waste Burial Grounds, Hanford Site, Washington State for disposal. Overland transport of whole reactor compartments by either truck or rail from the Kesselring Site to a U.S. Department of Energy disposal site is physically impractical. The weights of the entire S3G and D1G reactor compartments would exceed the weight limits for some bridges along the route from the Kesselring Site to the disposal sites. Similarly, the reactor compartment packages would not be able to clear all underpasses along the routes. The load-limiting bridges and underpass interferences of the available routes make this alternative impractical, and it was eliminated from further detailed evaluation.

The entombment alternative would involve leaving the S3G and D1G Prototype reactor plants permanently at the Kesselring site within one or two strong, durable structures. The entombment structures could be located either above grade or below grade and would be designed to last at least several hundred years to ensure that radionuclides in the reactor plant could not reach the environment. The entombment alternative for decommissioning commercial nuclear power plants is intended for use where the residual radioactivity will decay to levels permitting unrestricted release of the facility within a reasonable time period of about 100 years (Reference 3-3). Since nuclear reactors typically contain long-lived radionuclides (with half-lives in excess of 100 years), these radionuclides would not decay below the criteria for unrestricted release of the site within the anticipated lifetime of any man-made structure. The S3G and D1G Prototype reactor plants contain radionuclides with long half-lives and therefore, entombment would not be considered a viable alternative. This alternative would not offer any appreciable advantage in terms of health risk or other environmental benefit.

The on-site disposal alternative would involve placing the S3G and D1G Prototype reactor plants into an engineered land disposal unit. This disposal unit would be designed with impervious materials and liners beneath and over the reactor compartments and covered with earth. This on-site disposal alternative would require the approval of State regulatory agencies to use the Kesselring Site for the permanent disposal of hazardous materials. Similar to the entombment alternative, on-site disposal was eliminated from detailed evaluation because there would be no appreciable health or environmental benefit and it would prevent future unrestricted release of the Kesselring Site for other uses.

S.2 Impacts of Facility Activities

Evaluation of the full range of environmental impacts and other effects associated with the caretaking and dismantlement of the S3G and D1G Prototype reactor plants shows that the impacts would be small for each alternative. These impacts would be so small that they offer little assistance in differentiating among the alternatives. Topics considered in the evaluation included the effects on the land use, ecological resources, air and water resources, terrestrial resources, cultural resources, environmental justice, aesthetic and scenic values, noise, traffic and transportation, and energy usage. All environmental impacts in these topics would be small.

This Final Environmental Impact Statement evaluates the risk to the public and workers from exposure to radiation or radioactive material. Risk is defined as the product of the consequences of an event multiplied by the probability of that event. Since exposure to radiation could result from incident-free activities or from a hypothetical accident, the radiological impacts of each alternative were thoroughly evaluated from many perspectives. Analyses indicate that the risks to the public and to workers would be small for all of the alternatives considered in detail. Health effect risks resulting from exposure to radiation or radioactive materials are most commonly presented in terms of latent fatal cancers. For completeness, health effect risks from other nonradiological conditions, such as potential occupational injuries, were also evaluated.

Expressing numbers in terms of powers of ten is known as scientific notation (see Glossary). For example, 0.000026 can be expressed in scientific notation as 2.6×10^{-5}. To assist readers who are unfamiliar with scientific notation, data is presented in decimal form where practicable.

Table S-1 provides a comparison of the alternatives in terms of the annual average radiological risk per person due to facility activities and hypothetical accidents.

Table S-1: Collective Dose and Average Annual Radiological Risk per Person Due to Facility Activities

	Alternatives		
	No Action (first 30 years only)	**Prompt Dismantlement (preferred alternative)**	**Deferred Dismantlement**
Collective Dose (person-rem): Incident-Free Facility Activities			
Occupational [b] Public [c]	22 9.9×10^{-6}	205 8.6×10^{-6}	26 1.3×10^{-5}
Average Annual Radiological Risk per Person: Incident-Free Facility Activities [a]			
Occupational [b] Public [c]	4.2×10^{-5} 1.4×10^{-16}	5.8×10^{-4} 1.6×10^{-15}	4.0×10^{-5} 1.9×10^{-16}
Average Annual Radiological Risk per Person: Hypothetical Facility Accidents [a]			
Public [d]	4.2×10^{-17}	5.2×10^{-14}	1.4×10^{-15}

a. Risks of developing a latent fatal cancer.
b. Data from Table B-7, Radiation Worker average.
c. Data from Table B-7, Population average.
d. Hypothetical facility accidents resulting in the maximum risk to the public from the following tables:
No action alternative - High efficiency particulate air filter fire at the S3G Prototype, Table B-20.
Prompt & deferred dismantlement alternatives - Component drop accident at the D1G Prototype, Table B-12.

Public and Occupational Health Impacts From Incident-Free Facility Activities

As shown in Table S-1, the average annual risks per person associated with each alternative would be very small. Occupational (worker) radiation exposures were assessed for each alternative. The collective dose to workers associated with the prompt dismantlement alternative would be within a range of approximately 205 to 460 person-rem. Based on many years of experience in planning and executing other refueling and maintenance operations, it is reasonable to expect that the actual collective dose to workers would be close to the lower end of the range. Although the collective dose to workers would be higher for the prompt dismantlement alternative, average doses per worker would be comparable in magnitude to those routinely received during operation and maintenance of Naval prototype reactor plants. The occupational radiation doses that the workers would receive during dismantlement activities would be kept as low as reasonably achievable, consistent with the practices and policies of the Naval Reactors Program (Reference 4-22). Even on a cumulative basis for the entire work force, analyses showed that no immediate fatalities or latent cancer fatalities due to radiation exposure would be expected from incident-free activities for any of the alternatives considered. Health effects to workers from nonradiological conditions would be similarly small.

The radiation exposures to the general public would be so small for each alternative that they would be indistinguishable from naturally occurring background radiation. As shown in Table S-1, the collective dose to the public would be small for each alternative. The average annual risk per person to individuals in the general population would be very small (much less than 1 chance in 1 trillion). Analyses showed that no immediate fatalities or latent cancer fatalities due to radiation exposure would be expected from incident-free activities.

Public Health Impacts From Hypothetical Facility Accidents

Several hypothetical facility accident scenarios were analyzed, including dropping a large radioactive component, a high-wind event, a fire in a radioactive air filter, and a large volume spill of radioactive liquid. The analyses applied conservative modeling assumptions and considered many exposure pathways. As shown in Table S-1, hypothetical facility accidents would result in a very small average annual risk per person to an individual in the general population. Analyses showed that no immediate fatalities or latent fatal cancers would result from hypothetical accidents for any of the alternatives considered.

Two nonradiological facility accidents were also evaluated. These accident scenarios included a diesel fuel fire and a spill of stored chemical products. The source term for the fire involved four typical combustion products. The source term for the chemical spill considered eight compounds contained in various adhesives, strippers, solvents and lubricants. The analysis results indicated that all toxic chemical concentrations would be at or below Emergency Response Planning Guidelines level 1 values for the maximally exposed off-site individual. Emergency response plans are in place at the Kesselring Site to mitigate the effects on workers and the environment from these types of accidents.

S.3 Impacts of Transportation Activities

Since materials from S3G and D1G Prototype reactor plant dismantlements would require disposal outside of the Kesselring Site, the effects from transporting materials were analyzed from many perspectives. Transportation analyses apply to the prompt and deferred dismantlement alternatives only. Transportation analyses do not apply to the no action alternative since there would be no prototype reactor plant dismantlement activities and no waste shipments.

Risks to the public and workers from shipments of radioactive materials were thoroughly evaluated. Transportation analyses considered the impacts of these shipments to different disposal sites, both under incident-free conditions and considering hypothetical accident scenarios, using conservative assumptions. Transportation analyses indicated that the overall impacts would be small for either dismantlement alternative, and that no immediate fatalities or latent fatal cancer fatalities would be expected from any radioactive package shipments.

Transportation analyses considered health effects from several nonradiological perspectives. These perspectives included consideration of shipments of nonradioactive materials, vehicle exhausts from all shipments and traffic accidents. Analyses indicated these impacts would be small.

Table S-2 provides a comparison of the alternatives in terms of the average annual risk per person due to the shipment of materials from dismantlement activities.

Table S-2: Average Annual Risk per Person Due to Transportation Activities [a]

	Alternatives		
	No Action (first 30 years only)	Prompt Dismantlement (preferred alternative)	Deferred Dismantlement
Average Annual Risk per Person: Incident-Free Transportation			
Transportation Radiological [b] Occupational	Not applicable [e]	6.8×10^{-4}	2.6×10^{-5}
Public	Not applicable [e]	1.5×10^{-9}	4.1×10^{-11}
Transportation Nonradiological Public [c]	Not applicable [e]	8.1×10^{-10}	8.1×10^{-10}
Average Annual Risk per Person: Hypothetical Transportation Accidents			
Transportation Radiological Public [d]	Not applicable [e]	3.1×10^{-12}	6.3×10^{-14}
Average Annual Risk: Hypothetical Transportation Accidents			
Transportation Nonradiological Public	Not applicable [e]	1.6×10^{-2} [f]	1.6×10^{-2} [f]

a. Risk of a latent fatal cancer
b. Data from Appendix C, Tables C-13 and C-15 for prompt and deferred dismantlement alternatives, respectively.
c. Data from Appendix C, Table C-3 added to data from Tables C-13 and C-15.
d. Data from Appendix C, Tables C-17 and C-19 for prompt and deferred dismantlement alternatives, respectively.
e. Transportation impacts were not estimated for the no action alternative since there would be no shipments.
f. Nonradiological accident risk is based on national and state accident statistics for the distance traveled. Data from Appendix C, Tables C-4 and C-17, added for prompt dismantlement, and Tables C-4 and C-19, added for deferred dismantlement.

Public and Occupational Health Impacts From Incident-Free Transportation

For either dismantlement alternative, the risk of latent fatal cancer or other health effect to the general population along transportation routes to a disposal site would be small. No immediate fatalities or latent cancer fatalities from radiation exposure would be expected from transportation of wastes to the disposal sites. Adding the public radiological and nonradiological risks from Table S-2 for the prompt dismantlement alternative only yields a 2.3×10^{-9} per person risk of a latent fatal cancer. This per person risk equates to less than 1 chance in about 430 million that transportation of dismantled materials would cause a latent fatal cancer.

As shown in Table S-2, the risk to transportation workers who receive occupational radiation exposure was also estimated. Analyses assumed that 60 radioactive material shipments would be made from the Kesselring Site. For either dismantlement alternative, thousands of transportation operations would be required before a single additional latent cancer fatality might be expected to occur among the workers.

Public Health Impacts From Transportation Accidents

The risk of transportation accidents is based on estimates of latent cancer fatalities to the general population. Analysis of transportation accidents considers workers (the transportation crew) as part of the general population. No immediate fatalities due to radiation exposure would be expected to result from a transportation accident under any alternative. Analyses which used conservative modeling assumptions and which considered many pathways, estimated the risks from several hypothetical transportation accident scenarios. As shown in Table S-2, the average annual risk per person in the general population would be very small. Analyses showed that no immediate fatalities or latent fatal cancers would result from hypothetical transportation accidents for either dismantlement alternative.

S.4 Other Impacts

Although protection of human health and the environment are typical factors used to compare alternatives, these impacts would be small for each alternative. Besides radiological consequences, additional factors are taken into consideration, such as regulations, waste management, traffic and transportation, pollution prevention, environmental justice, socioeconomics, cumulative impacts, and cost. Other considerations include technical feasibility, work force availability, mitigative measures, long-term productivity of the environment, and public comments.

Regulations

All three alternatives can be performed within the framework of existing Federal and State environmental regulations. Regulatory requirements do not distinguish among the alternatives, although the regulatory requirements for the deferred dismantlement alternative are less certain because of the 30-year period of deferment. The no action alternative could present the greatest uncertainty in the area of regulatory requirements because it extends into the future for an indefinite period of time. Although dismantlement activities would involve meeting Federal and New York State permitting requirements, no new legislation would be required to implement any of these alternatives.

Waste Management

The prompt and deferred dismantlement alternatives would involve the generation of some wastes. While the no action alternative would result in the generation of only small amounts of waste as part of caretaking activities, this alternative does not provide for final reactor plant disposals. Even though the S3G and D1G Prototype reactor plants are small when compared to commercial reactors, emphasis would be placed on recycling as much material as practical under the prompt or deferred dismantlement alternatives. A variety of waste materials would be generated during dismantlement activities. Waste materials would include nonhazardous debris, low-level radiological waste, mixed waste, hazardous, and toxic wastes. All of the materials would be managed and controlled in accordance with Federal, State, and local regulations. Waste volumes would be reduced by using various technologies such as recycling, smelting and compaction. Recyclable materials would include elemental lead from shielding, carbon steel from the hull and deckplate structures, and corrosion resisting metals from reactor plant systems. Low-level radioactive metals would be recycled using various commercial vendors. The U.S. Department of Energy Savannah River Site in South Carolina currently receives low-level radioactive wastes from Naval Reactors Program sites in the eastern United States. The U.S. Department of Energy Hanford Site in Washington State is also available for disposal of low-level radioactive wastes generated by Naval Reactors Program activities. Mixed wastes would be temporarily stored and disposed of in accordance with the Kesselring Site Treatment Plan, which was approved by the New York State Department of Environmental Conservation. Analyses assumed that nonradioactive materials would be recycled or disposed of at commercial facilities located within approximately 310 kilometers (200 miles) of the Kesselring Site. The impacts of waste management would be small and would last for the relatively short duration of the dismantlement and disposal operations.

Traffic and Transportation

Shipments from dismantlement activities would represent less than 5 percent of total Kesselring Site shipments over a similar period and would not have a significant impact on area traffic and transportation. Although there would be no shipments associated with the no action alternative, a final means for disposal would be required in the future, which could eventually result in shipments of radioactive and nonradioactive material.

Pollution Prevention

Stringent pollution prevention practices are implemented at the Kesselring Site as part of normal operations. Airborne and waterborne releases to the environment are strictly controlled. These releases are monitored for compliance with applicable Federal and State regulations and permits. At the Kesselring Site, a water reuse system is employed. Liquids that may contain radioactivity are collected in holding tanks and processed through a series of filters and demineralizers. To minimize releases of radioactivity in air to the environment, high efficiency particulate air filters are routinely used in radioactive work applications. These filters effectively remove more than 99.95 percent of airborne particulate radioactivity. As a result of rigorous practices and Naval Reactors Program standards aimed at controlling radioactivity and protecting the environment, the annual releases of long-lived gamma radioactivity from <u>all</u> Naval Reactors Program activities are comparable to the annual releases from a <u>single</u> typical U.S. commercial nuclear reactor operating in accordance with its U.S. Nuclear Regulatory Commission license.

Actions involving waste minimization, recycling and procurement practices also serve to prevent pollution. For example, to reduce the volume of mixed wastes, the Naval Reactors Program is evaluating recycling options to reuse lead containing low levels of radioactive impurities in shielding applications at other U.S. Department of Energy facilities. The

Kesselring Site has participated in the New York State Hazardous Waste Reduction Plan since 1990. Since tracking of applicable waste streams began, 6 of 12 waste streams have been eliminated. Where practicable, the Kesselring Site recycles materials which are normally considered to be industrial waste. These materials include waste oil, batteries and lead. In the area of procurement practices, alternate materials which reduce or eliminate acquisition of products containing hazardous substances or toxic chemicals are considered. As a result of these many programs and practices currently in place, pollution prevention standards would continue to be met under any of the alternatives for S3G and D1G Prototype reactor plant disposal.

Environmental Justice

Environmental justice evaluations were based on 1990 U.S. Census Bureau data for the region within an 80-kilometer (50-mile) radius of the Kesselring Site. The data showed only a few localized areas in the region having minority populations which exceed an average of 6 percent of the overall population. The nearest of these areas is located more than 8 kilometers (5 miles) from the Kesselring Site.

The U.S. Census Bureau characterizes persons living in poverty as those whose income is less than a "statistical poverty threshold." For the 1990 Census, the statistical poverty threshold was based on a 1989 income of $12,500 per household. Persons living in poverty comprised approximately 9 percent of the overall population in the region surrounding the Kesselring Site. U.S. Census data showed only a few very small areas in the region having low income status populations comprising 25 percent or more of the population. Figures show that none of these populations are located within 8 kilometers (5 miles) of the Kesselring Site.

There would be no significant and adverse environmental impact to any person from any of the alternatives. Therefore, pursuant to Executive Order 12898, there would be no disproportionately high and adverse human health or environmental effects on any minority or low-income population. Analyses included consideration of unique consumption and cultural factors.

Socioeconomics

All of the alternatives would involve a reduction of about 200 jobs at the Kesselring Site in the short-term (less than 5 years). Under the prompt dismantlement alternative, the existing work force would be retained for the duration of dismantlement activities, which would be about a 3 to 4-year period. Although the 200 job reduction would be noticeable in the civilian work force at the Kesselring Site, it would represent only about 0.1 percent of the employment level in the surrounding region. Therefore, none of the alternatives would have any discernible socioeconomic impact.

Cumulative Impacts

A cumulative impact results when the incremental impact associated with implementation of an alternative is added to the impacts of other past, present, or reasonably foreseeable future actions. Cumulative impacts take into consideration the expectation that the other two prototype reactor plants at the Kesselring Site, MARF and S8G, will continue to operate for the foreseeable future to fulfill the mission of training U.S. Navy personnel and testing Naval nuclear propulsion plant equipment. The small impacts associated with any of the alternatives would not make a substantial contribution to the cumulative effects of Kesselring Site operations, especially when considered on a regional, state, or national basis. Dismantlement or caretaking activities would not result in discharges of radioactive liquids. None of the alternatives would cause the total air emissions to exceed any applicable air quality requirement or regulation in any radiological or nonradiological category. No additional land would have to be set aside for waste disposal. Impacts to existing land use or land conditions would not be expected. The cumulative transportation impacts associated with dismantlement activities would be small. The approximately 60 radioactive material shipments from dismantlement would be a small part of the more than 2 million shipments of radioactive materials made annually in the United States (Reference 4-33). Therefore, cumulative effects do not provide a basis for distinguishing among the alternatives.

Costs

The cost differences between the deferred dismantlement alternative (estimated to be approximately $114,000,000) and the prompt dismantlement alternative (estimated to be approximately $78,000,000) are primarily due to the cost of demobilizing the work force, preparing the S3G and D1G Prototype reactor plants for long-term caretaking, and remobilizing the dismantlement work force following the caretaking period. Although at first glance the no action alternative appears to be lowest in estimated cost (approximately $25,000,000 for the first 30 years of caretaking), it does not include final disposal actions. Therefore, final cost of the no action alternative is indeterminate.

Other Considerations

Based on a wide range of experience in dismantling reactor plants throughout the nuclear industry, any of the alternatives would be technically feasible. The Naval Reactors Program has removed the defueled reactor compartments from more than 60 decommissioned nuclear-powered U.S. Navy warships at the Puget Sound Naval Shipyard in Bremerton, Washington and shipped the reactor compartments for disposal at the U.S. Department of Energy Hanford Site. Several similar or larger sized reactor plants have been totally or partially dismantled by the U.S. Department of Energy or commercial utilities, including the Shippingport reactor plant in Pennsylvania, the Elk River demonstration reactor in Minnesota, the Pathfinder reactor plant in South Dakota, the Trojan reactor plant in Oregon, the Yankee Rowe reactor plant in Massachusetts, and the Fort St.Vrain reactor plant in Colorado. The technology and techniques used in these previous dismantlements are now proven. Activities under any of the alternatives would be conducted consistent with stringent Naval Reactors Program practices.

As discussed in the summary of socioeconomics impacts, all three alternatives evaluated in detail would involve a reduction of about 200 jobs within less than 5 years. The reduction in jobs would involve a work force experienced in the support of prototype refuelings, defuelings, overhauls and inactivations. The prompt dismantlement alternative would allow an efficient use of this trained and skilled work force for 3 to 4 years more than the deferred dismantlement and no action alternatives. Under the deferred dismantlement alternative, a future temporary staff increase would be required after the 30-year caretaking period to support dismantlement activities. This future work force may not start with the same knowledge and skills as the work force that currently exists at the Kesselring Site.

Since the adverse impacts would be small for any of the alternatives evaluated in detail, there are no mitigative measures identified or required for any of the alternatives. Stringent Naval Reactors Program requirements would further ensure that small, unavoidable effects are reduced to as low as reasonably achievable. The only discernible irreversible and irretrievable commitments of resources would be the relatively small amounts of energy that would be required to accomplish any of the alternatives.

Since there are no plans to shut down the other operating prototypes or to release the Kesselring Site or Federal reservation lands for other uses in the foreseeable future, none of the alternatives would have any impact on the long-term productivity of the environment. However, the prompt dismantlement alternative would make the eventual release of the Kesselring Site more readily achievable since dismantlement and disposal of two of the four prototype reactor plants would be completed. None of the alternatives involve construction of new structures or development of undisturbed lands.

Half of the agencies and individuals commenting on the Draft Environmental Impact Statement during the public comment period indicated support for one of the dismantlement alternatives (36 percent for prompt and 14 percent for deferred). The remainder of the commenters did not indicate a preference for any particular alternative. There was no support indicated for the no action alternative.

S.5 Conclusion

Although comparison of the three alternatives shows that the no action alternative would have the smallest environmental, health and safety impacts, the impacts associated with all of the alternatives would be small and consistent with ongoing Kesselring Site operations. Based on current conditions, any of the alternatives could be accomplished within Federal and State requirements, in both the short-term and the long-term. However, 30 years from now, changing conditions associated with the regulatory environment, and the availability of trained personnel and waste disposal facilities could result in unforeseeable complications or delays.

Such future unforeseeable conditions cause additional uncertainty in the impacts associated with the deferred dismantlement and no action alternatives.

The Naval Reactors Program has identified the prompt dismantlement alternative as the preferred alternative since it is consistent with the Naval Reactors Program's record to manage waste efficiently and minimize its generation. Prompt dismantlement would allow the Naval Reactors Program to utilize an experienced work force that is presently located at the Kesselring Site. Prompt dismantlement could be accomplished safely, economically, and with a high degree of certainty that the environmental impacts would be small.

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CHAPTER 1

PURPOSE AND NEED FOR AGENCY ACTION

1.0 Purpose and Need for Agency Action

The Naval Reactors Program is currently evaluating alternatives for disposal of the S3G and D1G Prototype reactor plants, located at the Knolls Atomic Power Laboratory Kesselring Site near West Milton, New York. The function of the S3G and D1G Prototype reactor plants was to train U.S. Navy personnel and test Naval nuclear propulsion plant equipment. As a result of the end of the Cold War and the downsizing of the U.S. Navy, the S3G and D1G Prototype reactor plants were permanently shut down in May 1991 and March 1996, respectively.

Since there is no further need for the S3G and D1G Prototype reactor plants, a decision is needed on their disposal. The S3G and D1G Prototype reactor plants must be preserved or dismantled in a way which will protect public health and the environment. The actions to manage these reactor plants must comply with all applicable Federal and State regulations and Kesselring Site permits.

Consistent with the Naval Reactors Program commitment to take care of its legacies in a responsible manner, this Environmental Impact Statement is designed to provide a comprehensive evaluation of potential impacts to human health and to the environment from a range of reasonable disposal alternatives. Two other prototype reactor plants, MARF and S8G, continue to operate at the Kesselring Site to fulfill the mission of training U.S. Navy personnel and testing Naval nuclear propulsion plant equipment. Future disposal of these prototypes would be considered a major Federal action which would require preparation of a separate Environmental Impact Statement. Since there are no plans to permanently shut down the remaining operating prototypes in the foreseeable future, an evaluation of their disposal and release of the Kesselring Site and Federal reservation lands for other uses is not required at this time.

1.1 Proposed Action

The Naval Reactors Program proposes to determine and implement a disposal strategy for the defueled S3G and D1G Prototype reactor plants. The preferred alternative is prompt dismantlement, which is discussed in detail in Section 3.6.

1.2 Public Involvement

As required by Council on Environmental Quality regulations (40 CFR Parts 1500 - 1508) and U.S. Department of Energy implementing procedures for the National Environmental Policy Act (10 CFR Part 1021), the decision making process includes providing the opportunity for public involvement. On July 16, 1997, the Naval Reactors Program began distribution of the Draft Environmental Impact Statement on the Disposal of the S3G and D1G Prototype Reactor Plants. Over 200 notices and Draft Environmental Impact Statements were distributed to regulatory agencies, elected officials, organizations, and individuals who have expressed an interest in the disposal of the defueled S3G and D1G Prototype reactor plants. The public comment period began with publication of the Notice of Availability in the *Federal Register* (62FR40074) on July 25, 1997 and remained open for 45 days, ending on September 8, 1997. In addition to the *Federal Register* notice, a public notice was published in the *Times Union*, *The Daily Gazette*, *The Saratogian*, and the *Ballston Journal* newspapers. During the comment period, a public hearing was held in the Town of Milton, New York, as announced in the *Federal Register* and the above listed newspaper notices.

The Naval Reactors Program received a total of 10 written statements and 4 oral statements during the public scoping process. Copies of the written statements and the stenographic record of the public hearing are contained in Appendix E. All comments were taken into consideration during preparation of this Final Environmental Impact Statement.

CHAPTER 2

BACKGROUND

2.0 Background

This chapter provides general background information on the Kesselring Site facilities, the S3G and D1G Prototype reactor plants and associated reactor compartment structures, and the Naval Reactors Program. This chapter also provides general discussions on Federal and State environmental statutes and regulations, Executive Orders, and U.S. Department of Energy Orders and regulations that are related to Kesselring Site activities.

2.1 Kesselring Site - General Description

The Kesselring Site is an approximately 26-hectare (65-acre) developed area situated within an approximately 1,600-hectare (3,900-acre) Federal reservation owned by the U.S. Department of Energy. The Kesselring Site is located near West Milton, Saratoga County, New York, approximately 27 kilometers (17 miles) north of the City of Schenectady, 14 kilometers (9 miles) southwest of Saratoga Springs, and 21 kilometers (13 miles) northeast of Amsterdam (see Figures 2-1 and 2-2). The Kesselring Site is currently operated by KAPL, Inc., a Lockheed Martin company, under contract with the U.S. Department of Energy.

The Kesselring Site mission is to train U.S. Navy personnel in the operation and maintenance of Naval nuclear propulsion plants for the U.S. Navy fleet and to test Naval nuclear propulsion plant equipment. The Kesselring Site includes four pressurized-water Naval nuclear propulsion prototype plants. Two of the prototypes, known as S3G and D1G, are permanently shut down and defueled. Management of Naval spent nuclear fuel has been addressed in a separate U.S. Department of Energy evaluation, Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference 2-7). Two other prototypes, known as MARF and S8G, and miscellaneous support facilities continue to operate to fulfill the mission of the Kesselring Site (see Figure 2-3). There are no plans to shut down the operating prototypes or to release the Kesselring Site or Federal reservation lands for other uses in the foreseeable future.

Descriptive and historical information regarding the Kesselring Site are contained in the Kesselring Site Environmental Summary Report (Reference 2-1). The Environmental Summary Report, issued periodically, describes the environmental conditions and impacts of Kesselring Site facilities and operations, and has concluded that there has been no significant impact from Kesselring Site operations on the environment or adverse effect on the community or the public. Additionally, the Environmental Summary Report provides an historical perspective on Kesselring Site operations and waste management practices.

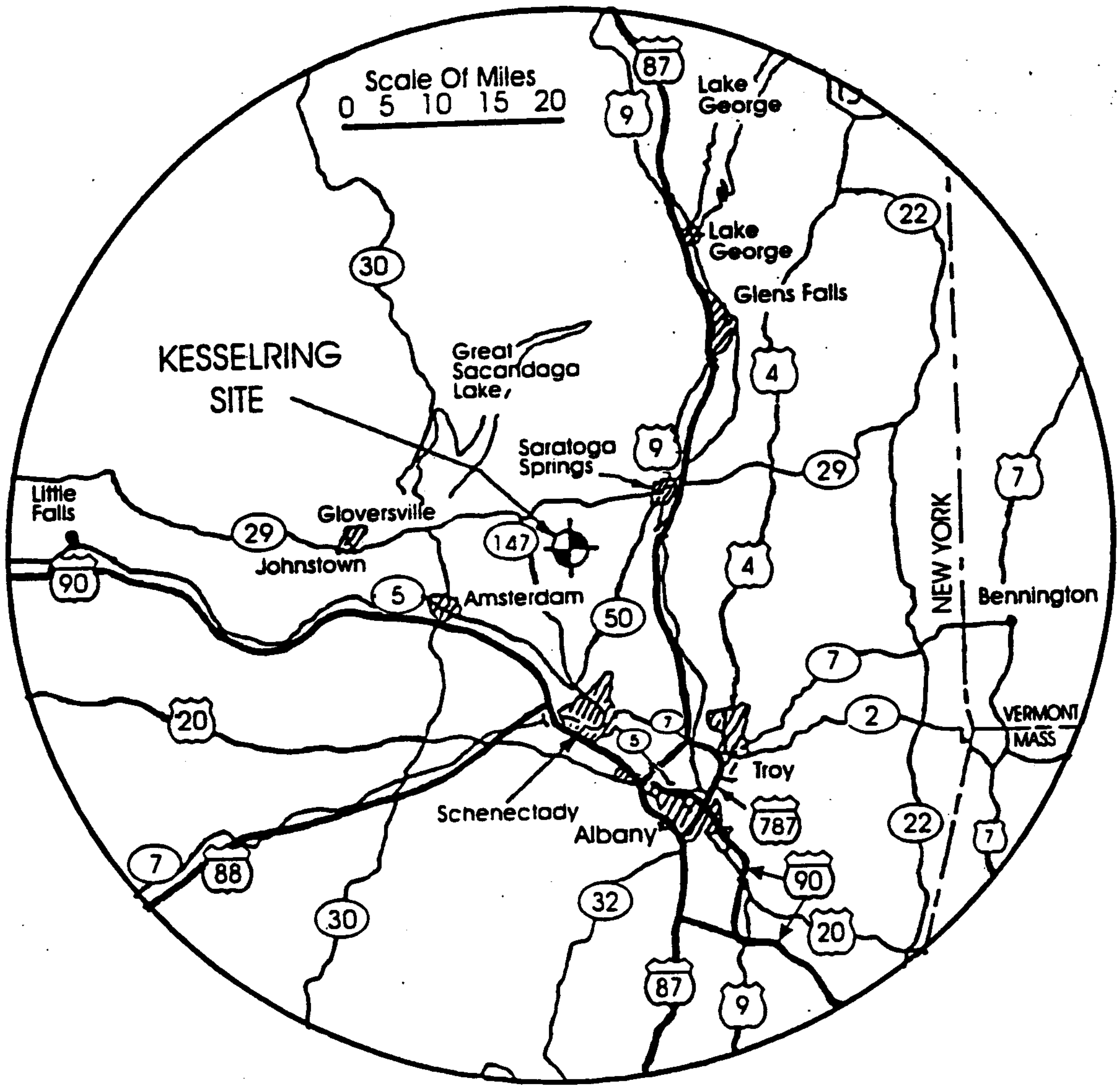

Figure 2-1: 80 Kilometer (50 Mile) Assessment Area Map of the Kesselring Site

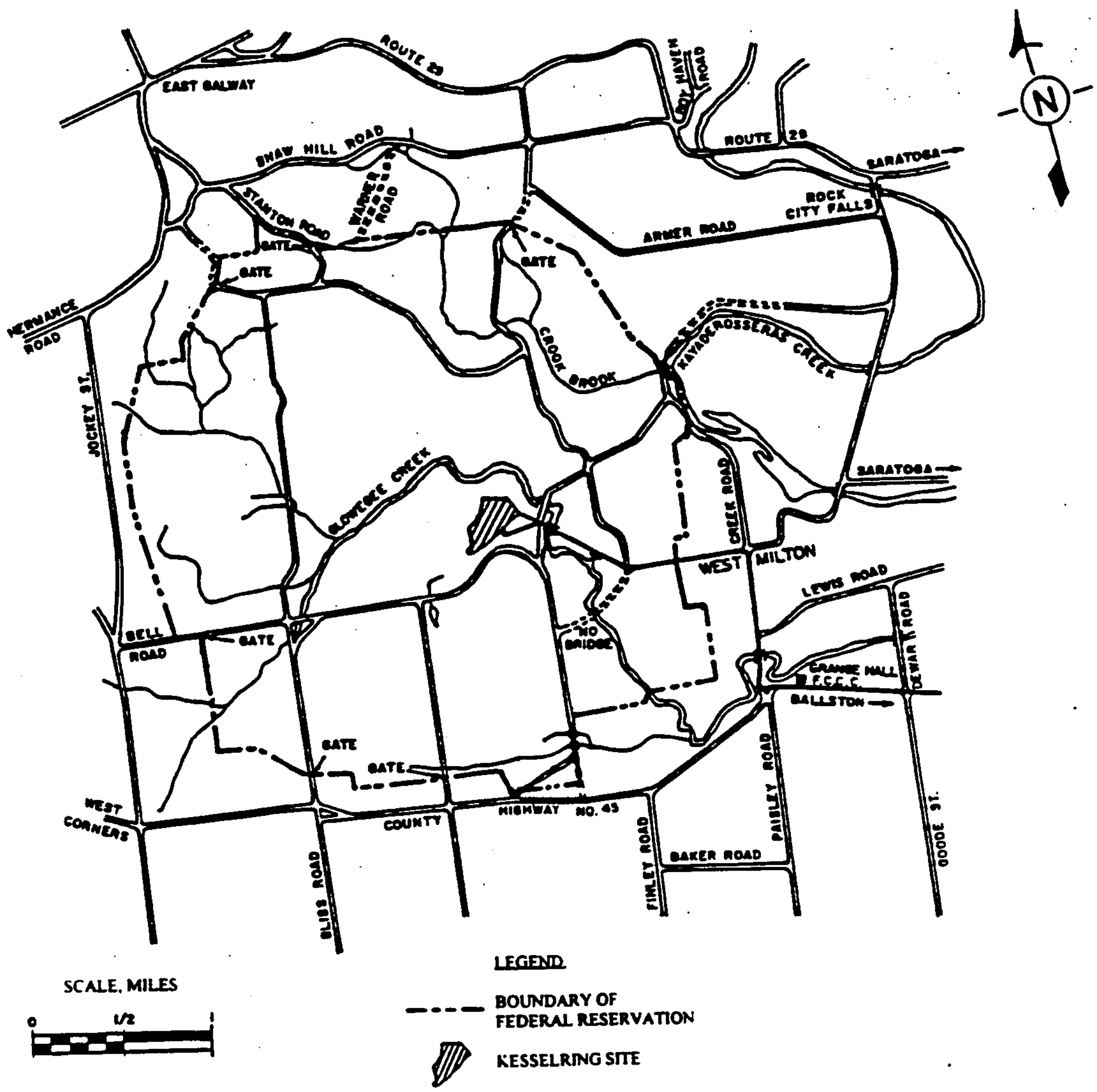

Figure 2-2: Map of the Federal Reservation and Surrounding Area

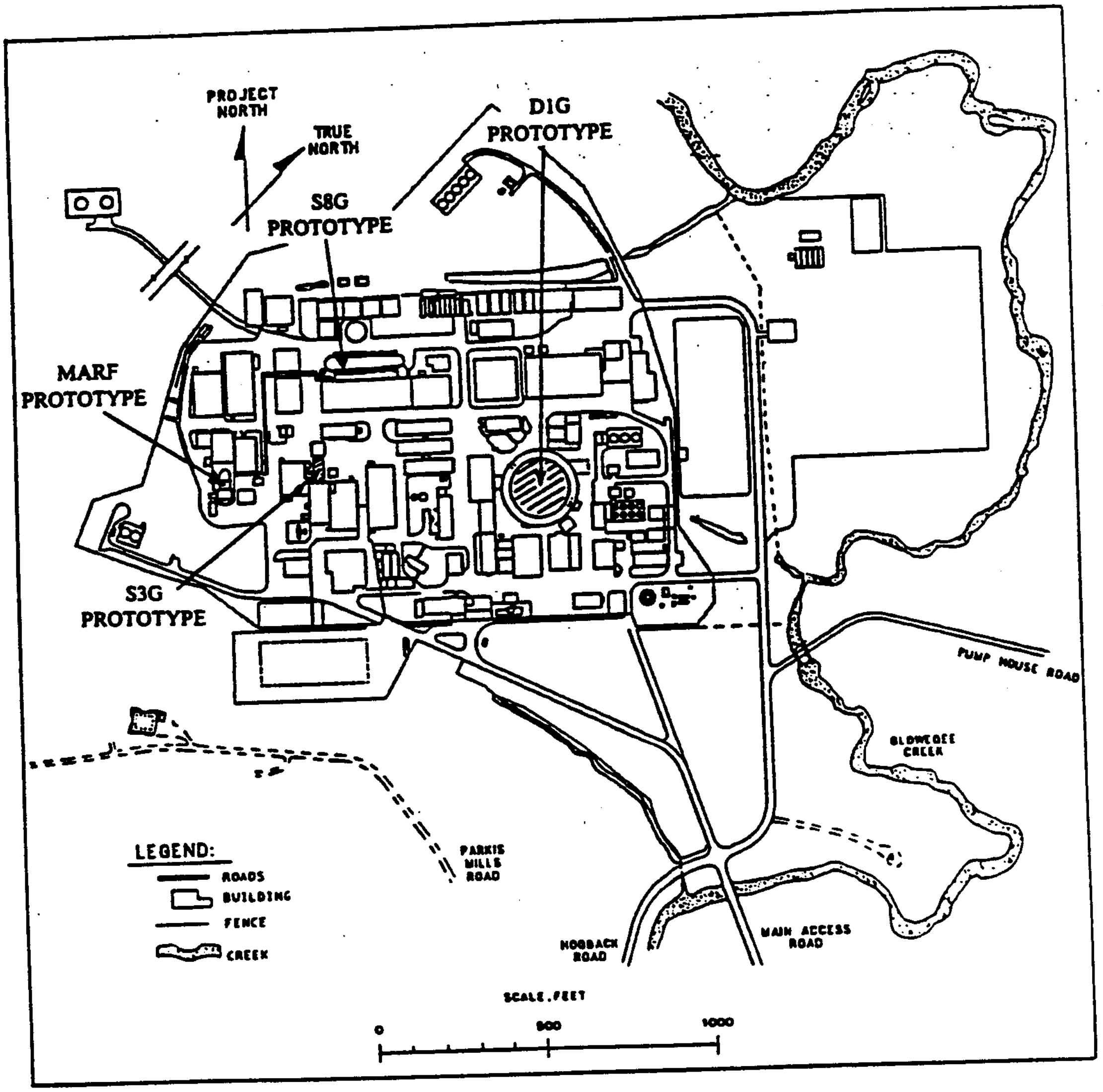

Figure 2-3: Map of the Kesselring Site

2.2 S3G Prototype - General Description

The S3G Prototype was placed in operation in 1958. In addition to its use as a training platform, the S3G Prototype served as a test facility for propulsion plant equipment. Removal of the spent nuclear fuel from the S3G Prototype reactor (defueling) and shipment of the spent nuclear fuel to the Expended Core Facility at the U.S. Department of Energy's Idaho National Engineering and Environmental Laboratory were completed in July 1994.

During defueling, all of the fuel assemblies, which fully contain uranium and fission products, were removed. More than 95 percent of the radioactive material inventory from the S3G Prototype reactor plant was removed during defueling. After defueling, the S3G Prototype reactor plant systems were placed in a safe and stable condition.

Figure 2-4 provides a sketch of the S3G Prototype reactor compartment in relation to the rest of the S3G Prototype prior to shutdown. The hull construction duplicates as completely as possible the comparable section in a seagoing submarine. The S3G Prototype reactor compartment is a horizontal cylinder, approximately 8.8 meters (29 feet) in diameter by 11.3 meters (37 feet) in length, formed by a section of the prototype's pressure hull. The prototype hull provided containment during reactor plant operations. Stiffened steel bulkheads separate the reactor compartment from the remainder of the prototype. The reactor compartment bulkheads are shielded to minimize radiation exposure to personnel.

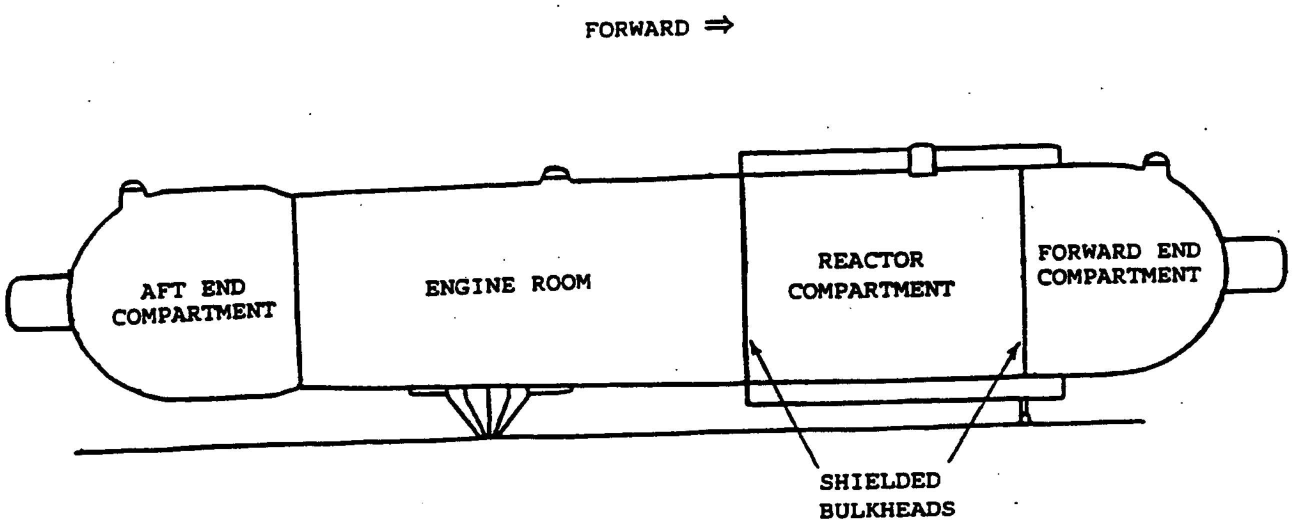

Figure 2-4: S3G Prototype

2.3 D1G Prototype - General Description

The D1G Prototype was placed in operation in 1962. In addition to its use as a training platform, the D1G Prototype served as a test facility for propulsion plant equipment. Removal of the spent nuclear fuel from the D1G Prototype reactor (defueling) and shipment of the spent nuclear fuel to the Expended Core Facility at the U.S. Department of Energy's Idaho National Engineering and Environmental Laboratory were completed in February 1997.

During defueling, all of the fuel assemblies, which fully contain uranium and fission products, were removed. More than 95 percent of the radioactive material inventory from the D1G Prototype reactor plant was removed during defueling. After defueling, the D1G Prototype reactor plant systems were placed in a safe and stable condition.

Figure 2-5 provides a sketch of the D1G Prototype reactor compartment in relation to the rest of the D1G Prototype prior to shutdown. The D1G Prototype reactor compartment is a vertical cylinder, approximately 8.2 meters (27 feet) in diameter by 9.1 meters (30 feet) in height, which holds the reactor plant. The reactor compartment stands within a partial section of a ship's hull, which duplicates as completely as possible the comparable section in a seagoing vessel. A stiffened steel bulkhead separates the reactor compartment from the remainder of the prototype. The reactor compartment bulkhead is shielded to minimize radiation exposure to personnel.

The D1G Prototype reactor compartment is located inside a steel sphere, approximately 69 meters (225 feet) in diameter, known as a Hortonsphere (see Figure 2-6). This structure, completed in 1953, provided containment during reactor plant operations and also housed support systems and miscellaneous facilities. The Hortonsphere shell is approximately 2.5 centimeters (1 inch) thick and is covered by foam insulation. The Hortonsphere lies partially below grade and is filled to grade with grout, sand, and crushed stone; the floor is concrete. Twenty-six column supports, connecting brace rods and struts support the structure externally. The Hortonsphere includes two airlocks for the passage of personnel and small equipment and an approximately 7-meter (22.5-foot) diameter sliding door for the passage of large equipment. Section 4.7 provides additional discussion on the Hortonsphere.

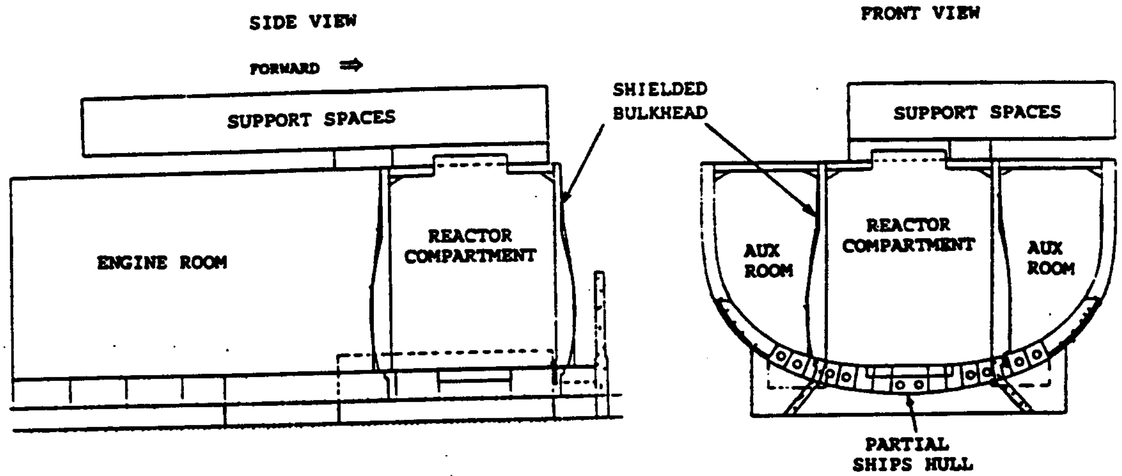

Figure 2-5: D1G Prototype

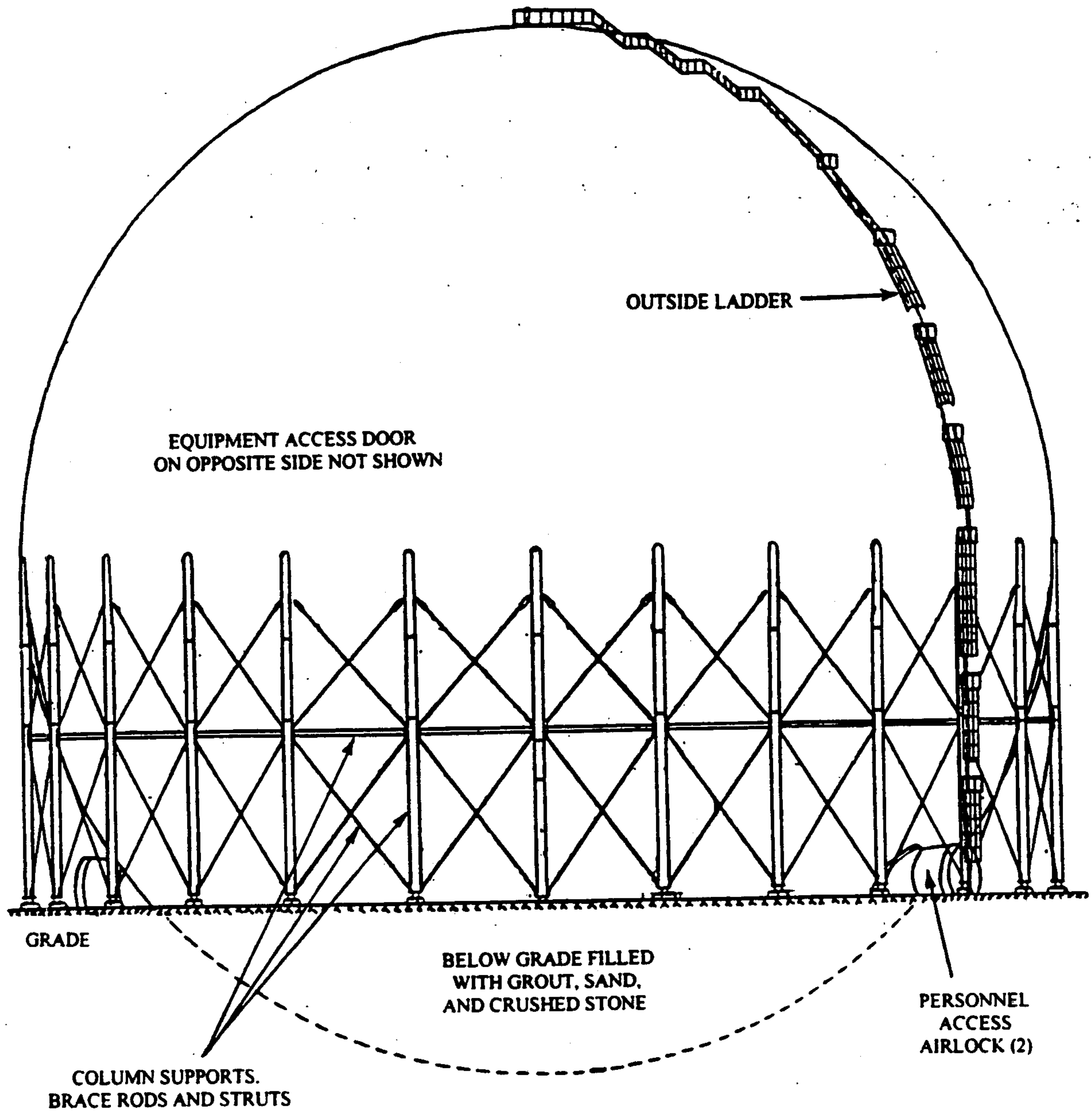

Figure 2-6: D1G Hortonsphere

2.4 Perspectives on the Naval Reactors Program

The following sections provide a general overview of the Naval Reactors Program. More detailed discussions are available in References 2-3, 2-4, and 2-5.

2.4.1 History and Mission of the Naval Reactors Program

In 1946, at the conclusion of World War II, Congress passed the Atomic Energy Act, which established the U.S. Atomic Energy Commission to succeed the wartime Manhattan Project, and gave it the sole responsibility for developing atomic energy. At that time, Captain (later Admiral) Hyman G. Rickover was assigned to the Navy Bureau of Ships, the organization responsible for Naval ship design. Captain Rickover recognized the military implications of successfully harnessing atomic power for submarine propulsion and that it would be necessary for the U.S. Navy to work with the U.S. Atomic Energy Commission to develop such a program. By 1949, Captain Rickover had forged an arrangement between the U.S. Atomic Energy Commission and the U.S. Navy that led to the formation of the Naval Reactors Program. In 1954, the first nuclear submarine, USS NAUTILUS, put to sea and demonstrated the basis for all subsequent Naval nuclear-powered warship propulsion designs. In the 1970s, government restructuring moved the U.S. Atomic Energy Commission part of the Naval Reactors Program from the U.S. Atomic Energy Commission (which was disestablished) to what ultimately became the U.S. Department of Energy. Although the Naval Reactors Program grew in size and scope over the years, it retained its dual responsibilities within the U.S. Department of Energy and the U.S. Department of the Navy, and its basic organization, responsibilities, and technical discipline have remained much as when it was first established.

Naval Reactors Program authority derives from the Atomic Energy Act of 1954 (as amended) and Presidential Executive Order 12344 issued February 1, 1982, and enacted as permanent law by Public Law 98-525 on October 19, 1984 (42 USC §7158). Pursuant to this authority, the Naval Reactors Program exclusively regulates the following areas at the Kesselring Site: reactor safety; radiological and nonradiological occupational safety and health; and waterborne emissions of Atomic Energy Act radioactivity. The Naval Reactors Program and the U.S. Environmental Protection Agency both have regulatory authority for airborne emissions of Atomic Energy Act radioactivity. The Naval Reactors Program and the New York State Department of Environmental Conservation both have regulatory authority for mixed waste (Atomic Energy Act radioactivity aspects are regulated by the Naval Reactors Program and chemically hazardous aspects are regulated by New York State). The Naval Reactors Program, the U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation all have regulatory authority for radiological cleanup standards. Sections 2.5 through 2.8 provide more detail regarding Federal statutes and regulations, Executive Orders, and State statutes and regulations that are applicable at the Kesselring Site.

The Naval Reactors Program is comprised of military personnel and civilians who design, build, operate, maintain, and manage the Naval nuclear-powered warships and many facilities which support the Naval nuclear-powered fleet. Naval Reactors Program elements include:

- The nuclear propulsion plants aboard nuclear-powered U.S. Navy warships;
- Moored Training Ships used for training of Naval nuclear propulsion plant operators;
- Land-based prototype Naval reactors used for research and development work and training of Naval nuclear propulsion plant operators;
- Research and development laboratories;
- Contractors responsible for the design, procurement, and construction of propulsion plant equipment;
- Shipyards that construct, overhaul, and service the propulsion plants of nuclear-powered U.S. Navy warships;
- Naval support facilities and tenders;
- The Expended Core Facility, located at the Idaho National Engineering and Environmental Laboratory; and
- The Naval Reactors Program headquarters organization and field offices.

Naval Reactors Program headquarters provides oversight and direction for all elements of the Program. Based on decades of engineering experience in nuclear propulsion, the headquarters organization exercises exacting control over all aspects of the Naval Reactors Program, demanding technical excellence and discipline unique in nuclear programs.

2.4.2 Philosophy of the Naval Reactors Program

Since radioactive material is an inherent by-product of the nuclear fission process, its control has been a central concern for the Naval Reactors Program. Radiation levels and releases of radioactivity have historically been controlled well below the limits permitted by national and international standards. Design, construction, operation, maintenance, and personnel selection, training and qualifications have been oriented toward minimizing environmental effects and ensuring the health and safety of workers, ships' crew members, and the general public. Conservative reactor safety design has been, from the beginning, a hallmark of the Naval Reactors Program.

2.4.3 Environmental Protection

From its inception, the Naval Reactors Program recognized that the environmental aspects of nuclear-powered U.S. Navy warships and their operations would be key to their acceptance in ports both at home and abroad. The Naval Reactors Program maintains the same rigorous attitude toward the control of radioactivity and protection of the environment as it does toward reactor design, testing, operation, and servicing. As a result, the Naval Reactors Program has a well-documented record of environmental responsibility; this record supports nuclear-powered U.S. Navy warships being welcomed into over 150 ports in over 50 foreign countries and dependencies, as well as U.S. ports.

The policy of the Naval Reactors Program is to reduce radiation exposure to personnel to as low as reasonably achievable. In carrying out this policy, the Naval Reactors Program has consistently maintained more stringent personnel radiation exposure standards than those in the civilian nuclear power industry or in other government nuclear programs. As a consequence, radiation exposure to the public and to personnel in the Naval Reactors Program has always been very low, in fact much lower than limits established by the U.S. Nuclear Regulatory Commission, the U.S. Department of Energy, or the U.S. Environmental Protection Agency for other activities involved in radiological work. For further information on the Naval Reactors Program radiological controls practices and performance, refer to References 2-9 and 4-22.

Routine, small environmental releases, both airborne and waterborne, are authorized or allowed by regulations and are strictly controlled. As a result, the annual releases of long-lived gamma radioactivity from all Naval Reactors Program activities are comparable to the annual releases from a single typical U.S. commercial nuclear reactor operating in accordance with its U.S. Nuclear Regulatory Commission license. For further information on the Naval Reactors Program radiological monitoring practices and performance associated with environmental protection, refer to References 2-1, 2-10, and 4-4. Existing radiological conditions in the environment surrounding the Kesselring Site are discussed further in Sections 4.3, 4.4, and 4.5 of this document. The Naval Reactors Program's conservative design practices and stringent operating procedures have resulted in the demonstrated safety record of Naval nuclear propulsion plants. Through the entire history of the Naval Reactors Program, over 4,800 reactor years of operation and over 110 million miles steamed on nuclear power, there has never been a reactor accident, or any release of radioactivity that has had an adverse effect on the public or the environment. The Naval Reactors Program's standards and record surpass those of any other national or international nuclear program.

The Naval Reactors Program has an environmental monitoring program at each of its major installations and facilities, including nuclear-capable shipyards and the home ports of nuclear-powered U.S. Navy warships. This monitoring program consists of analyzing water, sediment, air, and aquatic samples for radioactivity to verify that Naval Reactors Program operations have not had a significant effect on the environment or the public. For further information on the Naval Reactors Program environmental monitoring practices and performance, refer to References 2-1, 2-10, and 4-4. Independent surveys conducted by the U.S. Environmental Protection Agency, state and local governments confirm that Naval nuclear-powered warships and facilities have had no significant radiological effects on the environment.

Naval Reactors Program facilities are responsible for nonradiological as well as radiological environmental matters. Regular inspection of the Naval Reactors Program's laboratory and prototype sites by the U.S. Environmental Protection Agency and state officials in accordance with the Clean Air Act, the Resource Conservation and Recovery Act, and the Clean Water Act, has shown no significant problems. None of these sites qualifies for inclusion on the U.S. Environmental Protection Agency's National Priorities List (NPL) for cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act. The Naval Reactors Facility in Idaho is included under a Federal Facility Agreement and Consent Order as part of the Idaho National Engineering and Environmental Laboratory, but does not qualify for inclusion on the NPL by itself.

2.4.4 Past Experience

There is a wide range of experience in dismantling reactor plants throughout the nuclear industry. The Naval Reactors Program has removed the defueled reactor plants from more than 60 decommissioned nuclear-powered U.S. Navy warships at the Puget Sound Naval Shipyard in Bremerton, Washington and shipped the reactor plants for disposal at the U.S. Department of Energy Hanford Site. Several similar or larger sized reactor plants have been totally or partially dismantled by the U.S. Department of Energy or commercial utilities, including the Shippingport reactor plant in Pennsylvania, the Elk River demonstration reactor in Minnesota, the Pathfinder reactor plant in South Dakota, the Trojan reactor plant in Oregon, the Yankee Rowe reactor plant in Massachusetts, and the Fort St.Vrain reactor plant in Colorado. The technology and techniques used in these previous dismantlements are now proven. Waste from these dismantlement projects were disposed of at a variety of sites, including the U.S. Department of Energy Hanford Site, the commercial Barnwell Site in South Carolina, and the commercial Richland Site in Washington State.

Over the course of more than 40 years of Naval reactor plant operation and maintenance, including refuelings, the Naval Reactors Program has gained vast experience in the safe handling and shipment of radioactive material and large components. For example, the Naval Reactors Program has safely made more than 680 shipments of spent nuclear fuel. The Naval Reactors Program has safely made numerous other shipments of low-level radioactive materials. A total of approximately 1,000 shipments are made annually from nuclear-powered U.S. Navy warships and their support facilities, which is a small part of the more than 2 million shipments of radioactive materials made annually in the United States (Reference 2-10). All shipments have met applicable Federal, State, and local regulations.

2.5 Federal Environmental Statutes and Regulations

This section provides a general discussion of Federal environmental laws and regulations that are related to Kesselring Site activities. Additional detailed summaries of many of these laws, regulations and other requirements can be found in Volume 1, Chapter 7 of the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference 2-7).

2.5.1 National Environmental Policy Act of 1969, as amended (42 USC §4321 et seq.)

The National Environmental Policy Act establishes a national policy promoting awareness of the environmental consequences of human activities and promoting consideration of the environmental impacts during planning and decision making stages of a project. This Act requires all Federal agencies to prepare a detailed statement on the environmental effects of proposed major Federal actions that may significantly affect the quality of the human environment. This Environmental Impact Statement has been prepared in accordance with the Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (40 CFR Parts 1500 through 1508) and U.S. Department of Energy National Environmental Policy Act Implementing Procedures (10 CFR Part 1021).

2.5.2 Atomic Energy Act of 1954, as amended (42 USC §2011 et seq.)

The Atomic Energy Act, as amended, authorizes the U.S. Department of Energy, the U.S. Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency to issue regulations and establish standards for utilizing atomic energy for peaceful purposes consistent with public health and safety.

2.5.3 Clean Air Act, as amended (42 USC §7401 et seq.)

The Clean Air Act is intended to protect and enhance the quality of the Nation's air resources and to promote the public health and welfare and the productive capacity of its population. This Act requires each Federal agency to comply with all Federal, state, interstate, and local requirements with regard to the control and abatement of air pollution to the same extent as any nongovernmental entity. The Clean Air Act established the National Ambient Air Quality Standards program for criteria pollutants. Criteria pollutants include sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide, ozone and lead. This Act also addresses specific pollutants called hazardous air pollutants (which include radionuclides), visibility impairment, and through issuance of New Source Performance Standards, establishes specific, more stringent criteria for various categories of emission sources, such as boilers, coating operations and other manufacturing processes. Some associated regulations include:

- 40 CFR Part 50 - National Primary and Secondary Ambient Air Quality Standards
- 40 CFR Part 60 - Standards of Performance for New Stationary Sources
- 40 CFR Part 61 - National Emission Standards for Hazardous Air Pollutants
- 40 CFR Part 70 - State Operating Permit Programs
- 40 CFR Part 81 - Designation of Areas for Air Quality Planning Purposes
- 40 CFR Part 82 - Protection of Stratospheric Ozone
- 40 CFR Part 93 - Determining Conformity of Federal Actions to State or Federal Implementation Plans

As described in Section 2.8, the New York State Department of Environmental Conservation has been delegated authority by the U.S. Environmental Protection Agency to implement and enforce many portions of the Clean Air Act through approval of a State Implementation Plan.

2.5.4 Clean Water Act, as amended (33 USC §1251 et seq.)

The Clean Water Act was enacted to restore and maintain the chemical, physical and biological integrity of the Nation's water. This Act requires each Federal agency to comply with Federal, state, interstate, and local requirements with regard to any activity that might result in the discharge or runoff of pollutants to surface waters in the same manner and to the same extent as any nongovernmental entity. The regulations implementing major provisions of this Act, including controlling, permitting, and monitoring water discharges, are found in 40 CFR Part 122 et seq., National Pollutant Discharge Elimination System. The National Pollutant Discharge Elimination System program is administered by the Water Management Division of the U.S. Environmental Protection Agency. As described in Section 2.8, the New York State Department of Environmental Conservation, Division of Water Resources, has been granted regulatory authority by the U.S. Environmental Protection Agency for the National Pollutant Discharge Elimination System program in New York State.

2.5.5 Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 USC §6901 et seq.)

The treatment, storage, or disposal of hazardous and nonhazardous waste is regulated under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, the Hazardous and Solid Waste Amendments of 1984, and the Federal Facility Compliance Act. Hazardous wastes are regulated by the provisions of Subtitle C of the Resource Conservation and Recovery Act. The U.S. Environmental Protection Agency regulations implementing Subtitle C of the Resource Conservation and Recovery Act are found in 40 CFR Parts 260 through 280. These regulations define hazardous wastes and allowable methods for the proper handling, treatment, storage, and disposal of hazardous waste. The regulations imposed on a generator or a treatment, storage and/or disposal facility vary according to the type and quantity of materials or wastes involved. As with the Clean Air Act and Clean Water Act, there is a dual State and Federal regulatory program in New York State. As discussed in Section 2.8, the U.S. Environmental Protection Agency has granted final authorization to the New York State Department of Environmental Conservation to operate its hazardous waste program, subject to the authority retained by the U.S. Environmental Protection Agency in accordance with the Hazardous and Solid Waste Amendments of 1984. Where Hazardous and Solid Waste Amendments of 1984 apply, the U.S. Environmental Protection Agency administers and enforces these provisions until New York State receives final authorization to do so. Nonhazardous wastes are regulated in accordance with Subtitle D of the Resource Conservation and Recovery Act. The U.S. Environmental Protection Agency regulations implementing provisions of Subtitle D are found in 40 CFR Parts 257 through 258.

2.5.6 Comprehensive Environmental Response, Compensation, and Liability Act (42 USC §9601 et seq.), as amended by the Superfund Amendments and Reauthorization Act

This Act provides a statutory framework for the clean up of waste sites containing hazardous substances and, as amended by the Superfund Amendments and Reauthorization Act, provides an emergency response program in the event of a release (or threat of a release) of a hazardous substance to the environment. Under this Act, the Hazard Ranking System is used to rank past hazardous waste disposal sites located on Federal and private lands for possible inclusion on the National Priorities List. This Act requires Federal facilities having such sites to undertake investigations and remediation as necessary. The Superfund Amendments and Reauthorization Act includes requirements for reporting yearly use and immediate reporting of accidental releases of certain hazardous substances in excess of specified amounts to State and Federal agencies. Associated regulations include 40 CFR Parts 300, 302, 350, 355, 370, 372 and 373.

2.5.7 Emergency Planning and Community Right-to-Know Act of 1986 (42 USC §11001 et seq.) (also known as Superfund Amendments and Reauthorization Act Title III)

Under Subtitle A of the Emergency Planning and Community Right-to-Know Act, Federal facilities must provide various information (such as inventories of specific chemicals used or stored and releases that occur from these sites) to state emergency response commissions and local emergency planning committees to ensure emergency plans are in place to respond to unplanned releases of hazardous substances. The requirements for this Act were promulgated by the U.S. Environmental Protection Agency in 40 CFR Parts 350 through 372. Related Kesselring Site information has been provided to the New York State Emergency Management Office and to the Saratoga County Office of Emergency Services.

2.5.8 Toxic Substances Control Act (15 USC §2601 et seq.)

The Toxic Substances Control Act requires that the health and environmental effects of all new chemicals be reviewed before they are manufactured for commercial purposes. This Act authorizes the U.S. Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. Regulated activities under 40 CFR Part 761 include the manufacture, use, distribution in commerce, and disposal of chemical substances, including polychlorinated biphenyls, and abatement of asbestos and lead.

2.5.9 Federal Facility Compliance Act (42 USC §6921 et seq.)

The Federal Facility Compliance Act amended the Resource Conservation and Recovery Act and requires the U.S. Department of Energy to prepare plans for developing the required treatment capacity for mixed waste (see definition in the glossary) stored or generated at each facility. The New York State Department of Environmental Conservation, which has regulatory authority for mixed waste in New York State, approved a Site Treatment Plan for Mixed Wastes Generated at the Kesselring Site and issued an Administrative Consent Order that became effective on October 24, 1995 (Reference 2-2). The Administrative Consent Order authorizes implementation of the Site Treatment Plan.

2.5.10 Safe Drinking Water Act, as amended (42 USC §300f et seq.)

The Safe Drinking Water Act was enacted to protect potable water resources and ensure potable water quality. Among other things, this Act requires each Federal agency and department that owns or operates a public water system to comply with all Federal, state and local safe drinking water requirements. The U.S. Environmental Protection Agency has promulgated the Safe Drinking Water Act regulations in 40 CFR Parts 140 through 149. The New York State Department of Health has primary enforcement responsibility for the regulations implementing the potable water quality requirements and protection of potable water resources.

2.5.11 National Historic Preservation Act, as amended (16 USC §470 et seq.)

The National Historic Preservation Act, as amended, provides that properties with significant national historic value are placed on the National Register of Historic Places. There are no permits or certifications required under the Act. However, if a proposed Federally-funded activity could result in an impact on a listed property or a property potentially eligible for listing, then the Advisory Council on Historic Preservation has to be provided the opportunity to comment. The State Historic Preservation Officer may also be contacted to ensure that potentially significant sites are properly identified and appropriate mitigative actions are implemented. These consultations may result in the issuance of a Memorandum of Agreement which includes stipulations that must be followed to minimize adverse impacts.

2.5.12 Endangered Species Act, as amended (16 USC §1531 et seq.)

The Endangered Species Act, as amended, is intended to prevent the further decline of endangered and threatened species and to restore these species and habitats. This Act is jointly administered by the U.S. Departments of Commerce and the Interior. Section 7 of the Act requires consultation with the U.S. Fish and Wildlife Service to determine whether endangered species or their critical habitats are known to be in the vicinity of the proposed action, and whether an action will adversely affect listed species or designated critical habitats. The Fish and Wildlife Service list of endangered and threatened wildlife and plants can be found in 50 CFR Part 17.

2.5.13 Occupational Safety and Health Act of 1970, as amended (29 USC §651 et seq.)

The Occupational Safety and Health Act establishes standards to enhance safe and healthful working conditions in places of employment throughout the Nation. Implementing regulations are found in 29 CFR Parts 1910 and 1926. In general, under this Act, it is the duty of each employer to furnish all employees with a place of employment free of recognized hazards likely to cause death or serious physical harm. This Act excludes from coverage those activities which are regulated under separate statutory authority. Within the U.S. Department of Energy, the Naval Reactors Program is responsible for the regulation of occupational safety and health at Naval Reactors Program facilities under the authority of the Atomic Energy Act and Executive Order 12344 (enacted as permanent law in 42 USC §7158). Applicable U.S. Department of Energy Orders include 440.1, Worker Protection Management for DOE Federal and Contractor Employees.

2.5.14 Noise Control Act of 1972, as amended (42 USC §4901 et seq.)

Section 4 of the Noise Control Act of 1972, as amended, directs all Federal agencies to carry out to the fullest extent within their authority programs within their jurisdictions in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.

2.5.15 Hazardous Materials Transportation Act, as amended (49 USC §5101 et seq.)

The Hazardous Materials Transportation Act provides for the regulation of hazardous materials in commerce during the transportation cycle. This Act establishes requirements for the packaging of hazardous materials and for communicating hazards through the use of labels, markings, vehicle placards, and manifests. This Act also establishes emergency response responsibilities for both the shipper and transporter of hazardous materials.

In general, the transportation of hazardous and/or radioactive materials, including wastes, is governed by the U.S. Department of Transportation under authority of the Hazardous Materials Transportation Act. Applicable regulations include 49 CFR Parts 171 through 178 and Parts 383 through 397. Specifically, radiation level limitations are included in 49 CFR Part 173; requirements for rail transport are included in 49 CFR Part 174; and truck routing requirements are included in 49 CFR Part 397.

Both the U.S. Environmental Protection Agency and the U.S. Nuclear Regulatory Commission have also promulgated regulations which govern certain aspects of hazardous and/or radioactive material shipments. U.S. Environmental Protection Agency regulations, found in 40 CFR Parts 262 and 263, apply to transportation of hazardous waste defined by the Resource Conservation and Recovery Act. These regulations require the identification of hazardous wastes and use of a uniform hazardous waste manifest for shipment documentation. U.S. Nuclear Regulatory Commission regulations, found in 10 CFR Part 71, apply to the transportation of radioactive materials. These regulations define detailed packaging design requirements and package certification testing requirements. For certain categories of packages, complete documentation of design development, safety analysis and results of testing is submitted to the U.S. Nuclear Regulatory Commission to certify packages for use.

2.6 Executive Orders

This section provides a general discussion of Executive Orders that are related to Kesselring Site activities. Additional detailed summaries of many of these Executive Orders can be found in Volume 1, Chapter 7 of the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference 2-7).

2.6.1 Executive Order 12344 (Naval Nuclear Propulsion Program)

Executive Order 12344, enacted as permanent law by Public Law 98-525 (42 USC §7158) prescribes the authority and responsibility of the Naval Nuclear Propulsion Program (Naval Reactors Program), a joint U.S. Navy and U.S. Department of Energy organization, for matters pertaining to Naval nuclear propulsion. These responsibilities include all environmental and occupational safety and health aspects of the Program.

2.6.2 Executive Order 11514 (National Environmental Policy Act)

This Order directs Federal agencies to continually monitor and control their activities to protect and enhance the quality of the environment. This Order also directs Federal agencies to develop procedures to ensure full and timely provision of information to public officials and citizens. The U.S. Department of Energy implements its National Environmental Policy Act compliance through its own regulations (10 CFR Part 1021) and the Council on Environmental Quality regulations (40 CFR Parts 1500-1508). The regulations include provisions to actively seek and consider public and other agency comments in making decisions.

2.6.3 Executive Order 11593 (National Historic Preservation)

This Order directs all Federal agencies to locate, inventory, and nominate properties under their jurisdiction or control to the National Register of Historic Places, if those properties qualify. This process requires the U.S. Department of Energy to provide the Advisory Council on Historic Preservation the opportunity to comment on the possible impacts of the proposed activity on any potential eligible or listed properties.

2.6.4 Executive Order 11990 (Protection of Wetlands)

This Order directs Federal agencies to avoid, to the extent practicable, any short and long-term impacts on wetlands wherever there is a viable alternative.

2.6.5 Executive Order 12088 (Federal Compliance with Pollution Control Standards), as amended by Executive Order 12580 (Superfund Implementation)

This Order directs Federal agencies to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the Clean Air Act, the Noise Control Act, the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act, and the Resource Conservation and Recovery Act.

2.6.6 Executive Order 12580 (Superfund Implementation)

This Order delegates to the heads of executive departments and agencies the responsibility for undertaking remedial actions for the releases, or threatened releases that are not on the National Priorities List and removal actions, other than emergencies, where the release is from any facility under the jurisdiction or control of the executive departments and agencies.

2.6.7 Executive Order 12856 (Right-to-Know Laws and Pollution Prevention Requirements) as amended by Executive Order 12873 (Federal Acquisition, Recycling, and Waste Prevention)

Executive Order 12856, issued on August 3, 1993, directs all Federal agencies, including the U.S. Department of Energy, to comply with the Emergency Planning and Community Right-to-Know Act of 1986 (Superfund Amendments and Reauthorization Act Title III) and the Pollution Prevention Act of 1990. These Orders direct all Federal agencies to reduce and report toxic chemicals entering any waste stream; improve emergency planning, response, and public notification in the event of an accident; and encourage clean technologies and testing of innovative prevention technologies. The U.S. Department of Energy's goal is to reduce its total releases of all toxic chemicals by 50 percent by December 31, 1999.

2.6.8 Executive Order 12898 (Environmental Justice)

This Order directs all Federal agencies to achieve environmental justice to the extent practicable by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. This Order directs each Federal agency to develop strategies to identify and address environmental justice concerns.

2.7 U.S. Department of Energy Regulations and Orders

U.S. Department of Energy regulations are generally found in Title 10 of the Code of Federal Regulations. U.S. Department of Energy Orders generally set forth policy and programs and internal procedures for implementing department policies. These regulations address such areas as administrative requirements and procedures, general environmental protection, radiation protection of the public and the environment, radioactive waste management, and occupational health and safety. U.S. Department of Energy Orders are implemented by the Naval Reactors Program under authority of Executive Order 12344.

2.8 New York State Environmental Statutes and Regulations

In addition to Federal laws, New York State legislation includes a series of Environmental Conservation Laws. State implementing regulations are found in various titles of the New York State Code of Rules and Regulations (NYCRR). This section provides a general discussion of New York State regulations that are applicable to Kesselring Site activities.

2.8.1 New York State Air Regulations

The New York State Department of Environmental Conservation, in Environmental Conservation Law Article 19, has been delegated authority to implement and enforce many portions of the Clean Air Act through approval of a State Implementation Plan which includes regulation of hazardous air pollutants such as asbestos and lead. New York State air pollution control standards and air emission permitting requirements are contained in NYCRR Title 6, Parts 200 through 250, and 256, 257 and 301. In addition to the Federal criteria pollutants such as carbon monoxide, sulfur dioxide, oxides of nitrogen, particulate matter, ozone, and lead, the Federal and State regulations cover other general categories of air pollutants. The general categories include classes of air contaminants defined as hazardous air pollutants such as chlorine and volatile organic compounds such as acetone.

2.8.2 New York State Freshwater Wetlands Regulations

New York State freshwater wetlands are regulated under the authority of the State's Freshwater Wetlands Act (Environmental Conservation Law Article 24). This Act directs the New York State Department of Environmental Conservation to "preserve, protect and conserve freshwater wetlands and the benefits derived therefrom, to prevent the despoliation and destruction of freshwater wetlands, and to regulate use and development of such wetlands to secure the natural benefits of freshwater wetlands, consistent with the general welfare, beneficial economic, social and agricultural development of the State." Implementing regulations for this Act are found in NYCRR Title 6, Parts 647, and 662 through 665. The New York State Department of Environmental Conservation maintains a data base of freshwater wetlands locations that meet State criteria.

2.8.3 New York State Water Regulations

The New York State Department of Environmental Conservation, Division of Water Resources, has been granted regulatory authority for the National Pollutant Discharge Elimination System program in New York State (Environmental Conservation Law

Article 17). Discharges to waters of the State are regulated by the New York State Department of Environmental Conservation through issuance of State Pollutant Discharge Elimination System permits. New York State water pollution control standards and permitting requirements for liquid discharges to the waters of the State are contained in NYCRR Title 6, Parts 700 through 705 and 750 through 758. Liquid discharges include industrial waste waters, sanitary system effluents, and storm water runoff. Waters of the State include all surface waters and ground waters.

2.8.4 New York State Hazardous Waste Regulations

New York State hazardous waste regulations are found in NYCRR Title 6, Parts 361, 362, 364, and 370 through 376. In general, these regulations have adopted Federal regulations pursuant to Subtitle C of the Resource Conservation and Recovery Act, with some specific differences. Many of these differences are administrative in nature. However, one important difference concerns New York State regulation of polychlorinated biphenyl-containing waste as a hazardous waste. These regulations implement Environmental Conservation Law Article 27 (Titles 7 and 9) and Article 70.

2.8.5 New York State Hazardous Waste Reduction Plans

New York State Hazardous Waste Reduction Plans are contained in Environmental Conservation Law Article 27, Title 9, Section 27-0908. This Law was modified to help the State achieve an overall reduction in the generation and release of hazardous waste. The State Hazardous Waste Reduction Plan requires hazardous waste generators to certify that they have a program in place at each facility to reduce the volume and toxicity of their hazardous waste. Hazardous waste generators are required to submit their hazardous waste reduction plans to the New York State Department of Environmental Conservation biennially with an update in alternate years. No implementing regulations have been published; however, the New York State Department of Environmental Conservation has published a technical guidance document which provides instructions for required plans and submittals (Reference 2-8). The Kesselring Site Waste Reduction Plan includes a description of the waste processes at the facility, disposal costs, and evaluation of waste reduction methods.

2.8.6 New York State Solid Waste Regulations

New York State governs solid waste under separate statutes from hazardous waste. Environmental Conservation Law Article 27, Title 7, governs the management and disposal of solid waste in New York State. Implementing regulations for this statute are found in NYCRR Title 6, Parts 360 through 369. These regulations cover matters pertaining to siting, construction and closure of landfills; handling and disposal of waste oil; recycling and medical waste. New York State waste transporter permit requirements are contained in NYCRR Title 6, Part 364.

2.8.7 New York State Petroleum Bulk Storage Regulations

New York State regulations (based on Environmental Conservation Law Article 17, Title 10) governing the bulk storage of petroleum products are found in NYCRR Title 6, Parts 612 through 614, and are designed to prevent spills and leaks of petroleum products to the environment. This is accomplished by requiring registration and permitting of affected above ground and underground petroleum storage facilities with a combined storage capacity of more than 1,100 gallons. The regulations define proper handling and storage of petroleum products, periodic tank testing, inspections and record keeping requirements to document compliance. In addition, the regulations establish design standards which address tank performance, integrity, secondary containment, and monitoring system specifications for new and existing tanks and piping systems.

2.8.8 New York State Chemical Bulk Storage Regulations

New York State regulations (based on Environmental Conservation Law Article 40) for bulk storage of chemical products are found in NYCRR Title 6, Parts 595 through 599, and are designed to prevent spills and leaks of hazardous chemical products to the environment. The regulations apply to facilities that store hazardous chemical products in tanks which meet specified criteria. Regulated hazardous chemical bulk storage tanks include aboveground tanks with a capacity of 185 gallons or more; underground tanks of any capacity; and nonstationary tanks used to store greater than 1,000 kilograms (2,200 pounds) of product for a period of 90 or more consecutive days. Each tank that meets these criteria must be registered with the New York State Department of Environmental Conservation. The regulations cover all aspects of chemical bulk storage facilities including design, installation, operation, periodic testing, maintenance and repairs. The regulations identify applicable hazardous chemical substances, establish reportable quantities in the event of a spill, and provide requirements for spill cleanup.

2.8.9 New York State Drinking Water Standards

New York State drinking water standards are contained in the New York State Sanitary Code (Public Health Law Article 2, Title II, Section 225). Implementing regulations for drinking water suppliers are found in NYCRR Title 10, Chapter 1, Part 5, which are designed to protect potable water sources. These standards, which are administered by the New York State Department of Health, require each organization that owns and operates a public water system to comply with all Federal, State, and local drinking water requirements. These requirements include the treatment, sampling, and protection of the potable water sources.

2.8.10 New York State Environmental Quality Review Regulations

New York State Environmental Quality Review regulations (based on Environmental Conservation Law Article 8) are found in NYCRR Title 6, Part 617. The purpose of the State Environmental Quality Review is to incorporate consideration of environmental factors into the existing planning, review, and decision making processes of State, regional and local government agencies at the earliest possible time. Based on NYCRR Title 6, Part 617, Section 617.15, State Environmental Quality Review regulations do not apply to the Kesselring Site since the proposed actions covered by this Environmental Impact Statement are solely Federal activities (although they do apply to the approval of State permits connected to actions considered in this Environmental Impact Statement). Nevertheless, State Environmental Quality Review regulations were considered during preparation of this Environmental Impact Statement to assist reviews by New York State regulatory personnel. For example, the checklist contained in NYCRR Title 6, Part 617.20, Appendix A, was reviewed to ensure completeness of information contained in this Environmental Impact Statement.

2.8.11 New York State Low-Level Radioactive Waste Transportation Regulations

New York State regulations (based on Environmental Conservation Law Article 27, Title 3) governing the transportation of low-level radioactive waste are found in NYCRR Title 6, Part 381. These regulations establish transporter permit standards for low-level radioactive waste generators relating to the use of a waste manifest system and other record keeping requirements. The Kesselring Site, which is operated under DOE contract, is exempt from these regulations (§381.2(b)) with the exception of Section 381.16 which stipulates reporting requirements and emergency actions to be followed in the event of a transportation-related accident.

CHAPTER 3

ALTERNATIVES AND COMPARISONS

3.0 Alternatives

The following sections describe in detail three alternatives for disposal of the defueled S3G and D1G Prototype reactor plants: no action, prompt dismantlement, and deferred dismantlement. Several other alternatives are also considered in limited detail.

The MARF and S8G Prototype reactor plants continue to operate at the Kesselring Site to fulfill the mission of training U.S. Navy personnel and testing Naval nuclear propulsion plant equipment. Since there are no plans to permanently shut down the remaining operating prototypes in the foreseeable future, an evaluation of their disposal in connection with any of the S3G and D1G Prototype reactor plant disposal alternatives is not required at this time. None of the alternatives evaluated in detail for S3G and D1G Prototype reactor plant disposal would change the long-term use of the Kesselring Site or Federal reservation; therefore, it is not expected that any of these lands will be returned to the commercial or public domain in the foreseeable future. If, subsequent to issuance of this Environmental Impact Statement and a Record of Decision, a decision is made to permanently shut down the MARF and S8G Prototype reactor plants, the Naval Reactors Program would issue a separate Environmental Impact Statement and Record of Decision.

3.1 No Action Alternative

The no action alternative would include maintaining and monitoring the defueled S3G and D1G Prototype reactor plants in place and in a stable condition for a caretaking period of indefinite duration. This alternative involves no prototype reactor plant dismantlement activities and, hence, no waste shipments from dismantlement. This alternative does not provide for permanent disposal of the S3G and D1G Prototype reactor plants; disposal of these prototype reactor plants would be required at some time in the future.

3.1.1 Caretaking Period Activities

During the first 10 years of the caretaking period, a limited work force would place the defueled S3G and D1G Prototype reactor plants in a condition suitable for long-term caretaking. During the entire caretaking period, the defueled reactor plants would be periodically monitored. The purpose of this monitoring would be to verify overall physical integrity of the reactor plants and to verify that all radioactivity remains contained. The cost of these activities is summarized in Section 3.5.4, and compared to the estimated costs of the other alternatives.

Periodic monitoring would involve radiological surveys, air samples, and radiation monitoring, inside and outside of the reactor compartments. These surveys would identify any changes in radiological conditions. The only expected change would be the decay of residual radioactivity.

During the caretaking period, the reactor compartments would be periodically ventilated. The ventilation systems have high efficiency particulate air filters installed and have a 99.95 percent efficiency for removal of potential airborne particulate radioactivity. When operated, the reactor compartment ventilation exhaust would be sampled to verify that the applicable National Emission Standards for Emission of Radionuclides Other than Radon from Department of Energy Facilities (Reference 3-2), established by the U.S. Environmental Protection Agency, are met.

Visual inspections would be performed periodically to verify that physical conditions of the reactor plants remain stable. These visual inspections would be performed inside and outside of both reactor compartments. Potential deficiencies would be identified and corrective actions would be performed as needed.

3.2 Prompt Dismantlement Alternative

This alternative would dismantle the S3G and D1G Prototype reactor plants and would recycle or dispose of waste materials. Dismantlement of the defueled S3G and D1G Prototype reactor plants would begin shortly after the Record of Decision for this Environmental Impact Statement is issued. The project would be completed as soon as practicable, subject to available appropriated funding. The cost of these activities is summarized in Section 3.5.4 and compared to the estimated costs of the other alternatives.

3.2.1 Dismantlement Activities

Dismantlement activities would involve mechanical disassembly of all S3G and D1G Prototype reactor plant systems and the reactor compartment structures. Dismantlement activities are estimated to take approximately 2 years for S3G and approximately 3 years for D1G. Preliminary sequencing plans indicate that some overlap in S3G and D1G Prototype dismantlement operation schedules would be possible. As a result, dismantlement activities would occur over an estimated 3 to 4-year period.

The S3G and D1G Prototypes each have a dedicated, permanently installed crane that would be used to support lifting and handling operations during reactor plant disassembly. The S3G Prototype reactor compartment and reactor plant components are within the reach of a derrick crane. The derrick crane is located above a support building adjacent to the S3G Prototype hull. The D1G Prototype reactor compartment is located beneath a bridge crane in the Hortonsphere. Other lifting and handling equipment such as mobile cranes, fork lifts, jacking and blocking gear would also be used.

Large components would be cut free of interferences and packaged individually for shipment off-site. Large reactor plant components include the reactor pressure vessels, steam generators, pressurizers, and the S3G primary shield tank. Prior to the removal of each large component, interferences such as electrical cables, reactor system piping, pumps, deckplates, and hull sections would be removed. These smaller components would be disposed of periodically as warranted by the accumulated volume. Disassembly techniques would include proven methods such as machine cutting of piping, grinding, sawing, flame cutting, and plasma arc cutting. Cutting techniques would vary depending on the application, location and radiological status of the affected component.

Operations on radiologically contaminated piping and components would use appropriate measures to prevent the spread of radioactivity and to protect human health and the environment. The protective measures would adhere to the same stringent standards and practices that are used throughout Naval Reactors Program operations to successfully control maintenance evolutions on operating reactor plants (see Appendix A, Section A.3 for further detail).

In order to minimize the volume of waste generated from prototype dismantlement, emphasis would be placed on recycling as much material as practicable, consistent with current standards and practices. Most of the recyclable materials from dismantlement activities would be metals, such as carbon steel, corrosion resisting metals, and lead. These materials would be recycled through various commercial vendors. Types of wastes (waste streams) and estimated waste volumes are discussed in further detail in Chapter 5.

3.2.2 Packaging and Transport of Recyclable Material and Waste

All recyclable material and waste shipments would comply with applicable Federal and State regulations and disposal site waste acceptance criteria. All shipments would be properly categorized, described, packaged, marked and labeled. Dismantlement of the S3G and D1G Prototype reactor plants would require approximately 60 shipments of low-level radioactive recyclable material and waste, and approximately 50 shipments of nonradioactive recyclable material and waste. These waste materials would not be transferred to other Knolls Atomic Power Laboratory sites.

The largest waste shipments by weight, and radioactivity content would be the two reactor pressure vessels. Each reactor pressure vessel package, which includes the reactor pressure vessel and non-fuel internal structural components within a shipping container, would measure approximately 5.69 meters (224 inches) long by 3.23 meters (127 inches) in diameter and would weigh approximately 177 metric tons (195 tons). These packages would be moved individually by a heavy hauler over public roads to the Delaware and Hudson railroad terminus, located in Ballston Spa, approximately 13 kilometers (8 miles) southeast of the Kesselring Site. Because of their oversize dimensions and weight, transport of the two reactor pressure vessel packages from the Kesselring Site to the railroad terminus would require New York State approved permits. Due to the short distance involved, the reactor pressure vessel packages would likely be transported over the same route between the Kesselring Site and the railroad terminus that has been used for past shipments of similar size and weight. Due to their radioactivity content, the two reactor pressure vessel shipments would be considered highway route controlled and would require the use of a New York State preferred route; the route used in this case would coincide with the route used to meet oversize requirements. The reactor pressure vessel packages would then be transported individually by railroad to the U.S. Department of Energy Savannah River Site in South Carolina for disposal.

Although Naval Reactors Program low-level radioactive waste generated at sites in the eastern United States is usually disposed of at the Savannah River Site, the U.S. Department of Energy Hanford Site in Washington State is also available for disposal of low-level radioactive waste generated by Naval Reactors Program activities. Transportation analyses contained in Appendix C take into consideration both of these disposal sites as possible destinations for low-level radioactive wastes.

3.2.3 Final Kesselring Site Conditions After Dismantlement Activities

The Kesselring Site and the remaining prototypes, MARF and S8G, would continue to operate after completion of the S3G and D1G Prototype reactor plant dismantlements. There are no plans to shut down the operating prototypes or to release the Kesselring Site or Federal reservation lands for other uses in the foreseeable future. No buildings at the Kesselring Site are expected to be affected by S3G and D1G Prototype reactor plant dismantlement activities. The D1G Hortonsphere, which houses the D1G Prototype, would remain intact for possible future Naval Reactors Program use, although no future use is planned at this time.

Since the preferred alternative would not result in release of any lands for other uses, establishing radiological standards for unrestricted release of the Kesselring Site would not be appropriate at this time. For information and perspective, other Naval Reactors Program sites have recently been closed or are in the process of closure, including the former Mare Island and Charleston Naval Shipyards (both closed April 1, 1996) and the ongoing S1C Prototype dismantlement and site release project at Windsor, Connecticut. For these sites, the Naval Reactors Program has used radioactivity concentration limits for unrestricted site release which are substantially below the most restrictive site release criteria currently under consideration by other Federal agencies (that is, the maximum possible exposure to any future site resident is well below the March 16, 1995 draft U.S. Environmental Protection Agency release criteria of 15 millirem per year above background, with no more than 4 millirem per year from man-made beta/gamma radioactivity in ground water, and other guidance currently under consideration). Any future initiative to release the Kesselring Site for unrestricted use would also adhere to New York State guidelines applicable at that time. Currently, the New York State Department of Environmental Conservation Technical & Administrative Guidance Manual (TAGM) 4003 describes "the policy and procedure to be followed by Division of Hazardous Substances Regulation, Bureau of Radiation staff in evaluating cleanup plans for soils contaminated with radioactive materials" (Reference 4-25). However, these provisions are considered unnecessary at this time since S3G and D1G Prototype dismantlement alternatives do not involve Kesselring Site release activities.

3.3 Deferred Dismantlement Alternative

This alternative would dismantle the S3G and D1G Prototype reactor plants after a 30-year caretaking period. Deferred dismantlement would allow the radioactivity in reactor plant materials to decay to a lower amount. Deferred dismantlement activities would include recycling or disposal of waste materials. The cost of these activities is summarized in Section 3.5.4 and compared to the estimated costs of the other alternatives.

Similar analyses sponsored by the U.S. Nuclear Regulatory Commission have considered deferment periods of 50 or 60 years for commercial nuclear power plant dismantlements (Reference 3-1). However, based on differences between commercial and Naval nuclear fuels, described in Appendix A, which affect the type and amount of radioactivity in the plant, the Naval Reactors Program considers 30 years to be appropriate, for analytical purposes, for the S3G and D1G Prototype reactor plant caretaking period. Nearly all of the gamma radiation within the defueled S3G and D1G Prototype reactor plants comes from cobalt-60, which has a 5.27-year half-life. Deferring dismantlement for 30 years would allow cobalt-60 to decay to less than 2 percent of the radioactivity levels present in each prototype reactor plant in 1997.

Appendix A, Tables A-2 and A-3, provide detailed listings of the radionuclide inventories that are expected in the defueled S3G and D1G Prototype reactor plants, respectively, at various times after shutdown. Defueled commercial nuclear power plants contain a substantial amount of residual fission products, such as cesium-137 and strontium-90 which have approximately 30-year half-lives. Even after a longer deferment period of 60 years, commercial power plants would still contain approximately 25 percent of the cesium-137 and strontium-90 levels present at reactor shutdown. On the other hand, fission products present after the defueling of a Naval reactor plant are at very low levels and come only from fission events with trace amounts of uranium-238 in the fuel cladding. This is due to the high integrity of Naval nuclear fuel assemblies, which prevents release of fission products from the fuel.

Thus, because cobalt-60 decays relatively quickly, deferment beyond 30 years for the S3G and D1G Prototype reactor plants would provide little additional benefit in reducing the amount of remaining radioactivity. If the cobalt-60 were allowed to decay to much lower levels, the amount of materials handled as low-level radioactive waste would not be expected to change, due to the presence of other longer-lived radionuclides. Deferment for less than 30 years would be a variation between the prompt and deferred dismantlement alternatives, which bound the range of environmental impacts. If a deferment period of less than 30 years were to be selected, the radiological impacts can be roughly approximated by applying the radioactive half-life of cobalt-60 (5.27 years) to the prompt dismantlement alternative. For example, after a deferment of 5.27 years, the occupational radiation exposure associated with dismantlement would be approximately half of that expected for prompt dismantlement.

3.3.1 Caretaking Period Activities

Caretaking period activities for the deferred dismantlement alternative would be identical to caretaking period activities described for the no action alternative in Section 3.1.1. The only difference would be a defined end date for this alternative.

3.3.2 Deferred Dismantlement Activities

Following completion of the 30-year caretaking period, reactor plant dismantlement would commence. For the purposes of comparison, deferred dismantlement activities are assumed to be identical to dismantlement activities described for the prompt dismantlement alternative in Section 3.2.1. In order to compare the deferred and prompt dismantlement alternatives based on known and equal facts, no credit is taken in the deferred dismantlement evaluations for possible advances in technology 30 years in the future.

3.4 Other Alternatives

Other alternatives were also considered for this Environmental Impact Statement, but were eliminated from detailed evaluation. The following sections describe these alternatives and provide the reasons for eliminating them from further evaluation.

3.4.1 One-Piece Reactor Plant Off-Site Disposal Alternative

This alternative is based on the reactor compartment disposal program currently in use for dismantling decommissioned nuclear-powered U.S. Navy warships. Defueled reactor plant systems and lead shielding are left intact and each reactor compartment is sealed as a single package. Defueled reactor compartments are packaged at the Puget Sound Naval Shipyard and are then sent by barge and special ground transport to the U.S. Department of Energy Low-Level Waste Burial Grounds, Hanford Site, Washington State for disposal. A single package containing the S3G Prototype reactor compartment would measure approximately 12 meters (40 feet) in length, 8.8 meters (29 feet) in diameter and would weigh approximately 910 metric tons (1,000 tons). A single package containing the D1G Prototype reactor compartment would measure approximately 11 meters (37 feet) in height, 9.4 meters (31 feet) in diameter and weigh approximately 1,300 metric tons (1,400 tons).

Overland transport of whole reactor compartments by either truck or rail from the Kesselring Site to a U.S. Department of Energy disposal site is physically impractical due to load-limiting bridges and interferences, such as underpasses, along available routes. One-piece reactor plant disposal would be an attractive option if the Kesselring Site were readily accessible to public waterways to permit barge shipment. The nearest navigable waterways are the Mohawk River (Erie Canal) and the Hudson River (Champlain Canal), which are by road approximately 30 and 50 kilometers (20 and 30 miles) away, respectively. In order to transport the packaged reactor compartments by truck to either river, extensive roadway modifications would be required, which would affect public and private lands. For example, many intersections would have to be widened to allow turning of a heavy haul transport vehicle; drains, culverts, and bridges would have to be strengthened to handle the large weights involved; and interferences, such as trees, would require removal. Other interferences, such as overhead wires, would require temporary interruptions of services for short-term removal. In addition to roadway modifications, a major construction effort, including dredging, would be necessary to provide a suitable barge loading facility at either river. Therefore, transportation by truck to navigable water is considered to be impractical. Transport of the S3G and D1G Prototype reactor compartments in one-piece units by rail to navigable water is also considered to be impractical due to load-limiting bridges and underpass interferences along available routes. Based on these considerations, one-piece reactor plant disposal was eliminated from further detailed evaluation.

3.4.2 Entombment Alternative

The entombment alternative would involve leaving the S3G and D1G Prototype reactor plants permanently at the Kesselring Site within one or two strong, durable structures. There are many possible designs for suitable entombment structures, ranging from simply relying on the hull structures of the prototype reactor compartments that currently contain the respective reactor plants, to additional massively reinforced concrete enclosures. The entombment structures could be located either above grade or below grade. Entombment structures would be designed to last at least several hundred years to ensure radionuclides in the reactor plant could not reach the environment. The entombment structure would be appropriately maintained and continued surveillance monitoring would be carried out until the residual radioactivity decayed to levels which would not endanger public health or the environment.

The entombment alternative for decommissioning commercial nuclear power plants is intended for use where the residual radioactivity will decay to levels permitting unrestricted release of the facility within a reasonable time period, which would be on the order of 100 years (Reference 3-3). Detailed evaluation of an entombment alternative would have to take into consideration factors such as access restrictions and the design life of the entombing structure for containing the radioactivity. Typically, commercial fuel reprocessing plants, nuclear reactors, fuel storage facilities, and mixed oxide facilities contain radionuclides with half-lives in excess of 100 years. Since the residual radioactivity in these commercial facilities would not decay to levels below the criteria for unrestricted release within the anticipated lifetime of any man-made structure, entombment is typically eliminated as a viable alternative.

As discussed in Appendix A, the S3G and D1G Prototype reactor plants contain small but detectable amounts of radionuclides having long half-lives. Radionuclides such as carbon-14, niobium-94, and nickel-59 have half-lives of 5,730 years, 20,000 years, and 76,000 years, respectively. Similar to commercial facilities, the residual radioactivity in the S3G and D1G Prototype reactor plants would not decay to levels below the criteria for unrestricted release within the anticipated lifetime of a reasonably designed entombment structure. Maintaining engineering and institutional controls to restrict access for thousands of years would be difficult to ensure and costly.

In addition to radioactivity, the S3G and D1G Prototype reactor compartments contain significant quantities of lead shielding; lead is a hazardous material. The entombment alternative would require Federal and State regulatory approval to use the Kesselring Site for the long-term storage of hazardous materials.

The entombment alternative would offer no notable advantage in terms of health risk or other environmental benefit. From an occupational radiation exposure perspective, the environmental impacts of an entombment alternative would likely fall in the range between the no action alternative estimate and prompt dismantlement alternative estimate, described in Chapter 5 and Appendix B. Since the radiation levels from existing Kesselring Site operations are already indistinguishable from background radiation levels in areas accessible to the public, an entombment structure would not affect public radiation exposure. From an environmental perspective, the entombment alternative would serve to increase the number of long-term storage sites for radioactive and hazardous materials in the United States.

Since there would be no notable health or environmental benefit from the construction of one or more permanent entombment structures to contain the S3G and D1G Prototype reactor plants, and given that this alternative would essentially prevent future unrestricted release of the Kesselring Site for other uses, the entombment alternative was eliminated from further detailed evaluation.

3.4.3 On-Site Disposal Alternative

The on-site disposal alternative would involve placing the S3G and D1G Prototype reactor plants, within the sealed reactor compartments, into an engineered land disposal unit. This disposal unit would be designed with impervious materials and liners beneath and over the reactor compartments and covered with earth. The on-site disposal alternative would require the approval of Federal and State regulatory agencies to use the Kesselring Site for the permanent disposal of hazardous materials. From an environmental perspective, the on-site disposal alternative would serve to increase the number of permanent disposal sites for radioactive and hazardous materials in the United States.

Similar to the entombment alternative, the on-site disposal alternative would offer no notable health risk advantage or other environmental benefits. Assuming the prototype reactor compartments would be disposed of on-site as one-piece units, the conclusions relative to occupational exposure, public exposure, access restrictions, and future unrestricted release of the Kesselring Site are the same for the on-site disposal alternative as for the entombment alternative. Therefore, on-site disposal of the S3G and D1G Prototype reactor plants was eliminated from further evaluation.

3.5 Comparison of Alternatives

This section provides a comparison of the alternatives in terms of a wide variety of potential environmental consequences, all of which would be small. The impacts from all three alternatives are compared with regard to incident-free facility activities and hypothetical facility accidents. The impacts from incident-free transportation activities and potential transportation accidents are evaluated only for the prompt dismantlement and deferred dismantlement alternatives since the no action alternative would not require any shipments of wastes or materials. Environmental consequences of each alternative are discussed in detail in Chapter 5. Analyses of impacts related to facility activities are provided in Appendix B; analyses of transportation related impacts are provided in Appendix C.

Estimated impacts are expressed in terms of the risk of a single additional latent fatal cancer in the entire population that might occur due to activities associated with each of the three alternatives. Analyses show that all impacts would be small for each alternative.

Expressing numbers in terms of powers of ten is known as scientific notation (see Glossary). For example, 0.000026 can be expressed in scientific notation as 2.6×10^{-5}. To assist readers who are unfamiliar with scientific notation, data is presented in decimal form where practicable.

3.5.1 Incident-Free Facility Activity Consequences

Activities conducted at Naval Reactors Program facilities are pre-planned in detail to reduce incidents that might interfere with normal operations. The radiological consequences of incident-free facility activities at the S3G and D1G Prototype reactor plants are summarized in Table 3-1.

Table 3-1: Incident-Free Facility Activities - Radiological Risks [a]

		No Action (first 30 years)	Prompt Dismantlement	Deferred Dismantlement
Exposure (person-rem)	Worker	22	205	26
	General Population	9.9×10^{-6}	8.6×10^{-6}	1.3×10^{-5}
Average Annual Per Person Risk [b]	Worker	4.2×10^{-5}	5.8×10^{-4}	4.0×10^{-5}
	General Population	1.4×10^{-16}	1.6×10^{-15}	1.9×10^{-16}

a. All values from Appendix B, Table B-7.
b. Risk of developing a latent fatal cancer.

The radiation exposure to the general public would be small for all three alternatives and does not provide a distinguishing comparison between the alternatives. The exposures to the general public would be so small that they would be indistinguishable from naturally occurring background radiation. Analyses indicate that prompt dismantlement alternative incident-free facility activities would annually result in about a 1.6×10^{-15} risk of a latent fatal cancer to an average member of the general population. This very small risk equates to less than 1 chance in 1 trillion. For perspective, the risk of cancer for an individual from all causes is 1 chance in 5 over a lifetime. Analyses also considered the risks to a hypothetical maximally exposed off-site individual and the cumulative risk to the population. Even though analysis results indicate a hypothetical maximally exposed off-site individual would have a health risk about 100 times greater than the average member of the public (1.5×10^{-13} for the prompt dismantlement alternative, as shown in Appendix B, Table B-7), the annual risk would still be very small. Analyses indicate that the risk would be so small such that incident-free facility activities, under any of the alternatives, would be unlikely to cause even a single latent fatal cancer in the entire population.

One distinguishing comparison between the alternatives can be seen with regard to occupational (worker) exposure to radiation. As shown in Table 3-1, the worker exposure for deferred dismantlement would be less than 15 percent of the worker exposure for prompt dismantlement. This difference is primarily due to the radioactive decay of cobalt-60 in the reactor plants during the 30-year caretaking period associated with the deferred dismantlement alternative.

As shown in Appendix B, Table B-7, the occupational exposure associated with the prompt dismantlement alternative would fall within a range of approximately 205 to 460 person-rem. The higher value of this range is based on preliminary plans which include worst case assumptions regarding dismantlement operations. Based on many years of experience in planning and executing other refueling and maintenance operations, detailed work planning efforts typically result in actual occupational exposures which are well below preliminary estimates. Therefore, it is reasonable to expect that the actual occupational exposure would be close to the lower end of the range. On an annual basis, this expected exposure would be comparable in magnitude to the radiation exposure routinely received during operation and maintenance of Naval prototype reactor plants. The Naval Reactors Program limits individual worker exposures to 2 rem per year even though Federal limits allow exposure up to 5 rem per year. As a result, the highest annual risk to any worker from occupational radiation exposure would be a 8.0×10^{-4} chance of developing a latent cancer (less than 1 chance in 1,200). As shown in Table 3-1, the expected average annual risk to each worker would be even lower (5.8×10^{-4}, or less than 1 chance in 1,700). Appendix A, Section A.4, provides additional perspective on calculations of cancer fatalities and risk.

3.5.2 Hypothetical Facility Accident Consequences

The radiological consequences to the general population from hypothetical facility accidents are provided in Table 3-2. As discussed in more detail in Chapter 5 and Appendix B, several accident scenarios were evaluated for each alternative. Table 3-2 only identifies the accident scenario with the maximum risk to a member of the general population for each alternative.

Table 3-2: Maximum Radiological Risks to the General Population from Hypothetical Facility Accidents [a]

	No Action (first 30 years)	Prompt Dismantlement	Deferred Dismantlement
Accident Scenario	High Efficiency Particulate Air Filter Fire	Component Drop	Component Drop
Risk Per Year to the General Population	4.8×10^{-11} [b]	6.0×10^{-8} [c]	1.6×10^{-9} [c]
Average Annual Per Person Risk	4.2×10^{-17} [b]	5.2×10^{-14} [c]	1.4×10^{-15} [c]

a. Risk of a single additional latent fatal cancer.
b. Highest single event value from Appendix B, Tables B-20 and B-22.
c. Highest single event values from Appendix B, Tables B-10 and B-12.

For the no action alternative, the accident with the greatest risk would be a high efficiency particulate air filter fire. As discussed in more detail in Chapter 5 and Appendix B, a hypothetical fire in a high efficiency particulate air filter is assumed to release radioactive material to the environment. Analyses described in Appendix B estimated the potential radiation exposure to the general population from the released airborne particulate radioactivity. Even with the application of conservative modeling assumptions, which considered many pathways, the estimated risks from this accident scenario would be small since released airborne particulate radioactivity would be widely dispersed by prevailing winds.

For both the prompt and deferred dismantlement alternatives, the accident with the greatest risk would be a component drop accident. As discussed in more detail in Chapter 5 and Appendix B, a component drop accident is assumed to release radioactive material to the environment. Even with conservative modeling assumptions, which considered many pathways, the risks associated from this accident scenario would be small for both the prompt and deferred dismantlement alternatives. The highest risk per year of 6.0×10^{-8} equates to less than 1 chance in 16 million annually that any single member in the general public would develop an additional latent fatal cancer from exposure to radiation attributable to a dropped component accident during the prompt dismantlement alternative. Since the no action alternative does not involve any reactor plant dismantlement activities, the dropped component accident scenario does not apply.

Besides radiological consequences of facility accidents, analyses considered several nonradiological perspectives. The risks associated with nonradiological accidents, such as a spill of stored chemical products or a fire in a temporary diesel fuel storage tank, would be small and do not serve to distinguish between the alternatives. Nonradiological accidents involving injury to personnel, such as slips and falls, could occur during dismantlement activities. Based on U.S. Department of Energy accident rates, which are higher than rates for Naval Reactors Program activities, approximately 25 injuries could occur during dismantlement activities over the course of 3 to 4 years (see Table 5-2). No fatalities would be expected.

3.5.3 Transportation-Related Consequences

Transportation analyses considered two separate U.S. Department of Energy destinations for the purposes of comparison - the Savannah River Site in South Carolina and the Hanford Site in Washington State. Table 3-3 summarizes the consequences of shipping radioactive materials to the more distant disposal site, the Hanford Site. Analyses that assumed the Savannah River Site as a destination yielded results that were smaller than those shown in Table 3-3. Analyses conservatively assumed that S3G and D1G dismantlement activities would result in approximately 60 shipments of radioactive materials.

Table 3-3: Radiological Risks from the Incident-Free Transportation of Radioactive Materials [a]

		Prompt Dismantlement [c]	Deferred Dismantlement [d]
Total Risk [b]	Transportation Crew	2.7×10^{-3}	9.6×10^{-5}
	General Population	2.7×10^{-3}	7.4×10^{-5}
Average Annual Per Person Risk [b]	Transportation Crew	6.8×10^{-4}	2.6×10^{-5}
	General Population	1.5×10^{-9}	4.1×10^{-11}

a. Data represents shipments from the Kesselring Site to the Hanford Site.
b. Risk of latent fatal cancer.
c. Values from Appendix C, Table C-13.
d. Values from Appendix C, Table C-15.

The risks to the general public from transportation of radioactive materials would be small for either dismantlement alternative. These risks do not provide a distinguishing comparison between the alternatives. Analyses indicate that transportation of radioactive materials under the prompt dismantlement alternative would annually result in about a 1.5×10^{-9} risk of a latent fatal cancer to an average member of the general population. This small risk equates to less than 1 chance in 670 million. Analyses indicate that the risk would be small that transportation of dismantled radioactive materials would cause even a single additional latent fatal cancer in the entire population.

As shown in Table 3-3, the risk to transportation crew members who receive occupational radiation exposure was also estimated. Even if the same crew transported all of the radioactive materials under the prompt dismantlement alternative, which is an unlikely event, the resulting health risk (6.8×10^{-4} average annual per person risk) would be small. For either dismantlement alternative, thousands of years of transportation of waste would be required before a single latent fatal cancer would be expected to occur between these workers.

Besides the radiological consequences from the shipment of radioactive materials, transportation analyses evaluated several nonradiological aspects. Transportation analyses assumed S3G and D1G Prototype reactor plant dismantlement activities would result in 50 shipments of nonradioactive materials. The potential impacts of vehicle exhausts from all shipments were evaluated. Based on data contained in Appendix C, Tables C-3 (6.4×10^{-10}) and C-13 (1.7×10^{-10}), the resulting average annual per person health risk due to vehicle pollutants from all shipments would be approximately 8.1×10^{-10}, or less than 1 chance in 1 billion that a fatality would occur.

Table 3-4 summarizes the estimated health risks which would result from transportation related accidents involving a radioactive shipment.

Table 3-4: Radiological Risks to the Public from Transportation Accidents Involving Radioactive Materials [a]

	Prompt Dismantlement [c]	Deferred Dismantlement [d]
Risk to the General Population [b]	1.4×10^{-6}	2.9×10^{-8}
Average Annual Per Person Risk [b]	3.1×10^{-12}	6.3×10^{-14}

a. Data represents shipments from the Kesselring Site to the Hanford Site.
b. Risk of a single additional latent fatal cancer.
c. Values for prompt dismantlement are from Appendix C, Table C-17.
d. Values for prompt dismantlement are from Appendix C, Table C-19.

The risks of transportation accidents are estimates of latent cancer fatalities to the general population. Analysis of transportation accidents considers workers (the transportation crew) as part of the general population. No immediate fatalities due to radiation exposure would be expected to result from a transportation accident under any alternative. Analyses which used conservative modeling assumptions and which considered many pathways, estimated the risks from several hypothetical transportation accident scenarios. As shown in Table 3-4, the average annual risks per person to individuals in the general population would be very small. Analyses showed that no immediate fatalities or latent fatal cancers would result from hypothetical transportation accidents for either dismantlement alternative.

Analyses in Appendix C also evaluated the health risks associated with transportation accidents from a nonradiological perspective. Based on average fatality rates per mile, the number of shipments and the distances traveled, no traffic fatalities would be expected to occur due to accidents involving transportation of dismantled S3G and D1G reactor plant materials. Detailed results of these analyses are contained in Appendix C, Tables C-4 and C-16 through C-19.

The data in Tables 3-3 and 3-4 shows that the transportation-related risks associated with deferred dismantlement would be smaller than those associated with prompt dismantlement. This is due to the radioactive decay of cobalt-60. However, the difference is so small that it does not provide a distinguishing comparison between the two alternatives. The risks associated with the prompt dismantlement alternative remain small even with conservative assumptions related to transportation distance and accident scenarios. Therefore, the risks to individual members of the population and the risks to the population as a whole from transporting radioactive materials would be small for both alternatives.

3.5.4 Cost

The costs of the alternatives, summarized in Table 3-5, are rough order of magnitude estimates for the purposes of comparison.

Table 3-5: Estimated Costs of Alternatives [a]

Cost Description	No Action	Prompt Dismantlement	Deferred Dismantlement
Terminate Work/ Demobilize Work Force	$ 5,500,000	Not applicable	$ 5,500,000
Inactivation of the S3G and D1G Prototype Reactor Plants (years 1 - 10) [b]	$ 18,000,000	Not applicable	$ 18,000,000
Caretaking (years 11 - 30) [c]	$ 1,400,000	Not applicable	$ 1,400,000
Remobilize Work Force	Not applicable	Not applicable	$ 11,500,000
Dismantlement	Not applicable	$ 76,000,000	$ 76,000,000
Demobilize Work Force	Not applicable	$ 2,000,000	$ 2,000,000
Total [d]	$ 25,000,000	$ 78,000,000	$114,000,000

a. Costs are in 1997 dollars. In the past, the cost of working with radioactive waste has increased much faster than the Office of Management and Budget established nominal rates. Due to the uncertainty of these primary risk drivers, the U.S. Department of Energy did not forecast future values and then discount the costs to constant dollars, but took a more direct approach by applying fiscal year 1997 estimates for all anticipated work. This method provides the constant dollar cost estimates required in capital budgeting and is considered by the U.S. Department of Energy to be a more accurate and valid cost comparison procedure in this instance.

b. Assumes an annual cost of $1,800,000 per year for a limited work force to inactivate the reactor plants.

c. Assumes an annual caretaking cost of $70,000 per year for a limited work force to perform maintenance, periodic monitoring, inspections and security of the reactor compartments.

d. Rounded to the nearest million.

Since the no action alternative does not provide a permanent disposal decision for the S3G and D1G Prototype reactor plants, future dismantlement-related costs are not included. Taking into consideration the eventual need for a permanent disposal decision, the no action alternative would ultimately result in a higher figure.

The cost estimates associated with dismantlement of the S3G and D1G Prototype reactor plants are based on experience, engineering concepts, and comparison to similar projects, such as the Shippingport nuclear power plant dismantlement (Reference 3-4). The principal dismantlement costs included in this estimate are preparation of engineering procedures, procurement or rental of equipment, direct labor, support labor, disposal, and utilities. The highest single expense for each prototype would be the removal and disposal of the reactor pressure vessel. As discussed in Section 3.3.2, deferred dismantlement activities are assumed to be the same as prompt dismantlement activities. Assuming a constant dollar value, dismantlement costs would be the same for the prompt and deferred dismantlement alternatives.

The cost differences between the prompt and deferred dismantlement alternatives are primarily due to the cost of demobilizing the work force, preparing the S3G and D1G Prototype reactor plants for long-term caretaking, and remobilizing the dismantlement work force after the caretaking period. Caretaking costs over 30 years would be the same for the no action and deferred dismantlement alternatives since the caretaking activities would be identical.

3.5.5 Additional Factors

Although protection of human health and the environment and the cost of conducting the activities are typical factors used to compare alternatives, decision making takes into consideration additional factors to achieve a thorough and objective evaluation. Besides radiological consequences and cost, additional factors include public comments, technical feasibility, availability and efficiency of an experienced work force, regulatory impacts, pollution prevention and availability of waste disposal paths, environmental justice, mitigative measures, and long-term productivity of the environment (including future unrestricted release of the Kesselring Site). The rest of this section addresses each of these topics.

Half of the agencies and individuals commenting on the Draft Environmental Impact Statement during the public comment period indicated support for one of the dismantlement alternatives (36 percent for prompt and 14 percent for deferred). The remainder of the commenters did not indicate a preference for any particular alternative. There was no support indicated for the no action alternative. All comments were taken into consideration during preparation of this Final Environmental Impact Statement.

Technical feasibility does not distinguish among the alternatives. Activities under any of the alternatives would be conducted consistent with stringent Naval Reactors Program practices. The technology to support prototype reactor compartment dismantlements has already been proven in other dismantlement activities, such as the Shippingport nuclear power plant and decommissioned nuclear-powered U.S. Navy warships.

An experienced work force is currently available at the Kesselring Site. This experience includes prototype refuelings, defuelings, overhauls and inactivations. This work force is highly skilled and trained and could not be replaced easily or economically. An efficient use of this work force would include the complex task of reactor plant dismantlement. The presence and availability of an experienced work force is a positive aspect of the prompt dismantlement alternative. If dismantlement is deferred, even for a few years, this work force would have to be disbanded.

A reduction of about 200 Kesselring Site personnel would be required for all of the alternatives. Under the prompt dismantlement alternative, the existing work force would be retained for the duration of dismantlement activities. Although this would be a noticeable reduction in the civilian work force at the Kesselring Site, it represents only about 0.1 percent of the employment level in the surrounding region (see Table 4-2). Therefore, none of the alternatives would have any discernible socioeconomic impact.

Regulatory requirements also do not distinguish the alternatives. No new legislation would be required to implement any of the alternatives. Prompt dismantlement can be accomplished within the existing regulatory requirements, which would include regulatory agency review and approval of specific permits. It is assumed that deferred dismantlement could also be accomplished within future regulatory requirements. However, the extent of those regulatory requirements would be inappropriate to predict.

The U.S. Department of Energy Savannah River Site currently receives low-level radioactive waste from Naval Reactors Program sites in the eastern United States. Both the volume and radioactive content of the S3G and D1G Prototype reactor plant low-level radioactive waste fall within the projections of Naval Reactors Program waste provided to the Savannah River Site, which in turn are included in the Savannah River Site Waste Management Final Environmental Impact Statement dated July 1995 (Reference 5-1). Shipments resulting from dismantlement activities would result in approximately 60 radiological and 50 nonradiological shipments from the Kesselring Site over the dismantlement period (see Section 5.2.10). On an annual basis these shipments represent less than 5 percent of the total nonradiological and radiological shipments associated with normal Kesselring Site operations. The largest shipments by weight and radioactive content would be the two reactor pressure vessels. Transport of each of these packages from the Kesselring Site to the Delaware and Hudson railroad terminus would affect local traffic for a short period during one day each, principally on the lesser traveled secondary roads. Highway shipments of packages of similar size to the reactor pressure vessel packages have successfully occurred between the Kesselring Site and the Delaware and Hudson railroad terminus in the past.

From a pollution prevention perspective, all alternatives involve the generation of waste. Although the no action alternative does not involve any dismantlement activities, caretaking activities would generate small amounts of waste and reactor plant disposal would eventually be needed. Stringent pollution prevention practices are implemented at the Kesselring Site as part of normal operations. These practices include waste minimization, recycling and procurement practices that reduce or eliminate acquisition of products containing hazardous substances or toxic chemicals. Therefore, current technologies and practices would be in place to meet pollution prevention standards for any of the alternatives. With these practices in place, dismantlement activities would generate only a small volume of waste compared to the intact volumes of the reactor plants, which would be small compared to commercial standards.

The environmental impacts of any of the alternatives would be small for all population groups. Analyses indicate there would be no disproportionately high and adverse effect on any minority or low-income population. Therefore, none of the alternatives would create an environmental justice concern within the region. Since the adverse impacts would be small for any of the reasonable alternatives, there are no mitigative measures identified or required.

Since there are no plans to shut down the other operating prototypes or to release the Kesselring Site or Federal reservation lands for other uses in the foreseeable future, none of the alternatives would have any impact on the long-term productivity of the environment. However, the prompt dismantlement would make the eventual release of the Kesselring Site more readily achievable since dismantlement and disposal of two of the four prototype reactor plants would be completed. None of the alternatives involve construction of new structures or development of undisturbed lands.

3.6 Preferred Alternative

The identification of a preferred alternative in this Environmental Impact Statement, and the future selection of an alternative in the Record of Decision, takes into consideration the following factors: (1) public comments; (2) protection of human health and the environment; (3) cost; (4) technical feasibility; (5) operational efficiency; and (6) regulatory impacts.

Although comparison of the three alternatives evaluated in detail shows that the no action alternative would have the smallest environmental, health and safety impacts, the impacts associated with all of the alternatives would be small and consistent with ongoing Kesselring Site operations. Based on current conditions, any of the alternatives could be accomplished within environmentally responsible guidelines, in both the short-term and the long-term. However, 30 years from now, emergent conditions associated with the regulatory environment, and the availability of funds, trained personnel, and waste disposal facilities could result in unforeseeable complications or delays. Such unforeseeable conditions cause added uncertainty in the impacts associated with the deferred and no action alternatives.

Prompt dismantlement would make use of recycling and volume reduction services of commercial enterprises to minimize the volume of low-level radioactive waste and other wastes. Prompt dismantlement would make use of an existing trained work force at the Kesselring Site and would maintain approximately 200 staff positions at the Kesselring Site for the dismantlement duration. Compared to the no action and deferred dismantlement alternatives, prompt dismantlement has a greater degree of certainty in terms of predicted costs and waste disposal. While prompt dismantlement would not result in earlier unrestricted release of the Kesselring Site due to the continuing operation of the MARF and S8G Prototype reactor plants, it would make the eventual release of the Site more readily achievable since dismantlement and disposal of two of the four prototype reactor plants would be completed. Although dismantlement activities would involve meeting Federal and New York State permitting requirements, no new legislation would be required to implement any of these alternatives.

The Naval Reactors Program has identified prompt dismantlement as the preferred alternative for the disposal of the S3G and D1G Prototype reactor plants for the following reasons:

- An experienced work force is currently available at the Kesselring Site.
- Eventual release of the Kesselring Site is more readily achievable since two of the four prototype reactor plants would be dismantled and disposed of.
- Prompt dismantlement has a greater degree of certainty in completing the dismantlement and disposal within predicted costs and with small environmental impacts.

Identification of prompt dismantlement as the preferred alternative is consistent with the Naval Reactors Program's record to manage waste efficiently and minimize its generation.

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CHAPTER 4

AFFECTED ENVIRONMENT

4.0 Affected Environment

This chapter provides baseline environmental conditions pertaining to the Kesselring Site and its surrounding area. These baseline conditions are used as the starting point for establishing the potential impacts associated with S3G and D1G Prototype reactor plant dismantlement and disposal alternatives, which are discussed in Chapter 5.

Public information is readily available on the environmental performance of the Kesselring Site. The Kesselring Site Environmental Summary Report (Reference 2-1) and the annual Knolls Atomic Power Laboratory Environmental Monitoring Report (Reference 4-4) are referenced frequently throughout this chapter to highlight key aspects of the environmental conditions at the Kesselring Site. Both of these reports are available in the Saratoga Springs and Schenectady County public libraries.

The Kesselring Site uses trained personnel, written procedures, installed and portable instrumentation, audits and inspections to maintain high standards of environmental control. In addition, various aspects of the Kesselring Site environmental program are reviewed by other independent government agencies. For example, the New York State Department of Environmental Conservation and the U.S. Environmental Protection Agency have conducted on-site inspections of Resource Conservation and Recovery Act programs annually for the past 10 years. Over 80 inspections covering air, water, and hazardous waste have been conducted during that period (Reference 2-1, Table 1). There have been no fines or penalties levied, no enforcement actions taken, and no other adverse regulatory actions as a result of these inspections.

The General Accounting Office, a U.S. Congressional investigative organization, performed a detailed 14-month audit of Naval Reactors Program facilities in 1990-1991. The audit covered environmental, health, and safety matters, including reactor safety, and auditors had unrestricted access to personnel, facilities, and classified information. In April 1991, the General Accounting Office testified to a Congressional committee that the Naval Reactors Program is a "positive program in DOE," and that their review found "no significant deficiencies" (Reference 4-24). Their final report was issued in August 1991 (Reference 2-6).

With regard to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review process, the U.S. Environmental Protection Agency has assigned the Kesselring Site and Federal reservation with a recommendation of Site Evaluation Accomplished (Reference 4-8). This means that, based on current information, the Kesselring Site and Federal reservation do not qualify for inclusion on the National Priorities List. No further action is anticipated under CERCLA.

4.1 Land Use

The Kesselring Site is located near West Milton, in Saratoga County, New York, approximately 27 kilometers (17 miles) north of Schenectady, 14 kilometers (9 miles) southwest of Saratoga Springs, and 21 kilometers (13 miles) northeast of Amsterdam (see Figure 2-1). The Kesselring Site is an approximately 26-hectare (65-acre) developed area situated within an approximately 1,600-hectare (3,900-acre) Federal reservation owned by the U.S. Department of Energy (see Figures 2-2 and 2-3). Most of the Kesselring Site, including the prototype reactor plants, is bounded by a security fence. The Kesselring Site is located a minimum of 1.4 kilometers (0.9 miles) from the boundary of the Federal reservation. There are no permanent residents at the Kesselring Site or on the Federal reservation.

The area surrounding the Federal reservation is mostly rural and includes a mixture of woodlands, farmlands, and small residential tracts. Individual residences are located along the Federal reservation boundary on all sides. The nearest concentration of residences is located east of the Federal reservation, approximately 1.6 kilometers (1 mile) from the Kesselring Site. Farming activities are located primarily west and south of the Federal reservation and include dairy and beef cattle, orchards, and cropland. Crops include oats, hay-alfalfa, corn, potatoes, and vegetables. Large recreational areas, including New York State-owned lands, are located primarily 4 to 8 kilometers (2.5 to 5 miles) north-northeast of the Kesselring Site. There are also several smaller private recreational areas nearby, including a Boy Scout summer camp approximately 4.5 kilometers (2.8 miles) north-northeast and golf courses approximately 3.2 kilometers (2 miles) west and approximately 2.4 kilometers (1.5 miles) southwest of the Kesselring Site. The Cottrell Paper Company is the nearest industry and is located in Rock City Falls approximately 3.7 kilometers (2.3 miles) northeast of the Kesselring Site.

4.2 Ecological Resources

4.2.1 Terrestrial

The Federal reservation consists mostly of wooded areas typical of the Hudson-Mohawk Valley lowlands region. The natural stands are primarily hardwoods such as maple and birch. In addition, approximately 280 hectares (700 acres) were reforested several decades ago with spruce, larch and pine.

The S3G and D1G Prototype reactor plants are located within the 26-hectare (65-acre) Kesselring Site, an existing developed area, and are surrounded by buildings and pavement. The character of the area was changed from agricultural to industrial during construction activities over the past 45 years. The Kesselring Site has no terrestrial resources of significance; plant and animal species sensitive to disturbance by human activities have not been observed.

4.2.2 Wetlands

There are 13 New York State designated wetlands located on the Federal reservation (References 4-1 and 4-2), and no Federally designated wetlands. There are no State or Federally designated wetlands located within the Kesselring Site. However, the Kesselring Site parking lots are located adjacent to areas which meet Federal criteria for wetlands regulation (33 CFR Parts 320-330). Some of these areas are native wetlands and others have been created by construction activities over the past 45 years. Wetlands on the Federal reservation are not being impacted by current Kesselring Site operations.

4.2.3 Aquatic

The Glowegee and Kayaderosseras Creeks are classified under New York State Codes, Rules and Regulations as Class "C" - Trout Streams (Reference 4-36). Under this classification, the waters are suitable for fishing and fish propagation (Reference 4-3). Native brook trout and brown trout, as well as trout stocked by New York State, are found in the Glowegee Creek, both upstream and downstream of the Kesselring Site. Other native fish commonly found in the Glowegee Creek include creek chub, white sucker and various species of dace, shiner, darter, minnow, and stickleback. Environmental monitoring at the Kesselring Site and Federal reservation includes periodic identification and population assessments of fish and other aquatic life (periphyton and benthic macroinvertebrates) upstream, near Site discharge points and downstream in the Glowegee Creek. The environmental monitoring program and the most recent results are discussed in Reference 4-4. As stated in this reference, liquid effluent discharges from the Kesselring Site have resulted in no observable adverse effect on fish and other aquatic life in the Glowegee Creek. Section 4.3 provides additional discussion on environmental monitoring of water resources.

4.2.4 Critical Habitats and Endangered Species

Plant and animal species considered endangered or threatened do not generally inhabit developed industrial areas such as the Kesselring Site. However, the remainder of the Federal reservation does contain environments suitable for numerous types of plants and animals. Since caretaking and dismantlement activities associated with the range of alternatives for S3G and D1G Prototype reactor plant disposal would occur only within the 26-hectare (65-acre) developed area, a survey documenting the various species of plants or animals found on the remainder of the Federal reservation has not been performed for this Environmental Impact Statement.

According to the New York State Department of Environmental Conservation Wildlife Resources Center, the karner blue butterfly, an endangered species, and the red-shouldered hawk, a threatened species, may be found in the Saratoga County area (Reference 4-21). To date, there have been no documented observations of the karner blue butterfly, the red-shouldered hawk, or any other endangered, threatened, or special concern species on the Kesselring Site. A review of the New York State Natural Heritage Program files by the

Wildlife Resources Center of the New York State Department of Environmental Conservation, for the area of the Kesselring Site, did not identify any potential impacts on endangered, threatened, or special concern species (Reference 4-5). The review also did not identify any potential impacts on known occurrences of rare plants, animals, natural communities, or other significant habitats.

4.3 Water Resources

4.3.1 Surface Water - General Information

The Federal reservation is located in the Saratoga Lake drainage basin. The Glowegee Creek, its tributaries, and the Crook Brook drain the Federal reservation (see Figure 2-2). Both the Glowegee Creek and Crook Brook empty into the Kayaderosseras Creek to the east of the Federal reservation. The Kayaderosseras Creek, its tributaries and headwaters compose most of the Saratoga Lake watershed (Reference 4-28). As reported in Reference 4-4, the annual mean average flow in the Glowegee Creek is 1.43 cubic meters (50.7 cubic feet) per second and the minimum recorded 7-day average flow for a 10-year period is 0.026 cubic meters (0.92 cubic feet) per second. The annual mean average flow in the Kayaderosseras Creek is 4.08 cubic meters (144 cubic feet) per second and the minimum recorded 7-day flow for a 10-year period is 0.48 cubic meters (17 cubic feet) per second. The Kayaderosseras Creek flows approximately 14 kilometers (9 miles) from the Federal reservation through Ballston Spa and then approximately 16 kilometers (10 miles) to Saratoga Lake. Saratoga Lake drains to the Hudson River by way of Fish Creek. As discussed in Section 4.2.3, the New York State Department of Environmental Conservation has classified the Glowegee and Kayaderosseras Creeks as Class "C" - Trout Streams (Reference 4-36). Under this classification the water quality is also suitable for primary and secondary contact recreation (Reference 4-3). Per the New York State Sanitary Code, Class "C" streams are not recommended as sources of potable water.

The Flood Insurance Rate Map prepared by the Federal Emergency Management Agency (Reference 4-6) shows that narrow areas of the Federal reservation are located within the 100-year flood boundary; these areas are associated with the Glowegee and Kayaderosseras Creeks. However, the Kesselring Site is located at elevations above the indicated 100-year flood boundary. There are no records of flooding on the Kesselring Site during its operational history.

Waste water from the Kesselring Site is discharged to the Glowegee Creek from four permitted discharge points (see Figure 4-1). Waste water includes: (1) boiler discharges, (2) sewage treatment plant effluent, (3) cooling tower water, (4) process water, (5) storm drainage, and (6) service water used for drinking and once-through noncontact cooling of equipment. With the exception of sewage treatment plant effluent and some storm drainage, waste water is collected from around the Kesselring Site and conveyed to the Site's lagoon by underground drains and open channels.

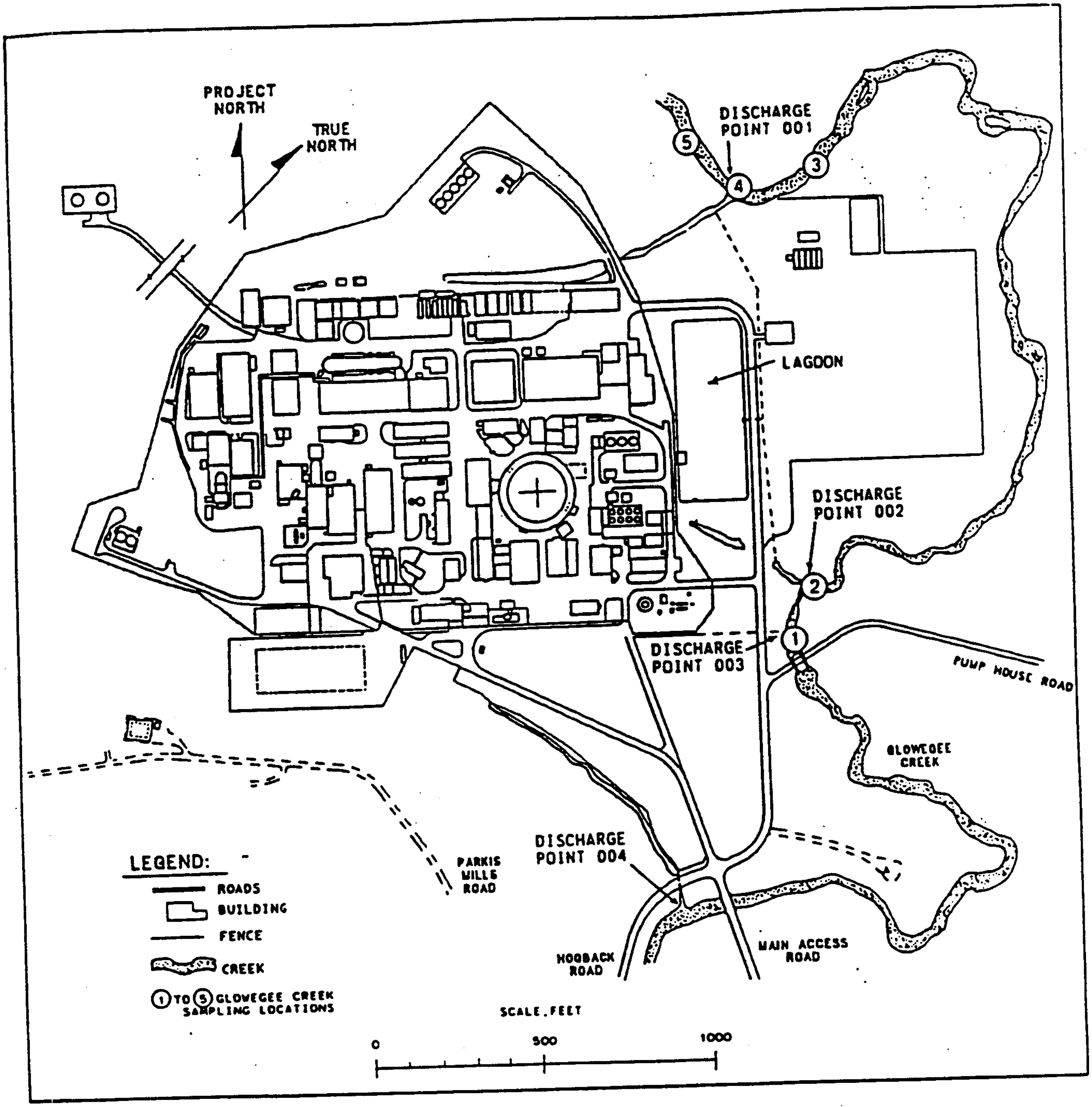

Figure 4-1: Kesselring Site Glowegee Creek Sampling Locations and Discharge Points

The lagoon has a capacity of approximately 19 million liters (5 million gallons) and receives an average of 3 million liters (800,000 gallons) per day of waste water and storm water. The function of the lagoon is to provide thermal equalization, chlorine dissipation and settling of suspended solids. In addition, pH control is necessary due to algae growth in the lagoon. The algae cause the pH to increase due to photosynthesis. The pH is controlled by a carbon dioxide treatment system which lowers the pH of the waste water prior to discharge. Algae growth and decay in the lagoon also causes an increase in the total amount of suspended solids, which is in direct contrast with one of the lagoon's intended functions. The Naval Reactors Program has developed an environmental assessment which evaluates several alternatives for reducing the amount of suspended solids in waste water discharges from the Kesselring Site lagoon (Reference 4-11). Installation of a new waste water treatment system began in July 1997. The required approval from the New York State Department of Environmental Conservation, as well as approval from the New York State Department of Health, as requested, was obtained prior to installation of this system. These actions are unrelated to the proposed action covered in this Environmental Impact Statement, and are cited here only for completeness.

Waste water is discharged from the lagoon to the Glowegee Creek through outfalls 001 and 002 (see Figure 4-1). A series of gates is located in the discharge system and the lagoon to provide a means to contain and control effluents which do not meet discharge limits. All discharges are controlled and monitored for conformance with the limits and parameters specified in the Kesselring Site's New York State Pollutant Discharge Elimination System permit (number N.Y. 0005843) and in accordance with Reference 4-3. The State Pollutant Discharge Elimination System permit contains limits for several conditions, including temperature, pH, suspended solids, and chlorine. In addition, continuous pH and temperature monitoring instrumentation are installed in the discharge system and the lagoon effluent. The instrumentation automatically control (shut) the gates and provide alarms if these waste water parameters approach specification limits.

Kesselring Site domestic sewage, cafeteria waste water, and grey water from utility sinks and locker rooms are collected by a separate drain system and conveyed to the Site's sewage treatment plant. Treated effluent is discharged from the plant to the Glowegee Creek through outfall 003. The sewage treatment plant is a tertiary treatment facility that uses the extended aeration/contact stabilization process, chemical precipitation of phosphorus, and sand filtration. Waste sludge is stored in a holding tank and is periodically removed by a licensed contractor for disposal at a State-approved, off-site disposal facility. A voluntary phosphorus removal program is in place to reduce the Site's contribution to phosphate input into Saratoga Lake. Although a previous study (Reference 4-28) indicated the Kesselring Site contributed less than 6 percent of the total phosphate input to Saratoga Lake, the intent of the voluntary program is to reduce this contribution as much as practicable.

Outfall 004 discharges only storm water runoff from the southern portion of the Kesselring Site and the main parking lots. A storm water permit application has been filed with the New York State Department of Environmental Conservation identifying two other storm water discharge points, shown as storm water outfalls (SWO) 005 and 006 on Figure 4-2 (page 4-9). Outfall 005 discharges storm water runoff from a portion of Hogback Road, and outfall 006 discharges storm water runoff from the closed landfill area.

Environmental monitoring of surface water at the Kesselring Site and Federal reservation includes: (1) at a minimum, the monthly collection of Glowegee Creek water samples for chemical analyses, (2) the continuous monitoring and recording of water temperature and pH upstream and downstream of Site discharges to the Glowegee Creek, (3) the collection of quarterly samples for radiological analysis of Glowegee Creek water and sediment at the five locations shown in Figure 4-1, (4) a periodic survey of aquatic life (periphyton and benthic macroinvertebrates) upstream, near Site discharge points and downstream in the Glowegee Creek, and (5) a periodic survey of fish upstream and downstream of Site discharges to the Glowegee Creek. A few of the fish collected from each location are retained for radioanalysis. This program and the most recent results are described in Reference 4-4. Discussions on the results of this monitoring are provided in Sections 4.3.3 and 4.3.4.

4.3.2 Ground Water - General Information

There are no ground water aquifers in the vicinity of the Kesselring Site that are designated as sole source aquifers by the U.S. Environmental Protection Agency or as primary/principal aquifers by the New York State Department of Environmental Conservation. The geologic overburden sequence within the Federal reservation consists of complex glacial and lake deposits overlying bedrock. In general, glacial till directly overlies bedrock across most of the Federal reservation. The glacial till and other fine grained lake deposits (silts) which are present have characteristically low permeabilities and historically produce very low volumes of water. Section 4.5.2 provides additional details of geologic conditions within the Federal reservation.

At the Kesselring Site, depth to the ground water table ranges approximately from 1 to 3 meters (3 to 10 feet) below grade. Ground water elevation data show that the gradient is low and that the flow of shallow ground water is generally toward the east and the Glowegee Creek. The ground water table generally conforms to the surface topography of the Kesselring Site; however, building foundations and backfill associated with underground utilities may alter the expected direction and rate of ground water flow in specific areas. The ground water elevation data also indicate that the Glowegee Creek, located approximately from 60 to 300 meters (200 to 1,000 feet) east of the Kesselring Site, forms a hydrologic boundary for shallow ground water.

Ground water in New York State is classified based on its best use, which in general is as a drinking water source. Ground water under the Kesselring Site and Federal reservation is classified as "GA" by the New York State Department of Environmental Conservation (Reference 4-3). The "GA" classification indicates that the water quality standards applied to this ground water serve to protect it as a potential drinking water source.

The Kesselring Site does not discharge liquid effluents to the ground water by either injection wells or seepage basins. The Kesselring Site has an ongoing ground water monitoring program that analyzes for a variety of inorganic and organic constituents and radioactivity from monitoring wells on the Federal reservation (see Figure 4-2) and within the Site (see Figure 4-3). The ground water monitoring program focuses on the solid waste landfill (Hogback Road), closed in accordance with New York State Department of Environmental Conservation regulations in October 1994, and other inactive (former) waste disposal areas located on the Federal reservation (see Section 4.5), and the Kesselring Site. Details of the Kesselring Site's ground water monitoring program and sampling results are provided in Reference 4-4. Discussions on the results of this monitoring are provided in Sections 4.3.3 and 4.3.4.

The source of service (potable) water for the Kesselring Site is a well field, located near the east boundary of the Federal reservation, adjacent to the Kayaderosseras Creek (see Figure 4-2). The well field is composed of five production wells which draw ground water from two aquifers, one shallow and one deep. These aquifers are hydrogeologically separate from the closed Hogback Road landfill and the other former waste disposal areas and are not influenced by materials at these locations. The Kesselring Site uses approximately 7.5 million liters (2 million gallons) of well water per day.

Kesselring Site potable water is treated with chlorine and periodically monitored in accordance with New York State Department of Health regulations (Reference 4-7). Chlorine is added to Site potable water as a drinking water disinfectant. The Kesselring Site currently disinfects its drinking water at reduced chlorine levels under a New York State Department of Health issued disinfection waiver (Reference 4-15). Periodic monitoring of chemical and biological constituents in the potable water is performed in order to demonstrate conformance with drinking water standards (Reference 4-7). The results of this monitoring are reported monthly to the New York State Department of Health. Reference 4-4 provides a summary of monitoring results.

The area surrounding the Federal reservation is not serviced by any municipal water systems. Privately owned individual domestic wells and private water systems serving multiple residences provide the major sources of potable water for the population living in the immediate vicinity. The nearest municipal water services are located in Ballston Spa and Saratoga Springs, which are approximately 8 kilometers (5 miles) and 14 kilometers (9 miles) away, respectively. These municipal water services draw on both surface and ground water sources, none of which are affected by Kesselring Site operations.

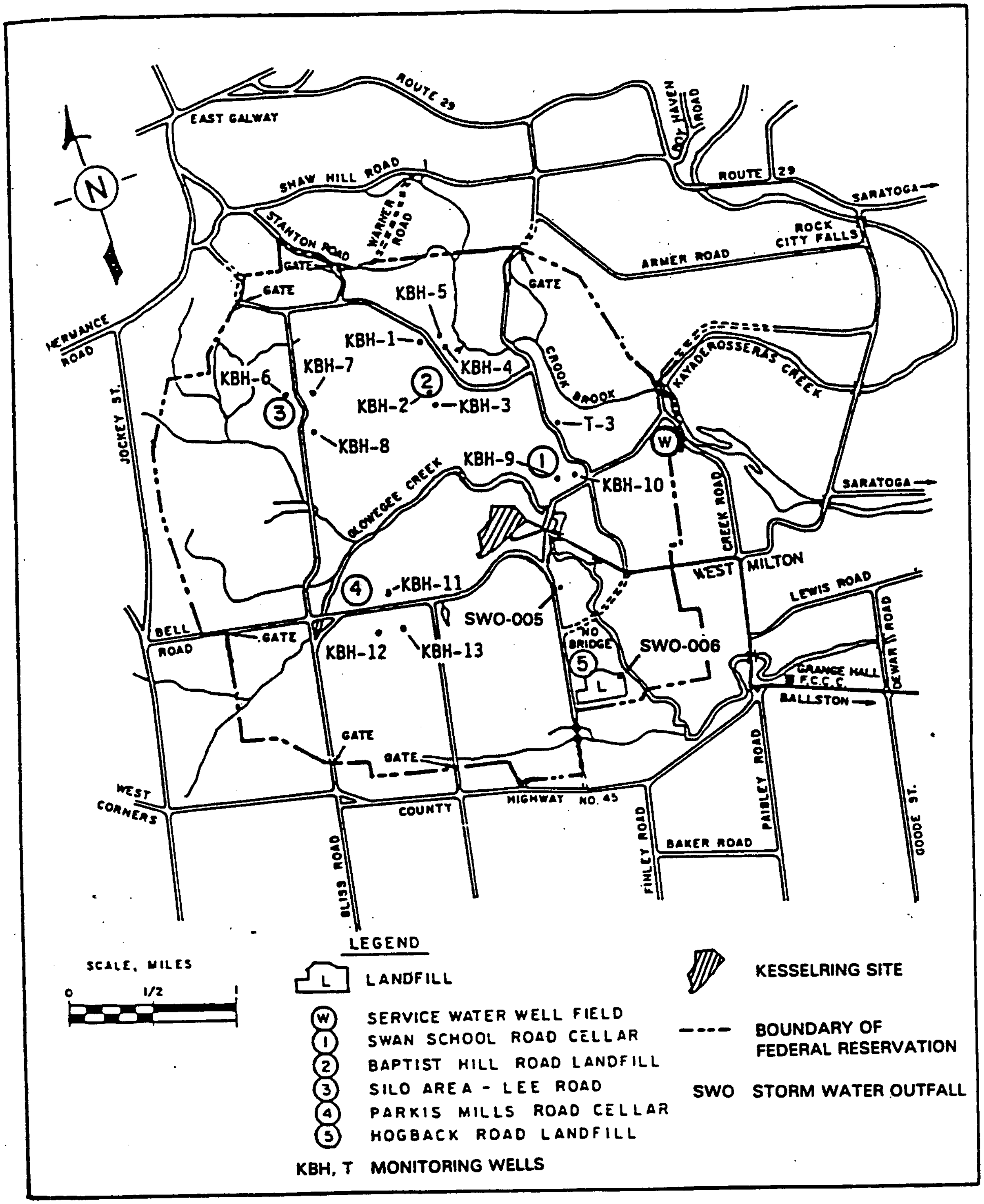

Figure 4-2: Former Waste Disposal Areas and Associated Ground Water Monitoring Wells Located Within the Federal Reservation

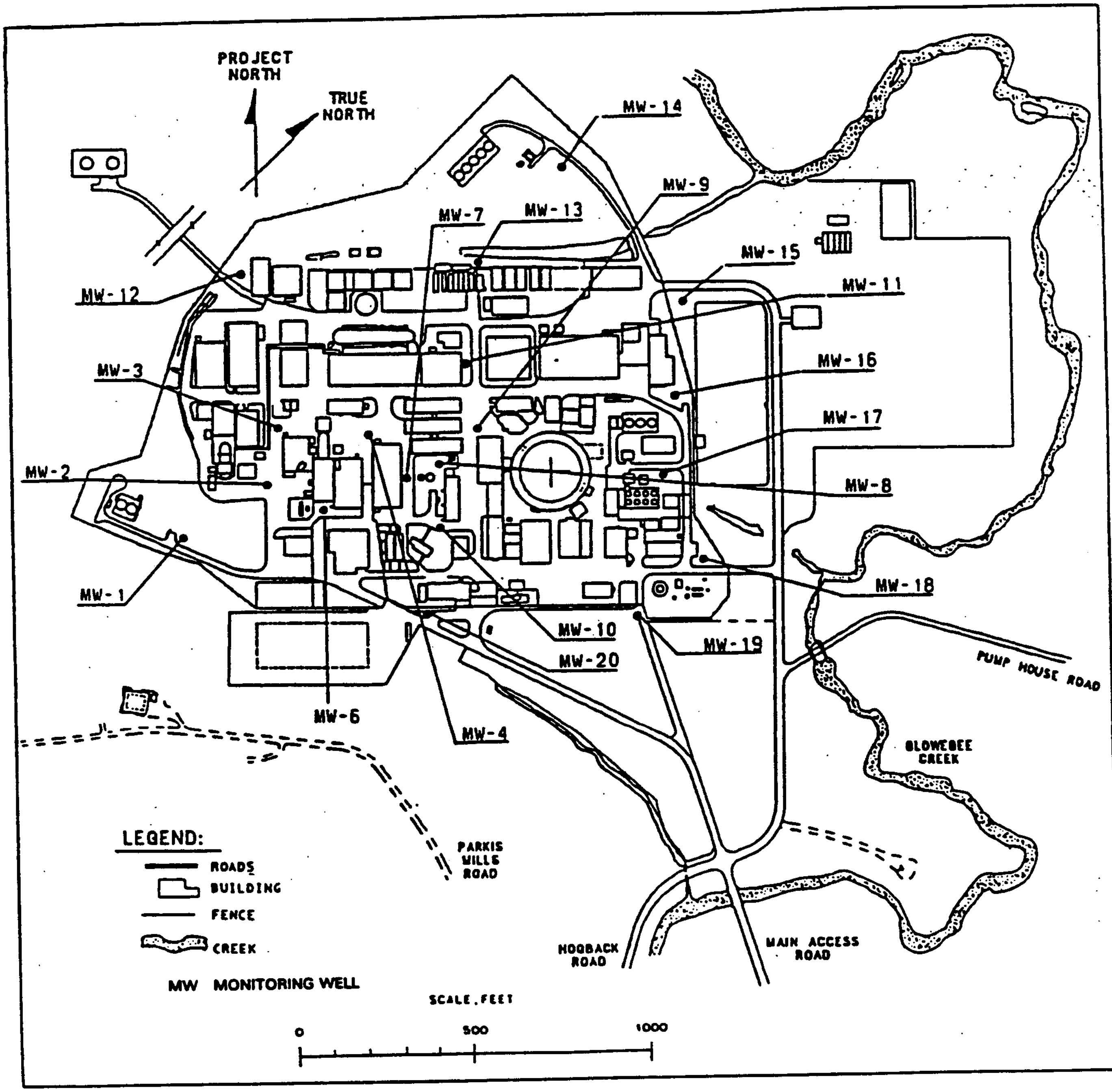

Figure 4-3: Ground Water Monitoring Wells Located Within the Kesselring Site

4.3.3 Existing Radiological Conditions - Water Resources

4.3.3.1 Existing Radiological Conditions - Surface Water

Radioactive liquid wastes are generated and controlled as part of Kesselring Site operations. As discussed in Reference 2-1, a vigorous radioactive liquid waste control and minimization program has been maintained for many years. Regulations applicable to the commercial nuclear industry in the United States permit discharge of liquids containing low levels of radionuclides if they meet concentration standards established by the U.S. Nuclear Regulatory Commission (10 CFR Part 20, Appendix B, Table 2). U.S. Department of Energy requirements permit similar discharges of these liquids. The Naval Reactors Program employs a more restrictive standard at the Kesselring Site and at other Program facilities, as described below.

Water used for reactor coolant is collected and processed to remove most of the particulate radioactivity prior to reuse in Kesselring Site operations. The reuse processing systems include collection tanks, particulate filters, activated carbon columns and ion-exchange columns. The processed water is then reused in operations involving radioactivity, such as reactor coolant makeup. Besides reactor coolant, other water that has the potential to contain low concentrations of radioactive material but which is not practicable to reuse is collected in holdup tanks and retention basins, monitored and processed in batches prior to discharge. The sources of the radioactivity in the water are small quantities of activated corrosion and wear products, and tritium. Samples are collected from each batch of processed water and analyzed. Samples are also combined into individual monthly composite samples for later analysis. Each sample is analyzed for the type and quantity of radioactive material to ensure that it has been removed to the lowest practicable level, and complies with applicable regulations and the more stringent Naval Reactors Program standards. Overall, the water processing and reuse practices ensure that more than 99.9 percent of the particulate radioactivity is removed.

As reported in Reference 4-4, the radioactivity released in liquid effluent during 1996 totaled less than 0.02 curies of tritium. The radioactivity was contained in approximately 1.4 billion liters (370 million gallons) of water. The resulting annual average radioactivity concentration in the effluent corresponded to less than 0.1 percent of the U.S. Department of Energy derived concentration guideline for effluent released to unrestricted areas (Reference 4-11) for the mixture of radionuclides present. In addition, the radioactivity concentration in the effluent was less than 1 percent of U.S. Nuclear Regulatory Commission concentration limits for unrestricted use. Liquid effluent monitoring data for radioactivity is included in the annual Knolls Atomic Power Laboratory Environmental Monitoring Report (Reference 4-4).

As reported in Reference 4-4, liquid discharges from the Kesselring Site have not resulted in any increase in detectable radioactivity in the Glowegee Creek and have had no observable adverse effect on fish and other aquatic life. Only naturally occurring radionuclides have been detected in the Glowegee Creek water samples. Sediment samples indicate that there is no significant difference between upstream and downstream radioactivity concentrations, and the radionuclides detected are attributed to either naturally occurring sources or to atmospheric nuclear weapons testing performed in the 1950s and 1960s. The results of the fish analyses show no radioactivity attributable to Kesselring Site operations.

The New York State Department of Health conducts independent environmental monitoring of radioactivity in water in the vicinity of the Federal reservation. State personnel collect monthly samples from the Glowegee Creek at a gaging station located downstream (southeast) of the Kesselring Site. The latest report on Environmental Radiation in New York State (Reference 4-29) states that analysis results "show values typical of normal background levels for gross alpha, gross beta, and tritium."

4.3.3.2 Existing Radiological Conditions - Ground Water

Results of Kesselring Site ground water monitoring are provided in Reference 4-4, and show that Site operations have had no measurable radiological impact on ground water within the Federal reservation and only minimal impact within the Kesselring Site. Levels of cesium-137 and cobalt-60 are consistently below minimum detection limits in samples collected in monitoring wells located at the closed Hogback Road landfill and the other former waste disposal sites, and at the Kesselring Site. Tritium was occasionally detected above normal background levels in one area at the Kesselring Site from 1988 through 1990, but has not been detected above normal background levels since then. The concentrations for all of these radionuclides were less than 0.1 percent of the derived concentration guideline values in accordance with the U.S. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment.

4.3.4 Existing Nonradiological Conditions - Water Resources

4.3.4.1 Existing Nonradiological Conditions - Surface Water

Detailed chemical analysis results for Kesselring Site liquid effluents and Glowegee Creek water are provided in Reference 4-4. The concentrations of chemical constituents present in Kesselring Site liquid discharges have been within applicable standards and have resulted in no observable adverse effect on fish and other aquatic life in the Glowegee Creek. Results of this monitoring are reported to the New York State Department of Environmental Conservation in a monthly Discharge Monitoring Report as required by the Kesselring Site's State Pollutant Discharge Elimination System permit (number N.Y. 0005843).

Between 1986 and 1994, the Kesselring Site's State Pollutant Discharge Elimination System program reported only 35 instances of exceeding discharge limits. These releases occurred over short periods of time and did not result in any observable long-term impact on the environment or public health and safety. The parameters which exceeded discharge limits included surfactants (these substances are sometimes found in soaps or detergents), total suspended solids, biological oxygen demand (5-day), chlorine, pH, and temperature. In the last two years, there have been no instances of exceeding discharge limits. However, there was one administrative noncompliance finding. This finding, which was self-reported, was the result of a missed field reading. For perspective, more than 16,000 field readings and samples were taken during 1995 and 1996.

New York State Department of Environmental Conservation personnel are allowed access to the Kesselring Site to take independent samples in the Glowegee Creek and to ensure that all applicable permit requirements and regulations are being met. A number of these regulatory inspections have been conducted by independent regulatory personnel over the past 10 years, as listed in the Knolls Atomic Power Laboratory Kesselring Site Environmental Summary Report (Reference 2-1). Some of these inspections have been made without prior notification. New York State Department of Environmental Conservation inspections have included taking independent water samples at the Kesselring Site outfall locations as well as observing the collecting, handling and control of environmental samples taken by Knolls Atomic Power Laboratory personnel. For compliance with the Site's State Pollutant Discharge Elimination System permit, samples are analyzed at an independent New York State Department of Health certified laboratory. The most recent New York State Department of Environmental Conservation inspection of the Kesselring Site outfalls occurred in October 1997. There have been no fines or penalties levied, no enforcement actions taken, and no other adverse regulatory actions as a result of these inspections.

4.3.4.2 Existing Nonradiological Conditions - Ground Water

Operations and past practices at the Kesselring Site and Federal reservation have had some observable effects on shallow ground water quality in localized areas. Due to the remoteness and hydrogeologic setting of these locations, there have been no identified potential threats to potable water sources in the surrounding area.

As reported in Reference 4-4, past waste disposal at the closed Hogback Road landfill (see Section 4.5.6.2) has resulted in some observable effects on shallow ground water quality downgradient of the landfill. The contaminants observed in ground water downgradient of the landfill are predominantly inorganic, typical of leachate from a sanitary landfill (Reference 4-30). Monitoring data are reported to the New York State Department of Environmental Conservation in Quarterly Monitoring Reports as required by New York State solid waste management facilities regulations (NYCRR Title 6, Part 360). As part of the Hogback Road landfill closure, a hydrogeologic study (Reference 4-34) was conducted to assess the potential impact of past waste disposal at the landfill to sources of potable water in the surrounding area. Based on the findings of this investigation, the overburden and bedrock aquifers at the landfill have not been significantly impacted by leachate generated from the landfill. The ground water analytical results from this investigation, which are consistent with historical ground water results, indicate slightly elevated levels of a number of parameters in the overburden aquifer immediately adjacent to the landfill. Elevated inorganic parameters include total dissolved solids, alkalinity, hardness, chloride, sulfate, boron, iron, manganese, sodium, calcium, and magnesium. Several volatile chlorinated organic compounds detected include 1,1-dichloroethane, chloroethane, dichlorodifluoromethane, and trichloroethylene.

The Hogback Road landfill is listed in New York State's annual report on inactive hazardous waste disposal sites (Reference 4-35). In assessing the impact of past waste disposal at the Hogback Road landfill, Reference 4-35 states "This site is on military property and well patrolled. The chemical waste is buried, therefore volatilization and particulate migration are not likely. Monitoring wells indicate some ground water contamination. However, the nearest drinking water well is more than one half mile away. The site does not pose a significant concern due to its remote location."

Ground water monitoring in the vicinity of other inactive disposal areas, shown on Figure 4-2, is conducted annually. As discussed in Reference 4-4, 1996 data are consistent with historical data collected since 1988, and indicate no apparent impact to local ground water quality.

Ground water monitoring results within the Kesselring Site have shown some elevated parameters in shallow ground water. Elevated inorganic constituents include chloride, sulfate, ammonia, total kjedahl nitrogen, sodium, iron, manganese and magnesium (Reference 4-4). The primary source of these elevated constituents is the application of deicing materials, which include rock salt, calcium chloride and urea. A small number of chlorinated organic compounds have been detected at low (parts per billion) concentrations in three of the Kesselring Site's monitoring wells. These compounds include trichloroethylene, tetrachloroethylene, 1,1,1 trichloroethane, trichlorofluoromethane, and dichlorodifluoromethane (Reference 4-4). The source of the detected chlorinated organic compounds is attributed to the past use of small amounts of chlorinated solvents at the Kesselring Site and associated incidental spills or leaks of these solvents. As discussed in Section 4.3.2, the shallow ground water under the Kesselring Site is hydrogeologically isolated from potable water sources in the surrounding area. Given this isolation and the low concentration of the organic compounds detected, there is no expected impact to these potable water sources.

4.4 Air Resources

4.4.1 Climate and Meteorology

The principal weather recording location for Saratoga County is at the Albany County Airport. The climate of the region is primarily continental in character, but is subject to changes from the maritime climate which prevails in the extreme southeastern portion of New York State. The moderating effect on temperatures is more pronounced during the warmer months than in winter, when bursts of cold air can sweep down from Canada. In the warmer seasons, temperatures can rise rapidly in the daytime, but can also fall rapidly after sunset so that nights are relatively cool. Occasionally, there are extended periods of oppressive heat and humidity up to a week or more in duration.

During the winter months, winds are generally from the west or northwest. During the warmer months, the winds are from the south. Wind velocities are moderate, and generally average less than 16 kilometers (10 miles) per hour.

The mean monthly temperature of the region is approximately 10°C (50°F). Daily extremes can range from approximately -34°C (-30°F) in the winter to approximately 38°C (100°F) in the summer. On an annual basis, the mean daytime relative humidity ranges approximately from 50 to 80 percent. During the summer, relative humidity frequently approaches 100 percent during the night.

Total yearly precipitation averages approximately 91 centimeters (36 inches). The average yearly snowfall is approximately 147 centimeters (58 inches) and the maximum snowfall in 24 hours is approximately 56 centimeters (22 inches).

4.4.2 Severe Weather Phenomena

The area of east central New York is subject to occasional sustained destructive winds associated with severe weather events such as thunderstorms, blizzards and tornadoes. During its almost 50-year history, severe weather effects at the Kesselring Site have been limited mainly to losses of commercial electrical power for short periods of time. During periods of commercial power loss, continuity of electrical power has been maintained at the Kesselring Site using available backup diesel generators.

For the period from 1966 through 1995, the east central area of New York that includes Saratoga County and adjacent counties has been subject to an average of 9 days per year with destructive winds associated with severe weather systems (Reference 4-9). This area is subject to about one tornado per year. Most of the severe weather events resulting in destructive winds have occurred in the months of December and January (blizzards) and in the months of June, July and August (thunderstorms).

4.4.3 Air Quality

The U.S. Environmental Protection Agency designates areas with regard to air quality based on National Ambient Air Quality Standards (Reference 4-10). The Hudson Valley Intrastate Air Quality Control Region, which includes Saratoga County and the Kesselring Site, is in attainment (within established limits) for total suspended particulate matter and sulfur dioxide, and is in marginal nonattainment for ozone. On the basis of available information, the U.S. Environmental Protection Agency has determined that the area is unclassifiable for carbon monoxide, nitrogen dioxide, and lead.

4.4.4 Existing Radiological Conditions - Air Resources

Operations having the potential for the release of airborne particulate radioactivity, such as in air exhausted from the operating prototype reactor plants, are serviced by continuously monitored exhaust systems. The air exhausted from all radiological facilities is continuously sampled for particulate radioactivity, and is regulated under the National Emission Standard for Emissions of Radionuclides Other than Radon from Department of Energy Facilities, 40 CFR Part 61, Subpart H (Reference 3-2). Prior to release, the exhaust air is passed through high efficiency (99.95 percent efficient) particulate air filters to minimize airborne particulate radioactivity.

As reported in Reference 4-4, the radioactivity contained in exhaust air during 1996 consisted of: (1) less than 0.001 curies each of krypton-85 and particulate fission and activation products having half-lives greater than 3 hours; (2) approximately 2.2 curies of noble gases with half-lives of 12 days or less, principally argon-41, xenon-133 and xenon-135; (3) approximately 0.3 curies of tritium; and (4) approximately 1.0 curies of carbon-14. The airborne radioactivity was contained in a total exhaust air volume of 620 billion liters (22 billion cubic feet). The average radioactivity concentration in the effluent air was well below the applicable standards in the U.S. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment. The annual radioactivity concentration at the nearest Federal reservation boundary, allowing for typical diffusion conditions, was less than 0.01 percent of the U.S. Department of Energy derived concentration guideline for effluent released to unrestricted areas (U.S. Department of Energy Order 5400.5) for the mixture of radionuclides present.

Environmental particulate air samplers are operated in the primary upwind and downwind directions from the Kesselring Site to measure normal background airborne radioactivity and to confirm that Site effluents have no measurable effect on normal background levels. As reported in Reference 4-4, there was no significant difference between the average upwind and downwind radioactivity concentrations. Therefore, any resulting radiation exposure from Kesselring Site operations to off-site individuals is too small to measure and must be calculated. Airborne effluent monitoring data and calculated off-site impact are reported as required by the U.S. Department of Energy Order 5400.1, General Environmental Protection Program, and by Reference 3-2. The Naval Reactors Program files annual reports with the U.S. Environmental Protection Agency Region II and the New York State Department of Environmental Conservation.

The New York State Department of Health conducts independent environmental monitoring of radioactivity in air in the vicinity of the Federal reservation. State personnel collect weekly air samples at a location east of the Federal reservation boundary, near Atomic Project Road. The latest report on Environmental Radiation in New York State (Reference 4-29) states that gross beta activity at this location was within the normal range for background levels, and that iodine-131 was below minimum detection levels.

4.4.5 Existing Nonradiological Conditions - Air Resources

The principal sources of industrial airborne emissions from the Kesselring Site are three steam generating boilers used primarily for heating buildings in the winter. Two boilers are each rated at 6.2 megawatts (21 million British thermal units per hour), and one boiler is rated at 8.8 megawatts (30 million British thermal units per hour). Combustion gases from these operating boilers are released through two exhaust stacks. A fourth boiler and its exhaust stack are no longer in service. The remaining three boilers operate under New York State issued permits and comply with the U.S. Environmental Protection Agency's New Source Performance Standards for emissions from stationary combustion installations (Reference 4-12). Compliance with State and U.S. Environmental Protection Agency standards and with State permit conditions is accomplished by utilization of no more than 700,000 gallons of Number 2 fuel oil in any 12-month period and certification by the fuel supplier that the fuel contains no more than 0.5 percent sulfur. Reports documenting sulfur content are provided to the U.S. Environmental Protection Agency Region II on a quarterly basis. A certification of compliance with State permit conditions, which documents fuel use, is submitted to the New York State Department of Environmental Conservation Region 5 on an annual basis.

Other permitted point sources of airborne emissions include three paint spray operations. Emissions from these operations are logged on a monthly basis to ensure compliance with permit conditions. There are no Federal reporting requirements; however, compliance with State permit conditions is included with the certification of compliance submitted annually to the New York State Department of Environmental Conservation Region 5. Other point sources of airborne emissions at the Kesselring Site are from welding operations, carpentry shops, abrasive cleaning, and metal preparation processes, all of which are associated with routine maintenance operations. Airborne emissions from these miscellaneous small point sources meet New York State requirements for exemption from permitting and reporting, as defined in New York State air regulation NYCRR Title 6, Part 201. As discussed in Reference 4-4, all emissions from permitted point sources at the Kesselring Site conform to the applicable State and Federal clean air standards.

Between 1994 and 1996, there were eight unplanned releases from the Kesselring Site to air. These releases were of chlorodifluoromethane (Freon 22) from air conditioning systems. While there is no Federal reportable quantity criterion for this chemical, the releases were of sufficient quantity (greater than 1 pound) to require reporting to the New York State Department of Environmental Conservation per NYCRR Title 6, Part 595.3. Prior to August 1994, reporting to New York State was not required. There were no health or safety impacts to the public as a result of these releases.

4.5 Terrestrial Resources

4.5.1 Topography

The Kesselring Site is located within the undulating transition zone between the Adirondack Mountains and the Hudson-Mohawk Valley lowlands. Ground elevations in the vicinity of the Federal reservation generally range from 120 to 270 meters (400 to 900 feet) above sea level. The terrain surrounding the Kesselring Site forms a partial bowl having a bottom diameter of approximately 610 meters (2,000 feet) and a maximum height of approximately 46 meters (150 feet). The Kesselring Site is essentially flat with ground elevations ranging approximately from 146 to 149 meters (480 to 490 feet) above sea level.

4.5.2 Geology

Borings drilled in the area surrounding the Kesselring Site identified depths to bedrock ranging from 0 to approximately 61 meters (200 feet), with an average depth of approximately 15 meters (50 feet). Bedrock underlying the broader West Milton area is variable and consists of several types of metamorphosed rocks, including gneiss and granite, and sedimentary rocks, including sandstone, dolomite, limestone and shale (Reference 4-13). Successive bedrock formations mapped in the area around the Kesselring Site (upper to lower layers) include Canajoharie shale, more than 150 meters (500 feet) thick; Trenton, Amsterdam and Lowville limestones, approximately 17 meters (55 feet) thick; Gailor dolomite, approximately 46 meters (150 feet) thick; the Galway Formation, approximately 37 meters (120 feet) thick; Potsdam sandstone approximately 15 to 30 meters (50 to 100 feet) thick; and Precambrian age (greater than 600 million years old) granite and gneiss.

The bedrock in the West Milton area is covered by unconsolidated overburden deposits. The overburden deposits consist of several mixtures of clay, sand, gravel and boulders (Reference 4-13). Categories of overburden deposits include: (1) till - a mixture of glacially deposited rock particles ranging in size from clay to boulders; (2) kames - irregularly layered glacial deposits of sand and gravel; (3) flood-plain deposits - generally horizontal, imperfectly stratified layers of stream-deposited clay, silt, and fine sand; (4) lake-bottom deposits - horizontally stratified layers of clay, silt, and fine sand; and (5) deltaic deposits - relatively homogeneous deposits of fine to coarse sand.

Within the Kesselring Site, overburden deposits range approximately from 4.6 to 46 meters (15 to 150 feet) deep and consist of lake-bottom deposits and glacial till. Coarse backfill materials consisting of sand, gravel and crushed stone have also been added during construction activities. There are no known geologic resources on the Kesselring Site having economic value. Additional information on Kesselring Site geology may be found in Reference 4-23.

4.5.3 Seismology

The Kesselring Site is located in a region with several known geologic faults (Reference 4-13). The two most prominent faults in the West Milton area, the East Galway and West Galway faults, are branches of the Hoffman's Ferry fault. The East Galway fault lies approximately 1,100 meters (3,500 feet) northwest of the Kesselring Site. The West Galway fault lies approximately 2.7 kilometers (1.7 miles) west of the Kesselring Site. The Hoffman's Ferry fault has been traced for approximately 64 kilometers (40 miles) between Hoffman's Ferry on the Mohawk River to Fort Ann, north of the Hudson River. Another fault, known as the Rock City Falls fault, begins approximately 3.2 kilometers (2 miles) northeast of the Kesselring Site. All of these faults generally run southwest to northeast. The faults are very old, dating back approximately 200 million years or more to the development of the Appalachian Mountains.

The Kesselring Site is located in an area that is subject to some seismic activity. The area is located in a seismic zone in which moderate damage is possible. However, records dating back to the 1700s indicate that earthquakes capable of causing damage in the vicinity of the Kesselring Site are rare. These records indicate that the maximum intensity earthquake for the region within a 160-kilometer (100-mile) radius of the Kesselring Site had a Modified Mercalli Intensity of VII, which results in negligible damage to buildings of good design and construction, slight to moderate damage in ordinary structures and considerable damage in poorly built or badly designed structures. The most recent earthquake of that intensity occurred at Lake George, New York, on April 30, 1931. Earthquakes of greater intensity have occurred at epicenters greater than 160 kilometers (100 miles) from the Kesselring Site. However, due to attenuation effects, ground motion at the Kesselring Site from these earthquakes fell below a Modified Mercalli Intensity of VI (felt by all, trees and bushes shake, weak plaster and masonry crack). There are no known voids or other subsurface conditions, either natural or man made, beneath the Kesselring Site property which could affect the surface conditions.

Additional information on local and regional seismic characteristics of the West Milton area may be found in reports issued for Kesselring Site evaluations conducted in association with Site construction projects (References 4-23 and 4-27).

4.5.4 Land Condition Reviews and Solid Waste Management

This section describes the processes under which conditions at the Kesselring Site and Federal reservation have been reviewed by regulatory agencies along with the existing status. Current solid waste management practices are also discussed in detail.

4.5.4.1 The CERCLA Review Process

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, required all Federal facilities to complete a review process known as a preliminary assessment. The preliminary assessment required each Federal facility to be evaluated for the presence of environmentally harmful historical releases. Identified areas were ranked in accordance with a National system used to identify facilities requiring prompt remedial action. Facilities requiring prompt remedial action were placed on the National Priorities List.

The preliminary assessment of conditions at the Kesselring Site and Federal reservation, completed in April 1988 (Reference 4-31), was submitted to the U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation. This assessment concluded that the Kesselring Site and Federal reservation had a ranking value which was below the criteria for placement on the National Priorities List. As part of a subsequent expanded site investigation, additional information was provided to the U.S. Environmental Protection Agency and New York State Department of Environmental Conservation in support of their review of the preliminary assessment. Based on Reference 4-31 and the supplementary information, the U.S. Environmental Protection Agency has assigned the Kesselring Site and Federal reservation with a recommendation of Site Evaluation Accomplished (Reference 4-8). This means that, based on current information, the Kesselring Site and Federal reservation do not qualify for inclusion on the National Priorities List. No further action is anticipated under CERCLA.

4.5.4.2 New York State RCRA Corrective Action Program

As required by regulations described in Section 2.5.5 and 2.8.4, the Kesselring Site manages hazardous wastes in accordance with a Resource Conservation and Recovery Act (RCRA) hazardous waste management facility permit issued by New York State on June 1, 1995 (Reference 4-16). In addition to regulating current hazardous waste management activities on the Kesselring Site, Module III of the permit (Corrective Action Requirements for Solid Waste Management Units and Areas of Concern) includes a process for evaluating and, if necessary, remediating locations where waste management activities historically occurred. Module III of the Kesselring Site's hazardous waste management facility permit describes 45 historic locations (formally referred to as solid waste management units or areas of concern - see Glossary). After the permit was issued, the Naval Reactors Program identified an additional 7 locations, which are described in References 4-38, 4-39, and 4-42. The first step of the evaluation process specified in the permit is to assess for each location whether or not hazardous constituents were potentially released to the environment (formally referred to as a RCRA facility assessment). As documented in the permit, the New York State Department of Environmental Conservation has concluded from preliminary assessment efforts that hazardous constituents were not released at 28 of the 52 locations and that no further action is required for those locations. The Naval Reactors Program is remediating 3 of the 52 locations through the completion of interim corrective measures, which are identified in the permit and described later in Sections 4.5.6.1 and 4.5.6.2. New York State approved sampling and analysis (formally referred to as a sampling visit) are ongoing to complete the assessment of another 14 locations. After completion of sampling, the Naval Reactors Program will review the results with the New York State Department of Environmental Conservation and reach agreement on any additional actions required to further characterize or to take remedial actions for the 24 locations where the State has not yet concluded that no further action is required. Final remedial actions (or a determination that no further action is required) for each location would be incorporated in a draft revision to the Site's hazardous waste management facility permit which would be published for public review and comment. Refer to Sections 4.5.6.1 and 4.5.6.2 for additional discussion on RCRA corrective actions.

4.5.4.3 General Nonradiological, Nonhazardous Waste Management

Solid waste generated by the Kesselring Site includes office waste, cafeteria wastes and recyclables. Office and cafeteria wastes do not include chemicals, solvents, cleaning solutions or paint. Recyclables include glass, plastic, newspaper, scrap metal, and corrugated cardboard. Kesselring Site and subcontractor personnel are instructed to segregate solid waste into proper waste streams and recyclables. The Kesselring Site office and cafeteria wastes are shipped to an incinerator in Hudson Falls, New York, for disposal. Construction and demolition debris is shipped to commercial landfills. Recyclables are shipped to a local recycling transfer station.

4.5.4.4 Hazardous and Chemical Waste Management

As discussed in Section 4.5.4.2, the Kesselring Site operates under a New York State issued hazardous waste management facility permit that became effective on June 1, 1995 (Reference 4-16). To ensure the safe use of chemicals and disposal of the resulting wastes, the Kesselring Site maintains hazardous substance control and waste minimization programs as detailed in Reference 4-4. As reported in Reference 4-4, the Kesselring Site shipped approximately 138 metric tons (154 tons) of RCRA and New York State hazardous waste off-site during calendar year 1996.

The Kesselring Site has participated in the New York State Hazardous Waste Reduction Plan (see Section 2.8.5) since 1990. The plan requires that 90 percent of the Kesselring Site's hazardous waste streams, including all streams over 5 tons or any acute hazardous waste stream, be included in the plan for reporting purposes. This plan requires reports to be submitted to New York State biennially with annual updates in alternating years. The report discusses 12 different routine waste streams and how the Kesselring Site plans to reduce the generation of these wastes. The Kesselring Site evaluates waste streams for possible recycling, reuse, reduction or elimination. Since the tracking of these waste streams began, 6 of the targeted waste streams have been eliminated.

Where practical, the Kesselring Site recycles materials which are normally considered industrial waste. These materials include waste oil, batteries and lead. The waste oil is shipped off-site to a disposal facility to be recycled or incinerated. Certain types of batteries and some bulk lead products are collected and recycled.

4.5.4.5 Radiological Waste Management

The solid radioactive wastes generated at the Kesselring Site are byproducts of prototype operations and maintenance. These wastes include items such as spent purification process media (such as used filters and ion exchange resin), high efficiency particulate air filters, solidified radioactive liquids, and consumable products such as sheet plastic and rags. The Kesselring Site maintains a vigorous radioactive waste management and waste minimization program. During 1996, approximately 20,000 kilograms (44,000 pounds) of radioactive metals were shipped off-site for recycling and reuse in other radiological applications. As reported in Reference 4-4, the Kesselring Site shipped approximately 133 cubic meters (175 cubic yards) of low-level radioactive waste off-site during calendar year 1996. This volume represented less than 1 percent of the total low-level radioactive waste volume generated at U.S. Department of Energy facilities during 1995 (Reference 4-37). As discussed in Reference 4-4, all radioactive waste shipments complied with applicable Federal and State regulations and were disposed of at government owned disposal sites.

4.5.4.6 Mixed Waste Management

Waste which is both radioactive and chemically hazardous, known as "mixed waste," is regulated under both the Atomic Energy Act of 1954, as amended, and RCRA, as amended. As described in Section 2.5.9, the New York State Department of Environmental Conservation, which has regulatory authority for mixed waste in New York State, approved a Site Treatment Plan for Mixed Wastes Generated at the Kesselring Site and issued an Administrative Consent Order that became effective on October 24, 1995 (Reference 2-2). The Kesselring Site currently operates under interim status in the New York State permitting process for mixed waste. As part of the permitting process for mixed waste, the New York State RCRA Facility Assessment phase, described in Section 4.5.4.2, was repeated with regard to locations at the Kesselring Site and Federal reservation which may contain mixed wastes. These locations were identified in the mixed waste permit application, which was submitted to the New York State Department of Environmental Conservation in August 1997. The permitting process for mixed waste is subject to public reviews separate from this decision making process for S3G and D1G Prototype reactor plant disposal.

Kesselring Site operations endeavor to generate only small amounts of mixed waste. During 1996, 0.21 cubic meters (7.4 cubic feet) of mixed waste were shipped to a commercial facility in the State of Utah. In January 1997, 0.47 cubic meters (16.6 cubic feet) of mixed waste were shipped to the U.S. Department of Energy's Idaho National Engineering and Environmental Laboratory. Treatment of mixed waste was consistent with requirements described in the Site Treatment Plan (Reference 2-2). The Site Treatment Plan includes the current estimates for generation and storage of mixed waste at the Kesselring Site. These projections are reviewed annually and updated as necessary.

4.5.5 Existing Radiological Conditions - General

The Kesselring Site maintains a comprehensive environmental monitoring program that covers all radiological aspects of Site operations. Reference 4-4 provides a description of this program and routine monitoring results. In addition to routine monitoring, special monitoring has been conducted in the areas potentially affected by past operations, such as the Kesselring Site drainage ditches and inactive (former) radiological facilities. As discussed in Reference 2-1, there is no detectable radioactivity due to Site operations in the Glowegee Creek sediment. Biological samples (fish) and water samples taken in the Glowegee Creek, both upstream and downstream of the Site outfalls, show only naturally occurring radionuclides (such as potassium-40) and no radionuclides attributable to Site operations. None of the alternatives being considered in detail for disposal of the S3G and D1G Prototype reactor plants include activities which would deposit radioactive materials to the soil on the Kesselring Site or Federal reservation.

4.5.5.1 Existing Radiological Conditions on the Kesselring Site Land

As discussed in Reference 2-1, radioactive materials attributable to Kesselring Site operations have never been disposed of on the Site. However, past activities have resulted in the release of small amounts of radioactive material to soil in localized areas of the Kesselring Site. Liquid effluents from the Site, including those containing low levels of radionuclides, flowed through on-site discharge channels, or ditches, prior to entering the Glowegee Creek. In the late 1950's and early 1960's, monitoring in these channels showed a slow build-up of low levels of radioactivity in the sediment from the discharge of water containing low-level radioactivity. These areas were dredged to prevent the radioactivity from entering the Glowegee Creek, the contaminated soil was shipped off-site to an approved disposal site, and a filter and demineralizer were installed to reduce radioactivity in the water being discharged. Subsequently, low levels of radioactivity build-up were found again during channel monitoring, and the radioactivity concentration discharge limits were further reduced to prevent this build-up of radioactivity from recurring. The areas were dredged and the contaminated soil was shipped off-site to an approved disposal site.

As discussed in Section 4.3.3.2, levels of cesium-137 and cobalt-60 are consistently below minimum detection limits in Site ground water samples. This indicates that the isolated soil areas containing detectable radioactivity, have not affected local ground water conditions.

Based on soil sampling and ground water monitoring results, it is estimated that less than 0.05 curies of man-made radioactivity is contained under the Kesselring Site. This is less than 0.1 percent of the naturally occurring radon radioactivity that is released from the Kesselring Site each year and is roughly equal to the naturally occurring radioactivity in the top 1 inch of soil from a local area the size of the Site.

4.5.5.2 Existing Radiological Conditions on the Federal Reservation Land Surrounding the Kesselring Site

As discussed in Reference 2-1, none of the Federal reservation land is used for disposal of radioactive material. However, evaluations of past activities have identified one remote, localized area on the Federal reservation where small amounts of radioactive material were released to the soil. Between 1958 and 1966, a 0.2-hectare (0.5-acre) area located in the northwest portion of the Federal reservation was used to burn oil and sodium containing low levels of radioactivity. The oil and sodium are attributable to past operation of the decommissioned S1G Prototype reactor plant and related past testing operations which were conducted at the Knolls Atomic Power Laboratory Niskayuna Site. The remote area, known as the Silo Area, is located at a former farm site which was abandoned at the time of the establishment of the Federal reservation (see Figure 4-2).

In 1978, numerous soil samples were collected and surveys were performed which resulted in finding localized areas containing low concentrations of radioactivity above natural background levels. Approximately 63 cubic meters (82 cubic yards) of contaminated soil were removed from the Silo Area in 1978 and sent to an approved disposal site. In 1987, additional surveys and sample collections were performed. The highest concentrations of radioactivity found in 1987 were 179 picocuries per gram of cesium-137 and 6 picocuries per gram of cobalt-60. An estimated 115 cubic meters (150 cubic yards) of soil containing radioactivity attributable to past operations remain in this area. The total radioactivity content in this soil is estimated to be about 0.05 curies. Gamma radiation monitoring of the Silo Area indicates natural background radiation levels except for one small area which has twice the natural background levels. Ground water samples from monitoring wells have indicated no detectable radioactivity above background levels. As discussed in Reference 2-1, the total amount of residual radioactivity in the soil of the Silo Area is less than the amount of naturally occurring radioactivity that would be found in the top 4 feet of soil covering a local area of the same size.

4.5.6 Existing Nonradiological Conditions - General

Since the beginning of prototype operations at the Kesselring Site more than 40 years ago, a variety of chemical and hazardous wastes have been generated, some of which were disposed of on Federal reservation land in accordance with normal practices at that time. All identified disposal locations are within the Federal reservation boundary and compose less than 1 percent of the Federal reservation land. Reference 2-1 provides general information on the nonradiological conditions at the Kesselring Site and Federal reservation. As discussed in Section 4.5.4.1 and Reference 4-8, the Kesselring Site and Federal reservation do not qualify for inclusion on the National Priorities List; no further action is anticipated under the Comprehensive Environmental Response, Compensation, and Liability Act.

4.5.6.1 Existing Nonradiological Conditions on the Kesselring Site Land

As discussed in detail in Section 4.5.4.2, an effort is ongoing to evaluate and, if necessary, remediate locations where waste management activities historically occurred. Forty-two (42) of these locations are within the developed area of the Kesselring Site. The locations are generally associated with waste water treatment tanks, waste water and waste oil collection tanks, and solid waste storage facilities. Each location is described in the Kesselring Site's hazardous waste management facility permit (Reference 4-16) or in References 4-38 and 4-39.

Interim corrective measures have been completed in two small areas of the Kesselring Site. These corrective measures involved removal of surface soil containing lead from an approximately 9.3 square meter (100 square foot) area associated with a firing range and an approximately 280 square meter (3,000 square foot) area formerly used for storage of temporary lead shielding. As documented in Reference 4-30, the New York State Department of Environmental Conservation considers remediation efforts in these two areas "were successful in decreasing the lead levels in soil to levels comparable to background levels in the vicinity of these areas" and no further action is required. The remaining locations either require no action or are still undergoing evaluation. Currently, no significant or large scale remedial actions are expected to be required for these remaining locations.

As part of Kesselring Site operations, small inadvertent spills of hazardous materials have occurred. When spills occur, immediate actions are taken to quickly contain and clean up the affected area. Between 1988 and 1996, there were 73 documented spills at the Kesselring Site consisting of a total volume of less than 3,400 liters (900 gallons). The spills contained either petroleum products or ethylene glycol (anti-freeze), as described in detail below. In accordance with regulations which define the minimum reportable quantities of specific hazardous materials, these spills were reported to the appropriate regulatory agencies.

Spills involving petroleum products, which account for 58 of the 73 documented spills, were reported to the New York State Department of Environmental Conservation. The majority of the spilled petroleum products originated from operating equipment and included products such as lubricating oil and hydraulic fluids, gasoline, and diesel fuel. These spills involved a total of approximately 3,300 liters (860 gallons). In the time since the spills occurred, applicable New York State regulations have changed. Under the current implementing regulations, 20 of the spills involving only small quantities would not have required reporting. The largest spill (2,300 liters, or 600 gallons, of diesel fuel) was completely contained in a concrete enclosure and subsequently cleaned up with no effect on Kesselring Site conditions. There was one historic spill of gasoline that was discovered during initiatives to remove an underground storage tank. Cleanup efforts included soil removal; however, residual petroleum products can still be detected in a small area near the southwest corner of the Kesselring Site. Conditions in this area have been reported and agreed to by the New York State Department of Environmental Conservation.

Spills involving ethylene glycol, which account for 15 of the 73 documented spills, were reported to the New York State Department of Environmental Conservation and the U.S. Environmental Protection Agency between 1992 and 1996. These spills involved a total of approximately 87 liters (23 gallons) having an estimated 50 percent mixture concentration. In the time since these spills occurred, applicable regulations have changed. Under the current implementing regulations for the Comprehensive Environmental Response, Compensation, and Liability Act, none of these spills would be reportable to the U.S. Environmental Protection Agency. Spills involving ethylene glycol occurred on paved areas; and after cleanup, conditions at the Kesselring Site were unaffected.

4.5.6.2 Existing Nonradiological Conditions on the Federal Reservation Land Surrounding the Kesselring Site

As discussed in detail in Section 4.5.4.2, an effort is ongoing to evaluate and, if necessary, remediate locations where waste management activities historically occurred. Ten (10) of these locations are on the Federal reservation land surrounding the developed area of the Kesselring Site. The locations are associated with various past waste disposal areas. Nine (9) of the locations are described in the Kesselring Site's hazardous waste management facility permit (Reference 4-16), and the other location is described in Reference 4-42.

Interim corrective measures have been completed in one of the past waste disposal areas, located near the west side of Hogback Road. These corrective measures involved limited sampling of an area used for construction material debris. As documented in Reference 4-40, the New York State Department of Environmental Conservation considers no further action is necessary in this area. The remaining locations either require no action or are still undergoing evaluation. Currently, no significant or large scale remedial actions are expected to be required for these remaining locations.

4.6 Socioeconomics

The population distribution within an 80-kilometer (50-mile) radius of the Kesselring Site, compiled from 1990 Census data, is shown in Figure 4-4. Table 4-1 summarizes the population distribution.

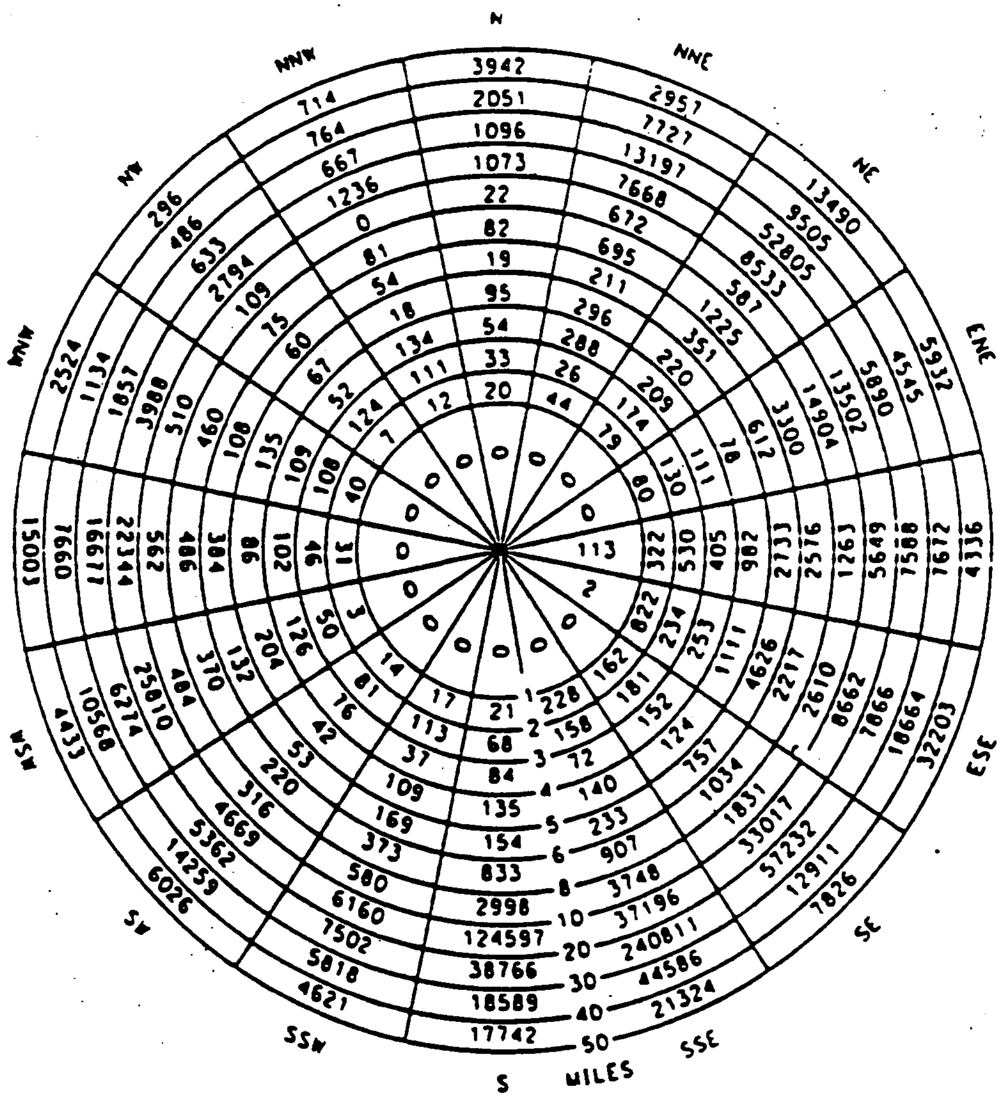

Figure 4-4: 1990 Population Distribution Within an 80-Kilometer (50-Mile) Radius of the Kesselring Site

Table 4-1: Population Distribution Within an 80-Kilometer (50-Mile) Radius of the Kesselring Site

Kilometers	Miles	People	Cumulative People
0 - 8	0 - 5	10,290	10,290
8 - 16	5 - 10	56,786	67,076
16 - 32	10 - 20	306,898	373,974
32 - 48	20 - 30	464,223	838,197
48 - 64	30 - 40	166,939	1,005,136
64 - 80	40 - 50	143,369	1,148,505

Kesselring Site staffing near the end of 1997 is estimated at approximately 700 civilian personnel (including subcontractor) and 1,000 U.S. Navy personnel. More than 75 percent of the labor force employed at the Kesselring Site resides in Saratoga and Schenectady Counties, within 32 kilometers (20 miles) of the Site. Table 4-2 presents socioeconomic data for the immediate vicinity of the Kesselring Site and for the surrounding region based on 1990 Census data compiled by the Capital District Regional Planning Commission and the New York State Data Center, Department of Economic Development.

Table 4-2: Socioeconomic Data for the Immediate Vicinity of the Kesselring Site and for the Surrounding Region

	Immediate Vicinity [a]	Surrounding Region [b]
Population	17,900	436,700
Percent Non - White Population [c]	1	4
Percent Hispanic Population	1	2
Civilian Labor Force	9,500	219,900
Civilian Employment	8,900	207,600
Unemployment Rate (percent)	6	6
Average Household Income	$33,000	$32,000
Percent Living Below Poverty [d]	7	8

a. Includes data for the Towns of Milton and Galway.
b. Includes data for the Counties of Saratoga, Schenectady, Montgomery and Fulton.
c. Includes "Black", "Asian or Pacific Islander", "American Indian, Eskimo or Aleut", and "Other Races".
d. The U.S. Census Bureau characterizes persons living in poverty as those whose income is less than a "statistical poverty threshold." For the 1990 Census, this threshold was based on a 1989 income of $12,500 per household.

4.7 Cultural Resources

Prior to construction of the Kesselring Site, land that is now part of the Federal reservation was used for agricultural purposes. There are three small burial plots on the Federal reservation that are of historical significance. Construction activities at the Kesselring Site have not identified any objects of historical, archaeological or cultural significance in the vicinity of the prototypes. The current National Register of Historic Places (Reference 4-17) does not list any historic sites, buildings, structures, or objects within the Kesselring Site or Federal reservation.

The Hortonsphere, the spherical containment structure in which the D1G Prototype reactor plant is housed at the Kesselring Site, has potential historical significance. When construction was completed in 1953, the Hortonsphere was the largest structural sphere built to date. In 1954, the Hortonsphere became the first operational power reactor pressure containment, establishing a major safety precedent of enclosing power reactors which are located near population centers. In 1986, the D1G Hortonsphere was designated as a Nuclear Historic Landmark by the American Nuclear Society. None of the alternatives would involve dismantling the Hortonsphere.

The Naval Reactors Program does not consider the S3G and D1G Prototypes to have any historical significance. Both prototypes are follow-on developments, and are merely part of the many land-based prototypes that were built and operated by the Naval Reactors Program. Each prototype had an operating follow ship: S3G was the prototype for a single U.S. Navy submarine, the USS Triton (SSN 586), and D1G was the prototype for a single U.S. Navy surface ship, the USS Bainbridge (CGN 25). The U.S. Navy has decommissioned and defueled both of these operating ships.

4.8 Noise, Aesthetic and Scenic Resources

The Kesselring Site is located a minimum of 1.4 kilometers (0.9 miles) from the boundary of the Federal reservation and is fully surrounded by woodlands and low hills. There is very little visibility of the Kesselring Site facilities from public roadways. Like many industrial facilities, there are no resources of scenic or aesthetic value on the Kesselring Site.

Noise is generated by routine Kesselring Site operations, typically equivalent to light industrial activity, such as noise from truck and automobile traffic, and from operating industrial equipment such as diesel or gasoline powered engines and pneumatic tools. Noise is generally not discernible beyond the Federal reservation boundary. However, noise from sirens and loudspeakers at the Kesselring Site may be heard occasionally beyond the Federal reservation boundary. Air operated sirens, similar to a typical firehouse siren, and loudspeakers are most commonly operated at the Kesselring Site in support of routine training exercises to maintain the proficiency of operating plant personnel and support personnel. The sirens are also routinely tested, and the loudspeakers are used for general Kesselring Site announcements. Because the Kesselring Site operates 24 hours a day, year round, the sirens and loudspeakers may occasionally be heard at night and on holidays.

4.9 Traffic and Transportation

No public roads, highways, railways, or navigable waterways traverse the Federal reservation.

Two major interstate highway corridors are located in the vicinity of the Federal reservation. Approximately 16 kilometers (10 miles) to the east, Interstate 87 serves north-south traffic through the Hudson-Champlain corridor. Approximately 24 kilometers (15 miles) to the south, Interstate 90 serves east-west traffic through the Hudson-Mohawk corridor. Secondary roads bounding the Federal reservation are used for local residential traffic, commuting, and delivery routes by a variety of businesses. Secondary roads include State Route 29, approximately 3 kilometers (2 miles) to the north; State Route 67, approximately 6 kilometers (4 miles) to the south; State Route 50, approximately 10 kilometers (6 miles) to the east; and State Route 147, approximately 6 kilometers (4 miles) to the west.

Traffic associated with Kesselring Site operations does not contribute notably to overall traffic conditions in the area. For example, during 1996, there were approximately 850 shipments of materials as a result of routine Kesselring Site operations. Of this total, less than 50 shipments contained radiological materials, such as low-level radiological waste, anti-contamination clothing and radiation monitoring equipment. The approximately 800 remaining shipments were associated with nonradiological materials such as construction debris, recyclable metals, and routine transfers of equipment with other facilities and vendors. The total number of shipments for 1996 is equivalent to an average number of 16 shipments per week.

Kesselring Site employee traffic represents only a small fraction of traffic on local and Saratoga County roads. Since the Kesselring Site operates 24 hours a day, year round, Site employee traffic is distributed over each day. Most traffic (about 900 to 1,000 vehicles) occurs during regular dayshift hours, Monday through Friday. The balance of general Kesselring Site employee traffic occurs on backshifts and on weekends. Both Atomic Project Road and Hogback Road are used for general employee traffic.

Two lines of the Delaware and Hudson Railroad cross the region within 16 kilometers (10 miles) of the Federal reservation. The main north-south line runs through Ballston Spa, approximately 13 kilometers (8 miles) to the southeast, and a branch line runs just over 8 kilometers (5 miles) to the northeast into the central Adirondack area.

Commercial barge traffic occurs on the New York State Erie Canal, southwest of the Federal reservation, and on the less used Champlain Canal, east of the reservation. Docking facilities are available at the Port of Albany and further south at the Port of New York.

Albany County Airport, approximately 35 kilometers (22 miles) south-southeast of the Federal reservation, is the nearest airport with scheduled flights by commercial jet aircraft. Schenectady County Airport, approximately 24 kilometers (15 miles) south of the Federal reservation, is an auxiliary field with a low volume of traffic relative to size. No commercial air carriers provide scheduled service out of Schenectady County Airport. The bulk of Schenectady County Airport's traffic is small corporate and private aircraft, with the rest being mostly military cargo aircraft from the 109th New York Air National Guard. Saratoga County Airport, located approximately 7.2 kilometers (4.5 miles) east of the Federal reservation, is a small airport used mostly by light private aircraft. Data furnished by air traffic control representatives for the three area airports indicate that regular airport traffic patterns for military, commercial, and private aircraft, large and small, do not pass within an 8-kilometer (5-mile) radius of the Kesselring Site (Reference 2-7). The instrument approaches for Albany and Schenectady County Airports, designated by the Federal Aviation Administration, also do not pass within an 8-kilometer (5-mile) radius of the Kesselring Site. Aircraft using the instrument approach to the Saratoga County Airport have the potential for overflying the Kesselring Site.

4.10 Health and Safety

4.10.1 Occupational Health and Safety

The Naval Reactors Program's policy is to maintain a healthful work environment at all of its facilities in accordance with U.S. Department of Energy regulations and consistent with Occupational and Safety Health Administration standards, where appropriate, for all site activities.

4.10.1.1 Radiological Occupational Health and Safety

The Naval Reactors Program's policy is to maintain the external exposure to personnel from ionizing radiation associated with Naval nuclear propulsion plants to levels as low as reasonably achievable. Stringent Naval Reactors Program radiological controls have been successful in minimizing occupational radiation exposure. No personnel at the Naval Reactors Program's facilities have ever exceeded the applicable Federal annual radiation exposure limit. The annual limit was 15 rem per year in 1958 and is currently 5 rem per year. No worker has exceeded the Naval Reactors Program limit of 5 rem per year since this limit was established in 1967, and no worker has received more than 2 rem per year from radiation associated with Naval nuclear propulsion plants since 1979. Since 1958, the average annual occupational exposure per person monitored has been 0.12 rem. The average lifetime accumulated radiation exposure for the 148,000 personnel who have been monitored at the Naval Reactors Program's facilities is about 0.34 rem (Reference 4-22). This corresponds to an average per person risk of developing a latent fatal cancer of 0.00014 (1 chance in about 7,400). Using data from Reference 4-22 specific only to Naval Reactors Program prototypes for the years 1990 through 1996, the average annual occupational exposure per person monitored was 0.074 rem. This value provides a representative measure of current Kesselring Site occupational exposure.

The Naval Reactors Program's policy on occupational exposure from ingested or inhaled radioactivity is to prevent any measurable radiation exposure to personnel from internal radioactivity. The limits invoked to achieve this objective are 10 percent of the levels allowed by Federal regulations for radiation workers. Since 1972, as a result of this policy, no worker has received more than 10 percent of the Federal annual occupational exposure limit from internal radiation exposure caused by radioactivity associated with work at Naval Reactors Program facilities.

4.10.1.2 Nonradiological Occupational Health and Safety

According to the U.S. Department of Labor, injuries in the workplace are most likely to be sprains and strains, bruises and contusions, cuts and lacerations, and fractures. Injuries are most likely to occur from contact with equipment and other objects, falls, and overexertion. Generally, fatalities in the workplace (non-violence related) are most likely to result from contact with equipment and other objects, falls, and exposure to harmful substances or conditions (Reference 4-18).

The Naval Reactors Program's approach to maintaining a safe and healthful work environment emphasizes personal responsibility, technical knowledge, training, and oversight. Engineered systems and administrative controls are the primary means employed for minimizing potential employee exposure to occupational hazards. If hazards cannot be controlled with engineering or administrative controls, personal protective equipment is used to provide additional protection.

Impact of workplace hazards other than radiation is measured by recordable injury/illness and fatality rates in the work force. Injury/illness and fatality rates for construction (demolition) workers are considered separately because of the more hazardous nature of their work. Table 4-3 provides recordable injury/illness and fatality rates for the Naval Reactors Program, averaged over a period of 5 years, as compared to private industry and the U.S. Department of Energy and its contractors. Recordable injury/illness and fatality rates for the Naval Reactors Program have been consistently lower than the rates reported by private industry and the U.S. Department of Energy. For further information on the Naval Reactors Program nonradiological occupational safety and health practices and performance, refer to Reference 4-14.

The evaluations provided by this Environmental Impact Statement involve heavy dismantlement (demolition) work, which represents only a small portion of Naval Reactors Program operations. Therefore, nonradiological occupational health and safety evaluations in this Environmental Impact Statement are based on overall U.S. Department of Energy statistics to provide more representative and conservative impact estimates.

Table 4-3: Average Occupational Injury/Illness and Fatality Rates

	All labor categories		Construction workers	
	Total injuries and illnesses per worker-year	Fatalities per worker-year	Total injuries and illnesses per worker-year	Fatalities per worker-year
Naval Reactors Program [a]	0.022	0	0.044	0
Department of Energy and Contractors [a]	0.036	0.00003	0.066	0.0001
Private Industry [b]	0.089	0.000058	0.12	0.00022

a. 1989-1993 averages (Reference 4-19).
b. 1990-1994 averages (Reference 4-20).

4.10.2 Public Health and Safety

4.10.2.1 Radiological Public Health and Safety

Effluent and environmental monitoring results show that the radioactivity in liquid and gaseous effluents from operations at the Kesselring Site in 1996 had no measurable effect on background radioactivity levels. Therefore, any radiation doses from Kesselring Site operations to off-site individuals were too small to be measured and must be calculated using conservative methods. As reported in Reference 4-4, the following estimates were determined: (1) the radiation dose to the maximally exposed individual in the vicinity of the Kesselring Site was less than 0.1 millirem, (2) the average dose to members of the public residing in the 80-kilometer (50-mile) radius assessment area surrounding the Site was less than 0.001 millirem, and (3) the collective dose to the population residing within 80 kilometers of the Site was less than 0.1 person-rem.

The results show that the estimated doses were less than 0.1 percent of that permitted by the U.S. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment. The results also show that the estimated dose to the population residing within 80 kilometers (50 miles) of the Kesselring Site was less than 0.001 percent of the natural background radiation dose to the same population. In addition, the estimated doses were less than 1 percent of that permitted by the U.S. Nuclear Regulatory Commission numerical guide listed in Reference 4-32 for whole-body dose, demonstrating that doses are as low as reasonably achievable. The dose attributed to radioactive air emissions was less than 1 percent of the U.S. Environmental Protection Agency standard given in Reference 3-2.

The collective radiation dose to the public along travel routes from Kesselring Site shipments of radioactive materials during 1995 was calculated using data given by the U.S. Nuclear Regulatory Commission in Reference 4-33. Based on the type and number of shipments made, the collective annual radiation dose to the public along the travel routes, including transportation workers, was less than 1 person-rem. This is less than 0.001 percent of the dose received by the same population from natural background radiation.

To provide perspective on the above discussion, the collective dose received in 1996 by the population residing within 80 kilometers (50 miles) of the Kesselring Site from natural background radiation is estimated to be 83,000 person-rem (Reference 4-4). This estimate is based on an average cosmic and terrestrial natural background radiation level of approximately 72 millirem measured in the vicinity of the Kesselring Site, which does not include radiation from radon and from radioactivity within the body.

4.10.2.2 Nonradiological Public Health and Safety

Nonradiological public health and safety involves a variety of factors. Details of Kesselring Site operations and existing nonradiological conditions in the environment surrounding the Site are discussed in other sections of this chapter. Related information is covered in Section 4.3 for water resources, Section 4.4 for air resources, and Section 4.5 for terrestrial resources. Based on information provided in References 2-1 and 4-4, Kesselring Site operations meet all applicable Federal, State and local requirements. In addition, Kesselring Site operations and existing nonradiological conditions in the environment surrounding the Site are not impacting public health and safety.

4.11 Utilities and Energy

Kesselring Site electricity is supplied by the Niagara Mohawk Power Company. During 1996, the Kesselring Site used approximately 47,000 megawatt-hours of electricity. Monthly fuel use at the Kesselring Site during 1996 averaged approximately 163,000 liters (43,000 gallons) of fuel oil, 7,000 liters (1,800 gallons) of liquid propane, 3,000 liters (800 gallons) of gasoline, and 800 liters (200 gallons) of diesel fuel.

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES

5.0 Environmental Consequences

This chapter describes the potential environmental consequences associated with the no action, prompt dismantlement, and deferred dismantlement alternatives for S3G and D1G Prototype reactor plant disposal. This chapter also provides a brief description of analysis methodology, results, and conclusions. A basic, overall understanding of the environmental consequences can be gained without reading the appendices. However, those appendices are frequently cited to assist the reader in finding additional information on specific topics. To further assist the reader and decision makers, this chapter is organized by alternatives. All environmental topics of concern are discussed within the section devoted to each alternative.

The environmental consequences are determined by comparing estimated impacts (such as hypothetical health risk) to the baseline environmental conditions described in Chapter 4. All of the environmental consequences would be very small. Detailed analyses of potential impacts on worker and public health are described in Appendix B for facility activities and Appendix C for transportation of materials off-site. In addition, Appendices B and C discuss potential consequences and risks of various accident scenarios. Appendix A provides information on common sources of radiation, radiological controls, risks associated with radiological and nonradiological hazards, potential health effects, and radiological characteristics of the S3G and D1G Prototype reactor plants. Appendix D provides classified information on the operating prototypes, MARF and S8G. Section 5.5 provides an unclassified summary of the safety aspects of reactor plant operations, and covers all potential environmental impacts and conclusions discussed in Appendix D.

Hypothetical radiological health effects are expressed in terms of latent fatal cancers. The most significant potential health effect from environmental and occupational radiation exposure is the inducement of latent fatal cancers. This effect is referred to as latent because cancer may take many years to develop. It is important to emphasize that these latent cancer fatalities are estimated results rather than actual expected fatalities. This is because the expected number of such fatalities is so small as to be unmeasurable and indistinguishable relative to the larger number of such deaths expected from naturally occurring conditions and from other man made effects not related to either Kesselring Site operations or to any of the alternatives discussed in the following sections.

Detailed analyses discussed in the appendices support the conclusion that public radiological exposure resulting from any of the reasonable alternatives for disposal of the S3G and D1G Prototype reactor plants would be very small.

NO ACTION ALTERNATIVE

5.1 No Action Alternative

The no action alternative would include maintaining and monitoring the defueled S3G and D1G Prototype reactor plants in place and in a stable condition for a caretaking period of indefinite duration. This alternative involves no prototype reactor plant dismantlement activities and no waste shipments.

Radiological work on contaminated systems or opening of contaminated systems in the reactor compartments would not be expected during the caretaking period. Periodic inspections and radiological surveys would be conducted each year during the caretaking period to confirm the continued integrity of the reactor plant systems and reactor compartment structures. Periodic monitoring would involve radiological surveys, air samples, and radiation monitoring, inside and outside of the reactor compartments.

For the purposes of comparison to the other alternatives, a 30-year time frame was assumed in analyses that evaluate the environmental effects of this alternative. Environmental impacts are discussed below.

5.1.1 Land Use

The no action alternative would not result in any changes to the present or planned use of the Kesselring Site, Federal reservation or surrounding areas. Caretaking activities would be confined to the Kesselring Site which is an already developed area. No land on the Federal reservation and no additional land outside the Federal reservation would have to be set aside for waste disposal. Impacts to existing agricultural, residential, recreational, or industrial land use in the surrounding area would not be expected.

5.1.2 Ecological Resources

There are no woodlands, State or Federally designated wetlands, or significant biological habitats within the Kesselring Site. There have been no documented sightings of Federal or State designated endangered, threatened, or special concern species on the Kesselring Site (Reference 4-5). Since caretaking activities would be confined to the Kesselring Site, ecological resources located on the Federal reservation would not be impacted.

5.1.3 Water Resources

Caretaking activities over an indefinite period would not change existing ground or surface water conditions on the Kesselring Site and Federal reservation. Independent of caretaking activities, monitoring and reporting of water conditions on the Kesselring Site and Federal reservation would continue as discussed in Section 4.3.

The Kesselring Site is located at elevations above the indicated 100-year flood boundary (Reference 4-6). Because caretaking activities would be confined to the Kesselring Site, floodplains that exist on the Federal reservation would not be affected. Since caretaking activities would not take place in a floodplain and would not affect any designated wetlands, caretaking is not a floodplain/wetlands action and the requirements of 10 CFR 1022 are not applicable.

5.1.3.1 Water Resources - Radiological Consequences

Caretaking activities would not result in any discharges of radioactive liquid effluents to the environment. Therefore, impacts to ground water and surface water resources on the Kesselring Site and Federal reservation would not be expected.

5.1.3.2 Water Resources - Nonradiological Consequences

While water usage and nonradiological waste water discharges would be less due to the lower staffing levels, it would be indistinguishable from existing conditions. Therefore, impacts to ground water and surface water resources on the Kesselring Site and Federal reservation would be not be expected. Nonradiological waste water discharges from the Kesselring Site to the Glowegee Creek would continue to be monitored in accordance with the State Pollutant Discharge Elimination System permit, and results would continue to be reported monthly.

5.1.4 Air Resources

Air discharges from the Kesselring Site would be approximately the same as existing conditions. Air discharges would continue to be monitored as discussed in Section 4.4.

5.1.4.1 Air Resources - Radiological Consequences

Airborne particulate radioactivity emissions associated with the no action alternative were evaluated. The details of the analysis are provided in Appendix B, Section B.2. Table B-4 provides the estimated radioactivity that would be discharged per year. Adding the data from Table B-4 for each radionuclide and for each prototype results in an estimated annual airborne discharge of 3.1×10^{-6} curies. The cumulative discharge of all radionuclides over a 30-year caretaking period would be approximately 9.3×10^{-5} curies.

As discussed in Section 4.4.4 and Reference 4-4, the radioactivity contained in exhaust air during 1996 consisted of: (1) less than 0.001 curies of krypton-85 and particulate fission and activation products having half-lives greater than 3 hours; (2) approximately 2.2 curies of noble gases with half-lives of 12 days or less, principally argon-41, xenon-133, and xenon-135; (3) approximately 0.3 curies of tritium; and (4) approximately 1.0 curies of carbon-14. Compared to these airborne discharges associated with normal Kesselring Site operations, which were well below applicable standards, the amount of airborne radioactivity that would be discharged annually during the no action alternative is small (less than 1 percent of existing conditions). Therefore, impacts to air resources would be indistinguishable from existing conditions.

NO ACTION ALTERNATIVE

5.1.4.2 Air Resources - Nonradiological Consequences

Environmental impacts on air resources from nonradiological emissions were evaluated for several sources, including facility heating and vehicle emissions. The S3G Prototype reactor compartment would be heated by electric heaters and would not result in any nonradiological emissions. The D1G Prototype reactor compartment would continue to be heated by steam from the Kesselring Site boilers. Nonradiological emissions from the heating load due to caretaking activities would be approximately the same as existing Kesselring Site emissions. Overall vehicle emissions would be somewhat reduced due to the lower staffing levels. Therefore, impacts to air resources would be indistinguishable from existing conditions.

5.1.5 Terrestrial Resources

Caretaking activities over an indefinite period would not change existing terrestrial conditions on the Kesselring Site and Federal reservation. Caretaking activities would include periodic inspections of the S3G and D1G Prototype reactor compartments and surrounding areas. Independent of caretaking activities, monitoring, reporting and corrective actions on the Kesselring Site and Federal reservation would continue as discussed in Sections 4.5.4 through 4.5.6.

5.1.5.1 Terrestrial Resources - Radiological Consequences

During the caretaking period, the stringent radiological controls practices used in the Naval Reactors Program would continue. Operations would include periodic radiological surveys of the S3G and D1G Prototype reactor compartments and surrounding areas. Surveys would be performed by trained Kesselring Site radiological controls personnel. Impacts to terrestrial resources would not be expected.

5.1.5.2 Terrestrial Resources - Nonradiological Consequences

During the caretaking period, general upkeep and maintenance inspections would be periodically conducted of the S3G and D1G Prototype reactor compartments and surrounding areas. Impacts to terrestrial resources would not be expected.

5.1.6 Socioeconomics

Kesselring Site staffing near the end of 1997 is estimated at approximately 700 civilian personnel (including subcontractors) and 1,000 U.S. Navy personnel. The labor force needed to support caretaking activities at the Kesselring Site is estimated at 1 equivalent full-time worker. The no action alternative would result in a staff reduction of approximately 200 civilian personnel for the caretaking period. While this would be a noticeable reduction of the civilian work force at the Kesselring Site, it would represent only about 0.1 percent of the employment level in the surrounding region (see Table 4-2). Therefore, the no action alternative would not have any discernible socioeconomic impact.

NO ACTION ALTERNATIVE

5.1.7 Cultural Resources

The no action alternative does not involve excavation, construction or demolition activities on the Kesselring Site or on the Federal reservation. Therefore, cultural resources would not be impacted.

5.1.8 Noise, Aesthetic and Scenic Resources

The Kesselring Site is located a minimum of 1.4 kilometers (0.9 miles) from the boundary of the Federal reservation and is fully surrounded by woodlands and low hills. There is very little visibility of the Kesselring Site facilities from public roadways. Like many industrial facilities, there are no resources of scenic or aesthetic value on the Kesselring Site. The no action alternative does not involve excavation, construction or demolition on the Kesselring Site or on the Federal reservation. Noise generation would be indistinguishable from existing levels. Therefore, noise, aesthetic or scenic resources would not be impacted.

5.1.9 Traffic and Transportation

The no action alternative would result in a staff reduction of approximately 200 civilian personnel. As a result, general Kesselring Site employee traffic would be lower. This alternative involves no waste shipments and consequently, no change in the volume of current truck traffic is expected. Therefore, the no action alternative would have a small positive impact on regional and local traffic conditions.

5.1.10 Occupational and Public Health and Safety (Incident-Free)

This section summarizes analytical results for expected incident-free conditions during a nominal 30-year caretaking period for the no action alternative. Detailed analyses of potential impacts on occupational (worker) and public health and safety for facilities activities are presented in Appendix B. There would be no off-site transport of materials associated with this alternative; therefore, the transportation analyses of Appendix C do not apply.

5.1.10.1 Facility Activities - Radiological Consequences

The radiological health risks associated with incident-free facility activities during a 30-year caretaking period were evaluated in Appendix B, Section B.2. Effects from assumed airborne particulate radioactivity releases and exposure to direct radiation were assessed for the worker, maximally exposed off-site individual and the general population. For the workers, analyses were based on radiation survey data from the S3G and D1G Prototype reactor compartments, staffing levels, and time in or near the reactor compartments. For the general population, analyses were based on the cumulative exposure to all members of the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

NO ACTION ALTERNATIVE

The details of the analyses are provided in Appendix B, Section B.2. The health risks from radiation exposure, through various pathways, have been summarized in Appendix B, Table B-7. It is conservatively estimated that radiation workers would receive a collective dose of 22 person-rem (0.0088 risk of single additional latent fatal cancer). On an annual basis, the average risk to radiation workers of a single additional latent fatal cancer would be 4.2×10^{-5}. The general population would receive a collective dose of 9.9×10^{-6} person-rem (5.0×10^{-9} risk of single additional latent fatal cancer) from exposure over 30 years during the caretaking period. On an annual basis, the average risk to an individual in the general population of a single additional latent fatal cancer would be 1.4×10^{-16}.

5.1.10.2 Facility Activities - Nonradiological Consequences

Naval Reactors Program policy is to maintain a safe and healthful environment at all facilities, including the Kesselring Site. Caretaking activities would be limited to maintenance, surveillance and security tours by a small number of personnel. As a result, incident-free nonradiological consequences would be very small.

5.1.11 Facility Accidents

Hypothetical accident scenarios were evaluated to estimate the potential for, and effects of, release of radioactive material and toxic chemicals. Appendix B, Section B.3, provides details of hypothetical facility accidents resulting in the release of radioactive materials to the environment. The results of these analyses are presented in terms of the latent fatal cancers, additional fatalities and health risks to workers and the public. Appendix B, Section B.4, provides analyses of two nonradiological facility accidents, including a diesel fuel fire and a spill of stored chemical products. The results of these analyses are compared to Emergency Response Planning Guideline values for individual workers and the public (maximally exposed off-site individual).

5.1.11.1 Facility Accidents - Radiological Consequences

Several hypothetical accident scenarios that would result in release of radioactivity to the environment were evaluated to determine the long-term health risks. The hypothetical release of airborne radioactivity and exposure to radiation during accident scenarios were assessed for the worker, maximally exposed off-site individual and the general population.

As described in Appendix B, Section B.1.2, accidents were considered if they were expected to contribute substantially to risk. Risk is defined as the product of the probability of occurrence times the consequence of the accident. The four hypothetical accident scenarios evaluated for this Environmental Impact Statement included: (1) a large component drop, (2) mechanical damage of a component due to a wind-driven missile, (3) a high efficiency particulate air filter fire, and (4) a large volume spill of radioactive water. Variables considered in the analyses include airborne particulate radioactivity source terms, population density, meteorological conditions, affected area, and pathways for exposure to radiation (such as external direct exposure and internal exposure from inhalation).

NO ACTION ALTERNATIVE

For the no action alternative, a high efficiency particulate air filter fire and a large volume spill of radioactive water were evaluated in detail. A component drop accident was not evaluated since lifting or handling of large components would not occur during the caretaking period. A wind-driven missile accident was not evaluated in detail since the D1G Hortonsphere and the steel hull of the S3G Prototype reactor compartment would absorb most of the energy from any wind-driven missiles and would prevent a release of radioactive materials to the environment.

The details of the analyses are provided in Appendix B, Sections B.3.3 and B.3.4. As shown in Appendix B, Table B-26, the accident with the greatest risk during caretaking activities would be a high efficiency particulate air filter fire. The combined S3G and D1G cumulative risk for a member of the general population developing a latent fatal cancer due to a high efficiency particulate air filter fire for a 30-year caretaking period would be 1.4×10^{-9}. This risk is the sum of the products of the probability of the accident occurring times the consequence of the accident times the duration of the caretaking period. On an annual basis, the highest individual risk to a member of the general population of a single additional latent fatal cancer would be 4.2×10^{-17}, as shown in Appendix B, Tables B-20 and B-22. These accident risks would be small compared to incident-free radiological impacts.

5.1.11.2 Facility Accidents - Nonradiological Consequences

Caretaking activities would be limited to maintenance, surveillance and security tours by a small number of personnel. Nonradiological occupational accidents, such as slips and falls, could occur during the caretaking period; however, the rate is not expected to be greater than rates for other Naval Reactors Program activities (see Table 4-3). For conservatism, projections of the number of fatalities and injuries/illnesses were estimated based on the U.S. Department of Energy and Contractors rates for all labor categories (see Table 4-3). The estimated number of fatalities and injuries/illnesses are summarized in Table 5-1 and indicate that the overall nonradiological occupational risks would be small.

NO ACTION ALTERNATIVE

Table 5-1: Estimated Nonradiological, Occupational Impacts for No Action

Estimated Kesselring Site Caretaking Staffing Level (equivalent full-time workers)	1
Estimated Average Number of Injuries/Illnesses per Year [a]	0.036
Estimated Number of Fatalities per Year [a]	0.00003
Total Estimated Number of Injuries/Illnesses [b]	1.1
Total Estimated Number of Fatalities [b]	0.0009

a. Calculated by multiplying Kesselring Site staffing level times the U.S. Department of Energy and Contractors rates provided in Table 4-3.
b. Total values calculated for a 30-year caretaking period.

5.1.12 Utilities and Energy

The use of energy and utility resources would be required to support caretaking activities, such as heating and lighting of the reactor compartments. However, this would be a small portion of the overall use of utility and energy resources that are routinely required to support normal Kesselring Site operations. Since this demand would be indistinguishable from existing demand, impacts to utility and energy resources would not be expected.

5.1.13 Hazardous Materials and Waste Management

Caretaking activities over an indefinite period would generate very small volumes of waste. Waste generated would consist mainly of commercial waste, and disposal would be consistent with State and local regulations. Hazardous materials and waste would be managed in accordance with Federal, State and local regulations and the impacts would be very small.

5.1.14 Irreversible and Irretrievable Commitments of Resources

The no action alternative would not involve any irretrievable or irreversible commitments of environmentally sensitive resources. As discussed previously in this section, this alternative would not contribute to any loss of endangered or threatened species, critical habitats, or areas of archeological, historical or cultural value. Demand on consumable resources such as utilities and energy for caretaking of the S3G and D1G Prototype reactor plants would be very small.

NO ACTION ALTERNATIVE

5.1.15 Impact Summary for the No Action Alternative

The distinguishing environmental consequences of this alternative are: (1) a reduction in the Kesselring Site staffing level of about 200 personnel, and (2) this alternative does not provide for the permanent disposal of the S3G and the D1G Prototype reactor plants. The staffing reduction of about 200 people (see Section 5.1.6) would be a noticeable impact on the total Kesselring Site civilian workforce. However, because this reduction represents only about 0.1 percent of the work force in the surrounding region (see Table 4-2), it would have no discernible impact on the unemployment rate. The no action alternative would include maintaining and monitoring the defueled S3G and D1G Prototype reactor plants in place and in a stable condition for an indefinite duration. Due to long half-life radionuclides and hazardous materials remaining in the reactor plants, a permanent disposal decision would be required sometime in the future.

PROMPT DISMANTLEMENT (PREFERRED ALTERNATIVE)

5.2 Prompt Dismantlement (Preferred) Alternative

This alternative would dismantle the S3G and D1G Prototype reactor plants and would recycle or dispose of waste materials. Dismantlement of the defueled S3G and D1G Prototype reactor plants would begin shortly after the Record of Decision is issued.

Dismantlement activities would involve disassembly of all S3G and D1G Prototype reactor plant systems and the reactor compartment structures. Dismantlement activities are estimated to take approximately 2 years for S3G and approximately 3 years for D1G. Dismantlement activities would be conducted in series. However, preliminary sequencing plans indicate that some overlap in S3G and D1G Prototype dismantlement activities schedules would be possible. As a result, dismantlement activities would occur over an estimated 3 to 4-year period. Environmental impacts are discussed below.

5.2.1 Land Use

The prompt dismantlement alternative would not result in any changes to the present or planned use of the Kesselring Site, Federal reservation or surrounding area. Dismantlement activities would be confined to the Kesselring Site which is an already developed area. The areas currently occupied by the S3G and D1G Prototype reactor compartments would continue to be used for Naval Reactors Program work following dismantlement. The D1G Hortonsphere, which houses the D1G Prototype, would remain intact for possible future Naval Reactors Program use, although no future use is planned at this time. No land on the Federal reservation and no additional land outside the Federal reservation would have to be set aside for waste disposal. Impacts to existing agricultural, residential, recreational, or industrial land use in the surrounding area would not be expected.

5.2.2 Ecological Resources

There are no woodlands, State or Federally designated wetlands, or significant biological habitats within the Kesselring Site. There have been no documented sightings of Federal or State designated endangered, threatened, or special concern species on the Kesselring Site (Reference 4-5). Since the dismantlement activities would be confined to the Kesselring Site, ecological resources located on the Federal reservation would not be impacted.

5.2.3 Water Resources

Dismantlement activities would not change existing ground or surface water conditions on the Kesselring Site and Federal reservation. Independent of dismantlement activities, monitoring and reporting of water conditions on the Kesselring Site and Federal reservation would continue as discussed in Section 4.3.

The Kesselring Site is located at elevations above the indicated 100-year flood boundary (Reference 4-6). Because dismantlement activities would be confined to the Kesselring Site, floodplains that exist on the Federal reservation would not be affected. Since dismantlement activities would not take place in a floodplain and would not affect any designated wetlands, dismantlement is not a floodplain/wetlands action and the requirements of 10 CFR 1022 are not applicable.

5.2.3.1 Water Resources - Radiological Consequences

Prompt dismantlement activities would not result in any discharges of radioactive liquid effluents to the environment. Therefore, impacts to ground water and surface water resources on the Kesselring Site and Federal reservation would not be expected.

5.2.3.2 Water Resources - Nonradiological Consequences

Water usage and nonradiological waste water discharges during dismantlement activities would be approximately the same as existing conditions. Therefore, impacts to ground water and surface water resources on the Kesselring Site and Federal reservation would not be expected. Nonradiological waste water discharges from the Kesselring Site to the Glowegee Creek would continue to be monitored in accordance with the State Pollutant Discharge Elimination System permit, and results would continue to be reported monthly. New permits or modifications to existing permits are not expected to be required. After completion of dismantlement activities, water usage would be less due to lower staffing levels.

5.2.4 Air Resources

Air discharges from the Kesselring Site would be approximately the same as existing conditions. Air discharges would continue to be monitored as discussed in Section 4.4.

5.2.4.1 Air Resources - Radiological Consequences

Dismantlement activities on radiologically contaminated piping and components would be performed using: (1) existing radiological ventilation facilities, and (2) environmental protection measures to minimize the emission of particulate radioactivity to air as discussed in Appendix A, Section A.3.3. High efficiency particulate air filters, which have a greater than 99.95 percent efficiency for removal of airborne particulate radioactivity, would be used. The resulting airborne particulate radioactivity emissions associated with incident-free prompt dismantlement activities were evaluated. The details of the analysis are provided in Appendix B, Section B.2. Table B-4 provides the estimated radioactivity that would be discharged per year. Adding the data from Table B-4 for each radionuclide and for each prototype results in an estimated annual airborne discharge of 1.9×10^{-5} curies. Based on dismantlement periods of 2 years for S3G and 2¾ years for D1G, the cumulative discharge of all radionuclides during dismantlement activities would be approximately 4.6×10^{-5} curies.

As discussed in Section 4.4.4 and Reference 4-4, the radioactivity contained in exhaust air during 1996 consisted of: (1) less than 0.001 curies of krypton-85 and particulate fission and activation products having half-lives greater than 3 hours; (2) approximately 2.2 curies of noble gases with half-lives of 12 days or less, principally argon-41, xenon-133, and

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xenon-135; (3) approximately 0.3 curies of tritium; and (4) approximately 1.0 curies of carbon-14. Compared to these airborne discharges associated with normal Kesselring Site operations, which were well below applicable standards, the amount of airborne radioactivity that would be discharged annually during the prompt dismantlement alternative is small (less than 1 percent of existing conditions). Therefore, impacts to air resources would be indistinguishable from existing conditions.

Airborne emissions from dismantlement activities have been further evaluated as a modification to an existing source of airborne radionuclides in accordance with U.S. Environmental Protection Agency (EPA) regulations contained in 40 CFR Part 61, Subparts A (General Provisions) and H (National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities). Using the conservative EPA calculation methods and based on existing dismantlement work methods, no application submittals to the EPA are required. However, since it is anticipated that plasma arc cutting of radiologically contaminated materials would be introduced as a prompt dismantlement work method, a modification to the National Emission Standards for Hazardous Air Pollutants radionuclide emissions from the Kesselring Site would be required. This modification would require EPA approval. Evaluation of the plasma arc work method at other sites indicates that there would be no significant environmental impacts from additional radioactivity emissions due to plasma arc cutting.

5.2.4.2 Air Resources - Nonradiological Consequences

Environmental impacts on air resources from nonradiological emissions were evaluated for several sources, including facility heating and vehicle emissions. The S3G Prototype reactor compartment would be heated by electric heaters and would not result in any nonradiological air emissions. The D1G Prototype reactor compartment would continue to be heated by steam from the Kesselring Site boilers. Nonradiological emissions from the heating load due to dismantlement activities would be approximately the same as existing Site emissions.

As discussed in Section 4.4.3, the Hudson Valley Intrastate Air Quality Control Region, which includes Saratoga County and the Kesselring Site, is in a marginal nonattainment area for ozone (due to volatile organic compounds or nitrogen oxides). Nonattainment areas exist where sources of pollution lead to air quality that fails to meet State and Federal ambient air quality standards. The analysis of impacts on air quality associated with dismantlement activities evaluated the conformity requirements of the State Implementation Plan that apply to volatile organic compounds and nitrogen oxides in the nonattainment area. Analyses indicate that dismantlement activities would result in an estimated emission of 1.8 metric tons (2 tons) per year of volatile organic compounds and 8.2 metric tons (9 tons) per year of nitrogen oxides. These estimates fall below the criteria that would require a conformity determination in a nonattainment area, 45 metric tons (50 tons) per year for volatile organic compounds and 91 metric tons (100 tons) per year for nitrogen oxides. Therefore, no additional limitations on air emissions would be expected.

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Prompt dismantlement activities would include cutting, handling and removal of systems and structures. The presence of materials such as asbestos insulation, lead shielding, and paint containing lead, chromium or polychlorinated biphenyls introduce the potential for small emissions of regulated air pollutants from these activities. Such emissions would be maintained below State and Federal limits through the use of engineered controls. Furthermore, these emissions would be transitory and, based on Naval Reactors Program experience, are not expected to result in the classification of the Kesselring Site under the Clean Air Act as a major source of air pollutants.

Nonradiological consequences of vehicle emissions from transport of dismantlement wastes and recyclable materials off-site is discussed in Sections 5.2.10 and 5.2.11. The overall discharge of nonradiological air pollutants from prompt dismantlement activities would be very small and impacts on air resources would be indistinguishable from existing conditions. New permits or modifications to existing permits are not expected to be required.

5.2.5 Terrestrial Resources

Prompt dismantlement of the S3G and D1G Prototype reactor plants would not change existing terrestrial conditions on the Kesselring Site or on the surrounding Federal reservation. Excavation work in support of reactor plant dismantlement activities would be confined to the Kesselring Site. Excavation work would be in small localized areas and limited in depth to a few feet. No liquids or solids would be disposed of on the Kesselring Site or on the Federal reservation. Independent of dismantlement activities, monitoring, reporting and corrective actions would continue, as discussed in Sections 4.5.4 through 4.5.6.

5.2.5.1 Terrestrial Resources - Radiological Consequences

Dismantlement activities would be conducted in accordance with the stringent radiological control practices used in the Naval Reactors Program (see Appendix A, Section A.3.3, and Reference 4-22). All radioactive materials would be recycled or disposed of off-site. Following dismantlement activities, radiological surveys would be conducted of the areas surrounding the former S3G and D1G Prototype reactor compartments. Surveys would be performed by trained Kesselring Site radiological controls personnel. Impacts to terrestrial resources would not be expected.

5.2.5.2 Terrestrial Resources - Nonradiological Consequences

Dismantlement activities would be conducted using proven methods such as machine cutting of piping, grinding, sawing, flame cutting and plasma arc cutting. All materials would be recycled or disposed of off-site. Following dismantlement activities, hazardous material surveys would be conducted, as necessary, of the areas surrounding the former S3G and D1G Prototype reactor compartments. Dismantlement of the S3G and D1G Prototype reactor plants is not expected to result in the identification of additional RCRA solid waste management units (see Section 4.5.4.2 for a discussion of existing solid waste management units). Impacts to terrestrial resources would not be expected.

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5.2.6 Socioeconomics

Kesselring Site staffing near the end of 1997 is estimated at approximately 700 civilian personnel (including subcontractors) and 1,000 U.S. Navy personnel. Approximately 200 personnel would be required for about 3 to 4 years to accomplish S3G and D1G Prototype reactor plant dismantlements. Under this alternative, no change in Kesselring Site staffing would be required until the completion of dismantlement activities, at which time a reduction in work force of approximately 200 civilian personnel would occur. While this would be a noticeable reduction of the civilian work force at the Kesselring Site, it would represent only about 0.1 percent of the employment level in the surrounding region (see Table 4-2). Therefore, the prompt dismantlement alternative would not have any discernible socioeconomic impact.

5.2.7 Cultural Resources

Based on past construction activities, no objects or structures of historic, archaeological or cultural significance have been identified on the Kesselring Site. The Naval Reactors Program does not consider the S3G and D1G Prototypes to have any historical significance. Neither prototype was the first land-based prototype; both prototypes are merely part of the many land-based prototypes that were built and operated by the Naval Reactors Program. Each prototype had an operating follow ship: S3G was the prototype for a single U.S. Navy submarine, the USS Triton (SSN 586), and D1G was the prototype for a single U.S. Navy surface ship, the USS Bainbridge (CGN 25). The U.S. Navy has decommissioned and defueled both of these operating ships.

The D1G Hortonsphere, which houses the D1G Prototype and has potential historical significance, would remain intact and would not be impacted by any of the D1G Prototype dismantlement activities. After completion of D1G Prototype reactor plant dismantlement, the Hortonsphere would be available for possible future Naval Reactors Program use, although no future use is planned at this time.

The Naval Reactors Program has reviewed with State, county, and local historians effects of actions associated with the alternatives under evaluation on historical, archaeological, or cultural resources in the area. The New York State Historic Preservation Field Service Bureau has concluded that these actions would have no effect upon cultural resources eligible for inclusion in the National Register of Historic Places (Reference 5-2). The Saratoga County Historian and the Town of Galway Historian have also concluded that these actions would not have any impact on historical, archeological or cultural resources in the area (References 5-3 and 5-4). The Town of Milton Historian considers the area of the Federal reservation to be of historical significance based on the development of the Kesselring Site, the presence of three small burial plots located on the reservation, and the likely presence of Native American and pioneer artifacts within the reservation. Additionally, the Town of Milton Historian requested a continuing dialogue during the decision making process for the dismantlement of the S3G and D1G Prototype reactor plants (Reference 5-7). The Naval Reactors Program will coordinate with the Town of Milton Historian as the process proceeds.

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Based on the reviews by the historians and because dismantlement activities would be confined to only the S3G and D1G Prototypes on the developed area of the Kesselring Site as discussed above, cultural resources would not be impacted.

5.2.8 Noise, Aesthetic and Scenic Resources

Dismantlement activities would be confined to the Kesselring Site. The Kesselring Site is located a minimum of 1.4 kilometers (0.9 miles) from the boundary of the Federal reservation and is fully surrounded by woodlands and low hills. There is very little visibility of the Kesselring Site facilities from public roadways. Like many industrial facilities, there are no resources of scenic or aesthetic value on the Kesselring Site.

As an industrial facility, the Kesselring Site is characterized by noise from truck and automobile traffic, operating industrial equipment such as diesel-powered engines, air-operated jackhammers, and other similar equipment. This noise is generally not discernible beyond the Federal reservation boundary. Dismantlement activities would not result in a noticeable increase in existing noise levels in occupied areas surrounding the Federal reservation. Therefore, noise, aesthetic or scenic resources would be not be impacted.

5.2.9 Traffic and Transportation

Traffic related to dismantlement activities would include commuting personnel, equipment mobilization and recyclable material and waste shipments. During dismantlement activities, staff levels, and consequently general Kesselring Site employee traffic, would remain at current levels. After completion of the dismantlement activities, employee traffic would be lower and this would have a small positive impact on regional and local traffic conditions.

Truck shipments associated with dismantlement activities have been estimated and analyzed in Appendix C. Truck shipments annually represent less than 5 percent of existing radiological and nonradiological shipments and would not be noticeably greater than that which currently exists in support of normal Kesselring Site operations. The largest shipments by weight and radioactive content would be the two reactor pressure vessels. Transport of each reactor pressure vessel package from the Kesselring Site to the Delaware and Hudson railroad terminus, approximately 13 kilometers (8 miles) southeast of the Kesselring Site, would affect local traffic for a short period during one day, principally on less traveled secondary roads. Transport of each of the reactor pressure vessel packages by heavy hauler would be planned for times that minimize such impacts. Highway shipments of packages of similar size to the reactor pressure vessel packages have occurred between the Kesselring Site and the Delaware and Hudson railroad terminus in the past. Based on past experience with these shipments, local police escorts would direct traffic to minimize congestion. The reactor pressure vessel packages would then be transported by railroad to the U.S. Department of Energy Savannah River Site in South Carolina for disposal.

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In addition to the two reactor pressure vessels, the S3G Prototype reactor plant primary shield tank may be shipped by rail as a single large package. Other components, such as steam generators and pressurizers, and miscellaneous recyclable material and waste would be shipped by truck to the Savannah River Site or to a commercial recycling facility to reduce the volume of disposed waste.

Prompt dismantlement of the S3G and D1G Prototype reactor plants would have no discernible impact on existing regional and local traffic conditions.

5.2.10 Occupational and Public Health and Safety (Incident-Free)

This section summarizes analysis results for expected incident-free conditions during prompt dismantlement. Detailed analyses of potential impacts from facility and transportation activities are presented in Appendices B and C, respectively.

5.2.10.1 Facility Activities - Radiological Consequences

The radiological health risks associated with incident-free facility activities during prompt dismantlement are evaluated in Appendix B, Section B.2. Effects from assumed airborne particulate radioactivity releases and direct radiation exposure were assessed for the worker, maximally exposed off-site individual, and the general population. Gamma radiation from cobalt-60 contained within the reactor plant systems is the primary source of direct radiation exposure. For the workers, analyses were based on radiation survey data from the S3G and D1G Prototype reactor compartments, staffing levels, and time in or near the reactor compartments. For the general population, analyses were based on the cumulative exposure to all members of the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

The health risks from radiation exposure, through various pathways, have been summarized in Table B-7. It is estimated that the radiation workers would receive a total of 205 to 460 person-rem (0.082 risk of a single additional latent fatal cancer) during prompt dismantlement. The larger value of the range represents an estimate based on preliminary plans. The lower value of the range reflects experience that detailed work planning typically results in additional exposure reductions. The annual occupational radiation exposure from prompt dismantlement would be comparable in magnitude to the radiation exposure routinely received during operation and maintenance of Naval nuclear reactor plants. In addition, each individual worker's exposure would be limited to 2 rem per year even though Federal limits allow exposure up to 5 rem per year. On an annual basis, the average risk to radiation workers of a single additional latent fatal cancer would be 0.00058. The general population would receive an estimated total of 8.6×10^{-6} person-rem (4.4×10^{-9} risk of single additional latent fatal cancer) from radiation exposure during prompt dismantlement. On an annual basis, the average risk to an individual in the general population of a single additional latent fatal cancer would be 1.6×10^{-15}.

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5.2.10.2 Facility Activities - Nonradiological Consequences

Naval Reactors Program policy is to maintain a safe and healthful environment at all facilities, including the Kesselring Site. Work practices are designed to minimize exposure to physical and chemical hazards. Employees are routinely monitored during work for exposure to such hazards and, when appropriate, are placed into medical surveillance programs. Dismantlement evolutions requiring the use of specialized equipment or the handling of hazardous materials would only be performed by trained personnel. Personnel exposure to hazardous materials would be minimized through the use of engineered controls, protective clothing, respiratory protection, enclosed containment tents and filtered ventilation. These controls would also ensure protection of the environment within applicable limits. Occupational nonradiological effects from reactor plant dismantlement work would be very small.

5.2.10.3 Transportation Analyses

Transportation evaluations in Appendix C assumed all shipments originate at the Kesselring Site. The analyses assumed that 50 shipments of nonradioactive materials would be recycled or disposed of at facilities located within New York State. The analyses assumed that 60 radioactive material shipments would be made from the Kesselring Site. The reactor pressure vessels would be shipped by heavy hauler to the Delaware and Hudson railroad terminus in Ballston Spa, and the rest of the trip to the disposal site would be made by rail. The S3G primary shield tank may also be shipped by rail. Although estimated impacts from both truck and rail shipments of the S3G Prototype primary shield tank are very small, rail shipments have lower impacts than truck shipments. Therefore, for the purposes of conservatism, the analysis results provided include the S3G Prototype primary shield tank as a truck shipment. Analyses assumed that the remaining shipments would be made by truck.

In the transportation analyses, two U.S. Department of Energy destinations were analyzed for shipments of low-level radioactive materials: the Savannah River Site in South Carolina and the Hanford Site in Washington State. The analyses included additional general assumptions to keep the meaning of the results simple and conservative. For example, the Savannah River Site and the Hanford Site were examined individually as the destination for all radioactive shipments. The Savannah River Site represents a reasonable close location for transportation analyses, and the Hanford Site represents a reasonable but more distant location. Combinations of shipping destinations, including available recycling facility locations for radioactive materials, are not examined. This is a conservative simplification because the total mileage of any combination of available destinations would be less than the total mileage of all shipments going cross-country to the Hanford Site. As a result, the estimated risks that are presented in this chapter are for the Hanford Site.

For certain large quantities of low-level radioactive materials, such as highway route-controlled quantities defined in 49 CFR §173.403, U.S. Department of Transportation regulations require the carrier to operate only on preferred routes. These include routes that have been designated by the appropriate state routing agency, as discussed in 49 CFR

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§397.101. Due to their radioactivity content, the two reactor pressure vessel shipments would be considered highway route controlled and would require the use of a New York State preferred route. Because of their oversize dimensions and weight, which would require New York State Department of Transportation issued permits, the two reactor pressure vessel packages would likely be transported over the same route between the Kesselring Site and the railroad terminus in Ballston Spa that has been used for past shipments of similar size and weight. For all other shipments with smaller quantities of low-level radioactive materials, the regulations do not designate which routes the carrier should follow. Other than the reactor pressure vessels, all other shipments of low-level radioactive materials from S3G and D1G Prototype reactor plant dismantlement would be less than highway route controlled quantities, and the carrier would determine the specific routing of the shipments. Because there are no specific regulations governing the routing for low-level radioactive material shipments made by rail, the rail carrier would select the routing for rail shipments from the railroad terminus.

Actual disposal of dismantlement materials would utilize multiple shipping destinations with emphasis on recycling as much material as practical. The topic of waste management and recycling is discussed in more detail in Section 5.2.13.

5.2.10.3.1 Transportation - Radiological Consequences

Gamma radiation from cobalt-60 contained within reactor components is the primary source of direct radiation exposure from the low-level radioactive recyclable material and waste shipments. All low-level radioactive recyclable material and waste shipments would be packaged to meet U.S. Department of Transportation standards for packaging integrity and dose rate limits.

The potential radiological health risks associated with incident-free transportation of reactor plant components were evaluated using the RADTRAN 4 computer code, an accepted industry predictive tool. Health effects were assessed for the general population, transportation crew, maximally exposed individual in the general population, and the maximally exposed individual in the transportation crew. Details on the technical approach for assessing incident-free radioactive shipments are provided in Appendix C, Section C.3. Computer model variables and assumptions are provided in Appendix C, Section C.4.

The health risks for shipments to the Hanford Site are summarized in Appendix C, Table C-13. However, the radiological health risks would still be very small. For shipment of low-level radiological waste from the Kesselring Site to the Hanford Site, analyses indicate the transportation crew would receive 6.8 person-rem (0.0027 risk of a single additional latent fatal cancer). On an annual basis, the average per person dose to the transportation crew would be 1.7 rem (0.00068 risk of a single additional latent fatal cancer). The general population would receive 5.4 person-rem (0.0027 risk of a single additional latent fatal cancer). On an annual basis, the average per person dose to the general population would be 2.9×10^{-6} rem (1.5×10^{-9} risk of a single additional latent fatal cancer).

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These results represent conservative estimates of the radiological consequences of incident-free transportation. Based on past experiences, the estimated radiation exposures are higher than actual radiation exposures from typical Naval Reactors Program low-level radioactive waste shipments.

5.2.10.3.2 Transportation - Nonradiological Consequences

The nonradiological health risks associated with incident-free transportation of recyclable material and waste were evaluated based on methods developed at Sandia National Laboratory. Nonradiological health risks for incident-free transportation would result from vehicle exhaust emissions (air pollutants). Health effects were assessed for the general population. The radiological shipment evaluations considered shipment to the U.S. Department of Energy Savannah River and Hanford disposal sites. For nonradiological shipments, the final destination can vary depending on the waste hauler. For the purposes of analyses, the nonradiological shipment evaluations conservatively assumed shipment to the southern part of New York State because of the higher population density.

Incident-free transportation analyses of nonradiological risks are discussed in detail in Appendix C, Section C.2. The nonradiological health risks (due primarily to vehicle exhaust emissions) are presented in Appendix C, Tables C-3 and C-13. Adding the nonradiological health risks for all waste shipments from the Kesselring Site results in a fatality risk to the general population of 0.0018. On an annual basis, the average per person fatality risk to a member of the general population would be 8.1×10^{-10} (the sum of 6.4×10^{-10} from Table C-3 and 1.7×10^{-10} from Table C-13). These risks would be small and would be within a factor of two of the radiological health risks discussed in Section 5.2.10.3.1 for radiological consequences.

5.2.11 Facility and Transportation Accidents

Hypothetical accident scenarios were evaluated to estimate the potential for, and effects of, release of radioactive material and toxic chemicals. Appendix B, Section B.3, provides details of hypothetical facility accidents resulting in the release of radioactive materials to the environment. Appendix C, Section C.5, describes the technical approach for assessing radioactive shipment accidents. The results of these analyses are presented in terms of latent fatal cancers and health risks to dismantlement workers and the public. Appendix B, Section B.4, provides analyses of two nonradiological facility accidents, including a diesel fuel fire and a spill of stored chemical products. The results of these analyses are compared to Emergency Response Planning Guideline values for individual workers and the public (maximally exposed off-site individual).

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5.2.11.1 Facility Accidents - Radiological Consequences

Several hypothetical accident scenarios that would result in release of radioactivity to the environment were evaluated to determine the long-term health risks. The hypothetical release of airborne particulate radioactivity and exposure to radiation during accident scenarios were assessed for the worker, maximally exposed off-site individual and the general population.

As described in Appendix B, Section B.1.2, accidents were considered if they were expected to contribute substantially to risk. Risk is defined as the product of the probability of occurrence times the consequence of the accident. The four hypothetical accident scenarios evaluated for the dismantlement activities included: (1) a large component drop, (2) mechanical damage of a component due to a wind-driven missile, (3) a high efficiency particulate air filter fire, and (4) a large volume spill of radioactive water. Variables considered in the analyses include airborne particulate radioactivity source terms, population density, meteorological conditions, affected area, and pathways for exposure to radiation (such as external direct exposure and internal exposure from inhalation).

The details of the analyses are provided in Appendix B, Section B.3. As shown in Appendix B, Table B-26, the accident with the greatest risk during dismantlement activities would be a component drop accident. The combined S3G and D1G cumulative risk for a member of the general population developing a latent fatal cancer due to a component drop accident over the duration of prompt dismantlement would be 1.9×10^{-7}. This risk is the sum of the products of the probability of the accident occurring times the consequence of the accident times the duration of the dismantlement period (2 years and 2¾ years for S3G and D1G, respectively). On an annual basis, the highest individual risk to a member of the general population of a single additional latent fatal cancer would be 5.2×10^{-14}, as shown in Appendix B, Tables B-10 and B-12. These accident risks would be small compared to incident-free radiological impacts due to the low probability of a component drop accident occurring.

5.2.11.2 Facility Accidents - Nonradiological Consequences

For the purpose of comparison with other risks associated with dismantlement and caretaking activities, Appendix B, Section B.4, provides analysis of two nonradiological facility accidents. These accident scenarios include a spill of approximately 750 liters (200 gallons) of stored chemical products, and a fire involving approximately 1,040 liters (275 gallons) of diesel fuel. Typical products that would be stored to support dismantlement activities include various adhesives, strippers, solvents, and lubricants. A hypothetical accident scenario involving a fire in a temporary hazardous waste container storage area was considered but eliminated from detailed analysis since the volume of stored hazardous waste from dismantlement activities is expected to be small.

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The airborne concentrations from the chemical spill and the combustion products resulting from the diesel fuel fire were evaluated with respect to the maximally exposed off-site individual and the on-site individual worker. The toxic chemicals that were assumed for the chemical spill include acetone, ethyl alcohol, formic acid, methyl alcohol, methyl ethyl ketone, mineral spirits, n-butyl alcohol, and toluene. The toxic chemicals that would be generated from combustion of diesel fuel include carbon monoxide, oxides of nitrogen (90 percent nitric oxide and 10 percent nitrogen dioxide), and sulfur dioxide.

The estimated airborne chemical concentrations were compared against the Emergency Response Planning Guidelines (ERPG) level 1, 2, and 3 concentration limits or alternates to determine the health impacts (References 5-5 and B-16). The analysis results indicate that all toxic chemical concentrations were at or below ERPG level 1 values for the maximally exposed off-site individual (Tables B-27 and B-28). For the on-site individual worker, toxic chemical concentrations may exceed the ERPG level 2 and ERPG level 3 values. However, in the event of a chemical spill or an accidental fire, actual toxic chemical exposures would be much less due to the mitigative measures that would be implemented as part of Kesselring Site safety procedures.

Nonradiological occupational accidents, such as slips and falls, could occur during the dismantlement activities; however, the rate is not expected to be greater than rates for other Naval Reactors Program activities (see Table 4-3). For conservatism, projections of the number of fatalities and injuries/illnesses were estimated based on the U.S. Department of Energy and Contractors rates for all labor categories (see Table 4-3). The estimated number of fatalities and injuries/illnesses are summarized in Table 5-2 and indicate that the overall nonradiological occupational risks would be small.

Table 5-2: Estimated Nonradiological, Occupational Impacts for Prompt Dismantlement

Estimated Kesselring Site Dismantlement Staffing Level (equivalent full-time workers)	200
Estimated Average Number of Injuries/Illnesses per Year [a]	7.2
Estimated Number of Fatalities per Year [a]	0.006
Total Estimated Number of Injuries/Illnesses [b]	25
Total Estimated Number of Fatalities [b]	0.021

a. Calculated by multiplying Kesselring Site dismantlement staffing level times the U.S. Department of Energy and Contractors rates provided in Table 4-3.

b. Total values calculated for a 3½-year duration of prompt dismantlement.

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5.2.11.3 Transportation Accidents

There has never been a major accident nor measurable release of radioactivity to the environment during shipment of Naval Reactors Program waste or materials. However, hypothetical transportation accidents were evaluated to determine potential environmental effects.

5.2.11.3.1 Transportation Accidents - Radiological Consequences

Appendix C, Section C.5, provides the technical approach used for assessing the consequences of hypothetical radioactive shipment accidents. Health effects were assessed for the general population and the maximally exposed individual. Analyses assumed that the transportation workers would evacuate the scene of an accident within a relatively short time after the accident occurred. Therefore, the risks associated with transportation accidents for transportation workers are included in the results for the general population. Risk calculations conservatively assume that the general population would not be evacuated.

Radiological health risks from releases of radioactivity to the environment and direct radiation exposure from damaged packages were evaluated using the RADTRAN 4 and RISKIND computer codes, both accepted industry predictive tools. Variables considered in the analyses include affected areas, pathways for exposure to radiation (such as external direct exposure and internal exposure from inhalation), weather conditions, and package release fractions. The major contributor to radiation exposure would be from the ground contamination pathway (more than 90 percent of total exposure).

The health risks associated with transportation accidents for shipments from the Kesselring Site to the Hanford Site for prompt dismantlement are summarized in Appendix C, Table C-17. Analyses indicate that the general population would receive 0.0027 person-rem (1.4×10^{-6} risk of single additional latent fatal cancer) in this scenario. On an annual basis, the per person risk to the general population of a single additional latent fatal cancer would be 3.1×10^{-12}.

When compared to the radiological health risks associated with incident-free radioactive waste shipments (see Section 5.2.10.3.1) the risks of hypothetical accidents are less. This is due to the very low probability of a severe accident occurring.

5.2.11.3.2 Transportation Accidents - Nonradiological Consequences

There would be no long-term environmental consequences from an accident in which a waste package containing hazardous or toxic materials is breached. Hazardous or toxic constituents such as polychlorinated biphenyls, lead, and chromium would be in a solid (insoluble) state. Asbestos, if present, could be disturbed in an accident. The Naval Reactors Program would ensure recovery, as necessary, of any spilled hazardous or toxic materials as part of the accident recovery action.

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The nonradiological health risks associated with transportation accidents resulting from the shipment of nonradiological and radiological materials are summarized in Appendix C, Tables C-4 and C-17. Analyses indicate that the estimated risk of an additional fatality from nonradiological and radiological shipments would be 0.0014 and 0.03, respectively. While these nonradiological health risks would be small, the risks would be higher than the radiological health risks from transportation accidents associated with the shipment of radiological materials (see Section 5.2.11.3.1).

5.2.12 Utilities and Energy

The use of energy and utility resources would be required to support dismantlement activities, such as heating, lighting, ventilation and dismantlement of the reactor compartments. However, this would be a small portion of the overall use of utility and energy resources that are routinely required to support normal Kesselring Site operations. Since this demand would be indistinguishable from existing conditions, impacts to utility and energy resources would not be expected.

5.2.13 Hazardous Materials and Waste Management

The S3G and D1G Prototype reactor plants are small in comparison to commercial reactor plants. The total volume and weight of both intact reactor compartments are approximately 1,200 cubic meters (41,000 cubic feet) and 1,400 metric tons (1,540 tons). Even though the S3G and D1G Prototype reactor plants are small, emphasis would still be placed on recycling as much material as practical. The following sections describe the various waste streams that would be generated as a result of dismantlement activities. Dismantlement of the S3G and D1G Prototype reactor plants is not expected to result in the identification of additional RCRA solid waste management units (see Section 4.5.4.2 for a discussion of existing solid waste management units). The amounts of hazardous materials and waste generated as a result of dismantlement activities are expected to be small and are not expected to have any significant impact on the environment.

5.2.13.1 Hazardous Materials Contained in the S3G and D1G Prototype Reactor Plants

The S3G and D1G Prototype reactor plants contain several types of hazardous materials, such as lead, chromium, cadmium, and silver. The hazardous material with the largest volume is lead. Most of the lead is encased within welded steel sheets. The encased lead is permanently installed as radiation shielding in the form of panels. The lead is encased in the panels either as layered sheets, bricks or poured in place. The S3G and D1G Prototype reactor plant dismantlement would generate approximately 45 cubic meters (1,600 cubic feet) of elemental lead weighing more than 450 metric tons (500 tons) that would require recycling or disposal. Lead that can be released from radiological controls would be recycled; other lead, containing radioactive impurities or surface contamination, would be treated in accordance with the Site Treatment Plan (see Section 5.2.13.2.3 and Reference 2-2).

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Typical of piping systems constructed before the mid-1970s, some items in the D1G Prototype reactor plant remain insulated with asbestos-containing materials. Thermal insulation that contains asbestos is installed on the steam generators, pressurizers and some piping. Essentially all of the asbestos-containing insulation has been removed from the S3G Prototype reactor plant. Miscellaneous items in the S3G and D1G Prototype reactor plants may also include asbestos-containing materials, such as electrical cable insulation, small components in electrical equipment, and gaskets in mechanical systems. In addition, PCBs are regulated as hazardous by New York State and are discussed in Section 5.2.13.2.4.

5.2.13.2 Waste Streams and Recycling

In order to minimize the volume of wastes generated from dismantlement activities and to minimize the costs associated with waste disposal, segregation of materials would occur. Segregation is a process of identifying and separating materials into different disposal categories, known as waste streams. To ensure the proper segregation and management of waste streams generated, preplanning would include the identification of hazardous materials through review of design and material specifications. Where necessary, sampling and analysis prior to dismantlement would also be done. Dismantlement activities would generate the following segregated waste streams:

- recyclable materials and volume reduction,
- low-level radioactive wastes,
- low-level radioactive and hazardous (mixed) wastes,
- polychlorinated biphenyl (PCB)-containing wastes,
- hazardous wastes, and
- nonhazardous and nonradioactive wastes.

5.2.13.2.1 Recyclable Materials and Volume Reduction

Waste minimization would be achieved through recycling and volume reduction services (such as metal smelting and compacting). Emphasis would be placed on recycling as much material as practical. Segregating radioactive and hazardous or toxic materials increases the options for recycling. Most of the recyclable materials generated from dismantlement activities would be metals such as carbon steel from the hull and deckplate structures, corrosion resisting metals from reactor plant systems, and lead shielding. These materials would be recycled using various commercial vendors. One existing business in Tennessee recycles low-level radioactive metals by melting them into shield blocks which are then provided to the U.S. Department of Energy for reuse in high energy physics applications. Other commercial enterprises are also starting to enter the radioactive metal recycling field with alternate recycling uses.

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Low-level radioactive materials from the S3G and D1G Prototype reactor plants that could be recycled include piping, valves, components and carbon steel structural materials. Low-level radioactive materials would be candidates for recycling if the radioactivity concentration is less than 0.002 microcuries per gram. In general, components with radiation levels that measure less than 0.02 rem per hour on contact would meet the radioactivity concentration criteria for recycling.

Radioactive components that exceed the criteria for recycling could still be candidates for volume reduction if their radiation levels measure less than 0.2 rem per hour on contact. Similar to recycling, S3G and D1G Prototype reactor plant materials that would be candidates for volume reduction include piping, valves and large components. Volume reduction savings vary widely depending on component and material construction.

5.2.13.2.2 Low-Level Radioactive Wastes

Other than recyclable materials, the largest waste stream, based on weight and volume, would be low-level radioactive wastes. Low-level radioactive wastes, consisting only of solid, nonhazardous material, would be disposed of at a U.S. Department of Energy disposal facility. The U.S. Department of Energy Savannah River Site in Aiken, South Carolina currently receives low-level radioactive wastes from Naval Reactors Program sites in the eastern United States. The U.S. Department of Energy Hanford Site in Washington State is also available for disposal of low-level radioactive wastes generated by Naval Reactors Program activities.

Compared to commercial reactor plants, the S3G and D1G Prototype reactor plants are small. The volume of the intact S3G Prototype reactor plant is approximately 680 cubic meters (24,000 cubic feet) and the volume of the intact D1G Prototype reactor plant is approximately 480 cubic meters (17,000 cubic feet). The combined volume of the intact reactor plants is approximately 1,200 cubic meters (41,000 cubic feet). Dismantlement of the S3G and D1G Prototype reactor plants would result in approximately 60 shipments of low-level radioactive materials. Based on the package volumes defined in Appendix C, Table C-6, the volume of low-level radioactive materials to be shipped from the Kesselring Site would be approximately 1,500 cubic meters (53,000 cubic feet). This is a highly conservative estimate that represents more than the combined volume of the intact reactor plants. After completion of all segregation, recycling, volume reduction processing, and efficient packaging of materials, S3G and D1G Prototype reactor plant dismantlement would generate approximately 450 cubic meters (16,000 cubic feet) of low-level radioactive wastes that would require disposal at a U.S. Department of Energy disposal site. In comparison, decommissioning of the Shippingport pressurized water reactor plant (a small plant by commercial standards) produced approximately 6,100 cubic meters (220,000 cubic feet) of low-level radioactive wastes that weighed approximately 3,800 metric tons (4,200 tons).

About 20 percent of the low-level radioactive waste volume, is due to the two reactor pressure vessels. Other low-level radioactive wastes would include the reactor coolant pumps, residuals from recycled material, volume reduced nonrecycled materials, and miscellaneous low-level wastes unsuitable for recycling or volume reduction.

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Some items in the S3G and D1G Prototype reactor plants contain asbestos bearing materials. Examples of these materials include thermal insulation installed before the mid-1970s, electrical cable insulation, small components in electrical equipment and gaskets in mechanical systems and components. Asbestos-bearing materials that cannot be released from radiological controls would be encapsulated and disposed of as low-level radioactive waste.

The U.S. Department of Energy Savannah River Site has established radioactivity concentration limits for acceptance of waste based upon site specific analysis. In addition, the Savannah River Site Waste Acceptance Criteria prohibits acceptance of waste exceeding the U.S. Nuclear Regulatory Commission Class C limits as defined by 10 CFR Part 61 (Licensing Requirements for Land Disposal of Radioactive Waste). Of the total radioactivity remaining in the S3G and D1G Prototype reactor plants listed in Appendix A, Tables A-2 and A-3, respectively, more than 95 percent would be in the two packages that contain the reactor pressure vessels and their internal structures. These packages would be within the limits of the Savannah River Site Waste Acceptance Criteria and would be within the U.S. Nuclear Regulatory Commission limits for Class C. The other low-level waste packages would have lower radioactivity concentrations. The volume of the S3G and D1G low-level radioactive wastes falls within the projection of Naval Reactors Program wastes previously provided to the Savannah River Site. The impacts of these waste disposal activities at the Savannah River Site are analyzed in the recent Savannah River Site Waste Management Final Environmental Impact Statement (Reference 5-1).

5.2.13.2.3 Low-Level Radioactive and Hazardous (Mixed) Wastes

The management, processing and treatment of mixed wastes generated by dismantlement activities would be in accordance with the Kesselring Site Treatment Plan, which was approved by the New York State Department of Environmental Conservation on October 24, 1995, for mixed wastes generated at the Kesselring Site (Reference 2-2). The Kesselring Site Treatment Plan includes volume projections for mixed wastes to be generated from dismantlement activities. Information in the Site Treatment Plan is updated annually, and is approved by the New York State Department of Environmental Conservation.

Mixed wastes are radioactive materials that include hazardous constituents, such as lead. Typically, mixed wastes generated from dismantlement activities would be homogeneous solids (such as radiologically activated or surface contaminated lead) or nonhomogeneous solids (such as radiologically activated composite shielding made of carbon steel and lead, or items coated with polychlorinated biphenyl-containing paint). Mixed wastes are regulated by the Resource Conservation and Recovery Act (40 CFR Parts 260 through 271), Codes, Rules and Regulations of the State of New York (NYCRR Title 6, Parts 370 through 376), Toxic Substances Control Act (40 CFR Part 761), Federal Facility Compliance Act (42 USC §6921 et seq.), as well as the Atomic Energy Act (42 USC §2011 et seq.).

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The potential for mixed waste results from the lead used in shielding the reactor plants (see Appendix A, Figure A-2). Although the lead used for permanently installed shielding is highly refined, the lead typically contains a small amount of impurities such as silver and cobalt. The lead closest to the reactors was exposed to a neutron flux, which caused the impurities in the lead to become activated (see Appendix A, Section A.3). Decontamination of lead containing radioactive impurities may not be practical because the impurity concentrations are very low and essentially inseparable. To reduce the volume of mixed wastes, the Naval Reactors Program is evaluating recycling options to reuse lead containing low levels of radioactive impurities in shielding applications at other U.S. Department of Energy facilities. Decontamination of lead with surface contamination is practical with commercially available technology which would further reduce the volume of mixed wastes. S3G and D1G Prototype reactor plant dismantlement would result in the generation of approximately 9,100 kilograms (20,000 pounds) of elemental lead containing radioactive impurities. This weight equals a volume of approximately 0.8 cubic meters (28 cubic feet), which is within the latest Kesselring Site Treatment Plan forecast for the elemental lead mixed waste stream. All other mixed wastes would be temporarily stored and disposed of in accordance with the Site Treatment Plan (Reference 2-2).

Removed paint containing PCBs at or above 50 parts per million and radioactivity would be managed and stored as mixed waste. Currently, there is no available treatment or disposal facility for this waste stream. The projected volume included in the 1997 update to the Kesselring Site Treatment Plan is 13.4 cubic meters (470 cubic feet) for the PCB-containing mixed waste stream which could be amenable to disposal by incineration. Paint removal processes that would minimize generation of PCB-containing mixed waste are under evaluation, including mechanical removal using media such as dry ice (solid carbon dioxide), sponge, and steel shot. The amounts of mixed waste that would be generated during paint removal activities vary with the process. Currently, it is conservatively estimated that reactor compartment dismantlement work will result in the generation of approximately 26 cubic meters (940 cubic feet or 7,000 gallons) of mixed waste, which primarily includes PCB-containing mixed waste.

In August 1997, the Naval Reactors Program submitted a mixed waste permit application to the New York State Department of Environmental Conservation. The permit application included a clause for increasing the mixed waste storage capacity in Kesselring Site Building 91 to cover the increased generation of mixed waste from sources apart from the S3G and D1G Prototype reactor plants. The impacts from increasing the Kesselring Site mixed waste storage capacity were evaluated in a separate environmental assessment (Reference 5-9). Based on this environmental assessment, the Naval Reactors Program issued a finding of no significant impact (Reference 5-10). The environmental impacts from storing an additional 7,000 gallons of mixed waste from reactor plant dismantlement paint removal operations would be small. The need for a second permit modification, to allow storing the additional waste from S3G and D1G Prototype reactor plant dismantlement, would be coordinated with the New York State Department of Environmental Conservation in accordance with NYCRR Title 6, Part 373-1.7(c).

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5.2.13.2.4 Polychlorinated Biphenyl (PCB)-Containing Wastes

Some S3G and D1G Prototype reactor plant components may contain regulated concentrations (greater than or equal to 50 parts per million) of polychlorinated biphenyls (PCBs). Examples of materials that could contain PCBs as a constituent include paint, adhesives, electrical cable coverings and rubber items manufactured before the mid-1970s. In these examples, PCBs are usually tightly bound in the composition of the solid material. While the amount of PCBs is small by weight, its use as a constituent in paint affects a large number of components. Painted surfaces in the S3G and D1G Prototype reactor plants include the hulls, large components such as the steam generators and pressurizers, decking support structures, pipe hangers, equipment foundations and thermal insulation.

PCB wastes are regulated by the Toxic Substances Control Act (40 CFR Part 761). The State of New York also regulates PCBs as hazardous waste (6 NYCRR §371.4(e)). Additionally, the Federal Facility Compliance Agreement on Storage of Radioactive and PCB Wastes between the U.S. Environmental Protection Agency, the U.S. Department of Energy, and the Naval Nuclear Propulsion Program, dated August 8, 1996, contains special provisions for the management and storage of radioactive and PCB wastes. Mixed radioactive and PCB-containing wastes are discussed in Section 5.2.13.2.3. Paint containing PCBs at or above the regulatory limit of 50 parts per million would be removed when practical from all materials not releasable from radiological controls. Removal of the paint would be in accordance with U.S. Environmental Protection Agency Alternate Method of Disposal Approval (40 CFR §761.60(e)).

5.2.13.2.5 Hazardous Wastes

Chemical products required for dismantlement operations would include small amounts of isopropyl alcohol in radiological control applications, building maintenance cleaning products, and miscellaneous petroleum products for routine vehicle and equipment maintenance. Small amounts of paint removal products (paint softeners) may be used in conjunction with mechanical paint removal processes (using abrasive media) to enhance efficiency. Consistent with pollution prevention initiatives, emphasis would be placed on using non-toxic paint removal products as much as practicable. Compared to the volume of other chemical products required for dismantlement operations, diesel fuel would constitute the largest volume. However, the amount of diesel fuel that would be stored in support of dismantlement operations would be small, less than 1,100 liters (300 gallons). Evaluation of a diesel fuel fire accident is provided in Appendix B, Section B.4.1 and summarized in Section 5.2.11.2. Even though dismantlement operations would not require any significant increase in the quantities or types of chemicals used at the Kesselring Site, a detailed chemical risk analysis was performed for substances other than diesel fuel for a hypothetical fire in a chemical storage locker. The results of this analysis are provided in Appendix B, Section B.4.2.

Only small amounts of hazardous waste would be expected as a result of dismantlement operations and the majority of these wastes would be in solid form. Dismantlement operations would not involve large bulk storage of toxic chemicals. Elemental lead is potentially the largest hazardous waste stream. Most of the lead is encased within welded steel sheets and is permanently installed as radiation shielding in the form of panels. Lead that can be released from radiological controls, more than 95 percent of the total, would be recycled and would not require disposal. Other elemental lead, less than 5 percent, containing radioactive impurities or surface radioactive contamination, would be treated as discussed in Section 5.2.13.2.3. Lead is also present as an alloy with other metals, such as in bronze, brass, and electrical solder, and as a constituent in paint. There are other hazardous materials that may be present in small quantities, such as chromates as a constituent of paint, and cadmium as a coating on electrical items. Because mercury can cause metals such as stainless steel to crack under stress, and can become a poisonous vapor when heated, the Naval Reactors Program has strictly controlled mercury concentrations in reactor plant components and materials to very low levels since the 1950s. Therefore, mercury is present only at incidental levels in the S3G and D1G Prototype reactor plants. The total volume of all hazardous wastes is expected to be small. In addition, PCBs are regulated as hazardous by New York State and are discussed in Section 5.2.13.2.4.

5.2.13.2.6 Nonhazardous and Nonradioactive Wastes

Commercial solid wastes, nonradioactive hazardous materials, and nonradioactive nonhazardous demolition debris from S3G and D1G Prototype reactor plant dismantlement would be recycled or disposed of off-site at permitted facilities using licensed haulers. Emphasis would be placed on recycling as much nonradioactive material as practical. Reusable materials, such as carbon steel and other metals, would be recycled through various commercial vendors. Nonradioactive, nonhazardous demolition debris which is generated from dismantlement activities and which is not recyclable would be disposed of in accordance with all applicable Federal, State and local regulations. The quantities of nonradioactive wastes and recyclable materials from reactor plant dismantlement (approximately 50 shipments) would be small compared to the quantities normally handled by the appropriate disposal or recycling vendors.

5.2.14 Irreversible and Irretrievable Commitments of Resources

The prompt dismantlement alternative would not involve any irretrievable or irreversible commitment of environmentally sensitive resources. As discussed previously in this section, this alternative would not contribute to any loss of endangered or threatened species, critical habitat, or areas of archeological, historical or cultural value. Demand on consumable resources such as utilities and energy for dismantlement activities would be very small. No additional disposal sites would be required to dispose of dismantlement wastes.

5.2.15 Impact Summary for the Prompt Dismantlement Alternative

The distinguishing environmental consequences of this alternative are: (1) the retention of about 200 personnel for approximately 3 to 4 years to accomplish dismantlement, followed by a staff reduction, (2) occupational radiation exposure from incident-free activities,.

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(3) radiation exposure to the general public from incident-free transportation activities, and (4) the number of material shipments resulting from dismantlement.

The retention of 200 personnel for approximately 3 to 4 years to accomplish dismantlement would be a positive impact on the Kesselring Site work force. However, this benefit would be temporary and would still require a Kesselring Site staff reduction once the dismantlement activities are completed. Because this reduction represents only about 0.1 percent of the work force in the surrounding region (see Table 4-2), it would have no discernible impact on the unemployment rate.

The occupational radiation exposure for incident-free activities is estimated at 205 to 460 person-rem (0.082 risk of a single additional latent fatal cancer; see Appendix B, Table B-7). On an annual basis, however, the average individual risk to radiation workers of a single additional latent fatal cancer would be 0.00058. This corresponds to 1 chance in about 1,700 that the average radiation worker might develop a latent fatal cancer sometime in his or her lifetime due to dismantlement work. Each member of the general population has 1 chance in 5 of developing a fatal cancer due to all causes (see Appendix A, Section A.4.1); thus, the increased risk for the most exposed worker would be very small. Therefore, the risk associated with the occupational radiation exposure is considered commensurate with the risks associated with everyday life.

Radiation exposure to the general public from incident-free transportation activities for radioactive material shipments is estimated at 5.4 person-rem (see Appendix C, Table C-13, Kesselring Site to Hanford Site). This corresponds to a latent fatal cancer risk of 0.0027. The 5.4 person-rem to the general public is for approximately 1 million people (see Appendix C, Section C.6). Therefore, the estimated average dose to a member of the public would be 5.4×10^{-6} rem, which is approximately the radiation exposure an individual receives in 8 minutes from natural background sources of radiation. The risks associated with the transportation related radiation exposure to the general public are considered much lower than the risks associated with everyday life.

Dismantlement activities would result in approximately 110 radiological and nonradiological shipments from the Kesselring Site over the dismantlement period (see Section 5.2.10). On an annual basis these shipments represent less than 5 percent of the total radiological and nonradiological shipments as a result of normal Kesselring Site operations. The largest shipments by weight and radioactive content would be the two reactor pressure vessels. Transport of each of these packages from the Kesselring Site to the Delaware and Hudson railroad terminus would affect local traffic for a short period during one day each, principally on the less traveled secondary roads. Highway shipments of packages of similar size to the reactor pressure vessel packages have successfully occurred between the Kesselring Site and the Delaware and Hudson terminus in the past. Based on past experience with these shipments, local police escorts would direct traffic to minimize congestion. Therefore, the shipments resulting from dismantlement activities would be commensurate with normal Kesselring Site operations in recent years.

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5.3 Deferred Dismantlement Alternative

This alternative would dismantle the S3G and D1G Prototype reactor plants after a 30-year caretaking period. Deferred dismantlement would allow the radioactivity in reactor plant materials to decay to a lower amount. Caretaking activities for the deferred dismantlement alternative would be identical to caretaking activities described for the no action alternative in Section 5.1. The only difference would be a defined end date for this alternative.

Following the 30-year caretaking period, reactor plant dismantlement would commence. For the purposes of comparison, deferred dismantlement activities are assumed to be identical to dismantlement activities described for the prompt dismantlement alternative in Section 5.2. Environmental impacts are discussed below.

5.3.1 Land Use

The deferred dismantlement alternative would not result in any changes to the present or planned use of the Kesselring Site, Federal reservation or surrounding areas. Caretaking and dismantlement activities would be confined to the Kesselring Site which is an already developed area. The areas currently occupied by the S3G and D1G Prototype reactor compartments would continue to be used for Naval Reactors Program work following the deferred dismantlement. The D1G Hortonsphere, which houses the D1G Prototype, would remain intact for possible future Naval Reactors Program use, although no future use is planned at this time. No land on the Federal reservation and no additional land outside the Federal reservation would have to be set aside for waste disposal. Impacts to existing agricultural, residential, recreational, or industrial land use in the surrounding area would not be expected.

5.3.2 Ecological Resources

There are no woodlands, State or Federally designated wetlands, or significant biological habitats within the Kesselring Site. There have been no documented sightings of Federal or State designated endangered, threatened, or special concern species on the Kesselring Site (Reference 4-5). Since the caretaking and dismantlement activities would be confined to the Kesselring Site, ecological resources located on the Federal reservation would not be impacted.

5.3.3 Water Resources

Caretaking and dismantlement activities of the S3G and D1G Prototype reactor plants would not change the existing ground water or surface water conditions on the Kesselring Site and Federal reservation. Independent of caretaking and dismantlement activities, monitoring and reporting of water conditions on the Kesselring Site and Federal reservation would continue as discussed in Section 4.3.

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The Kesselring Site is located at elevations above the indicated 100-year flood boundary (Reference 4-6). Because caretaking and dismantlement activities would be confined to the Kesselring Site, floodplains that exist on the Federal reservation would not be affected. Since caretaking and dismantlement activities would not take place in a floodplain and would not affect any designated wetlands, caretaking and dismantlement are not floodplain/wetlands actions and the requirements of 10 CFR 1022 are not applicable.

5.3.3.1 Water Resources - Radiological Consequences

Caretaking and deferred dismantlement activities would not result in any discharge of radioactive liquid effluents to the environment. Therefore, impacts to ground water and surface water resources on the Kesselring Site and Federal reservation would not be expected.

5.3.3.2 Water Resources - Nonradiological Consequences

When compared to existing conditions, water usage and nonradiological waste water discharges would be less during the caretaking period and approximately the same during deferred dismantlement activities. Therefore, impacts to ground water and surface water resources on the Kesselring Site and Federal reservation would not be expected. Nonradiological waste water discharges from the Kesselring Site to the Glowegee Creek would continue to be monitored per the State Pollutant Discharge Elimination System permit, and results would continue to be reported monthly.

5.3.4 Air Resources

Air discharges from the Kesselring Site would be approximately the same as existing conditions. Air discharges would continue to be monitored as discussed in Section 4.4.

5.3.4.1 Air Resources - Radiological Consequences

Airborne particulate radioactivity emissions associated with incident-free deferred dismantlement activities were evaluated. Airborne radioactivity discharges during the caretaking period would be the same as the no action alternative, as discussed in Section 5.1.4.1. During deferred dismantlement activities, existing radiological ventilation facilities would be used. High efficiency particulate air filters would also be used, which have a greater than 99.95 percent efficiency for removal of airborne particulate radioactivity. The details of the analysis are provided in Appendix B, Section B.2. Table B-4 provides the estimated radioactivity that would be discharged per year. Adding the data from Table B-4 for each radionuclide and for each prototype results in an estimated annual airborne discharge of 1.8×10^{-5} curies during deferred dismantlement activities. Based on dismantlement periods of 2 years for S3G and 2¾ years for D1G, the cumulative discharge of all radionuclides during deferred dismantlement activities would be approximately 4.2×10^{-5} curies. The cumulative discharge for the entire duration of this alternative (30-year caretaking period plus deferred dismantlement activities) would be approximately 0.00014 curies.

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As discussed in Section 4.4.4 and Reference 4-4, the radioactivity contained in exhaust air during 1996 consisted of: (1) less than 0.001 curies of krypton-85 and particulate fission and activation products having half-lives greater than 3 hours; (2) approximately 2.2 curies of noble gases with half-lives of 12 days or less, principally argon-41, xenon-133, and xenon-135; (3) approximately 0.3 curies of tritium; and (4) approximately 1.0 curies of carbon-14. Compared to these airborne discharges associated with normal Kesselring Site operations, which were well below applicable standards, the amount of airborne radioactivity that would be discharged annually during the deferred dismantlement alternative is small (less than 1 percent of existing conditions). Therefore, impacts to air resources would be indistinguishable from existing conditions.

5.3.4.2 Air Resources - Nonradiological Consequences

The discussion of nonradiological consequences of caretaking in Section 5.1.4.2 and for prompt dismantlement in Section 5.2.4.2 apply to the deferred dismantlement alternative. Impacts to air resources would not be expected.

5.3.5 Terrestrial Resources

Caretaking and dismantlement activities of the S3G and D1G Prototype reactor plants would not change the existing terrestrial conditions on the Kesselring Site or on the surrounding Federal reservation as presented in Section 4.5. Caretaking activities for the deferred dismantlement alternative would be identical to caretaking activities described for the no action alternative in Section 5.1.5. Deferred dismantlement activities are assumed to be identical to dismantlement activities described for the prompt dismantlement alternative in Section 5.2.5. Impacts to terrestrial resources would not be expected.

5.3.6 Socioeconomics

Kesselring Site staffing near the end of 1997 is estimated at approximately 700 civilian personnel (including subcontractors) and 1,000 U.S. Navy personnel. The labor force needed to support caretaking activities at the Kesselring Site is estimated at 1 equivalent full-time worker. This alternative results in a staff reduction of approximately 200 personnel for the 30-year caretaking period. At the beginning of the deferred dismantlement activities, staffing levels would be expected to be similar to the prompt dismantlement and increase by 200 personnel for an approximately 3 to 4-year period. While staff fluctuations associated with deferred dismantlement would be a noticeable portion of the civilian work force at the Kesselring Site, it would represent only about 0.1 percent of the employment level in the surrounding region (see Table 4-2). Therefore, the deferred dismantlement alternative would not have any discernible socioeconomic impact.

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5.3.7 Cultural Resources

Based on the discussions in Section 5.1.7 for the no action alternative and Section 5.2.7 for the prompt dismantlement alternative, caretaking and deferred dismantlement of the S3G and D1G Prototype reactor plants would not impact any cultural resources.

5.3.8 Noise, Aesthetic and Scenic Resources

Based on the discussions in Section 5.1.8 for the no action alternative and Section 5.2.8 for the prompt dismantlement alternative, caretaking and deferred dismantlement of the S3G and D1G Prototype reactor plants would not impact noise, aesthetic or scenic resources.

5.3.9 Traffic and Transportation

Based on the discussions in Section 5.1.9 for the no action alternative and Section 5.2.9 for the prompt dismantlement alternative, caretaking and deferred dismantlement of the S3G and D1G Prototype reactor plants would not have a discernible impact regional and local traffic conditions.

5.3.10 Occupational and Public Health and Safety (Incident-Free)

This section summarizes analysis results for expected incident-free conditions during a 30-year caretaking period followed by an approximately 3 to 4-year deferred dismantlement period. Detailed analyses of potential impacts for facility and transportation activities are presented in Appendices B and C, respectively.

5.3.10.1 Facility Activities - Radiological Consequences

The radiological health risks associated with incident-free facility activities during a 30-year caretaking period and deferred dismantlement of the S3G and D1G Prototype reactor plants were evaluated in Appendix B, Section B.2. Effects from assumed airborne particulate radioactivity releases and direct radiation exposure were assessed for the worker, maximally exposed off-site individual, and the general population. Gamma radiation from cobalt-60 contained within the reactor plant systems is the primary source of direct radiation exposure. During a 30-year caretaking period, much of the short half-life radionuclides, primarily cobalt-60, would decay. The decay of cobalt-60 would result in less than 2 percent of direct radiation exposure to workers compared to the prompt dismantlement alternative. For the workers, analyses were based on radiation survey data from the S3G and D1G Prototype reactor compartments, staffing levels, and time in or near the reactor compartments. For the general population, analyses were based on the exposure to all members of the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

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Analyses for radiological exposure during the caretaking period and deferred dismantlement were made using an approach consistent with the analyses for the no action and prompt dismantlement alternatives, discussed in Sections 5.1.10.1 and 5.2.10.1. Occupational exposure over the course of 30 years of caretaking activities would be approximately 22 person-rem. This occupational exposure would be the same as the 30-year caretaking period of the no action alternative. Occupational exposure from deferred dismantlement activities would be approximately 4 person-rem.

The health risks from radiation exposure, through various pathways, have been summarized in Appendix B, Table B-7. It is conservatively estimated that the caretaking and dismantlement workers would receive a total of 26 person-rem (0.01 risk of a single additional latent fatal cancer). On an annual basis, the average individual risk to radiation workers of a single additional latent fatal cancer would be 4.0×10^{-5}. The general population would receive 1.3×10^{-5} person-rem (6.9×10^{-9} risk of a single additional latent fatal cancer) from exposure during caretaking and deferred dismantlement. On an annual basis, the average risk to an individual in the general population of a single additional latent fatal cancer would be 1.9×10^{-16}.

5.3.10.2 Facility Activities - Nonradiological Consequences

Naval Reactors Program policy is to maintain a safe and healthful environment at all facilities, including the Kesselring Site. Caretaking activities would be limited to maintenance, surveillance and security tours by a small number of personnel. As a result, incident-free nonradiological consequences would be very small. During deferred dismantlement activities, the nonradiological consequences during incident-free facility activities would be the same as the prompt dismantlement alternative, discussed in Section 5.2.10.2.

5.3.10.3 Transportation Analyses

The discussion in Section 5.2.10.3 for shipment destinations and transportation analysis assumptions applies equally to the deferred dismantlement alternative.

5.3.10.3.1 Transportation - Radiological Consequences

The radiological consequences associated with incident-free shipment of low-level radiological recyclable material and waste from deferred dismantlement were analyzed using the same approach described in Section 5.2.10.3.1.

Packaging for the reactor pressure vessel shipments would be designed to meet the same transport index for both the deferred and prompt dismantlement alternatives. Transport index values represent the radiation levels at 1 meter from the package surface of radiological shipments in millirem per hour (see Appendix C, Section C.4.2). Analysis results for these shipments are identical for both the deferred and prompt dismantlement alternatives. The radiological risks for shipment of all other radioactive recyclable materials and waste under the deferred dismantlement alternative would be lower due to cobalt-60 radioactive decay.

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However, the amount of materials handled as low-level radioactive waste would not be expected to change, due to the presence of other longer-lived radionuclides.

The health risks for shipments to the Hanford Site are summarized in Appendix C, Table C-15. For shipments of low-level radiological waste from the Kesselring Site to the Hanford Site, analyses indicate the transportation crew would receive 0.24 person-rem (9.6×10^{-5} risk of a single additional latent fatal cancer). On an annual basis, the average per person dose to the transportation crew would be 0.065 rem (2.6×10^{-5} risk of a single additional latent fatal cancer). The general population would receive 0.15 person-rem (7.4×10^{-5} risk of a single additional latent fatal cancer). On an annual basis, the average per person dose to the general population would be 8.2×10^{-8} rem (4.1×10^{-11} risk of a single additional latent fatal cancer).

5.3.10.3.2 Transportation - Nonradiological Consequences

The nonradiological consequences associated with incident-free transportation of recyclable material and waste are assumed to be identical for the prompt and deferred dismantlement alternatives. The discussion in Section 5.2.10.3.2 is equally applicable for the deferred dismantlement.

5.3.11 Facility and Transportation Accidents

Hypothetical accident scenarios were evaluated to estimate the potential for, and effects of, release of radioactive material and toxic chemicals. Appendix B, Section B.3, provides details of hypothetical facility accidents resulting in the release of radioactive materials to the environment. Appendix C, Section C.5, describes the technical approach for assessing radioactive shipment accidents. The results of these analyses are presented in terms of latent fatal cancers and health risks to dismantlement workers and the public. Appendix B, Section B.4, provides analyses of two nonradiological facility accidents, including a diesel fuel fire and a spill of stored chemical products. The results of these analyses are compared to Emergency Response Planning Guideline values for individual workers and the public (maximally exposed off-site individual).

5.3.11.1 Facility Accidents - Radiological Consequences

Several hypothetical accident scenarios that would result in release of radioactivity to the environment were evaluated to determine the long term health risk. The hypothetical release of airborne particulate radioactivity and exposure to radiation during accident scenarios were assessed for the worker, maximally exposed off-site individual and the general population. The discussion in Section 5.1.11.1 for the no action alternative is applicable for the caretaking period, and the discussion in Section 5.2.11.1 for the prompt dismantlement alternative is applicable for the deferred dismantlement activities.

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The details of the analyses are provided in Appendix B, Section B.3. As shown in Appendix B, Table B-26, the combined S3G and D1G cumulative risk of a member of the general population developing a latent fatal cancer due to a high efficiency particulate air filter fire for a 30-year caretaking period would be 1.4×10^{-9}.

During deferred dismantlement activities, the accident with the greatest risk would be a component drop accident. The combined S3G and D1G cumulative risk of a member of the general population developing a latent fatal cancer due to a component drop accident would be 5.1×10^{-9}. This risk is the sum of the products of the probability of the accident occurring times the consequence of the accident times the duration of the dismantlement period (2 years and 2¾ years for S3G and D1G, respectively). On an annual basis, the highest risk to an individual in the general population of a single additional latent fatal cancer due to this accident would be 1.4×10^{-15}, as shown in Appendix B, Tables B-10 and B-12. These accident risks during the caretaking and deferred dismantlement activities would be small compared to incident-free radiological impacts due to the low probability of the accidents occurring.

5.3.11.2 Facility Accidents - Nonradiological Consequences

The nonradiological consequences associated with the caretaking and dismantlement activities would be the same as for the no action and the prompt dismantlement alternatives. The discussions in Sections 5.1.11.2 and 5.2.11.2 are applicable for the deferred dismantlement alternative.

Nonradiological occupational accidents, such as slips and falls, could occur during the caretaking period and deferred reactor plant dismantlement; however, the rate is not expected to be greater than rates for other Naval Reactors Program activities (see Table 4-3). For conservatism, projections of the number of fatalities and injuries/illnesses were estimated based on the U.S. Department of Energy and Contractors rates for all labor categories (see Table 4-3). The estimated number of fatalities and injuries/illnesses are summarized in Table 5-3 and indicate that the overall nonradiological occupational risks would be small.

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Table 5-3: Estimated Nonradiological, Occupational Impacts for Deferred Dismantlement

	Caretaking	Dismantlement
Estimated Kesselring Site Caretaking and Dismantlement Staffing Level (equivalent full-time workers)	1	200
Estimated Average Number of Injuries/Illnesses per Year [a]	0.036	7.2
Estimated Number of Fatalities per Year [a]	0.00003	0.006
Total Estimated Number of Injuries/Illnesses [b]	1.1	25
Combined Totals	26	
Total Estimated Number of Fatalities [b]	0.0009	0.021
Combined Totals	0.022	

a. Calculated by multiplying Kesselring Site staffing levels times the U.S. Department of Energy and Contractors rates provided in Table 4-3.
b. Total values calculated for a 30-year caretaking period and 3½-year dismantlement period.

5.3.11.3 Transportation Accidents

There has never been a major accident nor measurable release of radioactivity to the environment during shipment of Naval Reactors Program waste or materials. However, hypothetical transportation accidents were evaluated to determine potential environmental effects.

5.3.11.3.1 Transportation Accidents - Radiological Consequences

The discussion in Section 5.2.11.3.1 for the prompt dismantlement applies to this section. Because of radioactive decay, the risks would be lower.

The health risks associated with transportation accidents for shipments from the Kesselring Site to the Hanford Site for deferred dismantlement are summarized in Appendix C, Table C-19. Analyses indicate that the general population would receive 5.8×10^{-5} person-rem (2.9×10^{-8} risk of single additional latent fatal cancer) in this scenario. On an annual basis, the per person risk to the general population of a single additional latent fatal cancer would be 6.3×10^{-14}.

When compared to the radiological health risks associated with incident-free radioactive waste shipments (see Section 5.3.10.3) the risks of hypothetical accidents would be less. This is due to the very low probability of a severe accident occurring.

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5.3.11.3.2 Transportation Accidents - Nonradiological Consequences

The nonradiological consequences associated with the transportation accidents for the prompt dismantlement alternative (see Section 5.2.11.3.2) would be the same for the deferred dismantlement alternative.

5.3.12 Utilities and Energy

The use of energy and utility resources would be required to support caretaking and dismantlement activities. This would include maintenance activities during the 30-year caretaking period and dismantlement activities associated with the removal of the reactor compartments. However, this would be a small portion of the overall use of utility and energy resources that are routinely required to support normal Kesselring Site operations. Since this demand would be indistinguishable from existing conditions, impacts to utility and energy resources would not be expected.

5.3.13 Hazardous Materials and Waste Management

Caretaking activities would generate very small volumes of waste. Waste generated would consist mainly of commercial waste, and disposal would be consistent with State and local regulations. Hazardous materials would continue to be managed in accordance with Federal, State and local regulations.

Deferred dismantlement activities would be similar to prompt dismantlement activities. Although cobalt-60 would decay to less than 2 percent of the levels at the start of a 30-year caretaking period, the amount of materials handled as low-level radioactive waste would not be expected to change, due to the presence of other longer-lived radionuclides.

Deferred dismantlement would result in the same number of shipments of recyclable materials and waste as the prompt dismantlement alternative. Low-level radioactive waste from deferred dismantlement would meet the same disposal site requirements as discussed in Section 5.2.13. Decay of radioactivity in the S3G and D1G Prototype reactor plants could allow for a greater percentage of radioactive metals to be candidates for recycling or volume reduction than the percentages discussed in Section 5.2.13. However, considering that the estimated volume of low-level radioactive waste associated with prompt dismantlement falls within the range currently experienced within the U.S. Department of Energy, deferred dismantlement would have an even lower environmental effect. The volume of mixed waste resulting from deferred dismantlement is estimated to be the same as discussed in Section 5.2.13.

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5.3.14 Irreversible and Irretrievable Commitments of Resources

The deferred dismantlement alternative would not involve any irretrievable or irreversible commitment of environmentally sensitive resources. As discussed previously in this section, this alternative would not contribute to any loss of endangered or threatened species, critical habitat, or areas of archeological, historical or cultural value. Demand on consumable resources such as utilities and energy for caretaking and deferred dismantlement activities would be very small. No additional disposal sites would be required to dispose of dismantlement wastes.

5.3.15 Impact Summary for the Deferred Dismantlement Alternative

The distinguishing features of this alternative are: (1) fluctuation of Kesselring Site staffing levels for the caretaking and dismantlement activities, (2) occupational radiation exposure from incident-free activities, and (3) the number of waste shipments resulting from dismantlement.

This alternative would dismantle the reactor plants after a 30-year caretaking period. While the reactor plants would require maintenance and monitoring during the caretaking period, a staff reduction of 200 personnel at the Kesselring Site would still be required. After the caretaking period, an increase of 200 personnel at the Kesselring Site would occur to support the deferred dismantlement activities. This increase in staffing levels would be temporary (for approximately 3 to 4 years) since a subsequent staff reduction would occur once the dismantlement activities are completed. While this fluctuation in the staffing levels would have a noticeable impact on the Kesselring Site work force, it only represents about 0.1 percent of the work force in the surrounding region (see Table 4-2) and would have no discernible impact on the unemployment rate.

The occupational radiation exposure for incident-free activities is estimated to be 26 person-rem (see Appendix B, Table B-7). A comparison shows that the occupational radiation exposure for the deferred dismantlement alternative would be less than 15 percent of direct radiation exposure from the prompt dismantlement alternative. The occupational radiation exposure for deferred dismantlement reflects the radioactive decay of cobalt-60.

The discussion on the number of waste shipments for the prompt dismantlement alternative in Section 5.2.15 would also apply to this section. During the caretaking period, the radioactivity in reactor plant materials would decay to a lower amount when compared to the prompt dismantlement alterative. However, the amount of materials handled as low-level radioactive waste during deferred dismantlement activities would not be expected to change, due to the presence of long-lived radionuclides.

5.4 Environmental Justice

5.4.1 Introduction

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (see Section 2.6.8), directs Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies and activities on minority or low-income populations. A disproportionately high and adverse human health or environmental effect occurs when there is a significant and adverse effect that occurs for minority or low-income populations at an appreciably higher rate than for the general population.

5.4.2 Community Characteristics

Definitions, figures and data for minority and low-income populations used in this environmental justice analysis were obtained from the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference 2-7). The data and figures are based on the 1990 Census and include 304 census tracts within 80 kilometers (50 miles) of the Kesselring Site. The total population within this area is approximately 1,149,000. Distribution of the population in this area is shown in Figure 4-4.

Figure 5-1 shows the locations of populations within 80 kilometers of the Kesselring Site for which minority membership exceeds the average (6 percent). Figure 5-1 also shows the location of populations within this area for which minority membership exceeds 50 percent; these populations are difficult to distinguish in the figure due to their small size. The figure shows that none of these populations are located within 8 kilometers (5 miles) of the Kesselring Site.

The U.S. Census Bureau characterizes persons living in poverty as those whose income is less than a "statistical poverty threshold." For the 1990 Census, this threshold was based on a 1989 income of $12,500 per household. Figure 5-2 shows the locations of populations within 80 kilometers of the Kesselring Site for which the percent of the population living in poverty exceeds 25 percent (average is approximately 9 percent); these populations are difficult to distinguish in the figure due to their small size. The figure shows that none of these populations are located within 8 kilometers (5 miles) of the Kesselring Site.

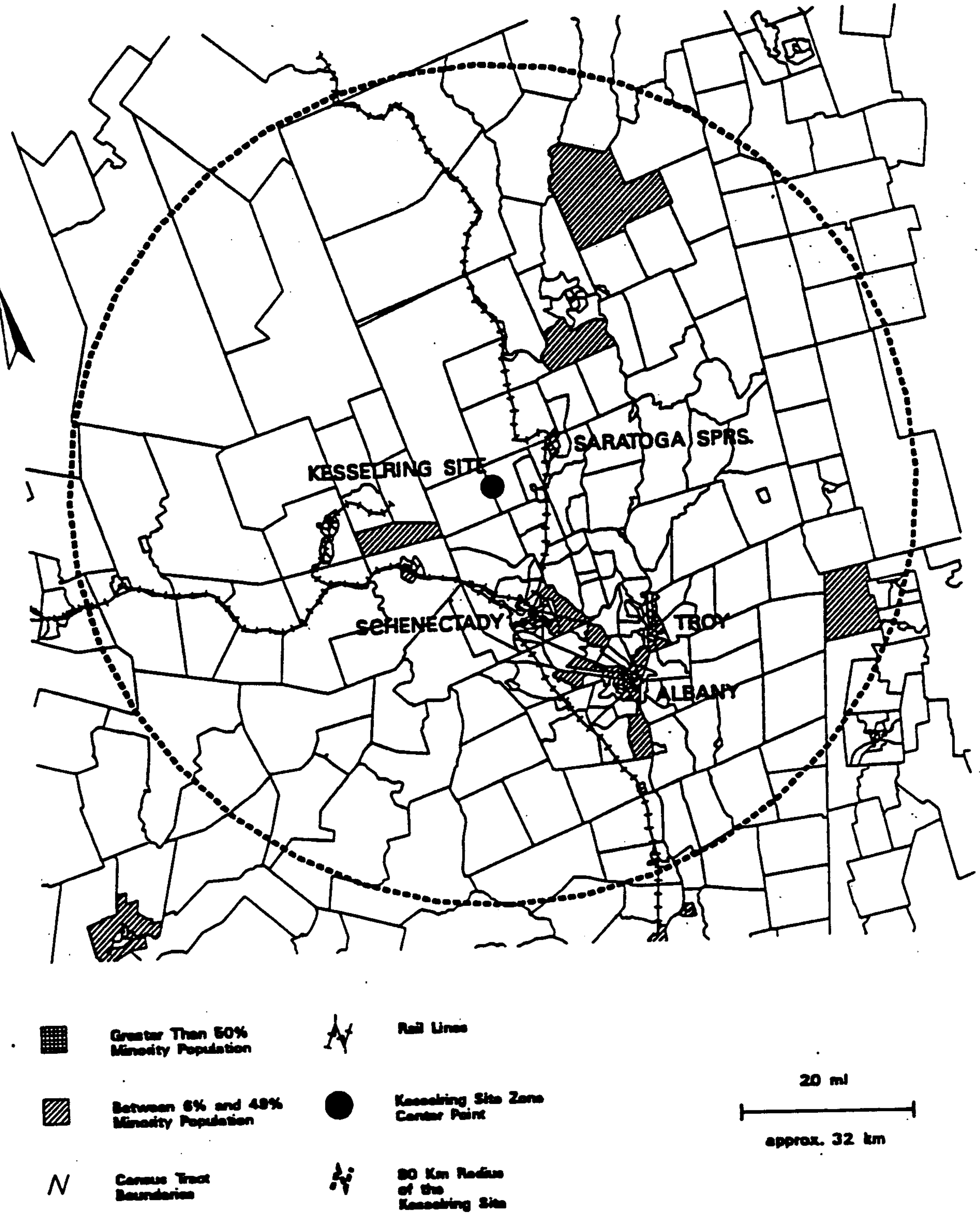

Figure 5-1: Minority Population Distribution Within an 80-Kilometer (50-Mile) Radius of the Kesselring Site

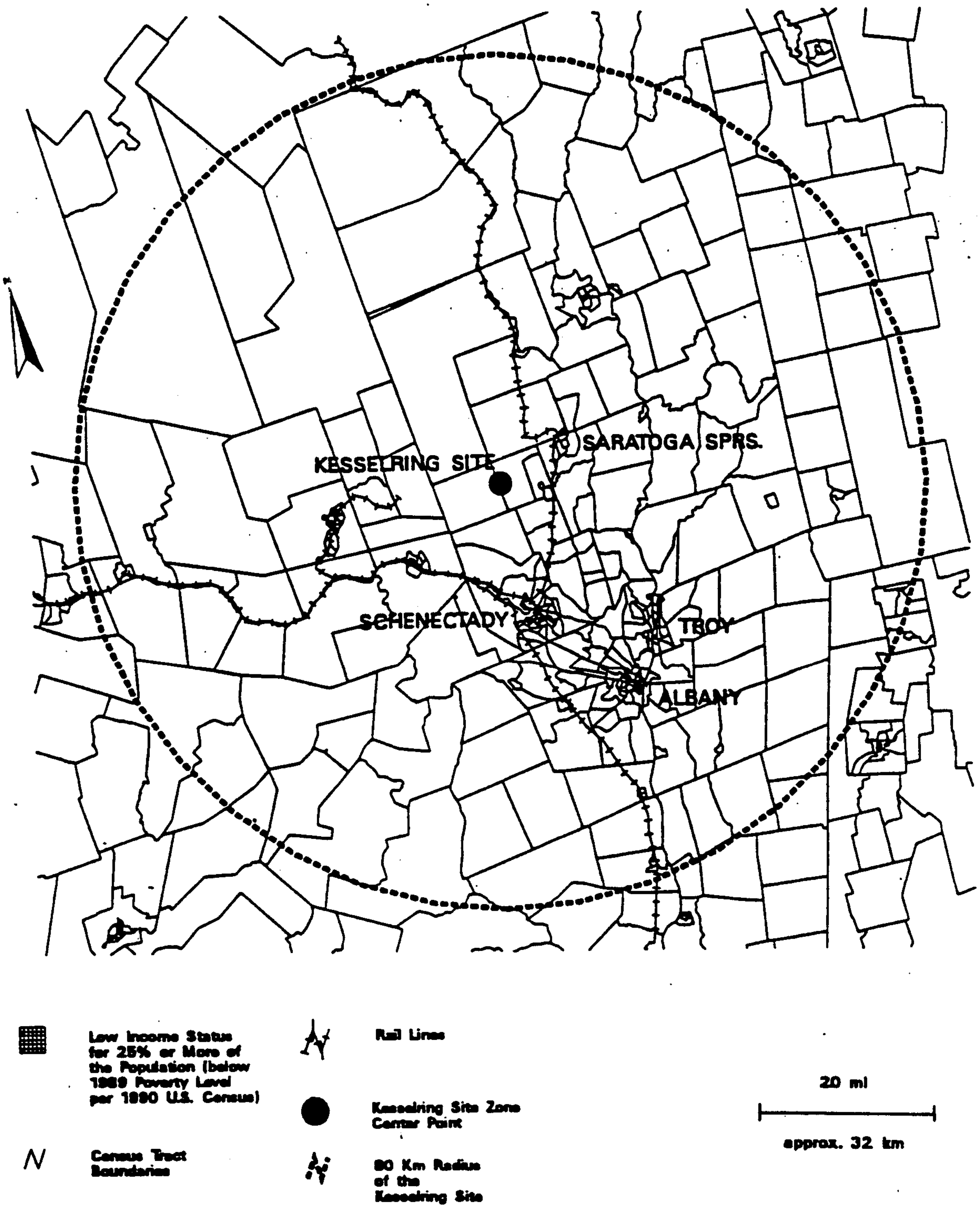

Figure 5-2: Low-Income Population Distribution Within an 80-Kilometer (50-Mile) Radius of the Kesselring Site

5.4.3 Environmental Justice Assessment

In the preceding sections of this chapter, a review was made of human health effects and environmental impacts associated with the three alternatives under evaluation. Caretaking and dismantlement activities present very small health effects and do not constitute reasonably foreseeable adverse impacts to the regional population.

The number of potential injuries and fatalities as a result of transportation and/or occupational accidents is very small for any of the alternatives. The latent fatal cancer risk to the public resulting from incident-free caretaking and/or dismantlement activities and from the incident-free transportation of recyclable materials and waste off-site would be very small. The number of potential injuries and fatalities as a result of occupational accidents is also very small. The risks to workers from any of the alternatives are small and comparable to risks commonly accepted in the workplace.

Transportation-related accidents could occur at any location along the transportation routes; however, the assumptions and parameters used in the transportation accident analyses in Appendix C of this Environmental Impact Statement make the results applicable to all segments of the population along the routes, including minority and low-income populations. Results of these accident analyses show that the potential impacts on the population along the transportation routes due to an accident would be very small. It is reasonable to state that the potential impacts would be very small for any particular segment of the general population, including minority and low-income populations.

All three alternatives under evaluation result in job reductions, although the timing would differ. These job reductions would represent a small fraction of the regional employment level. In addition, minority and low-income communities do not largely rely on the Kesselring Site for employment.

The character of the Federal reservation and the surrounding area would remain unchanged. None of the alternatives would result in the disturbance of undeveloped land or the addition of land to the Federal reservation. Liquid and gaseous discharges resulting from caretaking and dismantlement activities would be controlled to maintain water quality and air quality, consistent with present practice. Caretaking and dismantlement activities would be confined within the Kesselring Site and would not adversely impact any subsistence consumption of fish, game, or native plants in the region.

5.4.4 Conclusion

None of the alternatives analyzed would result in disproportionately high and adverse environmental or health effects on any particular segment of the population, including minority and low-income populations. Accordingly, none of the alternatives for disposal of the S3G and D1G Prototype reactor plants present an environmental justice concern.

5.5 Cumulative Impacts and Effects

Cumulative impacts are those effects resulting from implementation of one of the proposed alternatives considered in combination or association with other actions that are either directly or indirectly related. For the alternatives considered, the cumulative effects of the alternatives are discussed in the context of ongoing Kesselring Site operations which include the continued operations of the MARF and S8G Prototypes. A discussion of potential cumulative impacts associated with the three reasonable alternatives is provided in the following sections. There would be no discernible cumulative impacts specifically associated with any of the alternatives for disposal of the S3G and D1G Prototype reactor plants.

5.5.1 Land Use

The approximately 26 hectares (65 acres) of land comprising the Kesselring Site have already been developed from their previous agricultural use (see Section 4.1). None of the S3G and D1G disposal alternatives would change the existing character on any land on the Federal reservation. No land would have to be set aside for disposal of dismantlement waste materials. Therefore, there would be no cumulative land use impacts associated with any of the alternatives considered.

5.5.2 Water Resources

There would be no cumulative water resource impacts associated with any of the S3G and D1G Prototype reactor plants disposal alternatives. An overview of historical impacts from liquid effluents discharged at the Kesselring Site is discussed in detail in Section 4.3.

There has been no measurable impact on the environment or adverse effect on the community or the public associated with radiological discharges from Kesselring Site operations (Reference 4-4). None of the S3G and D1G Prototype reactor plants disposal alternatives would result in the discharge of radiological liquid effluents to the environment.

Nonradiological waste water discharges have included treated water from the sanitary system and storm water runoff. As discussed in Reference 4-4, the analytical results for the chemical constituents present in the Kesselring Site liquid effluents have been within applicable standards. Changes in Kesselring Site water usage or discharges as a result of the alternatives would be very small when compared to existing conditions and discharges would be expected to meet all discharge limits.

5.5.3 Air Resources

There would be no cumulative air resource impacts associated with any of the alternatives. Existing operations which have a potential for release of airborne particulate radioactivity are serviced by monitored exhaust systems. Prior to release, the exhaust air is passed through high efficiency particulate air filters to minimize radioactivity content. As discussed in Section 4.4.4 and Reference 4-4, the radioactivity contained in exhaust air during 1996 consisted of: (1) less than 0.001 curies of krypton-85 and particulate fission and activation products having half-lives greater than 3 hours; (2) approximately 2.2 curies of noble gases with half-lives of 12 days or less, principally argon-41, xenon-133, and xenon-135; (3) approximately 0.3 curies of tritium; and (4) approximately 1.0 curies of carbon-14. The average radioactivity concentration in the effluent air was well below the applicable standards in the U.S. Department of Energy Order 5400.5, Radiation Protection of the Public and the Environment.

Based on data discussed in Sections 5.1.4.1, 5.2.4.1 and 5.3.4.1, and Appendix B, Section B.2, annual radiological airborne emissions associated with the three disposal alternatives would be less than 1 percent of the existing air emissions for normal Kesselring Site operations and would not cause a discernible change. Therefore, radiological airborne emissions would not have a cumulative impact.

Based on data discussed in Sections 5.1.4.2, 5.2.4.2 and 5.3.4.2, and Appendix C, the effects of nonradiological air emissions would be very small and would not be expected to impact air resources. Sources of nonradiological air emissions, such as vehicle emissions and dismantlement operations, would be transitory. All nonradiological air emissions would be controlled in accordance with State and Federal regulations. No change in classification of the Kesselring Site under the Clean Air Act would be expected. Consequently, nonradiological air emissions would not have a cumulative impact.

5.5.4 Terrestrial Resources

No dismantlement materials would be disposed of on the Kesselring Site or on the Federal reservation. All of the monitoring and corrective actions discussed in Section 4.5 would continue independent of dismantlement activities. Therefore, there would be no cumulative impacts to terrestrial resources associated with any of the alternatives considered.

5.5.5 Transportation

The cumulative transportation impacts associated with the dismantlement activities of the prompt and deferred dismantlement alternatives would be small. The dismantlement activities would result in approximately 110 radiological and nonradiological shipments from the Kesselring Site over the dismantlement period (see Section 5.2.10.3). On an annual basis these shipments represent less than 5 percent of the total nonradiological and radiological shipments as a result of normal Kesselring Site operations. The largest shipments by weight and radioactive content would be the two reactor pressure vessels. Transport of each of these packages from the Kesselring Site to the Delaware and Hudson railroad terminus would affect local traffic for a short period during one day each, principally on the lesser traveled secondary roads. Highway shipments of packages of similar size to the reactor pressure vessel packages have successfully occurred between the Kesselring Site and the Delaware and Hudson terminus in the past. Based on past experience with these shipments, local police escorts would direct traffic to minimize congestion. Therefore, the shipments resulting from dismantlement activities would be commensurate with normal Kesselring Site operations in recent years. Since deferred dismantlement would not reduce the volume of radioactive waste generated compared to prompt dismantlement (see Section 5.3.13), due to long-lived radionuclides, the cumulative transportation impacts would be the same for both alternatives.

5.5.6 Occupational and Public Health and Safety

As discussed in Section 5.1.10, the impacts from the no action alternative on occupational health and safety from radiation exposure would be small. The cumulative impact of the no action alternative on public health and safety would not be discernible from the effects of existing Kesselring Site activities, including the operating prototypes, as reported in the annual Knolls Atomic Power Laboratory Environmental Monitoring Report (Reference 4-4).

As discussed in Section 5.2.10, the most notable impact from the prompt dismantlement alternative on occupational health and safety results from additional radiation exposure. Since individual worker exposure would be limited to 2 rem per year, and since the occupational radiation exposure would be comparable in magnitude to the radiation exposure routinely received during operation and maintenance of Naval nuclear reactor plants, the cumulative impact on the Kesselring Site work force would be small. The cumulative impact of the prompt dismantlement alternative on public health and safety would not be discernible from the effects of existing Kesselring Site activities, including the operating prototypes, as reported in Reference 4-4.

Occupational and public health and safety impacts from deferred dismantlement would be within the range of impacts for the no action and prompt dismantlement alternatives. Since the no action and prompt dismantlement alternatives would have no discernible cumulative impact, deferred dismantlement would also be expected to have no discernible cumulative impact.

5.5.7 Hazardous Materials and Waste Management

Waste volumes generated at the Kesselring Site vary from year-to-year. Between 1988 and 1994, low-level radioactive waste volume has been as high as 215 cubic meters (281 cubic yards). Compared to these previous years, the volume of low-level radioactive waste generated at the Kesselring Site during 1996, approximately 133 cubic meters (175 cubic yards), was small. From a cumulative impact perspective, prompt S3G and D1G Prototype dismantlement activities would noticeably add to the volume of low-level radioactive waste generated at the Kesselring Site for about a 3-year period. However, on an annual basis, the expected cumulative volumes would continue to fall within historical ranges generated at the Kesselring Site. On a broader scale, as discussed in Section 5.2.13, the end of the Cold War may result in some increases in radioactive wastes, such as from dismantlement of the S3G and D1G Prototype reactor plants. However, there has also been a larger decrease in radioactive waste generation due to the earlier-than-projected inactivation of Naval nuclear-powered warships and prototype reactor plants. As a result, the volume of the S3G and D1G low-level radioactive waste would be within the projection of Naval Reactors Program waste previously provided to the Savannah River Site, which in turn is included in existing Savannah River Site analyses (Reference 5-1).

S3G and D1G Prototype dismantlement activities would generate small amounts of hazardous waste, as discussed in Section 5.2.13. Between 1992 and 1996, the annual quantity of hazardous and chemical waste generated at the Kesselring Site ranged between 19.2 and 138 metric tons (21.2 and 154 tons). The high end of the range represents the quantity of hazardous and chemical waste generated during 1996. From a cumulative impact perspective, the quantity of hazardous and chemical waste shipped from the Kesselring Site during prompt dismantlement would continue to be within the historical ranges generated at the Kesselring Site.

As discussed in Section 4.5.4.6, the volume of mixed waste generated and stored at the Kesselring Site has been small. Prompt S3G and D1G Prototype dismantlement activities would add to the inventory of mixed waste stored at the Kesselring Site. The projected volume of elemental lead mixed waste is within existing forecasts in the Site Treatment Plan (Reference 2-2). The projected volume of PCB-containing mixed waste from paint removal operations and small miscellaneous rubber components could be above the existing forecast in the Site Treatment Plan. As discussed in the Site Treatment Plan, the inventory of mixed waste stored at the Kesselring Site will tend to increase over the next 5 years, pending the availability of off-site treatment and storage facilities. As part of a recent proposed modification to the New York State Department of Environmental Conservation (NYSDEC) issued Kesselring Site Part 373 Hazardous Waste Management Permit (Reference 4-16), Naval Reactors has requested NYSDEC approval to allow transfer of small quantities of mixed waste between the Knolls Site in Schenectady and the Kesselring Site. The purpose of this provision is to consolidate like forms of mixed waste to facilitate shipment out of the State for treatment and disposal. The cumulative impact of projected mixed waste from all site activities and mixed waste from prompt dismantlement activities, 76 cubic meters (2,700 cubic feet or 20,000 gallons), would be small and is not expected to result in any significant impacts on the environment. The projected amounts of mixed waste at the Kesselring Site represent less than 0.1 percent of the total amount of mixed waste stored and generated at U.S. Department of Energy facilities.

Since caretaking activities would generate very small quantities of waste, there would be no discernible cumulative impact on Kesselring Site waste generation under the no action alternative. Deferred dismantlement activities would generate approximately the same quantities of wastes as the prompt dismantlement alternative. Since Kesselring Site activities 30 years in the future are not established at this time, the cumulative impacts of deferred dismantlement waste generation cannot be fully determined. However, since the cumulative impacts of prompt dismantlement would be small with regard to waste generation, the cumulative impacts of deferred dismantlement are also estimated to be small.

5.5.8 Operating Reactors/Reactor Safety

This section provides background on Naval nuclear power plant design and operation and evaluates the cumulative impacts of the operating S8G and MARF Prototype reactor plants at the Kesselring site. This section has been developed making full use of the extensive body of unclassified environmental information available on Naval nuclear propulsion matters. This information includes detailed annual reports published over three decades, independent environmental surveys performed by the U.S. Environmental Protection Agency and by states in which Naval nuclear propulsion facilities are located, and a thorough independent review performed by the General Accounting Office in 1991 (Reference 2-6). Because nuclear propulsion technology is among the most sensitive military technologies possessed by the United States, Congress has placed stringent limitations on foreign access under the Atomic Energy Act of 1954 (amended) and other Federal statutes. Appendix D, which is classified, contains Naval reactor design information and evaluation of postulated accidents. However, all potential environmental impacts and conclusions discussed in Appendix D are covered in the following unclassified sections.

5.5.8.1 Naval Nuclear Power Plant Design

The source of energy for Naval nuclear power plants is heat which originates from fissioning uranium atoms contained within pressurized water reactor cores. Since the fission process also produces radiation, shielding is placed around the reactor to protect the crew. United States Naval nuclear propulsion plants, including the S8G and MARF Prototype reactor plants, use a pressurized water reactor design which has two basic systems: the primary system and the secondary system. The arrangement is shown schematically in Appendix A, Figure A-2. The primary system circulates ordinary demineralized water in an all-welded, closed loop consisting of the reactor pressure vessel, piping, pumps, and steam generators. The heat produced in the reactor core is transferred to the water, which is kept under pressure to prevent boiling. The heated water passes through the steam generators where it transfers its energy. The primary system water is then pumped back to the reactor to be heated again.

Inside the steam generators, the heat from the primary system is transferred across a water-tight boundary to the water in the secondary system, also a closed loop. The secondary system water, which is at a relatively low pressure, boils to create steam. Isolation of the secondary system from the primary system prevents water in the two systems from intermixing, keeping radioactivity out of the secondary system water.

In the secondary system, steam flows from the steam generators to drive the main propulsion turbines, which turn the ship's propellers, and the turbine generators, which supply the ship with electricity. After passing through the turbines, the steam is condensed back into water in a condenser cooled by seawater, and feed pumps return it to the steam generators for reuse. Thus, the primary and secondary systems are separate, closed systems in which constantly circulating water transforms energy produced in the nuclear chain reaction into useful work.

The reactor core is installed in a heavy-walled reactor pressure vessel within a primary shield. This shield limits exposure from gamma and neutron radiation produced when the reactor is operating. Reactor plant piping systems are installed primarily inside a reactor compartment, which is surrounded by a secondary shield. Because of these two shields, the resulting radiation levels outside the propulsion plant spaces during reactor plant operation are indistinguishable from background radiation levels. Fleet personnel operating nuclear-powered submarines receive less total annual exposure than they would if they were stationed on shore performing work not involving occupational radiation exposure. The exposure is less, because of the low natural background radiation in a steel hull submerged in the ocean, compared to natural background radiation from sources on shore (References 2-3 and 4-22).

5.5.8.2 Reactor Design and Operation

As stated in Section 2.4, Naval nuclear propulsion reactors have an outstanding safety record. In over 4,800 reactor-years of operation and over 110 million miles steamed by nuclear-powered U.S. Navy warships, there has never been a nuclear reactor accident or any incident having a large effect on the environment. A nuclear reactor accident is defined as an event which results in a significant release of fission products from the reactor fuel. The features which are built into Naval nuclear propulsion plants to make them battle worthy also enhance reactor reliability and safety. These features include inherent self-regulation for stability, ability to accommodate rapid power level changes repeatedly to meet changes in ship speed, equipment redundancy, and rugged design for battle shock with the nuclear plant contained within the confines of the hull. Further, prototype propulsion plants are operated and maintained by highly trained crews to the same stringent requirements, exacting standards, and explicit procedures applicable to all Naval nuclear propulsion plants.

The nuclear fuel in Naval nuclear propulsion reactor cores uses highly corrosion-resistant and highly radiation-resistant materials. Since the corrosion rate of the protective cladding on the fuel elements is very slow, the reactor could remain submerged in seawater indefinitely without releasing fission products while the radioactivity decays. As a result, the fuel is very strong and has very high integrity. The fuel is designed, built, and tested to ensure that the fuel construction will contain the radioactive fission products during normal reactor operations and other extreme conditions such as battle shock. In contrast, typical commercial nuclear power plants differ from Naval nuclear propulsion plants in fuel design. Commercial fuel may release some fission products within regulatory limits under normal operations. Naval nuclear fuel can withstand combat shock loads that are well in excess of 50 times the seismic loads a commercial plant might experience in a severe earthquake. Naval nuclear fuel routinely operates with rapid changes in power level since Naval warships must be able to change speed quickly in operational situations. Naval nuclear fuel consists of solid components which are nonexplosive, nonflammable, and noncorrosive.

Strict adherence to conservative principles of design and operation of Naval reactors was discussed on May 24, 1979, by the Director of Naval Nuclear Propulsion (then, Admiral H. G. Rickover) in congressional testimony following the accident at Three Mile Island. Admiral Rickover emphasized that ensuring reactor safety is the responsibility of all personnel who work on Naval nuclear propulsion plants and that each Naval Reactors Program element from training, to design, to construction, and to operation must be properly carried out in a coordinated fashion to achieve the goal of safe performance. A more thorough discussion of this topic can be found in Rickover and the Nuclear Navy: The Discipline of Technology (Reference 2-5).

The MARF and S8G Prototype reactor plants have pressurizable steel containment structures and engineered safety systems. Even though the Atomic Energy Act does not require the MARF and S8G Prototype reactor plant designs to be licensed by the U.S. Nuclear Regulatory Commission, the Naval Reactors Program has provided the designs to the U.S. Nuclear Regulatory Commission and the Advisory Committee on Reactor Safeguards for independent review. These reviews concluded that the S8G and MARF Prototype reactor plants could be operated without undue risk to the health and safety of the public.

5.5.8.3 Cumulative Impacts of Accidents for Reactor Operations and Dismantlement Activities

Notwithstanding the remote possibility of occurrence, the consequences of postulated nuclear accidents have been analyzed and are addressed in Appendix D. A range of hypothetical accident scenarios considering plant-specific design features, operational attributes, procedures, site physical characteristics, and population distribution have been evaluated to examine their resulting impacts on the surrounding environment and population. Those evaluations confirm that the S8G and MARF Prototype reactor plants are designed to withstand a wide variety of accident conditions without damage to the reactor core or release of large amounts of radioactivity.

In the unlikely event of an accident at either the S8G or MARF Prototype reactor plants, the impact on dismantlement work would be small. Virtually all dismantlement work can be stopped or interrupted without compounding the risks associated with the work. If a reactor accident required dismantlement workers to immediately leave the job and relocate to another area on or off the Kesselring Site, the dismantlement activities would remain in a stable condition since this work does not require special conditions or uninterrupted operator intervention to prevent loss of containment or shielding. Therefore, reactor accident consequences would not unduly impact dismantlement activities.

Similarly, if a dismantlement accident were to occur, the impact on reactor operations at the Kesselring Site would be small. Dismantlement activities would take place in locations which are several hundreds of feet away from the operating reactor plants and there would be no loads or lifts of large components near the operating reactor plants or near any of the prototype reactor plant systems which support operation of the plants. As shown in Appendix B, the consequences associated with hypothetical dismantlement accidents would be very small. Therefore, dismantlement accidents do not increase the likelihood or consequence of a reactor plant accident.

5.5.9 Other Resources

Since none of the alternatives would have any impact on environmental resources such as ecological resources, critical habitats, endangered species, cultural resources, or aesthetic resources, no cumulative impact would occur. With regard to resources such as noise, socioeconomics, and utility and energy usage, the potential impacts from all three alternatives would be so small that there would be no discernible cumulative impact.

5.5.10 Conclusion

The evaluation of the activities associated with the dismantlement alternatives combined with ongoing Kesselring Site operations does not result in any discernible cumulative impact or effect on health and the environment.

5.6 Unavoidable Adverse Effects

Each alternative includes small impacts which would be unavoidable. However, none of the alternatives would result in a discernible adverse effect on the environment or human health and safety. Compared to the deferred dismantlement and no action alternatives, the prompt dismantlement alternative would result in greater occupational radiation exposure. Occupational radiation exposure would still be comparable to the radiation exposure routinely received during ongoing operations and maintenance of Naval nuclear reactor plants. Radiation worker doses would be limited to 2 rem per year which is well below the Federal limit of 5 rem per year. Prompt dismantlement would also result in a slightly higher public exposure to radiation from transportation of recyclable materials and waste compared to the other alternatives. The exposure to individuals would be a small fraction of the radiation exposure received from other sources associated with everyday life, such as background radiation. Overall, the health effects associated with any of the alternatives would be very low and would not discernibly add to the incidence of cancer in the general population or the work force.

Dismantlement activities would consume some nonrenewable resources (energy and various materials) and would result in some emissions and wastes. New materials would be needed to ensure adequate isolation of radioactive components from the environment and as shielding to reduce external radiation dose to regulatory levels. Emphasis would be placed on recycling as much dismantled material as practical. Radioactive components that exceed the criteria for recycling could still be candidates for volume reduction including methods such as compaction and metal smelting. Emissions, direct radiation exposure and waste disposal would comply with existing regulations. Under the no action alternative, impacts of material and energy use, direct radiation exposure, and emissions and waste generation would be minimal since caretaking activities would be limited to surveillance and security tours.

Except for the transportation of materials under the prompt and deferred dismantlement alternatives, activities associated with each alternative would be confined to already developed areas of the Kesselring Site. Therefore, none of the alternatives would have any impact on ecological, cultural, geological, or aesthetic resources.

5.7 Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity

This section provides the relationship between short-term impacts versus long-term effects on the environment. With regard to short-term environmental impacts (within a 5-year period), there is little distinction between the alternatives because all environmental impacts would be small. However, the prompt dismantlement alternative is the only alternative that would result in a permanent disposal solution in the short-term. Prompt dismantlement activities would be completed within approximately 3 to 4 years. Wastes that would be generated from dismantlement activities fall within existing estimated forecasts and disposal sites have sufficient capacity at this time.

None of the alternatives would have a discernible long-term effect on the environment. However, there are some long-term considerations that factor into comparisons. For example, while the no action alternative would not have a long-term effect on the environment, it also does not provide for permanent disposal of the S3G and D1G Prototype reactor plants. Although there are no plans to close existing disposal facilities, such as the U.S. Department of Energy Savannah River Site, deferring dismantlement activities would introduce some uncertainty with regard to future waste disposal options.

Since there are no plans to shut down the other operating prototypes or to release the Kesselring Site or Federal reservation lands for other uses in the foreseeable future, none of the alternatives would have any impact on the long-term productivity of the environment. However, the prompt dismantlement would make the eventual release of the Kesselring Site more readily achievable since dismantlement and disposal of two of the four prototype reactor plants would be completed. None of the alternatives involve construction of new structures or development of undisturbed lands.

In terms of socioeconomic effects, each alternative would impact Kesselring Site employment with a reduction of approximately 200 personnel in the short-term. Under the no action and deferred dismantlement alternatives, Kesselring Site employment would be reduced and then a limited work force would place the defueled reactor plants in a condition suitable for long-term caretaking. In comparison, the prompt dismantlement alternative maintains the approximately 200 staff positions at the Kesselring Site for the dismantlement duration, and productivity is enhanced by use of currently available and experienced personnel. In a regional context, changes in Kesselring Site employment do not have any discernible impact on short-term or long-term socioeconomic trends. None of the alternatives involve any environmental justice concerns because all impacts would be small.

5.8 Impact Avoidance and Mitigative Measures

The strictly controlled conduct of activities at Naval Reactors Program facilities are mitigation measures integral to all three alternatives considered in detail for disposal of the S3G and D1G Prototype reactor plants. The Naval Reactors Program has directives and regulations for the conduct of operations at its facilities and has adopted stringent controls for minimizing occupational and public radiation exposure. The policy of these programs is to reduce radiation exposures to as low as reasonably achievable. Singly and collectively, these measures avoid, reduce, or eliminate any potentially adverse environmental impacts from activities at Naval Reactors Program facilities, including those associated with the alternatives considered. The following sections provide measures which are used at the Kesselring Site. The Naval Reactors Program has not identified a need for additional mitigative measures.

5.8.1 Pollution Prevention

Under Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, the Kesselring Site is required to eliminate or reduce the unnecessary acquisition of products containing extremely hazardous substances or toxic chemicals. Although the prototype reactor plants would contain lead and other hazardous materials, these substances would be managed in accordance with stringent safety procedures further discussed in Section 5.8.2. Therefore, current technologies for pollution prevention would be used and would meet pollution prevention standards for the dismantlement alternatives.

Consistent with normal Kesselring Site practice, emphasis during dismantlement would be placed on recycling as much material as practical. As discussed in Section 5.2.13, segregating radioactive and hazardous or toxic materials increases the options for recycling. Most of the recyclable materials generated from dismantlement activities would be metals such as carbon steel from the hull and deckplate structures, corrosion-resisting metals from reactor plant systems, and lead shielding. These materials would be recycled using various commercial vendors.

While the radioactive decay of cobalt-60 would substantially reduce occupational exposure associated with deferred dismantlement activities, many of the materials from reactor systems would still be radioactive due to the longer-lived radionuclides which remain even after 30 years. For the purposes of comparison, the number and types of radioactive shipments associated with deferred dismantlement were assumed to be the same as for the prompt dismantlement alternative. Methods for packaging, transport, disposal and recycling were also assumed to be the same for the deferred and prompt dismantlement alternatives.

Pollution prevention at the Kesselring Site includes two management plans which outline actions for storage requirements and spill management. The Best Management Practices and Spill Prevention Plan outlines proper management of several hazardous substances stored and used at the Kesselring Site. Proper management of these substances prevents accidental spills or releases. The Best Management Practices and Spill Prevention Plan specifically addresses actions for New York State registered Hazardous Substance Bulk Storage Tanks. This plan outlines proper storage, inspection and emergency spill procedures, and is required by the Kesselring Site's New York State Pollutant Discharge Elimination System permit. Additionally, the Spill Prevention Control and Countermeasures Plan outlines proper storage, inspection and emergency spill procedures for all petroleum storage locations at the Kesselring Site. This plan is required by 40 CFR Part 112.5.

5.8.2 Normal Facility Activities

Work on radiologically contaminated components is part of routine operations at the Kesselring Site. This work is pre-engineered and performed using appropriate measures to prevent the spread of radioactivity and to protect human health and the environment. The protective measures during dismantlement would adhere to the same standards and practices that were used to successfully control maintenance evolutions during plant operations. These protective measures include, but are not limited to:

- preliminary planning;
- preparation and use of detailed engineering work procedures;
- pre-engineering of processes and special tooling to minimize exposure to radiation and radioactive contamination;
- checkout of equipment and procedures, and training of personnel on mockups;
- engineered containment enclosures;
- nuclear grade high efficiency particulate air filtered ventilation systems;
- radiation shielding;
- isolation and sealing of component openings upon disassembly;
- controlled work areas with all personnel and materials evaluated and monitored for radiation and radioactive contamination at the exit; and
- monitoring and sampling within and adjacent to the controlled work areas.

5.8.3 Accidents

There has never been an accident in the history of the Naval Reactors Program that resulted in a significant release of radioactivity to the environment or that resulted in radiation exposure to workers in excess of specified limits. Appendix B provides a description of nontransportation related accidents which could occur during dismantlement of the reactor plants and loading of disposal containers at the Kesselring Site. Appendix C provides a description of the transportation related accidents that could occur. The results of these analyses are presented in terms of latent fatal cancer risk to caretaking and dismantlement workers and the public. The risks are based on hypothetical occurrences of the accidents and do not reflect the very low probabilities of the accidents actually occurring. Calculations of the latent fatal cancers which might occur as a result of all postulated accidents are provided in Appendices B and C. A comparison of the accident consequences for all alternatives is provided in Section 3.5.

Although a serious accident involving radioactive or other hazardous materials is highly unlikely, emergency plans are in place at all Naval nuclear facilities to mitigate the impacts of a facility or transportation accident. These plans include activation of emergency control organizations throughout the Naval Reactors Program to provide on-scene response as well as support for the on-scene response team. Emergency plans for the Kesselring Site have been provided to the New York State Emergency Management Office and local Saratoga County officials (Reference 5-8). Realistic training exercises are conducted periodically to ensure that the response organizations maintain a high level of readiness, and to ensure that coordination and communication lines with local authorities and other Federal and State agencies are effective.

Emergency response measures include provisions for immediate response to any emergency at any Naval Reactors Program site, identification of accident conditions, and communications with other authorities to provide radiological data and recommendations for any appropriate corrective actions. Periodic training and evaluation of the emergency response personnel is conducted to ensure that corrective actions are taken properly during an actual casualty. In the event of a facility accident involving radioactive or other hazardous materials, workers in the vicinity of the accident would promptly evacuate the immediate area. This evacuation can typically be accomplished within minutes of the accident and would reduce the hazard to workers. Other individuals who work at the Kesselring Site, or delivery personnel in transit within the Federal reservation boundary, would be evacuated from the affected area within a short time. Kesselring Site emergency response and security personnel would oversee any evacuation to ensure completion of actions in a safe and efficient manner.

For emergencies that impact areas beyond the Kesselring Site and Federal reservation property boundary, local community emergency services are responsible for providing initial response and on-scene command. The Naval Reactors Program would assist local response agencies, beginning with notification and initial assessment, and recommendations for public evacuation, if necessary.

As a result of the emergency plans and coordinated efforts described above, exposure of residents, workers and travelers to any hazard would be limited to the extent possible. Actions would be taken, if needed, to prevent the public from exceeding limits for exposure to radiation or other hazards. Following stabilization of accident conditions, recovery and remediation actions would be implemented.

5.9 Summary of Analysis Uncertainties

The calculations in this Environmental Impact Statement have generally been performed in such a way that the estimates of risk provided are conservatively high and are unlikely to be exceeded during transportation, dismantlement activities, caretaking activities, or in the event of an accident. The results of radiation surveys and monitoring of similar operations provide clearly realistic source terms for incident-free activities, which, when combined with conservative estimates of the effects of radiation, produce estimates of risk which are very unlikely to be exceeded.

The analyses of hypothetical accidents provide more opportunities of uncertainty, primarily because the calculations must be based on sequences of events and models of effects that have not occurred. The models have attempted to provide estimates of the probabilities, source terms, pathways for dispersion and exposure, and the effects on human health and the environment that are as realistic as possible. However, in many cases, the very low probability of the accidents postulated has required the use of models or values for input. These inputs produce estimates of consequences and risks which are higher than would actually occur. The risks presented in this Environmental Impact Statement are believed to be at least 10 to 100 times larger than what would actually occur. Even with the use of conservative analytical methods, the risks of all the alternatives would be very small. Since the resulting risks would be so small, the significance of any uncertainty in analysis parameters is greatly reduced.

The use of conservative analyses does not create a bias in this Environmental Impact Statement since all of the alternatives have been evaluated using the same methods and data, the potential impacts of each alternative can be fairly compared on the same basis. An extensive discussion of uncertainty relative to this Environmental Impact Statement can be found in Volume 1, Appendix D, Part B, Attachment F, Section F.1.5, of the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference 2-7).

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LIST OF PREPARERS

Naval Reactors Program

Donald L. Alf; BS in Electrical Engineering, University of Wisconsin, and MS in Electrical Engineering, Stanford University; graduate of the Bettis Reactor Engineering School; 29 years experience in Naval nuclear propulsion, including 24 years on nuclear safety matters.

Andrew S. Baitinger; BEng in Chemical Engineering, Georgia Institute of Technology, and MEng in Chemical Engineering, University of Idaho, PE; graduate of the Bettis Reactor Engineering School; 14 years experience in Naval nuclear propulsion matters, including 8 years oversight of prototype operations as a Naval Reactors Program field representative.

Stephen L. Cipperly; BS in Sociology, State University of New York - Albany; 24 years experience in Naval nuclear propulsion matters, including 3 years of environmental, safety and health experience.

Richard A. Guida; BS in Electrical Engineering, Massachusetts Institute of Technology, MS in Nuclear Engineering, Massachusetts Institute of Technology, MBA, George Washington University, PE; graduate of the Bettis Reactor Engineering School; 24 years experience in Naval nuclear propulsion matters, including 16 years on environmental matters.

Robert B. Haemer; BS in Chemical Engineering, Washington University; graduate of the Bettis Reactor Engineering School; 14 years experience in Naval nuclear propulsion matters, including 5 years on environmental matters, 3 years on occupational radiation controls, and 2 years on refueling of Naval reactors.

Laura M. Hartman; BS in Mechanical Engineering, North Carolina State University; over 3 years experience in Naval nuclear propulsion matters.

George M. Kamage; BS in Mechanical Engineering, Carnegie Mellon University; graduate of the Bettis Reactor Engineering School; 4 years experience in Naval nuclear propulsion matters, including over 2 years on environmental matters.

Alan C. Kepple; BS in Bioengineering, University of Pennsylvania, MS in Solid Mechanics and Materials Engineering, George Washington University; graduate of the Bettis Reactor Engineering School; 19 years experience in Naval nuclear propulsion matters, including 2 years on environmental matters.

William S. Knoll; BS in Chemistry, Birmingham-Southern University, MS in Engineering Administration, Virginia Polytechnic Institute; over 11 years experience in Naval nuclear propulsion matters, including 4 years on environmental matters.

John M. McKenzie; BS in Nuclear Engineering, Rensselaer Polytechnic Institute; graduate of the Bettis Reactor Engineering School; over 17 years experience in Naval nuclear propulsion matters, including 5 years on environmental matters.

Andrew R. Seepo; BS in Physics, Georgia Institute of Technology, MS in Nuclear Engineering, Georgia Institute of Technology; 24 years experience as a Naval Reactors Program field representative, including 9 years in environmental matters.

Michael T. Shannon; BS in Electrical Engineering, Georgia Institute of Technology; graduate of the Bettis Reactor Engineering School; over 5 years experience in Naval nuclear propulsion, all on environmental matters.

Jeffrey M. Steele; BA and MA in Chemistry, Northwestern University, PE; graduate of the Bettis Reactor Engineering School; 19 years experience in environmental monitoring and evaluation, radioactive waste disposal, and occupational radiological controls.

REFERENCES

2-1 Knolls Atomic Power Laboratory, KAPL-4827, *Kesselring Site Environmental Summary Report*, June 1996.

2-2 Administrative Consent Order Regarding the Site Treatment Plan for Mixed Wastes Generated at the Kesselring Site, effective on October 24, 1995.

2-3 U.S. Departments of Energy and Defense, *The United States Naval Nuclear Propulsion Program*, June 1997.

2-4 Hewlett, R. G., and F. Duncan, *Nuclear Navy*, 1946-1962, University of Chicago Press, 1974.

2-5 Duncan, F., *Rickover and the Nuclear Navy: The Discipline of Technology*, Naval Institute Press, 1990.

2-6 U.S. General Accounting Office, Report to the Chairman, Environment, Energy, and Natural Resources Subcommittee, Committee on Government Operations, House of Representatives, GAO/RCED-91-157, *Environmental, Health and Safety Practices at Naval Reactors Facilities*, August 1991.

2-7 U.S. Department of Energy, DOE/EIS-0203-F, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, April 1995.

2-8 New York State Department of Environmental Conservation, *New York State Waste Reduction Guidance Manual*, March 1989.

2-9 U.S. Department of the Navy, Report NT-97-2, *Occupational Radiation Exposure from U.S. Naval Nuclear Propulsion Plants and Their Support Facilities*, Naval Nuclear Propulsion Program, March 1997.

2-10 U.S. Department of the Navy, Report NT-97-1, *Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear-Powered Ships and Their Support Facilities*, Naval Nuclear Propulsion Program, March 1997.

3-1 U.S. Nuclear Regulatory Commission, NUREG/CR-5884, *Revised Analyses of Decommissioning for the Reference Pressurized Water Reactor Power Station*, Final Report, November 1995.

3-2 Code of Federal Regulations, Title 40, Part 61, Subpart H, *National Emission Standards for Emission of Radionuclides Other than Radon from Department of Energy Facilities*.

3-3 U.S. Nuclear Regulatory Commission, NUREG-0586, *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, Office of Nuclear Regulatory Research, August 1988.

3-4 U.S. Department of Energy, DOE/SSDP-0081, *Final Project Report, Shippingport Station Decommissioning Project*, prepared by Westinghouse Hanford Company for the U.S. Department of Energy, December 1989.

4-1 Codes, Rules and Regulations of the State of New York, Title 6, Part 664, *Freshwater Wetlands Maps and Classification*.

4-2 New York State Department of Environmental Conservation, New York State Freshwater Wetlands Map, Saratoga County, Map 17 of 28, 1987.

4-3 Codes, Rules and Regulations of the State of New York, Title 6, Parts 700-705, *Classifications and Standards of Quality and Purity*.

4-4 Knolls Atomic Power Laboratory, KAPL-4834, *Environmental Monitoring Report*, calendar year 1996.

4-5 Albert, Deborah L., New York State Department of Environmental Conservation, Wildlife Resources Center, Information Services, New York Natural Heritage Program, letter dated December 4, 1996 to A. S. Baitinger, Department of Energy, Schenectady Naval Reactors Office.

4-6 Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map 01-10, Town of Milton, New York - Saratoga County, Community No. 360722 B, Panel 4 of 10, May 15, 1985.

4-7 Codes, Rules and Regulations of the State of New York, Title 10, Part 5, *Drinking Water Supplies*.

4-8 Wing, Robert J., Chief, Federal Facilities Section, U.S. Environmental Protection Agency Region II, letter dated May 27, 1994 to Drew Seepo, Director, Radiological/Environmental Control and Safety Division, U.S. Department of Energy, Schenectady Naval Reactors Office.

4-9 U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *Storm Data and Unusual Weather Phenomena* monthly summaries, National Climatic Data Center, Asheville, North Carolina, 1966-1995.

4-10 Code of Federal Regulations, Title 40, Part 81, *Designation of Areas for Air Quality Planning Purposes*.

4-11 U.S. Department of Energy, *Environmental Assessment: Installation and Operation of a Wastewater Treatment System Located at the Knolls Atomic Power Laboratory Kesselring Site, West Milton, New York*, Schenectady Naval Reactors Office, Schenectady, New York, February 1996.

4-12 Code of Federal Regulations, Title 40, Part 60, *Standards of Performance for New Stationary Sources*.

4-13 Mack, F.K., F.H. Pauszek, and J.R. Crippen, USGS, *Geology and Hydrology of the West Milton Area, Saratoga County, New York*, Geological Survey Water-Supply Paper 1747, 1964.

4-14 U.S. Department of Energy, Report NT-97-4, *Occupational Safety, Health, and Occupational Medicine Report*, Naval Nuclear Propulsion Program, Office of Naval Reactors, March 1997.

4-15 Chiormitro, M.T., New York State Department of Health, letter dated October 4, 1994 to A.R. Seepo, Schenectady Naval Reactors.

4-16 New York Code of Rules and Regulations, Title 6, Part 373, Hazardous Waste Management Facility Permit for U.S. Department of Energy, Knolls Atomic Power Laboratory, Kesselring Site Operation, EPA ID Number NY 5890008993, UPA Number 5-4142-00005/00049-1, West Milton, New York, effective June 1, 1995.

4-17 National Park Service, National Trust for Historic Preservation, *National Register of Historic Places 1966-1994* and *Cumulative List Through January 1, 1994*, The Preservation Press, Washington, D.C.

4-18 *1995 World Almanac*, Occupational Illnesses by Industry and Type of Illness; and Fatal Occupational Injuries.

4-19 U.S. Department of Energy, DOE/EH-0507, *Occupational Injury and Property Damage Summary*, January-December 1994.

4-20 National Safety Council, *Accident Facts*, 1995 Edition.

4-21 New York State Department of Environmental Conservation, Wildlife Resource Center, List of Endangered, Threatened and Special Concern Species by Region and County, dated November 1993.

4-22 U.S. Department of Energy, Report NT-97-3, *Occupational Radiation Exposure from Naval Reactors' Department of Energy Facilities*, Naval Nuclear Propulsion Program, Office of Naval Reactors, March 1997.

4-23 United Engineers and Constructors, Inc., *Site Geology Evaluation Report - S8G for Kesselring Site*, United Engineers and Construction, Inc. of Boston, Massachusetts and E. D'Appolonia Consulting Engineers of Pittsburgh, Pennsylvania, Project #72-626, December 1973.

4-24 U.S. General Accounting Office, Testimony, GAO/T-RCED-91-24, *Environmental, Health and Safety Practices at Naval Reactors Facilities*, statement of Judy England-Joseph, Associate Director, Energy Issues, Resources, Community, and Economic Development Division before the Department of Energy Defense Nuclear Facilities Panel, Committee on Armed Services, House of Representatives, April 25, 1991

4-25 New York State Department of Environmental Conservation, Technical & Administrative Guidance Manual (TAGM) 4003, *Cleanup Guideline for Soils Contaminated with Radioactive Materials*, dated September 14, 1993.

4-26 DELETED

4-27 E. D'Appolonia Consulting Engineers, *Geotechnical Site Investigation, Kesselring Site, West Milton, New York*, E. D'Appolonia Consulting Engineers of Pittsburgh, Pennsylvania, Project #80-138, September 1981.

4-28 Hardt, F.W., G. Hodgson, and G.F. Mikol, *Saratoga Lake Diagnostic - Feasibility Study and Management Plan*, September 1983.

4-29 New York State Department of Health, *Environmental Radiation in New York State*, 1993 Annual Report.

4-30 Dassatti, Edwin, Chief, Bureau of Hazardous Waste Facilities, Division of Solid and Hazardous Materials, New York State Department of Environmental Conservation, letter dated December 31, 1996 to A.R. Seepo, Radiological/Environmental Control and Safety Division, Department of Energy, Schenectady Naval Reactors Office.

4-31 Preliminary Assessment for the Knolls Atomic Power Laboratory - Kesselring Site, April 1988.

4-32 Code of Federal Regulations, Title 10, Part 50, Appendix I, *Numerical Guide for Design Objectives and Limiting Conditions for Operation to Meet Criteria "As Low As Is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents.*

4-33 U.S. Nuclear Regulatory Commission, NUREG 0170, *Final Environmental Statement of the Transportation of Material by Air and Other Modes*, Volume 1, December 1977.

4-34 Hogback Road Landfill Closure Hydrogeologic Investigation, Phase 2, July 1993.

4-35 New York State Departments of Environmental Conservation and Health, *Inactive Hazardous Waste Disposal Sites in New York State*, Site List by Counties, Volume 5, Division of Hazardous Waste Remediation, April 1996.

4-36 Codes, Rules and Regulations of the State of New York, Title 6, Part 941, *Upper Hudson River Drainage Basin*, Table 1.

4-37 U.S. Department of Energy, DOE/RW-0006, *Integrated Data Base Report - 1995: U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics*, Revision 12, December 1996.

4-38 Seepo, A.R., Director, Radiological/Environmental Control and Safety Division, Department of Energy, Schenectady Naval Reactors Office, letter dated July 31, 1995 to Director, Bureau of Hazardous Waste Facility Management, Division of Hazardous Substances Regulation, and Regional Hazardous Substances Engineer, Region 5, New York State Department of Environmental Conservation.

4-39 Seepo, A.R., Director, Radiological/Environmental Control and Safety Division, Department of Energy, Schenectady Naval Reactors Office, letter dated March 6, 1996 to David J. Curtis, Regional Hazardous Substances Engineer, Region 5, New York State Department of Environmental Conservation.

4-40 Lahr, Tanya, Environmental Engineer, Corrective Action Section, Bureau of Hazardous Compliance and Land Management, Division of Solid and Hazardous Materials, New York State Department of Environmental Conservation, letter dated September 26, 1995 to A.R. Seepo, Director, Radiological/Environmental Control and Safety Division, Department of Energy, Schenectady Naval Reactors Office.

4-41 DELETED

4-42 Seepo, A.R., Director, Radiological/Environmental Control and Safety Division, Department of Energy, Schenectady Naval Reactors Office, letter dated May 29, 1997 to Chief, Bureau of Hazardous Waste Facilities, Division of Solid and Hazardous Materials, and Regional Solid and Hazardous Materials Engineer, Region 5, New York State Department of Environmental Conservation.

5-1 U.S. Department of Energy, DOE/EIS-0217, *Savannah River Site Waste Management Final Environmental Impact Statement*, July 1995.

5-2 Pierpont, Ruth L., Director, Historic Preservation Field Services Bureau, New York State Office of Parks, Recreation and Historic Preservation, letter dated December 23, 1996 to A.S. Baitinger, Department of Energy, Schenectady Naval Reactors Office.

5-3 Campola, Karen Ufford, Saratoga County Historian, letter dated November 21, 1996 to Department of Energy, Schenectady Naval Reactors Office.

5-4 Keeler, Phyllis, Town of Galway Historian, letter dated January 24, 1997 to A.S. Baitinger, West Milton Field Office - Department of Energy, Schenectady Naval Reactors Office.

5-5 American Industrial Health Association (AIHA), *Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Guides Handbook*, 1997.

5-6 DELETED

5-7 Trieble, Wilbur L., Town of Milton Supervisor, Irene G. Wood, Town of Milton Historian, letter dated March 14, 1997 to A.S. Baitinger, Department of Energy, Schenectady Naval Reactors Office.

5-8 New York State Radiological Response Plan, Appendix A, *Specific Operating Procedures for the Knolls Atomic Power Laboratory*, June 1993.

5-9 U.S. Department of Energy, *Environmental Assessment: Modification to Expand the Capacity of the Building 91 Mixed Waste Storage Area Located at the Knolls Atomic Power Laboratory - Kesselring Site*, Schenectady Naval Reactors Office, Schenectady, New York, June 1997.

5-10 U.S. Department of Energy, *Finding of No Significant Impact - Modification to Expand the Capacity of the Building 91 Mixed Waste Storage Area Located at the Knolls Atomic Power Laboratory - Kesselring Site*, Schenectady Naval Reactors Office, Schenectady, New York, August 1997.

GLOSSARY

100-Year flood	A flood event of such magnitude that it occurs, on average, every 100 years (equates to a 1 percent probability of occurring in any given year).
Activation	The process of making a material radioactive by exposing the material to neutrons, protons, or other nuclear particles.
Alpha radiation	Energy released in the form of large positively-charged particles emitted from the nuclei of some radioactive elements during radioactive decay.
Area of Concern	A location that is not known to be a Solid Waste Management Unit but where hazardous waste and/or constituents are present, or are suspected to be present, as a result of a release. Refer to "Solid Waste Management Unit."
Beta radiation	Energy released in the form of small charged particles emitted from the nuclei of some radioactive elements during radioactive decay. A beta particle may be either negatively-charged or positively-charged.
Cladding	A metal casing that surrounds nuclear fuel.
Corrosion products	The substances produced by the corrosion of a metal. Rust is a corrosion product resulting from the corrosion of iron.
Curie	The curie is the common unit used for expressing the magnitude of radioactive decay in a sample containing radioactive material. Specifically, the curie is that amount of radioactivity equal to 3.7×10^{10} (37 billion) disintegrations per second. This unit does not give any indication of the radiological hazard associated with the disintegration.
Defueling	The complete removal of all nuclear fuel from the reactor plant.
Fission products	The series of intermediate weight atoms left after the fission (splitting) of a heavy atom such as uranium. Because of the nature of the fission process, many fission products are unstable and, therefore, radioactive.

Gamma radiation	High energy, short wavelength electromagnetic radiation emitted from the nuclei of some radioactive elements during radioactive decay. Gamma rays are essentially similar to x-rays but are usually more energetic.
Half-life	The time required for a radioactive substance to lose 50 percent of its activity by decay.
Hazardous waste	The Resource Conservation and Recovery Act (40 CFR Part 261) defines Hazardous Waste as a waste that is listed on one of the U.S. Environmental Protection Agency's hazardous waste lists or meets one of four hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity.
Latent fatal cancer	The unit for the health detriment of fatal cancer, after a period of time, for an individual as a result of radiation dose. The product of dose in rem and the health effects conversion factor for fatal cancer for an individual (general public or worker).
Mixed waste	Waste that is radioactive and also hazardous as defined in the Resource Conservation and Recovery Act.
Naval Reactors Program	A joint program of the U.S. Department of Energy and the U.S. Department of the Navy which has as its objective the design and development of improved Naval nuclear propulsion plants having high reliability, maximum simplicity, and optimum fuel life for installation in ships ranging in size from small submarines to large combatant surface ships. The program is also referred to as the Naval Nuclear Propulsion Program.
Particulate	Pertaining to a very small piece or part of material.
Pathway	The route or course along which radionuclides could reach man.
Person-rem	A unit used to measure the radiation dose to an entire group of people over a specific period of time or during a specified work effort. It is obtained by multiplying the average dose (measured in rem) to the whole body by the number of persons in the group of interest.

Polychlorinated Biphenyls	A class of chemical substances, formerly manufactured as an insulating fluid in electrical equipment, that is highly toxic to aquatic life. Polychlorinated biphenyls (PCBs) persist in the environment for a long time and tend to accumulate in animals, with possible adverse effects.
Radioactive decay	The process of spontaneous transformation of a radioactive nuclide to a different nuclide or different energy state of the same nuclide. Radioactive decay involves the emission of alpha particles, beta particles, or gamma rays from the nuclei of the atoms. If a radioactive nuclide is transformed to a stable nuclide, the process results in a decrease in the number of original radioactive atoms. Radioactive decay is also referred to as radioactive disintegration.
Radiation	Energy in the form of waves (rays) or particles emitted from the nuclei of unstable atoms during decay (disintegration).
Radiation dose	The amount of radiation received (in rem or millirem). Radiation dose is also referred to as radiation exposure.
Radiation dose rate	The radiation dose per unit time (in rem per hour or millirem per hour).
Radiation shielding	Materials placed around a radioactive source to reduce radiation levels and protect personnel; usually concrete, water, or lead.
Radiation survey	The evaluation of an area or object with instruments to detect, identify, and quantify radioactive materials and radiation fields which may be present.
Radioactivation	Refer to "Activation."
Radioactivity	The process of spontaneous decay or disintegration of an unstable nucleus of an atom; usually accompanied by the emission of ionizing radiation.
Radionuclide	Atoms that exhibit radioactive properties. Standard practice for naming radionuclides is to use the name or atomic symbol of an element followed by its atomic weight (for example, cobalt-60, a radionuclide of cobalt).

Record of Decision	A public document that records the final decision(s) concerning a proposed action. The Record of Decision is based on information and technical analyses generated during the decision- making process, which takes into consideration public comments and community concerns.
Rem	Rem (Roentgen Equivalent Man) is a unit of radiation that relates energy deposited to biological damage. (1 rem = 1,000 millirem).
Scientific Notation	Expressing numbers in terms of powers of ten to simplify mathematical operations or results involving very large or very small numbers. For example: $1 \times 10^{9} = 1{,}000{,}000{,}000$ $1 \times 10^{6} = 1{,}000{,}000$ $1 \times 10^{3} = 1{,}000$ $1 \times 10^{1} = 10$ $1 \times 10^{-1} = 0.1$ $1 \times 10^{-3} = 0.001$ $1 \times 10^{-6} = 0.000001$ $1 \times 10^{-9} = 0.000000001$
Solid Waste Management Unit	A known waste management location at which solid wastes have been placed at any time, regardless of whether the location was intended for the management of hazardous waste.
Type B shipping container	A container designed to retain its containment and shielding integrity under both normal transportation conditions and the hypothetical accident test conditions of 10 CFR Part 71 (Packaging and Transportation of Radioactive Material).
X-rays	Penetrating electromagnetic radiations with wavelengths shorter than those of visible light. X-rays are usually produced (as in medical diagnostic x-ray machines) by irradiating a metallic target with large numbers of high energy electrons. X-rays are essentially similar to gamma rays but are usually less energetic and originate outside the nucleus.

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DOE/EIS-0274

FINAL ENVIRONMENTAL IMPACT STATEMENT

Disposal of the S3G and D1G Prototype Reactor Plants

Volume 2 of 2

November 1997

Prepared by the
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Office of Naval Reactors

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APPENDIX A

RADIATION SOURCES, RADIOLOGICAL CONTROLS AND HEALTH EFFECTS

This appendix describes the sources and types of radiation encountered in the Naval Reactors Program. Health effects resulting from radiation exposure and radiological controls are also discussed.

A.1 Background Radiation

People have always lived surrounded by natural background radiation. Background radiation is as much a part of the earth's environment as the light and heat from the sun's rays. There are four principal sources of natural background radiation:

- cosmic radiation from the sun and outer space,
- terrestrial radiation from the natural radioactivity in soil and rocks,
- radiation from radon and its decay products, and
- internal radiation from the naturally radioactive elements that are part of our bodies.

The unit used to measure radiation exposure to humans is called a "rem," which is an acronym for "roentgen equivalent man." One rem is relatively large compared with the level of radiation doses received from natural background sources or projected as a result of releases of radioactivity to the environment. A unit called the "millirem," which is one thousandth of a rem, is frequently used instead of the rem.

The National Council on Radiation Protection and Measurements estimates that the average member of the population of the United States receives an annual effective dose equivalent of approximately 300 millirem from natural background radiation (Reference A-1). This is composed of approximately 28 millirem from cosmic radiation, 28 millirem from terrestrial radiation, 39 millirem from radioactivity within the body and 200 millirem from inhaled radon and its decay products. The cosmic radiation component varies from 26 millirem at sea level to 50 millirem in Denver at 1,609 meters (5,280 feet). The terrestrial component varies from 16 millirem on the Atlantic and Gulf coastal plain to 63 millirem in the Rocky Mountains. The dose from inhaled radon and its decay products is the most variable. The average cosmic and terrestrial natural background radiation level measured in the vicinity of the Kesselring Site, which does not include radiation from radon and from radioactivity within the body, is approximately 72 millirem per year (Reference A-9).

In addition to natural background radiation, people are exposed to manmade sources of radiation, such as medical and dental x-rays. The average radiation dose from these sources is about 53 millirem per year. Other manmade sources include consumer products, such as color television sets. An individual's radiation exposure from color television averages 0.3 millirem per year. An airplane trip also results in increased radiation exposure. A round-trip flight between Los Angeles and New York results in a dose of about 5 millirem.

Background fission-product radioactivity also exists in the environment, primarily due to atmospheric nuclear weapons testing during the 1940s and 1950s. Although the level is very low, these fission products are routinely detected in air, food and water when analyzed with the extremely sensitive instruments and techniques currently available.

A.2 Uranium Fission

A brief description of how the reactor plant produces energy will help explain the origins of its radioactivity. The fuel in a pressurized water reactor contains enriched uranium sealed within a metal cladding. Uranium is one of the few materials capable of producing heat in a self-sustaining chain reaction. When a neutron strikes a uranium atom, the uranium nucleus may be split apart (that is, it may fission) producing atoms of lower atomic number called fission products (see Figure A-1). Some of the fission products produced by the nuclear reaction in the fuel are radioactive. When formed, the fission products initially move apart at very high speeds. However, fission products only travel a few thousandths of an inch before they are stopped within the fuel cladding. As the fission product movement is stopped, the kinetic energy of the fission products is converted to heat. The heat from the fuel is transferred via the reactor coolant into a steam generator which generates nonradioactive steam. The steam is used to drive propulsion plant equipment. Figure A-2 shows a simplified schematic of the reactor plant.

The nuclear reaction in the fuel also produces neutrons. Most of the neutrons produced during reactor operation are absorbed within the fuel and continue the chain reaction. However, some of the neutrons escape from the fuel. Most of the neutrons which escape from the fuel are absorbed in the walls of the reactor pressure vessel or the shielding immediately surrounding it. The remaining neutrons which escape from the fuel interact with other materials within the reactor compartment, which become activated, or radioactive.

Reactor plant components are constructed from many different materials. During normal reactor operations, trace amounts of corrosion and wear products from normal operation of these components are carried in the reactor coolant. A portion of the corrosion and wear products is removed from the coolant by a purification system. The portion that is not filtered out either redeposits throughout the reactor plant piping systems or stays in the coolant.

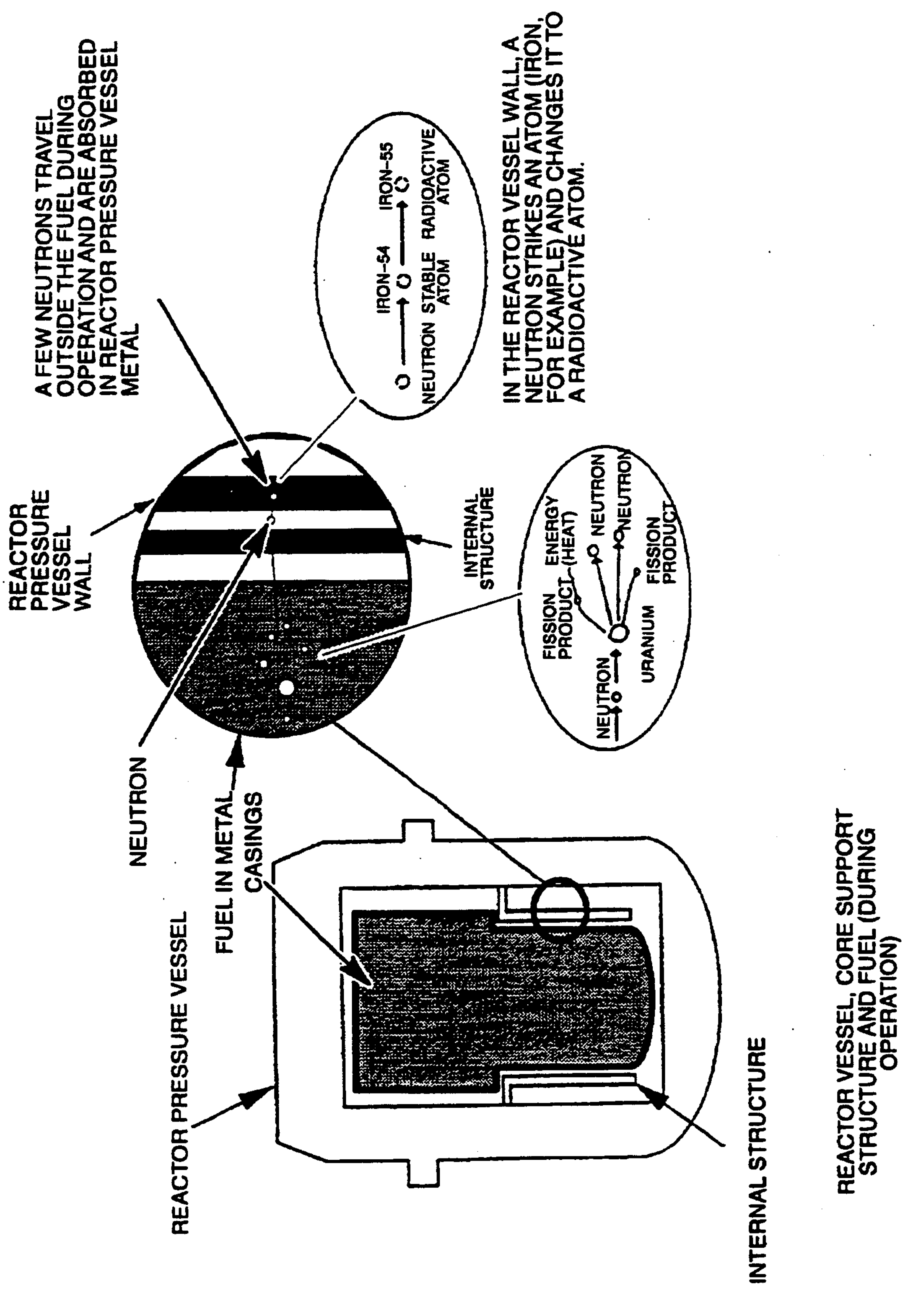

Figure A-1: Neutron and Fission Products From Uranium Fission

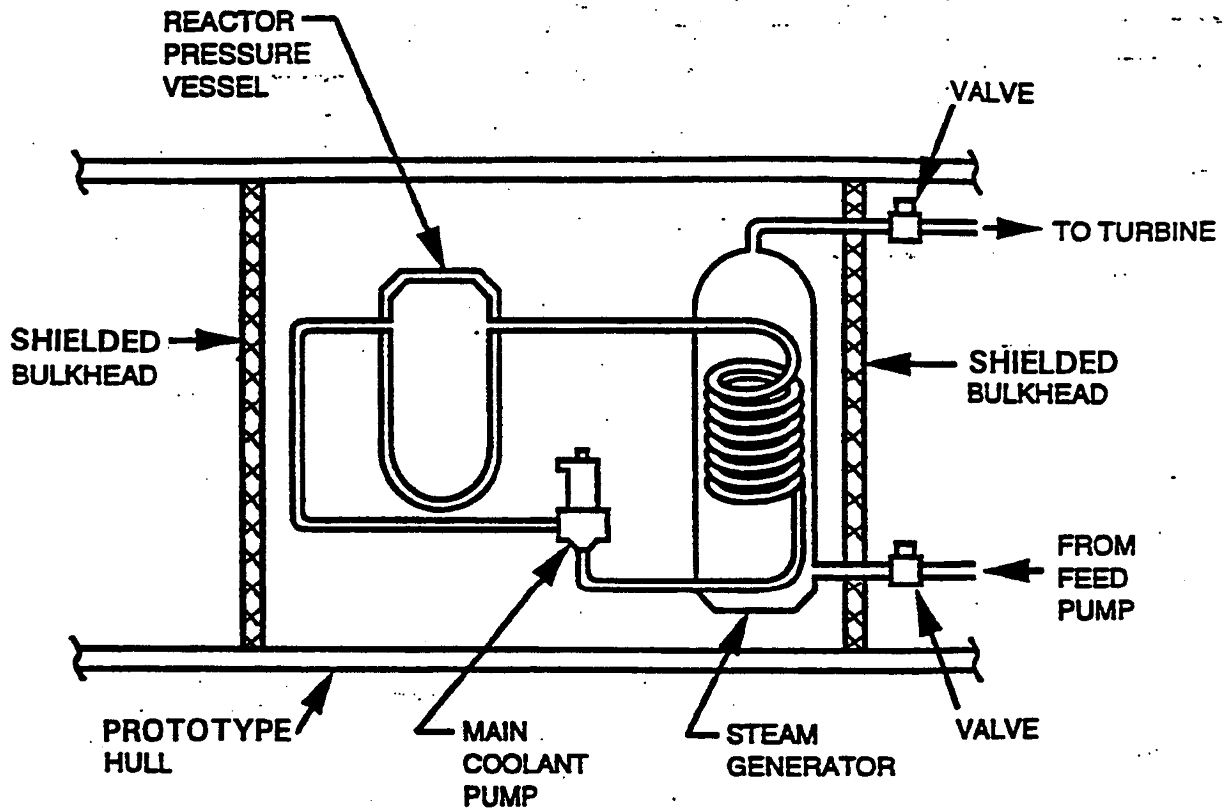

Figure A-2: Schematic of Nuclear Propulsion Plant

A.3 Radioactivation and Decay

A.3.1 Sources of Radioactivity

As discussed in Section A.2, the fuel elements in Naval propulsion reactor cores are designed and built with high integrity to retain the uranium fuel itself and the fission products created by the nuclear chain reaction. The high integrity of the fuel elements has been confirmed by operating experience. The remaining radioactive material present in a Naval nuclear reactor plant is encountered in two forms: activated metal and activated corrosion and wear products. Absorption of a neutron in the nucleus of a nonradioactive atom can produce a chemically identical radioactive atom (radionuclide). The process by which a material becomes radioactive from exposure to nuclear particles, such as neutrons, is known as activation.

A large percentage of the radioactivity present in a defueled nuclear reactor is from activated metal. More than 99 percent of the activation products in the defueled S3G and D1G Prototype reactor plants are an inseparable part of the metal components. Radioactive material in activated metal can only be released from the base material by the slow process of corrosion. The remaining radioactivity comes from the activated corrosion and wear products left from reactor operations, most of which adheres tightly to piping and component internal surfaces. The small amount which does not adhere is the source of potential loose radioactive material encountered during work on Naval nuclear reactor plants. Stringent radiological controls are used to prevent the spread of this radioactive material when working on reactor plant internals. Activated metal and corrosion and wear products in Naval nuclear reactor plants include the following radionuclides: nickel-63, cobalt-60, iron-55, manganese-54, nickel-59, carbon-14, and niobium-94. Cobalt-60 is the primary radionuclide of interest for Naval nuclear reactor plants due to its relative abundance, half-life, and the type of radiation it emits.

A.3.2 Radioactive Decay

The process by which radioactive atoms transform into nonradioactive atoms is known as radioactive decay. Typical particles and rays emitted during decay include alpha and beta particles, and gamma rays. Alpha radiation consists of small, positively charged particles of low penetrating power that can be stopped by a sheet of paper. Beta radiation consists of negatively charged particles that are smaller than alpha particles but are generally more penetrating and may require up to an inch of wood or other light material to be stopped. The gamma ray is an energy emission like an x-ray. Gamma rays have great penetrating power but are stopped by up to several feet of concrete or several inches of lead. In the defueled reactor plants, the most prevalent types of radiation are beta particles and gamma radiation.

The process of spontaneous transformation of a radionuclide (radioactive atom) to a different nuclide or different energy state of the same nuclide is termed radioactive decay. Radioactive decay involves the emission of alpha particles, beta particles or gamma rays from the nuclei of the radionuclide in various combinations and energies. Radioactive decay is also referred to as radioactive disintegration. Each radionuclide emits a unique combination of radiations. Radionuclides may be identified by measuring the type, relative amounts, and energy of the radiations emitted. Measurement of half-life and chemical properties may also be used to help identify radionuclides. The term half-life is a measure of the rate of radioactive decay. It is the time required for one-half of the atoms of a radioactive material to decay to another nuclear form.

Figure A-3 illustrates an example of the activation and radioactive decay processes. The nucleus of a nonradioactive (stable) iron atom, iron-54, contains a total of 54 particles. When a nonradioactive iron atom absorbs a neutron, the nucleus contains 55 particles and is transformed to the iron-55 isotope. Iron-55 is radioactive. By releasing energy in the form of radiation, iron-55 eventually decays into manganese-55, which is not radioactive.

The "curie" is the common unit used for expressing the amount of radioactive decay in a sample containing radioactive material. Specifically, the curie is that amount of radioactivity equal to 3.7×10^{10} (37 billion) disintegrations per second, which is approximately the rate of decay of 1 gram of radium. A curie is also a quantity of any radionuclide that decays at a rate of 3.7×10^{10} disintegrations per second. For environmental monitoring purposes, the curie is usually too large a unit to work with conveniently and is broken down into smaller units, such as the "microcurie," which is 1 millionth of a curie (1×10^{-6} curies) and the "picocurie," which is 1 trillionth of a curie (1×10^{-12} curies). The typical radium dial wrist watch has about 1 microcurie of radium on the dial. The average person has about 100,000 picocuries of naturally occurring potassium-40 in his or her body. Typical soil and sediment samples contain about 1 picocurie of natural uranium per gram.

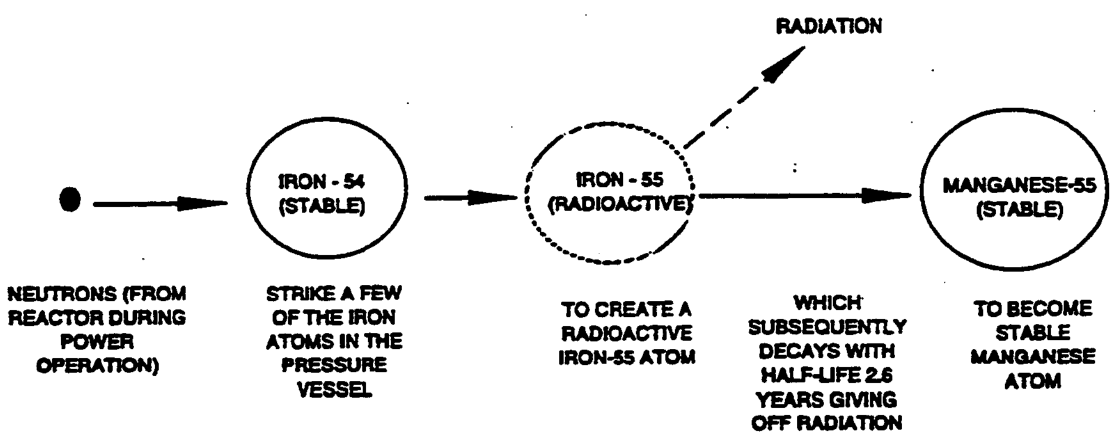

Figure A-3: Neutron Activation of Iron Atom in Reactor Pressure Vessel Wall

A.3.3 Summary of Controls Used While Performing Radiological Work

Stringent Naval Reactors Program radiological controls are used by trained personnel during all aspects of Program radiological work. Detailed radiological training is conducted for all personnel involved in radiological work such as document preparation, operations, maintenance, and management. Personnel responsible for monitoring radiologically controlled work undergo extensive radiological training. Training generally includes lectures and mock-up training, followed by written tests, performance tests and, for some, oral examinations. Training emphasizes the concept that everyone involved in radiological work must understand basic radiological controls concepts and adhere to the requirements. One of these important concepts is the term "As Low as Reasonably Achievable." The goal of the Naval Reactors Program's radiological exposure control program is to control radiation exposure to the lowest practical level while still accomplishing the required work. Formal requalification programs are conducted regularly.

Radioactive materials at the Kesselring Site are subject to stringent handling, inventory, and storage controls. Throughout Kesselring Site history, selected site facilities were utilized for radiological work or controlled storage of radioactive materials in support of routine maintenance, overhauls and refueling work. A radioactive material accountability system has been in effect at the Kesselring Site since initial construction. The accountability system includes a formal logging system and regular inventory checks.

Extensive radiological surveys are conducted with the use of sensitive instruments designed to measure radioactivity. Routine radiological monitoring surveys are performed most frequently in or near radiologically controlled areas. Radiological monitoring surveys associated with specific work activities are also performed to identify radiological conditions before, during, and after execution of each related task. If unplanned conditions are encountered, work is stopped and if needed, work documents are changed appropriately before the work resumes. Routine surveys of the surrounding environment are conducted and all Kesselring Site facilities and work areas, including nonradiological areas, are surveyed at least annually. The results of environmental surveys and general surveys of the Kesselring Site have demonstrated the success of the stringent Naval Reactors Program's radiological controls policies.

At the Kesselring Site, work on radiologically controlled equipment or systems with loose radioactive material on their surfaces is conducted within enclosed glovebag containments or equivalent engineered controls, and engineered ventilation. This approach ensures that loose radioactive material is controlled and not spread to the environment. Entry to and exit from a controlled area is made through a designated location, which provides for personnel monitoring. Monitoring is performed to ensure loose radioactive material is not affixed to personnel leaving the area.

The Naval Reactors Program radiation exposure limits since 1967 have been: 3 rem maximum per quarter year, and 5 rem maximum per year. Since 1979, no individual has received more than 2 rem in a year as a result of working at a Naval Reactors' Department of Energy facility. Also since 1979, the average exposure per person monitored has remained essentially constant at approximately 0.07 rem for prototype personnel (Reference A-6).

Written procedures, which include detailed instructions to prevent the uncontrolled spread of loose radioactive material, are prepared for all radiological work conducted at the Kesselring Site. Verbatim compliance with work procedures is enforced during work performance by trained radiological controls monitoring personnel. Radiological controls personnel make frequent checks of radiological work areas to ensure that all requirements are being met. In addition, a knowledgeable individual from a separate and independent auditing organization periodically monitors various aspects of radiological work, including surveillance of radiological work in progress. Findings are reported to senior site managers.

The Naval Reactors Program maintains a field office at the Kesselring Site, to oversee day-to-day activities, including radiological controls. Additionally, radiological controls at the Kesselring Site are overseen by Naval Reactors Program headquarters' personnel who perform on-site biennial audits of nuclear work practices, including radiological controls, worker training, quality control, and compliance with work procedures and headquarters requirements.

In addition to the radiological controls practices discussed above, several other key practices are used throughout the Naval Reactors Program to minimize personnel exposure to radiation and provide additional assurance that positive control of radioactivity is maintained, including the following:

- Radioactive materials are specially packaged, sealed, and tagged with yellow and magenta tags bearing the standard radiation symbol and the measured radiation level; the use of yellow packaging material is reserved solely for radioactive material.
- Access to radiological work areas is controlled by trained radiological controls personnel. In addition, personnel entering radiation areas, or handling radioactive material are required to wear dosimetry devices to measure their radiation exposures.
- Only trained personnel are authorized to handle radioactive materials.
- Radiological surveys are conducted by qualified radiological controls personnel inside and outside of facilities where radiological materials are installed or handled. This is a check to verify the methods used to control radioactivity are effective.
- Radioactive material or radioactive waste transported off-site is packaged and shipped in accordance with all applicable U.S. Department of Transportation regulations. Specially trained personnel accomplish this function.
- Preliminary planning and pre-engineering of processes and special tooling are conducted to minimize radiation exposure to "As Low As Reasonably Achievable" and to prevent the spread of loose radioactive material.

- Nuclear grade high efficiency (99.95 percent efficient) particulate air filters are used in all ventilation systems serving radiologically controlled facilities to minimize the potential for airborne radioactive particulate emissions.
- Radiation shielding is used extensively as part of minimizing radiation exposure to "As Low As Reasonably Achievable."
- Component openings are isolated and sealed upon disassembly to prevent the spread of loose radioactive material.

Finally, the Naval Reactors Program has emphasized the need to minimize the generation of low-level radioactive waste and mixed (radioactive and hazardous) waste. The Naval Reactors Program has been successful at minimizing waste generation, as exemplified by Kesselring Site's long history of small waste volumes. Techniques used include reuse of radioactively contaminated tools, a prohibition on unnecessary mixing of clean and contaminated materials, minimizing the amount of clean materials needed to perform work in a radiologically controlled area, and routine cleanup of any loose radioactive material while work is in progress.

A.3.4 Past Successful Decommissionings

Since the end of the Cold War, there have been two decommissionings of Naval shipyards, the Mare Island Naval Shipyard and Charleston Naval Shipyard. Both were successful, and both highlight the Naval Reactors Program's commitment to strict radiological work practices and radioactive material controls. These stringent controls made the shipyard decommissionings practical and permitted completion within the required time and resources.

Mare Island Naval Shipyard, Vallejo, California, was authorized to begin Naval nuclear propulsion plant work in 1954 and continued this work through decommissioning in early 1996. The total radioactive material generated during the decommissioning of the shipyard was 7,700 cubic meters (272,000 cubic feet). Through volume reduction at a commercial processor, the total volume disposed of at licensed radioactive waste disposal sites was approximately 1,500 cubic meters (53,000 cubic feet). Of the amount of material disposed of as radioactive waste at licensed disposal sites, approximately 140 cubic meters (5,000 cubic feet) was generated by remediation of shipyard facilities. The final closure report (Reference A-11) concluded that: (1) the berthing of, and work on, nuclear-powered U.S. Navy warships at Mare Island Naval Shipyard had no adverse effect on the environment of the region, (2) those few shipyard areas requiring remediation, have been remediated, and (3) the State of California and the U.S. Environmental Protection Agency have agreed that the facilities are acceptable for release to the local community for unrestricted use with respect to Naval nuclear propulsion plant radioactivity.

Charleston Naval Shipyard, Charleston, South Carolina, was authorized to begin Naval nuclear propulsion plant work in 1962 and continued this work through decommissioning in late 1995. The total radioactive material generated during the decommissioning of the shipyard was 5,000 cubic meters (177,000 cubic feet). Through volume reduction at a commercial processor, the total volume disposed of at licensed radioactive waste disposal sites was approximately 2,700 cubic meters (94,900 cubic feet). Of the amount of material disposed of as radioactive waste at licensed disposal sites, approximately 210 cubic meters (7,300 cubic feet) was generated by remediation of shipyard facilities. The final closure report (Reference A-12) concluded that: (1) the berthing of, and work on, nuclear-powered U.S. Navy warships at Charleston Naval Shipyard had no adverse effect on the environment of the region, (2) those few shipyard areas requiring remediation, have been remediated, and (3) the State of South Carolina Department of Health and Environmental Controls and the U.S. Environmental Protection Agency agreed that the facilities are acceptable for release to the local community for unrestricted use with respect to Naval nuclear propulsion plant radioactivity.

A.4 Health Effects

Body tissue can be damaged if enough energy from radiation is absorbed. The amount of energy absorbed by body tissue during radiation exposure is called absorbed dose. Studies of populations exposed to radiation have been performed to develop numerical estimates of the risks associated with radiation exposure. These risk estimates are useful in addressing the question of how hazardous radiation exposure is, and evaluating and setting radiation protection standards. Control of radiation exposure in the Naval Reactors Program has always been based on the assumption that any exposure, no matter how small, may involve some risk; however, exposure within Naval Reactors Program limits represents a risk that is small compared with the other risks of everyday life. The Report on Occupational Radiation Exposure From Naval Reactors' Department of Energy Facilities (Reference A-6) contains detailed information on radiation exposure and the risk associated with that exposure.

A.4.1 Risk of Radiation Exposure

Since the inception of nuclear power, scientists have cautioned that exposure to radiation in addition to that from natural background may involve some risk. The International Commission on Radiological Protection (Reference A-7) explained the assumed risk as follows: "The basis of the Commission's recommendations is that any exposure to radiation may carry some risk. The assumption has been made that, down to the lowest levels of dose, the risk of inducing disease or disability in an individual increases with the dose accumulated by the individual, but is small even at the maximum permissible levels recommended for occupational exposure." The conclusion of this report and other reports discussed in Reference A-6 is that radiation exposure to personnel should be minimized. This conclusion has been a major driving force of the Naval Reactors Program.

As discussed in Reference A-6, a large amount of experimental evidence of radiation effects on living systems is available. What sets the extensive knowledge of radiation effects on humans apart from other hazards is the evidence that has been obtained from studies of people exposed to high doses of radiation (that is, significantly higher than current occupational limits). The studies of atomic bomb survivors have provided the single most important source of information on the immediate and delayed effects of whole body exposure to ionizing radiation. Based on the studies of populations exposed to high doses of radiation, the most important health effect from the standpoint of occupationally exposed workers is the potential for developing a cancer (References A-3 and A-6). As further discussed in Reference A-6, various studies of populations exposed to low doses of radiation (that is, within current occupational limits) have not shown consistent or conclusive evidence of an associated increase in the risk of cancer. The National Academy of Sciences has reviewed a number of low radiation dose studies in References A-3 and A-8. Their overall conclusion was: "Studies of populations chronically exposed to low-level radiation, such as those residing in regions of elevated natural background radiation, have not shown consistent or conclusive evidence of an associated increase in the risk of cancer."

The development of numerical risk estimates has many uncertainties. Excess latent fatal cancers attributed to radiation exposure can only be observed in populations exposed to high doses and high dose rates. Therefore, the risk estimates derived from the high dose studies must be extrapolated to low doses. This extrapolation introduces a major uncertainty. As stated at the beginning of this section, the Naval Reactors Program has always conservatively assumed that radiation exposure, no matter how small, may involve some risk.

The most recent risk estimates were prepared in 1988 and 1990 by the United Nations Scientific Committee on the Effects of Atomic Radiation (Reference A-2), and the National Academy of Sciences - National Research Council Advisory Committee on the Biological Effects of Ionizing Radiation (Reference A-3), respectively. These estimates were based on the use of new models for predicting risk, revised dose estimates for survivors of the Hiroshima and Nagasaki atomic bombs, and additional data on the cancer experience by both atomic bomb survivors and persons exposed to radiation for medical purposes. The risk estimate for radiation-induced cancer derived from these most recent analyses can be briefly summarized as follows:

> In a group of 10,000 workers in the United States, a total of about 2,000 (20 percent, or 1 chance in 5) will normally die of cancer. If each of the 10,000 received over his or her career an additional 1 rem of radiation exposure, an estimated 4 additional cancer deaths (0.04 percent, or 1 additional chance in 2,500) might occur. Therefore, the average worker's lifetime risk of cancer has been increased nominally from 20 percent to 20.04 percent (or from 1 chance in 5 to 1 chance in 4.99).

This risk estimate was extrapolated from estimates applicable to high doses and dose rates, and probably overstates the true lifetime risk at low doses and dose rates. In an assessment of this uncertainty, the National Academy of Sciences pointed out that "the possibility that there may be no risks from exposures comparable to external natural background radiation cannot be ruled out" (Reference A-3).

The health risk conversion factors used in this evaluation are taken from the International Commission on Radiation Protection which specifies 0.0005 latent fatal cancers per person-rem of exposure to the general public and 0.0004 latent fatal cancers per person-rem to workers (Reference A-4). Risk factors are lower for workers than for the general public because occupational exposures do not have to account for individuals in sensitive age groups (that is, less than 18 years of age and more than 65 years of age). These risk factors are consistent with the most recent risk estimates for radiation exposure (References A-2 and A-3).

In addition to latent fatal cancers, other health effects could result from environmental and occupational exposures to radiation. These effects include nonfatal cancers among the exposed population and genetic effects in subsequent generations. For clarity and to allow ready comparison with health impacts from other sources, such as those from chemical carcinogens, this Environmental Impact Statement presents estimated effects of radiation only in terms of latent fatal cancers. The nonfatal cancers and genetic effects are less probable consequences of radiation exposure. Estimates of the total detriment (latent fatal cancers, nonfatal cancers, and genetic effects) due to radiation exposure may be obtained from the estimates of latent fatal cancers presented in this Environmental Impact Statement by multiplying by 1.4 for workers and by 1.46 for the general public. These factors have been obtained by dividing the risk for the weighted total effects of radiation, by the risk for a latent fatal cancer for workers and for the general population. All of these values are found in Reference A-4. For example, the risk for a latent fatal cancer to a member of the general public is 0.0005 for each rem of exposure. The weighted total effect is 0.00073 for each rem. Dividing 0.00073 by 0.0005 equals 1.46.

A.4.2 Perspective on Estimates of Latent Fatal Cancers and Risk

The topics of human health effects caused by radiation and the risks associated with the alternatives and postulated accidents are discussed many times throughout this Environmental Impact Statement. It is important to understand these concepts and how they are used in order to understand the information presented in this document. It is also valuable to have some frame of reference or comparison for understanding how the risks compare to the risks of daily life.

The method used to estimate the risk of any impact is fundamental to all of the evaluations presented and follows standard accepted practices. The first step is to determine the probability that a specific event will occur. For example, the probability that a routine task, such as operating a crane, will be performed sometime during a year of normal operations at a facility would be 1.0 or 100 percent. That means that the action would certainly occur. The probability that an accident might occur is less than 1.0. This is true because accidents occur only infrequently and some of the more severe accidents, such as a catastrophic earthquake, might occur at any location only once in hundreds, thousands, or millions of years.

Once the probability of an event has been determined, the next step is to predict what the consequences might be. One important measure of consequences chosen for this Environmental Impact Statement is the number of latent fatal cancers induced by radiation, which are attributable to dismantlement activities. The number of latent fatal cancers that might be caused by any routine operation or any postulated accident can be estimated using a standard technique based on the amount of radiation exposure that might occur from all conceivable pathways and the number of people who might be affected.

Some examples should serve to illustrate the calculation of risk. In the first, the lifetime risk of dying in a motor vehicle accident can be computed from the likelihood of an individual being in an automobile accident and the consequences or number of fatalities per accident. According to National Safety Council data, there were approximately 11,200,000 motor vehicle accidents during 1994 in the United States resulting in about 43,000 deaths (Reference A-10). Thus, the probability of a person being in an automobile accident is 11,200,000 divided by approximately 255,000,000 persons in the United States, or 0.04 per year. The number of fatalities per accident is 43,000 deaths divided by 11,200,000 accidents, or 0.004. This number is less than 1.0 because many accidents do not cause fatalities. Multiplying the probability of an accident (0.04 per year) by the consequences of the accident (0.004 deaths per accident) by the number of years the person is exposed to the risk (72 years is considered to be an average lifetime) gives the risk for any individual being killed in an automobile accident. From this calculation, the overall risk of someone dying over his or her lifetime in a motor vehicle accident is 0.012, or 1 chance in about 83.

A second example illustrates the calculation of risk for another event which occurs daily. Fossil fuels, such as natural gas, coal and fuel oil, contain naturally occurring radioactive material that is released into the air during combustion. This radioactive material in the air finds its way into our bodies through food and the air we breathe. This radioactivity has been estimated to produce about 0.5 millirem of radiation dose to the average United States resident each year (Reference A-1). The probability of this happening to an individual is 1.0 because these fuels are burned every day all over the country. The number of latent fatal cancers from exposure to 0.5 millirem per year is estimated by multiplying 0.5 millirem (0.0005 rem) per year times 72 years (average lifetime for an individual) times 0.0005 latent fatal cancers per rem. This equals a risk probability of 1.8×10^{-5} that any one person might experience a latent fatal cancer during that person's lifetime, or 1 chance in about 55,000 of someone dying of cancer from the combustion of fossil fuels over a lifetime.

A third illustration of risk calculation involves the radiation from naturally occurring sources (background radiation) (see Section A.1), which is an average of 0.3 rem per year per person. The probability of this happening to an individual is 1.0 because background radiation exists every day all over the country. The risk of latent fatal cancer for a person from exposure to 0.3 rem per year is estimated by multiplying 0.3 rem per year times 72 years (average lifetime for an individual) times 0.0005 latent fatal cancers per rem. This equals a risk of 0.011 that a person might develop a latent fatal cancer in a lifetime, or 1 chance in about 91 of someone dying of cancer from background radiation over a lifetime.

A fourth illustration involves the radiation from the Kesselring Site operations to persons living off-site. As discussed in the Kesselring Site Environmental Summary Report (Reference A-5) radiation exposures from Kesselring Site operations are too small to be measured and must be estimated. Techniques that conservatively estimate potential exposures consider exposure pathways that include fishing, boating and swimming in the Glowegee Creek, using the creek water for drinking and irrigation, breathing, and consuming regional animal and vegetable farm products. The most recent assessment for 1996 shows that the maximum potential radiation exposure to any member of the public was less than 0.0001 rem (0.1 millirem) for the entire year. This is about 5 percent of the exposure that a person would receive from naturally occurring radiation during a single cross-country airplane flight, and less than 0.1 percent of what a person receives annually from all sources of natural background radiation. It is conservatively estimated that the total accumulated radiation exposure to a member of the public living continuously next to the Federal reservation during all the time the facility has been operating (more than 40 years) would not exceed 0.013 rem. This is less than the exposure an average person actually receives in about three weeks from natural radiation sources. The risk to a person of latent fatal cancer from exposure to 0.013 rem can be estimated by multiplying 0.013 rem times 0.0005 latent fatal cancers per rem. This equals a risk to an individual of 6.5×10^{-6} that he or she might develop a latent fatal cancer, or 1 chance in about 154,000 of that individual dying of cancer from Kesselring Site operations due to living continuously next to the Federal reservation boundary for the past 40 years.

Table A-1 summarizes the preceding discussion and provides excerpted information from the Report on Occupational Radiation Exposure From Naval Reactors' Department of Energy Facilities (Reference A-6).

Table A-1: Risk Comparisons

Cause of Death	Individual Lifetime Risk of Dying		
	Expressed as a decimal	Expressed in scientific notation	Expressed as one chance in X
Cancer: all causes	0.2	2.0×10^{-1}	5
Smoking	0.12	1.2×10^{-1}	8.5
Occupation: mining, quarrying	0.028	2.8×10^{-2}	36
Occupation: agriculture	0.022	2.2×10^{-2}	45
Automobile accident	0.012	1.2×10^{-2}	83
Cancer: naturally occurring radiation	0.011	1.1×10^{-2}	91
Home accident	0.0079	7.9×10^{-3}	127
Occupation: services	0.003	3.0×10^{-3}	333
Accidental fire	0.002	2.0×10^{-3}	500
Accidental poisoning	0.001	1.0×10^{-3}	1,000
Cancer: exposure to fossil fuel radioactive emissions	0.000018	1.8×10^{-5}	55,000
Cancer: Kesselring Site operations (past 40 years)	0.0000065	6.5×10^{-6}	154,000

A.4.3 Low-Level Radiation Controversy (Reference A-6)

In discussions about low-level radiation a very effective way to alarm people is to claim that no one knows what the effects are. This has been repeated so often that it has almost become an article of faith that no one knows the effects of low-level radiation on humans. Human studies of low-level radiation exposure are unable to be conclusive as to whether or not an effect exists in the exposed groups, because of the extremely low incidence of an effect. Therefore, assumptions are needed regarding extrapolation from the high-dose groups. The reason low dose studies are not able to be conclusive is because the risk, if it exists at these levels, is too small to be seen in the presence of all the other risks in life.

The fact that the controversy exists after the many years of study is evidence that the radiation risk is small. This matter has been studied extensively over the past 50 years and continues to be carefully studied.

In summary, the effect of radiation exposures at occupational levels or at the levels to which the public might be exposed is extremely small. There are physical limits to how far scientists can go to ascertain precisely the value of this risk, but a great deal is known about how small the actual effects are.

A.4.4 Conclusions on the Effects of Radiation on Personnel (Reference A-6)

This perspective provides a better position to answer the question, "Is radiation safe?". If safe means zero effect, then the conclusion would have to be that radiation may be unsafe. But to be consistent, background radiation and medical radiation would also have to be considered unsafe. Or more simply, being alive is unsafe.

"Safe" is a relative term. Comparisons are necessary for actual meaning. For a worker, safe means the risk is small compared to other risks accepted in normal work activities. Aside from work, safe means the risk is small compared to the risks routinely accepted in life.

Each recommendation on limits for radiation exposure from the scientific and advisory organizations referenced herein has emphasized the need to minimize radiation exposure. Thus, the Naval Reactors Program is committed to keeping radiation exposure to personnel as low as reasonably achievable. No level of radiation exposure has been identified for which responsible organizations have agreed there is no effect. Similarly, it is difficult to find a single activity of man for which one can confidently state that the risk is zero. However, the above summaries show that the risk from radiation exposure associated with the Naval Reactors' Department of Energy facilities is low compared to the risks normally accepted in industrial work and in daily life outside of work.

A.5 Radiological Characterization of the S3G and D1G Prototype Reactor Plants

Tables A-2 and A-3 list the radionuclide inventories that are expected in the defueled S3G and D1G Prototype reactor plants, respectively, at various times after shutdown. S3G data for 6 years after shutdown and D1G data for 1 year after shutdown represent the radiological conditions expected for the prompt dismantlement alternative. S3G data for 36 years after shutdown and D1G data for 31 years after shutdown represent radiological conditions expected for the deferred dismantlement alternative.

Cobalt-60 is the predominant radionuclide in activated corrosion and wear products within the reactor plant systems. Gamma radiation from cobalt-60 is the major source of occupational radiation exposure in the defueled prototype reactor plants. Cobalt-60 has a 5.27-year half-life and emits beta and penetrating gamma radiation.

While iron-55 is also a predominant radionuclide at the time of shutdown in terms of numbers of curies, it is not significant for disposal considerations. Iron-55 has a relatively short half-life (2.73 years) and emits nonpenetrating, low energy x-ray radiation. Iron-55 is not a major source of occupational radiation exposure because the low energy x-rays emitted by iron-55 are stopped within the reactor plant piping and structure.

Some of the radionuclides listed in Tables A-2 and A-3 have long half-lives. Examples of long half-life radionuclides include nickel-63 (100 years, beta radiation), carbon-14 (5,730 years, beta radiation), niobium-94 (20,000 years, beta and gamma radiation) and nickel-59 (76,000 years, weak x-ray). Nickel-59, nickel-63, and carbon-14 are not major sources of occupational radiation exposure since the radiation they emit is stopped within the prototype reactor plant piping. Niobium-94 is present in small quantities and would be the only measurable gamma radiation dose emitter after cobalt-60 and all of the other short half-life radionuclides have decayed away.

Table A-2: Radioactivity by Individual Radionuclide Present in the Defueled S3G Prototype Reactor Plant 6 Years and 36 Years After Final Reactor Shutdown

Radionuclide [a]	Half-life [b] (years)	Radiation Emitted [b]	Radioactivity 6 Years After Reactor Shutdown (curies)	Radioactivity 36 Years After Reactor Shutdown (curies)
Nickel-63	100	beta	9.81×10^4	7.97×10^4
Cobalt-60	5.27	beta and gamma	9.73×10^3	1.88×10^2
Iron-55	2.73	x-ray	3.79×10^3	1.86
Nickel-59	76,000	x-ray	8.70×10^2	8.69×10^2
Carbon-14	5,730	beta	1.38×10^1	1.37×10^1
Manganese-54	0.85	x-ray and gamma	1.36	0.00
Niobium-94	20,000	beta and gamma	1.01	1.01
Cesium-137	30.2	beta and gamma	7.86×10^{-3}	3.94×10^{-3}
Plutonium-241	14.4	alpha, beta and gamma	7.39×10^{-3}	1.74×10^{-3}
Strontium-90	29.1	beta	5.32×10^{-3}	2.61×10^{-3}
Americium-241 [c]	432.7	alpha and gamma	2.55×10^{-4}	4.11×10^{-4}
Plutonium-239	24,100	alpha and gamma	1.66×10^{-4}	1.66×10^{-4}
Plutonium-238	87.7	alpha and gamma	1.52×10^{-4}	1.20×10^{-4}
Curium-244	18.1	alpha and gamma	2.67×10^{-5}	8.47×10^{-6}
Cobalt-58	0.19	x-ray, beta and gamma	1.13×10^{-5}	0.00
		TOTALS:	1.13×10^5	8.08×10^4

a. The radionuclides listed were considered in facility and transportation accident evaluations in Appendices B and C, respectively. The amounts of radioactivity for each radionuclide represent a combined total from activated metals (inseparable from the base metal) and activated corrosion products (which could potentially be released in the event of an accident). More than 99 percent of the remaining radioactivity in the defueled S3G Prototype reactor plant is an inseparable part of the metal components.

b. Data on half-life and types of radiation emitted were obtained from the Chart of the Nuclides, 14th Edition. Section A.3 includes brief discussions on half-life and the types of radiation emitted.

c. Americium-241 is a by-product of the radioactive decay of plutonium-241. Americium-241 undergoes radioactive decay at a much slower rate than it is produced by the radioactive decay of plutonium 241. This results in a net buildup of americium-241 until approximately 70 years after shutdown, after which its decay will exceed its production. The maximum amount of americium-241 that would result is in the order of 10^{-4} to 10^{-3} curies, which would be very small when compared to the total number of curies remaining after 70 years.

Table A-3: Radioactivity by Individual Radionuclide Present in the Defueled D1G Prototype Reactor Plant 1 Year and 31 Years After Final Reactor Shutdown

Radionuclide [a]	Half-life [b] (years)	Radiation Emitted [b]	Radioactivity 1 Year After Reactor Shutdown (curies)	Radioactivity 31 Year After Reactor Shutdown (curies)
Nickel-63	100	beta	3.66×10^{4}	2.97×10^{4}
Cobalt-60	5.27	beta and gamma	1.86×10^{4}	3.59×10^{2}
Iron-55	2.73	x-ray	1.74×10^{4}	8.57
Cobalt-58	0.19	x-ray, beta and gamma	3.19×10^{3}	0.00
Manganese-54	0.85	x-ray and gamma	5.03×10^{2}	1.37×10^{-8}
Nickel-59	76,000	x-ray	2.99×10^{2}	2.99×10^{2}
Carbon-14	5,730	beta	2.10	2.09
Niobium-94	20,000	beta and gamma	1.07	1.07
Strontium-90	29.1	beta	1.01×10^{-2}	4.94×10^{-3}
Cesium-137	30.2	beta and gamma	1.01×10^{-2}	5.09×10^{-3}
Plutonium-241	14.4	alpha, beta and gamma	5.42×10^{-3}	1.28×10^{-3}
Plutonium-239	24,100	alpha and gamma	3.32×10^{-4}	3.31×10^{-4}
Curium-244	18.1	alpha and gamma	1.39×10^{-4}	4.40×10^{-5}
Americium-241 [c]	432.7	alpha and gamma	1.06×10^{-4}	1.79×10^{-4}
Plutonium-238	87.7	alpha and gamma	1.02×10^{-4}	8.23×10^{-5}
		TOTALS:	7.67×10^{4}	3.04×10^{4}

a. The radionuclides listed were considered in facility and transportation accident evaluations in Appendices B and C, respectively. The amounts of radioactivity for each radionuclide represent a combined total from activated metals (inseparable from the base metal) and activated corrosion products (which could potentially be released in the event of an accident). More than 99 percent of the remaining radioactivity in the defuele D1G Prototype reactor plant is an inseparable part of the metal components.

b. Data on half-life and types of radiation emitted were obtained from the Chart of the Nuclides, 14th Edition. Section A.3 includes brief discussions on half-life and the types of radiation emitted.

c. Americium-241 is a by-product of the radioactive decay of plutonium-241. Americium-241 undergoes radioactive decay at a much slower rate than it is produced by the radioactive decay of plutonium 241. Thi results in a net buildup of americium-241 until approximately 70 years after shutdown, after which its deca will exceed its production. The maximum amount of americium-241 that would result is in the order of 10^{-4} to 10^{-3} curies, which would be very small when compared to the total number of curies remaining after 70 years.

REFERENCES

A-1 National Council on Radiation Protection and Measurements Report 93, *Ionizing Radiation Exposure of the Population of the United States*, September 1987.

A-2 United Nations Scientific Committee on the Effects of Atomic Radiation, *Sources, Effects and Risks of Ionizing Radiation*, 1988.

A-3 National Academy of Sciences-National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation, BEIR V*, Report of the Committee on the Biological Effects of Ionizing Radiations, Washington, D.C., National Academy Press, 1990.

A-4 International Commission on Radiological Protection, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Annals of the ICRP, Vol. 21, No. 1-3, New York, Pergamon Press, 1991.

A-5 Knolls Atomic Power Laboratory, KAPL-4827, *Kesselring Site Environmental Summary Report*, June 1996.

A-6 U.S. Department of Energy, Report NT-97-3, *Occupational Radiation Exposure From Naval Reactors' Department of Energy Facilities*, Naval Nuclear Propulsion Program, Office of Naval Reactors, March 1997.

A-7 International Commission on Radiological Protection, *Recommendations of the International Commission on Radiological Protection,* ICRP Publication 6, New York, Pergamon Press, 1964.

A-8 National Academy of Sciences-National Research Council, *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980,* Report of the Committee on the Biological Effects of Ionizing Radiations, Washington, D.C., National Academy Press, 1980.

A-9 Knolls Atomic Power Laboratory, KAPL-4834, *Environmental Monitoring Report*, calendar year 1996.

A-10 National Safety Council, *Accident Facts*, 1995 Edition.

A-11 Naval Nuclear Propulsion Program, *Radiological Final Report for the Decommissioning of Mare Island Naval Shipyard,* Volume I, April 1996.

A-12 Naval Nuclear Propulsion Program, *Radiological Final Report for the Decommissioning of Charleston Naval Shipyard,* Volume I, April 1996.

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APPENDIX B

ANALYSIS OF NONTRANSPORTATION RELATED IMPACTS

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APPENDIX B

ANALYSIS OF NONTRANSPORTATION RELATED IMPACTS

This appendix presents estimated environmental consequences, event probabilities, and risk (a product of probability and consequence) for both facility activities and postulated accident scenarios related to the disposal of the S3G and D1G Prototype reactor plants. Facility activities and accident scenarios are evaluated to estimate the effects of potential releases of radioactive material and toxic chemicals to the environment. For hypothetical radioactive material releases, the results of analyses are presented in terms of predicted health effects to workers and to the general population. In addition, effects on the environment are presented, based on the amount of land that could be impacted by postulated accidents. For the hypothetical airborne release of toxic chemicals, health effects are evaluated with respect to the concentrations of toxic chemicals that the maximally exposed off-site individual and a worker located 100 meters (330 feet) from the accident scene would be exposed. Analysis results are presented for each of the three alternatives being considered for the disposal of the S3G and D1G Prototype reactor plants: no action, prompt dismantlement (preferred alternative), and deferred dismantlement.

B.1 Basis of Radiological Impact Analyses for Facility Activities

B.1.1 Reactor Plant Conditions

The S3G and D1G Prototypes are defueled. Management of spent nuclear fuel has been addressed in a U.S. Department of Energy evaluation, Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference B-21), and a U.S. Department of the Navy evaluation, Final Environmental Impact Statement for a Container System for the Management of Naval Spent Nuclear Fuel (Reference B-23).

The S3G and D1G Prototype reactor plants are located within separate prototype reactor compartments at the Kesselring Site. The S3G and D1G Prototype reactor plant systems have been placed in a safe and stable protective storage condition.

B.1.1.1 Caretaking Activities

The no action and the deferred dismantlement alternatives include a 30-year caretaking period. During the caretaking period, the S3G and D1G Prototype reactor plants would be periodically monitored. This monitoring would include routine radiological surveys in each reactor compartment, air samples, and perimeter radiation measurements. Periodic monitoring would verify reactor plant integrity and expected radiological conditions. Airflow from the reactor compartment to the environment would be exhausted through a controlled exhaust system containing high efficiency particulate air filters. This analysis evaluates the radiological impacts of direct radiation exposure to workers and the general population during the caretaking period. In addition, radiological impacts from potential airborne releases durin the caretaking period, including potential accidents, are estimated.

B.1.1.2 Dismantlement Activities

Dismantlement activities for the prompt and deferred dismantlement alternatives are similar. The dismantlement work includes removal of reactor plant piping systems and components, disassembly of the prototype hull, and preparations for shipment. Dismantlemen activities would be performed using proven radiological control methods to prevent the spread of any contamination. The radiological doses associated with dismantlement work would be lower for the deferred dismantlement alternative due primarily to cobalt-60 radioactivity decay This analysis evaluates the radiological impacts of direct radiation exposure to workers and the general population during dismantlement activities. Radiological impacts from potential releases to the atmosphere during dismantlement activities, including potential accidents, are also estimated. Evaluations of the impacts associated with transportation of materials from the dismantlement of the reactor plants are discussed in Appendix C.

B.1.2 Selection of Facility Accidents for Detailed Evaluation

In selecting accidents to include in detailed analyses, several variables were considered. Variables included probability of occurrence and consequences. Risk is defined as the product of the probability of occurrence of the accident times the consequence of the accident. This analysis only evaluates accidents that contribute substantially to risk.

B.1.2.1 Accident Probability Considerations

Accidents were categorized into three types as either abnormal events, design basis accidents, or beyond design basis accidents. These categories are characterized by their probability of occurrence as described below.

Abnormal Events

Abnormal events are unplanned or improper events that result in little or no consequence. Abnormal events include industrial accidents and accidents during facility activities such as spills of radioactive liquids or exposure to direct radiation due to improper placement of shielding. The occurrence of these unplanned events has been anticipated, and mitigative procedures are in place that immediately detect and eliminate the events and limit the effects of these events on individuals. As a result, there is little or no hazard to the general population from these events. Such events are considered to occur in the probability range of 1×10^{-3} to 1 per year (1 chance in 1,000 to 1 chance in 1). The probability referred to here includes the probability the event occurs multiplied by other probabilities required for the consequences. For accidents included in this range, results are presented for the 95 percent meteorological condition (see Section B.1.3.1).

Design Basis Accident Range

Accidents that have a probability of occurrence in the range of less than 1×10^{-6} to 1×10^{-3} per year (1 chance in 1,000,000 to 1 chance in 1,000) are included in the range called the design basis accident range. The terminology "design basis accident," which normally refers to facilities to be constructed, also includes the "evaluation" basis accident that applies to existing facilities. For accidents included in this range, results are presented for the 95 percent meteorological condition.

Beyond Design Basis Accidents

This range includes accidents that are less likely to occur than the design basis accidents but that may have very large or catastrophic consequences. Accidents included in this range typically have a total probability of occurrence in the range of less than 1×10^{-7} to 1×10^{-6} per year (1 chance in 10,000,000 to 1 chance in 1,000,000). For accidents included in this range, results are presented for the 95 percent meteorological condition. Accidents which are less likely than 1×10^{-7} per year typically are not discussed since it is expected they would not contribute in any substantial way to the risk.

B.1.2.2 Accident Consequence Considerations

Only accidents involving radioactivity that could reasonably be assumed to result in severe consequences were evaluated. Severe consequences include a large release of radioactive material to the environment or a large increase in radiation levels. Variables affecting accident severity include: dispersibility of the radioactive materials involved, the mechanism that causes the release of radioactive materials from the facility, and the conditions affecting off-site dispersion of the released materials. Initiating events for severe consequence accidents can include natural phenomena (earthquakes, tornadoes, hurricanes, and other natural events) and human induced events (human error, equipment failures, fires, explosions, plane crashes, transportation accidents, and terrorism). The resulting exposure pathways from accidental releases of radioactive materials include direct exposure to radiation, inhalation of radioactive materials, or ingestion of radioactive materials.

Most accident events, such as procedure violations, equipment failures, and minor spills, affect limited areas. The environmental consequences of these events are very small owing to the small amount of radioactive and hazardous materials involved. Despite the higher frequency of occurrence, the very low severity of these events results in very low risk. Accidents involving small releases and affecting small areas were eliminated from further evaluation.

B.1.2.3 Accidents Selected for S3G and D1G Prototype Reactor Plant Dismantlement Evaluation

Based on the selection process described above, several accident scenarios were developed for further detailed analysis. The following four hypothetical accident scenarios ar considered to be more severe than all other reasonably foreseeable accidents. These scenarios produce results which are bounding in nature.

- a large component drop resulting in a breach of the component,
- mechanical damage of a component due to a wind-driven missile,
- a high efficiency particulate air filter fire, and
- a large volume spill of radioactive water.

The probabilities of an airplane crashing into the S3G and D1G Prototype reactor compartments were also evaluated. The method outlined in the U.S. Nuclear Regulatory Commission Standard Review Plan for Aircraft Hazards (Reference B-8) was used to predict the crash probabilities. Results of these calculations indicate the probabilities of an airplane crashing into the S3G and D1G Prototype reactor compartments are 2.8 x 10^{-8} and 2.1 x 10^{-8} per year, respectively, which places this accident outside the beyond design basis accident range (see Section B.1.2.1). Therefore, the consequences of a hypothetical airplane crash accident were not considered further for the S3G and D1G Prototype reactor plants.

B.1.3 Analysis Methods for Evaluation of Radiation Dose

B.1.3.1 Computer Programs and Meteorological Modeling

The radiation doses to the general population, individual worker, and maximally exposed off-site individual were calculated using the following computer programs and meteorological modeling. These computer programs have also been used in other Environmental Impact Statements (References B-21, B-22, B-23, B-24). Radiation doses wer calculated for incident-free facility activities and for hypothetical accidents conditions. The calculation methods are consistent with the International Commission on Radiological Protection (References B-1 and B-2).

GENII

GENII (Reference B-4) was used in the facility activity evaluations of long-term exposure to released radioactive contaminants. This program was developed at Pacific Northwest Laboratory by Battelle Memorial Institute. The program incorporates internal dosimetry models recommended by the International Commission on Radiological Protection in Publication 26 (Reference B-1) and Publication 30 (Reference B-2). The code uses averaged meteorological conditions to evaluate long-term effects of airborne releases. Calculations include potential radiation doses to maximally exposed individuals or population groups via inhalation, ingestion, exposur to radionuclides deposited on the ground surface, immersion in airborne radioactive material, and radiation from a cloud of radioactive material.

RSAC-5

The Radiological Safety Analysis Computer Program, RSAC-5 (Reference B-5), was used to calculate the consequences of the release of radionuclides to the atmosphere. This program was developed by Westinghouse Idaho Nuclear Co., Inc. for the U.S. Department of Energy - Idaho Operations Office. RSAC-5 meteorological modeling capabilities include Gaussian plume dispersion for Pasquill-Gifford conditions. RSAC-5 release scenario modeling allows reduction of radionuclides by chemical group or element and calculates decay and buildup during transport through operations, facilities, and the environment. It allows the amount of each nuclide from a nuclear event to be designated individually or to be calculated internally by the code. It can also be used to model the effect of filters or other cleanup systems. Calculations include potential radiation doses to maximally exposed individuals or population groups via inhalation, ingestion, exposure to radionuclides deposited on the ground surface, immersion in airborne radioactive material, and radiation from a cloud of radioactive material.

SPAN 4

SPAN 4 (Reference B-6) was used to calculate the direct radiation levels. The computer code was developed by the Bettis Atomic Power Laboratory for use in Naval Reactors Program work. The SPAN 4 program models the effects of distance from a radiation source on resulting radiation dose. Estimated doses are derived by mathematical integration over specified areas.

WATER RELEASE

WATER RELEASE, a computer code developed by the Bettis Atomic Power Laboratory, was used to calculate doses to humans arising from radionuclides that have been introduced into water in the vicinity of the radiological facilities. There are two processes by which radionuclides might enter water - via liquid discharge or via airborne discharges. The WATER RELEASE computer code models the resulting effects on humans from exposure to the assumed released radioactivity. Exposure to such releases can be received in several different pathways. Examples of pathways that the program can analyze include consumption of affected water, consumption of affected foods, and immersion (for example, swimming). The total dose to the general population or individual is the resultant sum of the doses from each pathway analyzed.

Meteorological Modeling

Meteorological data used in the analyses were obtained from the Support Center fc Regulatory Air Models bulletin board system. The Support Center for Regulatory Air Models is an organization within the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Bulletin board data files for surface meteorological conditions consist of data acquired from the National Climatic Data Center. Meteorological data from the Albany County Airport, from a recent 5-year period, were used in this evaluation.

Data and computer programs from the Support Center for Regulatory Air Models were used to develop meteorological data in the Stability Array format. The Stability Array format is a joint frequency distribution of 6 wind speed intervals, 16 wind directions, and 6 stability categories. The Stability Array meteorology data were used to calculate the 95 percent meteorological conditions for the accident analyses. The 95 percent condition represents the meteorological conditions which could produce the highest calculated doses. This is defined as that condition which is not exceeded more than 5 percent of the time or is the worst combination of weather stability class and wind speed. Each of these conditions is evaluated for 16 wind directions. The Stabilit Array data were also reformatted for use in the GENII program calculations.

B.1.3.2 Radiation Dose Categories

Radiation doses were calculated for the following categories of individuals for the thre disposal alternatives and hypothetical accidents:

Radiation Worker

Radiation workers are individuals who would be directly involved in performing the actual dismantlement or caretaking activities. The occupational doses were calculated based on radiation survey data. Occupational doses in person-rem were estimated for specific dismantlement and packaging tasks. Similar estimates were calculated for workers who would perform surveillance tours or security duties during caretaking period.

Individual Worker

A hypothetical individual located 100 meters (330 feet) from the radioactive material release point. This hypothetical individual worker would not be directly involved with the dismantlement or caretaking activities but would be involved with other Kesselring Site work activities.

Maximally Exposed Off-Site Individual

The maximally exposed off-site individual is a hypothetical individual living at the Federal reservation boundary receiving the maximum dose. No evacuation of this individual is assumed to occur.

Population

The population living within an 80-kilometer (50-mile) radius of the Kesselring Site is based on 1990 Census data. The total number of people living within an 80-kilometer radius of the Kesselring Site is approximately 1,148,000. The population distribution in 16 compass directions, and various radial intervals from the Kesselring Site is included in Chapter 4, Figure 4-4, of this Environmental Impact Statement.

B.1.3.3 Health Effect Evaluations

Table B-1 lists the health risk conversion factors used in this appendix. Health effects are calculated based on the radiation dose results from incident-free facility activities and hypothetical accidents. The risk factors used for calculations of health effects are taken from Publication 60 of the International Commission on Radiological Protection (Reference B-3). Health risk conversion factors are weighted higher for the general population to account for longer life expectancies of children in the general population compared to adult workers.

Table B-1: Health Risk Conversion Factors for Ionizing Radiation Exposure

Effect [a]	Radionuclide	Risk Factor (probability per rem)	
		Worker	General Population
Fatal cancer (all organs)	All	4.0×10^{-4}	5.0×10^{-4}
Weighted non-fatal cancer	All	8.0×10^{-5}	1.0×10^{-4}
Weighted genetic effects	All	8.0×10^{-5}	1.3×10^{-4}
Weighted total effects	All	5.6×10^{-4}	7.3×10^{-4}

a. In determining a means of assessing health effects from radiation exposure, the International Commission on Radiological Protection has developed a weighting method for fatal cancers, nonfatal cancers, and genetic effects to obtain a total weighted effect, or "health detriment."

B.1.3.4 Evaluation of Impacted Areas for Hypothetical Accident Analyses

The impacted area following a facility accident was determined for each accident scenario. The impacted area was defined as that area in which the plume deposited radioactive material to such a degree that an individual standing on the boundary of the fallout area would receive approximately 0.01 millirem per hour of exposure above background. If this individual spends 24 hours per day at this location, that person would receive an additional

88 millirem per year from direct radiation from radioactivity deposited on the ground. This is within the U.S. Nuclear Regulatory Commission dose limit of 100 millirem per year for individual members of the general population (10 CFR Part 20, Standards for Protection Against Radiation).

To best characterize the affected areas for each casualty, a typical 50 percent meteorology (Pasquill-Gifford Class D, wind speed 16 kilometers (10 miles) per hour) was chosen. The 95 percent worst case meteorology was used when calculating dose and risk to workers and the general population. Computer modeling results (RSAC-5) for ground surface dose were interpolated to determine the distance downwind where the centerline dose had dropped to approximately 88 millirem per year based on 24 hours per day exposure. For the wind class chosen, the plume remains within a single 22.5-degree sector. The area affected by the plume is conservatively assumed to be the entire sector contaminated to the calculated downwind distance rather than the narrower plume profile. Use of a typical 50 percent meteorology is also a conservative assumption for the footprint evaluation of a tornado generated wind-driven missile accident. Stormy, windy conditions would disperse any release sufficiently such that no location would have a dose greater than 88 millirem per year.

Although the radioactive plume resulting from an accident would be contained within a single wind chart sector, the direction of the wind is unknown. Since the accidents occur over a short duration of time, calculations assumed no changes in the general wind direction. Impacts were evaluated in each of the 16 directions around the facility out to a distance equaling the footprint length. The footprint estimates for all hypothetical facility accidents are less than 100 meters (328 feet) in length. This results in an impacted area of less than 0.4 hectares (1 acre). Table B-2 describes secondary effects of hypothetical facility accidents.

Table B-2: Secondary Impacts of Hypothetical Facility Accidents

Topic	Impact
Surrounding Environment	The footprint length would not extend beyond the Kesselring Site.
Biotic Resources Including Endangered Species	Plants and animals on the Kesselring Site and on the Federal reservation would experience no long-term impacts. An accident would not result in the extinction or adversely affect potential for survival of any endangered species.
Water Resources	The water used for drinking and industrial purposes is monitored and use may be temporarily suspended during cleanup operations. No enduring impacts are expected
Economic Impacts	Some costs would be incurred for the actual cleanup operation at the Kesselring Site.
Land Use	Access to areas outside the Federal reservation would not be restricted.

B.1.3.5 Estimated Exposure Times and Mitigative Measures Following Hypothetical Facility Accidents

Accident analysis calculations take no credit for any preventive or mitigative actions that would limit exposure to members of the general population who are assumed to reside in close proximity to the Kesselring Site. Radiation dose calculations for the maximally exposed off-site individual (individual who lives nearest the Federal reservation boundary) assume exposure to the entire contaminated plume as it travels downwind from the accident site. Calculations assume no action is taken to prevent these people from continuing their normal day-to-day routines or changing their food sources. The general population is assumed to spend approximately 30 percent of the day within their homes or other buildings. Since buildings and homes provide some shielding, general population annual radiation dose from the contaminated ground surface was reduced by 30 percent.

Workers all undergo training to take quick, decisive action during a casualty. In the event of a casualty, workers would quickly evacuate the affected area and assemble in an area upwind of the affected area. Analyses assumed that workers would move indoors. While the workers are moving indoors, analyses conservatively assumed that workers would receive exposure to the released radioactivity for a total of 5 minutes at a distance of 100 meters (328 feet) from the affected area. Worker doses were calculated for the direct radiation and inhalation pathways. Doses due to ingestion of contaminated food were not specifically calculated for workers since they would not eat contaminated food following the accident.

Table B-3 provides the individual exposure times utilized in the hypothetical facility accident analyses.

Table B-3: Estimated Exposure Times Following a Hypothetical Facility Accident

Exposure Pathway	Individual Worker	Maximally Exposed Off-Site Individual and General Population
Plume	5 minutes	100 percent of release time
Fallout on Ground Surface	5 minutes	0.7 years
Food Ingestion	None	1 year

B.1.3.6 Modeling Assumptions for Hypothetical Facility Accident Evaluations

Unless stated otherwise, the following post-accident modeling assumptions were used when performing airborne radioactivity release calculations with the RSAC-5 computer program. In most cases, these conditions are the default conditions in the computer program

Meteorological Data

- Wind speed, direction, and Pasquill stability are taken from 95 percent meteorology.
- The release is calculated as occurring at ground level (0 meters).
- Mixing layer height is 400 meters (1,310 feet). Airborne materials freely diffuse in tl atmosphere near ground level in what is known as the mixing depth. A stable layer exists above the mixing depth which restricts vertical diffusion.
- Wet deposition is zero (no rain occurs to accelerate deposition and reduce the area affected).
- Dry deposition of the cloud is modeled. During movement of the radioactive plume, fraction of the plume is deposited on the ground due to gravitational forces and becomes available for exposure by ground surface radiation and ingestion.
- The quantity of deposited radioactive material is proportional to the material size and speed. The following dry deposition velocities (meters per second) were used:
  solids = 0.001 halogens = 0.01 noble gases = 0.0 cesium = 0.001
- If radioactive releases occur through a stack, then additional plume dispersion can be accounted for by calculating a jet plume rise. In this analysis, jet plume rise is not used.
- When released gases have a heat content, the plume can disperse more quickly. In th calculation, buoyant plume effects are not used.

Inhalation Data

- Breathing rates are 3.33×10^{-4} cubic meters (1.18×10^{-2} cubic feet) per second for individual workers and 2.66×10^{-4} cubic meters (9.40×10^{-3} cubic feet) per second 1 people at the Federal reservation boundary and beyond.
- Particle size is 1.0 micron.
- The internal exposure period is 50 years from the time of internal deposition for individual organs and tissues.
- Exposure for the maximally exposed off-site individual and general population is to tl entire plume. Exposure to the plume for individual workers is discussed in Section B.1.3.5.
- Inhalation exposure factors are based on Reference B-2.

Ground Surface Exposure

- The general population and maximally exposed off-site individual are exposed to contaminated ground surface for one year. Exposure to the individual workers from the contaminated ground surface is discussed in Section B.1.3.5.
- The building shielding factor is 0.7. People are exposed to contaminated ground surface for 16 hours a day.

Ingestion Data

- The following dietary consumption rates were used:
  177 kilograms (390 pounds) of stored vegetables per year
  18.3 kilograms (40.3 pounds) of fresh vegetables per year
  94 kilograms (207 pounds) of meat per year
  112 liters (29.6 gallons) of milk per year
- Ten (10) percent of the food consumed is assumed to be locally grown (such as in a person's garden) and contaminated by the accident.

B.2 Radiological Analysis Results - Incident-Free Facility Activities

B.2.1 Facility Activities

The purpose of this analysis is to determine the hypothetical health effects on workers and the general population from incident-free facility activities associated with disposal of the S3G and D1G Prototype reactor plants. Unique source terms were used for each alternative for the evaluation of facility activities. Site-specific meteorological and population data were used. For facility activities, the radiation dose evaluation addresses workers, the maximally exposed off-site individual, and the general population.

B.2.1.1 Source Term

The radioactive material release source term for the analysis is based on a conservative calculation of expected release. For the no action alternative and the first 30 years of the deferred dismantlement alternative, the S3G and D1G Prototype reactor compartment would be maintained in a heated and dry condition. The systems and components would be closed and sealed such that none of the contamination would be available for release to the environment. None of the reactor plant systems would be vented. Therefore, the routine airborne release was calculated based on a minimum detectable airborne activity level of 2×10^{-14} microcuries per milliliter and the expected volume of air which would flow through each reactor compartment. For both dismantlement alternatives, the airborne release source term was selected based on data from typical reactor servicing ventilation systems. The ventilation systems have high efficiency particulate air filters installed and have a 99.95 percent efficiency for removal of potential airborne particulate radioactivity. The source term was derived from the radiation levels measured on typical air filters installed in ventilation systems used during maintenance work on radioactive systems.

Table B-4 lists the radionuclides and the estimated amounts of radioactivity that result in at least 99 percent of the possible exposure due to airborne releases to the environment.

Table B-4: Source Terms for S3G and D1G Incident-Free Facility Activities

Radionuclide	Radioactivity Discharged (curies per year) [a]					
	No Action		Prompt Dismantlement		Deferred Dismantlement [b]	
	S3G	D1G	S3G	D1G	S3G	D1G
Cobalt-60	6.6×10^{-8}	1.7×10^{-9}	2.1×10^{-7}	3.7×10^{-7}	4.1×10^{-9}	7.2×10^{-9}
Iron-55	6.3×10^{-8}	3.1×10^{-9}	2.0×10^{-7}	6.6×10^{-7}	c	c
Cobalt-58	c	2.1×10^{-10}	c	4.4×10^{-8}	c	c
Manganese-54	c	8.8×10^{-11}	c	1.9×10^{-8}	c	c
Nickel-63	4.2×10^{-8}	c	1.3×10^{-7}	c	1.1×10^{-7}	1.0×10^{-7}
Niobium-93m	c	c	c	c	c	1.7×10^{-9}
Carbon-14	2.9×10^{-6}	4.0×10^{-8}	9.2×10^{-6}	8.4×10^{-6}	9.2×10^{-6}	8.4×10^{-6}
Plutonium-238	3.4×10^{-13}	c	1.1×10^{-12}	c	8.7×10^{-13}	8.3×10^{-13}
Plutonium-239	c	c	c	c	1.8×10^{-13}	1.7×10^{-13}
Americium-241	5.0×10^{-13}	6.9×10^{-15}	1.6×10^{-12}	1.5×10^{-12}	1.5×10^{-12}	1.4×10^{-12}
TOTALS	3.1×10^{-6}	4.5×10^{-8}	9.7×10^{-6}	9.5×10^{-6}	9.3×10^{-6}	8.5×10^{-6}
	3.1×10^{-6}		1.9×10^{-5}		1.8×10^{-5}	

a. Ventilation system discharges are estimated for the first year of the prompt and no action alternatives and the thirty-first year of the deferred dismantlement alternative (first year of deferred dismantlement operations). The no action source term is used for the 30-year caretaking period prior to deferred dismantlement. Listed radionuclides are from activated corrosion products which could be released.

b. The radionuclides listed for deferred dismantlement were derived based on prompt dismantlement data and individual nuclide decay rates for a 30-year period.

c. These and all other radionuclides not listed in the table contribute a total of less than 1 percent to the calculated doses.

B.2.1.2 Incident-Free Facility Activities Analysis Results

Tables B-5 and B-6 contain the detailed analysis results for radiation exposure from S3G and D1G facility activities, respectively, through various pathways, assuming no accidents occur. Table B-7 contains the detailed analysis results for the combined radiation exposure from each reactor plant. Since each of the alternatives represents different lengths of time, the results presented are cumulative doses and effects. The no action alternative data represent the cumulative dose for a 30-year caretaking period. The deferred dismantlement alternative data represent the cumulative dose for a 30-year caretaking period plus a 2-year dismantlement period for S3G and a 2¾-year dismantlement period for D1G. The prompt dismantlement alternative data represent the cumulative dose for a 2-year and a 2¾-year dismantlement period for S3G and D1G, respectively. The health effects are based on the cumulative doses times the appropriate conversion factor (see Table B-1).

Comparison of the data shows that the prompt dismantlement alternative would result in the largest cumulative radiation dose to radiation workers. Radiation worker dose associated with deferred dismantlement reflects the radioactive decay of cobalt-60. Radiation worker dose during the 30-year caretaking period would be small.

Exposure to the general population would be essentially the same for the no action and deferred dismantlement alternatives because the time durations would be approximately the same. The radiation dose from facility activities to the general population during the prompt dismantlement alternative would be lower because of the short 2-year and 2¾-year durations for S3G and D1G, respectively, with no caretaking activities.

The average annual individual risk to a member of the general population of dying from all cancer causes is 1 chance in 360 (Reference B-18). The average annual individual risk of latent fatal cancer for the population and the maximally exposed off-site individual are presented in Tables B-5 through B-7 for comparison purposes. The annual individual (population and maximally exposed off-site individual) risk of latent fatal cancer from combined S3G and D1G incident-free facility activities would be less than 1 chance in 1 trillion. The risk of cancer to an individual of the general population from incident-free facility activities would be very small when compared to the risk of dying from all cancer causes.

Table B-5: Dose Results for S3G Incident-Free Facility Activities

		No Action	Prompt Dismantlement	Deferred Dismantlement
Radiation Workers (Occupational Dose)	Collective Dose (person-rem)	6	100 to 250 [a]	8
	Risk of Latent Fatal Cancer	2.4×10^{-3}	4.0×10^{-2}	3.2×10^{-3}
	Average Annual Individual Risk of Latent Fatal Cancer	1.5×10^{-5} [f]	3.3×10^{-4} [g]	1.5×10^{-5} [h]
Individual Worker	Dose [b] (rem)	9.5×10^{-4}	2.4×10^{-4}	9.5×10^{-4}
	Risk of Latent Fatal Cancer	3.8×10^{-7}	9.6×10^{-8}	3.8×10^{-7}
	Annual Risk of Latent Fatal Cancer	1.3×10^{-8}	4.8×10^{-8}	1.2×10^{-8}
Maximally Exposed Off-Site Individual	Dose [c] (rem)	8.0×10^{-10}	2.6×10^{-10}	9.5×10^{-10}
	Cumulative Risk of Latent Fatal Cancer	4.0×10^{-13}	1.3×10^{-13}	4.7×10^{-13}
	Annual Risk of Latent Fatal Cancer	1.3×10^{-14}	6.5×10^{-14}	1.5×10^{-14}
Population	Collective Dose (person-rem) [d]	9.7×10^{-6}	3.1×10^{-6}	1.1×10^{-5}
	Cumulative Risk of Latent Fatal Cancer	4.9×10^{-9}	1.6×10^{-9}	5.7×10^{-9}
	Average Annual Individual Risk of Latent Fatal Cancer [e]	1.4×10^{-16}	7.0×10^{-16}	1.6×10^{-16}

a. The collective dose values for radiation workers represent the occupational dose for each alternative based on estimates of worker staffing levels and time in or near the S3G Prototype reactor compartment. The larger value for the prompt dismantlement represents an estimate based on preliminary plans. The lower value for the prompt dismantlement reflects experience that detailed work planning typically results in lower doses. The risk of latent fatal cancer is based on the lower value. Radiation worker dose would be limited to 2 rem per year per person, which results in a risk of 8×10^{-4} additional latent fatal cancers.

b. The dose values for the Individual Worker represent conservative estimates for a hypothetical worker located 100 meters from the reactor compartment, working 40 hours per week for the duration of the respective alternative.

c. The dose values for the maximally exposed off-site individual represent conservative estimates for a hypothetical individual who resides at the boundary of the Federal reservation for the duration of the respective alternative.

d. The collective dose values for the population represent conservative estimates of cumulative dose to all members of the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site for the duration of the respective alternative.

e. The cumulative risk divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site and the total number of years for each of the alternatives.

f. Based on a worker staff-level weighted average for inactivation and caretaking activities over 30 years.

g. Based on 60 workers receiving dose over a 2-year dismantlement period.

h. Based on a worker staff-level weighted average for inactivation, caretaking and dismantlement activities over a 32-year period.

Table B-6: Dose Results for D1G Incident-Free Facility Activities

		No Action	Prompt Dismantlement	Deferred Dismantlement
Radiation Workers (Occupational Dose)	Collective Dose (person-rem)	16	105 to 210 [a]	18
	Risk of Latent Fatal Cancer	6.4×10^{-3}	4.2×10^{-2}	7.2×10^{-3}
	Average Annual Individual Risk of Latent Fatal Cancer	2.7×10^{-5} [f]	2.5×10^{-4} [g]	2.5×10^{-5} [h]
Individual Worker	Dose [b] (rem)	4.5×10^{-3}	1.5×10^{-3}	4.5×10^{-3}
	Risk of Latent Fatal Cancer	1.8×10^{-6}	6.2×10^{-7}	1.8×10^{-6}
	Annual Risk of Latent Fatal Cancer	6.0×10^{-8}	2.3×10^{-7}	5.5×10^{-8}
Maximally Exposed Off-Site Individual	Dose [c] (rem)	2.1×10^{-11}	4.6×10^{-10}	2.1×10^{-10}
	Cumulative Risk of Latent Fatal Cancer	1.1×10^{-14}	2.3×10^{-13}	1.0×10^{-13}
	Annual Risk of Latent Fatal Cancer	3.7×10^{-16}	8.4×10^{-14}	3.1×10^{-15}
Population	Collective Dose (person-rem) [d]	1.5×10^{-7}	5.5×10^{-6}	2.4×10^{-6}
	Cumulative Risk of Latent Fatal Cancer	7.5×10^{-11}	2.8×10^{-9}	1.2×10^{-9}
	Average Annual Individual Risk of Latent Fatal Cancer [e]	2.2×10^{-18}	8.9×10^{-16}	3.2×10^{-17}

a. The collective dose values for radiation workers represent the occupational dose for each alternative based on estimates of worker staffing levels and time in or near the D1G Prototype reactor compartment. The larger value for the prompt dismantlement represents an estimate based on preliminary plans. The lower value for the prompt dismantlement reflects experience that detailed work planning typically results in lower doses. The risk of latent fatal cancer is based on the lower value. Radiation worker dose would be limited to 2 rem per year per person, which results in a risk of 8×10^{-4} additional latent fatal cancers.

b. The dose values for the Individual Worker represent conservative estimates for a hypothetical worker located 100 meters from the reactor compartment, working 40 hours per week for the duration of the respective alternative.

c. The dose values for the maximally exposed off-site individual represent conservative estimates for a hypothetical individual who resides at the boundary of the Federal reservation for the duration of the respective alternative.

d. The collective dose values for the population represent conservative estimates of cumulative dose to all members of the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site for the duration of the respective alternative.

e. The cumulative risk divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site and the total number of years for each of the alternatives.

f. Based on a worker staff-level weighted average for inactivation and caretaking activities over 30 years.

g. Based on 60 workers receiving dose over a 2¾-year dismantlement period.

h. Based on a worker staff-level weighted average for inactivation, caretaking and dismantlement activities over a 32¾-year period.

Table B-7: Dose Results for Combined S3G and D1G Incident-Free Facility Activities

		No Action	Prompt Dismantlement	Deferred Dismantlement
Radiation Workers (Occupational Dose)	Collective Dose (person-rem)	22	205 to 460 [a]	26
	Risk of Latent Fatal Cancer	8.8×10^{-3}	8.2×10^{-2}	1.0×10^{-2}
	Average Annual Individual Risk of Latent Fatal Cancer	4.2×10^{-5}	5.8×10^{-4}	4.0×10^{-5}
Individual Worker	Dose [b] (rem)	5.5×10^{-3}	1.7×10^{-3}	5.5×10^{-3}
	Risk of Latent Fatal Cancer	2.2×10^{-6}	7.2×10^{-7}	2.2×10^{-6}
	Annual Risk of Latent Fatal Cancer	7.3×10^{-8}	2.8×10^{-7}	6.7×10^{-8}
Maximally Exposed Off-Site Individual	Dose [c] (rem)	8.2×10^{-10}	7.2×10^{-10}	1.2×10^{-9}
	Cumulative Risk of Latent Fatal Cancer	4.1×10^{-13}	3.6×10^{-13}	5.7×10^{-13}
	Annual Risk of Latent Fatal Cancer	1.3×10^{-14}	1.5×10^{-13}	1.8×10^{-14}
Population	Collective Dose (person-rem) [d]	9.9×10^{-6}	8.6×10^{-6}	1.3×10^{-5}
	Cumulative Risk of Latent Fatal Cancer	5.0×10^{-9}	4.4×10^{-9}	6.9×10^{-9}
	Combined Average Annual Individual Risk of Latent Fatal Cancer [e]	1.4×10^{-16}	1.6×10^{-15}	1.9×10^{-16}

a. The collective dose values for radiation workers represent the occupational dose for each alternative based on estimates of worker staffing levels and time in or near the S3G and D1G Prototype reactor compartments. The larger value for the prompt dismantlement represents an estimate based on preliminary plans. The lower value for the prompt dismantlement reflects experience that detailed work planning typically results in lower doses. The risk of latent fatal cancer is based on the lower value. Radiation worker dose would be limited to 2 rem per year per person, which results in a risk of 8×10^{-4} additional latent fatal cancers.

b. The sum of the S3G and D1G conservative dose estimates for a hypothetical worker located 100 meters from the reactor compartment, working 40 hours per week for the duration of the respective alternative.

c. The sum of the S3G and D1G conservative dose estimates for a hypothetical individual who resides at the boundary of the Federal reservation for the duration of the respective alternative.

d. The sum of the S3G and D1G conservative cumulative dose estimates for all members of the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site for the duration of the respective alternative.

e. The cumulative risk divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site and the total number of years for each of the alternatives for each prototype, combined.

B.3 Radiological Analysis Results - Hypothetical Facility Accidents

B.3.1 Component Drop Accident

B.3.1.1 Description of Conditions

During dismantlement of the S3G and D1G Prototype reactor plants, many large components and portions of piping systems would be disassembled and removed from the facilities. Because of strict verbatim procedure compliance rules, proven safe rigging practices, and required crane maintenance, coupled with independent oversight, a drop of one of these large components at a Naval nuclear facility is considered very unlikely. However, a drop accident of one of these components was evaluated using commercial industry failure probabilities (Reference B-9). Since these components contain some radioactive materials in the form of corrosion products, it is postulated that some portion of the corrosion products could be released into the environment.

B.3.1.2 Source Term

The source term for the component drop accident is based on the following considerations. The corrosion product activity on the component is the best estimate deposition on reactor plant wetted surfaces. The steam generator is the component with the most corrosion deposits since it has the largest internal surface area, and thus, bounds the impacts to the public of a component drop accident. Due to the smaller internal surface area, damage to the reactor pressure vessel from a drop accident or from a wind driven missile would result in a smaller release of radioactivity in the form of corrosion products. Damage to a reactor pressure vessel in the form of a breach or hole could result in more severe levels of radiation in narrow, localized areas (known as radiation streaming) compared to similar damage to a steam generator. However, this localized radiation streaming would not affect members of the general public, who are located at least one mile away. Also, casualty response actions would be implemented by on-site individual workers to minimize the effects by quickly installing temporary shielding, like lead blankets. Therefore, the Naval Reactors Program considers that hypothetical accident analysis results involving steam generators bound the risks of similar accidents involving other reactor plant components, such as a reactor pressure vessel.

The impact associated with the component drop accident is assumed to loosen 33 percent of the corrosion products adhering to the steam generator internal surfaces. Of this loose activity, 10 percent is assumed to be released to the environment as an airborne contaminant. Thus, a total release of 3.3 percent of the corrosion products from the steam generator is assumed in the airborne dose analysis.

The following amounts of radionuclides from activated corrosion products could be released to the environment. Table B-8 includes radionuclides that result in at least 99 percent of the possible exposure.

Table B-8: Source Terms for S3G and D1G Component Drop Accidents

Radionuclide	Prompt Dismantlement (curies)		Deferred Dismantlement (curies)	
	S3G	D1G	S3G	D1G
Cobalt-60	3.6×10^{-2}	1.4×10^{-1}	7.0×10^{-4}	2.7×10^{-3}
Iron-55	3.5×10^{-2}	2.4×10^{-1}	a	a
Cobalt-58	a	1.6×10^{-2}	a	a
Manganese-54	a	7.0×10^{-3}	a	a
Nickel-63	2.3×10^{-2}	4.7×10^{-2}	1.9×10^{-2}	3.8×10^{-2}
Niobium-93m	a	a	2.6×10^{-4}	6.2×10^{-4}
Niobium-94	a	a	1.6×10^{-5}	3.1×10^{-5}
Carbon-14	8.0×10^{-4}	a	8.0×10^{-4}	1.6×10^{-3}
Cesium-137	a	a	1.4×10^{-5}	3.1×10^{-5}
Strontium-90	a	a	1.4×10^{-5}	3.0×10^{-5}
Plutonium-238	1.9×10^{-7}	3.9×10^{-7}	1.5×10^{-7}	3.1×10^{-7}
Plutonium-239	a	a	3.2×10^{-8}	6.3×10^{-8}
Plutonium-240	a	a	2.0×10^{-8}	3.9×10^{-8}
Plutonium-241	6.0×10^{-6}	1.5×10^{-5}	1.4×10^{-6}	3.5×10^{-6}
Americium-241	2.8×10^{-7}	5.5×10^{-7}	2.6×10^{-7}	5.2×10^{-7}

a. These and all other radionuclides not listed in the table contribute a total of less than 1 percent to the calculated doses.

B.3.1.3 Radiological Analysis Results - Component Drop Accident

Tables B-9 through B-12 summarize the health risks to individuals and the general population that might result from the hypothetical drop of a component during dismantlement activities. Risk is defined as the product of the number of fatal cancers times the probability of occurrence. The results are presented for the design basis accident with 95 percent meteorology. Section B.1.3.4 discussed the affected area size. The probability of any crane failure is 3×10^{-6} per hour of operation (Reference B-9). It is estimated that the large components will be lifted by a crane for approximately 8 hours (S3G) and 12 hours (D1G) to support removal from the prototype reactor plant and preparations for shipment. However, it is estimated that the S3G and D1G large components will be at a height high enough to result in severe damage which would release the amount of corrosion products discussed in the previous section for a maximum of 80 minutes and 120 minutes per year, respectively. This results in probabilities of a large component drop of 4×10^{-6} and 6×10^{-6} per year for S3G and D1G, respectively. These probabilities account for the estimated number of large component lifts at each prototype plant.

Table B-9: Individual Dose Results for Hypothetical S3G Component Drop Accident

	Prompt Dismantlement		Deferred Dismantlement	
	Dose (rem)	Risk of Latent Fatal Cancer [a]	Dose (rem)	Risk of Latent Fatal Cancer [a]
Individual Worker	2.2×10^{-2}	3.5×10^{-11}	1.4×10^{-3}	2.2×10^{-12}
Maximally Exposed Off-Site Individual	2.8×10^{-3}	5.6×10^{-12}	8.8×10^{-5}	1.8×10^{-13}

a. Risk is calculated as follows: Dose x Health Risk Conversion Factor (see B.1.3.3) x Probability per Year of Accident Occurring (see table below).

Table B-10: General Population Dose Results for Hypothetical S3G Component Drop Accident

	Prompt Dismantlement	Deferred Dismantlement
Collective Dose Within 80-Kilometer (50-Mile) Radius (person-rem)	5.3	1.8×10^{-1}
Number of Fatal Cancers	2.6×10^{-3}	9.1×10^{-5}
Probability per Year of Accident Occurring	4.0×10^{-6}	4.0×10^{-6}
Risk per Year of Single Latent Fatal Cancer	1.0×10^{-8}	3.6×10^{-10}
Annual Individual Risk of Latent Fatal Cancer [a]	8.7×10^{-15}	3.1×10^{-16}

a. Value equals risk per year of a single latent fatal cancer divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

Table B-11: Individual Dose Results for Hypothetical D1G Component Drop Accident

	Prompt Dismantlement		Deferred Dismantlement	
	Dose (rem)	Risk of Latent Fatal Cancer [a]	Dose (rem)	Risk of Latent Fatal Cancer [a]
Individual Worker	8.2×10^{-2}	2.0×10^{-10}	3.5×10^{-3}	8.4×10^{-12}
Maximally Exposed Off-Site Individual	1.1×10^{-2}	3.3×10^{-11}	2.7×10^{-4}	8.4×10^{-13}

a. Risk is calculated as follows: Dose x Health Risk Conversion Factor (see B.1.3.3) x Probability per Year of Accident Occurring (see table below).

Table B-12: General Population Dose Results for Hypothetical D1G Component Drop Accident

	Prompt Dismantlement	Deferred Dismantlement
Collective Dose Within 80-Kilometer (50-Mile) Radius (person-rem)	21	5.4×10^{-1}
Number of Fatal Cancers	1.0×10^{-2}	2.7×10^{-4}
Probability per Year of Accident Occurring	6.0×10^{-6}	6.0×10^{-6}
Risk per Year of Single Latent Fatal Cancer	6.0×10^{-8}	1.6×10^{-9}
Annual Individual Risk of Latent Fatal Cancer [a]	5.2×10^{-14}	1.4×10^{-15}

a. Value equals risk per year of a single latent fatal cancer divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

B.3.2 Wind-Driven Missile Accident

B.3.2.1 Description of Conditions

During certain S3G and D1G Prototype reactor plant dismantlement activities (such as shipment preparations), portions of the reactor plants and large components would be vulnerable to wind-driven missile damage. Since these components contain some radioactive materials in the form of corrosion products, it is postulated that a portion of these particles could become released into the environment. During the caretaking period, the thick steel hull of the reactor compartment would provide protection from any naturally caused wind-driven missiles.

B.3.2.2 Source Term

The source term for the wind-driven missile accident is based on the following considerations. The best estimate corrosion product activity is used as the basis of the source term. The steam generator is assumed to be the component which is hit by the wind-driven missile because it has the highest inventory of activity. The impact associated with the missile strike is assumed to loosen 33 percent of the corrosion products adhering to the steam generator internal surfaces. Of this loose activity, 1 percent is assumed to be released to the environment as an airborne contaminant. Thus, a total release of 0.33 percent of the corrosion products from the steam generator is assumed in the airborne dose analysis.

The following amounts of radionuclides from activated corrosion products could be released to the environment. This listing in Table B-13 includes radionuclides that result in at least 99 percent of the possible exposure.

Table B-13: Source Terms for S3G and D1G Wind-Driven Missile Accidents

Radionuclide	Prompt Dismantlement (curies)		Deferred Dismantlement (curies)	
	S3G	D1G	S3G	D1G
Cobalt-60	3.6×10^{-3}	1.4×10^{-2}	7.0×10^{-5}	2.7×10^{-4}
Iron-55	3.5×10^{-3}	2.4×10^{-2}	a	a
Cobalt-58	a	1.6×10^{-3}	a	a
Manganese-54	a	7.0×10^{-4}	a	a
Nickel-63	2.3×10^{-3}	4.7×10^{-3}	1.9×10^{-3}	3.8×10^{-3}
Niobium-93m	a	a	2.6×10^{-5}	6.2×10^{-5}
Niobium-94	a	a	1.6×10^{-6}	3.1×10^{-6}
Carbon-14	8.0×10^{-5}	a	8.0×10^{-5}	1.6×10^{-4}
Cesium-137	a	a	1.4×10^{-6}	3.1×10^{-6}
Strontium-90	a	a	1.4×10^{-6}	3.0×10^{-6}
Plutonium-238	1.9×10^{-8}	3.9×10^{-8}	1.5×10^{-8}	3.1×10^{-8}
Plutonium-239	a	a	3.2×10^{-9}	6.3×10^{-9}
Plutonium-240	a	a	2.0×10^{-9}	3.9×10^{-9}
Plutonium-241	6.0×10^{-7}	1.5×10^{-6}	1.4×10^{-7}	3.5×10^{-7}
Americium-241	2.8×10^{-8}	5.5×10^{-8}	2.6×10^{-8}	5.2×10^{-8}

a. These and all other radionuclides not listed in this table contribute a total of less than 1 percent to the calculated doses.

B.3.2.3 Radiological Analysis Results - Wind-Driven Missile Accident

Tables B-14 through B-17 summarize the health risks to individuals and the general population that might result from the hypothetical wind-driven missile accident. Risk is defined as the product of the number of fatal cancers times the probability of occurrence. The results are presented for the design basis accident with 95 percent meteorology. Section B.1.3.4 discussed the affected area size. The probability of occurrence of a tornado was obtained using the data in the U.S. Atomic Energy Commission document WASH-1300 (Reference B-10). These analyses assumed the probability of a tornado occurring in the continental United States is 1×10^{-3} per year per square mile. The probability of generation of a missile sufficient to cause a release of radioactive material is assumed to be 1.0. The probability of the missile hitting the target component was conservatively estimated to be 1×10^{-2} due to the small size of the component (compared to a square mile) and the limited amount of time each year the component was in a vulnerable position. The overall probability of a wind-driven missile accident occurrence of 1×10^{-5} per year was used in the risk assessment.

Table B-14: Individual Dose Results for Hypothetical S3G Wind-Driven Missile Accident

	Prompt Dismantlement		Deferred Dismantlement	
	Dose (rem)	Risk of Latent Fatal Cancer [a]	Dose (rem)	Risk of Latent Fatal Cancer [a]
Individual Worker	2.2×10^{-3}	8.7×10^{-12}	1.4×10^{-4}	5.5×10^{-13}
Maximally Exposed Off-Site Individual	2.8×10^{-4}	1.4×10^{-12}	8.8×10^{-6}	4.4×10^{-14}

a. Risk is calculated as follows: Dose x Health Risk Conversion Factor (see B.1.3.3) x Probability per Year of Accident Occurring (see table below).

Table B-15: General Population Dose Results for Hypothetical S3G Wind-Driven Missile Accident

	Prompt Dismantlement	Deferred Dismantlement
Collective Dose Within 80-Kilometer (50-Mile) Radius (person-rem)	5.3×10^{-1}	1.8×10^{-2}
Number of Fatal Cancers	2.6×10^{-4}	9.1×10^{-6}
Probability per Year of Accident Occurring	1.0×10^{-5}	1.0×10^{-5}
Risk per Year of Single Latent Fatal Cancer	2.6×10^{-9}	9.1×10^{-11}
Annual Individual Risk of Latent Fatal Cancer [a]	2.3×10^{-15}	7.9×10^{-17}

a. Value equals risk per year of a single latent fatal cancer divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

Table B-16: Individual Dose Results for Hypothetical D1G Wind-Driven Missile Accident

	Prompt Dismantlement		Deferred Dismantlement	
	Dose (rem)	Risk of Latent Fatal Cancer [a]	Dose (rem)	Risk of Latent Fatal Cancer [a]
Individual Worker	8.2×10^{-3}	3.3×10^{-11}	3.5×10^{-4}	1.4×10^{-12}
Maximally Exposed Off-Site Individual	1.1×10^{-3}	5.5×10^{-12}	2.7×10^{-5}	1.4×10^{-13}

a. Risk is calculated as follows: Dose x Health Risk Conversion Factor (see B.1.3.3) x Probability per Year of Accident Occurring (see table below).

Table B-17: General Population Dose Results for Hypothetical D1G Wind-Driven Missile Accident

	Prompt Dismantlement	Deferred Dismantlement
Collective Dose Within 80-Kilometer (50-Mile) Radius (person-rem)	2.1	5.4×10^{-2}
Number of Fatal Cancers	1.0×10^{-3}	2.7×10^{-5}
Probability per Year of Accident Occurring	1.0×10^{-5}	1.0×10^{-5}
Risk per Year of Single Latent Fatal Cancer	1.0×10^{-8}	2.7×10^{-10}
Annual Individual Risk of Latent Fatal Cancer [a]	8.7×10^{-15}	2.4×10^{-16}

a. Value equals risk per year of a single latent fatal cancer divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

B.3.3 High Efficiency Particulate Air Filter Fire Accident

B.3.3.1 Description of Conditions

In this hypothetical accident scenario, a fire in a bank of high efficiency particulate air filters is postulated to occur at the S3G or D1G Prototype. The accident scenario would affect only one reactor plant. This accident could be initiated by the ignition of a flammable mixture released upstream of the system by an external, unrelated fire that spreads to the system. Although the risks associated with this accident would be relatively minor, it was analyzed to bound the higher-probability, lower-consequence type accident category. The airborne release fractions associated with this accident were conservatively chosen so that a high efficiency particulate air filter failure by crushing or impact was also bounded.

B.3.3.2 Source Term

A maximum inventory of activity in a high efficiency particulate air filter bank is assumed to be present in the filters at the time of the fire. This activity would only occur after an extended period of operation and is based on previous experience during normal reactor plant maintenance. Maintenance included work on open reactor plants. For the caretaking period, the activity in the filters is based on the minimum detectable activity being discharged through the filters. The hypothetical fire is assumed to spread to the filters from another source and is assumed to release 1 percent of the radioactive materials from the filter to the environment. The release would be relatively small because the filters are constructed of material containing glass fibers which would melt during a fire and trap the radioactive particles in the medium. Measurements from experiments show that 0.01 percent of the material in the filter could be released during a fire (Reference B-12). The use of 1 percent is conservatively selected for this analysis.

The following amounts of radionuclides from activated corrosion products could be released to the environment. This listing in Table B-18 includes radionuclides that result in at least 99 percent of the possible exposure. For the no action and prompt dismantlement alternatives, the fire is assumed to occur at the end of the first year. For the deferred dismantlement alternative, the fire is assumed to occur at the end of the thirty-first year (the end of the first year of the dismantlement period after a 30-year caretaking period).

Table B-18: Source Terms for S3G and D1G High Efficiency Particulate Air Filter Fire Accidents

Radionuclide	No Action (curies)		Prompt Dismantlement (curies)		Deferred Dismantlement (curies)	
	S3G	D1G	S3G	D1G	S3G	D1G
Cobalt-60	1.3×10^{-6}	3.5×10^{-8}	4.2×10^{-6}	7.4×10^{-6}	8.1×10^{-8}	1.4×10^{-7}
Iron-55	1.3×10^{-6}	6.1×10^{-8}	4.0×10^{-6}	1.3×10^{-5}	a	a
Cobalt-58	a	4.1×10^{-9}	a	8.7×10^{-7}	a	a
Manganese-54	a	1.8×10^{-9}	a	3.7×10^{-7}	a	a
Nickel-63	8.3×10^{-7}	1.2×10^{-8}	2.7×10^{-6}	2.5×10^{-6}	2.2×10^{-6}	2.0×10^{-6}
Niobium-93m	a	a	a	a	2.9×10^{-8}	3.3×10^{-8}
Niobium-94	a	a	a	a	1.8×10^{-9}	1.7×10^{-9}
Carbon-14	a	a	a	a	9.2×10^{-8}	8.4×10^{-8}
Cesium-137	a	a	a	a	1.6×10^{-9}	1.6×10^{-9}
Strontium-90	a	a	a	a	1.6×10^{-9}	1.6×10^{-9}
Plutonium-238	6.9×10^{-12}	9.8×10^{-14}	2.2×10^{-11}	2.1×10^{-11}	1.7×10^{-11}	1.6×10^{-11}
Plutonium-239	a	a	a	a	3.7×10^{-12}	3.4×10^{-12}
Plutonium-240	a	a	a	a	2.3×10^{-12}	2.1×10^{-12}
Plutonium-241	2.2×10^{-10}	3.8×10^{-12}	6.9×10^{-10}	8.0×10^{-10}	1.6×10^{-10}	1.9×10^{-10}
Americium-241	1.0×10^{-11}	1.4×10^{-13}	3.2×10^{-11}	2.9×10^{-11}	3.0×10^{-11}	2.8×10^{-11}

a. These and all other radionuclides not listed in this table contribute a total of less than 1 percent to the calculated doses.

B.3.3.3 Radiological Analysis Results - High Efficiency Particulate Air Filter Fire Accident

Tables B-19 through B-22 summarize the health risks to individuals and the general population that might result from the hypothetical high efficiency particulate air filter fire accident for S3G and D1G. Risk is defined as the product of the number of fatal cancers times the probability of occurrence. The results are presented for the design basis accident with 95 percent meteorology. Section B.1.3.4 discussed the affected area size.

The probability of a chemical fire is 5×10^{-3} per year (Reference B-11). The probability of high efficiency particulate air filter fires is considered to be less than a chemical fire since chemicals would not be stored in the immediate vicinity of the high efficiency particulate air filter system, and high efficiency particulate air filters are not volatile or explosive. It is estimated that the probability for an existing fire to spread to the high efficiency particulate air filters is less than 1×10^{-1}. Thus, the probability of occurrence of an event leading to a high efficiency particulate air filter fire is estimated at 5×10^{-4} per year. This probability is applied to all alternatives but is very conservative for the no action alternative because no flammable materials would be stored in the reactor plants.

Table B-19: Individual Dose Results for Hypothetical S3G High Efficiency Particulate Air Filter Fire Accident

	No Action (Caretaking Period)	Prompt Dismantlement Period	Deferred Dismantlement Period
Individual Worker Dose (rem)	7.9×10^{-7}	2.5×10^{-6}	1.6×10^{-7}
Risk of Latent Fatal Cancer [a]	1.6×10^{-13}	5.0×10^{-13}	3.2×10^{-14}
Maximally Exposed Off-Site Individual Dose (rem)	1.0×10^{-7}	3.3×10^{-7}	1.0×10^{-8}
Risk of Latent Fatal Cancer [a]	2.6×10^{-14}	8.0×10^{-14}	2.6×10^{-15}

a. Risk is calculated as follows: Dose x Health Risk Conversion Factor (see B.1.3.3) x Probability per Year of Accident Occurring (see table below).

Table B-20: General Population Dose Results for Hypothetical S3G High Efficiency Particulate Air Filter Fire Accident

	No Action (Caretaking Period)	Prompt Dismantlement Period	Deferred Dismantlement Period
Collective Dose Within 80-Kilometer (50-Mile) Radius (person-rem)	1.9×10^{-4}	6.1×10^{-4}	2.1×10^{-5}
Number of Fatal Cancers	9.5×10^{-8}	3.0×10^{-7}	1.0×10^{-8}
Probability per Year of Accident Occurring	5.0×10^{-4}	5.0×10^{-4}	5.0×10^{-4}
Risk per Year of Single Latent Fatal Cancer	4.8×10^{-11}	1.5×10^{-10}	5.0×10^{-12}
Annual Individual Risk of Latent Fatal Cancer [a]	4.2×10^{-17}	1.3×10^{-16}	4.4×10^{-18}

a. Value equals risk per year of a single latent fatal cancer divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

Table B-21: Individual Dose Results for Hypothetical D1G High Efficiency Particulate Air Filter Fire Accident

	No Action (Caretaking Period)	Prompt Dismantlement Period	Deferred Dismantlement Period
Individual Worker Dose (rem)	2.1×10^{-8}	4.4×10^{-6}	1.9×10^{-7}
Risk of Latent Fatal Cancer [a]	4.1×10^{-15}	8.5×10^{-13}	3.7×10^{-14}
Maximally Exposed Off-Site Individual Dose (rem)	2.8×10^{-9}	5.8×10^{-7}	1.5×10^{-8}
Risk of Latent Fatal Cancer [a]	7.0×10^{-16}	1.5×10^{-13}	3.7×10^{-15}

a. Risk is calculated as follows: Dose x Health Risk Conversion Factor (see B.1.3.3) x Probability per Year of Accident Occurring (see table below).

Table B-22: General Population Dose Results for Hypothetical D1G High Efficiency Particulate Air Filter Fire Accident

	No Action (Caretaking Period)	Prompt Dismantlement Period	Deferred Dismantlement Period
Collective Dose Within 80-Kilometer (50-Mile) Radius (person-rem)	5.2×10^{-6}	1.1×10^{-3}	2.9×10^{-5}
Number of Fatal Cancers	2.6×10^{-9}	5.5×10^{-7}	1.4×10^{-8}
Probability per Year of Accident Occurring	5.0×10^{-4}	5.0×10^{-4}	5.0×10^{-4}
Risk per Year of Single Latent Fatal Cancer	1.3×10^{-12}	2.8×10^{-10}	7.0×10^{-12}
Annual Individual Risk of Latent Fatal Cancer [a]	1.1×10^{-18}	2.4×10^{-16}	6.1×10^{-18}

a. Value equals risk per year of a single latent fatal cancer divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

B.3.4 Large Volume Spill of Radioactive Water

B.3.4.1 Description of Conditions

In this hypothetical accident scenario, approximately 7,600 liters (2,000 gallons) of radioactive liquid (primary coolant water) is assumed to spill, resulting in a release to the environment. This accident was analyzed to bound the higher-probability, lower-consequence minor liquid spill accident category. The source of the liquid spill is assumed to be water contained in the D1G Prototype reactor pressure vessel. Analyses assumed that this accident would be initiated by a vehicular accident within the Kesselring Site security area. The accident is assumed to result in a catastrophic failure of a temporary tank used to transfer the liquid from the D1G Prototype to other Kesselring Site facilities for processing. This scenario conservatively bounds the risks since catastrophic failure of a temporary tank would result in a more rapid, and less controllable spill compared to an accident that could occur during pressure vessel pump-out operations. This accident scenario equally applies to all three alternatives. For all alternatives, the spill is assumed to occur during the first year since it is expected that the D1G Prototype reactor pressure vessel will likely be drained within this period.

B.3.4.2 Source Term

The source term used for this hypothetical large volume spill of radioactive water was a bounding and conservative estimate of 1×10^{-3} microcuries per milliliter. For this evaluation, it was postulated that all 2,000 gallons spill onto the ground and that 0.01 percent of the activity becomes airborne during the time that the water is entering the ground. The assumption that the spill would involve all 2,000 gallons is conservative since radioactive liquids are typically transported in smaller capacity containers.

Analysis assumed the following amounts of radionuclides could be released to the environment. This listing includes radionuclides that result in at least 99 percent of the possible exposure.

Table B-23: Source Terms for Large Volume Spill of Radioactive Water

Radionuclide	Curies
Cobalt-60	7.6×10^{-3}
Iron-55	1.3×10^{-2}
Cobalt-58	9.0×10^{-4}
Manganese-54	3.9×10^{-4}
Nickel-63	2.6×10^{-3}
Niobium-93m	1.2×10^{-4}
Niobium-94	1.7×10^{-6}
Carbon-14	8.6×10^{-5}
Cesium-137	3.4×10^{-6}
Strontium-90	3.4×10^{-6}
Plutonium-238	2.1×10^{-8}
Plutonium-239	3.5×10^{-9}
Plutonium-240	2.2×10^{-9}
Plutonium-241	8.2×10^{-7}
Americium-241	3.0×10^{-8}
Tritium	1.5×10^{-1}

B.3.4.3 Radiological Analysis Results - Large Volume Spill of Radioactive Water

Tables B-24 and B-25 summarize the health risks to individuals and the general population that might result from the hypothetical large volume spill of radioactive water. Risk is defined as the product of the number of fatal cancers times the probability of occurrence. The results are presented for the design basis accident with 95 percent meteorology.

For this risk assessment, a probability of 1×10^{-7} per year was used. This probability is a conservative estimate based on the following information. Under normal traffic conditions, the probability of a motor vehicle accident involving U.S. Department of Energy and Contractor personnel is 2.5×10^{-6} per mile (Reference B-25). The distance traveled to transport the liquid to other Kesselring Site facilities would be less than 0.4 kilometers (0.25 miles). This results in an accident probability of 6.3×10^{-7} with normal traffic conditions. Since vehicle traffic is limited to 8 kilometers (5 miles) per hour on the Kesselring Site, and since every transfer of radioactive materials involves qualified personnel over designated routes, an additional probability of 1×10^{-1} was applied. This additional probability accounts for conditions that tend to reduce accident severity. The resulting calculated probability of 6.3×10^{-8} is smaller than the assumed 1×10^{-7}.

Table B-24: Individual Dose Results for Large Volume Spill of Radioactive Water - All Alternatives

Individual Worker Dose (rem)	4.5×10^{-7}
Risk of Latent Fatal Cancer [a]	1.8×10^{-17}
Maximally Exposed Off-Site Individual Dose (rem)	3.1×10^{-5}
Risk of Latent Fatal Cancer [a]	1.6×10^{-15}

a. Risk is calculated as follows: Dose x Health Risk Conversion Factor (see B.1.3.3) x Probability per Year of Accident Occurring (see table below).

Table B-25: General Population Dose Results for Large Volume Spill of Radioactive Water - All Alternatives

Collective Dose Within 80-Kilometer (50-Mile) Radius (person-rem)	2.1×10^{-1}
Number of Fatal Cancers	1.0×10^{-4}
Probability per Year of Accident Occurring	1.0×10^{-7}
Risk per Year of Single Latent Fatal Cancer	1.0×10^{-11}
Annual Individual Risk of Latent Fatal Cancer [a]	8.7×10^{-18}

a. Value equals risk per year of a single latent fatal cancer divided by the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site.

B.3.5 Cumulative Radiological Impacts to the General Population from Hypothetical Facility Accidents

Table B-26 presents cumulative risk results to the general population living within an 80-kilometer (50-mile) radius of the Kesselring Site for the specific hypothetical accidents that were evaluated in this analysis. For each accident type, the cumulative results are based on the annual risk times the duration of the alternative.

Table B-26: Cumulative Radiological Impacts Risk to the General Population from Hypothetical Accidents

	No Action (risk of latent fatal cancer)	Prompt Dismantlement (risk of latent fatal cancer)	Deferred Dismantlement (risk of latent fatal cancer)
Component Drop			
S3G Annual Risk (Table B-10)	Not applicable [a]	1.0×10^{-8}	3.6×10^{-10}
D1G Annual Risk (Table B-12)		6.0×10^{-8}	1.6×10^{-9}
S3G Cumulative Risk (2 years)		2.0×10^{-8}	7.2×10^{-10}
D1G Cumulative Risk (2¾ years)		1.7×10^{-7}	4.4×10^{-9}
Combined S3G and D1G Cumulative Risk		1.9×10^{-7}	5.1×10^{-9}
Wind-Driven Missile			
S3G Annual Risk (Table B-15)	Not applicable [a]	2.6×10^{-9}	9.1×10^{-11}
D1G Annual Risk (Table B-17)		1.0×10^{-8}	2.7×10^{-10}
S3G Cumulative Risk (2 years)		5.2×10^{-9}	1.8×10^{-10}
D1G Cumulative Risk (2¾ years)		2.8×10^{-8}	7.4×10^{-10}
Combined S3G and D1G Cumulative Risk		3.3×10^{-8}	9.2×10^{-10}
High Efficiency Particulate Air Filter Fire			
S3G Annual Risk (dismantlement period; Table B-20)	Not applicable [b]	1.5×10^{-10}	5.0×10^{-12}
D1G Annual Risk (dismantlement period; Table B-22)	Not applicable [b]	2.8×10^{-10}	7.0×10^{-12}
S3G Annual Risk (caretaking period; Table B-20)	4.8×10^{-11}	Not applicable [b]	4.8×10^{-11}
D1G Annual Risk (caretaking period; Table B-22)	1.3×10^{-12}	Not applicable [b]	1.3×10^{-12}
S3G Cumulative Risk (entire time span for each alternative) [b]	1.4×10^{-9}	3.0×10^{-10}	1.5×10^{-9}
D1G Cumulative Risk (entire time span for each alternative) [b]	3.9×10^{-11}	7.7×10^{-10}	5.8×10^{-11}
Combined S3G and D1G Cumulative Risk	1.4×10^{-9}	1.1×10^{-9}	1.6×10^{-9}
Large Volume Spill of Radioactive Water			
D1G Annual Risk (Table B-25)	1.0×10^{-11}	1.0×10^{-11}	1.0×10^{-11}

a. Lifting of components would not occur during the no action alternative. The thick steel hull of the reactor compartments would remain in place during the caretaking period, therefore no radiological releases to the environment would be expected for the wind-driven missile accident.

b. The prompt dismantlement alternative does not include any caretaking activities. The no action alternative does not include any dismantlement activities. S3G and D1G Prototype reactor plant dismantlements are estimated to take 2 years and 2¾ years, respectively. The caretaking period for both prototype reactor plants would be 30 years. The deferred dismantlement cumulative risks for each plant are calculated as follows:
S3G cumulative risk = (2 x annual dismantlement risk) + (30 x annual caretaking risk)
D1G cumulative risk = (2¾ x annual dismantlement risk) + (30 x annual caretaking risk)

B.4 Nonradiological Analysis Results - Hypothetical Facility Accident

B.4.1 Fire Involving Diesel Fuel

B.4.1.1 Accident Description

This analysis assumed that during dismantlement operations, a 1,040 liter (275 gallon) capacity diesel fuel storage tank could be temporarily located near a work area for refueling power equipment and on-site vehicles. A catastrophic failure of a temporarily located diesel fuel storage tank was postulated to occur, resulting in spilling of the entire quantity of diesel fuel and a subsequent fire. The airborne release of toxic chemicals resulting from the fire was evaluated with respect to the maximally exposed off-site individual and individual worker. The individual worker is assumed to be located 100 meters (330 feet) from the fire.

B.4.1.2 Computer Model Used to Estimate Chemical Exposures

The Emergency Prediction Information Computer Code (EPIcode™) was used for estimating airborne concentrations resulting from releases of chemicals (Reference B-13). The computer code uses the well-established Gaussian plume model to calculate the airborne chemical concentrations. The computer code database contains information on over 600 substances listed by the American Conference of Governmental Industrial Hygienists. Factors such as locations of affected persons, terrain, meteorological conditions, release conditions, and characteristics of the chemical inventory are required as input parameters for calculations to determine human exposure from airborne releases of chemicals.

B.4.1.3 Source Term

The combustion products generated during a diesel fuel fire would include the following compounds: carbon monoxide; carbon dioxide; oxides of nitrogen; sulfur dioxide; partially oxygenated hydrocarbons like aldehydes; aliphatic and simple aromatic hydrocarbons; and particulate matter containing a wide range of polycyclic aromatic hydrocarbons (Reference B-19).

Free-burning fires are flaming fires that have an excess supply of air. These well-ventilated fires are generally of little concern in terms of generating toxic species (Reference B-20). However, this analysis evaluated the following toxic chemicals:

- Carbon monoxide
- Oxides of nitrogen (90 percent nitric oxide and 10 percent nitrogen dioxide)
- Sulfur dioxide

Carbon monoxide is the most common toxic material generated from a fire. Over half of all fire fatalities have been attributed to carbon monoxide inhalation (Reference B-20). Information on the toxic properties of carbon monoxide and additional compounds are provided below.

Carbon Monoxide is a colorless, odorless and toxic gas which is a product of incomplete combustion. It is a potent chemical asphyxiant capable of causing headache, nausea, fatigue, confusion, and coma when present in high concentrations.

Sulfur dioxide is a colorless and toxic gas with a pungent odor. Sulfur dioxide is an eye, skin, and mucous membrane irritant. It chiefly affects the upper respiratory tract and bronchi and at higher concentrations, sulfur dioxide causes respiratory paralysis (Reference B-15).

Nitric oxide and **nitrogen dioxide** occur together in dynamic equilibrium. Nitric oxide is a colorless gas, and nitrogen dioxide is a reddish brown gas. Both chemicals are eye, skin, and mucous membrane irritants and primarily affect the respiratory system. Exposure to 47 milligrams per cubic meter of nitrogen dioxide can cause respiratory irritation and chest pain, 93 milligrams per cubic meter can cause lung injuries, and 187 milligrams per cubic meter can be fatal (Reference B-15).

B.4.1.4 Conditions and Key Parameters

- A total of 1,040 liters (275 gallons) of diesel fuel is spilled into a revetment with dimensions of 1.9 meters (6.3 feet) long by 1.2 meters (3.8 feet) wide by 1.1 meters (3.8 feet) high. The entire amount of diesel fuel is consumed by the fire in about 160 minutes.
- The releases per 3.8 liters (1 gallon) of fuel burned are as follows:

  Carbon monoxide = 154 grams (0.34 pounds)
  Oxides of nitrogen = 717 grams (1.58 pounds)
  Sulfur dioxide = 47.7 grams (0.105 pounds)

  The chemicals generated from a diesel fuel fire were developed based on calculated emissions from diesel generators and fuel oil boilers. The emissions were increased by a factor of two to represent bounding conditions for a diesel fuel fire. The conditions used for the analysis in this Environmental Impact Statement are conservative when compared to the amount of carbon monoxide produced from a well-ventilated diesel fuel fire in Reference B-20.
- The airborne release of toxic chemicals occurs at ground level.
- Standard rural terrain was assumed and building wake effects were not considered.
- Wind speeds and atmospheric stability classifications were based on 95 percent meteorology.
- The estimated concentrations were compared against the Emergency Response Planning Guideline levels 1, 2, and 3 concentration limits or alternates to determine the health impacts. Emergency Response Planning Guideline values are estimates of airborne concentration thresholds above which one can reasonably anticipate observing adverse effects (Reference B-14).

B.4.1.5 Diesel Fuel Fire Accident Analysis Results

The airborne concentrations, averaged over the duration of each exposure, were calculated using the Emergency Prediction Information computer program for the combustion products resulting from the fire for the individual worker and maximally exposed off-site individual under 95 percent meteorology. Table B-27 lists the downwind concentrations and corresponding Emergency Response Planning Guideline (or equivalent) values. Results for the diesel fuel fire accident indicate that all toxic chemical concentrations were well below Emergency Response Planning Guideline level 1 values for the maximally exposed off-site individual.

Toxic chemical concentrations may exceed Emergency Response Planning Guideline level 2 values for on-site individual workers. Toxic chemical concentrations for sulfur dioxide, nitrogen dioxide, and nitric oxide may exceed Emergency Response Planning Guideline level 3 values for on-site individual workers. For the on-site individual workers who could be exposed to toxic chemicals above Emergency Response Planning Guideline level 2 and 3 values, it is expected that actual toxic chemical exposures would be much less due to the mitigative measures that would be implemented. Emergency planning, emergency preparedness and training, and emergency response programs are in place and involve established resources such as warning communications, fire departments, and emergency command centers.

Table B-27: Expected Chemical Concentrations from a Hypothetical Diesel Fuel Fire

	Chemical Concentrations (milligrams per cubic meter) - 95% meteorology			
	Sulfur Dioxide ERPG-1 0.79 ERPG-2 7.9 ERPG-3 39	Carbon Monoxide TWA 29 0.1(IDLH) 139 IDLH 1,390	Nitric Oxide TWA 30 0.1(IDLH) * IDLH 125	Nitrogen Dioxide TWA 5.6 0.1(IDLH) * IDLH 38
Maximally Exposed Off-Site Individual	0.4	1.3	5.3	0.6
Individual Worker	56	180	750	83

ERPG = Emergency Response Planning Guidelines

ERPG-1 = The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

ERPG-2 = The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

ERPG-3 = The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Where ERPG values have not been derived for a toxic substance, other chemical toxicity values are substituted, as follows:

For ERPG-1, Threshold Limit Value, Time-Weighted Average (TLV-TWA) values (Reference B-16) are substituted: The TWA is the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all individual workers may be repeatedly exposed, day after day, without adverse effect.

For ERPG-2, Level of Concern values (equal to 0.1 of Immediately Dangerous to Life or Health) are substituted: Level of Concern is defined as the concentration of a hazardous substance in air, above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time (Reference B-17).

For ERPG-3, Immediately Dangerous to Life or Health (IDLH) values are substituted: IDLH is defined as the maximum concentration from which a person could escape within 30 minutes without a respirator and without experiencing any effects which would impair the ability to escape or irreversible side effects (Reference B-7).

* The 0.1(IDLH) level not assigned since the value (12.3) would be less than the TWA level.

B.4.2 Chemical Spill

B.4.2.1 Accident Description

In this hypothetical accident scenario, it is assumed that a chemical spill occurs, resulting in a release to the environment. The source of the spill is assumed to be from one of the larger chemical storage lockers located at the Kesselring Site which supports dismantlement activities. Analysis assumed that this spill would be initiated by a catastrophic accident, such as a large vehicular crash, associated with the chemical storage locker which causes the total quantity of each chemical to spill. The airborne release of toxic chemicals resulting from the spill was evaluated with respect to the maximally exposed off-site individual and individual worker. The individual worker is assumed to be located 100 meters (330 feet) downwind from the spill. This scenario conservatively bounds the risks since the chemical storage locker is constructed of steel, is located on a concrete pad, and includes a fire suppression system; and it is unlikely that the entire contents of the locker would spill.

B.4.2.2 Computer Model Used to Estimate Chemical Exposures

As indicated in Section B.4.1.2, the Emergency Prediction Information Computer Code (EPIcode™) was used for estimating airborne concentrations resulting from releases of chemicals (Reference B-13).

B.4.2.3 Source Term

The source term used for the chemical spill analysis was based on the estimated quantities of chemicals typically stored in the chemical locker during dismantlement activities. Typical products that are stored include various adhesives, strippers, solvents and lubricants. The following quantities of chemicals were used in the analysis:

- Acetone = 45 liters (12 gallons)
- Methyl ethyl ketone = 19 liters (5 gallons)
- Ethyl alcohol = 200 liters (53 gallons)
- Mineral spirits = 57 liters (15 gallons)
- Formic acid = 34 liters (9 gallons)
- n-Butyl alcohol = 210 liters (56 gallons)
- Methyl alcohol = 120 liters (31 gallons)
- Toluene = 68 liters (18 gallons)

B.4.2.4 Conditions and Key Parameters

The analysis used the following conservative key conditions and parameters:

- 100 percent of the liquid was released to the atmosphere, which is conservative since cleanup actions would promptly be initiated to minimize the volume of the release.
- Liquids were released into a pool 0.25 centimeters (0.1 inches) deep.
- The liquid was at its boiling point, which is conservative since it results in faster release rates to the environment and higher concentrations.
- The release period was the longer of the calculated evaporation time or 10 minutes. Ten minutes is the minimum time that can be entered as a release time in the EPIcode™.

- The release area was equal to the pool area.
- The deposition velocity was 0.1 centimeters per second.
- The airborne release of chemicals occurs at ground level.
- Standard rural terrain was assumed and building wake effects were not considered.
- Wind speeds and atmospheric stability classifications were based on 95 percent meteorology.
- Downwind chemical concentrations were calculated independently.
- The estimated concentrations are compared against the Emergency Response Planning Guideline level 1, 2, and 3 concentration limits or alternate published limits to determine the health impacts. Emergency Response Planning Guideline values are estimates of airborne concentration thresholds above which one can reasonably anticipate observing adverse effects (Reference B-14).

B.4.2.5 Chemical Spill Accident Analysis Results

The airborne concentrations, averaged over the duration of each exposure, were calculated using the Emergency Prediction Information computer program for the individual worker and maximally exposed off-site individual using 95 percent meteorology. Table B-28 lists the downwind concentrations and corresponding Emergency Response Planning Guideline (or equivalent) values. Results for the chemical spill accident indicate that all chemical concentrations were at or below Emergency Response Planning Guideline level 1 values for the maximally exposed off-site individual.

The modeling assumptions used in Section B.4.2.4 were selected as conservative relative to other possible parameters. Based on these conservative assumptions, the chemical concentrations may exceed Emergency Response Planning Guideline level 2 values for on-site individual workers. Chemical concentrations for formic acid and n-butyl alcohol may exceed Emergency Response Planning Guideline level 3 values for on-site individual workers; however, this assumes that this unlikely and very conservative scenario would occur. Even in the event of such a scenario, it is expected that actual exposures would be much less due to the mitigative measures that would be implemented. Emergency planning, emergency preparedness and training, and emergency response programs are in place and involve established resources such as warning communications, fire departments, hazardous materials response teams, and emergency command centers.

For the substances evaluated, no human or experimental animal carcinogen data has been reported or the data is inadequate to classify the agent in terms of its ability to cause cancer in humans or animals (Reference B-16). These substances are liquids, and in general, the most common symptoms of exposure include eye and skin irritation, skin dermatitis, and general flu-like symptoms, such as nausea, vomiting, and fatigue.

Table B-28: Expected Chemical Concentrations from a Hypothetical Spill of Stored Chemicals

	Chemical Concentrations (milligrams per cubic meter) - 95% meteorology			
	n-Butyl Alcohol TLV-C 150 0.1(IDLH) 431 IDLH 4,310	Ethyl Alcohol TWA 1,880 0.1(IDLH) * IDLH 6,340	Methyl Alcohol ERPG-1 262 ERPG-2 1,330 ERPG-3 6,650	Toluene ERPG-1 188 ERPG-2 1,149 ERPG-3 3,830
Maximally Exposed Off-Site Individual	74	57	28	28
Individual Worker	5,800	4,500	2,500	2,800

	Chemical Concentrations (milligrams per cubic meter) - 95% meteorology			
	Mineral Spirits TWA 350 0.1(IDLH) 2,000 IDLH 20,000	Acetone TWA 590 0.1(IDLH) 605 IDLH 6,050	Formic Acid TWA 9 0.1(IDLH) * IDLH 57	Methyl Ethyl TWA 590 0.1(IDLH) 900 IDLH 9,000
Maximally Exposed Off-Site Individual	21	17	9	7
Individual Worker	2,200	1,900	1,100	910

ERPG = Emergency Response Planning Guidelines

ERPG-1 = The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

ERPG-2 = The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

ERPG-3 = The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Where ERPG values have not been derived for a toxic substance, other chemical toxicity values are substituted, as follows:

For ERPG-1, Threshold Limit Value - Time-Weighted Average (TLV-TWA) and Threshold Limit Value-Ceiling (TLV-C) values (Reference B-16) are substituted: The TWA is the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all individual workers may be repeatedly exposed, day after day, without adverse effect. The TLV-C is the concentration that is considered a boundary and should not be exceeded during any part of a work day.

For ERPG-2, Level of Concern values (equal to 0.1 of Immediately Dangerous to Life or Health) are substituted: Level of Concern is defined as the concentration of a hazardous substance in air, above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time (Reference B-17).

For ERPG-3, Immediately Dangerous to Life or Health (IDLH) values are substituted: IDLH is defined as the maximum concentration from which a person could escape within 30 minutes without a respirator and without experiencing any effects which would impair the ability to escape or irreversible side effects (Reference B-7).

* The 0.1(IDLH) level not assigned since the value would be less than the TWA level.

B.5 Impacts of Accidents on Close-in Workers

This section qualitatively evaluates the impacts to close-in dismantlement workers from the various postulated accidents.

Component Drop Accident Lifting and handling operations typically require only a small number of workers and a supervisor. During these operations, unnecessary personnel are kept out of the affected area through the use of routine safety measures such as temporary boundaries and postings. As discussed in Section B.3.1.1, strict verbatim compliance rules, proven safe rigging practices, and required crane maintenance, coupled with independent oversight, make the probability of a crane-related failure low. Based on the fact that workers involved in lifting and handling operations are trained in casualty responses, and the short amount of time that large components would be suspended above the ground, the nonradiological risks of a fatality from this type of accident are expected to be small. It is also not likely that any nearby worker fatalities would occur due to the radiological consequences of this type of accident. As discussed in Section B.1.3.5, in the event of a casualty involving airborne radioactivity, workers are trained to quickly evacuate the affected area and assemble in an area upwind of the affected area. Therefore, nearby workers would not be expected to receive significant direct radiation exposure or internal exposure from inhalation of airborne radioactivity.

Wind-Driven Missile Accident The risk of fatalities from nonradiological aspects of a wind-driven missile accident are expected to be approximately the same for close-in dismantlement workers as for workers at other industrial locations. While high wind conditions can arise in a short time, without much warning, the Kesselring Site is no more susceptible to this event than other surrounding areas of the community. In cases where there is some warning, or when observable high winds build up gradually, the Kesselring Site invokes local Site emergency procedures to establish stable work area conditions until the severe weather subsides. Similar to the component drop accident discussed above, nearby workers would not be expected to receive significant radiation exposure or internal exposure from inhalation of airborne radioactivity based on established casualty response training.

High Efficiency Particulate Air Filter Fire Accident The risk of fatalities from nonradiological aspects of a high efficiency particulate air filter fire are expected to be extremely small. High efficiency particulate air filters are not located in areas where close-in dismantlement workers would be working. As part of casualty response training, workers are aware to avoid unusual clouds of smoke. The Kesselring Site maintains a trained incident prevention staff in attendance 24 hours per day, year round, and a fully equipped firehouse to quickly respond to a fire casualty or attend to injured personnel. From a radiological perspective, similar to the preceding hypothetical accidents, nearby workers would not be expected to receive significant radiation exposure or internal exposure from inhalation of airborne radioactivity based on established casualty response training.

Large Volume Spill of Radioactive Water As discussed in Section B.3.4.1, this hypothetical scenario involves a vehicular accident within the Kesselring Site security area. The accident is assumed to result in the catastrophic failure of a typical tank used to transfer the radioactive liquid across the Site. From a nonradiological perspective, the risk of fatalities to the close-in dismantlement work force are expected to be extremely small. The transportation route would pass outside of dismantlement work areas. Radioactive material transfers are attended by radiological monitoring staff who walk beside transporting vehicles, when used. Other on-site traffic has a limited frequency and travels at similar slow speeds. From a radiological perspective, similar to the preceding hypothetical accidents, nearby workers would not be expected to receive significant radiation exposure or internal exposure from inhalation of airborne radioactivity based on established casualty response training.

Fire Involving Diesel Fuel Similar to the risks associated with a hypothetical high efficiency particulate air filter fire, the risk of fatalities from nonradiological aspects of a diesel fuel fire are expected to be extremely small. Temporary diesel fuel storage tanks would typically be located in low traffic areas of the Kesselring Site, away from areas where close-in dismantlement workers would be working. As part of casualty response training, workers are aware to avoid unusual clouds of smoke. The Kesselring Site incident prevention staff is trained and equipped to quickly respond to a fire casualty or attend to injured personnel. This accident scenario does not involve a radiological aspect.

Chemical Spill Similar to the risks associated with a hypothetical diesel fuel fire, the risk of fatalities from nonradiological aspects of a chemical spill are extremely small. Chemical storage lockers are located in low traffic areas of the Kesselring Site, away from areas where close-in dismantlement workers would be working. The Kesselring Site incident prevention staff is trained and equipped to quickly respond to chemical spill casualties or attend to injured personnel. This accident scenario does not involve a radiological aspect.

REFERENCES

B-1 International Commission on Radiological Protection, *Recommendations of the International Commission on Radiological Protection,* ICRP Publication 26, Annals of the ICRP, Vol. 1, No. 3, Oxford, Great Britain, Pergamon Press, 1977.

B-2 International Commission on Radiological Protection, *Limits for Intakes of Radionuclides by Workers,* ICRP Publication 30, Part 1, Annals of the ICRP, Vol. 2, No. 3/4, Oxford, Great Britain, Pergamon Press, 1979.

B-3 International Commission on Radiological Protection, *The 1990 Recommendations of the ICRP,* ICRP Publication 60, Annals of the ICRP, Vol. 21, No. 1-3, Elmsford, New York, Pergamon Press, 1991.

B-4 Napier, B. A., R. A. Peloquin, D. L. Strenge, J. V. Ramsdell, *GENII The Hanford Environmental Radiation Dosimetry Software System*, PNL-6584, UC-600, November 1988.

B-5 Wenzel, D. R., *The Radiological Safety Analysis Computer Program (RSAC-5),* U.S. Department of Energy Report WINCO-1123, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, October 1993.

B-6 Wallace, O. J., *SPAN4 A Point Kernel Computer Program for Shielding,* WAPD-TM-809(L), Volumes I and II, October 1972.

B-7 National Institute for Occupational Safety and Health, *Pocket Guide to Chemical Hazards,* June 1994.

B-8 U.S. Nuclear Regulatory Commission, Standard Review Plan 3.5.1.6, *Aircraft Hazards*, NUREG-0800, July 1981.

B-9 U.S. Nuclear Regulatory Commission, *Reactor Safety Study - An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants,* WASH-1400 (NUREG-75/014), Washington, D.C., 1975.

B-10 U.S. Atomic Energy Commission, *Technical Basis for Interim Regional Tornado Criteria,* WASH 1300, U.S. Atomic Energy Commission Office of Regulation, May 1974.

B-11 Ganti, C.S. and L.M. Krasner, *Navy Fire Risk Management: A Methodology for Prioritizing Fire Protection Recommendations,* Factory Mutual Research, Norwood, Massachusetts, September 1984.

B-12 U.S. Department of Energy, *DOE HANDBOOK: Recommended Values and Technical Bases for Airborne Release Fractions, Airborne Release Rates, and Respirable Fractions at DOE Non-Reactor Nuclear Facilities,* DOE-STD-0013-93, 1993.

B-13 Homan (Homan Associates, Inc.), *Emergency Prediction Information Computer Code (EPIcode™) Manual*, Fremont, California, 1988.

B-14 Rusch, G. M., *The History and Development of Emergency Response Planning Guidelines*, Journal of Hazardous Materials, Volume 33, Amsterdam: Elsevier Publishers, pp. 193-202, 1993.

B-15 U.S. Department of Health and Human Services, Toxicology Data Network (TOXnet), National Library of Medicine, Bethesda, Maryland, 1993.

B-16 American Conference of Governmental Industrial Hygienists, *Threshold Limit Values and Biological Exposure Indices*, 1996.

B-17 U.S. Environmental Protection Agency, *Technical Guidance for Hazards Analysis,* Federal Emergency Management Agency, U.S. Department of Transportation, December 1987.

B-18 American Cancer Society, *Cancer Facts & Figures-1996,* 1996.

B-19 Feunekes, F.D.J.R., F.J. Jongeneelen, H. v.d. Laan, F.H.G. Schoonhof, *Uptake of Polycyclic Aromatic Hydrocarbons Among Trainers in a Fire-Fighting Training Facility*, American Industrial Hygiene Association Journal, Volume 58, No.1, pp. 23-28, January 1997.

B-20 DiNenno, P.J., Editor, et al, The SFPE Handbook of Fire Protection Engineering, 2nd Edition, 1995.

B-21 U.S. Department of Energy, DOE/EIS-0203-F, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, April 1995.

B-22 U.S. Department of the Navy, *Final Environmental Impact Statement for Seawolf Class Submarine Homeporting on the East Coast of the United States*, July 1995.

B-23 U.S. Department of the Navy, DOE/EIS-0251, *Department of the Navy Final Environmental Impact Statement for a Container System for the Management of Naval Spent Nuclear Fuel*, November 1996.

B-24 U.S. Department of Energy, DOE/EIS-0275, *Final Environmental Impact Statement for S1C Prototype Reactor Plant Disposal*, Office of Naval Reactors, November 1996.

B-25 U.S. Department of Energy, DOE/EH-0507, *Occupational Injury and Property Damage Summary*, January-December 1994.

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APPENDIX C

ANALYSIS OF TRANSPORTATION RELATED IMPACTS

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APPENDIX C

ANALYSIS OF TRANSPORTATION RELATED IMPACTS

This appendix presents an evaluation of the health risks to the public and workers from the shipment of all materials and components that would result from dismantlement of the defueled S3G and D1G Prototype reactor plants. This evaluation covers the prompt dismantlement (preferred alternative) and deferred dismantlement alternatives. Transportation analyses for the no action alternative are not required because there would be no dismantlement wastes generated or shipments made. Analyses were performed consistent with the methods and computer models used in the development of the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference C-1), the Final Environmental Impact Statement on the Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants (Reference C-2), the Final Environmental Impact Statement on S1C Prototype Reactor Plant Disposal (Reference C-3), and the Department of the Navy Final Environmental Impact Statement for a Container System for the Management of Naval Spent Nuclear Fuel (Reference C-4).

C.1 Shipments Evaluated

This evaluation assumes all shipments originate at the Kesselring Site located near West Milton in Saratoga County, New York. Analyses assume that there would be 50 shipments of nonradioactive materials which would be recycled or disposed of at facilities located approximately 310 kilometers (about 200 miles) from the Kesselring Site. The analyses evaluated two U.S. Department of Energy destinations for disposal of low-level radioactive materials: the Savannah River Site in South Carolina and the Hanford Site in Washington State. These analyses include additional general assumptions to keep the meaning of the results simple and conservative. For example, the Savannah River Site and the Hanford Site are examined individually as the destination for all radioactive shipments. The Savannah River Site represents a reasonable and close location for transportation analyses, and the Hanford Site represents a reasonable but significantly more distant location. Combinations of shipping destinations, including available recycling facility locations for radioactive materials, are not examined. This is a conservative simplification because the cumulative mileage of any combination of available destinations would be less than the cumulative mileage of all shipments going cross-country to the Hanford Site. Actual disposal of dismantlement materials would utilize multiple shipping destinations with emphasis on recycling as much material as practicable. The topic of waste management and recycling is discussed in detail in Chapters 3 and 5 of this Environmental Impact Statement. Table C-1 summarizes the types of packages, the transportation modes, the origin and the destinations that are analyzed for shipments of low-level radioactive materials from the S3G and D1G Prototype reactor plant dismantlements.

Table C-1: Summary of Package Type, Transportation Mode, Origin, and Destination

<table>
<tr><th>PACKAGE TYPE</th><th>TRANSPORTATION MODE</th><th>ORIGIN</th><th>DESTINATION</th></tr>
<tr><td rowspan="2">Miscellaneous Components</td><td rowspan="2">Truck</td><td rowspan="2">Kesselring Site</td><td>Savannah River Site</td></tr>
<tr><td>Hanford Site</td></tr>
<tr><td rowspan="3">Reactor Pressure Vessel</td><td>Heavy Hauler</td><td>Kesselring Site</td><td>Delaware and Hudson Railroad Terminus [a]</td></tr>
<tr><td rowspan="2">Rail</td><td rowspan="2">Delaware and Hudson Railroad Terminus [a]</td><td>Savannah River Site</td></tr>
<tr><td>Hanford Site</td></tr>
<tr><td rowspan="2">Large Components</td><td rowspan="2">Truck</td><td rowspan="2">Kesselring Site</td><td>Savannah River Site</td></tr>
<tr><td>Hanford Site</td></tr>
</table>

a. Alternate transportation modes that would eliminate the use of the Delaware and Hudson Railroad terminus in Ballston Spa, New York for shipment of the reactor pressure vessel package were also considered but eliminated from detailed evaluation. Each reactor pressure vessel package, which includes the reactor pressure vessel and non-fuel internal structural components within a shipping container, would measure approximately 5.69 meters (224 inches) in length and 3.23 meters (127 inches) in diameter and would weigh approximately 177 metric tons (195 tons). Due to load limiting bridges and speed limitations that would result in traffic disruptions, transport of the reactor pressure vessel packages for long distances over highways was considered impractical.

Analyses assumed there would be a total of 60 shipments of low-level radioactive materials. Fifty-one (51) of these shipments would consist of miscellaneous components (24 shipments for S3G + 27 shipments for D1G). Shipping packages would be transported on open, flat bed trailers conservatively allowing for a total of 6 miscellaneous components packages per shipment. There would be 7 separate shipments of large components (3 shipments for S3G and 4 shipments for D1G). Large components include the S3G and D1G Prototype steam generators and pressurizers. Additionally, 2 reactor pressure vessels would be shipped by heavy hauler to the Delaware and Hudson Railroad terminus in Ballston Spa, New York and then by rail to a U.S. Department of Energy disposal site. All shipments were assumed to occur over a 2-year period.

Due to its large size, the D1G Prototype primary shield tank would be dismantled and shipped as multiple miscellaneous packages. The smaller S3G Prototype primary shield tank could be shipped either by rail or by truck as a single large package. This single package would be approximately 3.6 meters (142 inches) in diameter by 3.1 meters (120 inches) tall. Although radiological and nonradiological impacts from multiple shipments of miscellaneous packages from the dismantled S3G Prototype primary shield tank would be very small, a single shipment of the entire primary shield tank either by rail or truck would have lower impacts. Therefore, for the purposes of conservatism, the transportation analysis provided in this section include the S3G Prototype primary shield tank as dismantled and shipped as multiple miscellaneous packages.

C.2 General Technical Approach for Calculating Health Risks

This section describes the general approach taken to evaluate the health risks associated with the shipment of dismantled S3G and D1G Prototype reactor plant materials. First, the radiological health risks to the general population, to the transportation crew, and to hypothetical maximally exposed individuals are evaluated for gamma radiation emanating directly from the packages during normal (incident-free) transport conditions. Radiological health risks are reported in terms of latent fatal cancers. Next, the radiological health risks to the general population for accident scenarios are evaluated. Accidents are evaluated based on corrosion product release to the atmosphere, probability for occurrence, and accident severity. To provide an upper bound to the significance of an accident, the radiological consequences are also evaluated for hypothetical maximally exposed individuals. In conjunction with these radiological evaluations, nonradiological risks to the population are also evaluated for vehicular exhaust emissions and transportation accidents.

C.2.1 Computer Codes

Several computer codes were used in the analysis of transportation related impacts. General analyses used the RADTRAN 4 and RISKIND computer codes. Additional computer programs, such as INTERLINE and HIGHWAY, were used to provide input for the RADTRAN 4 and RISKIND computer codes. Due to the simplicity of variables for calculating the risks to the maximally exposed individual in the general population during incident-free conditions, simple equations without computer modeling were sufficient for the analysis.

RADTRAN 4

The RADTRAN 4 computer code was developed by Sandia National Laboratories (References C-5 and C-6). RADTRAN 4 was used to calculate radiological risks for the general population and the transportation crew for incident-free and accident risk scenarios. RADTRAN 4 was also used to calculate radiological risks for the maximally exposed individual worker for incident-free scenarios.

RISKIND

The RISKIND computer code was developed by Argonne National Laboratory (Reference C-7). A version of RISKIND, which accepts fuel-specific isotopes, was found to be the best code to calculate the maximum radiological consequences to the general population and the maximally exposed individual in the general population for postulated accident scenarios.

INTERLINE

The INTERLINE computer program was developed at Oak Ridge National Laboratory (Reference C-8). The latest available version of INTERLINE was used to model conditions in the vicinity of railroad routes. The INTERLINE database consists of networks representing various competing railroad companies in the United States. The routes used in this study use the standard assumptions in the INTERLINE model which simulate the selection process that railroads would use to direct shipments of Naval reactor plant components. The code is updated periodically to reflect current track conditions and has been benchmarked against reported mileage and observations. INTERLINE also provides the weighted population densities for rural, suburban, and urban populations averaged over all states along the shipment route and the percentage of mileage traveled in each population density. The version of INTERLINE used in these analyses contains 1990 Census data. The distance traveled, weighted population density, and percentage of distance in each population density, as generated by INTERLINE, are input variables in the RADTRAN 4 computer code.

HIGHWAY

The HIGHWAY computer program was developed at Oak Ridge National Laboratory (Reference C-9). The latest available version of HIGHWAY was used to model conditions in the vicinity of highway routes. The code is updated periodically as new roads are added. The routes used for this study use the standard assumptions in the highway model. Similar to the INTERLINE computer code, HIGHWAY provides the distance between the origin and destination, the weighted population densities along the route and the percentage of distance traveled in each population density, which are all input variables for the RADTRAN 4 computer code.

C.2.2 Radiological and Nonradiological Fatality Rates

The health risk conversion factors used in this evaluation are taken from the International Commission on Radiological Protection (Reference C-10) which specified 0.0005 latent fatal cancers per person-rem for members of the public and 0.0004 latent fatal cancers per person-rem for workers. Health risk conversion factors are weighted higher for the general population to account for longer life expectancies of children in the general population compared to adult workers. These risk estimates were extrapolated from estimates applicable to high doses and dose rates and probably overstate the true lifetime risk at low doses and dose rates. In an assessment of this uncertainty, the National Academy of Sciences pointed out that "the possibility that there may be no risks from exposures comparable to external natural background radiation cannot be ruled out" (Reference C-11).

In these analyses, the radiological impacts are first expressed as the calculated total effective dose. Doses to the general population and the transportation crew are reported as person-rem and doses to maximally exposed individuals are reported as rem. The appropriate health risk conversion factor, above, is then applied to the calculated total exposure in order to estimate the health risks in terms of latent fatal cancers. When interpreting the results of these analyses, the health risk per person-rem of dose to the general population is equivalent to the health risk per rem of dose to an individual. For example, ten people in the general population receiving a dose of 0.1 rem each yields the same net population health risk as one individual who receives a dose of one rem (10 people x 0.1 rem each = 1.0 person-rem = 1 person x 1 rem).

Nonradiological risks related to the transportation of Naval reactor plant components are also evaluated. The nonradiological risks are those resulting from vehicle exhaust emissions for incident-free transportation and fatalities resulting from transportation accidents for accident risk assessment. The nonradiological risks associated with return of transport vehicles to their points of origin are also included. Risk factors for exhaust emissions and fatality rates used in these analyses were obtained from References C-12, C-13, and C-14 and are provided in Table C-2.

Table C-2: Fatality Rates for Nonradiological Risks

	Rail [a]	**Truck** [a]	**Truck** [b]
Fatalities per Kilometer Due to Pollutants	1.3×10^{-7}	1.0×10^{-7}	1.0×10^{-7}
Fatalities per Kilometer Due to Accidents	2.8×10^{-8}	5.8×10^{-8}	4.6×10^{-8}

a. National average fatality rate used for shipment of radiological equipment to Savannah River and Hanford.

b. State (New York) average fatality rate used for shipment of nonradiological equipment to a disposal facility located within New York State.

C.2.3 Formulas Used for Nonradiological Shipment Health Risk Calculations

The estimated fatalities during incident-free transportation of nonradiological components are determined according to the following formula:

$$F_1 = D \times U \times R_1 \times N \times 2$$

where:

F_1 = Estimated fatalities for the total number of shipments.

D = Average distance traveled (kilometers) per shipment.

U = Percent of the distance traveled through urban areas.

R_1 = Fatalities per kilometer due to pollutants based on Reference C-12.

N = Number of shipments.

2 = Factor which is applied for the return of the transport vehicle to its point of origin.

A summary of the variables and the estimated fatalities due to incident-free shipment of the nonradiological components from the defueled S3G and D1G Prototype reactor plants is provided in Table C-3. The average distance traveled and percent urban density values are based on travel to the New York City area which provides a conservative estimate for fatalities to the public due to pollutants when compared to other likely disposal destinations.

Table C-3: Variables and Fatalities for Incident-Free Shipment of Nonradiological Components

	D (kilometers)	U (percent urban)	R_1 (fatalities per kilometer) [a]	N (shipments)	F_1 (estimated fatalities)	Average Annual Per Person Risk [b]
S3G	312	14%	1.0×10^{-7}	25	2.2×10^{-4}	3.2×10^{-10}
D1G				25	2.2×10^{-4}	3.2×10^{-10}
Total				50	4.4×10^{-4}	6.4×10^{-10}

a. 1.0×10^{-7} fatalities per kilometer = 1.6×10^{-7} fatalities per mile.
b. Based on affected population size and on 2 years of transportation.

For the shipments of nonradiological components involving an accident, the estimated fatalities are determined according to the following formula:

$$F_2 = D \times R_2 \times N \times 2$$

where:

F_2 = Estimated fatalities for the total number of shipments.

D = Average distance traveled (kilometer) per shipment.

R_2 = State (New York) average truck accident fatality rate (per kilometer) based on Reference C-13.

N = Number of shipments.

2 = Factor which is applied for the return of the transport vehicle to its point of origin.

A summary of the variables and the estimated fatalities due to accidents involving shipment of the nonradiological components from the defueled S3G and D1G Prototype reactor plants is provided in Table C-4.

Table C-4: Variables and Fatalities Due to Accidents Involving Shipments of Nonradiological Components

	D (kilometers)	R_2 (fatalities per kilometer) [a]	N (shipments)	F_2 (estimated fatalities)	Average Annual Risk [b]
S3G	312	4.6×10^{-8}	25	7.2×10^{-4}	3.6×10^{-4}
D1G			25	7.2×10^{-4}	3.6×10^{-4}
Total			50	1.4×10^{-3}	7.0×10^{-4}

a. 4.6×10^{-8} fatalities per kilometer = 7.4×10^{-8} fatalities per mile.
b. Based on 2 years of transportation.

C.3 Technical Approach for Assessing Incident-Free Radioactive Shipments

C.3.1 General Population Exposure and Transportation Crew Exposure

The RADTRAN 4 computer code includes models for calculating incident-free risks for shipment of radioactive packages. For shipments of radioactive materials resulting from S3G and D1G Prototype reactor plant dismantlements, RADTRAN 4 models were used to estimate:

- dose to persons within approximately 0.80 kilometers (0.5 miles) of each side of the transport route (off-link doses),
- dose to persons sharing the transport route (such as passengers on passing trains or vehicles, known as on-link doses),
- dose to persons at stops (such as residents or workers not directly involved with the shipment), and
- dose to transportation crew members.

The exposures calculated for the first three groups were added together to obtain the general population dose estimates. The dose calculated for the transportation crew was designated as the occupational dose. The impacts of dose to the S3G and D1G Prototype package handlers are included in the facility activities analyses in Appendix B, Section B.2.

Highway shipments of packages similar in size to the reactor pressure vessel package have occurred between the Kesselring Site and the Delaware and Hudson Railroad terminus in the past. Based on past experience for similar shipments, analyses assumed that limited traffic would pass the slow moving heavy hauler portion of the reactor pressure vessel shipment.

The transportation crew would receive radiation dose directly from radioactive packages during transit and/or inspection periods. For truck and heavy hauler shipments, RADTRAN 4 assumes crew dose is only received during the transit period and no inspections occur. For rail shipments, RADTRAN 4 assumes crew dose is only received during periods of package inspections. Crew dose is assumed to be negligible during transit due to the relatively long separation distance between the crew and the package and massive shielding of intervening structures. Therefore, for rail shipments, RADTRAN 4 calculates crew dose to one individual, the inspector.

C.3.2 Maximally Exposed Individuals

To estimate the maximum radiological exposure to an individual member of the transportation crew and an individual in the general public during incident-free radioactive shipments, various hypothetical scenarios were evaluated. Four scenarios were evaluated for individuals in the general population during rail shipments:

- a rail yard worker working at a distance of 10 meters (about 33 feet) from the radioactive package for 2 hours,
- a resident living 30 meters (about 98 feet) from a rail line used to ship a radioactive package with the package in transit,
- a resident living 200 meters (about 656 feet) from a rail line used to ship a radioactive package and the shipment is stopped for 20 hours, and
- a person standing still for 1 hour at a distance of 6 meters (about 20 feet) from a radioactive package loaded on a railcar.

Since the inspector is the only transportation crew member exposed during rail shipments, the inspector is also the maximally exposed individual worker.

Three hypothetical scenarios were evaluated for individuals in the general population during highway shipments:

- a person who is caught in traffic at a distance of 1 meter (about 39 inches) from the radioactive package for 0.5 hours,
- a resident living 30 meters (about 98 feet) from a highway used to ship a radioactive package with the package in transit, and
- a service station worker working at a distance of 20 meters (about 66 feet) from the package for 2 hours.

The maximally exposed individual worker for highway shipments is the truck driver.

The following formula was used to calculate the radiological dose to individuals at a fixed distance from a radioactive package during a stop:

$$E = (T \times K \times TI) / D^2$$

where:

E = Dose (millirem).

T = Total exposure time (hours).

K = Point source conversion factor (meters squared).

TI = Transport Index (a dimensionless number that represents the radiation level at 1 meter from the package surface in millirem per hour).

D = Average distance from centerline of container to exposed person (meters).

The dose to individuals at a fixed distance from the route along which the shipment is being transported was calculated using the following formula for a moving radiation source traveling with a fixed velocity, V, in meters per hour. The symbol π (pi) represents a dimensionless constant and is approximately equal to 3.14. All other terms are the same as described for the previous formula.

$$E = (\pi \times K \times TI) / (V \times D)$$

C.4 Computer Model Variables and Assumptions

This section highlights various assumptions and specific variables that were used in transportation related analyses for S3G and D1G Prototype related shipments. Table C-5 identifies the transportation values assigned to variables in calculations that used the RADTRAN 4 computer program. Selected default values were changed to assumed values to more closely reflect expected conditions and current practices.

Table C-5: Values for RADTRAN 4 Key Input Parameters

RADTRAN 4 Input Parameter	Default Value		Value Used in Analyses			
			Hanford		Savannah River	
	Truck	Rail	Truck	Rail	Truck	Rail
1) Fraction of Travel in Rural Zone	0.90	0.90	0.79 a	0.79 a	0.53 a	0.58 a
2) Fraction of Travel in Suburban Zone	0.05	0.05	0.18 a	0.18 a	0.42 a	0.35 a
3) Fraction of Travel in Urban Zone	0.05	0.05	0.03 a	0.03 a	0.05 a	0.07 a
4) Velocity in Rural Zone (kilometers per hour)	88.49	64.37	=	=	=	=
5) Velocity in Suburban Zone (kilometers per hour)	40.25	40.25	=	=	=	=
6) Velocity in Urban Zone (kilometers per hour)	24.16	24.16	=	=	=	=
7) Number of Crew Members Exposed on a Shipment	2	5	c	1.00 b	c	1.00 b
8) Average Distance from Radiation Source to Crew During Shipment (meters)	3.10	152.40	=	=	=	=
9) Number of Handlings per Shipment	0.0	2.00	=	=	=	=
10) Stop Time for Shipment (hours per kilometer)	0.011	0.033	0.005 b	=	0.005 b	=
11) Minimum Stop Time per Trip (hours)	0.0	10	=	=	=	=
12) Distance-Independent Stop Time per Trip (hours)	0.0	60	=	=	=	=
13) Minimum Number of Rail Inspections or Classifications	0.0	2	=	=	=	=
14) Number of Persons Exposed During Stop	50	100	=	=	=	=
15) Average Exposure Distance When Stopped (meters)	20	20	=	=	=	=
16) Storage Time per Shipment (hours)	0.0	4.0	=	0.0 b	=	0.0 b
17) Number of Persons Exposed During Storage	100	100	0.0 b	0.0 b	0.0 b	0.0 b
18) Average Exposure Distance During Storage (meters)	100	100	0.0 b	0.0 b	0.0 b	0.0 b
19) Number of Persons per Vehicle Sharing the Transport Link	2	3	=	=	=	=
20) Fraction of Urban Travel During Rush Hour	0.08	0.0	=	=	=	=
21) Fraction of Urban Travel on City Streets	0.05	1.0	=	=	=	=
22) Fraction of Rural and Suburban Travel on Freeways	0.85	0.0	=	=	=	=
23) One-way Traffic Count in Rural Zones	470	1	=	=	=	=
24) One-way Traffic Count in Suburban Zones	780	5	=	=	=	=
25) One-way Traffic Count in Urban Zones	2800	5	=	=	=	=

= RADTRAN 4 default value was assumed.

a. RADTRAN 4 default value not used. Data obtained from INTERLINE and HIGHWAY computer programs.

b. RADTRAN 4 default value not used. Data based on historical information.

c. RADTRAN 4 default value used for normal truck highway shipment. Crew size of 4 assumed for heavy hauler shipment.

C.4.1 Planned Number of Shipments and Package Sizes

As discussed in Section C.1, analyses assumed there would be 6 miscellaneous components packages per truck shipment which would result in a total of 51 separate miscellaneous shipments. The large components and reactor pressure vessels would be shipped as whole units in 9 separate shipments. Table C-6 defines the assumed size of each radioactive package type that would be shipped from the Kesselring Site.

Table C-6: Package Sizes for the S3G and D1G Prototype Reactor Plant Components

Package Type	Prototype		External Package Dimensions
Miscellaneous Components	S3G and D1G		Approximately 1.9 meters (76 inches) long x 1.3 meters (49 inches) wide x 1.3 meters (52 inches) tall
Reactor Pressure Vessel	S3G and D1G		Approximately 5.69 meters (224 inches) long x 3.23 meters (127 inches) diameter
Large Components	S3G	Steam Generator/ Pressurizer	Approximately 6.1 meters (240 inches) long x 2.4 meters (96 inches) wide x 2.6 meters (102 inches) tall
	D1G	Steam Generator/ Pressurizer	Approximately 12.2 meters (480 inches) long x 2.4 meters (96 inches) wide x 2.6 meters (102 inches) tall

C.4.2 Transport Index

Transport index values represent the radiation levels at 1 meter from the package surface of radiological shipments in millirem per hour. The transport index values used in the transportation analyses, listed in Table C-7, are based on records of similar low-level radioactive waste shipments.

For the reactor pressure vessel shipment, a large shielded disposal container would be required. It was assumed that the large shielded disposal container would be designed to meet a desired transport index at the time of shipment. As a result, the same transport index value was used in the transportation analyses of the reactor pressure vessel shipments for the prompt and deferred dismantlement alternatives. The majority of radioactivity in the reactor plant comes from cobalt-60. Since greater than 98 percent of the cobalt-60 would decay during a 30-year caretaking period, the transport indexes under the deferred dismantlement alternative for miscellaneous and large components reflect a large reduction.

Table C-7: Transport Index [a, b]

Package Type	Prompt Dismantlement		Deferred Dismantlement	
	S3G	D1G	S3G	D1G
Reactor Pressure Vessel	2.0	2.0	2.0	2.0
Large Components	6.0	6.0	0.1	0.1
Miscellaneous (6 boxes per shipment)	3.0	3.0	0.1	0.1

a. The Transport Index is a dimensionless number (rounded to the first decimal place) that represents the radiation level at 1 meter from the package surface in millirem per hour.

b. All packages would be designed and prepared for shipment to meet U.S. Department of Transportation requirements, 49 CFR Part 173.

C.4.3 Transportation Distances and Population Densities

As discussed in Section C.2.1, the HIGHWAY and INTERLINE computer codes were used for determining transportation distances and the population densities along the transportation routes. Based on historical data from similar radioactive material shipments, and for added conservatism, the total distances used for reactor pressure vessel rail shipment analysis were increased by approximately 11 percent above the distances predicted by the INTERLINE computer program. Similarly, the total distances used for highway shipment analyses were increased by approximately 3 percent above the distances predicted by the HIGHWAY computer program. The increased distance factors were applied equally for each population density area.

C.4.4 Fraction of Travel in Population Zones

The fraction of travel in each population area (rural, suburban, and urban) was obtained from HIGHWAY and INTERLINE for truck and rail, respectively, for each origin/destination combination. Assumed values used for each population zone are indicated in items 1, 2, and 3 of Table C-5.

C.4.5 Velocity

Truck Speed: For truck shipments, the RADTRAN 4 default values were used in all three population density zones. For the heavy hauler segment of the reactor pressure vessel shipment, the velocity was assumed to be approximately 3.2 kilometers (2.0 miles) per hour.

Train Speed: For train shipments of the reactor pressure vessel, the RADTRAN 4 default values were used in all three population zones.

The RADTRAN 4 truck and rail velocity default values used in the analyses are indicated in items 4, 5, and 6 of Table C-5.

C.4.6 Crew Size

Truck Crew Size: The default value of two for the truck crew was used for the shipments of the miscellaneous and large component packages. For the shipment of the reactor pressure vessel, the number of persons assumed to be in the heavy hauler crew was four.

Train Crew Size: The RADTRAN 4 default value for the number of personnel that accompany a special radioactive shipment is five, which includes three crew members plus two escorts. Although the reactor pressure vessel is radioactive, it does not contain spent fuel and would not be considered a special shipment; therefore, escorts would not be required, reducing the train crew size to three. However, during transit, crew exposure is assumed to be negligible due to the relatively long separation distance between the crew and the package and the shielding effects of intervening structures. Furthermore, RADTRAN 4 assumes crew exposure is only received during routine package inspections while the train is stopped. As a result, crew exposure is assigned to only one individual, the inspector. Item 7 of Table C-5 shows crew size values.

C.4.7 Distance to the Package

As shown in item 8 of Table C-5, RADTRAN 4 default values were used for the distance between the transportation crew and the package. The truck and heavy hauler crews were assumed to be located approximately 3.1 meters (10 feet) from the outside of the package. The train crew was assumed to be located approximately 152.4 meters (500 feet) from the reactor pressure vessel package during transit.

C.4.8 Stop Time

Truck Stop Time: A calculated stop time of 0.005 hours per kilometer (about 0.008 hours per mile) was used for all highway and heavy hauler shipments. This value is based on historical data from other low-level radioactive waste shipments that originated at the Kesselring Site.

Train Stop Time: Item 10 of Table C-5 shows that the stop time for rail shipments was assumed to be the RADTRAN 4 default value of 0.033 hours per kilometer (about 0.053 hours per mile).

C.4.9 Shipment Storage Time

Highway and rail shipments of Naval Reactors Program radioactive material are not stored while in the process of being shipped. Therefore, there was no shipment storage time associated with any of the shipments. The zero-storage values are reflected in items 16, 17, and 18 of Table C-5.

C.4.10 Shielding Factor

For train stops, the RADTRAN 4 default value for the gamma shield factor is 0.1. This value assumes the presence of substantial rail yard structures equivalent to approximately 10 centimeters (about 4 inches) of steel. This thickness of steel reduces gamma radiation exposure by more than a factor of 10. Therefore, a shield factor of 0.1 was considered to be reasonable.

C.5 Technical Approach for Assessing Radioactive Shipment Accidents

Risk is the product of the probability of an event and the consequences. Health risks from hypothetical accidents involving radioactive shipments were evaluated for the general population only. Analyses assumed that the transportation workers would evacuate the scene of an accident within a relatively short time after the accident occurred. Therefore, the risks of transportation accidents on transportation workers are included in the results for the general population.

C.5.1 General Population and Risk

The RADTRAN 4 computer code was used to calculate the radiological risk to the general population under accident conditions. The RADTRAN 4 computer code evaluates six pathways for radiation dose resulting from an accident. The six pathways are:

- direct radiation dose from the damaged package,
- inhalation dose from the plume of radioactive material released from the damaged package,
- direct radiation dose from immersion in the plume of radioactive material released from the damaged package,
- direct radiation dose from ground deposition of the radioactive material released from the damaged package,
- inhalation dose from resuspension of the radioactive material deposited on the ground, and
- ingestion dose from food products grown on the soil contaminated by ground deposition of radioactive material released from the damaged package.

A specific formula is used to estimate the radiological dose from each pathway. The formula accounts for the probability of an accident occurring and the severity. The doses from internal pathways (inhalation and ingestion) are based on exposure to the body over a 50-year period. The total radiation exposure resulting from the hypothetical accident equals the sum ($\sum$) of the doses from each pathway. The general equation for the radiation exposure to the general population from all pathways is:

$$D_R = \sum_{c,r} L_C \, P_r \times \sum_{i,j,k} (P_j \times RF_j \times D_{i,j,k})$$

where:

D_R = Total risk from radiation dose to the general population from the accident.

L_C = Shipment distance.

P_r = Probability of traffic accidents per unit distance (Accident Probabilities, Table C-8).

P_j = Probability that an accident of a specific severity category occurs.

RF_j = Fraction of curies released from shipping container after a severe accident (Corrosion Product Release Fractions, Table C-11).

$D_{i,j,k}$ = Radiation dose commitment resulting from an accident of a specific severity category (j), received through a specific pathway (i) in a specific population density zone (k).

Because it is impossible to predict the specific location of a transportation accident, neutral weather conditions were assumed (Pasquill Stability Class D as defined in Reference C-15). Since neutral meteorological conditions are the most frequently occurring atmospheric conditions in the United States, these conditions are most likely to be present in the event of a transportation accident.

C.5.2 Package Categorization

All reactor plant components would be shipped as packages meeting U.S. Department of Transportation regulations 49 CFR Part 173 (Shippers - General Requirements for Shipments and Packagings). The regulations include requirements for several types of packaging. Transportation risk analyses assumed that the reactor pressure vessel would be shipped in a single package meeting Type B criteria for materials with high curie contents. Type B packaging is designed and tested to rigorous standards to prevent any release of contents under most accident conditions. Type B packaging design and testing standards are defined in U.S. Nuclear Regulatory Commission regulations 10 CFR Part 71 (Packaging and Transportation of Radioactive Material). The large components and miscellaneous materials would be shipped as packages meeting the U.S. Department of Transportation criteria for either low specific activity materials or surface contaminated objects for materials with lower curie content than Type B packages.

C.5.3 Accident Probability

The probabilities used in transportation accident risk analyses, which represent all categories of accidents, are presented in Table C-8. Note that rail accident probability rates are the same for rural, suburban, and urban areas. The rates in Table C-8 are described in Reference C-13 as the average probabilities of accidents in the United States by transportation mode.

Table C-8: Accident Probabilities

Transport Mode	Accidents per Kilometer in Rural Zones (National average)	Accidents per Kilometer in Urban and Suburban Zones (National average)
Truck	2.0×10^{-7}	3.6×10^{-7}
Rail	5.6×10^{-8}	5.6×10^{-8}

C.5.1 General Population and Risk

The RADTRAN 4 computer code was used to calculate the radiological risk to the general population under accident conditions. The RADTRAN 4 computer code evaluates six pathways for radiation dose resulting from an accident. The six pathways are:

- direct radiation dose from the damaged package,
- inhalation dose from the plume of radioactive material released from the damaged package,
- direct radiation dose from immersion in the plume of radioactive material released from the damaged package,
- direct radiation dose from ground deposition of the radioactive material released from the damaged package,
- inhalation dose from resuspension of the radioactive material deposited on the ground, and
- ingestion dose from food products grown on the soil contaminated by ground deposition of radioactive material released from the damaged package.

A specific formula is used to estimate the radiological dose from each pathway. The formula accounts for the probability of an accident occurring and the severity. The doses from internal pathways (inhalation and ingestion) are based on exposure to the body over a 50-year period. The total radiation exposure resulting from the hypothetical accident equals the sum ($\sum$) of the doses from each pathway. The general equation for the radiation exposure to the general population from all pathways is:

$$D_R = \sum_{c,r} L_C\ P_r \times \sum_{i,j,k} (P_j \times RF_j \times D_{i,j,k})$$

where:

D_R = Total risk from radiation dose to the general population from the accident.

L_C = Shipment distance.

P_r = Probability of traffic accidents per unit distance (Accident Probabilities, Table C-8).

P_j = Probability that an accident of a specific severity category occurs.

RF_j = Fraction of curies released from shipping container after a severe accident (Corrosion Product Release Fractions, Table C-11).

$D_{i,j,k}$ = Radiation dose commitment resulting from an accident of a specific severity category (j), received through a specific pathway (i) in a specific population density zone (k).

Because it is impossible to predict the specific location of a transportation accident, neutral weather conditions were assumed (Pasquill Stability Class D as defined in Reference C-15). Since neutral meteorological conditions are the most frequently occurring atmospheric conditions in the United States, these conditions are most likely to be present in the event of a transportation accident.

C.5.2 Package Categorization

All reactor plant components would be shipped as packages meeting U.S. Department of Transportation regulations 49 CFR Part 173 (Shippers - General Requirements for Shipments and Packagings). The regulations include requirements for several types of packaging. Transportation risk analyses assumed that the reactor pressure vessel would be shipped in a single package meeting Type B criteria for materials with high curie contents. Type B packaging is designed and tested to rigorous standards to prevent any release of contents under most accident conditions. Type B packaging design and testing standards are defined in U.S. Nuclear Regulatory Commission regulations 10 CFR Part 71 (Packaging and Transportation of Radioactive Material). The large components and miscellaneous materials would be shipped as packages meeting the U.S. Department of Transportation criteria for either low specific activity materials or surface contaminated objects for materials with lower curie content than Type B packages.

C.5.3 Accident Probability

The probabilities used in transportation accident risk analyses, which represent all categories of accidents, are presented in Table C-8. Note that rail accident probability rates are the same for rural, suburban, and urban areas. The rates in Table C-8 are described in Reference C-13 as the average probabilities of accidents in the United States by transportation mode.

Table C-8: Accident Probabilities

Transport Mode	Accidents per Kilometer in Rural Zones (National average)	Accidents per Kilometer in Urban and Suburban Zones (National average)
Truck	2.0×10^{-7}	3.6×10^{-7}
Rail	5.6×10^{-8}	5.6×10^{-8}

C.5.4 Severe Accident Probability

The severe accident probability for S3G and D1G shipments (which do not involve spent nuclear fuel) is based on the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference C-1). That Environmental Impact Statement utilized the Modal Study (Reference C-16) as a basis to conservatively estimate that 99.4 percent of truck and rail accidents involving Type B packages would not result in any release of package contents to the environment. The study estimated that 0.6 percent of truck and rail accidents involving Type B packages would be severe enough to cause a breach in the container and would result in a release of loose corrosion products to the environment. A severe accident probability of 0.6 percent was assumed in analyses of all S3G and D1G truck and rail shipments. Because Type B containers are more robust than the other types of packages, damage to other packages would likely be greater under similar severe accident conditions. Therefore, the analyses for other than Type B containers account for this difference by assuming a release fraction which is 10 times greater than the release fraction associated with reactor pressure vessel (Type B) packages to ensure that analyses for all shipments remain conservative. Further discussion of package types and release fractions is provided in Section C.5.6.

C.5.5 Corrosion Product Activity

The amount of activated corrosion products was derived based on formulas that correlate reactor plant pipewall dose rate measurements with calculated wetted surface areas and corrosion product deposition levels. The radioactivity amounts used in the transportation accident analyses were based on end-of-life radiation measurements. The data were then decay corrected to an assumed time of dismantlement.

- For S3G, values for prompt dismantlement were decay corrected for 6 years and values for deferred dismantlement were decay corrected for 36 years.
- For D1G, values for prompt dismantlement were decay corrected for 1 year and values for deferred dismantlement were decay corrected for 31 years.

S3G Corrosion Product Activity: Cobalt-60 contributes approximately 98 percent to the total exposure levels in the accident analyses for the prompt dismantlement alternative. The radionuclides that result in at least 99 percent of the possible dose for the deferred dismantlement alternatives are: cobalt-60, niobium-94, americium-241, nickel-63, plutonium-238, strontium-90, curium-244, plutonium-239, and plutonium-241. Table C-9 provides the total amount of S3G corrosion product radioactivity (curies) assumed in transportation analyses for each package type.

Table C-9: S3G Corrosion Product Radioactivity Content of Package Types, Decay Corrected

Package Type	6-year Prompt Dismantlement (curies)	36-year Deferred Dismantlement (curies)
Miscellaneous	3.4	0.7
Reactor Pressure Vessel	1.0	0.2
Large Components	6.0	1.3

D1G Corrosion Product Activity: Cobalt-60 alone contributes approximately 98 percent to the total exposure levels in the accident analyses for the prompt dismantlement alternative. However, manganese-54 combines with cobalt-60 to contribute more than 99 percent of the possible exposure level.

The radionuclides that result in at least 99 percent of the possible dose for the deferred dismantlement alternatives are: cobalt-60, niobium-94, americium-241, nickel-63, plutonium-238, strontium-90, curium-244, and plutonium-241. Table C-10 provides the total amount of D1G corrosion product radioactivity (curies) assumed in transportation analyses for each package type.

Table C-10: D1G Corrosion Product Radioactivity Content of Package Types, Decay Corrected

Package Type	1-year Prompt Dismantlement (curies)	31-Year Deferred Dismantlement (curies)
Miscellaneous	18.7	1.8
Reactor Pressure Vessel	7.0	0.7
Large Components	43.8	4.2

C.5.6 Package Release Fractions

The package release fraction represents the percentage of radioactive material in the shipment that could be released to the environment following a severe accident. The amount of radioactivity in each package was derived based on historical activated corrosion product models. The corrosion product model accounts for all activated corrosion products which adhere to all wetted surfaces inside the reactor pressure vessel and the components of the coolant system over plant life. Most of the radioactive corrosion products contained in reactor plant materials are tightly adhering to the inside surfaces and are not likely to result in readily dispersible forms of contamination. Based on results of laboratory testing of reactor pressure vessel and coolant system specimens (independent of packaging), transportation accident analyses for each package type conservatively assumed that 33 percent of corrosion product radioactivity would be loosened from the impact of a severe hypothetical accident.

As discussed in Section C.5.4 for severe accident probability, only severe accidents would result in a release of radioactivity to the environment. Although the same severe accident probability was assumed in the accident analyses for all packages, the Type B reactor pressure vessel package would be much less susceptible to damage or breaching. Consistent with the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference C-1), transportation risk analysis of the Type B reactor pressure vessel package (Type B package) assumed that 10 percent of its loose corrosion products would be released following a severe accident. Since 33 percent is a conservative prediction of the available corrosion products which could be loosened, as discussed above, the severe accident analysis of the reactor pressure vessel package applied a package release fraction of 0.033 (33 percent of the total available corrosion product radioactivity in the package x 10 percent release = 3.3 percent = 0.033).

Since the large and miscellaneous components would be shipped in packages other than Type B (see the discussion in Section C.5.2), transportation risk analyses conservatively assumed that 100 percent of the loose corrosion products would be released following a severe accident. Severe accident analyses of these package types applied a package release fraction of 0.33 (33 percent of the total available corrosion product radioactivity x 100 percent release = 33 percent = 0.33). Table C-11 summarizes the release fractions used in transportation risk analyses.

Table C-11: Package Release Fractions for Severe Accident Conditions

Package Type	Release Fraction
Miscellaneous (other than Type B packages)	0.33
Reactor Pressure Vessel (Type B package)	0.033
Large Components (other than Type B packages)	0.33

C.5.7 Maximum Consequence to Individuals and Population

Maximum consequences were evaluated for the large components and miscellaneous packages assuming that a hypothetical accident occurs. For the reactor pressure vessel shipment, maximum consequences were evaluated for very severe accidents which have a low probability of occurrence. For all package types, radiological doses were calculated for the maximally exposed individual and the general population. Because it is impossible to predict the specific location of a transportation accident, doses to the general population were calculated for each of the three population density regions (rural, suburban and urban) over an approximate 80-kilometer (50-mile) radius. The RISKIND computer code was used to calculate the maximum consequence doses.

The exposure pathways evaluated by RISKIND are identical to those used in the RADTRAN 4 computer code for exposures to the general population as discussed in Section C.5.1. However, the analyses for the maximum consequence doses to an individual considered acute doses only. Because the food ingestion pathway does not result in an acute dose, this pathway was not included in the maximum consequence analyses for individuals. Analyses assumed that the maximally exposed individual would be exposed unshielded during the passage of the radioactive plume released from the accident under worst (stable) atmospheric conditions.

Remedial actions following an accident would significantly reduce the consequences of the accident; however, analyses conservatively assume no cleanup actions.

C.5.7.1 Probability Cutoff Criterion

Consistent with Reference C-1, maximum consequence analyses applied a cutoff criterion of a 1 in 10 million (1.0×10^{-7}) chance of occurrence per year for excluding improbable accidents from detailed evaluation. Probability calculations considered variables such as the probability of an accident occurring (see Section C.5.3), the severe accident probability (see Section C.5.4), the fraction of travel in each population area, the number of shipments, and the probability of meteorological conditions that would lead to the higher consequences.

C.5.8 Plume Release Height Following an Accident

For the accident risk assessment, a ground level release was used in the RADTRAN 4 model. For the maximum consequence assessment, a plume release height of 10 meters (about 33 feet) was used in the RISKIND model.

C.5.9 Direct Dose from a Damaged Package

The radiation level following an accident was assumed to be at the U.S. Nuclear Regulatory Commission limit in 10 CFR Part 71 of 1 rem per hour at 1 meter (about 3.3 feet) from the package surface. Analyses concluded that the total direct dose to the general population or maximally exposed individual from the damaged package is negligible.

C.5.10 Food Transfer Factors

These transportation analyses used the same food transfer factors as similar analyses in the Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Reference C-1).

C.5.11 Distance from the Accident Scene to the Maximally Exposed Individual

Analyses assumed that the maximally exposed individual would remain in one location, unshielded, during the time that a radioactive plume passed by following a hypothetical accident. The location of maximum exposure was also assumed to be within the range of 100 meters (about 330 feet) to 400 meters (about 0.25 miles) from the accident site. This location was determined using RISKIND based on the assumed atmospheric stability and plume release height.

C.5.12 Population Density in the Vicinity of a Hypothetical Accident

For the accident risk evaluation (using RADTRAN 4), the population density information was obtained from HIGHWAY and INTERLINE for truck and rail, respectively. For the maximum consequence evaluation (using RISKIND), the RADTRAN 4 default values for rural, suburban, and urban areas of 6; 719; and 3,861 people per square kilometer (or about 15; 1,864; and 10,012 people per square mile), respectively, were used.

C.6 Summary of Analysis Results

This section provides the results of all transportation-related analyses performed for radioactive packages that would be shipped as a result of S3G and D1G Prototype reactor plant dismantlements.

Since transportation analyses assumed that the total number of people along transportation routes would be about 1 million, the estimated total average dose for incident-free transportation would be 5.4×10^{-6} rem per person and the average risk would be 2.7×10^{-9} per person, which is a very small risk.

C.6.1 Incident-Free Risk

Incident-free transportation analysis results are provided in the following tables:

Destination	Prompt Dismantlement	Deferred Dismantlement
Savannah River Site	Table C-12	Table C-14
Hanford Site	Table C-13	Table C-15

Radiological exposure and latent fatal cancers are provided for the general population, for the transportation crew and for the maximally exposed individual. The predicted numbers of fatalities from nonradiological sources (pollutants) are provided for comparison purposes. The results show the nonradiological risks are comparable to the radiological risks.

C.6.2 Accident Risk

Transportation accident analysis results are provided in the following tables:

Destination	Prompt Dismantlement	Deferred Dismantlement
Savannah River Site	Table C-16	Table C-18
Hanford Site	Table C-17	Table C-19

Tables C-16 through C-19 present the risks of accidents that would involve a release of radioactivity to the environment. Radiological latent fatal cancer risks are provided for the general population. The dose values presented in these tables are a summation of the dose times the probability of the accident occurring in each of three areas: rural, suburban, and urban. The predicted numbers of fatalities from nonradiological sources (traffic accidents) are included for comparison purposes. The major contributor is the ground contamination pathway (more than 90 percent of the total exposure). The ingestion pathway is the next important pathway. The analyses indicate that the nonradiological risks from accidents exceed the radiological risks for both the prompt and deferred alternatives.

C.6.3 Accident Maximum Consequences

Analysis results estimating the maximum consequences from a severe accident are provided in Table C-20 for the prompt dismantlement alternative and Table C-21 for the deferred dismantlement alternative. These results apply to shipments to either the Savannah River Site or to the Hanford Site. The accident with the highest maximum consequences involves the steam generator shipments (large component) because the steam generators have the largest primary surface area which causes them to have the highest corrosion product radioactivity content. Tables C-20 and C-21 indicate the numbers of latent cancer fatalities under maximum consequence accident conditions in either a rural, suburban, or urban population are expected to be small: $\leq 5.5 \times 10^{-1}$ and $\leq 1.3 \times 10^{-2}$ for the prompt and deferred dismantlement alternatives, respectively.

Table C-12: Incident-Free Transportation Risks, Kesselring Site to Savannah River Site, Prompt Dismantlement Alternative

		General Population		Transportation Crew		Maximally Exposed Individual in the General Population [a]		Maximally Exposed Worker [a]		Non-Radiological Fatality Risk [d]
		Dose (person-rem)	Latent Fatal Cancer Risk [b]	Dose (person-rem)	Latent Fatal Cancer Risk [c]	Dose (rem)	Latent Fatal Cancer Risk [b]	Dose (rem)	Latent Fatal Cancer Risk [c]	
Miscellaneous	S3G	4.2×10^{-1}	2.1×10^{-4}	9.9×10^{-1}	4.0×10^{-4}	3.8×10^{-2}	1.9×10^{-5}	5.0×10^{-1}	2.0×10^{-4}	3.8×10^{-4}
	D1G	4.7×10^{-1}	2.4×10^{-4}	1.1×10^{0}	4.4×10^{-4}	4.2×10^{-2}	2.1×10^{-5}	5.6×10^{-1}	2.2×10^{-4}	4.3×10^{-4}
Reactor Pressure Vessel	S3G	6.3×10^{-3}	3.2×10^{-6}	1.6×10^{-2}	6.4×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	8.9×10^{-3}	3.6×10^{-6}	3.6×10^{-5}
	D1G	6.3×10^{-3}	3.2×10^{-6}	1.6×10^{-2}	6.4×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	8.9×10^{-3}	3.6×10^{-6}	3.6×10^{-5}
Large Components	S3G	3.5×10^{-1}	1.8×10^{-4}	3.6×10^{-1}	1.4×10^{-4}	7.5×10^{-3}	3.8×10^{-6}	1.8×10^{-1}	7.2×10^{-5}	4.7×10^{-5}
	D1G	9.3×10^{-1}	4.7×10^{-4}	4.3×10^{-1}	1.7×10^{-4}	3.1×10^{-2}	1.6×10^{-5}	2.1×10^{-1}	8.4×10^{-5}	6.3×10^{-5}
Total by Plant	S3G	7.8×10^{-1}	3.9×10^{-4}	1.4×10^{0}	5.6×10^{-4}	4.6×10^{-2}	2.3×10^{-5}	6.9×10^{-1}	2.8×10^{-4}	4.6×10^{-4}
	D1G	1.4×10^{0}	7.0×10^{-4}	1.5×10^{0}	6.0×10^{-4}	7.4×10^{-2}	3.7×10^{-5}	7.8×10^{-1}	3.1×10^{-4}	5.3×10^{-4}
Total S3G + D1G		2.2×10^{0}	1.1×10^{-3}	2.9×10^{0}	1.2×10^{-3}	1.2×10^{-1}	6.0×10^{-5}	1.5×10^{0}	5.9×10^{-4}	9.9×10^{-4}
Average Annual per Person [e]		1.7×10^{-6}	8.5×10^{-10}	7.3×10^{-1}	2.9×10^{-4}	6.0×10^{-2}	3.0×10^{-5}	7.3×10^{-1}	2.9×10^{-4}	3.6×10^{-10}

a. Data for the maximally exposed individual are conservatively assumed to apply to the same person for all shipments.
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0004 (see Section C.2.2).
d. Based on distance traveled.
e. Based on affected population size and 2 years of transportation. General population data is based on the approximate number of people that live within a 1-mile corridor along the transportation route. Transportation crew sizes are shown in Table C-5.

Table C-13: Incident-Free Transportation Risks, Kesselring Site to Hanford Site, Prompt Dismantlement Alternative

		General Population		Transportation Crew		Maximally Exposed Individual in the General Population [a]		Maximally Exposed Worker [a]		Non-Radiological Fatality Risk [d]
		Dose (person-rem)	Latent Fatal Cancer Risk [b]	Dose (person-rem)	Latent Fatal Cancer Risk [c]	Dose (rem)	Latent Fatal Cancer Risk [b]	Dose (rem)	Latent Fatal Cancer Risk [c]	
Miscellaneous	S3G	1.0×10^{0}	5.0×10^{-4}	2.3×10^{0}	9.2×10^{-4}	3.8×10^{-2}	1.9×10^{-5}	1.2×10^{0}	4.8×10^{-4}	5.6×10^{-4}
	D1G	1.2×10^{0}	6.0×10^{-4}	2.6×10^{0}	1.0×10^{-3}	4.2×10^{-2}	2.1×10^{-5}	1.3×10^{0}	5.2×10^{-4}	6.2×10^{-4}
Reactor Pressure Vessel	S3G	1.0×10^{-2}	5.0×10^{-6}	2.2×10^{-2}	8.8×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	1.5×10^{-2}	6.0×10^{-6}	4.9×10^{-5}
	D1G	1.0×10^{-2}	5.0×10^{-6}	2.2×10^{-2}	8.8×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	1.5×10^{-2}	6.0×10^{-6}	4.9×10^{-5}
Large Components	S3G	8.7×10^{-1}	4.4×10^{-4}	8.3×10^{-1}	3.3×10^{-4}	7.5×10^{-3}	3.8×10^{-6}	4.2×10^{-1}	1.7×10^{-4}	6.9×10^{-5}
	D1G	2.3×10^{0}	1.2×10^{-3}	9.9×10^{-1}	4.0×10^{-4}	3.1×10^{-2}	1.6×10^{-5}	5.0×10^{-1}	2.0×10^{-4}	9.3×10^{-5}
Total by Plant	S3G	1.9×10^{0}	9.5×10^{-4}	3.2×10^{0}	1.3×10^{-3}	4.6×10^{-2}	2.3×10^{-5}	1.6×10^{0}	6.4×10^{-4}	6.7×10^{-4}
	D1G	3.5×10^{0}	1.8×10^{-3}	3.6×10^{0}	1.4×10^{-3}	7.4×10^{-2}	3.7×10^{-5}	1.8×10^{0}	7.2×10^{-4}	7.7×10^{-4}
Total S3G + D1G		5.4×10^{0}	2.7×10^{-3}	6.8×10^{0}	2.7×10^{-3}	1.2×10^{-1}	6.0×10^{-5}	3.4×10^{0}	1.4×10^{-3}	1.4×10^{-3}
Average Annual per Person [e]		2.9×10^{-6}	1.5×10^{-9}	1.7×10^{0}	6.8×10^{-4}	6.0×10^{-2}	3.0×10^{-5}	1.7×10^{0}	6.8×10^{-4}	1.7×10^{-10}

a. Data for the maximally exposed individual are conservatively assumed to apply to the same person for all shipments.
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0004 (see Section C.2.2).
d. Based on distance traveled.
e. Based on affected population size and 2 years of transportation. General population data is based on the approximate number of people that live within a 1-mile corridor along the transportation route. Transportation crew sizes are shown in Table C-5.

Table C-14: Incident-Free Transportation Risks, Kesselring Site to Savannah River Site, Deferred Dismantlement Alternative

		General Population		Transportation Crew		Maximally Exposed Individual in the General Population [a]		Maximally Exposed Worker [a]		Non-Radiological Fatality Risk [d]
		Dose (person-rem)	Latent Fatal Cancer Risk [b]	Dose (person-rem)	Latent Fatal Cancer Risk [c]	Dose (rem)	Latent Fatal Cancer Risk [b]	Dose (rem)	Latent Fatal Cancer Risk [c]	
Miscellaneous	S3G	1.4×10^{-2}	7.0×10^{-6}	3.3×10^{-2}	1.3×10^{-5}	1.3×10^{-3}	6.5×10^{-7}	1.7×10^{-2}	6.8×10^{-6}	3.8×10^{-4}
	D1G	1.6×10^{-2}	8.0×10^{-6}	3.7×10^{-2}	1.5×10^{-5}	1.4×10^{-3}	7.0×10^{-7}	1.9×10^{-2}	7.6×10^{-6}	4.3×10^{-4}
Reactor Pressure Vessel	S3G	6.3×10^{-3}	3.2×10^{-6}	1.6×10^{-2}	6.4×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	8.9×10^{-3}	3.6×10^{-6}	3.6×10^{-5}
	D1G	6.3×10^{-3}	3.2×10^{-6}	1.6×10^{-2}	6.4×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	8.9×10^{-3}	3.6×10^{-6}	3.6×10^{-5}
Large Components	S3G	5.8×10^{-3}	2.9×10^{-6}	5.9×10^{-3}	2.4×10^{-6}	1.3×10^{-4}	6.5×10^{-8}	3.0×10^{-3}	1.2×10^{-6}	4.7×10^{-5}
	D1G	1.5×10^{-2}	7.5×10^{-6}	7.1×10^{-3}	2.8×10^{-6}	5.1×10^{-4}	2.6×10^{-7}	3.5×10^{-3}	1.4×10^{-6}	6.3×10^{-5}
Total by Plant	S3G	2.6×10^{-2}	1.3×10^{-5}	5.5×10^{-2}	2.2×10^{-5}	2.3×10^{-3}	1.2×10^{-6}	2.9×10^{-2}	1.2×10^{-5}	4.6×10^{-4}
	D1G	3.7×10^{-2}	1.9×10^{-5}	6.0×10^{-2}	2.4×10^{-5}	2.7×10^{-3}	1.4×10^{-6}	3.1×10^{-2}	1.2×10^{-5}	5.3×10^{-4}
Total S3G + D1G		6.3×10^{-2}	3.2×10^{-5}	1.2×10^{-1}	4.6×10^{-5}	5.0×10^{-3}	2.5×10^{-6}	6.0×10^{-2}	2.4×10^{-5}	9.9×10^{-4}
Average Annual per Person [e]		4.7×10^{-8}	2.4×10^{-11}	3.0×10^{-2}	1.2×10^{-5}	2.5×10^{-3}	1.3×10^{-6}	3.0×10^{-2}	1.2×10^{-5}	3.6×10^{-10}

a. Data for the maximally exposed individual are conservatively assumed to apply to the same person for all shipments.
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0004 (see Section C.2.2).
d. Based on distance traveled.
e. Based on affected population size and 2 years of transportation. General population data is based on the approximate number of people that live within a 1-mile corridor along the transportation route. Transportation crew sizes are shown in Table C-5.

Table C-15: Incident-Free Transportation Risks, Kesselring Site to Hanford Site, Deferred Dismantlement Alternative

		General Population		Transportation Crew		Maximally Exposed Individual in the General Population [a]		Maximally Exposed Worker [a]		Non-Radiological Fatality Risk [d]
		Dose (person-rem)	Latent Fatal Cancer Risk [b]	Dose (person-rem)	Latent Fatal Cancer Risk [c]	Dose (rem)	Latent Fatal Cancer Risk [b]	Dose (rem)	Latent Fatal Cancer Risk [c]	
Miscellaneous	S3G	3.5×10^{-2}	1.8×10^{-5}	7.7×10^{-2}	3.1×10^{-5}	1.3×10^{-3}	6.5×10^{-7}	3.9×10^{-2}	1.6×10^{-5}	5.6×10^{-4}
	D1G	3.9×10^{-2}	2.0×10^{-5}	8.7×10^{-2}	3.5×10^{-5}	1.4×10^{-3}	6.0×10^{-7}	4.4×10^{-2}	1.8×10^{-5}	6.2×10^{-4}
Reactor Pressure Vessel	S3G	1.0×10^{-2}	5.0×10^{-6}	2.2×10^{-2}	8.8×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	1.5×10^{-2}	6.0×10^{-6}	4.9×10^{-5}
	D1G	1.0×10^{-2}	5.0×10^{-6}	2.2×10^{-2}	8.8×10^{-6}	8.2×10^{-4}	4.1×10^{-7}	1.5×10^{-2}	6.0×10^{-6}	4.9×10^{-5}
Large Components	S3G	1.5×10^{-2}	7.5×10^{-6}	1.4×10^{-2}	5.6×10^{-6}	1.3×10^{-4}	6.5×10^{-8}	7.0×10^{-3}	2.8×10^{-6}	6.9×10^{-5}
	D1G	3.9×10^{-2}	2.0×10^{-5}	1.7×10^{-2}	6.8×10^{-6}	5.1×10^{-4}	2.6×10^{-7}	8.3×10^{-3}	3.3×10^{-6}	9.3×10^{-5}
Total by Plant	S3G	6.0×10^{-2}	3.0×10^{-5}	1.1×10^{-1}	4.4×10^{-5}	2.3×10^{-3}	1.2×10^{-6}	6.1×10^{-2}	2.4×10^{-5}	6.7×10^{-4}
	D1G	8.8×10^{-2}	4.4×10^{-5}	1.3×10^{-1}	5.2×10^{-5}	2.7×10^{-3}	1.4×10^{-6}	6.7×10^{-2}	2.7×10^{-5}	7.7×10^{-4}
Total S3G + D1G		1.5×10^{-1}	7.4×10^{-5}	2.4×10^{-1}	9.6×10^{-5}	5.0×10^{-3}	2.5×10^{-6}	1.3×10^{-1}	5.1×10^{-5}	1.4×10^{-3}
Average Annual per Person [e]		8.2×10^{-8}	4.1×10^{-11}	6.5×10^{-2}	2.6×10^{-5}	2.5×10^{-3}	1.3×10^{-6}	6.5×10^{-2}	2.6×10^{-5}	1.7×10^{-10}

a. Data for the maximally exposed individual are conservatively assumed to apply to the same person for all shipments.
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0004 (see Section C.2.2).
d. Based on distance traveled.
e. Based on affected population size and 2 years of transportation. General population data is based on the approximate number of people that live within a 1-mile corridor along the transportation route. Transportation crew sizes are shown in Table C-5.

Table C-16: Transportation Accident Risks, Kesselring Site to Savannah River Site, Prompt Dismantlement Alternative

		General Population			Nonradiological Fatality Risk	
		Dose [a] (person-rem)	Latent Fatal Cancer Risk [b]	Annual Risk per Person [c]	Total	Average Annual [d]
Miscellaneous	S3G	1.1×10^{-4}	5.5×10^{-8}	5.5×10^{-14}	4.2×10^{-3}	2.1×10^{-3}
	D1G	5.0×10^{-4}	2.5×10^{-7}	2.5×10^{-13}	4.7×10^{-3}	2.4×10^{-3}
Reactor Pressure Vessel	S3G	7.1×10^{-7}	3.6×10^{-10}	1.3×10^{-16}	1.1×10^{-4}	5.5×10^{-5}
	D1G	4.2×10^{-6}	2.1×10^{-9}	7.5×10^{-16}	1.1×10^{-4}	5.5×10^{-5}
Large Components	S3G	2.0×10^{-4}	1.0×10^{-7}	1.0×10^{-13}	5.2×10^{-4}	2.6×10^{-4}
	D1G	1.2×10^{-3}	6.0×10^{-7}	6.0×10^{-13}	6.9×10^{-4}	3.5×10^{-4}
Total by Plant	S3G	3.1×10^{-4}	1.6×10^{-7}	1.6×10^{-13}	4.8×10^{-3}	2.4×10^{-3}
	D1G	1.7×10^{-3}	8.5×10^{-7}	8.5×10^{-13}	5.5×10^{-3}	2.8×10^{-3}
Total S3G + D1G		2.0×10^{-3}	1.0×10^{-6}	1.0×10^{-12}	1.0×10^{-2}	5.2×10^{-3}

a. This value is calculated by RADTRAN 4 and is a summation of the dose times the probability of the accident occurring in each of three areas: rural, suburban, and urban (see Table C-8).
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Based on a weighted average population within a 1-mile wide corridor along the transportation route and on 2 years of transportation.
d. Based on 2 years of transportation.

Table C-17: Transportation Accident Risks, Kesselring Site to Hanford Site, Prompt Dismantlement Alternative

		General Population			Nonradiological Fatality Risk	
		Dose [a] (person-rem)	Latent Fatal Cancer Risk [b]	Annual Risk per Person [c]	Total	Average Annual [d]
Miscellaneous	S3G	1.5×10^{-4}	7.5×10^{-8}	1.6×10^{-13}	1.2×10^{-2}	6.0×10^{-3}
	D1G	6.7×10^{-4}	3.4×10^{-7}	7.5×10^{-13}	1.4×10^{-2}	7.0×10^{-3}
Reactor Pressure Vessel	S3G	9.9×10^{-7}	5.0×10^{-10}	1.8×10^{-16}	2.7×10^{-4}	1.4×10^{-4}
	D1G	5.8×10^{-6}	2.9×10^{-9}	1.1×10^{-15}	2.7×10^{-4}	1.4×10^{-4}
Large Components	S3G	2.7×10^{-4}	1.4×10^{-7}	3.1×10^{-13}	1.6×10^{-3}	8.0×10^{-4}
	D1G	1.6×10^{-3}	8.0×10^{-7}	1.8×10^{-12}	2.1×10^{-3}	1.1×10^{-3}
Total by Plant	S3G	4.2×10^{-4}	2.1×10^{-7}	4.7×10^{-13}	1.4×10^{-2}	7.0×10^{-3}
	D1G	2.3×10^{-3}	1.2×10^{-6}	2.6×10^{-12}	1.6×10^{-2}	8.0×10^{-3}
Total S3G + D1G		2.7×10^{-3}	1.4×10^{-6}	3.1×10^{-12}	3.0×10^{-2}	1.5×10^{-2}

a. This value is calculated by RADTRAN 4 and is a summation of the dose times the probability of the accident occurring in each of three areas: rural, suburban, and urban (see Table C-8).
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Based on a weighted average population within a 1-mile wide corridor along the transportation route and on 2 years of transportation.
d. Based on 2 years of transportation.

Table C-18: Transportation Accident Risks, Kesselring Site to Savannah River Site, Deferred Dismantlement Alternative

		General Population			Nonradiological Fatality Risk	
		Dose [a] (person-rem)	Latent Fatal Cancer Risk [b]	Annual Risk per Person [c]	Total	Average Annual [d]
Miscellaneous	S3G	2.7×10^{-6}	1.4×10^{-9}	1.4×10^{-15}	4.2×10^{-3}	2.1×10^{-3}
	D1G	1.1×10^{-5}	5.5×10^{-9}	5.5×10^{-15}	4.7×10^{-3}	2.4×10^{-3}
Reactor Pressure Vessel	S3G	1.7×10^{-8}	8.5×10^{-12}	3.0×10^{-18}	1.1×10^{-4}	5.5×10^{-5}
	D1G	8.9×10^{-8}	4.5×10^{-11}	1.6×10^{-17}	1.1×10^{-4}	5.5×10^{-5}
Large Components	S3G	4.7×10^{-6}	2.4×10^{-9}	2.4×10^{-15}	5.2×10^{-4}	2.6×10^{-4}
	D1G	2.5×10^{-5}	1.3×10^{-8}	1.3×10^{-14}	6.9×10^{-4}	3.5×10^{-4}
Total by Plant	S3G	7.4×10^{-6}	3.7×10^{-9}	3.8×10^{-15}	4.8×10^{-3}	2.4×10^{-3}
	D1G	3.6×10^{-5}	1.8×10^{-8}	1.9×10^{-14}	5.5×10^{-3}	2.8×10^{-3}
Total S3G + D1G		4.3×10^{-5}	2.2×10^{-8}	2.3×10^{-14}	1.0×10^{-2}	5.2×10^{-3}

a. This value is calculated by RADTRAN 4 and is a summation of the dose times the probability of the accident occurring in each of three areas: rural, suburban, and urban (see Table C-8).
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Based on a weighted average population within a 1-mile wide corridor along the transportation route and on 2 years of transportation.
d. Based on 2 years of transportation.

Table C-19: Transportation Accident Risks, Kesselring Site to Hanford Site, Deferred Dismantlement Alternative

		General Population			Nonradiological Fatality Risk	
		Dose [a] (person-rem)	Latent Fatal Cancer Risk [b]	Annual Risk per Person [c]	Total	Average Annual [d]
Miscellaneous	S3G	3.6×10^{-6}	1.8×10^{-9}	4.0×10^{-15}	1.2×10^{-2}	6.0×10^{-3}
	D1G	1.4×10^{-5}	7.0×10^{-9}	1.5×10^{-14}	1.4×10^{-2}	7.0×10^{-3}
Reactor Pressure Vessel	S3G	2.4×10^{-8}	1.2×10^{-11}	4.3×10^{-18}	2.7×10^{-4}	1.4×10^{-4}
	D1G	1.2×10^{-7}	6.0×10^{-11}	2.2×10^{-17}	2.7×10^{-4}	1.4×10^{-4}
Large Components	S3G	6.4×10^{-6}	3.2×10^{-9}	7.0×10^{-15}	1.6×10^{-3}	8.0×10^{-4}
	D1G	3.4×10^{-5}	1.7×10^{-8}	3.7×10^{-14}	2.1×10^{-3}	1.1×10^{-3}
Total by Plant	S3G	1.0×10^{-5}	5.0×10^{-9}	1.1×10^{-14}	1.4×10^{-2}	7.0×10^{-3}
	D1G	4.8×10^{-5}	2.4×10^{-8}	5.2×10^{-14}	1.6×10^{-2}	8.0×10^{-3}
Total S3G + D1G		5.8×10^{-5}	2.9×10^{-8}	6.3×10^{-14}	3.0×10^{-2}	1.5×10^{-2}

a. This value is calculated by RADTRAN 4 and is a summation of the dose times the probability of the accident occurring in each of three areas: rural, suburban, and urban (see Table C-8).
b. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
c. Based on a weighted average population within a 1-mile wide corridor along the transportation route and on 2 years of transportation.
d. Based on 2 years of transportation.

Table C-20: Hypothetical Severe Accident Analysis Results (Maximum Consequences), Prompt Dismantlement Alternative

	Maximally Exposed Individual			Rural		Suburban		Urban	
	Dose (rem)	Latent Fatal Cancer Risk [a]	Annual Risk [b]	Collective Dose (person-rem)	Latent Fatal Cancer Risk [a]	Collective Dose (person-rem)	Latent Fatal Cancer Risk [a]	Collective Dose (person-rem)	Latent Fatal Cancer Risk [a]
S3G	5.5×10^{-2}	2.8×10^{-5}	1.4×10^{-5}	8.9×10^{0}	4.5×10^{-3}	1.0×10^{2}	5.0×10^{-2}	1.7×10^{2}	8.5×10^{-2}
D1G	3.1×10^{-1}	1.6×10^{-4}	8.0×10^{-5}	5.2×10^{1}	2.6×10^{-2}	6.0×10^{2}	3.0×10^{-1}	9.7×10^{2}	4.9×10^{-1}
Total	3.7×10^{-1}	1.9×10^{-4}	9.5×10^{-5}	6.1×10^{1}	3.1×10^{-2}	7.0×10^{2}	3.5×10^{-1}	1.1×10^{3}	5.5×10^{-1}

a. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
b. Based on 2 years of transportation.

Table C-21: Hypothetical Severe Accident Analysis Results (Maximum Consequences), Deferred Dismantlement Alternative

	Maximally Exposed Individual			Rural		Suburban		Urban	
	Dose (rem)	Latent Fatal Cancer Risk [a]	Annual Risk [b]	Collective Dose (person-rem)	Latent Fatal Cancer Risk [a]	Collective Dose (person-rem)	Latent Fatal Cancer Risk [a]	Collective Dose (person-rem)	Latent Fatal Cancer Risk [a]
S3G	3.4×10^{-3}	1.7×10^{-6}	8.5×10^{-5}	3.0×10^{-1}	1.5×10^{-4}	2.3×10^{0}	1.2×10^{-3}	4.0×10^{0}	2.0×10^{-3}
D1G	1.3×10^{-2}	6.5×10^{-6}	3.3×10^{-6}	1.4×10^{0}	7.0×10^{-4}	1.2×10^{1}	6.0×10^{-3}	2.1×10^{1}	1.1×10^{-2}
Total	1.6×10^{-2}	8.0×10^{-6}	4.0×10^{-6}	1.7×10^{0}	8.5×10^{-4}	1.4×10^{1}	7.0×10^{-3}	2.5×10^{1}	1.3×10^{-2}

a. Latent Fatal Cancer Risk values are determined by multiplying the dose times 0.0005 (see Section C.2.2).
b. Based on 2 years of transportation.

REFERENCES

C-1 U.S. Department of Energy, DOE/EIS-0203-F, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, April 1995.

C-2 U.S. Department of the Navy, *Final Environmental Impact Statement on the Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants*, April 1996.

C-3 U.S. Department of Energy, DOE/EIS-0275, *Final Environmental Impact Statement for S1C Prototype Reactor Plant Disposal,* November 1996.

C-4 U.S. Department of the Navy, DOE/EIS-0251, *Department of the Navy Final Environmental Impact Statement for a Container System for the Management of Naval Spent Nuclear Fuel*, November 1996.

C-5 Neuhauser, K. S. and F. L. Kanipe, SAND89-2370, TTC-0943, UC-722, *RADTRAN 4 Users Guide*, Sandia National Laboratories, Albuquerque, New Mexico, January 1992.

C-6 Neuhauser, K. S. and F. L. Kanipe, SAND89-2370, *RADTRAN 4 Volume II: Technical Manual*, Sandia National Laboratories, Albuquerque, New Mexico, August 1993.

C-7 Yuan, Y. C., S. Y. Chen, D. J. LePoire, R. Rothman, *RISKIND - A Computer Program for Calculating Radiological Consequences and Health Risks from Transportation of Spent Nuclear Fuel*, Environmental Assessment and Information Sciences Division, Argonne National Laboratory, Argonne, Illinois, February 1993.

C-8 Johnson, P. E., D. S. Joy, D. B. Clark, J. M. Jacobi, ORNL/TM-12090, *INTERLINE 5.0, An Expanded Railroad Routing Model: Program Description, Methodology, and Revised User's Manual*, Oak Ridge National Laboratory, Oak Ridge, Tennessee, March 1993.

C-9 Johnson, P. E., D. S. Joy, D. B. Clark, J. M. Jacobi, ORNL/TM-12124, *HIGHWAY 3.01, An Enhanced Transportation Routing Model: Program Description, Methodology, and Revised User's Manual*, Oak Ridge National Laboratory, Oak Ridge, Tennessee, March 1993.

C-10 International Commission on Radiological Protection (ICRP), *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Annals of the ICRP, Vol. 21, No. 1-3, New York, Pergamon Press, 1991.

C-11 National Academy of Sciences - National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation, BEIR V*, Report of the Committee on the Biological Effects of Ionizing Radiations, 1990.

C-12 Rao, R. K., E. L. Wilmot, R. E. Luna, SAND81-1703, TTC-0236, *Nonradiological Impacts of Transporting Radioactive Material*, Sandia National Laboratories, Albuquerque, New Mexico, February 1982.

C-13 Saricks, C. and T. Kvitek, ANL/ESD/TM-68, *The Longitudinal Review of State-Level Accident Statistics for Carriers of Interstate Freight*, Argonne National Laboratory, Center for Transportation Research, Argonne, Illinois, 1994.

C-14 Cashwell, J. W., K. S. Neuhauser, P. C. Reardon, G. W. McNair, SAND85-2715, TTC-0633, *Transportation Impacts of the Commercial Radioactive Waste Management Program*, Sandia National Laboratories, Albuquerque, New Mexico, April 1986.

C-15 Pasquill, F., *Atmospheric Diffusion*, 2nd ed., John Wiley & Sons, New York, 1974.

C-16 U.S. Nuclear Regulatory Commission, NUREG/CR-4829, *Shipping Container Response to Severe Highway and Railway Accident Conditions*, prepared by Lawrence Livermore National Laboratory for U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Washington, D.C., 1987.

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APPENDIX D

CLASSIFIED ASPECTS OF

S8G AND MARF PROTOTYPE REACTOR PLANT

DESIGN, OPERATION, AND SAFETY

Unclassified Summary

Appendix D discusses classified aspects concerning reactor safety of the S8G and MARF Prototype reactor plants and their potential effect on the disposal of the S3G and D1G Prototype reactor plants. In particular, this appendix discusses the technical, organizational and philosophical basis for the Naval Reactors Program's approach to nuclear safety. All potential environmental impacts and conclusions discussed in Appendix D are covered in Sections 5.5.8 through 5.5.8.3 of this Environmental Impact Statement.

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APPENDIX E

COMMENTS AND RESPONSES

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TABLE OF CONTENTS

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Introduction

This Appendix did not appear in the Draft Environmental Impact Statement. It has been added to the Final Environmental Impact Statement to present comments received following distribution of the Draft Environmental Impact Statement together with the Naval Reactors Program's responses to those comments. In cases where text of the Final Environmental Impact Statement has been changed from the Draft Environmental Impact Statement, a sidebar has been placed in the margin of the Final Environmental Impact Statement adjacent to the revised text.

On July 16, 1997, the Naval Reactors Program began distribution of the Draft Environmental Impact Statement on the Disposal of the S3G and D1G Prototype Reactor Plants. Over 200 notices and Draft Environmental Impact Statements were distributed to regulatory agencies, elected officials, organizations, and individuals who have expressed an interest in the disposal of the defueled S3G and D1G Prototype reactor plants. The public comment period began with publication of the Notice of Availability in the *Federal Register* (62FR40074) on July 25, 1997 and remained open for 45 days, ending on September 8, 1997. In addition to the *Federal Register* notice, a public notice was published in the *Times Union*, *The Daily Gazette*, *The Saratogian*, and the *Ballston Journal* newspapers. During the comment period, a public hearing was held in the Town of Milton, New York, as announced in the *Federal Register* and the above listed newspaper notices.

A total of 10 written statements and 4 oral statements were received as follows:

	Written	Oral
Federal Agencies	1	0
State Agencies	5	0
Federal Officials	0	0
Local Officials	2	2
Organizations	0	0
Individuals	2	2

In the Final Environmental Impact Statement Summary, the Naval Reactors Program has identified the prompt dismantlement alternative as its preferred alternative.

The New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials; the Honorable J.M. O'Connell, Mayor of Saratoga Springs; Mr. Wilbur Trieble, Town of Milton Supervisor; Mr. Louis J. Gnip, Town of Milton Councilperson; and one private citizen supported the prompt dismantlement alternative. Two private citizens supported the deferred dismantlement alternative. There was no support expressed for the no action alternative.

This appendix provides responses to all other comments and issues identified during the public review. A copy of each comment letter received is exhibited in this appendix with the corresponding comment response(s) immediately following each letter. A copy of the public hearing transcript is also exhibited with corresponding comment responses following the transcript. For purposes of clarity, when necessary, individual comments in the letters and public hearing transcript have been annotated with sidebars and corresponding comment numbers. Copies of letters received with no identified comments are included for the record following the comments and responses. Also included at the end of this appendix are copies of letters read at the public hearing, the contents of which are reflected in the public hearing transcript, and miscellaneous attachments in support of the comment responses.

Index of Comments and Responses

COMMENTS AND RESPONSES

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COURTENAY W. HALL
County Attorney

Telephone: (518) 884-4770
Fax: (518) 884-4720

Saratoga County Municipal Center
40 McMaster Street
Ballston Spa NY 12020

August 18, 1997

Mr. Andrew S. Baitinger, Chief
West Milton Field Office
Office of Naval Reactors
U.S. Dept. of Energy
P.O. Box 1069
Schenectady, New York 12301-1069

Dear Mr. Baitinger:

Thank you for the copy of the DEIS for the Disposal of the S3G and D1G Prototype Reactor Plants, in two volumes. The following written comments are hereby submitted.

I Rejection of Alternatives - On Site Disposal and Entombment Alternatives
The DEIS informs, p. 3-7 to 3-9, that entombment or other on-site disposal of the reactor components were evaluated but subsequently eliminated from consideration. The decision to exclude those courses of action from the range of considered alternatives is sound. According to 1990 census figures, 1,148,505 people reside within the circle having a 50 mile radius, the midpoint of which is the Kesselring Site. Vol. 1 Table 4-1. The County of Saratoga is one of the most rapidly growing in the State of New York. Some of the radioactive substances present in the two reactors have such disturbingly long half-lives as to be unsuited for long-term siting in a populated and developing area. The 239 isotope of plutonium, for one, has a half life of 24,100 years, an extraordinary toxicity, and is a source of penetrating gamma radiation. App. Table A-2. Niobium 94 with a half-life of 20,000 years is a source of gamma radiation. id. Nickel-59 surpasses all these with a staggeringly long 1
half-life of 76,000 years. id. While the Nickel 59 isotope emits x-rays, rather than the higher energy gamma rays, these, too, are a source of carcinogenicity.

No structure yet wrought by the hand of man has endured for such periods. The longevity of radioactivity has plagued DOE in the past at its Hanford site and most dramatically at Yucca Mountain, Nevada where DOE engineers are struggling to devise a containment structure able to last a million years. Given the geologic dimension of these time-scales, siting of wastes in a developing area is contraindicated, by inhument or otherwise. A secondary consideration is the path of least resistance concern. Given the prevalent popular aversion to having radioactive materials, especially wastes, being sited in any given community, one could expect local resistance to such siting to be fierce. This effectively would create a preference for sitting wastes where similar substances are already situated. The DEIS indicates at one point, that limiting the number of radioactive waste storage sites in the

United States is a policy consideration. In short, were the D1G and S3G plants to be kept here, I perceive that it would soon be added to.

Finally, there is the issue of perception versus reality. Even assuming the wastes could safely be stored on site, the popular perception to the contrary could throttle Saratoga County's vibrant and crucial tourist industry. Having a naval reactor present, I submit, does not pose the same images to popular opinion as does a waste repository. With the operational reactor, one envisions highly efficient technicians monitoring every aspect of activity whereas with a waste repository, one envisions an abandoned and contaminated wasteland. The existence of this perception rather than its truth is what matters here. A deleterious effect on commerce and the thriving tourist industry would occur were Saratoga County to be linked in the public mind with a nuclear waste dump. These considerations second the judgment of the Office of Naval Reactors that neither alternative be pursued. Other issues concerning the remaining alternatives will next be discussed.

II "No Action" Alternative

This alternative is, as the Office of Naval Reactors believes, unsuitable. It merely postpones the inevitable without addressing the costs, risks, and benefits of the various avenues of disposal. 2

III Rem Exposure to Worker - Prompt Dismantlement Option

Of the two alternatives remaining, prompt dismantlement will result in highest radiation exposures. The most affected group would be, as one would expect, the workers. The DEIS indicates that worker exposure will total 205-460 person-rem under this prompt dismantlement exposure.

App. A-17 and App. Table B-1 indicate that the health risk conversion factors established by the International Commission on Radiation Protection is 0.0004 latent fatal cancers per person-rem for workers and 0.0005 latent fatal cancers per person-rem to the general population.

App. Table B-5, B-6, and B-7 and the accompanying discussion in the DEIS and Appendix calculate latent fatal neoplasms using the lower figure of 205 person-rems in yielding (by multiplication of 205 person-rem x 0.0004 health risk conversion factor) the risk of 0.082 (or 8.2 x 10). However, if the higher exposure of 460 person-rem is used, as is conservative, (460 x 0.0004), the risk is 0.184 fatalities. App. p. A-19 indicates that 1.0 is certainty, thus 0.184 is nearly a 1 out of 5 risk of a fatality. The FEIS should state what is to be done to assure exposure is closer to the 205 person-rem end of the range. 3

IV Calculation of Per Person Risk

The methodology employed to derive per person risk from overall risk is unclear. 4

V Cadmium

Departing from the radiological subjects for the nonce, the DEIS Vol. I. p. 5-29 lists cadmium among the non-radioactive hazardous wastes which will originate from the work. Cadmium is, of course, one of the most poisonous metals known. How much is expected to be produced? Are any special precautions needed? What state is the Cadmium in? 5

VII Statement of Risk Based on Probability of Occurance

In several locations in the DEIS and technical Appendix, the method of calculation of risk is said to be derived by multiplying likelihood of occurrence by consequences of act. It may be that remoteness of occurrence downplays the consequences. Perhaps these risks should be discussed in greater detail. (e.g. what types of neoplasm, what are the genetic effects etc.)

In short, the consequences of the radiological effects should be stated. 6
The cancers should be discussed and the "genetic effects" explicated. What are the health care costs involved and how do these compare with the costs of the two primary alternatives?

VIII Plutonium

Three isotopes of plutonium are present in the reactor components. Plutonium is, of course, probably the most toxic substance known. Are special precautions necessary given this material's presence or are the ordinary 7
safeguards for general radioactive substances sufficient?

IX Miscellaneous

a) Component drop scenario and wind driven missile discussion. Do these hypotheticals consider the reactor pressure vessel or only non-reactor core 8
wetted surfaces.

Thank you very much for your consideration of these comments.

Sincerely yours,

LEIGH FINE
Assistant County Attorney

LF:jat

WM332/TXTATY01

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Commenter: Leigh Fine, Assistant County Attorney, Saratoga County, New York

Comment Responses:

Comment 1.
The Naval Reactors Program acknowledges the commenter's agreement that the on-site disposal and entombment alternatives can be eliminated from detailed consideration. While the commenter brings up several points regarding possible impacts associated with these alternatives, the Naval Reactors Program considers that further evaluation is unnecessary. The Naval Reactors Program has never used the Kesselring Site for disposal of radioactive materials and has never accepted wastes from other locations. Comments related to other U.S. Department of Energy facilities such as Yucca Mountain are outside the scope of this environmental impact statement.

Comment 2.
As discussed in Section 3.1.1 of the Draft Environmental Impact Statement, the Naval Reactors Program acknowledges that the no action alternative does not provide for permanent disposal of the S3G and D1G Prototype reactor plants. However, postponing a final decision on permanent disposal does constitute a viable alternative which we were obliged to review under the National Environmental Policy Act. While the Naval Reactors Program has identified prompt dismantlement as the preferred alternative, the risks associated with the no action and deferred dismantlement alternatives would be similarly small, as discussed throughout Sections 5.1 and 5.3 of the Draft Environmental Impact Statement.

Comment 3.
As discussed in Section 4.10.1.1 and Appendix A, Section A.3.3, "the goal of the Naval Reactors Program's radiological exposure control program is to control radiation exposure to the lowest practical level while still accomplishing the required work." As stated in Footnote a. to Appendix B, Table B-7, and Section 5.2.10.1, the higher occupational dose estimate (460 person-rem) for prompt dismantlement is based on preliminary plans. The lower value (205 person-rem) reflects Program experience that detailed work planning typically results in lower doses. This experience is based on many years of planning and executing other refueling and maintenance operations. In addition to detailed work planning, other key aspects of the Naval Reactors Program to minimize radiation exposure include the use of pre-engineered processes and special tooling, radiological training, routine radiological surveys, written procedures, verbatim compliance, independent auditing, and Program oversight (see Section A.3.3 of Appendix A). The Naval Reactors Program also uses radiation shielding extensively to minimize radiation exposure. As a result of these normal practices, it is reasonable to expect that the actual collective dose to workers will be on the lower end of the estimated range.

Comment 4.
The methodology used to derive per person risk values from cumulative risk values was to divide the cumulative risk (total risk of an event to the population) by the number of affected people. In the case of facility analyses, described in Appendix B, the per person risk for a member of the general population was based on the number of people that live within an

Commenter: Leigh Fine, Assistant County Attorney, Saratoga County, New York

Comment Responses:

80-kilometer (50-mile) radius of the Kesselring Site (Footnote e. to Tables B-5 through B-7 of Appendix B). For clarification, additional footnotes have been added to Tables B-10, B-12, B-15, B-17, B-20, B-22, and B-25 in Appendix B of the Final Environmental Impact Statement.

In the case of transportation analyses, described in Appendix C, the per person risk for a member of the general population was based on the approximate number of people that live within a one mile corridor along the transportation route. Analyses to determine per person risk for workers was based on the number of dismantlement workers on-site and the number of transportation workers involved with the shipments. For clarification, additional information has been added to footnotes for Tables C-12 through C-19 in Appendix C of the Final Environmental Impact Statement.

Comment 5.
Based on reviews of Naval nuclear reactor plant construction information and material studies, cadmium is present in only very small amounts. Cadmium is most commonly found on threaded fastener surfaces as a corrosion inhibiting plating material, and as a coating on electrical materials as noted in Section 5.2.13.2.5 of the Draft Environmental Impact Statement. These applications are not unique to the Kesselring Site; they are prevalent in commercial applications. Cadmium plating is applied in a very thin layer, is tightly adherent, is not in contact with internal wetted surfaces in the reactor plant and is not leachable. No special precautions are required to handle cadmium plated fasteners. Normal industrial work controls for dismantlement operations (described in Section 5.2.10.2), and normal waste segregation practices (described in Section 5.2.13.2) would be followed to ensure compliance with disposal site waste acceptance criteria and all applicable Federal and State regulations for occupational safety and waste handling.

Comment 6.
Assuming that a low-probability, design basis accident occurs, the consequences of radiological effects are small. As documented in the Draft Environmental Impact Statement, the chance of a single latent fatal cancer within 80 kilometers (50 miles) of the Kesselring Site from the worst design basis accident considered was 1 in 100. By comparison, over 200,000 cancer cases would be expected to occur in the same population from all other causes. Such small, incremental impacts do not warrant further study of indirect effects such as health care costs.

Cancer fatalities were used to summarize and compare the risks in this environmental impact statement since this effect was viewed to be of the greatest interest to most people, and allows ready comparison with health impacts from other sources, such as those from chemical carcinogens. As discussed in Appendix A, Section A.4.1, estimates of total detriment (including latent fatal cancers, nonfatal cancers and genetic effects) may be obtained from the estimates of latent fatal cancers by multiplying by 1.4 for workers and 1.46 for the general public. These factors have been obtained by dividing the risk for weighted total effects of

Commenter: Leigh Fine, Assistant County Attorney, Saratoga County, New York

Comment Responses:

radiation, by the risk for a latent fatal cancer for workers and for the general population. For example, the risk for a latent fatal cancer to a member of the general public is 0.0005 for each rem of exposure. The weighted total effect is 0.00073 for each rem. Dividing 0.00073 by 0.0005 equals 1.46. A comparison of these health risk factors was provided in Appendix B, Table B-1, of the Draft Environmental Impact Statement. Appendix A, Section A.4, provides further discussion on the health effects of radiation exposure. There is no methodology for predicting which specific forms of cancer will result from radiation exposure.

Comment 7.
The structural steel components of the reactor plant contain trace (extremely small) amounts of naturally occurring uranium, as do all steel products such as cars and household appliances. When these steel components are used in or in close proximity to a nuclear reactor, a very small amount of this trace uranium is transformed into plutonium. Distributed throughout the steel components, the amount of plutonium is well below our ability to measure even with sensitive instruments, and is too small to require any special handling or disposal precautions. The stringent radiological controls invoked as a routine part of Naval Reactors Program operations are described in Appendix A, Section A.3.3, of the Draft Environmental Impact Statement and are sufficient for handling such material.

Comment 8.
Analysis of hypothetical accident scenarios involving a steam generator were considered to have greater consequences than similar accidents involving a reactor pressure vessel. The release of radioactive corrosion products is considered to have the greatest impact to the public since it is assumed that the radioactivity would be released as an airborne contaminant. The estimated amount of radioactivity available in the steam generator for release to the environment is based on the uniform deposition of corrosion products on the wetted surfaces of components throughout the reactor plant, which is consistent with past experience. The steam generators have the largest internal wetted surface area within the reactor plant.

Due to the smaller internal surface area, damage to the reactor vessel from a drop accident or from a wind driven missile would result in a smaller release of radioactivity in the form of corrosion products. Damage to a reactor vessel in the form of a breach or hole could result in more severe levels of radiation in narrow, localized areas (known as radiation streaming) compared to similar damage to a steam generator. However, this localized radiation streaming would not affect members of the general public, who are located at least one mile away. Also, casualty response actions would be implemented by on-site individual workers to minimize the effects by quickly installing temporary shielding, like lead blankets. Therefore, the Naval Reactors Program considers that hypothetical accident analysis results involving steam generators bound the risks of similar accidents involving other reactor plant components, such as a reactor pressure vessel. Appendix B, Section B.3.1.2, has been clarified in the Final Environmental Impact Statement to include this information.

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
84 HOLLAND AVENUE
ALBANY, NEW YORK 12208-3471

BONNY J. CAWLEY
REGIONAL DIRECTOR

JOSEPH H. BOARDMAN
COMMISSIONER

September 5, 1997

A. S. Baitinger, Chief
West Milton Field Office
U. S. Department of Energy
Schenectady Naval Reactors Office
P. O. Box 1069
Schenectady, New York 12301-1069

Dear Mr. Baitinger:

Thank you for your July 16, 1997 letter providing the opportunity to comment on the Draft Environmental Impact Statement for Disposal of the S3G and D1G Prototype Reactor Plants located at the Department of Energy's Kesselring site in the Town of Milton, Saratoga County.

As stated in Regional Planning & Program Manager Richard Carlson's letter of September 17, 1996
to you, if the Department of Energy decides to transport the low-level radioactive metal components
it could require various permits from this Department. Depending on the size of the vehicles used 1
on the highways, there could be a need for oversize and overweight load permits. And, depending
on the level of radioactivity of the shipments, there may be a need for permits and inspection for the
movement of nuclear material.

Please contact me at (518) 474-6215 if you have any questions or need further information.

Sincerely,

Donald E. Robertson

Donald E. Robertson
Planning & Program Management
NYSDOT - Region 1

cc: Richard W. Carlson, Regional Planning & Program Manager, Region 1
Bernard F. Briggs, Saratoga County Resident Engineer

Commenter: Donald E. Robertson, Planning and Program Management, New York State Department of Transportation, Region I

Comment Responses:

Comment 1.
The commenter is correct in noting that transport of certain low-level radioactive metal components could require various permits from the New York State Department of Transportation. As discussed in Section 5.2.10.3 of the Draft Environmental Impact Statement, the two reactor pressure vessel shipments would be considered highway route controlled due to their radioactivity content and would require the use of a New York State preferred route. Because of their oversize dimensions and weight, the two reactor pressure vessel packages would likely be transported over the same route between the Kesselring Site and the railroad terminus in Ballston Spa that has been used for past shipments of similar size and weight. Section 5.2.10.3 has been clarified in the Final Environmental Impact Statement to more clearly indicate that New York State issued permits would be required for the two reactor pressure vessel packages. As discussed further in Section 5.5.5 of the Draft Environmental Impact Statement, based on past experience with similar size and weight radioactive shipments, local police escorts would direct traffic to minimize congestion. None of the low-level radioactive waste shipments from dismantlement of the S3G and D1G Prototype reactor plants would involve nuclear materials. As discussed in Sections 2.2 and 2.3 of the Draft Environmental Impact Statement, the S3G and D1G Prototype reactor plants have been defueled, and the spent nuclear fuel shipped off-site safely and without incident in July 1994 and February 1997, respectively.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

SEP 08 1997

Mr. Andrew S. Baitinger, Chief
West Milton Field Office
Office of Naval Reactors
U.S. Department of Energy
P.O. Box 1069
Schenectady, New York 12301-1069 Class: LO

Dear Mr. Baitinger:

The Environmental Protection Agency (EPA) has reviewed the draft environmental impact statement (EIS) for the disposal of the S3G and D1G Prototype Reactor Plants at the Knolls Atomic Power Laboratory, Kesselring Site, West Milton, New York. This review was conducted in accordance with Section 309 of the Clean Air Act, as amended (42 U.S.C. 7609, PL. 91-604 12(a), 84 Stat. 1709), and the National Environmental Policy Act.

The Knolls Kesselring site has been operated as a reactor testing and training facility under the Naval Reactors Program since the mid-1950's, and is expected to continue operating in this capacity in the future. The draft EIS examines the dismantlement and disposal options for the defueled S3G and D1G Prototype reactor plants at this facility. The S3G and D1G Prototype reactor plants were permanently shut down in May 1991, and March 1996, respectively. All spent nuclear fuel was removed from the S3G and D1G Prototype reactors and shipped off-site in July 1994, and February 1997, respectively.

The draft EIS evaluates three alternatives for dismantlement and disposal of the S3G and D1G Prototype reactor plants. These include, no action, deferred dismantlement, and prompt dismantlement. Under the no action alternative, the reactors would be left in a defueled, safe, and stable condition; monitoring would take place into the indefinite future. The deferred dismantlement alternative would leave the reactor plants in a defueled, safe, and stable condition for a period of 30 years in order for some of the radioactive material to decay prior to dismantlement. Prompt dismantlement, the preferred alternative, would have the reactor plants dismantled shortly after the record of decision. Materials would be disposed of off-site or recycled at existing commercial or Department of Energy facilities. This alternative would take advantage of the experienced work force currently available at the Kesselring site. Based on our review of the draft EIS, we have the following comments.

A variety of wastes would be generated during dismantlement activities. Waste materials would include hazardous and nonhazardous debris, low level radiological waste, mixed waste, and toxic wastes. Please note that mixed waste, regardless of its type of radioactive element, is hazardous waste and subject to Resource Conservation and Recovery Act (RCRA) regulations. Additionally, mixed waste slated for land disposal is subject to RCRA land disposal restrictions (LDRs). Specifically, the LDRs in 40 CFR 268 require that hazardous waste meet established treatment standards prior to placement in a landfill. Lastly, hazardous debris is subject to 40 CFR 268.45 (Treatment Standards for Hazardous Debris) prior to land disposal. 1

The draft EIS states on page 3-4, that radioactivity concentration limits for unrestricted site release will be below EPA's, March 16, 1995 draft release criteria of 15 millirem/year above background. EPA agrees, but recommends citing our most recent draft, March 12, 1997, in the final EIS. 2

Lastly, the draft EIS states that work on radiologically controlled equipment or systems with loose radioactive material would be conducted using enclosed glovebag containments or equivalent engineered controls, and engineered ventilation. EPA concurs with this approach. However, the final EIS should identify additional radio nuclide National Emission Standards for Hazardous Air Pollutants (NESHAP) permits and/or modifications that may be required. 3

Based on our review, we do not anticipate that the proposed project would result in significant adverse environmental impacts. Therefore, in accordance with EPA policy, we have rated this project as LO, indicating that we do not object to its implementation.

Thank you for the opportunity to comment. If you have any questions concerning this letter, please contact Mark Westrate of my staff at (212) 637-3789.

Sincerely yours,

Robert W. Hargrove, Chief
Strategic Planning and Multi-Media Programs Branch

Commenter: Robert W. Hargrove, Chief, Strategic Planning and Multi-Media Programs Branch, U.S. Environmental Protection Agency

Comment Responses:

Comment 1.
The Naval Reactors Program acknowledges the applicability of the regulations cited by the commenter. The Naval Reactors Program considers that the regulatory framework for managing mixed wastes and the Program's responsibility to adhere to those regulations, including the Resource Conservation and Recovery Act (RCRA), was sufficiently covered in the Draft Environmental Impact Statement, Sections 2.5.5, 4.5.4.6, and 5.2.13.2.3, and considers that further discussion specifically focused on land disposal restrictions are not required.

Comment 2.
Changes to the release criteria for sites involved in radiological work are a matter currently under review by the Office of Management and Budget. Since there are differences between standards proposed by the U.S. Environmental Protection Agency and standards adopted by the U.S. Nuclear Regulatory Commission, it is inappropriate to cite the March 12, 1997 draft guidance since it is not available to the public. Nevertheless, Section 3.2.3 has been clarified in the Final Environmental Impact Statement to additionally reflect the fact that the cleanup limits for site unrestricted release will be more stringent than any other guidance currently under consideration.

Comment 3.
As discussed in Section 5.2.4.1 of the Draft Environmental Impact Statement, no application submittals to the U.S. Environmental Protection Agency (EPA) are required based on existing dismantlement work methods. However, it is anticipated that plasma arc cutting of radiologically contaminated materials would be introduced as a prompt dismantlement work method. Preliminary estimates using EPA methods outlined in 40 CFR Part 61 indicate that a modification to the National Emission Standards for Hazardous Air Pollutants radionuclide emissions from the Kesselring Site would be required. This modification would require EPA approval. Evaluation of the plasma arc work method at other sites indicates that there would be no significant environmental impacts from additional radioactivity emissions due to plasma arc cutting. Section 5.2.4.1 has been clarified in the Final Environmental Impact Statement to address this concern.

New York State Department of Environmental Conservation
Division of Solid & Hazardous Materials
50 Wolf Road, Albany, New York 12233-7250
518-457-6934 FAX 518-457-0629

John P. Cahill
Commissioner

VIA FAX AND MAIL

Mr. Andrew S. Baitinger
Chief, West Milton Field Office
United States Department of Energy
Schenectady Naval Reactors Office
P.O. Box 1069
Schenectady, NY 12301-1069

SEP 11 1997

Dear Mr. Baitinger:

We received the draft Environmental Impact Statement (EIS) prepared by the United States Department of Energy, Schenectady Naval Reactors Office entitled "Disposal of the S3G and D1G Prototype Reactor Plants," dated July 1997. Staff members of our Bureau of Pesticides & Radiation have reviewed the draft EIS. Their specific comments on the EIS are enclosed.

We concur with your selection of prompt dismantlement and disposal as the preferred alternative and believe that the EIS adequately supports that selection.

In general, the EIS was well organized and written in a manner easily understood. Inclusion of basic scientific and radiological information makes the document more meaningful to the general public.

Thank you for the opportunity to comment on this document.

Sincerely,

Norman H. Nosenchuck, P.E.
Director
Division of Solid & Hazardous Materials

Enclosure

New York State Department of Environmental Conservation
Division of Solid & Hazardous Materials
50 Wolf Road
Albany, New York

Comments on Draft Environmental Impact Statement, Disposal of the S3G and D1G Prototype Reactor Plants, United State Department of Energy, Office of Naval Reactors, July 1997

September 8, 1997

Specific Comments Volume 1

Page 2-10 Sentences 33-36 would be more clear if it was stated that the United States Environmental Protection Agency has sole regulatory authority under the National Emissions Standards for Hazardous Air Pollutants (NESHAPS) for radionuclide emissions of Atomic Energy Act radioactivity. The New York State Department of Environmental Conservation does have radiological cleanup standards in the Division of Solid & Hazardous Materials' Technical & Administrative Guidance Manual (TAGM) 4003 dated September 14, 1993. 1

Page 2-12 The environmental releases mentioned in sentence 9 should be briefly described and a reference given as to where in the document, or in the references, specific data can be obtained. 2

Page 3-17 In lines 1 through 7 (and elsewhere) the DEIS makes the point that one positive aspect of the prompt dismantlement option is the experienced work force currently available at the Kesselring Site. We concur with this conclusion. Experienced workers who are already familiar with the two plants should be able to perform the decommissioning not only more efficiently, but also more safely and effectively than would staff that would be hired years later under the deferred disposal option. 3

Page 4-24 Lines 7 and 8 refer to "New York State exempt concentration limits" for cesium-137 and cobalt-60. The cited reference is 12 NYCRR Part 38, *Ionizing Radiation Protection*. This may have been true at the time the samples were taken, but the table of exempt concentrations (Table 2) was not included when those regulations were revised in 1994. 4

Specific Comments Volume 2

Appendix B. Analysis of Nontransportation Impacts

Page B-7 Lines 4-8 on page B-7 state, "This appendix presents estimated environmental consequences, event probabilities, and risk (a product of probability and consequence) for both facility activities and postulated accident scenarios related to the disposal of the S3G and D1G Prototype reactor plants. Facility activities and accident scenarios are evaluated to estimate the effects of potential releases of radioactive material and toxic chemicals to the environment." The method used to estimate the risk of any impact is specifically stated on page B-8 in Appendix B, where the DEIS (lines 17-18, page B-8) states, "risk is defined as the product of the probability of occurrence of the accident times the consequence of the accident."

In the case of the radiological facility accidents, the environmental consequences were not described in sufficient detail. In the case of the non-radiological facility accidents, the event probabilities and risks were not described at all. In light of this, Appendix B does not achieve its stated purpose. From the lines on page B-7 quoted above, Appendix B should: (1) present environmental consequences, (2) present event probabilities, and (3) present the risk for both facility activities and postulated accident scenarios. 5 5, 6

Notably, the non-radiological accidents analyzed (a fire involving diesel fuel and a chemical spill) make no use of the probability of such an event occurring in their analysis. Therefore, no risks can be accurately determined. Also lacking from both of the accidents involving fires (diesel fuel fire and HEPA filter fire) is a consideration of the probability of an individual worker dying in the fire event due to burns, smoke inhalation, suffocation, etc. 7

The radionuclide-releasing accident scenarios presented and analyzed in Appendix B stress the annual individual risk of a latent fatal cancer (purpose 3 from above), but do not adequately describe the first stated purpose of this appendix (the environmental consequences to workers or the public) should an accident of the specified type occur. 8

Supporting information for all the radiological accident effects are lacking, such as the results from the GENII, SPAN 4, WATER RELEASE, and RSAC-5 computer codes. The final reports from these computer codes should be included in the DEIS. 9

Page B-13 Section B.1.3.4 on pages B-13 through B-14 provides only a brief statement evaluating the impacted areas for the hypothetical accidents. These three paragraphs and one table (Table B-2), which summarizes the "secondary impacts," give no detailed data nor do they present the method used to determine the impacts. Individual "secondary impact" analyses (meaning effects on the surrounding environment, biotic resources, water resources, economic impacts, and land uses) of the four radiological and two non-radiological accident scenarios should be provided. The input arguments and results of the RSAC-5 computer model should also be provided. 10

Page B-14 Line 31 on page B-14 states, "No enduring impacts are expected," with respect to the effect of the hypothetical accidents on water resources. This statement requires some form of supporting documentation. 11

Page B-15 Lines 9-12 on page B-15 essentially states that the general population spends 30% of the time within buildings, and that the general population radiation dose from contaminated ground was reduced by 30%. This assumes a shielding factor for the buildings of 100%, which is not the case. The shielding factor for the buildings should be stated and utilized, and the dose reduction factor changed appropriately. Table B-3 on the same page states estimated exposure times for workers and the general public, giving 0.7 years as the exposure time for fallout and 1 year for ingestion of contaminated food. An explanation of these exposure times should be provided. 12

Page B-20 In Tables B-5 and B-6 (on pages B-20 and B-21, respectively), the prompt dismantlement option gives an estimated range (line 2 in both tables) for the collective dose to radiation workers exposed to radiation during the deactivation. The lowest end of the range is then used to calculate the risk of latent fatal cancer and the annual individual risk of latent fatal cancer. Although the reasons for basing this calculation on the low limit is given in footnote "a" starting on line 13 on both pages, a calculation using the median of the given range should be used, and then caveat this result with the comments contained in footnote "a." 13

Page B-32 The HEPA filter fire analysis does not analyze the non-radioactive source term for toxic chemicals. 1

Appendix C. Analysis of Transportation Related Impacts

Page C-11 In Table C-2 on Page C-11, the fatality rates due to pollutants are consistently higher than the fatality rates given for vehicle accidents. Although the references are provided, it seems that based on Table C-2, 1
it is more hazardous to breathe than to drive a car. A more detailed explanation of the basis of these factors and how they were derived would clarify this anomaly.

Page C-18 Table C-6 would be more informative and useful in analysis if it included the activity levels, waste class and waste volumes for each of the large component, reactor pressure vessel, and miscellaneous component packages. In addition, the specific package type should also be included especially for the LSA shipments. LSA or SCO that exceeds the packaging limits in §173.427 of 49 CFR (i.e., unshielded 1
dose rate limit), must be packaged in accordance with 10 CFR Part 71 (i.e., in accident resistant Type B packages). The exemption to this requirement set forth in §71.52 will expire in April 1999, after which the NRC Type A package can no longer be used for many LSA shipments. The Type B package must then be used.

Page C-28 Paragraph C.5.9 states that the direct dose to the general public or maximally exposed individual from the damaged package is negligible. It is accepted that Type B packages have never been breached (to date) to release radioactive material. However, in the unlikely event that a Type B package should sustain some form of breach, the direct exposure dose due to radiation streaming would be substantially higher than the one rem per hour estimated in the DEIS. This would be especially true if the package contains the 107,000 curie S3G reactor pressure vessel with 10,000 curies of cobalt-60.

Commenter: Norman H. Nosenchuck, Director, Division of Solid & Hazardous Materials, New York State Department of Environmental Conservation

Comment Responses:

Comment 1.
Section 2.4.1 has been revised in the Final Environmental Impact Statement to clarify the regulatory authority for airborne radionuclide emissions, mixed waste and radiological cleanup standards.

The Naval Reactors Program acknowledges that the New York State Department of Environmental Conservation Technical & Administrative Guidance Manual (TAGM) 4003 describes "the policy and procedure to be followed by Division of Hazardous Substances Regulation, Bureau of Radiation staff in evaluating cleanup plans for soils contaminated with radioactive materials." TAGM 4003 has been added as a reference in the Final Environmental Impact Statement and cited in Section 3.2.3, however, its provisions are considered unnecessary at this time since S3G and D1G Prototype dismantlement alternatives do not involve Kesselring Site release activities.

Comment 2.
Section 2.4.3 has been clarified in the Final Environmental Impact Statement to cite other sections and applicable references which contain further information on the radiological aspects of the Kesselring Site environmental monitoring and protection program.

Comment 3.
The Naval Reactors Program acknowledges New York State Department of Environmental Conservation agreement that the presence of an experienced work force is a positive aspect of the prompt dismantlement alternative.

Comment 4.
The Naval Reactors Program acknowledges that the table of exempt concentrations which appeared in the cited New York State regulations at the time the samples were taken, was removed by subsequent revision to the regulations. Accordingly, Reference 4-41 and the sentence that cited it in Section 4.5.5.2 have been deleted from the Final Environmental Impact Statement.

Comment 5.
The Naval Reactors Program considers that Appendix B does achieve its stated purpose for radiological facility activities and accidents. The Draft Environmental Impact Statement provides a general overview of Appendix B in the introductory paragraph preceding Section B.1. The introductory paragraph states that "Facility activities and accident scenarios are evaluated to estimate the effects of potential releases of radioactive material and toxic chemicals to the environment. The results of these analyses are presented in terms of predicted health effects to workers and to the general population. Effects on the environment are also presented, based on the amount of land that could be impacted by postulated accidents." The analysis methods used for the radiological scenarios are described in detail in

Commenter: Norman H. Nosenchuck, Director, Division of Solid & Hazardous Materials, New York State Department of Environmental Conservation

Comment Responses:

Section B.1.3 of the appendix, including Section B.1.3.3, Health Effect Evaluations, and Section B.1.3.4, Evaluation of Impacted Areas for Hypothetical Accident Analyses.

Sections B.2 and B.3 provide the results of the incident-free activities and hypothetical radiological accident analyses, respectively. The results in the tables are presented in terms of consequences (both dose and human health effects) should the accident occur and risk (a product of consequences and the probability of the accident occurring). Since the probability of facility activities, or incident-free activities, is one, the consequences are equal to the risk. Event probabilities are presented for each of the hypothetical accident scenarios analyzed in the section preceding the results tables. A qualitative evaluation of other environmental impacts due to the area impacted by the hypothetical accidents is provided in Table B-2.

Comment 6.
The commenter is correct in stating that a risk is not presented for the nonradiological accidents as implied in the introductory paragraph preceding Section B.1 of the Draft Environmental Impact Statement. The analysis methods used for the toxic chemical scenarios are described in Section B.4 of the appendix, which states that the airborne release of toxic chemicals is evaluated with respect to the concentrations of toxic chemicals that the maximally exposed off-site individual and a worker located 100 meters from the accident scene would be exposed. The analysis results for the two hypothetical accidents evaluated are presented in Tables B-27 and B-28. The downwind concentrations, or consequences, are compared to Emergency Response Planning Guideline (or equivalent) values. For the maximally exposed off-site individual, the ERPG-1 (or equivalent) values are not exceeded for any of the chemicals evaluated, therefore, the risk of health effects to any member of the public is very small.

This methodology is similar to that used by the U.S. Environmental Protection Agency (Publication 9200.6-303(94-1), EPA540/R-94/020, PB94-92119, *Health Effects Assessment Summary Tables*, March 1994) for noncarcinogenic toxic chemicals. There has been no quantitative methodology developed which converts acute or chronic exposure to noncarcinogenic toxic chemicals into estimated health effects or consequences (such as an increased risk of developing cancer for an individual or increased number of cancers for a population) like those developed for exposure to radiation and carcinogenic toxic chemicals. Therefore, the probability of hypothetical chemical accidents cannot be used to calculate a risk value as was done for the radiological accident scenarios.

The text in the introductory paragraph preceding Section B.1 has been modified in the Final Environmental Impact Statement to reflect the differences between the radiological and toxic chemical analyses.

Commenter: Norman H. Nosenchuck, Director, Division of Solid & Hazardous Materials, New York State Department of Environmental Conservation

Comment Responses:

Comment 7.
As explained in the response to New York State Department of Environmental Conservation Comment 6, health effects conversion factors are not available for use in evaluating noncarcinogenic toxic chemical accident scenarios; therefore, a probability factor cannot be used to provide a risk estimate. For the maximally exposed off-site individual, the ERPG-1 (or equivalent) values are not exceeded for any of the chemicals evaluated; therefore, the risk of health effects to any member of the public is very small, even in the unlikely event that such accidents were to occur. Additional supplementary information has been included in the Final Environmental Impact Statement as Section B.5 in Appendix B to address the potential impacts of hypothetical accidents on close-in workers on a qualitative basis since that is the best methodology available.

Estimated impacts from other nonradiological, occupational hazards were covered in the Draft Environmental Impact Statement in Table 5-1 for the no action alternative, Table 5-2 for the prompt dismantlement alternative, and Table 5-3 for the deferred dismantlement alternative. As discussed in the corresponding text preceding these tables, the estimated number of fatalities and injuries/illnesses indicate that the overall nonradiological occupational risks would be small for all three alternatives.

Comment 8.
The analyses presented in Appendix B adequately evaluate the consequences of hypothetical facility accidents and provide conservative, upper bound risk estimates. Consequences of a radiological accident fall into two categories: impacts on the health and safety of workers and the public and impacts on the affected environment. The analysis methods used for the radiological scenarios are described in detail in Section B.1.3 of Appendix B, including Section B.1.3.3, Health Effect Evaluations, and Section B.1.3.4, Evaluation of Impacted Areas for Hypothetical Accident Analyses. The consequences of radiological accidents to people are exposure to radiation, as measured in rem. These results are reported in Appendix B for each scenario evaluated. Section A.4 of Appendix A describes in detail the health risks associated with radiation exposure, including latent fatal cancers, nonfatal cancers, and genetic effects in subsequent generations. As noted in the appendix, the dominant risk from exposure is latent fatal cancer. Estimates of these health effects were calculated for the hypothetical accident scenarios using the methodology recommended by the International Commission on Radiation Protection. The estimated impacts on the affected environment due to hypothetical facility accidents are presented in Table B-2.

Comment 9.
Appendix B provides sufficient information on computer codes, source terms, and modeling assumptions to allow for an independent overcheck of the results. Including raw data results from the computer code analyses in the Final Environmental Impact Statement would create unnecessary detail and length to the document with no added benefit. Including such detailed

Commenter: Norman H. Nosenchuck, Director, Division of Solid & Hazardous Materials, New York State Department of Environmental Conservation

Comment Responses:

results would also be inconsistent with Council on Environmental Quality requirements contained in 40 CFR Part 1502.2 which states that environmental impact statements shall be kept concise and that length should vary with potential environmental problems. Since the results of this study show that the environmental impacts associated with any of the disposal alternatives evaluated in detail would be small, additional detail in Appendix B is not warranted.

Comments 10 and 11.
The methodology used to determine the impacted area for the radiological accident scenarios was provided in Appendix B, Section B.1.3.4, of the Draft Environmental Impact Statement, including detailed assumptions and information on the computer codes utilized. This information was provided to allow for independent overcheck of the results. The impacted area of about 0.4 hectares (1 acre) was discussed in text immediately preceding Table B-2. Since the impacted area would be small, would not extend beyond the boundaries of the Kesselring Site, and was estimated using conservative assumptions, the qualitative assessment of the impacts on the affected environment discussed in Section B.1.3.4 and summarized in Table B-2 is adequate. Further detail would not assist in distinguishing among the alternatives since the environmental impacts associated with all of the disposal alternatives evaluated in detail would be small.

Comment 12.
The analyses do not assume that buildings would provide 100 percent shielding. The ground surface exposure calculated by the RSAC-5 computer code is the dose that a hypothetical individual would receive while continuously located outside in a radiation field during an assumed length of time. As shown in Appendix B, Table B-3, of the Draft Environmental Impact Statement, analyses for the maximally exposed off-site individual and general population assumed an exposure period of one year. The use of the building shielding factor to reduce the ground surface dose in these analyses takes into account a number of realistic situations. For example, it is reasonable to expect that every individual spends some amount of time indoors. While spending time indoors, the structure will provide some shielding from beta and gamma radiation. In addition, while indoors, the individual would be located a greater distance away from the area impacted by the hypothetical accident. It is also reasonable to expect that an individual would spend some time away from the impacted area for normal activities such as work, school, shopping, vacations, and the like. The RSAC-5 default value of 0.7 for the building shielding factor is meant to cumulatively account for all of these conditions. As discussed in Appendix B, Section B.1.3.6 of the Draft Environmental Impact Statement, use of the 0.7 default value for the building shielding factor means that the affected individuals were assumed to spend approximately 16 hours each day for an entire year standing outside of their homes receiving direct radiation dose from the hypothetical accident conditions. This is a very conservative assumption.

Commenter: Norman H. Nosenchuck, Director, Division of Solid & Hazardous Materials, New York State Department of Environmental Conservation

Comment Responses:

Appendix B provides sufficient information on computer codes, source terms, and modeling assumptions to allow for an independent overcheck of the results. As discussed in Section 5.9 of the Draft Environmental Impact Statement, the estimates of risk provided in this study are believed to be highly conservative (that is at least 10 to 100 times larger than what would actually occur) and are unlikely to be exceeded in the event of an accident. Even with the use of conservative analytical methods, the risks of all the alternatives would be very small. Since the resulting risks would be so small, the significance of any uncertainty in the analysis parameters is greatly reduced. The use of conservative analyses does not create a bias in this study since all of the alternatives have been evaluated using the same methods and data.

Comment 13.
As discussed in Appendix A, Section A.3.3, of the Draft Environmental Impact Statement, "the goal of the Naval Reactors Program's radiological exposure control program is to control radiation exposure to the lowest practical level while still accomplishing the required work." As stated in Footnote a. to Tables B-5 through B-7, the higher occupational dose estimate for prompt dismantlement is based on preliminary plans. The lower value reflects experience that detailed work planning typically results in lower doses. This experience is based on many years of planning and executing other refueling and maintenance operations. Therefore, using the lower end of the range for estimates of health risks to more workers is consistent with past experience.

Comment 14.
The commenter is correct in noting that nonradiological impacts were not evaluated for the high efficiency particulate air (HEPA) filter fire analysis. The chemical source term from this scenario would be limited to the weight of the combustion products from the HEPA filter media, which is constructed from fire resistant materials for this type of application. In the unlikely event that the filter media were entirely consumed in a fire, the total weight of the combustion products is estimated to be less than 100 pounds. Appendix B, Section B.4, of the Draft Environmental Impact Statement included two hypothetical accident analyses (a diesel fuel fire and a large chemical spill) which involved larger nonradiological toxic chemical source terms. The source term for the hypothetical diesel fuel fire involved over 500 pounds of toxic chemicals, including carbon monoxide, oxides of nitrogen, and sulfur dioxide. The source term for the hypothetical chemical spill involved approximately 200 gallons of chemicals and solvents as discussed in Section B.4.2.3. The environmental impacts from the two hypothetical nonradiological accidents evaluated in detail are small. The impacts from the nonradioactive source term under a HEPA filter fire scenario are also considered to be small and within the bounds of the other analyses.

Commenter: Norman H. Nosenchuck, Director, Division of Solid & Hazardous Materials, New York State Department of Environmental Conservation

Comment Responses:

Comment 15.
The Draft Environmental Impact Statement included an evaluation of nonradiological transportation risks to determine if there were any significant differences among the three alternatives. As discussed in Appendix C, Section C.2.2, of the Draft Environmental Impact Statement, the assumed fatality rates for vehicle exhaust emission pollutants and transportation accidents were obtained from referenced studies reported by the Argonne and Sandia National Laboratories (References C-12, C-13, and C-14). These three references utilize a combination of accident event data and computer codes to arrive at estimated fatality rates (in fatalities per kilometer) for both truck and rail modes of travel. The fatality rates for vehicle exhaust emission pollutants are estimated values based on analytical models which require many assumptions, many of which are conservative. For example, the Reference C-12 preface states, "In preparing this report, we realize the uncertainties that exist in the analysis as well as the conservatism (upper limits) that the health-effects reflect." In addition, page 11 of this reference states, "In fact, the assumptions and models used for calculating the health effects are such that the results must be considered as upper limits to the nonradiological impacts of pollutants emitted during transportation." Where the three references provided different results, the most conservative value was selected for use in Appendix C transportation analyses. Selection of the most conservative value does not create a bias in this study since all of the alternatives have been evaluated using the same methods and data.

Comment 16.
The regulatory requirements identified by the commenter are acknowledged, but additional information is not needed in Table C-6. There is sufficient detail in Appendix C of the Draft Environmental Impact Statement to independently check the results of the risk analyses provided. Radioactivity levels on packages are provided by the transportation indexes listed in Table C-7. As indicated in Footnote b. to that table, all packages would be designed and prepared to meet U.S. Department of Transportation requirements contained in 49 CFR Part 173 (Shipping - General Requirements for Shipments and Packagings). Corrosion product radioactivity source terms for the transportation accidents analyses are provided in Appendix C, Tables C-9 and C-10. The waste class and overall waste volumes from dismantlement activities are summarized in Section 5.2.13.2.2 of the Draft Environmental Impact Statement. The waste class of all radioactive materials from dismantlement would be low-level radioactive waste or recyclable metal.

As discussed in Appendix C, Section C.5.2, of the Draft Environmental Impact Statement, all reactor components would be shipped as packages meeting U.S. Department of Transportation regulations 49 CFR Part 173. Based on existing requirements, the two reactor pressure vessels would require a Type B package due to their high curie content. The remaining large components and miscellaneous materials would be shipped as packages meeting the U.S. Department of Transportation criteria for either low specific activity materials or surface contaminated objects for materials with lower curie content than Type B packages. Shipments

Commenter: Norman H. Nosenchuck, Director, Division of Solid & Hazardous Materials, New York State Department of Environmental Conservation

Comment Responses:

of radioactive packages would be accomplished within the regulatory requirements applicable at the time of the dismantlement activities.

Comment 17.
As discussed in Appendix C, Section C.5.2, of the Draft Environmental Impact Statement, the reactor pressure vessels would be shipped in individual packages meeting Type B criteria, which are defined in U.S. Nuclear Regulatory Commission (NRC) regulations 10 CFR Part 71 (Packaging and Transportation of Radioactive Materials). The Type B packages that would be used to transport the reactor pressure vessels are large, robust pieces of equipment designed to protect and retain their contents in both normal and severe accident conditions. As discussed in Section C.5.9, the radiation level following an accident was assumed to be at the NRC limit in 10 CFR Part 71 of 1 rem per hour at 1 meter (about 3.3 feet) from the package surface. This assumption covers direct radiation exposure to the general public from streaming in the case where a Type B container is breached. Catastrophic failure of a Type B container, resulting in a total loss of shielding and full exposure of the radioactive contents, has a probability of less than 1×10^{-7}, which is below the probability cutoff criterion discussed in Appendix C, Section C.5.7.1. Therefore, given the designed strength of Type B containers, it is reasonable to assume that a breached Type B container would continue to provide ample shielding for the radioactive contents. As noted by the commenter, Type B packages have never been breached under accident conditions. In fact, data from actual accidents as well as analytical projections show that actual accident conditions are far less severe than the Type B hypothetical accident conditions of the regulations. Based on proven evidence that the design criteria for Type B packaging are highly conservative, additional analysis of a breached Type B container is not warranted.

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STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

September 12, 1997

Mr. Andrew S. Baitinger, Chief
West Milton Field Office, Office of Naval Reactors
U.S. Department of Energy
PO Box 1069
Schenectady, NY 12301-1069

Dear Mr. Baitinger:

Thank you for the opportunity to comment on the *Draft Environmental Impact Statement for the Disposal of the S3G and D1G Prototype Reactor Plants*. The Washington State Department of Ecology has two significant concerns regarding the identification of the Hanford Site as a potential recipient of additional low-level radioactive waste. First, we are concerned about the cumulative impacts this and other waste and nuclear material transfers will have at Hanford and throughout the USDOE complex. Second, decisions to ship waste to Hanford must be made with a full understanding and analysis of the environmental impacts at Hanford. 1

As Governor Locke stated in his July 17, 1997 letter to Secretary Peña (attached). "Individually or collectively, the options being considered for Hanford pose enormous implications for the Northwest." To that end, Washington strongly advocates a national dialogue on issues associated with the disposition of nuclear materials and waste. Such a dialogue must include the pending decisions under the *Waste Management Programmatic Environmental Impact Statement* (WM-PEIS) and the *Plutonium Disposition Environmental Impact Statement.* Without such a national dialogue, Washington will find it extremely difficult to consider the disposal of any new wastes at Hanford, including the decommissioned S3G and D1G prototype reactor plants.

This EIS fails to examine impacts of disposal at the Hanford Site. Any additional wastes sent to Hanford may impact many areas, including: disposal site capacity, state-designated priority habitat, ground and surface water, long-term human health risk, cultural and archeological resources, and site-wide cumulative impacts. In addition, the EIS does not examine the compliance with Washington State waste disposal laws and Hanford Site policy and planning. Nor do other NEPA documents provide the analysis. *The Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants Environmental Impact Statement* does not include impacts from the S3G and D1G Prototype Reactor wastes. The WM-PEIS broadly considers these types of wastes, but it is unclear whether it includes these decommissioned reactors in its inventory. Moreover, the WM-PEIS defers site-specific impact analysis to follow-up NEPA documents.

Before any decision is made to ship waste from the decommissioning of the S3G and D1G Prototype Reactors to Hanford, USDOE should complete the phased NEPA process established in the WM-PEIS and conduct a national dialogue. In any event, all waste disposal decisions at Hanford, including this one, must be accompanied by full analysis of the environmental impacts pursuant to the National Environmental Policy Act.

If you have any questions on these comments, please contact Geoff Tallent with our Nuclear Waste Program at (360) 407-7112.

Sincerely,

Barbara J. Ritchie

Barbara J. Ritchie
Environmental Review Section

BJR:ri

EIS 975524

cc: Geoff Tallent, Nuc Waste
Max Powers, Nuc Waste

GARY LOCKE
Governor

STATE OF WASHINGTON

OFFICE OF THE GOVERNOR

P.O. Box 40002 • Olympia, Washington 98504-0002 • (360) 753-6780 • TTY/TDD (360) 753-6466

July 17, 1997

The Honorable Federico Peña, Secretary
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

COPY

Dear Secretary Peña:

I appreciate the opportunity to comment on the scope of the U.S. Department of Energy's Plutonium Disposition Environmental Impact Statement (EIS). I commend your efforts to develop a strategy to dispose of our nation's surplus weapons plutonium. I share your belief that there is an urgent need to come to grips with our pressing nuclear material and waste problems.

Individually, or collectively, the options being considered for Hanford pose enormous implications for the Northwest. I understand that your department is proposing a role for Hanford in six of the 12 alternatives to be evaluated in the Plutonium Disposition EIS. I am also aware that Hanford is being considered for several major roles in dealing with radioactive waste from Department of Energy facilities across the nation.

I find it extremely difficult to even consider any new role for Hanford in dealing with nuclear materials or waste. Hanford's existing waste and contamination threaten the health and well-being of the people of the Northwest. The fact that the Department of Energy is struggling to meet existing commitments to clean up the site makes us very concerned that commitments associated with any future role also may go unfulfilled. The Department of Energy must fulfill its moral and legal obligation to clean the Hanford site. This includes retrieving and vitrifying tank wastes in accordance with the schedule agreed on in the Tri-Party Agreement.

I also believe that the burden of dealing with the department's legacy of nuclear material and waste must be shared equitably among states hosting Department of Energy facilities. Any discussion of equity must take into consideration the tremendous burden Washington already shoulders at Hanford.

To this end, the public should be engaged in comprehensive regional and national discussions which examine the full range of issues associated with the disposition of nuclear materials and waste. A clear understanding of public concerns and desires is essential to sound decision-making. I urge you to follow through on plans to conduct the "National Dialogue" on these issues.

Thank you again for the opportunity to comment on this important national issue. I remain interested in working with you and the governors of other affected states to forge workable solutions to the department's nuclear material and waste disposition.

Sincerely,

Gary Locke
Governor

Commenter: Barbara J. Ritchie, Environmental Review Section, State of Washington Department of Ecology

Comment Responses:

Comment 1.
As discussed in Appendix C, Section C.1, the analyses evaluated two U.S. Department of Energy destinations for disposal of low-level radioactive materials: the Savannah River Site in South Carolina and the Hanford Site in Washington State. The Savannah River Site represents a reasonable and close location for transportation analyses, and the Hanford Site represents a reasonable but significantly more distant location. Under the preferred alternative (prompt dismantlement), low level radioactive waste that cannot be recycled would be disposed of at the U.S. Department of Energy Savannah River Site.

As discussed in the Summary, Section S.4, the Savannah River Site currently receives low-level radioactive waste from Naval Reactors Program sites in the eastern United States. While the Hanford Site is identified as being available for disposal of low-level radioactive wastes, there are no current plans to ship low-level radioactive wastes from S3G and D1G Prototype reactor plant dismantlements to the Hanford Site. If disposal of waste at Hanford becomes necessary, it will be done within the constraints which exist for acceptance of waste by Hanford for disposal.

THE STENOGRAPHIC RECORD

UNITED STATES DEPARTMENT OF ENERGY

In the Matter

-of-

a Public Hearing to Receive Comments on the Draft Environmental Impact Statement Concerning Disposal of the S3G and D1G Prototype Reactor Plants at the Knolls Atomic Power Laboratory Kenneth A. Kesselring Site at West Milton, Saratoga County, New York.

PROCEEDINGS:
August 13, 1997
1:00 and 7:00 p.m.

PAULINE E. WILLIMAN
CERTIFIED SHORTHAND REPORTER
447 LOUDONVILLE ROAD
ALBANY, NEW YORK 12211

UNITED STATES DEPARTMENT OF ENERGY

In the Matter

-of-

a Public Hearing to Receive Comments on the Draft Environmental Impact Statement Concerning Disposal of the S3G and D1G Prototype Reactor Plants at the Knolls Atomic Power Laboratory Kenneth A. Kesselring Site at West Milton, Saratoga County, New York.

Town of Milton Community Center
Northline Road
Ballston Spa, New York

August 13, 1997
1:00 and 7:00 p.m.

PRESIDING:

ANDREW R. SEEPO, Director of Radiological/ Environmental Controls, SNR

PRESENT:

ANDREW BAITINGER, West Milton Field Office

JAMES LERCH, West Milton Field Office

P R O C E E D I N G S

MR. SEEPO: Good afternoon, ladies and gentlemen. Thank you for attending. My name is Drew Seepo, and I am the Director of Radiological/Environmental Controls at the Department of Energy Naval Reactors Office in Schenectady. I will be the moderator for this afternoon's public meeting. With me are Mr. Andrew Baitinger and Mr. James Lerch from the West Milton Field Office.

On July 22nd, the Department of Energy announced in the Federal Register the availability of the Draft Environmental Impact Statement, or Draft EIS for short, concerning the disposal of the S3G and D1G Prototype reactor plants. After completion of general distribution of the documents to public officials and interested citizens, Naval Reactors filed copies with the Environmental Protection Agency. On July 25th, the Environmental Protection Agency published another notice of availability in the Federal Register to officially start the public comment period.

This meeting is being held as

PAULINE E. WILLIMAN
CERTIFIED SHORTHAND REPORTER

part of the decision-making process required by the National Environmental Policy Act, or NEPA for short. NEPA is our basic national charter for protection of the environment. NEPA procedures ensure that environmental information is made available to public officials and citizens before actions are taken. The Draft EIS was developed with consideration of public input received during the scoping phase of the NEPA process.

The purpose of today's meeting is to receive comments on the Draft EIS. We are here to listen to what you have to say. It is our responsibility to receive statements so that your comments can be considered in the development of the final EIS. For that reason, this meeting is being recorded.

The order of today's meeting will begin with a brief overview by Mr. Baitinger of the S3G and D1G Prototype plants and the dismantlement alternatives addressed in the EIS. This presentation will last approximately 20 minutes. We will then take a short break and reconvene the meeting to receive public comments. After all oral comments have been

given, I will conclude the session.

The public comment period is the time that we listen to you. As stated in the July 22nd Notice of Availability, speakers will be allotted five minutes each to allow sufficient time for all individuals desiring to speak. Please be considerate of your fellow participants by adhering to this limit. The order in which speakers will be heard is as follows: Federal government, state government, county government, local government, organizations, private citizens. As time permits, depending on the number of persons wishing to speak, individuals who have spoken subject to the five-minute rule will be afforded additional speaking time. Additional time will be allotted first to elected officials or speakers representing multiple parties or organizations.

Persons wishing to speak on behalf of organizations are requested to identify the organization they represent. Anyone wishing to speak who did not register on the way in should, during the break following Mr. Baitinger's presentation, register at the registration table that is right under the entrance sign to my right.

This is not an evidentiary hearing. Speakers will not be cross-examined. However, to ensure that comments are fully understood, we may ask clarifying questions.

Whether or not you speak this afternoon, you may also provide written comments. Oral and written comments will be considered equally in the development of the Final EIS. If you have written comments with you this afternoon, you may leave them with support staff at the registration table. If you choose to provide written comments at a later time, they should be sent to Mr. Baitinger, and Mr. Baitinger's mailing address for comment is indicated on the view graph. The address is also shown on the first page of the Draft EIS and is available at the registration table.

Your written comments should be postmarked by September 8th to be considered during development of the Final EIS. Comments postmarked after that date will be considered to the extent practicable. A written transcript of today's public meeting will be provided in the Final EIS. Distribution of the Final EIS will

include placing copies in the Schenectady and Saratoga libraries. Following completion of the Final EIS, Naval Reactors will issue a Record of Decision after a 30-day waiting period.

I would like now to introduce Mr. Andrew Baitinger, from the West Milton Field Office. He will provide a general overview of the S3G and D1G Prototype reactor plants and discuss alternatives to reactor plant disposal.

MR. BAITINGER: Thank you, Mr. Seepo.

The S3G and D1G Prototype reactor plants are located on the U.S. Government-owned Kenneth A. Kesselring Site in West Milton, part of the Town of Milton in Saratoga County. (Slide No. 1) The Kesselring site is an approximately 65-acre developed area situated within an approximately 3900-acre Federal reservation owned by the U. S. Department of Energy. (Slide No. 2) This is a recent photograph of the Kesselring Site. The S3G Prototype is this structure here, and started operation in 1958. The D1G Prototype is located here within a 225-foot diameter containment structure called the Hortonsphere. The D1G

Prototype first began operation in 1962. For over 30 years, the S3G and D1G Prototype plants served as reactor plant component and equipment test facilities as well as training platforms for Naval personnel. As a result of the end of the Cold War and the downsizing of the Navy, the S3G Prototype reactor plant was shut down permanently in 1991 and has been defueled, drained and placed in a safe and stable condition requiring minimal attention for the foreseeable future. We refer to this condition as "protective storage". The S3G spent nuclear fuel was shipped to a government facility in Idaho in 1994. The D1G Prototype reactor plant has been placed in a similar defueled, safe and stable condition. The D1G spent nuclear fuel was shipped to the same government facility in Idaho in February 1997. Because there is no further need for the S3G and D1G Prototype reactor plants, a decision is needed on their disposal. For that purpose, a Draft Environmental Impact Statement was prepared.

(Slide No. 3) This is a simplified schematic of a nuclear-powered submarine or cruiser reactor plant. Typical of

Naval nuclear reactor plants, the S3G and D1G reactor plants are rugged, compact, pressurized water reactor plants. Major components within the reactor compartments include the pressure vessel, steam generators, main coolant pumps and the pressurizer. All Kesselring Site prototype reactor plants have a containment structure which is comparable to a commercial nuclear power plant's containment.

(Slide No. 4) This is a drawing of the S3G Prototype; the reactor compartment is located here. Below it is a drawing of the D1G Prototype; the reactor compartment is located here. The reactor plants located within each of the reactor compartments provided steam for turbines located in the engine rooms, shown here and here. The reactor compartments are separated from the rest of the prototype by shielded walls or bulkheads. Those are shown in the cross-hatch around the reactor compartments.

A factor requiring consideration in disposing of the S3G and D1G Prototype reactor plants is hazardous materials. Those include lead, heavy metals, and PCBs used in the prototype plants. Because of its high density, lead is an excellent radiation shielding material. The reactor compartment bulkheads contain lead to shield crew members from radiation during reactor operation. The S3G and D1G reactor compartments each contain over 100 tons of lead. The reactor compartments contain other hazardous materials used in the 1950s during construction of the plants, but in much lesser quantities. These include such items as chromium in brazing alloys and polychlorinated biphenyls (or PCBs) in common industrial materials such as paint, rubber and adhesives.

Another factor requiring consideration in disposing of the S3G and D1G Prototype reactor plants is radioactivity remaining from reactor operations. Defueling of the reactor plants removed about 95 percent of the radioactivity, but some radioactivity remains. Of the remaining 5 percent, over 99 percent is an integral part of the reactor plant's internal structural metals and components. This is a result of the metals becoming activated during reactor plant operation. The other one percent of the

remaining radioactivity is radioactive corrosion and wear products which have been deposited on the inside surfaces of reactor plant piping systems and components.

First I will discuss the alternatives that Naval Reactors is considering for disposal of the S3G and D1G Prototype reactor plants. Later I will cover the potential environmental consequences.

(Slide No. 5) Alternatives considered in the Draft Environmental Impact Statement include the no action alternative, prompt dismantlement, deferred dismantlement, one-piece off-site disposal, entombment and on-site disposal. Naval Reactors has identified prompt dismantlement as the preferred alternative. Three of these alternatives, one-piece off-site disposal, entombment and on-site disposal, were eliminated from further consideration. (Slide No. 6)

The one-piece off-site disposal alternative is based on the submarine reactor compartment disposal program for dismantling decommissioned U.S. Navy submarines. Defueled reactor compartments are packaged in their entirety at the Puget Sound Naval Shipyard. The packaged reactor compartments are then sent by barge and special ground transport for disposal at the Department of Energy's low level radioactive waste disposal area at the Hanford Site in Washington State. As a single package, the S3G Prototype reactor compartment would measure approximately 40 feet in length, 29 feet in diameter and would weigh approximately 1000 tons. As a single package, the D1G Prototype reactor plant would measure 37 feet in height, 31 feet in diameter and would weigh approximately 1400 tons. This alternative was ruled out because, unlike Puget Sound Naval Shipyard, the Kesselring Site is not adjacent to navigable water. Transport of these two reactor compartments to the nearest barge facility on either the Mohawk or Hudson Rivers is considered impractical by either highway or rail due to interferences and load limiting bridges along available routes.

The entombment and on-site disposal alternatives were both ruled out from further consideration because neither alternative offers any notable health risk

advantage or other environmental benefit. From a health risk perspective, the impacts of these alternatives would be expected to fall within the range between the no action estimates and the prompt dismantlement estimates.

From an environmental perspective, the entombment and on-site disposal alternatives would only serve to increase the number of long-term storage or disposal sites for radioactive and hazardous materials in the United States. These alternatives would essentially prevent future unrestricted re-lease of the Kesselring Site for other uses.

(Slide No. 7) The remaining alternatives, no action, prompt dismantlement and deferred dismantlement, were evaluated in detail.

The National Environmental Policy Act specifically requires consideration of a "no action" alternative. The no action alternative would involve keeping the S3G and D1G Prototype reactor plants in protective storage in-definitely. This alternative involves no prototype reactor plant dismantlement activities, so there would be no waste shipments from reactor plant dismantlement. Throughout the protective storage caretaking period, the defueled S3G and D1G Prototype reactor plants would be periodically monitored. The monitoring would verify the overall physical integrity of the plant and would verify that all radioactive material remains contained. Since there is some residual radioactivity with long half-lives, such as nickel-59 in the defueled reactor plants, the no action alternative would leave the long-lived radioactivity and lead shielding at the Kesselring Site indefinitely. This alternative does not provide for permanent disposal of the S3G and D1G Prototype reactor plants. Disposal would be required at some time in the future.

Under the prompt dismantlement alternative, dismantlement of the S3G and D1G Prototype reactor plants would begin shortly after the Record of Decision. The project would be completed as soon as practicable, subject to appropriated funding. Prompt dismantlement involves cutting out piping, valves, pumps and instrumentation and placing the items in containers for shipping. Large components, such

as steam generators, pressurizers, and pressure vessels would be packaged individually. To the extent practical, the resulting low level radioactive metals would be recycled at existing commercial facilities that recycle radioactive metals. The remaining low level radioactive waste would be disposed of at the Department of Energy's Savannah River Site in South Carolina. The Savannah River Site currently receives low level radioactive waste from Naval Reactors Sites in the eastern United States. Both the volume and the content of the S3G and D1G Prototype reactor plant waste fall within projections of the Naval Reactors waste provided to the Savannah River Site which, in turn, are included in the July 1995 Savannah River Site Waste Management Final Environmental Impact Statement.

Under the deferred dismantlement alternative, the S3G and D1G Prototype reactor plants would be kept in protective storage for about 30 years. This would allow most of the cobalt-60 radioactivity to decay away. Nearly all of the gamma radiation within the reactor plants comes from cobalt-60. Cobalt-60 has a radioactive half-life of about five years.

After 30 years, about two percent of the original cobalt-60 radioactivity will remain. There will still be other residual radioactive isotopes with longer half-lives present. As a result, the volume of radioactive material to be disposed of will be about the same as the prompt dismantlement option. The reactor plant would then be dismantled and disposed of in the same manner as under the prompt dismantlement alternative. Similar to the no action alternative, during the 30-year caretaking period, the defueled S3G and D1G Prototype reactor plants would be periodically monitored to verify the overall physical integrity of the plant and to verify that all radioactivity remains contained.

The purpose of this Environmental Impact Statement is to document the evaluation of the impacts of the various options on the workers, public and the environment. Comparison of the impacts can then be made as part of the final decision-making process. (Slide No. 8) This slide summarizes the various impacts that were analyzed in detail in the Draft Environmental Impact Statement.

I would like to next review the results of risk analyses performed for the three options evaluated in detail. The analyses evaluated the risks to two affected groups: workers involved in disassembling the S3G and D1G Prototype reactor plants and the general public including those that live near the Kesselring Site and those residing along the routes that would be used to transport material from the dismantled reactor plants to their ultimate disposal site. Risks were calculated for a variety of conditions including routine incident-free operations, radiological and non-radiological facility accidents, incident-free transportation, and radiological and non-radiological transportation accidents.

Before I present the analytical results, a brief discussion of risk is warranted. Risk is defined as the product of the consequences of an event multiplied by the probability of that event. (Slide No. 9) This next slide provides comparisons of risks for a variety of activities and occupations. Details of the calculations of these risks can be found on pages A-18 and A-19 of the Draft

Environmental Impact Statement. Several points and cautions should be noted.

Risk is expressed as a unitless number. Because many of the values that are dealt with are very small, scientific notation is often used. The first two columns show the same value expressed in both decimal and scientific notation form. These are the same numbers just expressed in different forms.

Risk values are most useful for comparison of different activities. The comparison of risks for different activities must be made on the same basis. Therefore, when reviewing risk values, the basis of the calculation must be known. For example, the risks on this table are calculated and expressed over the lifetime of an individual. To determine the average annual risk for any of these factors, the lifetime values would be divided by the individual's average lifetime, 72 years.

The risk expressed in the last column here as one chance in X is calculated by dividing the risk into the number one.

The calculation of risk due to

radiation exposure is made by multiplying the exposure in person-rem by the risk factor of 0.0005 latent fatal cancers per person-rem for the general public. A risk factor of 0.0004 latent fatal cancers per person-rem is used for workers. The higher risk factor for the general population accounts for people in sensitive age groups; that is, younger than 18 and older than 65.

The accuracy of risk calculations depends on the certainty of the data used in the calculations. For example, the risk of dying in an automobile accident in one's lifetime is fairly well known based on many years of traffic accident and death data. The calculations of risk for radiation exposure due to accidents in this Draft Environmental Impact Statement are based on computer models of events that have not occurred. Based on the conservative factors used to create the models, the consequences and risks calculated are expected to be larger by at least a factor of 10 to 100 than what would actually occur.

As can be seen from the table, the risk of developing a latent fatal cancer due to Kesselring Site operations over the last 40 years is extremely small when compared to the risks of other activities and occupations. For example, an individual is almost 2,000 times more likely in their lifetime to die in an automobile accident than from living continuously at the Federal reservation boundary of the Kesselring Site during the last 40 years.

(Slide No. 10) This slide presents the risks associated with facility activities for each of the three alternatives. Also shown on the table is the collective radiation exposure to the workers and the public for each alternative. Of note on this table, the collective dose for workers for the prompt dismantlement option is higher than the other two options. That's these numbers across the top line. Based on the number of workers necessary to perform the dismantlement work and the time period over which the dismantlement would take place, the average annual dose per worker would be comparable to the annual dose routinely received during operation and maintenance of Naval prototype plants and would

be well within Federal guidelines.

(Slide No. 11) This slide compares the risks calculated for workers and the public for the three options to the risks of other activities and occupations that I showed you before. As I stated earlier, risks need to be compared on a common basis. Therefore, the average annual risks for the various options presented in the previous slide were multiplied by the time period over which the option would take place to determine the lifetime risk. As you can see, the risk for workers is somewhat less than other occupational risks while the risk to the public is extremely low in comparison to other risks. These are the worker risks, and the public risks are at the bottom.

(Slide No. 12) The next slide presents the risks associated with transportation activities for each of the three alternatives. In this case risks are calculated for only the prompt and deferred dismantlement options since the no action alternative does not result in the transportation of any materials from reactor plant dismantlement from the site.

site. Again the risk to workers is comparable to risks of other occupations and activities while the risk to the public is far below those.

Naval Reactors considers the impacts of each of the options in the other areas evaluated to be small to non-existent. With regard to waste management, the prompt dismantlement option would result in the generation and temporary on-site storage of a small amount, up to 7,000 gallons, of mixed waste pending completion of treatment and disposal facilities at other locations. Mixed waste is predominantly solid material (such as paint chips, metal fittings and cabling) that contains both low levels of radioactive contamination and hazardous constituents such as lead, chrome or PCBs. If prompt dismantlement is selected, approval for the expansion of the mixed waste storage area would be obtained from the New York State Department of Environmental Conservation. Naval Reactors also evaluated mitigative effects for each of the options and determined that there are no mitigative measures required for any of the options based upon the

small impacts of each.

(Slide No. 13) This is a comparison of the costs of the various alternatives. These costs are in 1997 dollars to offset the effects of inflation. The deferred dismantlement process is roughly the sum of the other two alternatives since the deferred dismantlement alternative is a combination of those alternatives. The no action alternative is ultimately expected to have the highest cost since dismantlement would need to take place some time in the future. The dollar amount on the slide only represents care-taking and does not take into account dismantlement or disposal. Therefore, of the three alternatives, prompt dismantlement would ultimately result in the lowest overall cost.

Naval Reactors has concluded that all of the alternatives would have minimal impact on the general public and the environment. The principal impact associated with prompt dismantlement is that Kesselring Site workers would receive some exposure to radiation. Although the collective dose to workers would be higher for the prompt dismantlement alternative, average doses per worker would be comparable in magnitude to those routinely received during operation and maintenance of Naval prototype reactor plants and would be well within Federal guidelines. Even on a cumulative basis for the entire work force, analyses showed that no immediate fatalities or latent cancer fatalities would be expected. While deferred dismantlement has the advantage of less radiation exposure, radiation exposure is low for all alternatives.

Prompt dismantlement was selected as the preferred method of disposal of the S3G and D1G Prototype reactor plants for the following reasons. An experienced work force is currently available at the Kesselring Site. Prompt dismantlement has a greater degree of certainty in completing the dismantlement and disposal within predicted costs and with small environmental impacts. And, although there is no plan to release the Kesselring Site for other uses in the foreseeable future, eventual release of the Kesselring Site would be more readily achievable since two of the four prototype plants reactor would be dismantled and disposed

of.

This concludes my presentation. Thank you for your courtesy and attention. We'll take a short break and then reconvene the meeting to take your comments. After all comments have been given, we will conclude the meeting.

Thank you.

MR. SEEPO: As Mr. Baitinger indicated, we're going to take a short break. I'd like to reconvene at 1:40. Thank you.

(At 1:28 p.m., a recess was taken until 1:40 p.m.)

MR. SEEPO: We're going to reconvene the meeting at this point in time. We have three individuals who have registered to speak this afternoon. First will be Mr. Wilbur Trieble, Town of Milton Supervisor. Come on up, Wilbur.

Following Mr. Trieble, we have two additional speakers: Ms. Linda Williams and Mr. James Lambert.

MR. TRIEBLE: Thank you.

First off, I just want to read a little letter here from my friend, the mayor of

Saratoga Springs. I think you already have a copy of it, but for the people here, this is dated to Mr. Baitinger, and it says:

"I have reviewed the Draft EIS on the reactor plants at West Milton. Although I can understand the need for development of alternatives, from my perspective the prompt dismantlement option is the preferred one and, in fact, this eliminates any on-site storage for 30 years or indefinitely, which the others require.

"I hope that the Navy -- I hope that the Navy Reactor program will hold firm on this selection which is prompt dismantlement as a preferred alternative," and it's signed by J. Michael O'Connell, Mayor of Saratoga Springs; and the Town of Milton would like to second that same thing, the prompt -- the way our constituents have been calling, and they've sent a message, a lot of them, that they would like to see it taken out of here as promptly as possible.

The one thing, I think, that we fear is that it becomes harder and harder to site facilities for radioactive wastes and such 1

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if it's not done now maybe in 30 years from now there'll be no site available for it, so we are in favor of prompt dismantlement. 1

Thank you for the opportunity to speak.

MR. BAITINGER: Thank you.

MR. SEEPO: Thank you.

Ms. Williams.

MS. WILLIAMS: Good afternoon. My name is Linda Williams. I'm a resident of Ballston Spa, and through my association over the past ten years with numerous former and current Kesselring personnel who designed, operated, repaired and inspected the Site's reactor plants, have gained a great deal of knowledge about their operation. Through my attempts to obtain Freedom of Information documents regarding Kesselring's operation, I've also gained a knowledge of how information is denied, accidents covered up, and what I call the Navy's "doublespeak". 2 An example of "doublespeak" is the Navy's assertion that DEC monitors the outflow of water in the Gloweegee Creek. However, no one verifies where or if the DEC itself is allowed access to place testing 3

equipment and what equipment is used. To the
best of my knowledge, Kesselring is on the honor
system to withdraw water samples itself and to
present the results to the DEC, and if this is 3
untrue I would like some evidence to the
contrary. I would welcome it. Testing can be
easily manipulated by where equipment is placed
and when the samples are drawn.

With this knowledge, I was
focused on listening between the lines to Mr.
Guida's responses to the Milton Town Board
members at a recent public meeting. When trying
to defend allegations that many drums of
radioactive waste are buried on the Kesselring
premises, Mr. Guida said the managers had been
asked if they polled their employees to see if
anyone had knowledge of buried drums, and the
managers assured officials that they had indeed
polled their employees, and there was no such 4
knowledge. Please compare that with the
statement in the fraudulent GAO report of '91
where investigators state they contacted all
persons whose names had been given them who
wanted to give information. Not only did the
GAO investigators not contact persons on the

list, but one former KAPL employee died of
asbestosis waiting to be contacted by the GAO. 4
The GAO had knowledge that his death was
imminent and failed to act.

For the record, I am in favor of
immediate dismantlement. However, I am very
concerned about the ability to -- the ability to
obtain Congressional appropriation of funds in
light of the recently reported failure of
Lockheed Martin to clean one acre of Idaho 5
contamination and other revelations in the
January '97 GAO report entitled Nuclear Waste:
DOE's Estimates of Potential Savings from
Privatizing Clean-up Projects. I'm also very
concerned about future use of the Hortonsphere,
the current home of the D1G reactor. This has 6
not been addressed in the current EIS and could
covertly be used for nuclear waste storage.
In a hearing July 22, 1994, I warned against
future importing of radioactive waste to the
Site. Part of the waste to be stored in
the proposed expansion of Building 91 will 7
be imported from the KAPL facility in
Niskayuna. Where will the waste come from
next?

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The towns and cities of Saratoga County, and New York State legislators have little idea of the depths to which top nuclear Naval officials will sink to accomplish their goal.

I'd like to read an excerpt from the July 28, 1993 U. S. Senate Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence hearing transcript. Following considerable litigation, Federal District Court Judge, Harold Ryan, had granted the state of Idaho an injunction against additional shipments of high level radioactive spent fuel rods until the DOE and Navy prepared an Environmental Impact Statement under the provisions of NEPA. The Naval Nuclear Propulsion Program then requested the above-named committee and Congress exempt it from NEPA, one of this nation's most basic environmental laws.

The following is from Idaho's Governor Andrus' testimony on pages 28 and 29, and I've left a segment of this handout out at the desk with the EIS. The quote is:

"Early on in the litigation, the Federal Government submitted the declaration of

Admiral DeMars to support its position that substantial disruption would follow if the relief requested by Idaho was granted. He stated that the only place to store spent nuclear fuel removed from nuclear-powered warships and submarines is the INEL... and... work would come to a halt if shipments of spent nuclear fuel were enjoined, leading to thousands of lost jobs and an inability to return vessels to the fleet.

"As Idaho would discover, the Admiral's testimony was prepared by Richard Guida, Associate Director of Regulatory Affairs for the U. S. Navy Nuclear Propulsion Program. Mr. Guida was deposed and, in the course of that deposition, conceded that the NNPP has the flexibility to store the spent nuclear fuel elsewhere until the required EIS is completed.

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"Mr. Guida testified that over one-third of the Navy's shipments to Idaho would be comprised of spent nuclear fuel removed from the U.S.S. Enterprise. He then conceded that the fuel had already been removed from the Enterprise and was being stored in a facility at Newport News, Virginia. He further conceded

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that the fuel can remain stored in that facility for the next two to three years."

Further testimony under oath showed that none of the 18 nuclear-powered vessels scheduled to be overhauled, defueled, refueled or inactivated during the period of 8 time projected to complete the EIS would be affected by the injunction.

Richard Guida did not admit the truth until questioned under oath. Neither the Draft EIS or the presentation today is under oath. Anyone here who still wants to trust everything the Navy has to say today, I have some oceanfront property in Arizona I'd like to sell you.

Thank you.

MR. SEEPO: Thank you, Ms. Williams.

The third speaker this afternoon will be Mr. James Lambert.

MR. LAMBERT: I'd like to start off with a letter from John Shannon to Saratoga County Supervisors.

I attended a meeting at the Milton Town Hall on July 28, 1997 concerning the

dismantling of the major nuclear -- radioactive nuclear plant components and proposal to greatly increase storage of radioactive materials at the Kesselring Site. As a result of the meeting, I have comments to make based on knowledge of Naval Reactors deception, as well as on the documented track record of the Department of Energy as an organization that does not hesitate to resort to wholesale coverups of its misdeeds. This meeting appeared to have been called and chaired by Mr. Guida, a Federal 9 Government employee from Washington, D.C.

Mr. Guida made several incorrect or misleading statements concerning a report written about KAPL/KSO, a fraudulent document 10 which is currently under investigation by the FBI and the U.S. Attorney's Office. Previously Mr. Guida lied to the Governor of Idaho regarding storage of radioactive waste by NR in 11 that state, as documented in ISBND-16 D43425-4 of the 103rd Congress, July 28, 1993. The state of Idaho also sued DOE/NR concerning other false statements made to Idaho officials concerning the kind and amount of radioactive materials that would be sent to the state.

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A recent article written by Fredreka Schouten and published by the Saratogian, concerns the attempt by the Federal Government to fail to clean up a single acre of contaminated soil in the state of Idaho. The article states that not a single square inch of contaminated soil has been removed after the expenditure of $179 million. The contractor, Lockheed Martin, the same contractor running the KSO site, is now requesting an additional $158 million to complete the clean-up of the same acre. Using this case as a measure of radioactive site clean-up costs, the cost of cleaning up KSO will be staggering if ever done at all. We should not forget the Hanford Site in the state of Washington which, after spending billions for radioactive clean-up, has little, if any, progress to show. 12

The subject of KSO dismantling and increased radioactive storage waste -- waste storage, is of such importance that it must be a concern to all citizens of New York State and of special concern by every town in Saratoga.

I submit that only the state of 13

New York has the technical resources to overcome -- oversee such a project and provide independent daily oversight of these people. 13

The oversight is an absolute necessity. The state courts should also be involved in enforcing any contracts or promises made by Mr. Guida or any other DOE employee or DOE contractor. Unless Saratoga and New York State become involved, we will all be stuck with a long-term radioactive hazardous dump site, Mr. Guida's promises notwithstanding. 14

The issue of dismantling major radioactive plant components and of greatly increasing storage of radioactive material at KSO are orders of magnitude more serious than the recent dispute in the Town of Northumberland over a conventional non-radioactive landfill. The KSO, and its sister site in Niskayuna, are quite likely to be the biggest ecological disasters in New York State since Love Canal. 15 The bottom line is that, based on these documented track records, neither the Naval Reactors or DOE are to be trusted, and they should never be trusted to oversee this potential risk to the citizens of New York

State.

And I'd like to add, as to the risk assessments in the EIS, all one has to do is look to hospital records within the area to show that they are a false risk assessment.

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Thank you.

MR. SEEPO: Thank you, Mr. Lambert.

Since there's no one else that has registered to speak, is there anyone else present that would like to speak before we conclude this afternoon's meeting?

(There was no response.)

If not, I'd like to conclude the meeting. I'd like to also announce that there will be an evening hearing at 7:00 o'clock tonight right here.

Thank you very much, everyone, for attending. The meeting is closed.

(Whereupon at 1:53 p.m., the afternoon meeting was closed.)

(The evening session of the meeting convened at 7:00 p.m., at the Town of Milton Community Center.)

P R O C E E D I N G S

MR. SEEPO: Good evening, ladies and gentlemen. Thank you for attending. My name is Drew Seepo. I am the Director of Radiological/Environmental Controls and Safety at the Department of Energy office in Schenectady. I will be the moderator for tonight's public meeting. With me this evening are Mr. Andrew Baitinger and Mr. James Lerch from the West Milton Field Office.

On July 22, the Department of Energy announced in the Federal Register the availability of the Draft Environmental Impact Statement, or Draft EIS for short concerning the disposal of the S3G and D1G prototype reactor plants. After completion of general distribution of the documents to public officials and interested citizens, Naval Reactors filed copies with the Environmental Protection Agency. On July 25th, the Environmental Protection Agency published another notice of availability in the Federal Register to officially start the public

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comment period.

This meeting is being held as part of the decision-making process required by the National Environmental Policy Act, or NEPA. NEPA is our basic national charter for protection of the environment. NEPA procedures ensure that environmental information is made available to public officials and citizens before actions are taken. The Draft EIS was developed with consideration of public input received during the scoping phase of the NEPA process.

The purpose of today's, or excuse me, the purpose of tonight's meeting is to receive comment on the Draft EIS. We are here to listen to what you have to say. It is our responsibility to receive statements, so that your comments can be considered in the development of the final EIS. For that reason, this meeting is being recorded.

The order of tonight's meeting will begin with a brief overview by Mr. Baitinger of the S3G and D1G Prototype reactor plants and the dismantlement alternatives discussed in the Draft EIS. This presentation

will last approximately 20 minutes. We will then take a short break and reconvene the meeting to receive public comments. After all oral comments have been given, I will conclude the meeting.

The public comment period is the time that we listen to you. As stated in the July 22nd Notice of Availability, speakers will be allotted five minutes each to allow sufficient time for all individuals desiring to speak. Please be considerate of your fellow participants by adhering to this limit. The order in which speakers will be heard is as follows: Federal government, state government, county government, local government, organizations, private citizens. As time permits, depending on the number of persons wishing to speak, individuals who have spoken subject to the five-minute rule will be afforded additional speaking time. Additional time will be allotted first to elected officials or speakers representing multiple parties or organizations.

Persons wishing to speak on behalf of organizations are requested to identify the organizations that they represent. Anyone wishing to speak who did not register on the way in should, at the break following Mr. Baitinger's presentation, fill out a registration form at the table by the door. That way, we can assure all persons who want to speak are given an opportunity to do so.

This is not an evidentiary hearing. Speakers will not be cross-examined. However, to ensure that comments are clearly reflected in the record, we may ask some clarifying questions.

Whether or not you speak this evening, you may also provide written comments. Oral and written comments will be considered equally in the development of the Final EIS. If you have written comments with you this evening, you may leave them with support staff at the registration table. If you choose to provide written comments at a later time, they should be sent to Mr. Baitinger. (Slide No. 1) This is his address. The address is also shown on the front page of the Draft EIS and is also available at the registration table. The written comments should be postmarked by

September 8th to be considered during the development of the Final EIS. Comments after that time will be considered to the extent practicable. A written transcript of tonight's meeting will be provided in the Final EIS. Distribution of the Final EIS will include placing copies in the Saratoga and Schenectady County libraries. Following completion of the Final EIS, Naval Reactors will issue a Record of Decision after a 30-day waiting period.

I would now like to introduce Mr. Baitinger, from the West Milton Field Office who will provide a general overview of the S3G and D1G Prototype reactor plants and discuss the alternatives for the plant disposal.

MR. BAITINGER: Thank you, Mr. Seepo.

The S3G and D1G Prototype reactor plants are located on the U.S. Government-owned Kenneth A. Kesselring Site in West Milton, part of the Town of Milton in Saratoga County. The Kesselring Site is an approximately 65-acre developed area situated within an approximately 3900-acre Federal reservation owned by the U.S. Department of Energy. (Slide No. 2) This is a recent photograph of the Kesselring site. The S3G Prototype is this structure here. The S3G Prototype began operation in 1958. The D1G Prototype is located in the 225-foot diameter containment structure we call the Hortonsphere. The D1G Prototype first began operation in 1962. For over 30 years the S3G and D1G Prototype reactor plants served as reactor plant component and equipment test facilities as well as training platforms for Naval training personnel. As a result of the end of the Cold War and the downsizing of the Navy, the S3G Prototype reactor plant was shut down permanently in 1991 and has been defueled, drained, and placed in a safe and stable condition requiring minimal attention for the foreseeable future. We refer to this condition as "protective storage". The S3G spent nuclear fuel was shipped to a government facility in Idaho in July 1994. The D1G Prototype reactor plant has been placed in a similar defueled, safe and stable condition. The D1G spent nuclear fuel was shipped to the same government facility in Idaho in February 1997. Because there is no further need for the S3G and D1G

Prototype reactor plants, a decision is needed on their disposal. For that purpose, a Draft Environmental Impact Statement was prepared.

(Slide No. 3) This is a simplified schematic of a nuclear-powered submarine or cruiser reactor plant. Typical of Naval nuclear reactor plants, the S3G and D1G Prototype reactor plants are rugged, compact pressurized water reactor plants. Major components within the reactor compartments include the pressure vessel, steam generators, main coolant pumps and the pressurizers. All Kesselring Site prototype reactor plants have a containment structure which is comparable to a commercial nuclear power plant's containment.

(Slide No. 4) This is a drawing of the S3G Prototype; the reactor compartment is located here. Below it is a drawing of the D1G Prototype; the reactor compartment is located here. The reactor plants located within each of the reactor compartments provided steam for turbines located in the engine room, shown here and here. The reactor compartments are separated from the rest of the prototypes by shielded walls or bulkheads. Those are depicted in the cross-hatched areas around the reactor compartment.

A factor requiring consideration in disposing of the S3G and D1G Prototype reactor plants is hazardous materials. Those include lead, heavy metals, and PCBs used in the prototype plants. Because of its high density, lead is an excellent radiation shielding material. The reactor compartment bulkheads contain lead to shield crew members from radiation during reactor operations. The S3G and D1G reactor compartments each contain over 100 tons of lead. The reactor compartments contain other hazardous materials used in the 1950s during construction of the plants, but in much lesser quantities. These include chromium in brazing alloys and polychlorinated biphenyls (or PCBs) in common industrial materials such as paint, rubber and adhesives.

Another factor requiring consideration in disposing of the S3G and D1G Prototype reactor plants is radioactivity remaining from the reactor operations. Defueling of the reactor plants removed about 95 percent of the radioactivity, but some

radioactivity remains. Of the remaining 5 percent, over 99 percent is an integral part of the reactor plant's internal structural metals and components. This is a result of the metals becoming activated during reactor plant operation. The other one percent of the remaining radioactivity is radioactive corrosion and wear products which have been deposited on internal surfaces of reactor plant piping systems and components.

First I will discuss the alternatives that Naval Reactors has considered for disposal of the S3G and D1G Prototype reactor plants. Later, I will cover the related potential environmental consequences. (Slide No. 5) Alternatives considered in the Draft Environmental Impact Statement include the no action alternative, prompt dismantlement, deferred dismantlement, one piece off-site disposal, entombment and on-site disposal. Naval Reactors has identified prompt dismantlement as the preferred alternative. Three of these alternatives, one-piece off-site disposal, entombment and on-site disposal, were eliminated from further consideration.

(Slide No. 6) The one-piece off-site disposal alternative is based on the submarine reactor compartment disposal program for dismantling decommissioned U.S. Navy submarines. Defueled reactor compartments are packaged in their entirety at the Puget Sound Shipyard. The packaged naval reactor compartments are then sent by barge and special ground transporters for disposal at the Department of Energy's low level radioactive waste disposal site at the area at the Hanford Site in Washington State. As a single package, the S3G Prototype reactor compartment would measure approximately 40 feet in length, 29 feet in diameter and would weigh approximately 1000 tons. As a single package, the D1G Prototype reactor plant would measure 37 feet in height, 31 feet in diameter and would weigh approximately 1400 tons. This alternative was ruled out because, unlike Puget Sound Naval Shipyard, the Kesselring Site is not adjacent to navigable water. Transport of these two reactor compartments to the nearest barge facility on either the Mohawk or Hudson Rivers is considered impractical by either highway or rail due to

interferences and load limiting bridges along available routes.

The entombment and on-site disposal alternatives were both ruled out from further consideration because neither alternative offers any notable health risk advantage or other environmental benefit. From a health risk perspective, the impacts of these alternatives would be expected to fall within the range of the no action estimates and the prompt dismantlement estimates. From an environmental perspective, the entombment and on-site disposal alternatives would only serve to increase the number of long-term storage or disposal sites for radioactive and hazardous materials in the United States. These alternatives would essentially prevent future unrestricted release of the Kesselring Site for other uses.

(Slide No. 7) The remaining alternatives, no action, prompt dismantlement and deferred dismantlement, were evaluated in detail.

The National Environmental Policy Act requires consideration of a "no action" alternative. The no action alternative would involve keeping the S3G and D1G Prototype reactor plants in protective storage indefinitely. This alternative involves no prototype reactor plant dismantlement activities, so there would be no waste shipments from reactor plant dismantlement. Throughout the storage caretaking period, the S3G and D1G prototype reactor plants would be periodically monitored. The monitoring would verify the overall physical integrity of the plant and would verify that all radioactivity remains contained. Since there is some residual radioactivity with long half-lives, such as nickel-59, in the defueled reactor plants, the no action alternative would leave the long-lived radioactivity and lead shielding at the Kesselring Site indefinitely. This alternative does not provide for permanent disposal of the S3G and D1G Prototype reactor plants. Disposal would be required at some time in the future.

Under the prompt dismantlement alternative, dismantlement of the S3G and D1G Prototype reactor plants would begin shortly after the Record of Decision. The project would

be completed as soon as practicable, subject to appropriated funding. Prompt dismantlement involves cutting out piping, valves, pumps and instrumentation and placing the items in containers for shipping. Large components, such as steam generators, pressurizers, and the pressure vessels would be packaged individually. To the extent practicable, the resulting low level radioactive metals would be recycled at existing commercial facilities which recycle radioactive metals. The remaining low level radioactive waste would be disposed of at the Department of Energy's Savannah River Site in South Carolina. The Savannah River Site currently receives low level radioactive waste from the Naval Reactor Sites in the eastern United States. Both the volume and the content of the S3G and D1G Prototype reactor plant waste fall within the projections of the Naval Reactors waste provided to the Savannah River Site which, in turn, are included in the July 1995 Savannah River Site Waste Management Final Environmental Impact Statement.

Under the deferred dismantlement alternative, the S3G and D1G prototype reactor

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plants would be kept in protective storag for about 30 years. This would allow most of the cobalt-60 radioactivity to decay away. Nearly all of the gamma radiation within the reactor plants comes from cobalt-60. Cobalt-60 has a radioactive half-life of about five years. After 30 years, about two percent of the original cobalt-60 radioactivity will remain. There will still be other residual radioactive isotopes with longer half-lives present. As a result, the volume of radioactive material to be disposed will be about the same as the prompt dismantlement option. The reactor plant would then be dismantled and disposed of in the same manner as under the prompt dismantlement option. Similar to the no action alternative, during the 30-year caretaking period, the defueled S3G and D1G Prototype reactor plants would be periodically monitored to verify the overall physical integrity of the plant and to verify that all radioactivity remains contained.

The purpose of this Environmental Impact Statement is to document the evaluation of the impacts of the various options on the

workers, public and environment. Comparison of the impacts can then be made as part of the final decision-making process. (Slide No. 8) This slide summarizes the various impacts that were analyzed in detail in the Draft Environmental Impact Statement.

I would next like to review the results of risk analyses performed for the three options evaluated in detail. The analyses evaluated the risks to two affected groups: workers involved in dismantling the S3G and D1G Prototype reactor plants and the general public including those that live in the area surrounding the Kesselring Site and those residing along the routes that would be used to transport material from the dismantled reactor plants to their ultimate disposal sites. Risks were calculated for a variety of conditions including routine incident-free operations, radiological and non-radiological facility accidents, incident-free transportation, and radiological and non-radiological transportation accidents.

Before I present the analytical results, a brief discussion of risk is

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warranted. Risk is defined as the product of the consequences of an event multiplied by the probability of that event. (Slide No. 9) This next slide provides comparisons of risks for a variety of activities and occupations. Details of the calculations of these risks can be found on pages A-18 and A-19 of the Draft Environmental Impact Statement. Several points and cautions should be noted.

Risk is expressed as a unitless number. Because many of the values that are dealt with are very small, scientific notation is often used. The first two columns show the same value expressed in both decimal and scientific notation form. Reading across these lines are the same numbers expressed in both forms.

Risk values are most useful for comparison of different activities. The comparison of risks for different activities must be made on the same basis. Therefore, when reviewing risk values, the basis of the calculation must be known. For example, the risks on this table are calculated and expressed over the lifetime of an individual. To determine the average annual risk for any of

these factors, the lifetime values would be divided by the individual's average lifetime, 72 years.

The risk expressed as one chance in X in this column here is calculated by dividing the risk into one.

The calculation of risk due to radiation exposure is made by multiplying the exposure in person-rem by the risk factor of 0.0005 latent fatal cancers per person-rem for the general public. A risk factor of 0.0004 latent fatal cancers per person-rem is used for workers. The higher risk factor for the general population accounts for people in sensitive age groups, those younger than 18 or older than 65.

The accuracy of risk calculations depends on the certainty of the data used in the calculations. For example, the risk of dying in an automobile accident in one's lifetime is fairly well known based on many years of traffic accidents and death data. The calculations of risk for radiation exposure due to accidents in this Draft Environmental Impact Statement are based on computer models of events that have not occurred. Based on the conservative factors used to create the models, the consequences and risks calculated are expected to be larger by at least a factor of 10 to 100 than what would actually occur.

As can be seen from the table, the risk of developing a latent fatal cancer due to Kesselring Site operations over the last 40 years is extremely small when compared to the risks of other activities and occupations. For example, an individual is almost 2,000 times more likely in their lifetime to die in an automobile accident than from living continuously at the Federal reservation boundary of the Kesselring Site during the last 40 years.

(Slide No. 10) This slide presents the risks associated with facility activities for each of the three alternatives. Also shown on the table is the collective radiation exposure to the workers and the public for each alternative. That's the data that's presented here across the top. Of note on this table, the collective dose for workers for the prompt dismantlement option is higher than the other two options. That's this figure right

here, compared to those two. Based on the number of workers necessary to perform the dismantlement work and the time period over which the dismantlement would take place, the average annual dose per worker would be comparable to the annual dose routinely received during operation and maintenance of Naval prototype plants and would be well within federal guidelines.

(Slide No. 11) This slide compares the risks calculated for workers and the public for the three options to the risks of other activities and occupations that I showed you before. As I stated earlier, risks need to be compared on a common basis. Therefore, the average annual risks for the various options presented in the previous slide were multiplied by the time period over which the option would take place to determine the lifetime risk. As you can see, the risk to workers is somewhat less than the other occupational risks while the risk to the public is extremely low in comparison to other risks. The worker risks are these values here. Risk to the public are the last three entries on the table.

(Slide No. 12) The next slide presents the risks associated with transportation activities for each of the three alternatives. In this case risks are calculated for only the prompt and deferred dismantlement options since the no action alternative does not result in the transportation of any materials from reactor plant dismantlement from the site. Again, the risk to workers is comparable to risks of other occupations and activities while the risk to the public is far below those.

Naval Reactors considers the impacts of each of the options in the other areas evaluated to be small to non-existent. With regard to waste management, the prompt dismantlement option would result in the generation and temporary on-site storage of a small amount, up to 7,000 gallons of mixed waste pending completion of treatment and disposal facilities at other locations. Mixed waste is predominantly solid material (such as paint chips, metal fittings and cabling) that contains both low levels of radioactive contamination and hazardous constituents such as lead, chrome or PCBs. If prompt dismantlement is selected,

approval for the expansion of the mixed waste storage area would be obtained from the New York State Department of Environmental Conservation. Naval Reactors also evaluated mitigative effects for each of the options and determined that there are no mitigative measures required for any of the options based on the small impacts of each.

(Slide No. 13) This is a comparison of the costs for the various alternatives. These costs are in 1997 dollars to offset the effects of inflation. The deferred dismantlement process is roughly the sum of the other two alternatives since the deferred dismantlement alternative is a combination of those other two alternatives. The no action alternative is expected to ultimately have the highest cost since dismantlement would need to take place some time in the future. The dollar amount on the slide only represents caretaking and does not take into account dismantlement or disposal. Therefore, of the three alternatives, prompt dismantlement would ultimately result in the lowest overall cost.

Naval Reactors has concluded that all of the alternatives would have minimal impact on the general public and the environment. The principal impact associated with prompt dismantlement is that Kesselring Site workers would receive some exposure to radiation. Although the collective dose to workers would be higher for the prompt dismantlement alternative, average doses per worker would be comparable in magnitude to those routinely received during operation and maintenance of Naval prototype reactor plants and would be well within Federal guidelines. Even on a cumulative basis for the entire work force, analyses showed that no immediate fatalities or latent cancer fatalities would be expected. While deferred dismantlement has the advantage of less radiation exposure, radiation exposure is low for all of the alternatives.

Prompt dismantlement was selected as the preferred alternative for disposal of the S3G and D1G Prototype reactor plants for the following reasons. An experienced work force is currently available at the Kesselring site. Prompt dismantlement has a greater degree of

certainty in completing the dismantlement and disposal within predicted costs and with small environmental impacts. And, although there is no plan to release the Kesselring Site for other uses in the foreseeable future, eventual release of the Kesselring Site would be more readily achievable since two of the four prototype reactor plants would be dismantled and disposed of.

This concludes my presentation. Thank you for your courtesy and attention. We'll take a short break and then reconvene the meeting to take your comments. After all the comments have been heard, we will conclude the meeting.

Thank you very much.

MR. SEEPO: I'd like to reconvene the meeting at 7:35. Thank you very much.

(The meeting recessed from 7:25 to 7:35 p.m.)

MR. SEEPO: We have three individuals who have registered to speak tonight. First will be Councilman Gnip; second will be Ms. Linda Williams, and third will be Mr. James Lambert. I remind everybody, if you would like to make comments tonight, please do register so we can get the evening done in that manner.

Mr. Gnip, if you will please make your remarks.

MR. GNIP: Thank you very much, Mr. Seepo, Mr. Baitinger.

During September of 1996, the residents of the town of Milton and neighboring communities had the opportunity to provide comments regarding disposal strategy for the defueled S3G and the D1G Prototype nuclear reactor plants at the Atomic Knolls Power Laboratory Kesselring Site in West Milton. The Atomic Power Laboratory Kesselring Site in West Milton -- I'm sorry. The following is a response to the the Draft Environmental Impact Statement prepared by the U. S. Department of Energy, Office of Naval Reactors, during July of 1997.

The DEIS evaluates in detail the three alternatives for the disposition of the two reactors under review. I've stated these options as they were addressed by Mr. Baitinger, so I will not read those options.

Many residents of our municipality have continually expressed concern for the disposition of these decommissioned reactors and have favored the prompt dismantlement option. We are, therefore, pleased with the report's indication that this is the preferred method. We are also pleased with the fact that the managers of the DOE's Naval Nuclear Propulsion Program have allowed our town board members to visit the Kesselring Site and for taking the time to address our concerns for expansion of storage of radioactive and hazardous waste (referred to as mixed waste) at the Kesselring Site during the special meeting held on July 28th. The so-called low level radioactive "mixed waste" which is generated as part of the normal operations will also include waste generated in connection with the dismantlement of the two reactors under review. However, the two issues are being -- are reviewed separately. We have been informed that such waste is that of low level radioactive materials which are being targeted for off-site disposal by the year 2004 when new approved disposal sites are available. Even though it is preferred to have this mixed waste immediately disposed to off-site repositories, short-term storage will not appear to pose a significant threat to the health and safety of the residents of our community.

Of greater concern, we must focus on the two operating reactors, the MARF and the S8G prototype reactor plants which are used for the training of U.S. Navy personnel and testing of naval nuclear propulsion plant equipment. Since there are no plans to permanently shut down these reactors in the foreseeable future they are not evaluated under the action -- under current review. These fueled reactors are currently operating without concrete containment vessels which are designed to capture radio-active gases that may leak from the reactor plant. Civilian nuclear reactors have such 17 containment vessels to protect the public from such exposure from such leaking radioactive gases. It is my understanding that the Kesselring Site is one of the few operating reactor plants in the western world without a containment vessel.

We should be mindful of the

Department of Energy's lack of response to the nuclear testing and fallout during the 1950s in Idaho and the resulting radioactive exposure to many of the residents of that local area including our Northeast. The Department of Energy has the responsibility to not only ensure that the 18 West Milton -- that West Milton not become a nuclear graveyard but to take the necessary action to ensure that such reactors operate with containment vessels for the basic protection of 17 our residents. There is no cost that can be justified when it relates to the compromise of the health and safety of our residents. Should operations discontinue at Kesselring, we want to be assured that this site will become productive 19 again and be an asset to our community.

We continually strive to make the Town of Milton a nice place to raise a family. It is our hope that the U.S. Government acts responsibly to ensure the same.

Thank you very much.

MR. SEEPO: Thank you, Mr. Gnip.

Next speaker will be Ms. Linda Williams.

MS. WILLIAMS: Good evening. My

name is Linda Williams. I'm a Ballston Spa resident. Through my association over the past ten years with numerous former and current Kesselring personnel who designed, operated, repaired and inspected the Site's reactor plants, I have gained a great deal of knowledge about their operation. Through my attempts to obtain Freedom of Information documents regarding Kesselring's operation, I have also 2
gained a knowledge of how information is denied, accidents covered up, and what I call the Navy's "doublespeak". An example of doublespeak is the Navy's assertion that DEC monitors the out-flow water in the Gloweegee Creek. However, no one verifies where or if the DEC itself is allowed access to place testing equipment and what equipment is used. To the best of my knowledge, Kesselring is on the honor system to 3
withdraw water samples itself and present the results to the DEC. If this is not the case, I would welcome speaking with someone from the DEC to prove my statement incorrect. Testing can easily be manipulated by where equipment is placed and where the sampling is done.

With this knowledge, I was

focused on listening between the lines to Mr. Guida's responses to the Milton Town Board members at a recent public meeting. When trying to defend allegations that many drums of radioactive waste are buried on the Kesselring premises, Mr. Guida said the managers had been asked if they polled their employees to see if anyone had knowledge of buried drums, and the managers assured their officials that they had indeed polled their employees and there was no such knowledge. Compare that with the statement in the fraudulent GAO report of '91 where 4
investigators state they contacted all persons whose names had been given them who wanted to give information. Not only did the GAO investigators not contact persons on the list but one former KAPL employee died of asbestosis waiting to be contacted by the GAO. The GAO had knowledge that his death was imminent and failed to act.

For the record, I am in favor of the immediate dismantlement. However, I am very concerned about the ability to obtain Congressional appropriation of funds in light of 5
the recently reported failure of Lockheed Martin

to clean one acre of Idaho contamination and other revelations in the January '97 GAO report entitled Nuclear Waste: DOE's Estimates of Potential Savings from Privatizing Clean-up Projects. 5

I am also very concerned about future use of the Hortonsphere, the current home of the DIG reactor. This has not been addressed in the current EIS and could covertly be used for nuclear waste storage. 6 In a hearing July 22, '94, I warned against future importing of radioactive waste to the site. Part of the waste to be stored in the proposed expansion of Building 91 would be imported from the KAPL facility in Niskayuna. Where would the waste come from next? 7

The towns and cities of Saratoga County and the New York State legislators have little idea of the depths to which top Nuclear Naval officials will sink to accomplish their goals.

I'd like to read an excerpt from the July '93 U.S. Senate Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence hearing transcript. Following

considerable litigation, Federal District Court Judge Harold Ryan had granted the state of Idaho an injunction against additional shipments of high level radioactive spent fuel rods until the DOE and Navy prepared an Environmental Impact Statement under the provisions of NEPA. The Naval Nuclear Propulsion Program then requested the above-named committee and Congress exempt it from NEPA, one of the nation's most basic environmental laws.

The following is from Idaho's Governor Andrus' testimony on pages 28 and 29:

"Early on in the litigation, the Federal Government submitted the declaration of Admiral DeMars to support its position that substantial disruption would follow if the relief requested by Idaho was granted. He stated that the only place to store spent nuclear fuel removed from nuclear-powered war-ships and submarines is the INEL, and that work would come to a halt if shipments of spent nuclear fuel were enjoined, leading to thousands of lost jobs and an inability to return vessels to the fleet. 8

"As Idaho would discover, the

Admiral's testimony was prepared by Richard Guida, the Associate Director of Regulatory Affairs for the U. S. Naval Nuclear Propulsion Program. Mr. Guida was deposed and, in the course of that deposition, conceded that the NNPP has the capability to store the spent nuclear fuel elsewhere until the required EIS is completed.

"Mr. Guida testified that over one-third of the Navy's shipments to Idaho would be comprised of spent nuclear fuel removed from the U.S.S. Enterprise. He then conceded that the fuel had already been removed from the Enterprise and was being stored in a facility at Newport News, Virginia. He further conceded that the fuel can remain stored in that facility for the next two to three years."

Further testimony under oath showed that none of the 18 nuclear-powered vessels that were scheduled to be overhauled, defueled, refueled or inactivated during the period of time projected to complete the EIS would be affected by the injunction.

Richard Guida did not admit the truth until questioned under oath. Neither this

8

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Draft EIS or the Navy's presentation today is under oath. Anyone here who still wants to trust everything the Navy has to say, I have some oceanfront property in Arizona I'd like to sell you. 8

In conclusion, I would like to state why I have spent the past years trying to ferret out the -- some of the lack of accountability, some of the accidents that I believe have occurred, and so forth, because as Mr. Gnip testified to health problems which do result from radioactivity. I have a child that was diagnosed with acute leukemia at the age of three and a half. He is one of the first people who lived in this -- in the Capital District because there was a treatment that became available back in the early '70s that is now the standard treatment for that type of leukemia, but I know what our family went through with 11 years of chemotherapy and numerous trips to the hospital where we were told, you will not be taking your son home. Today he is in good health, and I'm thankful to God for that. But I would hate to see anybody else ever, ever go through this, and the reason that the doctors were investigating the cause of this leukemia was radioactive exposure to his father prior to conception, and his father died at the age of 43 of a blood clot on the brain.

That's why I persist in watching over you fellows. Thank you.

MR. SEEPO: Thank you.

Our next speaker will be Mr. James Lambert.

MR. LAMBERT: As you know earlier I read the letter from John Shannon which is outside. This time I'd like to address the panel.

I worked on all these reactors. I worked in and around them. There is no such thing as a containment structure around them, and there is no fill system. If you look at 20
drawing 2.4 it shows you the S3G, you'll notice there is an air space right below the reactor component so if they ever melt down, it's right into the atmosphere right away. As for the GAO report it shows time and time again that is a 10
false record.

You use this to produce this EIS and which in itself makes it a false record,

plus you have taken and fraudulently put in here the different noise control act, the hazardous 21
material transportation, the wetlands act which you know you're exempt from, which is a fraudulent misrepresentation and now to give you an example, spent fuel left at the Site during when the National Weather Service is issuing flood warnings for three days. During the 22
middle of that time, they sent the fuel rods by rail on its way, O.K., which was in -- if you look at the Act, you'll find that's completely wrong.

Now, your risk assessment, all you have to do is look at the hospital records in the area and you will find that if you 16
compile them together, you will find that the risk assessment from this site is a lot worse than you're saying.

Reactors, you have two operating reactors. Some of the technology on those 23
reactors goes back to 1936. Your weakest point is the best technology you have. Calling for you to clean up the site, clean up the creeks 24
that are polluted here, and all the way down the Hudson.

Thank you.

MR. SEEPO: Thank you, Mr. Lambert.

There are no other registered speakers. I'd like to ask the audience if there's anyone else that would like to avail themselves of the opportunity to make a public comment.

(There was no response.)

If not, the meeting will be concluded.

Thank you very much.

(Whereupon at 7:48 p.m., the meeting was concluded.)

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STATE OF NEW YORK)
COUNTY OF ALBANY)

Pauline E. Williman, being duly sworn, deposes and says:

That she is a Certified Shorthand Reporter licensed by the University of the State of New York under permanent Certificate Number 297 issued May 21, 1949; that she acted as the Official Reporter at the hearing herein on August 13, 1997; that the transcript to which this affidavit is annexed is an accurate transcript of said proceedings to the best of deponent's knowledge and belief.

Pauline E. Williman

Sworn to before me this
22nd day of August, 1997

Paula C. Hosking
My Comm Ex. 9/12/98

Public Hearing Commenters

Comment Responses:

Comment 1 (Mr. Trieble).
As discussed in the Draft Environmental Impact Statement Summary conclusion, "30 years from now, changing conditions associated with the regulatory environment, and the availability of trained personnel and waste disposal facilities could result in unforeseeable complications or delays." Despite the added uncertainty, analysis of the deferred dismantlement alternative in the Draft Environmental Impact Statement is consistent with reasonably foreseeable radioactive waste disposal practices. In particular, there are no current plans to close the U.S. Department of Energy Savannah River Site in South Carolina. To the contrary, an Environmental Impact Statement (Reference 5-1 of the Draft Environmental Impact Statement) analyzing future radioactive waste disposal operations at the Savannah River Site was recently issued. The Naval Reactors Program acknowledges the commenter's preference for the prompt dismantlement alternative.

Comment 2 (Ms. Williams).
The commenter states that information related to Kesselring Site operations which can be released to the public is limited. As discussed in Section 4.0 of the Draft Environmental Impact Statement, public information is readily available on the environmental performance of the Kesselring Site. The Kesselring Site Environmental Summary Report and the annual Knolls Atomic Power Laboratory Environmental Monitoring Report are referenced frequently throughout the Environmental Impact Statement. Both of these reports are available in the Saratoga Springs and Schenectady County Public Libraries.

Comment 3 (Ms. Williams).
The allegation is incorrect. New York State Department of Environmental Conservation (NYSDEC) personnel are allowed access to the Kesselring Site to take independent environmental samples from around the Site and to ensure that all applicable permit requirements and regulations are being met. NYSDEC analyzes these samples for radioactivity, as it does for commercial nuclear power plants and other U.S. Department of Energy sites in New York. One of the locations monitored is the Glowegee Creek downstream of the Kesselring Site. As discussed in Section 4.3.1 of the Draft Environmental Impact Statement, all Kesselring Site waste water discharges are controlled and monitored for conformance with the limits and parameters specified in the New York State approved Pollutant Discharge Elimination System permit and applicable New York State regulations. Figure 4-1 of the Draft Environmental Impact Statement indicates five locations in the vicinity of the discharge points where Kesselring Site samples are collected. As discussed in the Draft Environmental Impact Statement, over 80 inspections covering air, water, and hazardous waste have been conducted by independent regulatory personnel over the past 10 years. Some of these inspections have been made without prior notification. NYSDEC inspections have included taking independent water samples at the Kesselring Site outfall locations as well as observing the collecting, handling and control of environmental samples taken by Knolls Atomic Power Laboratory personnel. For compliance with the Site's State Pollutant Discharge Elimination System permit, samples are analyzed at an independent New York State Department of Health certified laboratory. The most recent NYSDEC inspection of the

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Comment Responses:

Kesselring Site outfalls occurred in July 1997. There have been no fines or penalties levied, no enforcement actions taken, and no other adverse regulatory actions as a result of these inspections. This additional information has been incorporated into Section 4.3.4.1 of the Final Environmental Impact Statement for completeness.

Comment 4 (Ms. Williams).
The commenter reiterates a historical issue that the review process used to evaluate alleged conditions at the Kesselring Site was flawed. This allegation is incorrect. The General Accounting Office (GAO) is the auditing arm of Congress and is independent of the Executive branch, which includes the U.S. Departments of Energy (DOE) and the Navy. The GAO audit was performed by personnel who had security clearances, and included technically trained individuals and those with experience auditing other DOE facilities where problems had been found and reported. The audit extended over 14 months and included unrestricted access to classified information and facilities. The Program made all records available and responded fully to all questions. In 1991, GAO testified before Congress and issued their final report refuting concerns such as the one raised by the commenter, and deeming the Naval Reactors Program as a "positive program" within the DOE having "no significant deficiencies." The GAO routinely issues reports which are critical of Federal agencies, including the DOE and the Navy. There is no reason to believe that the GAO would be fraudulent or biased.

Comment 5 (Ms. Williams).
If selected in the Record of Decision, prompt dismantlement would be completed as soon as practicable, subject to available appropriated funding. As discussed in Section 3.2.1 of the Draft Environmental Impact Statement, disassembly techniques would include proven methods and technologies. As discussed in Section 3.5.4 of the Draft Environmental Impact Statement, cost estimates associated with dismantlement of the S3G and D1G Prototype reactor plants are based on experience, engineering concepts, and comparison to similar projects. As indicated in Section S.5 of the Draft Environmental Impact Statement, prompt dismantlement could be accomplished safely, economically, and with a high degree of certainty that the environmental impacts would be small.

Comment 6 (Ms. Williams).
As discussed in Section 4.7 of the Draft Environmental Impact Statement, none of the alternatives would involve dismantling the D1G Hortonsphere. As discussed in Sections 5.2.1, 5.2.7 and 5.3.1, after completion of D1G Prototype reactor plant dismantlement, the Hortonsphere would be available for possible future Naval Reactors Program use, although no future use is planned at this time. Under the prompt and deferred dismantlement alternatives, low-level radioactive materials from D1G Prototype reactor plant dismantlement would be held for short times in the Hortonsphere, pending transfer of materials to other radioactive waste processing facilities at the Kesselring Site to prepare them for off-site disposal. Radioactive materials from Kesselring Site operations have never been disposed of on the Site or Federal reservation, and there is no plan to use the Hortonsphere for waste storage in the future. Such

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use would necessitate additional National Environmental Policy Act (NEPA) review with public notification.

Comment 7 (Ms. Williams).
As part of a recent proposed modification to the New York State Department of Environmental Conservation (NYSDEC) issued Kesselring Site Part 373 Hazardous Waste Management Permit, the Naval Reactors Program has requested NYSDEC approval to allow transfer of small quantities of mixed waste between the Knolls Site in Schenectady and the Kesselring Site. The purpose of this provision is to consolidate like forms of mixed waste to facilitate shipment out of the State for treatment and disposal. Additional discussion to clarify these points has been added to the Final Environmental Impact Statement. The proposed permit modification is currently undergoing NYSDEC review as part of a regulatory process which is separate from this environmental impact statement.

Comment 8 (Ms. Williams).
This comment is beyond the scope of this environmental impact statement. Nonetheless, the commenter is incorrect in alleging that statements on spent nuclear fuel shipments to Idaho made by the Associate Director for Regulatory Affairs in the Office of Naval Reactors (Mr. R.A. Guida) to the Governor of Idaho were "changed" when provided to the Senate Armed Services Committee. The July 28, 1993 Congressional hearing report explains that the information provided to the State of Idaho and under oath in Federal district court was accurate and complete. The information was not changed when provided to Congress. Pages 149 to 154 of the report include a question and answer specifically dealing with the issue of information supplied to the State of Idaho. A copy of those pages are provided as Attachment E-1 at the end of this appendix.

Comment 9 (Mr. Lambert/Mr. Shannon).
This comment is beyond the scope of this environmental impact statement. Nonetheless, the commenter is incorrect in asserting that the meeting held on July 28, 1997 was called and chaired by Mr. Guida. The meeting was a Milton Town Board meeting which was called and chaired by Mr. Wilbur Trieble, Town of Milton Supervisor. See Attachments E-2, E-3 and E-4 at the end of this appendix for additional information.

Comment 10 (Mr. Lambert/Mr. Shannon).
The commenter's allegations are incorrect, unsupported, and have been previously and repeatedly rebutted. The General Accounting Office (GAO) is the auditing arm of Congress and is independent of the Executive branch, which includes the U.S. Departments of Energy (DOE) and the Navy. The GAO audit was performed by personnel who had security clearances, and included technically trained individuals and those with experience auditing other DOE facilities where problems had been found and reported. The audit extended over 14 months and included unrestricted access to classified information and facilities. The Program made all records available and responded fully to all questions. In 1991, GAO testified before Congress and issued their final report refuting concerns such as the one raised

Public Hearing Commenters

Comment Responses:

by the commenter, and deeming the Naval Reactors Program as a "positive program" within the DOE having "no significant deficiencies." The GAO routinely issues reports which are critical of Federal agencies, including the DOE and the Navy. There is no reason to believe that the GAO would be fraudulent or biased. The Naval Reactors Program is unaware of any ongoing investigation by agencies within the U.S. Department of Justice into any of these matters.

Comment 11 (Mr. Lambert/Mr. Shannon).
See response to Public Hearing Comment 8. The accusation of "lying" is incorrect. The record contained in pages E-149 to E-153 of Senate Hearing 103-352 fully demonstrates the Naval Reactors Program's veracity.

Comment 12 (Mr. Lambert/Mr. Shannon).
The commenter's discussion about problems at Pit 9 at the Idaho National Engineering and Environmental Laboratory are outside the scope of this environmental impact statement and unrelated to the Naval Reactors Program. The Naval Reactors Program has no involvement in or responsibility for the work at Pit 9. See response to Public Hearing Comment 19 for further information on the Naval Reactors Program's record related to site release activities.

Comment 13 (Mr. Lambert/Mr. Shannon).
Kesselring Site operations must comply with all applicable Federal and New York State environmental statutes and regulations. On a Federal level, regulatory compliance is routinely monitored by the U.S. Environmental Protection Agency; on a State level, regulatory compliance is routinely monitored by independent State agencies such as the New York State Departments of Environmental Conservation and Health. These agencies have the regulatory authority to monitor Kesselring Site operations at any time, at any frequency, and they can impose fines, penalties and other enforcement actions in the event that significant noncompliance conditions are observed. As discussed in Section 4.0 of the Draft Environmental Impact Statement, there have been no fines or penalties levied, no enforcement actions taken, and no other adverse regulatory action as a result of Kesselring Site reviews by other independent government agencies. Therefore, there has never been a reason for involvement by the State courts in matters relating to Kesselring Site operations.

As discussed in Sections 2.4.2, 2.4.3, and 2.4.4 of the Draft Environmental Impact Statement, the Naval Reactors Program has a well-documented record of environmental responsibility and technical experience. The Naval Reactors Program maintains the same rigorous attitude toward control of radioactivity and protection of the environment as it does toward reactor design, testing, operation, and servicing. As discussed in Section 3.2.1 of the Draft Environmental Impact Statement, disassembly techniques would include proven methods and technologies. Operations on radiologically contaminated piping and components would use appropriate measures to prevent the spread of radioactivity and to protect human health and the environment. The protective measures would adhere to the same stringent standards and practices that are used throughout Naval Reactors Program operations to successfully control

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Comment Responses:

maintenance evolutions on operating Naval reactor plants, and to keep worker exposures as low as reasonably achievable.

Comment 14 (Mr. Lambert/Mr. Shannon).
The commenter's assertions that the Kesselring Site will be used as a long term radioactive hazardous dump site are incorrect. As discussed in Sections 5.2.5.1, 5.2.5.2, and 5.5.4 of the Draft Environmental Impact Statement, all dismantlement wastes would be shipped off-site for either recycling or disposal.

Comment 15 (Mr. Lambert/Mr. Shannon).
The commenter's assertion is incorrect. As discussed in Section 2.4.3 of the Draft Environmental Impact Statement, the Naval Reactors Program, including the Kesselring and Knolls Sites, has a well-documented record of environmental responsibility and technical expertise. Public information is readily available on the environmental performance of both sites. The Kesselring Site Environmental Summary Report (Reference 2-1 of the Draft Environmental Impact Statement), the Knolls Site Environmental Summary Report, and the annual Knolls Atomic Power Laboratory Environmental Monitoring Report (Reference 4-4 of the Draft Environmental Impact Statement) provide comprehensive information on the environmental conditions at the Kesselring and Knolls Sites. All of these reports demonstrate in detail that in over four decades of operation, there has been no significant impact from Kesselring and Knolls Site operations on the environment or adverse effect on the community or the public. All three reports are available in local public libraries.

The Draft Environmental Impact Statement discusses the existing environmental conditions at the Kesselring Site in detail in Chapter 4. The U.S. Environmental Protection Agency, as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review process, has performed a review of the Kesselring Site and determined in 1994 that the Site does not qualify for inclusion on the National Priorities List (NPL) and is therefore not a Superfund Site, unlike Love Canal, which is on the NPL.

Comment 16 (Mr. Lambert).
This environmental impact statement was prepared using a methodology that is consistent with other Federal agencies' guidance for preparing National Environmental Policy Act (NEPA) documentation involving radiological analyses. The incidence of fatal cancer was evaluated using International Commission on Radiological Protection (ICRP) methodology which is also consistent with the methodology set forth in the National Academy of Sciences Biological Effects of Ionizing Radiation Report (BEIR V). The BEIR V report states "the possibility that there may be no risks from exposures comparable to natural background radiation cannot be ruled out. At such low doses and dose rates, it must be acknowledged that the lower limit of the range of uncertainty in the risk estimates extends to zero." For very small doses, the ICRP methodology is believed to be conservative because it assumes no threshold exists below which exposure fails to cause a health effect, and it assumes a linear response throughout the exposure range.

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Comment Responses:

Epidemiological studies of U.S. Navy and private shipyard workers have been performed by John Hopkins University. The latest evaluation, published in 1991, covered 70,000 shipyard workers who received occupational radiation exposure between the years 1957 and 1981. That study concluded there was no excess incidence of cancer associated with radiation exposure from naval nuclear propulsion work. Those results are consistent with results obtained using the ICRP methodology.

Comment 17 (Mr. Gnip).
This matter is not relevant to the dismantlement of the S3G and D1G Prototype reactor plants. However, in the interest of completeness, the following information is provided. The MARF and S8G Prototype reactor plants have pressurizable steel containment structures and engineered safety systems. The U.S. Nuclear Regulatory Commission (NRC) regulations permit commercial power reactors to use either steel or concrete containment structures, and there are many NRC licensed commercial nuclear power plants that operate with steel containment. Even though the Atomic Energy Act does not require the MARF and S8G designs to be licensed by the NRC, the Naval Reactors Program has provided the designs to the NRC for review. These reviews concluded that the S8G and MARF Prototype reactor plants could be operated without undue risk to the health and safety of the public.

As discussed in Section 5.5 of the Draft Environmental Impact Statement, the prototype reactor plants incorporate the same design features which are built into Naval submarine and surface ship nuclear propulsion plants to make them battle worthy, safe and reliable. These features include ability to accommodate frequent and rapid power level changes, equipment redundancy, and rugged design for battle shock far more severe than what might be experienced in a seismic event. The Naval Reactors Program designs are safe, well proven, and have an extraordinary track record. In over 4,800 reactor-years of operation and over 110 million miles steamed by nuclear-powered U.S. Navy warships, there has never been a nuclear reactor accident or any significant effect on the environment.

The fact that the Kesselring Site reactors meet or exceed commercial reactor standards has been independently confirmed. The General Accounting Office (GAO), the auditing arm of Congress, performed a detailed 14-month audit of Naval Reactor Program facilities in 1990 - 1991. The GAO report is cited as Reference 2-6 of the Draft Environmental Impact Statement. The auditors investigated environmental, health and safety matters, including reactor safety, and had unrestricted access to personnel, facilities, and classified information. The auditors also met with NRC officials to understand the nature of their requirements and the reviews NRC does on Naval reactor designs. In April 1991, the GAO testified to a Congressional committee that, "Contrary to some allegations, we found that the [Kesselring Site] prototype reactors do employ enhanced safety systems and do meet the intent of the NRC's safety criteria for normal operations and accident conditions." Additional discussion to clarify these points has been added to the Final Environmental Impact Statement.

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Comment Responses:

Comment 18 (Mr. Gnip).
As discussed in Sections 4.5.5.1 and 4.5.5.2 of the Draft Environmental Impact Statement, and the Knolls Atomic Power Laboratory Kesselring Site Environmental Summary Report (Draft Environmental Impact Statement Reference 2-1), radioactive materials attributable to Kesselring Site operations have never been disposed of on the Site or Federal reservation. In addition, radioactive wastes from other sites have never been disposed of on the Kesselring Site or Federal reservation. Operations at the Kesselring Site over the past four decades have demonstrated the value of maintaining rigorous standards to protect human health, safety, and the environment. As discussed in Sections 5.2.5.1, 5.2.5.2, and 5.5.4 of the Draft Environmental Impact Statement, all dismantlement wastes would be shipped off-site for either recycling or disposal.

Comment 19 (Mr. Gnip).
As discussed in Section 3.0 of the Draft Environmental Impact Statement, there are no plans to permanently shut down the remaining operating prototypes in the foreseeable future; therefore, it is not expected that any of the Kesselring Site or Federal reservation lands will be returned to the commercial or public domain in the foreseeable future. If the remaining operating prototypes were to be shut down in the future, the disposal of the remaining reactor plants would be considered a major Federal action which would require the preparation of a separate environmental impact statement under current National Environmental Policy Act (NEPA) regulations. That environmental impact statement would have to evaluate other related activities at the Kesselring Site, such as future potential site release, and would include public and regulator involvement.

The Naval Reactors Program has recent experience in releasing nuclear facilities for unrestricted use at the Charleston Naval Shipyard in South Carolina, and at the Mare Island Shipyard in California. Both facilities went through a detailed characterization process to search for Naval Reactors Program radioactivity. This process was approved and overseen by the respective State regulatory agencies and U.S. Environmental Protection Agency regional offices to ensure protection of the environment and public. Only very small amounts of Naval Reactors Program radioactivity were encountered - less than that found in a typical household smoke detector - which had to be removed to meet State requirements. This would have not been possible were it not for the comprehensive and conservative requirements which the Naval Reactors Program has applied to stringently control radioactivity. Since those same controls have applied throughout the history of Kesselring Site operations, it is reasonable to conclude that any future effort to release the Kesselring Site for unrestricted use would follow a similar process and would achieve similar success.

Public Hearing Commenters

Comment Responses:

Comment 20 (Mr. Lambert).
See response to Public Hearing Comment 17.

Comment 21 (Mr. Lambert).
The commenter's allegations are incorrect. As outlined in Section 2.5 of the Draft Environmental Impact Statement, the Naval Reactors Program in general, and the Kesselring Site in particular, are subject to all applicable Federal environmental statutes. Where the Federal statutes waive sovereign immunity, State and local environmental statutes and ordinances apply as well. The commenter made similar allegations at a Milton Town Board meeting conducted on July 28, 1997 (see response to Public Hearing Comment 9). Following that meeting, a letter was sent to Mr. Wilbur Trieble, Town of Milton Supervisor, which provides further response on this matter. A copy of that letter is provided as Attachment E-2 at the end of this appendix.

Comment 22 (Mr. Lambert).
This comment is beyond the scope of the S3G and D1G Prototype Reactor Plant dismantlement EIS. Nonetheless, the following information is provided. As stated in Section 2.4.4 of the Draft Environmental Impact Statement, the Naval Reactors Program has safely made more than 680 container shipments of spent nuclear fuel. All past shipments, including radioactive, as well as nonradioactive, materials from Naval Reactors Program facilities have met applicable Federal, State, and local regulations. Applicable Federal transportation regulations, discussed in Section 2.5.15 of the Draft Environmental Impact Statement, do not specifically cite restrictions for transportation during inclement weather. However, these regulations allow the carrier to change a preferred route based on conditions which might arise on an emergent basis.

Comment 23 (Mr. Lambert).
As discussed in Section 5.5.8.2 of the Draft Environmental Impact Statement, the Naval reactor designs are safe, well proven, and have an extraordinary track record. In over 4,800 reactor-years of operation (which includes land based prototypes) and over 110 million miles steamed by nuclear-powered U.S. Navy warships, there has never been a nuclear reactor accident or any significant effect on the environment. Even though the Atomic Energy Act does not require the MARF and S8G Prototype reactor plant designs to be licensed by the U.S. Nuclear Regulatory Commission (NRC), the Naval Reactors Program previously provided the designs to the NRC and the Advisory Committee on Reactor Safeguards for independent review. These reviews concluded that the S8G and MARF Prototype reactor plants could be operated without undue risk to the health and safety of the public.

Public Hearing Commenters

Comment Responses:

Comment 24 (Mr. Lambert).
As discussed in Sections 4.3.3.1 and 4.3.4.1 of the Draft Environmental Impact Statement and in the annual Knolls Atomic Power Laboratory Environmental Monitoring Report, (Reference 4-4 of the Draft Environmental Impact Statement), Kesselring Site operations, including waste water discharges to the Glowegee Creek have met applicable Federal, State, and local standards and have resulted in no observable adverse effect on fish and other aquatic life. The New York State Department of Health conducts independent environmental monitoring of radioactivity in water in the vicinity of the Federal reservation. The latest report on Environmental Radiation in New York State (Reference 4-29 of the Draft Environmental Impact Statement) states that analysis results "show values typical of normal background levels for gross alpha, gross beta, and tritium." New York State Department of Environmental Conservation personnel are allowed access to the Kesselring Site to take independent samples in the Glowegee Creek and to ensure that all applicable permit requirements and regulations are being met (see response to public hearing comment 3 for further information). There have been no fines or penalties levied, no enforcement actions taken, and no other adverse regulatory actions as a result of these independent inspections.

July 27, 1997

Mr. A. S. Baitinger, Chief
West Milton Field Office
U. S. Dept. of Energy
P.O. Box 1069
Schenectady, NY 12301

Dear Sir:

We prefer the deferred dismantlement of the reactors because by your DRAFT ENVIRONMENTAL IMPACT STATEMENT the radiological risks decrease several orders of magnitudes. As your report notes, the risk factors for accidents, should one occur, will be less after 30 years. 1

We sincerely hope you will consider our opinions the same as any politicians. Mayors and town supervisors cannot speak for anyone but themselves in this critical matter.

Very truly yours,

Mr. & Mrs. David Hicks
345 Middleline Road
Ballston Spa, NY 12020

Commenter: David and Joan Hicks

Comment Responses:

Comment 1.
The Naval Reactors Program acknowledges the commenters' support for the deferred dismantlement alternative. However, as summarized in Section 3.5 of the Draft Environmental Impact Statement, the environmental, health, and safety impacts of implementing any of the alternatives are small and comparable.

City of Saratoga Springs
J. Michael O'Connell, Mayor

August 4, 1997

A.S. Baitinger
Chief, West Milton Field Office
Naval Reactors
Department of Energy
P.O. Box 1069
Schenectady, New York 12301-1069

Dear Chief Baitinger:

I have reviewed the draft E.I.S. on the reactor plants in West Milton. Although I can understand the need to develop alternatives, from my perspective the prompt dismantlement option is the preferred one. In effect, this eliminates any on site storage for thirty years or indefinitely which the others require.

I would hope that the Naval Reactors Program will hold firm on the selection which is prompt dismantlement as the preferred alternative.

Sincerely,

J. Michael O'Connell
Mayor

cc: Wilbur Trieble
City Council
City Attorney

E:\WPWIN60\MAYOR\CORRESPO\BAITINGF

City Hall, Saratoga Springs, New York 12866-2296
518/587-3550 • 518/587-1688 fax

Commenter: J. Michael O'Connell, Mayor, Saratoga Springs, New York

Comment Responses:

Comment 1.
The Naval Reactors Program acknowledges the commenter's support for the prompt dismantlement alternative.

Aug 18 1997

Dear Mr. A. S Baitinger,

Thank you for sending me a copy of the statement for the disposal of S3G + D1G prototype reactors. My wife and I attended the Aug 4/97 meeting at the Wilton Town Hall, but unfortunately will not be in the area for the Aug 13/97 meeting. I'm sure the D.O.E. has decided how to dispose of these reactors contrary to any future meetings. My family and I have with a common boundary between us for 42 yrs in East Galway without any known major incident at Kesselring and I doubt if there will be any. You have only one of two choices. If you intend to close down in the near future, then you have to dismantle and be ready to ship it out. If you are going to stay in Galway and West Milton for the next fifty (50) years, then why not go for deferred dismantling and save yourself a headache. Putting the reactors in ~~protective~~ protective storage for 30 years until they decay may be the easiest of solutions. As you know from past experience, everyone has a complaint about how you ship. God forbid there was a mishap. Let them set for 30 years. I'm sure everyone within 50 miles and not adjacent to Kesselring had questions that even Moses would have trouble answering. I only wish I knew those who lived next to Kesselring, 1 mile from it, 5 miles, etc. I sure the most questions came from those who lived the furthest.

What ever you decide, I sure it will be for the best interests of all concerned especially Navy training.

Sincerely
George Koslowsky
2838 Baptist Hill Rd
Middle Grove N.Y.

Commenter: George Koslowski

Comment Responses:

Comment 1.
The Naval Reactors Program acknowledges the commenter's support for the deferred dismantlement alternative. As summarized in Section 3.5 of the Draft Environmental Impact Statement, the environmental, health, and safety impacts are small and comparable among all the alternatives.

While the commenter is correct in noting that deferred dismantlement has some advantages in terms of the ease of accomplishment and in context with continuing Kesselring Site operations, the Naval Reactors Program must take into consideration the full spectrum of impacts of all alternatives in its decision making process.

From an overall perspective, the Naval Reactors Program considers the prompt dismantlement alternative to be the preferred for the reasons discussed in Section 3.6.

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ADDITIONAL LETTERS

STATE CLEARINGHOUSE
NYS Division of the Budget
State Capitol, Albany, NY 12224
(518) 474-1605

SAI # 450845 U.S.Energy Department Disposal of Prototype Reactor Plants in West Milton

A S. Baitinger
U S Department of Energy
P.O. Box 1069
Schenectady, New York 12301-1069

Dear Applicant

The State Clearinghouse has submitted a summary of your proposed federal funding application identified above to the State and local review agencies participating in the New York State Intergovernmental Review Process No review agency has objected to, or commented on, your proposed project as described The review, therefore, is complete, and you may submit this clearance letter to the federal grantor agency as evidence that you have complied with the procedures set up under Presidential Executive Order 12372 If a substantial change is made in the nature or magnitude of the project, kindly submit a revised project notification to us and to the appropriate areawide clearinghouse

Please note that this clearance letter does not preclude applicants' responsibilities under other Federal requirements, i.e., those concerning Coastal Zone Management (CZM), the National Environmental Policy Act (NEPA), and section 106 of the National Historic Preservation Act Intergovernmental review does not take the place of those requirements

Very truly yours,

Marcia Roth

Marcia Roth
State Clearinghouse
Administrator

STATE OF SOUTH CAROLINA
State Budget and Control Board
OFFICE OF STATE BUDGET

October 1, 1997

Mr. A. S. Baitinger
Chief, West Milton Field Office Naval Reactor
U. S. Department of Energy
Post Office Box 1069
Schenectady, New York 12301-1069

Project Name: Draft Environmental Impact Statement, Disposal of the S3G and D1G Prototype Reactor Plants.

Project Number: EIS-970802-002

Dear Mr. Baitinger,

The Office of State Budget, has conducted an intergovernmental review on the above referenced activity as provided by Presidential Executive Order 12372. All comments received as a result of the review are enclosed for your use.

The State Application Identifier number indicated above should be used in any future correspondence with this office. If you have any questions call me at (803) 734-0485.

Sincerely,

Rodney P. Grizzle
Grants Services Coordinator

Enclosures

E-95

Budget & Control Board: Office of State Budget
South Carolina Project Notification and Review System
1122 Lady Street, 12th floor
Columbia, SC 29201

State Application Identifier EIS-970802-002
Suspense Date 9/12/97

George Bistany
South Carolina Department of Commerce

The Office of State Budget is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0494. Rodney Grizzle

RECEIVED
SEP 0 2 1997
Budget & Control Board
OFFICE OF STATE BUDGE

- [ ] Project is consistent with our goals and objectives.
- [ ] Request a conference to discuss comments.
- [ ] Please discontinue sending projects with this CFDA# to our office for review.
- [ ] Comments on proposed Application is as follows:

Signature: George Bistany Date: 8-28-97
Title: Grants Manager Phone: 734-0655

AUG 27 1997

Budget & Control Board: Office of State Budget
South Carolina Project Notification and Review System
1122 Lady Street, 12th floor
Columbia, SC 29201

State Application Identifier EIS-970802-002
Suspense Date 9/12/97

Steve Davis
S.C. Department of Health and Enviromental Control

The Office of State Budget is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

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SEP 0 2 1997
Budget & Control Board
OFFICE OF STATE BUDGET

- [x] Project is consistent with our goals and objectives.
- [ ] Request a conference to discuss comments.
- [ ] Please discontinue sending projects with this CFDA# to our office for review.
- [ ] Comments on proposed Application is as follows:

Signature: [illegible] Date: 8/28/97
Title: Phone:

Budget & Control Board: Office of State Budget
South Carolina Project Notification and Review System
1122 Lady Street, 12th floor
Columbia, SC 29201

State Application Identifier EIS-970802-002
Suspense Date 9/12/97

Joel T. Cassidy
South Carolina Employment Security Commission

The Office of State Budget is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

E-96

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0494. Rodney Grizzle

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SEP 1 2 1997
Budget & Control Board
OFFICE OF STATE BUDGET

- [x] Project is consistent with our goals and objectives.
- [ ] Request a conference to discuss comments.
- [ ] Please discontinue sending projects with this CFDA# to our office for review.
- [ ] Comments on proposed Application is as follows:

Signature: Joel T. Cassidy Date: September 12, 1997

Title: Executive Director Phone: 803-737-2617

Budget & Control Board Office of State Budget
South Carolina Project Notification and Review System
1122 Lady Street, 12th floor
Columbia, SC 29201

State Application Identifier EIS-970802-002
Suspense Date 9/12/97

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AUG 2 9 1997
CHARLESTON OFFICE

Jeannie R. Kelly
S.C. Coastal Council

The Office of State Budget is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

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Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0494. Rodney Grizzle

RECEIVED
SEP 1 5 1997
Budget & Control Board
OFFICE OF STATE BUDGET

- [x] Project is consistent with our goals and objectives.
- [ ] Request a conference to discuss comments.
- [ ] Please discontinue sending projects with this CFDA# to our office for review.
- [ ] Comments on proposed Application is as follows:

Signature: [signature] Date: 9/11/97

Title: Phone:

Budget & Control Board: Office of State Budget

South Carolina Project Notification and Review System
1122 Lady Street, 12th floor
Columbia, SC 29201

State Application Identifier EIS-970802-002
Suspense Date 9/12/97

Dr. James A. Timmerman, Jr.
South Carolina Wildlife and Marine Resources Department

The Office of State Budget is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

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E-97

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0494. Rodney Grizzle

- [x] Project is consistent with our goals and objectives.
- [ ] Request a conference to discuss comments.
- [ ] Please discontinue sending projects with this CFDA# to our office for review.
- [ ] Comments on proposed Application is as follows:

Signature: Danny Johnson for Robert E. Duncan Date: 9/4/97

Title: Emer. Programs Director Phone: 732-0800

Budget & Control Board: Office of State Budget

South Carolina Project Notification and Review System
1122 Lady Street, 12th floor
Columbia, SC 29201

State Application Identifier EIS-970802-002
Suspense Date 9/12/97

RECEIVED
Emergency Preparedness Division
Office of the Adjutant General

Stan M. McKinney
Office of the Adjutant General

The Office of State Budget is authorized to operate the South Carolina Project Notification and Review System (SCPNRS). Through the system the appropriate state and local officials are given the opportunity to review, comment, and be involved in efforts to obtain and use federal assistance, and to assess the relationship of proposals to their plans and programs.

Please review the attached information, mindful of the impact it may have on your agency's goals and objectives. Document the results of your review in the space provided. Return your response to us by the suspense date indicated above. Your comments will be reviewed and utilized in making the official state recommendation concerning the project. The recommendation will be forwarded to the cognizant federal agency.

Should you have no comment, please return the form signed and dated.

If you have any questions, call me at (803) 734-0494. Rodney Grizzle

- [x] Project is consistent with our goals and objectives.
- [ ] Request a conference to discuss comments.
- [ ] Please discontinue sending projects with this CFDA# to our office for review.
- [ ] Comments on proposed Application is as follows:

RECEIVED
SEP 17 1997
Budget & Control Board
OFFICE OF STATE BUDGET

Signature: Stan M. McKinney Date: Sept. 12, 1997

Title: Director Phone: (803) 734-8020

ORAL AND WRITTEN COMMENT AT PUBLIC HEARING
DEPARTMENT OF ENERGY
Draft Environmental Impact Statement
Disposal of S3G and D1G Prototype Reactor Plants
August 13, 1997

My name is Linda Williams. I'm a Ballston Spa resident, and through my association over the past ten years with numerous former and current Kesselring personnel who designed, operated, repaired and inspected the Site's reactor plants, have gained a great deal of knowledge about their operation. Through my attempts to obtain Freedom of Information documents regarding Kesselring's operation, I have also gained a knowledge of how information is denied, accidents covered up, and what I call the Navy's "doublespeak." An example of doublespeak is the Navy's assertion that DEC monitors the outflow water in the Gloweegee Creek. However, no one verifies where or if the DEC itself is allowed access to place testing equipment and what equipment is used. To the best of my knowledge, Kesselring is on the honor system to withdraw water samples itself and present the results to the DEC. Testing can be easily manipulated by where equipment is placed and when the samples are drawn.

With this knowledge, I was focused on listening "between the lines" to Mr. Guida's responses to the Milton Town Board members at a recent public meeting. When trying to defend allegations that many drums of radioactive waste are buried on the Kesselring premises, Mr. Guida said the managers had been asked if they polled their employees to see if anyone had knowledge of buried drums. And the managers assured officials that they had indeed polled their employees and their was no such knowledge. Compare that with

the statement in the fraudulent GAO report of 1991 where investigators state they contacted all persons whose names had been given them who wanted to give information. Not only did the GAO investigators not contact persons on the list, but one former KAPL employee died of asbestosis waiting to be contacted by the GAO. The GAO had knowledge that his death was imminent and failed to act.

For the record, I am in favor of immediate dismantlement. However, I am very concerned about the ability to obtain Congressional appropriation of funds in light of the recently reported failure of Lockheed Martin to clean one acre of Idaho contamination and other revelations in the January 31, 1997, GAO report, document GAO/RCED-97-49R, "Nuclear Waste: DOE's Estimates of Potential Savings From Privatizing Cleanup Projects.

I am also very concerned about future use of the hortensphere, the current home of the D1G reactor. This has not been addressed in the current EIS and could covertly be used for nuclear waste storage. In a hearing July 22, 1994, I warned against future importing of radioactive waste to the Site. Part of the waste to be stored in the proposed expansion of Building 91 will be imported from the KAPL facility in Niskayuna. Where will the waste come from next?

The towns and cities of Saratoga County and the NYS legislators have little idea of the depths to which Nuclear Naval officials will sink to accomplish their goals.

I'd like to read an exerpt from the July 28, 1993, US Senate

Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence hearing transcript. Following considerable litigation, Federal District Court Judge Harold Ryan had granted the State of Idaho an injunction against additional shipments of high level radioactive spent fuel rods until the DOE/Navy prepared an Environmental Impact Statement under the provisions of NEPA. The Naval Nuclear Propulsion Program *then* requested the above named committee and Congress exempt it from NEPA--one of this Nation's most basic environmental laws.

The following is from Idaho's Governor Andrus' testimony, on pages 28 and 29:

> Early on in the litigation, the Federal Government submitted the declaration of Admiral DeMars to support its position that substantial disruption would follow if the relief requested by Idaho was granted. He stated that the only place to store spent nuclear fuel removed from nuclear-powered warships and submarines is the INEL...and ...[work] would come to a halt if shipments of spent nuclear fuel were enjoined, leading to thousands of lost jobs and an inability to return vessels to the fleet.
>
> As Idaho would discover, the Admiral's testimony was prepared by Richard Guida, the Associate Director of Regulatory Affairs for the U.S. Naval Nuclear Propulsion Program. Mr. Guida was deposed and, in the course of that deposition, conceded that the NNPP has the flexibility to store the spent nuclear fuel elsewhere until the required EIS is completed.
>
> Mr. Guida testified that over one-third of the Navy's shipments to Idaho would be comprised of spent nuclear fuel removed from the U.S.S. Enterprise. He then conceded that the fuel had already been removed from the U.S.S. Enterprise and was being stored in a facility at Newport News, Virginia. He further conceded that the fuel can remain stored in that facility for the next 2 to 3 years.

Further testimony under oath showed that none of the 18 nuclear powered vessels scheduled to be overhauled, defueled, refueled or inactivated during the period of time projected to

complete the EIS would be affected by the injunction.

Richard Guida did not admit the truth until questioned under oath. Neither this Draft EIS or the Navy's presentation today is under oath. Anyone here who still wants to trust everything the Navy has to say today, I have some oceanfront property in Arizona I'd sure like to sell you.

Linda G. Williams
PO Box 553
Ballston Spa, NY 12020
(518) 885-9678

August 6, 1997
John P. Shannon
262 Jones Road
Saratoga Springs
NY 12866
518 587 3245

This letter was read at the August 13, 1997 public hearing by Mr. James Lambert.

To the Leaders of Saratoga County:

I attended a meeting at the Milton Town Hall, on July 28, 1997, concerning the dismantling of major radioactive nuclear plant components and of a proposal to greatly increase storage of radioactive materials at the Kesselring Site Operation (KSO). As a result of the meeting I have comments to make based on personal knowledge of Naval Reactors deception, as well as on the documented track record of the Department of Energy (DOE) as an organization that does not hesitate to resort to wholesale coverups of its misdeeds. The meeting appeared to have been called and chaired by Mr. Richard Guida, a Federal Government employee from Washington, D.C.

Mr. Guida made several incorrect and misleading statements concerning a report written about KAPL/KSO. This fraudulent document is currently under investigation by the FBI and the U.S. Attorney's Office. Previously, Mr. Guida lied to the Governor of Idaho regarding storage of radioactive waste by Naval Reactors (NR) in that state, as documented in ISBND-16 D43425-4, 103rd Congress, July 28, 1993. The State of Idaho also sued the DOE/NR concerning other false statements made to Idaho officials concerning the kind and amount of radioactive material that would be sent to that state.

A recent article written by Fredreka Schouten, and published in the Saratogian, concerns and attempt by the Federal Government (DOE) to clean up a single acre of contaminated soil in the State of Idaho. The article states that not a single square inch of contaminated soil has been removed after the expenditure of $179,000,000. The contractor, Lockheed Martin, the same contractor now running the KSO site, is now requesting an additional $158,000,000 to complete clean up of the same acre. Using this case as a measure of radioactive site cleanup costs, the cost of cleaning up the KSO will be staggering, if ever done at all. We should not forget the Hanford site in the State of Washington, which, after spending billions for a radioactive cleanup has little, if any, progresses to show.

The subject of the KSO dismantling and increased radioactive waste storage, is of such importance that it must be a concern to all citizens of New York State, and of special concern by every other Town in Saratoga County. I submit that only the State of New York has the technical resources to oversee such a project and to provide daily independent oversight of these people. The oversight is an absolute necessity. The State Courts should also be involved to enforce any contracts or promises made by Mr. Guida, or any other DOE employee or DOE contractor. Unless Saratoga and NY State becomes involved we will all be stuck with long term radioactive/hazardous dump sites, Mr. Guida's promises notwithstanding.

The issues of dismantling major radioactive plant components and of greatly increasing storage of radioactive materials at KSO are orders of magnitude more serious than the recent dispute in the Town of Northumberland over a conventional (non-radioactive) landfill. The KSO and its sister site in Niskayuna are quite likely the biggest ecological disasters in New York State since Love Canal. The bottom line is that, based on their own documented track record, neither Naval Reactors nor the Department of Energy are to be trusted. And, they should never be trusted to oversee this potential risk to the citizens of New York State.

Respectfully Submitted,

John P. Shannon

John P. Shannon

Distribution: Saratoga County Supervisors, Saratoga County Mayors
Mr. J. Michael O'Connell, Mr. Edward King, Mr. Philip Klein, Mr. John E. Lawler, Mr. Marvin LeRoy, Mr. Paul F. Lilac
Mr. Richard Lucia, Mr. Roy McDonald, Mr. Frederick J. McNearney, Mr. David Meager, Mrs. Jean Raymond,
Mr. Paul St. John, Mr. Robert Stokes, Mr. Wilbur Trieble, Mr. Richard Weber, Mr. Thomas J. Higgins, Mr. John Romano,
Mr. Raymond F. Callahan, Mrs. Anita Daly, Mr. Lawrence DeVoe, Mr. Henry Guthers, Jr., Mr. Robert Hall, Mr. James Hovey
Mr. Richard Hunter, Mrs. Mary Ann Johnson, Mr. Christopher Sgambati

cc: Governor Geoge Patacki

MISCELLANEOUS

ATTACHMENTS

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CPP-603 Safety Analysis Report to meet new Department of Energy requirements is scheduled to be completed by February 1995.

Actions are being taken to mitigate degraded conditions. Routine fuel handling operations at CPP-603 have been suspended until recovery actions relative to corroded equipment and fuel separation issues can be completed. These recovery actions are being conducted on a case-by-case basis with Department of Energy approval required for each fuel movement.

Senator GLENN. Secretary Grumbly, if the Nuclear Regulatory Commission has certified several dry storage systems for long-term storage of commercial PWRs and BWRs, why haven't you considered that option?

Secretary GRUMBLY. We are actively considering these options. The specific storage options to be used will be selected after trade-off studies to be accomplished in the future.

Senator GLENN. Secretary Grumbly, will the planned re-racking of Navy fuel in CPP-666 delay the removal of spent fuel from non-Navy reactors currently being stored in CPP-603 and how have you justified this in light of reports that CPP-603 is inadequate for storage of any spent fuel?

Secretary GRUMBLY. No, there is sufficient space in CPP-666 to accommodate the CPP-603 transfers without the re-racking of the CPP-666 basins.

QUESTIONS SUBMITTED BY SENATOR TRENT LOTT

Senator LOTT. Admiral DeMars, please elaborate on the national security implications of tying up decommissioned ships at the pier rather than removing the fuel and deactivating them.

Admiral DEMARS. Berthing ships at the pier with fuel on board rather than removing the fuel and completing the inactivation ties up highly trained operating personnel and incurs maintenance and storage costs, to the detriment of the active fleet.

Senator LOTT. Admiral DeMars, please provide a rough schedule of the number of ships scheduled into each shipyard each quarter for refueling or defueling (hull numbers not needed).

Admiral DEMARS. The following is a preliminary schedule of ships planned to be refueled or defueled at each shipyard through fiscal year 1996. Changes to this schedule are expected over the next several months as a result of the base closure process and budget cuts under review within the Department of Defense.

	Fiscal years		
	1994	1995	1996
Portsmouth	1		1
Norfolk	1		1
Charleston	2	2	1
Puget Sound	7	4	5
Mare Island	2	1	
Pearl Harbor	2	1	
Newport News	1		

Senator LOTT. Admiral DeMars, please explain the Guida deposition statement that there was storage for the U.S.S. *Enterprise* fuel for 2 to 3 years.

Admiral DEMARS. There is no inconsistency between Mr. Guida's statements in his January 1993 deposition and the Navy position on spent fuel from the U.S.S. *Enterprise* and other ships. Mr. Guida's testimony has been quoted either incorrectly or out of context.

a. Mr. Guida correctly testified that the injunction would not interfere with the U.S.S. *Enterprise* refueling—and that the fuel removed from U.S.S. *Enterprise* could remain at Newport News for 2 to 3 years—as the Governor reports in his testimony. But the Governor does not quote Mr. Guida's clarifying testimony to the effect that storing instead of shipping that fuel would preclude timely fuel examination, deviate from current practice and thus give rise to potential challenge, and preclude defueling of the nuclear cruiser, U.S.S. *Long Beach*, and possibly refueling the nuclear carrier, U.S.S. *Nimitz*.

b. Mr. Guida correctly testified that there are enough containers to store fuel from the eight ships identified in a deposition question from Idaho, all of which initiated refueling or defueling in fiscal year 1993 or earlier. The Governor, however, does not cite Mr. Guida's subsequent statements at that same deposition explaining that this would preclude timely inspection of the fuel, impact later refuelings, and not solve the problem of an injunction lasting until late 1995 when the Department of Energy predicted getting the environmental impact statement completed.

c. The Governor testified that the Navy response to a February 1993 interrogatory said only 2 of 20 scheduled refuelings and defuelings could not be supported through fiscal year 1994. Actually, the Navy response said that 5 of 21 submarines and two of three surface ships (i.e., a total of 7 of 24 vessels) would be unsupported. The figures presented to the Senate Armed Services Committee on July 28, 1993, differ only in that they have been updated to reflect changes in schedules and spent naval fuel shipments made after February but prior to the injunction.

d. The Governor correctly quotes Mr. Guida as testifying that spent naval fuel examinations have not revealed any safety problems on operating reactors—but he does not quote that part of the deposition where Mr. Guida explained how important these examinations are to research and development efforts to design longer-lived fuel, and how they have been instrumental in the program achieving its over 4,200 reactor years of safe naval reactor operation.

Excerpts from Mr. Guida's testimony and the Navy's interrogatories are attached for the record, juxtaposed against statements made in the Governor's testimony.

Quotation from Governor Andrus' July 28, 1993 Testimony for the Senate Armed Services Committee	Actual Statement from the Transcript of the Deposition of Richard A. Guida
Q. [A]ssume the Court enjoined any further shipments of spent naval fuel to INEL for the next two to three years, and assume the USS Enterprise's spent nuclear fuel remains stored during that two to three year period [in the facility at Newport News], . . would [the U.S. Naval Nuclear Propulsion Program] have enough shipping containers available to store at the applicable shipyards the spent nuclear fuel that has not yet been removed from the USS Los Angeles, USS Haddock, USS Philadelphia, USS A. Hamilton, USS H.L. Stimson, USS G.W. Carver, USS W. Rogers, and USS Texas?	
A. The answer is that there are sufficient shipping containers to allow the fuel to be removed from those ships, so as not to cause an impact on those specific refuelings and defuelings.	A. The answer is that there are sufficient shipping containers to allow the fuel to be removed from those ships, so as not to cause an impact on those specific refuelings and defuelings, but then creating a potential problem for refuelings and defuelings that will come subsequent to those specific refuelings and defuelings.
Testimony by Cecil D. Andrus, Governor of Idaho, at 14.	*Deposition of Richard Anthony Guida, January 25, 1993*, at 163.

NOTE: The eight ships cited by the State in their question were all in FY 1993 or before.

Quotation from Governor Andrus' July 28, 1993 Testimony for the Senate Armed Services Committee	Actual Statement from the Transcript of the Deposition of Richard A. Guida
Mr. Guida testified that over one-third of the Navy's shipments to Idaho would be comprised of spent nuclear fuel removed from the USS Enterprise. He then conceded that the fuel had already been removed from the USS Enterprise and was being stored in a facility at Newport News, Virginia. He further conceded that the fuel can remain stored in that facility for the next two to three years. *Guida Depo.*, at 47, 92-93 and 96. *Testimony by Cecil D. Andrus, Governor of Idaho*, at 13.	Q. Assume, if you will, the court enjoined and further shipments of spent naval fuel to INEL. Could the USS Enterprise spent nuclear fuel remain stored in the surface ship support barge for the next 2 to 3 years? A. It is physically possible, but there would be impacts -- significant impacts. Q. Could you describe those impacts? A. Yes. The situation with the ENTERPRISE refueling and the ENTERPRISE facility that supports that refueling is such that the same facility is intended for use, scheduled reuse to support the defueling and deactivation of the USS LONG BEACH, which is a cruiser, and that would begin in mid-1994, and it's also scheduled to be used for the refueling overhaul for the USS NIMITZ, which is a nuclear-powered aircraft carrier, which is scheduled to occur later this decade. *Deposition of Richard Anthony Guida, January 25, 1993*, at 96-97.

Statement in Governor Andrus' July 28, 1993 Testimony for the Senate Armed Services Committee	Actual Response to the Governor's 3rd Set of Interrogatories
The state thereafter sought to determine whether the same answer would apply to the 11 nuclear-powered warships and submarines that are scheduled for overhauls and refuelings or defuelings and inactivations in fiscal year 1994. The following question was asked: Assuming you were enjoined from any further shipment of spent naval fuel to the Idaho National Engineering Laboratory for the next two to three years, . . . [are] enough shipping containers available to store during that period of time the spent fuel that has not yet been removed from the other [11] warships (including submarines scheduled for inactivation) listed on the document entitled "Warships Commencing Refueling/Defueling by October of 1994 (Planning as of 12/31/92)?"	
The answer yet again was "yes" for nine of those vessels, with the Naval Nuclear Propulsion Program admitting that "[s]ufficient shipping containers are available [at the applicable shipyards] to receive the spent naval fuel from [the] USS George Bancroft, USS Von Steuben, USS Benjamin Franklin, USS Francis Scott Key, USS Tecumseh, USS Omaha, USS Baton Rouge, USS Virginia, USS Memphis." *DOE's Responses to Governor Andrus' 3rd Set of Interrogatories*, at 3-4. In other words, the work scheduled on those nine nuclear-powered vessels can go forward next fiscal year as planned, unimpeded by the injunction.	Sufficient shipping containers are available to receive the spent naval fuel from USS Los Angeles, USS Haddock, USS Philadelphia, USS A. Hamilton, USS H.L. Stimson, USS G.W. Carver, USS W. Rogers, USS Texas, USS George Bancroft, USS Von Steuben, USS Benjamin Franklin, USS Francis Scott Key, USS Tecumseh, USS Omaha, USS Baton Rouge, USS Virginia, USS Memphis, and 8 of 13 submarine inactivations listed on the document entitled "Warships Commencing Refueling/Defueling by October of 1994 (Planning as of 12/31/92)." Sufficient containers would not be available to support USS Long Beach and USS Truxtun defueling and inactivation, nor 5 of the 13 submarine inactivations currently scheduled for Fiscal Year 1994.
Testimony by Cecil D. Andrus, Governor of Idaho, at 14.	*DOE's Responses to Idaho's Third Set of Interrogatories*, at 4.

Senator LOTT. Admiral DeMars, on page 13 of Governor Andrus's testimony, he mentions a facility at Newport News in which you can store fuel. Will you please describe this facility?

Admiral DEMARS. The facility at Newport News that stores fuel is a water basin in the Surface Ship Support Barge, a Government-owned barge used to support east coast refuelings of nuclear powered aircraft carriers and defueling of U.S.S. *Long Beach* (CGN 9). The barge is a section from a former tanker that was originally used to support U.S.S. *Enterprise* refuelings in 1963 and 1970, and then was refurbished in 1990 for a 50-year additional service life at a cost of $80 million. The water basin in the barge is approximately 14 feet wide, 53 feet long, and 31 feet deep. Sixty percent of this space is used for holding fuel and the remaining space is reserved for fuel servicing equipment. Fuel is transferred from the ship in a rugged, shielded container and placed in holding racks in the Support Barge water basin. While in the water basin, non-fuel support structure is removed from the fuel so that the fuel can fit in the shipping containers. The fuel is then transferred to the shipping container for shipment to the Expended Core Facility in Idaho for examination.

Senator LOTT. Admiral DeMars, please describe how the refueling barge works. I have heard it must be stored in the dry dock at a cost of $4.8 million per year. Why can't you just float the barge with fuel off to a corner of the harbor?

Admiral DEMARS. The refueling Support Barge is described above. The Support Barge is located in a large drydock. The average drydock charge the Government will pay for this Support Barge over the next year is $300,000 per month. In addition, the charges for labor and material associated with maintenance and operation of the barge and its supporting systems while loaded with spent fuel have averaged approximately $102,000 a month. Finally, there are costs of approximately $33,000 per month associated with security for the loaded shipping containers at Newport News. The total cost for barge drydocking, barge support, and loaded shipping container security of about $435,000 per month is the origin of the $4.8 million cost per year.

Although this equipment is installed on a barge, it does not constitute a floating spent fuel storage site, nor is it a proper conveyance to move spent fuel from one shipyard to another. When in use, the barge sits next to the ship in drydock until all of the spent fuel has been removed from the ship to the barge, and then is transferred from the barge to shipping containers. When all of the spent fuel has been offloaded, the barge is towed to another pier awaiting its next use with a carrier or cruiser.

It is preferable to have the barge in a drydock because that facilitates maintenance work and enhances security.

Senator LOTT. Secretary Dalton, what will be your plan if the localities around your nuclear shipyards contend in the courts that you need an environmental impact statement? How will you proceed while preparing one?

Secretary DALTON. The options available during the pendency of the environmental impact statement are storage of spent fuel in ships or storage in shipping containers, to the extent the latter are available. If the injunction is not removed, both options will be used in the near term as was described during Admiral DeMars' testimony, but both entail disruption of normal practices and incur substantial costs. Both are safe owing to the rugged nature of naval fuel and conservative design of naval ships and spent fuel shipping containers. The Navy will immediately undertake preparation of any required environmental assessment under the National Environmental Policy Act covering sites where spent naval fuel will be stored pursuant to the injunction.

Senator LOTT. Secretary Dalton, it appears to us that the Navy has been swept into an ongoing dispute between the Department of Energy and the State of Idaho, and that you are being held hostage. Is the Navy getting adequate support from the Department of Energy to get the injunction lifted?

Secretary DALTON. Yes, we are. The Department of Energy has agreed to pursue legislative and judicial relief if we cannot reach prompt agreement with the Governor. As you suggest, many of the issues in this lawsuit are uniquely the Department of Energy's, so we will continue to work closely with them since the satisfactory and timely completion of their environmental impact statement is pivotal to resolving the dispute with Idaho.

Senator LOTT. Secretary Grumbly, the Department of Energy recently agreed, at the urging of the Secretary of State, to accept spent fuel from foreign research reactors. Does any of that go to Idaho, and is it included in the injunction?

Secretary GRUMBLY. Secretary O'Leary proposed to renew the U.S. policy regarding the receipt of foreign research reactor spent nuclear fuels. The original program, begun in 1978 to help deter nuclear proliferation, expired in 1988. Now, the

Attachment E-2
supporting response to
Lambert / Shannon Comment 9
and Lambert Comment 21.

Department of Energy
Washington, DC 20585

July 31, 1997

The Honorable Wilbur Trieble, Supervisor
Town of Milton
503 Geyser Road
Ballston Spa, NY 12020

Dear Mr. Trieble:

During the public meeting on July 28, 1997 concerning Kesselring Site efforts to dismantle inactive facilities, two members of the public, Mr. John Shannon and Mr. James Lambert, alleged that the Site is not subject to oversight by State or Federal environmental regulators, and that the Naval Nuclear Propulsion Program is exempt from environmental requirements. As I explained at the meeting, those allegations are wrong. I offered to memorialize my comments in a letter so that the councilmembers have a record; this letter does that.

The Naval Nuclear Propulsion Program in general, and the Kesselring Site in particular, are subject to all federal environmental statutes and, where the federal statutes waive sovereign immunity, state and local environmental statutes and ordinances as well. Specifically:

1. For chemically hazardous waste, including mixtures of such waste with radioactivity (called "mixed waste"), we must comply with the federal Resource Conservation and Recovery Act and the corresponding New York State statute and regulations. We must also comply with the Federal Facility Compliance Act which requires us to have a State-approved Site Treatment Plan identifying how much mixed waste we have and expect to generate, and where that mixed waste is scheduled to go for treatment so that it may be disposed of.

2. For accidental releases of hazardous substances, and for cleanup of such substances, which includes Atomic Energy Act radioactivity, we must comply with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA - also known as SUPERFUND) and the SUPERFUND Amendments and Reauthorization Act (SARA). What these statutes require is that Federal facilities be reviewed so that EPA can determine whether to list them on the National Priorities List (NPL) of facilities requiring expedited cleanup with EPA setting the standards. Kesselring was reviewed by EPA Region II on that point in the early 1990s, and Region II issued a letter dated May 27, 1994, copy enclosed, which concluded that Kesselring did <u>not</u> qualify for the NPL. For facilities not on the NPL, CERCLA provides that state requirements governing cleanup apply. Thus, when the Kesselring Site ultimately ceases operation at some indefinite time in the future, and the Program acts to release the site for

unrestricted use, we will have to meet New York State requirements for that purpose.

This is the same general process which we used in releasing the Charleston Naval Shipyard in South Carolina, and the Mare Island Naval Shipyard in California, for unrestricted use. As I explained at the public meeting, both facilities were closed as a consequence of Base Realignment and Closure Commission decisions, and each went through a detailed characterization process, approved and overseen by their respective State regulatory agencies and EPA regional offices, to ensure protection of the environment and the public. Attached are letters from the relevant regulators commending the Naval Nuclear Propulsion Program on our efforts which resulted in each facility receiving radiological free release approval in April 1996. Also attached is a report detailing the extensive efforts undertaken to search for Program radioactivity in the environment, and the very small amounts - less than that found in a typical household smoke detector - which had to be removed to meet state requirements. This would not have been possible were it not for the comprehensive and conservative requirements which the Program has applied to the control of radioactivity since the beginning of nuclear work at the shipyards in the 1950s. Those same controls apply to the Kesselring site.

3. For the management and disposal of toxic substances such as polychlorinated biphenyls, we must comply with the federal Toxic Substances Control Act.

4. For airborne emissions of hazardous materials, including radioactivity regulated under the Atomic Energy Act, we must comply with the provisions of the Clean Air Act and the corresponding New York State statute and regulations.

5. For waterborne emissions of hazardous materials, we must comply with the Clean Water Act and the corresponding New York State statute and regulations. Under a 1976 U.S. Supreme Court ruling, the Clean Water Act was determined not to apply to Atomic Energy Act radioactivity regulated by the Nuclear Regulatory Commission for commercial nuclear power plants, by the Department of Energy for their facilities, or by the Naval Nuclear Propulsion Program for activities performing nuclear propulsion work. Congress has not amended the Act since then to change those regulatory distinctions.

6. For chemically hazardous materials, and Atomic Energy Act radioactivity, relevant to groundwater and aquifers, we must meet the requirements of the federal Safe Drinking Water Act.

In the interest of completeness, please note that there are other federal environmental statutes, too numerous to list, which we are also required to meet. These include the Fungicide, Insecticide and Rodenticide Act and, of course, the National Environmental Policy Act. I believe that the list above covers those of greatest significance to the councilmembers. In addition, and although not required to do so under federal law, the Program has a long history of interactions with the Nuclear Regulatory Commission (NRC) including getting NRC review of, and agreement with, our reactor and reactor plant designs. This serves to provide further assurance that naval reactor designs are safe and protective of human health and the environment.

At the Kesselring Site, we have received during the past decade over 75 inspections from federal and state regulators, many of whom held security clearances allowing them access to classified areas within the Site. During that time, we have never been cited for a significant violation or received a fine, a penalty, or any enforcement action. These inspections, and their results, are a matter of public record; enclosed is the latest Site environmental history report which recites the dates and subjects of each inspection. I should also note that contrary to Mr. Shannon's assertion, our policy is, and always has been, to provide a security clearance to any regulator who requires one to perform his or her duties; we have never refused to process any clearance requests from regulators.

Finally, I have also enclosed a copy of the audit which I mentioned during the public meeting, performed by the Congressional General Accounting Office in 1990-1991 covering environmental, safety and health activities at Program facilities, and the testimony which they gave to Congress at that time. As you can see, the audit and the testimony lauded the Program as a "positive program" within DOE, and found "no significant deficiencies."

I appreciate the opportunity to set the record straight on this matter, and especially appreciate the careful consideration which the Council is giving to our desire to expand the floor area within Building 91 at the Kesselring Site for temporary storage of waste incidental to facility dismantlement. That matter is described in a separate letter to the Council from Mr. Andrew Baitinger, Chief of our West Milton Field Office. If you have any further questions, or need any further information, please do not hesitate to contact Mr. Baitinger or myself.

Sincerely,

Richard A. Guida

Richard A. Guida, P.E.
Associate Director
for Regulatory Affairs
Naval Nuclear Propulsion Program

Copy to:
Mr. Phil Salm, Manager, SNRO
Mr. Andrew Baitinger, Chief, West Milton Field Office
Mr. Albert Dewey, Emergency Planning Director, Saratoga County
Mr. George Stahler, NYSDEC Region V

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET. N.E.
ATLANTA. GEORGIA 30365

March 14, 1996

4WD-FFB

HAND DELIVERY

CAPT William F. Nold
Commander, Charleston Naval Shipyard
Charleston, SC 29408-6100

SUBJ: Release from Radiological Controls Buildings and Areas at Naval Base Charleston

Dear Captain Nold:

The Environmental Protection Agency (EPA) has evaluated the radiological data from the surveys of buildings and areas at Naval Base Charleston, including the oversight data provided by the South Carolina Department of Health and Environmental Control (SCDHEC). Our evaluation includes EPA on-site oversight conducted in August and November 1995, and January and February 1996. We have been assured that Naval Base Charleston and the South Carolina Department of Health and Environmental Control have used the Nuclear Regulatory Commission's Draft "Manual for Conducting Radiological Surveys in Support of License Termination" (NUREG/CR-5849).

Our evaluation indicates no radiological problem in the areas surveyed. Therefore, EPA concurs with the release of these buildings and areas from radiological controls. To the best of our knowledge, all buildings and areas needing a radiological survey have been surveyed, except for the Defense Reutilization and Marketing Office (DRMO) which will be surveyed after operations there have been completed. While EPA has been involved in reviewing and approving incremental progress reports, it is our understanding that a final report will be issued which will document the results of all of these surveys.

Completion of the radiological investigation and cleanup effort accomplishes several notable milestones.

1. Under the Base Realignment and Closure Act (BRAC), Naval Base Charleston is required to conduct an environmental investigation for all types of environmental contaminants and to clean up contaminated parcels for transfer. It is important to note that the radiological investigation and cleanup is the first environmental investigation and cleanup to be completed.

2. The radiological investigation was very extensive and thorough. Yet, no radiological contamination of concern was found. This speaks very highly of the quality of work that the Navy has done in managing radioactive materials throughout the history of Naval Base Charleston.

3. Throughout this environmental investigation, Naval Base Charleston worked very closely and openly with the South Carolina Department of Health and Environmental Control (SCDHEC) and U.S. Environmental Protection Agency (EPA). Completion of this monumental effort in such a short timeframe shows the efficiency, effectiveness, and expediency which can be accomplished when governmental agencies work together as members of the same team with a common goal.

4. At no time did EPA ever feel that the Navy was "trying to hide something." Rather, the Navy always "wanted to do the right thing," and to do it well. This provides assurance to the future workers at Naval Base Charleston, and the community, and EPA that no radiological problem is being left at Naval Base Charleston.

5. Faced with the closure of Naval Base Charleston (something which is still almost unbelievable even to outsiders) and the loss of their jobs, it is important to note that the radiological workers took pride in their work to the very end never "slacking off" in the quality or quantity of their work. Their performance remained exemplary which says a lot about the professionalism of the people and the program.

Indeed, it has been a privilege to work with the personnel in the radiological program at Naval Base Charleston.

If you have any questions, please call me at (404) 347-3555, VMX 2061, or Jon Richards at (404) 347-3555, VMX 6904.

Sincerely,

Doyle T. Brittain

Doyle T. Brittain
Senior Remedial Project Manager

cc: Virgil Autry, SCDHEC
Henry Porter, SCDHEC
Ann Ragan, SCDHEC
Tommy Gerken, CNSY
Bobby Dearhart, CNSY
Daryle Fontenot, SODIVNAVFACENGCOM
Jon Richards, EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

March 19, 1996

Robert D. O'Brien, Director
Radiological Control Office, Code 105
Mare Island Naval Shipyard
Vallejo, CA 94592-5100

Re: Naval Nuclear Propulsion Program (NNPP) Radiological Survey Plan for Decommissioning of Mare Island Naval Shipyard, Volume I, dated 2/28/96, and Naval Nuclear Propulsion Program Radiological Final Report for Decommissioning of Mare Island Naval Shipyard, Volume II, dated 4/1/96.

Dear Mr. O'Brien:

The U.S. Environmental Protection Agency (EPA) has reviewed the subject documents. The subject documents describe the plans and final results for surveys and any necessary remediation of all known NNPP concerns at Mare Island Naval Shipyard. Our review of the Survey Plan consisted of reviewing the changes made to this document from the previously agreed to plan dated 11/14/95. Our review of the Final Report consisted of reviewing it for consistency with the Survey Plan and with previously agreed to site specific completion reports.

In addition to these reviews, we have also conducted jointly with the State of California various quality assurance oversight activities to assess the quality of the NNPP radiological survey work and to determine its consistency with the agreed to plans and procedures. These joint State and EPA oversight activities included inspections of the radiological counting laboratory at Mare Island, reviews of laboratory and backup documentation for the survey work, periodic observations of survey and remediaiton field work, reanalysis by EPA's National Air and Radiation Environmental Laboratory of selected solid samples collected by the Navy, and independent field instrument surveys.

The findings from the above oversight activities have to date demonstrated data quality and integrity consistent with the standards and procedures established by the NNPP Survey Plan and supporting documents and have not uncovered any problems which would alter the conclusions contained in the Final Report.

Our review of the su   ct documents finds that they have ad   sed all our outstanding comments and concerns. Based on this review and the oversight activities conducted by EPA and the State, we agree with the Navy's conclusion that all radiological concerns associated with the NNPP program at Mare Island Naval Shipyard have been resolved.

In addition, we would like to complement the Navy and the Mare Island personnel involved with this program on the tremendous effort and dedication demonstrated in completing this enormous task. We also greatly appreciate your cooperation in working with us to address our concerns and reach agreement on the Final Report.

If you have any questions regarding this letter, please call me at 415/744-2407.

Sincerely,

Tom Huetteman

Tom Huetteman
Remedial Project Manager

cc: Dick Logar, MINS
Chip Gribble, DTSC
Penny Leinwander, DHS
Vince Christian, RWQCB

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278-0012

MAY 2 7 1994

Mr. Drew Seepo, Director
Radiological/Environmental Control
and Safety Division
U.S. Department of Energy
Schenectady Naval Reactors Office
P.O. Box 1069
Schenectady, N.Y. 12301-1069

Re: Expanded Site Inspections Knolls Atomic Power Labs Niskayuna and Kesserling Sites

Dear Drew:

The U.S. Environmental Protection Agency (EPA) has completed reviewing the Expanded Site Inspection (ESI) reports which the Department of Energy (DOE) submitted for the Knolls Atomic Power Laboratory sites (Niskayuna and Kesserling). Attached please find the review reports for the subject sites prepared by our contractor Ebasco Environmental Inc. for the purposes of evaluating the facilities for possible listing on EPA's National Priorities List (NPL) under Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). EPA is assigning both of these facilities with a recommendation of Site Evaluation Accomplished (SEA) meaning that, based on current information, the sites do not qualify for inclusion on the NPL.

Although the sites do not qualify for the NPL, EPA is still concerned for the hazardous waste contaminants found at both sites and the possible effect on drinking water obtained from the groundwater and/or surface water. Therefore, EPA will be notifying the appropriate county health offices of our concerns regarding the two sites.

Furthermore, we understand that the extensive DOE environmental monitoring programs established for both of the aforementioned sites under the provisions of the Resource Conservation and Recovery Act (RCRA) will continue to be overseen by both EPA (RCRA program) and the New York State Department of Environmental Conservation (NYSDEC) with appropriate corrective action taken as required.

I hope this information proves helpful to you. If you have any questions, please call me at (212) 264-8670.

Sincerely yours,

Robert J. Wing, Chief
Federal Facilities Section

Attachments

cc: J. Rider, NYSDEC, w/o attach
A. Bellina, EPA, w/o attach

Attachment E-3
supporting response to
Lambert / Shannon Comment 9

Department of Energy
Schenectady Naval Reactors Office
Post Office Box 1069
Schenectady, New York 12301-1069

July 31, 1997

Mr. Wilbur Trieble, Supervisor
Town of Milton
503 Geyser Road
Ballston Spa, New York 12020

Dear Mr. Trieble:

The purpose of this letter is to provide the Town of Milton Board with supplementary information on actions that the Naval Nuclear Propulsion Program proposes to take to support dismantlement of inactive facilities at the Kesselring Site. These actions entail either promptly removing hazardous, radioactive, and other waste created from such work, or temporarily storing within an existing building those small quantities of mixed radioactive and hazardous waste created incidental to the work until arrangements can be made for the waste's shipment to facilities outside the State of New York for treatment and ultimate disposal.

As you know from our appearance before the Board on July 28, 1997, the Program has minimized, and will continue to minimize, the amount of mixed waste generated from Program work. We currently have about four cubic meters (2,900 gallons) in temporary storage at the Kesselring Site, compared to approximately 600,000 cubic meters at other DOE facilities. We manage this waste in full compliance with State hazardous waste regulations as well as Program radiological controls. We have also been successful in getting mixed waste shipped to facilities for treatment and disposal as soon as those facilities become available. For example, from the Kesselring Site alone, we made shipments of mixed waste late last year, early this year, and expect to make another shipment later this year.

Despite these efforts, however, we expect to generate small quantities of mixed waste which require temporary storage until facilities are available for treatment and disposal. Specifically, to allow us to proceed with facility dismantlement activities, we need an increase in temporary storage capacity at the Kesselring Site from the currently permitted limit of 7,500 gallons, to 13,000 gallons (about 16 cubic meters). If prompt dismantlement of the S3G and D1G reactor plants is adopted following completion of the Environmental Impact Statement recently issued for public review, and presuming that funding is available for that work, we expect to need a further increase in temporary storage capacity to 20,000 gallons (about 20 cubic meters - equivalent to a cube about eight feet on a side). With respect to this temporary storage capacity, I would like to emphasize the following points:

1. There is no need to construct new buildings or facilities at the Site; rather, we would simply use the space within an existing building;

2. We must obtain State approval for our proposed action and that approval process affords the public and interested parties the opportunity to express their views before the State makes a final determination;

3. Moreover, the State permit for mixed waste storage expires in 2001 and must be reviewed at that time. This affords a further opportunity for members of the Board and the public to review mixed waste storage at Kesselring;

4. We are not seeking, and we do not expect the State to approve, any provisions allowing the importation of mixed waste from any other sites for storage at Kesselring. We are, however, seeking agreement to allow small quantities of mixed waste from the Knolls Site in Schenectady to be shipped to Kesselring, but only for consolidation of like forms of waste, to facilitate shipment out of the State for treatment and disposal;

5. We will minimize the duration of temporary on-site storage of mixed wastes. Consistent with the Kesselring Site Treatment Plan prepared in compliance with the Federal Facility Compliance Act of 1992 and approved by the State, a copy of which has been placed in the Saratoga Library, wastes have been (and will be) shipped off-site as soon as treatment facilities become available. Attached to this letter is an excerpt from the Plan that identifies the dates and destination for all Kesselring Site mixed wastes currently on hand and forecast to be generated in the next five years. We do not have the authority to change any of those dates unilaterally. Failure to comply with the provisions of the State-approved Plan results in our being subject to fines and penalties set forth in the Plan or otherwise determined by the State pursuant to the Plan;

6. All of the mixed waste which we generate, or project to generate, contains low-level radioactive material. None of the mixed waste involves spent nuclear fuel, high level radioactive waste, or transuranic radioactive waste. The amounts of radioactivity present in a typical 55-gallon waste drum are comparable to those present in a household smoke detector;

7. The majority of the mixed waste is in the form of such things as electrical cabling, thermal insulating materials (lagging), brass or bronze fittings and valves, and other solid material which is not unusual in nature.

On behalf of the Program, I wish to express my appreciation to the Board for affording us the opportunity to discuss the facts and circumstances on this matter. I trust this letter is responsive to your needs.

A. S. Baitinger, Chief
West Milton Field Office

Attachment: As stated

cc: Mr. Philip Salm, Manager, SNRO
Mr. Richard Guida, Associate Director Regulatory Affairs, NR
Mr. Albert Dewey, Director, Saratoga County Emergency Services
Mr. George Stahler, New York State Department of Environmental Conservation, Region 5

Site Treatment Plan Annual Update for Knolls Atomic Power Laboratory Kesselring Site

TREATMENT FACILITY SCHEDULE ANALYSIS	TREATMENT FACILITY ID #	FACILITY NAME	SUBMISSION OF PERMIT APPLICATIONS	ENTERING INTO CONTRACTS	INITIATING CONSTRUCTION	CONDUCT SYSTEM TESTING	START DATE OF OPERATION	SUBMIT SCHEDULE OF BACKLOGGED & CURRENTLY GENERATED WASTE	PROJECTED SHIPPING DATE
1996 STP	RL-S006	Hanford WRAP I Facility	Jul 1998	Complete	Complete	Commenced Oct. 1995	Mar 1997	Complete	Sep 1998
1997 STP Annual Update	RL-S006	Hanford WRAP I Facility	Jul 1998	Complete	Complete	Complete	Commenced Mar 1997	Complete	Sep 1998

IMPACT ANALYSIS: The Hanford WRAP I Facility commenced operations in March 1997 The projected shipping date has not changed.

The following table summarizes the updated schedule for shipment of each mixed waste stream targeted to an off-site treatment facility

Waste Stream ID #	Waste Stream Name	Treatment Facility ID #	Treatment Facility Name	Current Projected Shipping Date	1996 STP Projected Shipping Date
KK-W002	Cadmium Plated Solids	RL-S007 (D)	Hanford Non-Thermal Treatment (Debris) Contract	Sep. 1999	Mar 2001
KK-W003	Oils	IN-S005	INEEL WERF Incinerator	See Note 1	Mar 1997
KK-W004	Miscellaneous Laboratory Chemicals without Metals	IN-S005	INEEL WERF Incinerator	See Note 1	Mar 1997
KK-W005	Organic Debris	IN-S005	INEEL WERF Incinerator	See Note 1	Mar 1997
KK-W006	Inorganic Debris and Equipment	RL-S007 (D)	Hanford Non-Thermal Treatment (Debris) Contract	Sep. 1999	Mar. 2001
KK-W007	Inorganic Sludges/Particulates	RL-S007 (ND)	Hanford Non-Thermal Treatment (Non-Debris) Contract	Sep 1999	Mar 2001
KK-W008	Organic Sludges/Particulates	IN-S005	INEEL WERF Incinerator	See Note 1	Mar 1997
KK-W009	Organic Debris without Metals	IN-S005	INEEL WERF Incinerator	See Note 1	Mar 1997
KK-W010	Elemental Lead (Lead Bricks, Sheets, or Wool)	RL-S007 (EL)	Hanford Non-Thermal Treatment (Elemental Lead) Contract	Mar. 2002	Mar 2001
KK-W011	Cutting Oils and Liquids	IN-S005	INEEL WERF Incinerator	See Note 1	Mar 1997
KK-W012	Miscellaneous Laboratory Chemicals	RL-S006	Hanford WRAP I Facility	Sep. 1998	Sep. 1998
KK-W013	Soils	IN-S150	INEEL Advanced Mixed Waste Treatment Project	Sep. 2004	Sep 2004
KK-W014	Mercury Contaminated Organics	IN-S128	INEEL WROC Mercury Retort Facility	Sep 2001	Sep. 2001
KK-W015	Mercury Contaminated Inorganics	IN-S128	INEEL WROC Mercury Retort Facility	Sep. 2001	Sep 2001
KK-W016	Elemental Mercury	IN-S150	INEEL Advanced Mixed Waste Treatment Project	Sep. 2004	Sep 2004
KK-W017	PCB Contaminated Waste	IN-S150	INEEL Advanced Mixed Waste Treatment Project	Sep. 2004	Sep. 2004
KK-W018	PCB Contaminated Waste (not amenable to incineration)	IN-S150	INEEL Advanced Mixed Waste Treatment Project	Sep 2004	Sep 2004

Site Treatment Plan Annual Update for Knolls Atomic Power Laboratory Kesselring Site

Note 1: The schedule milestone for shipment is complete. Any future shipment of this waste stream will commence upon accumulation of sufficient quantities to facilitate treatment.

The updated treatment facility schedule information identified above has been incorporated into Section 3.1 of both the Background Volume and the Compliance Plan Volume of the revised STP

KAPL-Kesselring is continuing to pursue commercial treatment of each mixed waste stream, via the Oak Ridge Reservation mixed waste treatment privatization effort, as a backup to the current planned treatment options. The 1996 KAPL-Kesselring STP Annual Update, identified a schedule for the Oak Ridge mixed waste treatment privatization effort which included planned issuance of a RFP by May 1996, and placement of a contract for full treatment in October 1996 Treatment of some waste streams was scheduled to begin in calendar year 1997. Although the schedule for this effort has subsequently slipped somewhat, progress is being made. In October 1996 DOE-Oak Ridge issued a draft Invitation For Bid (IFB) for the mixed waste treatment privatization effort, for review and comment within the DOE complex. In March 1997 DOE-Oak Ridge identified that they plan to issue an IFB for this effort in the third quarter of FY 1997, and to place a single phase contract for full treatment in the fourth quarter of FY 1997 Treatment of some waste streams under this contract is scheduled to begin in late 1997 or early 1998. This new schedule information concerning the Oak Ridge Reservation privatization effort has been incorporated in Section 3.1 of the revised STP. KAPL-Kesselring remains committed to pursuing commercial treatment for its small amounts of mixed waste through the Oak Ridge privatization effort.

In the 1996 STP Annual Update, KAPL-Kesselring informed NYSDEC that the DOE-Idaho Mixed Waste Focus Area (MWFA) and Envirocare of Utah had entered into a cooperative agreement under which polymer macroencapsulation technology and equipment developed by DOE was to be used by Envirocare to treat up to 500,000 pounds of lead and debris mixed waste in a demonstration effort. On October 18, 1996, DOE-Idaho MWFA informed the Naval Nuclear Propulsion Program (NNPP) that some NNPP mixed waste streams could be included in this demonstration effort. Detailed review of mixed waste streams KK-W002, KK-W006 and KK-W010, previously identified in the 1996 STP Annual Update as potential candidates for macroencapsulation treatment at Envirocare, determined that only a portion of mixed waste stream KK-W006 met the Envirocare waste acceptance criteria for this effort. On December 16, 1996, KAPL-Kesselring shipped 0.21 cubic meters of waste to Envirocare for treatment and disposal under the macroencapsulation demonstration effort, approximately 3 years ahead of the projected shipping date to the planned treatment facility for this stream (Hanford Non-Thermal Treatment (Debris) Contract). Because the contract was for a one time demonstration effort, no changes have been made to the STP planned treatment option for waste stream KK-W006, however KAPL-Kesselring remains committed to pursuing commercial treatment for any future generation of waste stream KK-W006. If future follow-on contracts with Envirocare are established, KAPL-Kesselring will re-evaluate at that time whether to pursue shipments of additional mixed waste to Envirocare under such contracts, and whether it is appropriate to propose changes to the STP planned treatment options.

Town of Milton

Wilbur L Trieble, Supervisor

503 Geyser Road • Ballston Spa, New York 12020
(518) 885-9220

Attachment E-4
supporting resp
Lambert / Shan
Comment 9

August 15, 1997

Department of Energy
Schenectady Naval Reactors Office
Post Office Box 1069
Schenectady, New York 12301-1069

Gentlemen:

The Town of Milton has received correspondence from George Stahler, NYS DEC in regard to their involvement in the monitoring of waste storage at the Kesselring Site at West Milton. The concerns of the Milton Town Board were addressed to our satisfaction.

The majority of mixed waste is scheduled to be shipped off site for treatment at the U.S. Department of Energy Waste Treatment Facilities by the year 2004; a specific process and schedule, which can only be modified by DEC approval, is in place.

Since the enlargement of the mixed waste area is part of the overall plan, we do not have a problem with the environmentally safe and secure storage of mixed waste until shipment can be made and a provision which requests that Kesselring be allowed to receive small amounts of mixed waste from Knolls Site in Schenectady only for the purpose of consolidation prior to off-site shipment.

Sincerely,

Wilbur L. Trieble
Supervisor

WLT/mam