Safety Evaluation Report

for the Renewal of

Special Nuclear Material License SNM-1227

for the

Siemens Power Corporation

Richland Engineering and Manufacturing Facility

Richland, Washington

Docket 70-1257

November 1996

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1. INTRODUCTION

1.1 General Information

On August 26, 1992, SPC submitted an application for renewal of license SNM-1227. During a site visit in December 1993, the U. S. Nuclear Regulatory Commission (NRC) and SPC representatives discussed NRC's comments on the renewal application. NRC's comments were submitted to SPC in letters dated April 25, June 14, and July 27, 1994. By letters dated September 12 and October 31, 1994, SPC provided additional information and revised pages to the renewal application. On October 28, 1996, SPC revised the renewal application in its entirety, incorporating changes resulting from NRC review comments and amendments issued during the period of timely renewal. By letter dated November 11, 1996, SPC submitted additional revised pages. This SER provides the conclusions of NRC staff review of the August 1992 renewal application; subsequent submittals of supplemental information; the responses to NRC's requests for additional information (RAI); the October 28, 1996, revised application, and the additional revised pages submitted by letter dated November 13, 1996.

The staff reviewed SPC's commitments, which are presented as proposed license condition in Part I of the renewal application, Chapters 1 through 8. the commitments address (1) the organization and administration of the nuclear safety program; (2) the technical requirements for the radiation safety, nuclear criticality safety, and environmental monitoring programs; (3) the emergency plan and (4) the decommissioning plan. Part I of the application contains specific performance requirements for the operations of the facility, and these requirements are inspectable by NRC regional office and NRC headquarters Fuel Cycle Operations Branch inspectors. The staff also reviewed the safety demonstration portion, Part II of the application, which is Chapters 9 through 15. The intent of these chapters is to illustrate how Part I is to be interpreted and to demonstrate the adequacy of SPC's proposed license conditions. The information in Part II is subject to change within the limitations and controls of Part I.

The application addresses only the health and safety areas of the license. The safeguards conditions, issued pursuant to 10 CFR Parts 70 and 73, are affected by this licensing action only to reflect the most recent Plan revisions, and remain in effect as a part of the license. To include both safety and safeguards conditions into one NRC license, the following license condition is recommended:

Condition 10. The license shall be deemed to contain two sections: Safety Conditions and Safeguards Conditions. These sections are part of the license, and the licensee is subject to compliance with all listed conditions in each section.

1.2 Site Description

The SPC Richland Engineering and Manufacturing Facility is located in the City of Richland, Benton County, in south-central Washington State, as shown on Figure 1.1. The facility is on the south side of Horn Rapids Road, which forms a southern boundary of the Hanford Reservation, a large facility formerly used by the federal government for the production of plutonium for

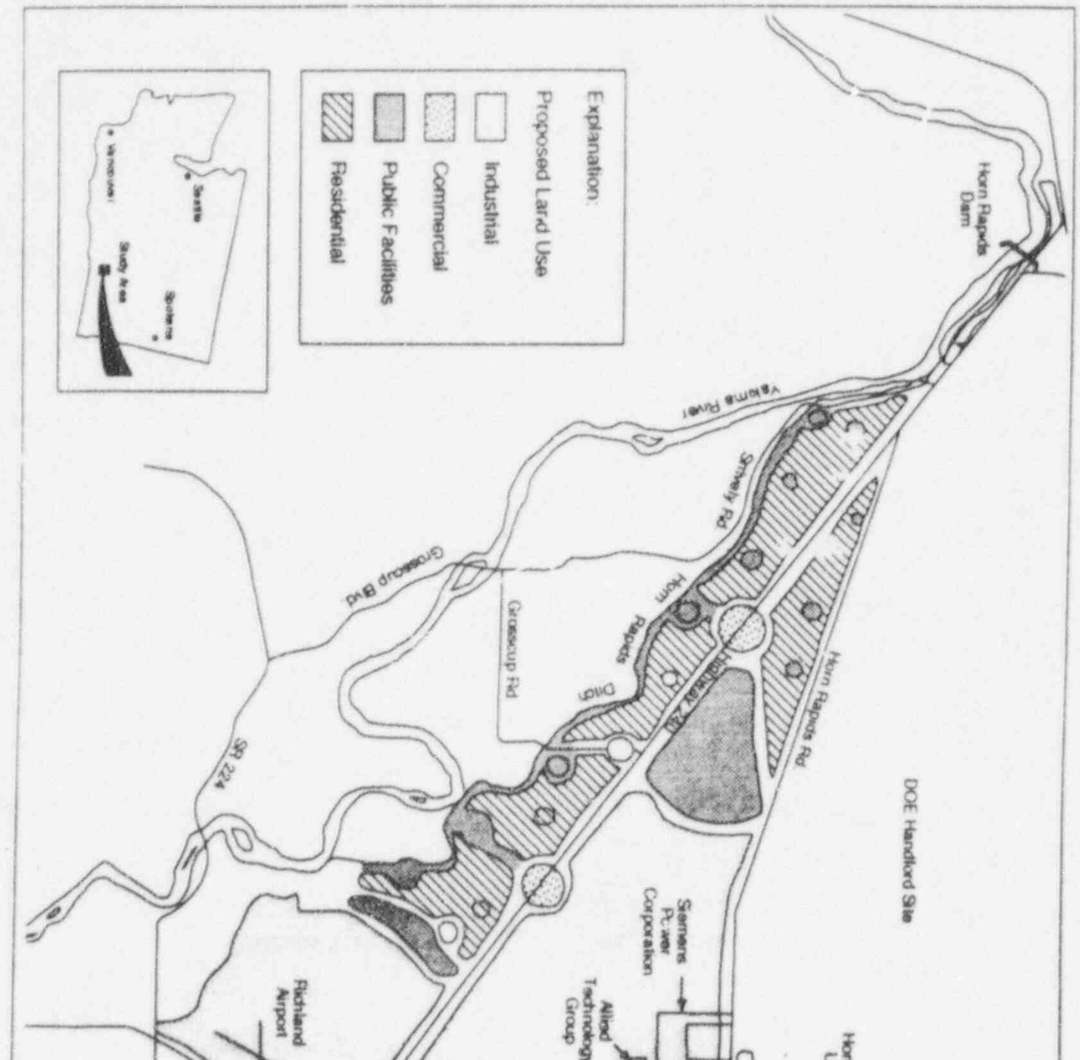

Figure 1.1 Location of SPC Site

national defense. The environment is a semiarid shrub and grassland between the Columbia and Yakima Rivers, at an elevation of 114 meters (373 feet) above mean sea level.

The facility is located on a 131-hectare (320-acre) site. The uranium handling and processing areas are located within a restricted 21.5 hectare (53-acre) area. The facility consists primarily of an office building complex, a uranium dioxide (UO_2) building, dry conversion facility (DCF) building, specialty fuels (SF) building, engineering laboratory operations (ELO) building, product development test facility (PDTF), process chemical waste storage lagoon system, materials warehouses, and ancillary facilities. These facilities are shown on Figure 1.2. The majority of the fuel fabrication activities are performed in the UO_2, DCF, and SF buildings.

SPC fabricates and assembles nuclear fuel assemblies for light-water reactors. This activity includes receipt, possession, storage, and transfer of special nuclear material. The fabrication and assembly steps include uranium hexafluoride (UF_6) to UO_2 conversion, UO_2 powder preparation, pellet pressing, rod loading, fuel bundle assembly, uranium scrap recycling, and waste treatment and disposal. The licensed facility produces about 700 metric tons (772 tons) per year of UO_2 from UF_6. The plant feed is UF_6 enriched to less than or equal to 5 weight percent U-235, and the primary product is fuel assemblies for use in nuclear power reactors.

The SPC operation uses either a wet ammonium diuranate (ADU) process or a dry conversion process to convert UF_6 into UO_2 powder. The ADU process uses chemical reaction and physical separation steps to convert UF_6 to UO_2. In the dry conversion process, UF_6 gas is reacted directly with a hydrogen-nitrogen-steam atmosphere in a fluidized bed to form UO_2 powder. The UO_2 powder is pressed into pellets, which are sintered and then loaded into fuel rods. The fuel rods are placed in storage and are withdrawn as needed and fabricated into fuel assemblies.

Ancillary facilities are used for the cleaning of contaminated clothing in the laundry facility, the storage of packaged special nuclear materials in the fuels storage warehouse and radioactive materials warehouse, the handling and storage of UF_6 cylinders in the UF_6 receiving and storage facility, recovery of ammonia from the lagoon system at the ammonia recovery facility (ARF), recovery of uranium from the lagoons at the lagoon uranium recovery (LUR) facility, incineration of combustible waste and uranium recovery at the solid waste uranium recovery (SWUR) facility in the SF building, and storage of plutonium-contaminated waste in the SF building.

1.3 License History

A special nuclear material license was first issued to Jersey Nuclear Company on December 14, 1970, primarily to authorize possession and storage only of UF_6 at maximum 5 weight percent uranium-235 (U-235) enrichment. The license was subsequently revised on September 14, 1971 to authorize processing operations with low-enriched uranium, but was conditioned to expire within 4 months and to require the submittal of supplemental information to the Environmental Report. The license was extended and amended to permit limited operations with mixed oxide in the Mixed Oxide & Specialty Fuels Building pending the environmental review.

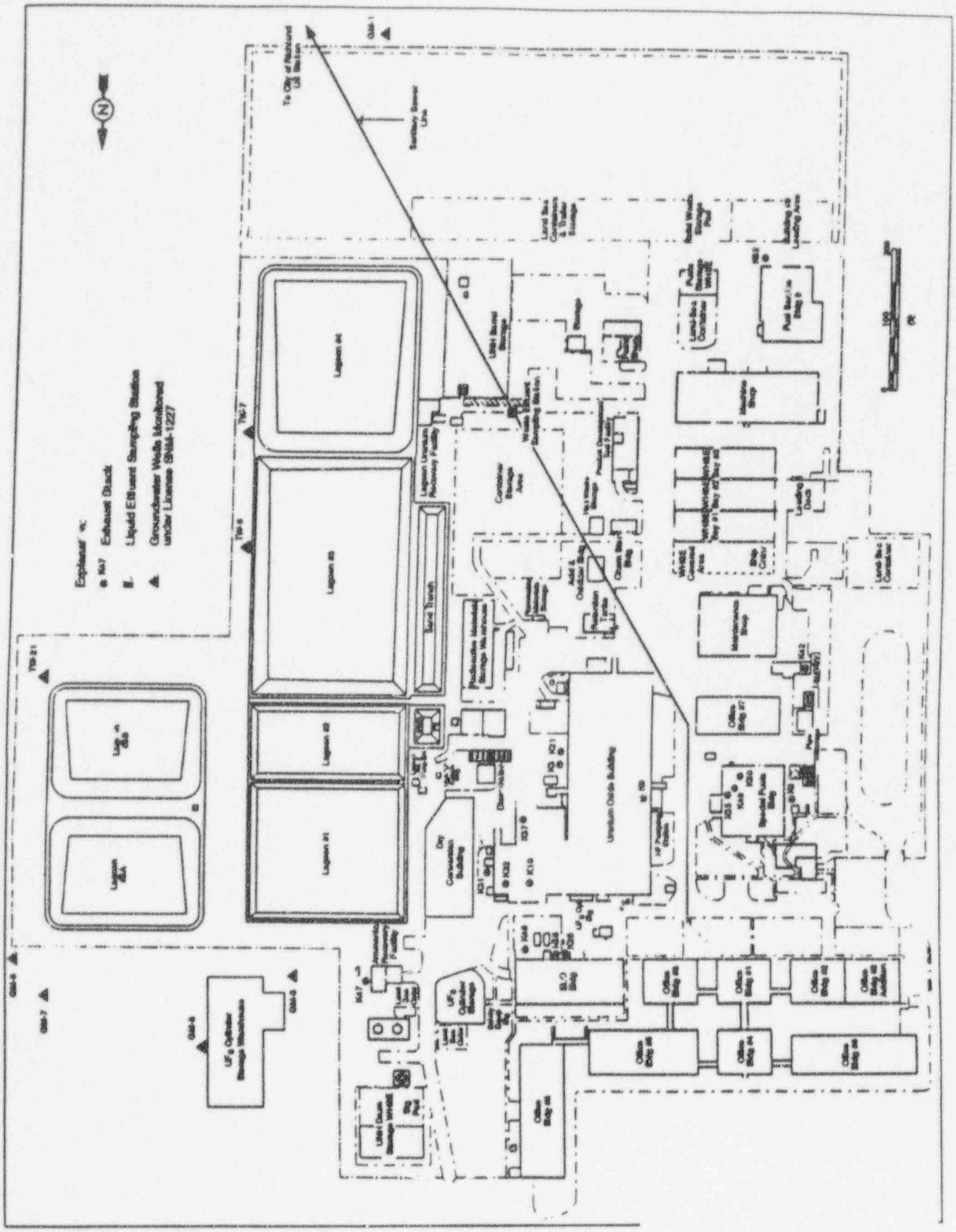

Figure 1.2 Site Plan

The name of the licensee was changed to Exxon Nuclear Company, Inc., in an amendment issued March 22, 1973. The license was revised and issued for a full 5-year term on July 18, 1974, following issuance of the Final Environmental Impact Statements for the Uranium Oxide Plant and Mixed Oxide Fabrication Plants in March and June 1974, respectively. Exxon Nuclear filed an application for renewal in May 1979, and, following the completion of an Environmental Impact Appraisal in August 1981, the license was renewed again in October 1981. The license, as renewed, authorized the possession, use, and storage of uranium and the possession and storage of plutonium.

On September 12, 1986, Exxon Nuclear submitted an application for a 5-year renewal of SNM-1227. In February 1987, the licensee's name was changed to Advanced Nuclear Fuels Corporation. The license was renewed in 1987 for a period of 5 years, to expire on September 30, 1992. During the term of the license, 36 amendments were issued, 23 of which were issued after the renewal application was submitted. These later amendments were also incorporated into the renewal application. In November 1991, the license was amended to reflect a change in the corporate name to Siemens Nuclear Power Corporation (SNP).

In August 1992, SPC submitted an application for renewal of the license for a term of 10 years. In March 1993, the license was amended to change the corporate name to Siemens Power Corporation (SPC). SPC has continued to operate under the recent license, as permitted by the timely renewal provision of 10 CFR 70.33. This SER describes the basis for NRC staff's determination that the license can be renewed without adverse effects on public health and safety and the environment.

1.4 Compliance History

The compliance history for 1987 through 1995 was reviewed using inspection reports issued by the NRC Region V office, the NRC Region IV office, the Walnut Creek Field office, and the NRC Headquarters Fuel Cycle Operations Branch. During this period, NRC has performed 64 health and safety inspections and 10 safeguards inspections. These inspections resulted in approximately 20 Notices of Violation. Of these, two were of Severity Level III and included assessment of civil penalties. These two violations and their resolutions are discussed in the following sections. Severity Levels are defined in NUREG-1600, General Statement of Policy and Procedures for NRC Enforcement Actions, and range from Level I to Level IV, with Level I being the most serious. The licensee has usually responded promptly with corrective measures that bring the facility into compliance with the license. A number of significant compliance issues and their resolutions are discussed here.

1.4.1 Severity Level III Violations

Events resulting in two Severity Level III violations are described in the following Sections 1.4.1.1 and 1.4.1.2.

1.4.1.1 August 1992 Loss of Criticality Safety Control

On August 8, 1992, an event occurred that involved the transfer of low enriched uranium dioxide powder from a favorable geometry vessel to an unfavorable geometry vessel prior to verifying that the moisture content of

the material was within the limits prescribed in the applicable nuclear criticality safety analysis (CSA). After an onsite inspection on August 12 through 14, 1992, and an in-office inspection on August 17 through 27, 1992, the NRC identified six violations of NRC requirements that had occurred. These violations are described in the NRC Inspection Report 70-1257/92-06 and resulted in a Notice of Violation and Proposed Imposition of Civil Penalty dated October 23, 1992.

1.4.1.2 <u>February 1993 Loss of Criticality Safety Control</u>

On February 7, 1993, an event occurred that involved the inadvertent discharge of approximately 124 kilograms of low-enriched uranium powder from a process system into a lexan enclosure. After an Augmented Inspection Team (AIT) inspection on February 9 through 12, 1993, documented in Inspection Report 70-1257/93-02, and an Enforcement Conference on May 17, 1993, documented in Inspection Report 70-1257/93-06, NRC issued a Notice of Violation and Proposed Imposition of Civil Penalty dated July 2, 1993.

1.4.2 <u>CSA Update Program</u>

None of the events described in Section 1.3.1 above resulted in a criticality event; however, they represented a loss of criticality control for the affected processes and equipment. These two events and a number of others involving the loss of nuclear criticality safety controls have resulted in management and procedure changes at the plant. In December 1992, the licensee initiated a comprehensive program to upgrade the criticality safety analysis program at the Richland facility. This upgrade program included checking the CSA assumptions against the equipment and processes actually present in the plant; preparing new as-built drawings, process diagrams, and analyses to reflect the current plant configurations; establishing a program to maintain the CSAs in up-to-date condition; training operators in the procedures and importance of criticality control; and making procedural changes to assure increased management oversight of criticality controls. Phase II of this CSA update program was completed in July 1995. The commitments and new procedures are included in the renewed license as a commitment to develop, maintain, and follow established plant operating procedures.

1.4.3 <u>April 1993 Loss of Criticality Safety Control in SWUR Incinerator</u>

On April 28, 1993, SPC reported a buildup of ash in the primary and secondary chambers and flue of the Solid Waste Uranium Recovery (SWUR) incinerator used to burn uranium-contaminated combustible waste. This discovery was reported to NRC under the provisions of NRC Bulletin 91-01. The ash buildup was discovered during a cleanout of the incinerator in preparation for restart. This buildup resulted from SPC's method of estimating the amount of uranium remaining in the ash pit when the ash was pushed out after a burn. During the cleanout, SPC removed the ash from the incinerator in amounts that exceeded the safe mass amounts of uranium at the average enrichment of 3.25 percent, but did not exceed critical mass. The SWUR was shut down at the time of the discovery, and was restarted in May 1996 following reengineering and reanalysis of the SWUR design.

1.4.4 Insoluble Uranium Discharge to Sanitary Sewer

NRC revised the regulations in 10 CFR Part 20, "Standards for Protection Against Radiation," effective January 1, 1994. This revised rule included a prohibition on the discharge of insoluble radioactive materials to a sanitary sewer (20.2003). In April 1994, SPC requested an exemption to this rule for the discharge of laundry water to the Richland city sewer system. SPC's basis for the exemption was that the amount of insoluble uranium they discharge is too small to cause an adverse effect on public health, and that treatment to remove this small amount of insoluble uranium would be unreasonably expensive.

When SPC submitted the exemption request, they were discharging laundry water to the sewer. On June 23, 1994, NRC issued an order and demand for information which stated that SPC may be in violation of 20.2003(a)(1), and that the filing of an exemption request does not relieve the licensee from the obligation to comply with the regulations. The demand for information required the licensee to: (1) state what actions have been taken to comply with 10 CFR 20.2003(a)(1); (2) describe the circumstances under which insoluble uranium was discharged to the sewer since January 1, 1994; and (3) state what actions the licensee will take to ensure future compliance. SPC immediately stopped discharge of laundry water to the sewer, diverting it to one of the onsite lagoons, and responded to the demand for information by letter dated July 6, 1994.

NRC continued to review the exemption request, and on July 5, 1994, requested additional information. SPC replied to the request in a letter dated August 25, 1994, providing data that demonstrated that the insoluble uranium in the plant effluent was nondetectable at a level of 0.1 picocuries per milliliter (pCi/ml), and that the presence of uranium in sewage sludge would not pose a health risk to sludge handlers at the treatment plant or at the landfill to which the sludge is sent for disposal. In a letter dated February 24, 1995, the NRC informed SPC that: (1) an exemption is not required, and (2) SPC can resume discharge of laundry water to the sewer system.

2. LICENSE APPLICATION

2.1 Possession Limits

In the renewal application SPC requests authorization to possess U-235 in the following quantities and enrichments:

1. Three hundred fifty grams, in addition to the limits listed below, of any enrichment or form for analytical purposes and for sources;

2. Twenty-five thousand kilograms contained in uranium compounds in any form enriched to a maximum of 5 weight percent in the U-235 isotope.

SPC also requests authorization to possess plutonium in the following quantities:

1. One milligram and not more than 1.5 millicuries as contained in sealed sources and standards;

2. Less than 500 grams Pu in PuO_2 or PuO_2-UO_2 as stored waste.

The possession of uranium and plutonium is authorized as requested, and these possession limits are specified in Conditions 6, 7, and 8, to read as follows:

6. Special Nuclear Material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under the license
A. Uranium enriched in U-235	A. Any	A. 350 g U-235
B. Uranium enriched up to 5.00 wt % U-235	B. Uranium compounds	B. 25,000 kg U-235
C. Plutonium	C. Sealed sources	C. 1 mg Pu and not more than 1.5 millicuries
D. Plutonium	D. PuO_2-UO_2 stored waste	D. 500 g Pu

2.2 Facilities

The SPC Engineering and Manufacturing Facility is located in the State of Washington, county of Benton, city of Richland. The plant is sited on a 320-acre tract 0.9 miles west of Stevens Drive on Horn Rapids Road. The facility consists of 36 buildings plus various outside facilities. Many of these buildings, such as the office complex, guardhouse, and warehouse complex are not used for radioactive materials. The facilities which are involved with enriched uranium handling and processing are the following:

1. Specialty Fuels (SF) Building
2. Uranium Oxide (UO_2) Building
3. Dry Conversion Building
4. Engineering Laboratory Operations (ELO) Building
5. Contaminated Clothing Laundry
6. Fuels Storage Warehouse
7. UNH Drum Storage Warehouse
8. Radioactive Material Storage Warehouse
9. Product Development Test Facility (PDTF)
10. UF_6 Receiving and Storage Facility
11. Lagoon Uranium Recovery (LUR) Facility
12. Ammonia Recovery Facility (ARF)

All activities with special nuclear materials are conducted within a controlled access area. The processing of uranium compounds is conducted primarily within the UO_2 and SF Buildings, with some development activity or pilot scale work in the ELO Building. Liquid waste processing is conducted primarily in the Ammonia Recovery and Lagoon Uranium Recovery facilities, which are located within the wastes storage lagoon area.

Solid waste is packaged in the various buildings and stored in containers in designated storage areas while awaiting shipment to a low-level waste disposal facility. Combustible waste is also stored while awaiting incineration in the SWUR, which is in the SF Building.

Uranium compounds are stored in the various production facilities or in the Radioactive Materials Storage Warehouse, the Materials Warehouse, the Fuels Storage Warehouse, or the UNH Drum Storage Warehouse. Uranium hexafluoride (UF_6) cylinders are stored outside on a pad north of the lagoons, and packaged fuel elements or other uranium products are stored outside or in warehouses while awaiting shipment.

2.3 Authorized Activities

Specific locations of authorized activities involving special nuclear materials are identified in Table 1.1 shown below.

TABLE 1.1 Specific Locations of Authorized Activities[1)]

LOCATION	SNM	Authorized Activity
SF Building	Pu and PuO_2-UO_2 contaminated waste	Storage and repackaging.
	UO_2 (up to 5 wt% U-235)	Storage, blending, pressing, sintering, fuel rod loading and downloading, fuel rod welding, fuel element assembly; process tests; associated quality control activities.

	Uranium Compounds (up to 5 wt% U-235)	Waste storage, sorting, incineration, packaging, and associated quality control activities.
UO_2 Building (including Powder Storage)	Uranium Compounds (up to 5 wt% U-235)	All operational steps of fuel manufacturing from UF_6-UO_2 conversion to packaging finished fuel elements, scrap recycling and reprocessing; process tests; waste sorting, packaging, and inspection; associated quality control activities.
	UO_2 (up to 5 wt% U-235)	All operational steps of fuel manufacturing involving UO_2; including associated quality control activities.
ELO Building	Uranium Compounds (up to 5 wt% U-235)	All operational steps of fuel manufacturing involving uranium compounds: including process tests and scrap reprocessing.
PDTF Building	UO_2 (up to 5 wt% U-235)	Hydraulic flow tests and seismic tests involving single fuel elements.
Dry Conversion Building	Uranium Compounds (up to 5 wt% U-235)	All operational steps of dry UF_6-UO_2 conversion and powder preparation.
Radioactive Materials Storage Warehouse	Uranium Compounds (up to 5 wt% U-235)	Storage of closed and externally free-of-significant-contamination[2)] containers of product, scrap, and waste materials.
Temporary Storage Facilities	Uranium Oxide (up to 5 wt% U-235)	Storage of a planar array of closed containers of oxide pellets which are externally free of significant contamination.
Fuels Storage Warehouse	Uranium Compounds (up to 5 wt% U-235)	Storage of closed and externally free-of-significant-contamination[2)] containers of product, scrap and waste materials; and the unloading of such containers from shipping containers.

Materials Warehouse (Bay 2)	Uranium Compounds (up to 5 wt% U-235)	Storage of closed and externally free-of-significant-contamination[2)] containers of product, scrap, and waste materials; and the loading of such containers into shipping containers.
UNH Drum Storage Warehouse	Storage of Uranyl Nitrate solutions (up to 5 wt% U-235 and less than 140 gU/l)	Storage of Uranyl Nitrate solutions in a single tier of closed 55 gallon drums free of significant contamination.
Laundry Facility	Uranium Compounds (up to 5 wt% U-235)	Cleaning of contaminated protective clothing and equipment.
UF_6 Cylinder Storage Areas	UF_6 (up to 5 wt% U-235)	Outside storage of UF_6 cylinders (full and empty).
Packaged Fuel Storage Areas	UO_2 (up to 5 wt% U-235)	Outside storage of fuel packaged for shipment; the transport containers are closed, sealed and properly labeled for shipment.
Packaged Waste Storage Areas	Uranium Compounds (up to 5 wt% U-235)	Outside storage of contaminated materials (including low level waste and incinerator ash) which are packaged, sealed, labeled and externally free of contamination.
Process Chemical Waste Storage Lagoon System	Uranium Compounds (up to 5 wt% U-235)	Transfer, mixing, sampling, storage and solar evaporation of contaminated liquid wastes.
Retention Tanks	Uranium Compounds (up to 5 wt% U-235)	Interim storage of potentially contaminated liquid wastes.
High Uranium Solids Pond	Uranium Compounds (up to 5 wt% U-235)	Transfer of uranium bearing solids, leaching for uranium recovery.
Solids Trench	Uranium Compounds (up to 5 wt% U-235)	Transfer and storage of contaminated solids awaiting leaching or burial.
Lagoon Uranium Recovery	Uranium Compounds (up to 5 wt% U-235)	Recovery of uranium from waste solutions.
Ammonia Recovery Facility	Uranium Compounds (up to 5 wt% U-235)	Removal and recovery of ammonia from uranium contaminated liquid wastes.

Lagoon 5A IX Process-ARF Building	Uranium Liquid Wastes (up to 5 wt% U-235 and less than 140 gU/l concentrations in filters and resins)	Filtration and ion exchange of uranium liquid wastes.
Any Permanent or Portable Building having HEPA filtration and Isokinetic sampling	Uranium solid waste (up to 5 wt% U-235)	Sorting and compaction.
[1] The locations described in this table are shown on the site plan Figure 1.2 [2] "externally free of significant contamination" means that the containers meet the external radiation standards for packaging and transportation of radioactive material in 10 CFR Part 71.		

The exis.ing license authorizes these activities. Based upon the discussion in this Safety Evaluation Report, the staff considers the request for authorization of the activities at the locations identified in Table 1.1 above to be acceptable and recommends continuing the authorization. To authorize the proposed activities, the following license condition is recommended:

S-1. Authorized use: For use in accordance with the statements, representations, and conditions of Part I of the licensee's application dated October 28, 1996, and revised pages submitted with letter dated November 11, 1996.

2.4 Organization and Administration

2.4.1 Organizational Responsibilities and Authority

Section 2.1 of the renewal application describes the positions, responsibilities, and authority of the applicant's staff who are directly responsible for industrial and radiological safety.

The President of Siemens Power Corporation has the ultimate responsibility for ensuring that all company operations are conducted safely and in full compliance with applicable Federal, State, and local regulations, licenses, and permits. For the Nuclear Division of the company, such responsibilities are borne by the Senior Vice President and General Manager, Nuclear Division.

All functions which handle or store special nuclear material (SNM) authorized by this license reside within the Manufacturing and Engineering Departments of the Nuclear Division. The relationship of these segments of the organization which contain significant safety or licensing responsibility is depicted in Figure 2.1. The organization of Safety, Security, and Licensing, which contains the responsible safety specialists and professionals including industrial safety and health, nuclear criticality safety, health physics,

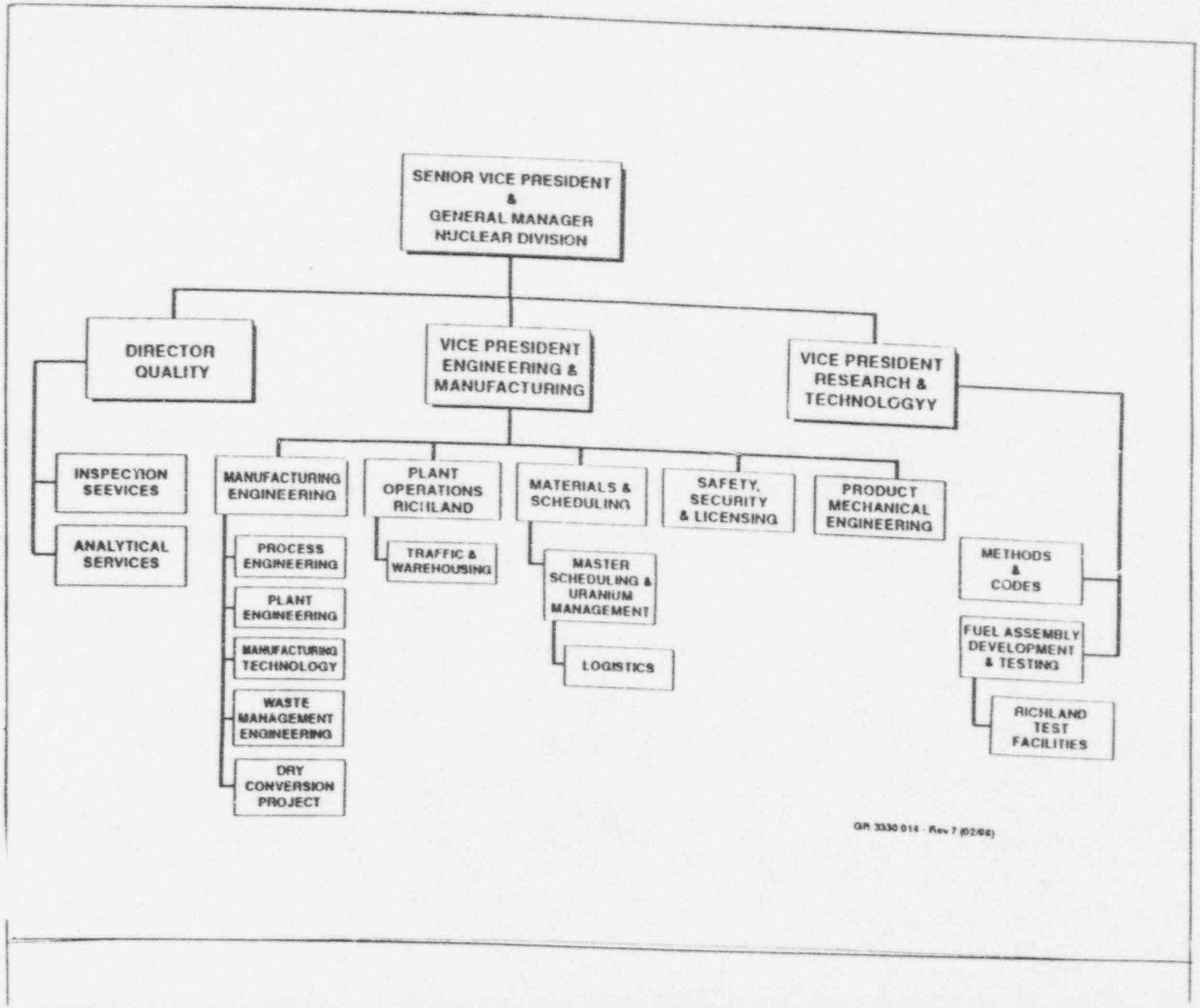

Figure 2.1 SPC Organization

health records, radiological safety, licensing, safeguards, environmental engineering, and industrial hygiene, is shown in Figure 2.2.

The organization charts show that the safety functions are independent of the functions of production and are therefore acceptable.

The Manager, Safety, Security, and Licensing, and his reporting Manager, Safety, have the authority to request management to shut down any operation that either Manager judges to be unsafe. In case of disagreement between line management and either of these two Managers, the operation will be immediately shut down, and the issue brought to the attention of upper management.

This commitment of authority to the safety staff to shut down any operations deemed to be unsafe show that the safety staff have sufficient authority to assure plant safety and is, therefore, acceptable.

2.4.2 Personnel Education and Experience Requirements

Section 2.2 of the license application states that hiring of all managers and key professionals in plant operations, health physics, and nuclear criticality safety is subject to the approval of the Vice President, Engineering and Manufacturing. Minimum qualifications for this Vice President, the Manager of Plant Operations, and managers in engineering and technical services functions which have responsibilities for processing, storing, or handling of special nuclear material are a minimum of two years experience in the nuclear industry and a degree in science or engineering. Specific requirements for key safety professionals whose major responsibility is in a safety field are listed below.

For other positions not specifically listed in the license, incumbents to those positions shall have adequate job training, and technical support and overview shall be available. Additional training for operations employees is described in Section 2.4.4. below. Education and experience statements for current plant staff are provided in Chapter 11 of the Safety Demonstration that accompanied the license application.

1. Manager, Safety, Security, and Licensing

The minimum qualifications of the Manger, Safety, Security, and Licensing shall be a Bachelor of Science degree in a technical field with 10 years experience in the nuclear energy field, of which four shall have been in positions with nuclear safety responsibility.

2. Manager, Regulatory Compliance

The minimum qualification for the Manager, Regulatory Compliance shall be a Bachelor's degree in science or engineering, plus eight years experience in the nuclear or environmental safety fields.

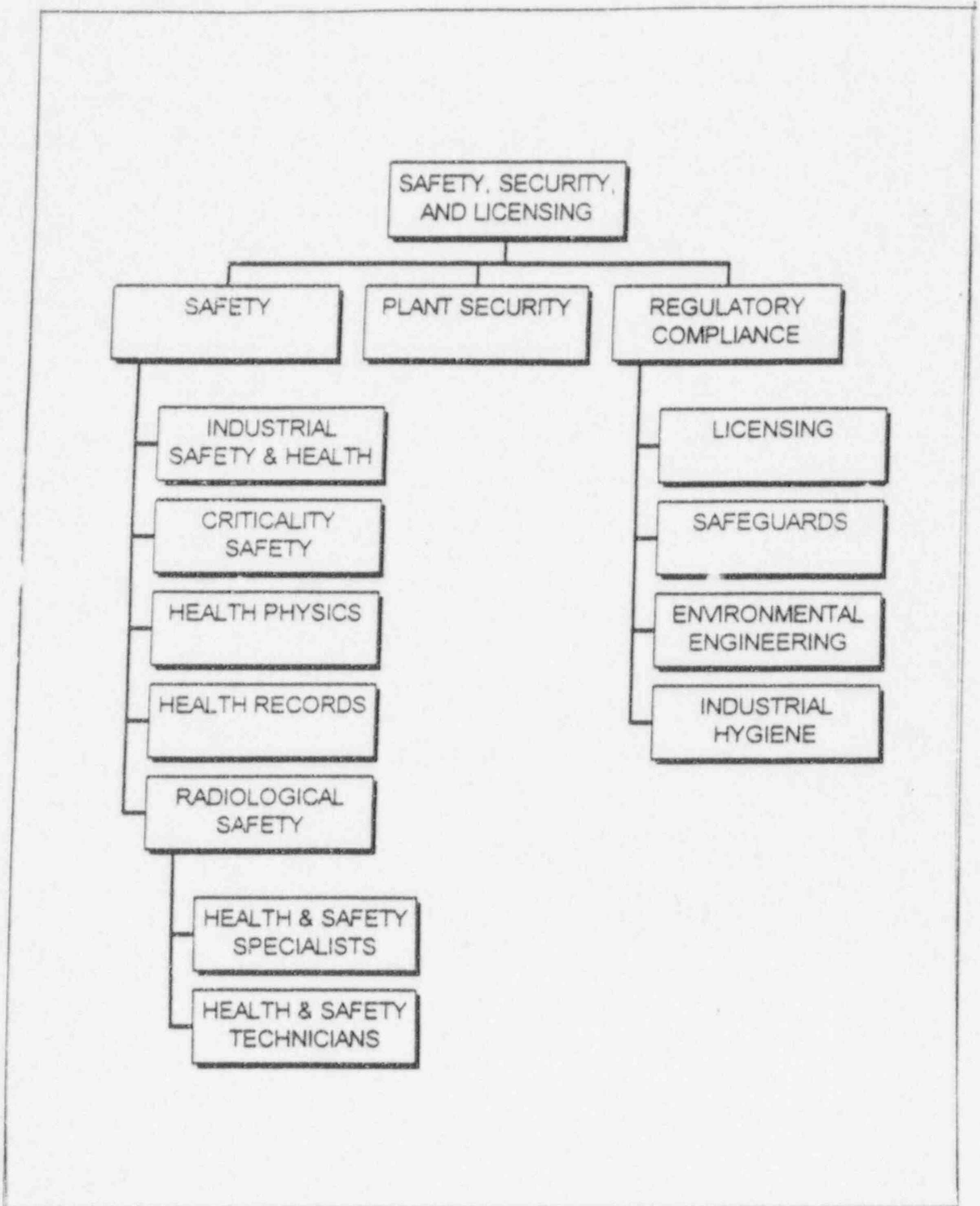

Figure 2.2 Safety, Security, and Licensing Organization

3. Staff Engineer, Licensing

The minimum qualifications shall be a Bachelor's degree in science or engineering, plus at least five years experience in the nuclear field, of which three years experience shall have been in safety-related or safeguards fields requiring significant interaction with regulatory agencies.

4. Manager, Safety

The minimum qualifications shall be a Bachelor's degree in a technical field, with five years experience in safety-related fields (industrial, radiological, health physics, or nuclear).

5. Industrial Safety and Health Specialist

The minimum qualifications of at least one member of the Industrial Safety and Health Component shall be a Bachelor's degree in science or engineering with two years experience in industrial safety or health.

6. Supervisor, Radiological Safety

The minimum qualifications shall be a Bachelor's degree in a technical field, with five years experience in radiation safety, preferable in fuel cycle facilities, or, in the absence of a degree, then 10 years experience shall be required.

7. Industrial Hygienist

The minimum qualifications of the Industrial Hygienist shall be a Bachelor's degree in science or engineering with two years experience in industrial safety or health.

8. Criticality Safety Specialist

The minimum qualifications of at least one member of the Criticality Safety Component, as well as for each second-party reviewer, shall be a Bachelor's degree in science or engineering with two years experience in nuclear criticality safety analysis.

9. Health Physics Specialist (Health Physicist)

The minimum qualifications of at least one member of the Health Physics Component shall be a Bachelor's degree in science or engineering with five years general experience in radiation protection, or at least two years of radiation protection experience allied with nuclear fuel fabrication.

10. Health and Safety Technician Specialists

The minimum qualifications shall be a high school diploma with ten years experience in radiation and chemical monitoring. They shall have passed the SPC Environmental Monitoring Training and Qualification Program or shall have had the equivalent prior training. They must have extensive experience in

radiological, industrial and environmental protection programs and are assigned to provide technical support in the conduct of SPC's programs in these areas.

11. Health and Safety Technicians

The minimum qualifications of certified Health and Safety Technicians shall be a high school diploma with two years of radiation and/or chemical monitoring experience, or four years of similar experience in lieu of a high school diploma. Health and Safety Technicians shall complete a formal SPC training program, or shall have had equivalent prior training. They shall be proficient in SPC's radiological and chemical safety programs, criteria, specifications, procedures, and routines.

12. Environmental Engineer

The minimum qualifications of at least one member of the Environmental Component shall be a Bachelor's degree in science or engineering, and at least one year's experience in the environmental field.

NRC staff have reviewed the minimum qualifications for the Vice President, Engineering and Manufacturing; the Manager of Plant Operations; managers in engineering and technical services functions which have responsibilities for processing, storing, or handling of special nuclear material; and key safety professionals whose major responsibility is in a safety field, and have determined that the minimum qualifications are sufficient to provide reasonable assurance that the staff will have adequate education and experience to carry out operations involving licensed material safely, and are therefore acceptable.

2.4.3 Safety Review Committees

The applicant has established two committees to provide safety-related oversight of plant operations. These are the Health and Safety Council and the ALARA Committee.

2.4.3.1 Health and Safety Council

The Health and Safety Council convenes monthly to review various aspects of the safety program, including the following:

1. Industrial safety practices and trends.
2. Radiological safety practices and trends.
3. Criticality safety practices and trends.
4. Environmental protection practices and performance.
5. Adequacy of emergency planning and procedures, including results of tests and drills.
6. Overall safety awareness and attitude of employees and programs for promoting improvements.
7. Unusual occurrences and accident investigations, including recommendations to prevent recurrences.
8. Status of Council-related items.

Membership on this Council includes:

1. Vice President, Engineering and Manufacturing (Chairman).
2. Manager, Safety (Secretary).
3. Manager, Safety, Security, and Licensing (Co-Chairman).
4. Director, Quality.
5. Appropriate managers within these and other organizations.
6. Key safety engineers and specialists.

Designated members of the Council make monthly inspections of buildings and grounds for housekeeping and safety practices and report the findings to the Council at the monthly meetings. Findings are assigned to individuals for resolution and are held open until resolved.

NRC staff has reviewed the responsibilities and composition of the Health and Safety Council and has determined that it provides a system for comprehensive oversight and management attention to safety issues and is acceptable.

2.4.3.2 ALARA Committee

The ALARA (as low as is reasonably achievable) Committee maintains awareness of trends in employee radiation exposure and radioactivity content of effluent releases. The ALARA Committee convenes at least semi-annually and issues an annual ALARA Report to the Health and Safety Council. The ALARA Reports include review of required audits and inspections performed during the year, and review of employee external exposures, bioassay results, unusual occurrences, effluent releases, in-plant airborne activity, and environmental monitoring. The ALARA Report has three purposes:

1. To identify trends in personnel exposures and effluents.
2. To determine if personnel exposures or radioactive effluents might be lowered under the concept of ALARA.
3. To determine if equipment for effluent and exposure control is properly designed, used, maintained, and inspected.

The ALARA Committee membership includes the following:

1. Manager, Regulatory Compliance (Chairman).
2. Health Physics Specialist (Secretary).
3. Manager, Safety.
4. Manager, Plant Engineering.
5. Manager, Safety, Security, and Licensing.
6. Manager, Plant Operations.
7. Manager, Process Engineering.
8. Supervisor, Radiological Safety.

The NRC staff has reviewed the functions and membership of the ALARA Committee and has determined that the functions are sufficiently comprehensive to review and identify ALARA issues, that the membership includes individuals with adequate knowledge of ALARA issues to perform these functions, and that the functions and membership are acceptable.

2.4.4 Training

New employees receive training in radiation protection and nuclear criticality safety requirements and procedures, industrial safety, hazardous chemical safety, fire protection, and emergency procedures. The degree of training is commensurate with each employee's position in the company and with the extent of the employee's contact with radioactive and fissile materials.

Training requirements and course contents are established by Safety, Security, and Licensing. Instruction is provided by personnel qualified in the training topics. All formal training is documented and records maintained by Safety, Security, and Licensing.

When changes are made in radiation protection, criticality safety controls, or emergency procedures, each employee affected is promptly informed and properly instructed. Safety topics are discussed in monthly safety meetings held by operating components. Annual refresher training in radiation protection and criticality safety is provided to employees working with special nuclear material.

Health and Safety Technicians are given special training related to their radiation protection and chemical safety assignments. The Health and Safety Technicians are required to become proficient in SPC's radiation protection, chemical safety, and criticality safety programs, criteria, specification, procedures, and routines, as demonstrated by successfully passing an SPC Certification examination within six months after employment as a Health and Safety Technician. In addition, refresher training is provided to all Health and Safety Technicians annually.

The staff has reviewed SPC's training program and concludes that the training program is consistent with good industry practice and is, therefore, acceptable.

2.4.5 Operating Procedures, Standards, and Guides

SPC operates the Engineering and Manufacturing Facility in accordance with Standard Operating Procedures, Company Standards, and Policy Guides. These documents are prepared, reviewed, revised, approved, and implemented in accordance with the Approval and Responsibility Matrix in Figure 2.3. This matrix lists the safety-related standards, procedures, criteria, analyses, plans, notices, and authorizations used in the plant operation and identifies the staff responsible for their preparation, approval, acceptance, and audit. This matrix indicates that safety-related activities are performed according to procedures that are prepared, reviewed, and audited by staff that are qualified for their responsibilities and possess the authority to carry them out.

NRC staff have reviewed the applicant's commitment to following established procedures and to provide management oversight, and has determined that it constitutes a management system that is expected to result in safe plant operation and is, therefore, acceptable.

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FIGURE I-2.3 APPROVAL AND RESPONSIBILITY MATRIX

A - Prepare/Initiate

B - Approve: Overall agreement that proper reviews have been conducted

C - Concur: Agreement within area of expertise

D - Accept: Agreement to comply with imposed conditions

E - Audit

A primed letter (') indicates signatory action limited to area of responsibility

	Vice President Engineering & Manufacturing	Manager Manufacturing Engineering	Manager Process Engineering	Manager Plant Engineering	Project Engineer	Manager Plant Operations	Manager Inspection Services	Manager Analytical Services	Manager Materials and Scheduling	Supervisor Traffic and Warehousing	Manager Safety, Security, and Licensing	Manager Regulatory Compliance	Environmental Engineering Component	Industrial Hygienist	Manager Safety	Criticality Safety Component	Health Physics Component	Manager Product Mechanical Engineering	Manager Manufacturing Technology	FA Development and Testing Component	Director, Quality
Radiation Protection Standards	B	D				D	D	D	D		C						A/C/E	D			
Radiation Safety Operating Procedures												C			B		A/C/E				
Radiation Work Procedures		D'			D'	D'	D'	D'		D'							A/B/E		D'	D'	
Nuclear Criticality Safety Criteria	B										C	C				A/C					
Nuclear Criticality Safety Analysis	D	D				D					C					A/B					
Nuclear Criticality Safety Standards	B	D'				D'	D'	D'	D		C	C				A/E		D'			
Criticality Safety Specifications	D	D'				D'	D'	D'	D'						B	A/E		D'	D'	D'	
Criticality Safety Limit Cards						D'	D'	D'		D'					B	A/E		D'	D'	D'	
Environmental Safety Standards	B	D'				D'			D'		C	C	A/E		C		A'	D'	D'		
Industrial Safety Standards	B	D				D	D	D	D		C	C		A/E	C			D			
Emergency Plan	B	D				D					C	A/E									
Engineering Change Notice Procedure		A/B				B					B										
Process Test Authorization		B	A	C'		D	C'								C'				C'		
Radioactive Material Shipping Standards	B					D'			D'		C	A'					A'/E				
Operating Procedures			B'	B'		A'/B'	A'/B'	A'/B'	A'	A'/B'	C				C				A'		E

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Figure 2.3 Approval and Responsibility Matrix

2.4.6 Configuration Control and Maintenance/Calibration of Safety-Related Equipment

The applicant has committed to conducting a configuration management program to assure that complete and proper reviews are undertaken prior to and after changes to facilities or equipment used to process nuclear material. The program is implemented via the applicant's Engineering Change Notice (ECN) procedure, which is described in detail in Chapter 11 of the Safety Demonstration section of the license renewal application. This ECN procedure provides instruction for authorizing and documenting the installation of new equipment, facilities, and services and modifications to existing equipment, facilities, and services. The procedure defines what kinds of work require the use of an ECN, and what kinds of work may be accomplished via a work order. During a site visit on June 25-27, 1996, NRC staff reviewed the ECN Procedure and determined that it includes the essential features of an effective configuration management program. The staff conclusion is documented in a letter to SPC dated July 23, 1996.

The applicant has also committed to conducting a preventative maintenance program covering equipment, facilities, systems, and support activities with emphasis on safety-related items. Within the applicant's instrument calibration program, certain instruments related to safety are identified with a special label; instruments with this label may not be used beyond the calibration due date. Preventive maintenance for testing or verification of a criticality safety function is identified by a unique numbering system and by an appropriate cautionary statement identifying it as criticality safety-related. Preventive maintenance falling into this category must be performed as scheduled or the affected equipment may not be operated until such a time that the preventive maintenance has been completed.

NRC staff has reviewed the applicant's commitments to configuration control and maintenance/calibration of safety-related equipment and has determined that they are adequate to maintain safety during and following plant changes and are adequate to maintain equipment and instrumentation in safe working order and are, therefore, acceptable.

2.4.7 Internal Audits and Inspections

Internal inspections and audits are conducted to determine that plant operations are performed in compliance with regulatory requirements, license conditions, and formal procedures. SPC has committed to performing audits and inspections in the areas of radiation protection, criticality safety, hazardous chemical safety, fire protection, and environmental protection. The staff members responsible for audits and inspections in each of these areas are identified in Section 2.7 of the license application. The staff members responsible for collecting data, most of whom are technicians, are also responsible for reporting data to their respective supervisors. Periodic scheduled audits are performed by staff other than the technicians.

This inspection and audit program demonstrates that inspections are performed by qualified staff, and that there is a separation between the staff who perform the inspections and those who audit them, and is, therefore, acceptable.

2.4.8 Investigations and Reporting of Reportable Incidents

In Section 2.8 of the renewal application, the applicant has committed to a reporting schedule for specified items in accordance with 10 CFR 19.13, 20.1906, 20.2201, 20.2202, 20.2203, 20.2206, 70.50, 70.59, and 71.5(b); in accordance with effluent monitoring action levels specified in Chapter 5 of the renewal application; and including changes in parameters important to dose assessment of the public with respect to gaseous effluents from the plant. The responsibility for investigating, recording, reporting, and following up on actions taken for reportable incidents is assigned to the Manager, Safety, Security, and Licensing.

NRC staff have reviewed the applicant's commitments to reporting of reportable incidents and information and have determined that they are comprehensive, are compliant with the applicable regulations, and are acceptable.

2.4.9 Records Retention

The applicant has committed to the retention of specific records for a period of five years, unless there are legal or license requirements for longer retention periods for specific records. Section 2.9 of the application lists 18 specific types of records that will be retained. These include: (1) records pertaining to the areas of radiation safety; (2) environmental protection; (3) nuclear criticality safety; (4) incident investigations; (5) employee training records, equipment test results, and (6) other areas.

The staff reviewed SPC's records retention commitments and concluded that the applicant's records retention requirements are consistent with good industry practice, are compliant with the regulations, and are acceptable.

2.5 Radiation Protection

2.5.1 Radiation Safety Administration

2.5.1.1 Radiation Protection Organization

The Radiation Safety Organization at SPC reports to the Manager, Safety, who reports to the Manager, Safety, Security, and Licensing. The Manager, Safety, directs the activities of industrial safety and health, criticality safety, health physics, and radiological safety personnel, in conformance with approved company policies and programs and in direct support of plant operations. The Manager, Safety is authorized to recommend suspension of any operation that he believes unsafe.

The Health Physics Component (which includes the Health Physicist) resides within the Safety Organization. The responsibilities of the Health Physics Component include: (1) providing technical bases, criteria, and methods related to health physics; (2) preparing and updating the Radiation Protection Standard section of the company safety manual; (3) establishing radiological protection programs; (4) performing compliance inspections; and (5) providing professional advice.

The Supervisor, Radiological Safety Component, who reports to the Manager, Safety, provides information, advice, and assistance to company operating and

engineering components. Specific responsibilities of the Supervisor, Radiological Safety Component, include: (1) administering the plant radiological safety program and evaluating its effectiveness; (2) directing the activities of the health and safety technicians; and (3) providing radiological safety analyses of proposed operational changes or modifications.

The overall objective of the radiation protection organization is to ensure adequate containment of radioactive material and reduce the levels of radiation to meet the ALARA goal. The staff has reviewed the licensee's proposed radiation safety organization and finds that it is sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

2.5.1.2 Radiation Work Procedures

The Radiation Work Procedures (RWPs) are prepared by Radiological Safety, and establish the radiological safety requirements of all work involving radiation and/or radioactive materials. The RWPs are available to personnel working with such material. The RWPs include the following information:

1. The identification number of the procedure.

2. A description of the nature, extent, and location of the work to be done.

3. A description of the types and potential for contamination that may be encountered.

4. A description of the types and estimated maximum personnel dose rates.

5. Personal survey and protective clothing requirements.

6. Personal dosimetry requirements.

7. A statement of the respiratory protection equipment required for entry into an airborne radioactive materials area.

The staff finds the licensee-proposed RWPs system acceptable because it is consistent with good industry practice and in accordance with the requirements of 10 CFR Part 20.

2.5.1.3 ALARA Commitment

The licensee has made a commitment to maintain the radiation exposure to employees and the general public to an ALARA level. To do this, the licensee has established an ALARA/Radiation Safety Committee which consists of senior members of the plant staff and a Health Physics specialist. The Committee meets at least twice a year and is responsible for reviewing the ALARA activities at the plant. The ALARA/Radiation Safety Committee, which makes an annual report, reviews employee exposures and effluent data to determine: (1) trends in personnel exposures and effluents; (2) if personnel exposures or radioactive effluent might be lowered under the ALARA concept; and (3) if equipment for effluent and exposure control is properly designed, used, maintained, and inspected.

To have a basis for comparison and judgment, the following information and data are reviewed each year by the Committee:

1. Airborne contamination levels.
2. Bioassay data (urinalysis and in-vivo examinations).
3. External radiation exposure data.
4. Effluent data.
5. Environmental sampling/monitoring data.
6. Integrity of waste lagoon liners and "between-liner" sampling data.
7. Operational history of effluent treatment and measurement systems.
8. Documentation of incidents, unusual occurrences, etc., for facilities, equipment, systems, etc., that deal with personnel exposure to radioactive material.
9. Documentation of facilities, equipment, procedures, etc., put in place to reduce personnel exposures, or to reduce environmental impact of plant operations.
10. Documentation of pertinent audits and inspections.

The staff has reviewed the applicant's ALARA commitment and procedures and finds them to be in accordance with 10 CFR 20.1101(b) and acceptable.

2.5.2. External Exposure Control

To ensure that SPC employees do not exceed the NRC annual limits contained in 10 CFR 20.1201, and to alert management to unusual exposure, SPC has established company guides (CGs) lower than the NRC limits. External exposures are controlled and evaluated using radiation exposure dosimeters as required by 10 CFR Part 20. The dosimeters are read and analyzed at least quarterly. Should an individual's exposure exceed the CG, an investigation will be conducted by the licensee.

External exposure of personnel has generally not been a problem in uranium fuel fabrication plants, and SPC is fairly typical. The external exposure data reported by the licensee in its 1993 ALARA report shows that most of the individuals' annual exposures are less than 10 percent of the regulatory limit, with no exposure near the 5 rem per year limit.

The staff has reviewed the applicant's external exposure control program and determined that it is sufficient to meet the requirement of 10 CFR 20.1201, consistent with good industrial practices, and thus acceptable.

2.5.3 Internal Exposure Control

Radioactive material may enter the body by breathing of contaminated air, by ingestion as a consequence of poor hygiene practices, or by failure to self-monitor. At SPC, protection of operating personnel from excessive internal exposure is provided by the use of:

1. Ventilation systems designed to limit the concentration of radioactive material in breathing air and the confinement of uranium within process equipment.

2. An air sampling and analysis program for evaluating the airborne concentration of radioactivity in working areas.

3. A bioassay program to evaluate any significant deposition of radionuclides in the body.

4. Protective clothing to minimize direct contact with the radioactive material.

5. Respiratory protective equipment to limit the inhalation of airborne radioactive material. The use of respiratory protective devices will be in accordance with 10 CFR 20.1703.

6. Surveys to detect the presence and extent of radioactive surface contamination.

7. Procedures, including action levels for investigation, control, and decontamination of contaminated surfaces.

8. Procedures for combining, as appropriate, internal doses with external as required by Part 20.

2.5.3.1 Ventilation

The ventilation system at SPC is designed and maintained to limit the spread of airborne contamination by maintaining air-pressure gradients and airflows from general areas of low potential airborne contamination to general areas of higher potential contamination. The ventilation system is balanced so that the air pressure differentials between clean and contaminated areas are maintained at a minimum of 0.05 inch of water. All exhaust systems from the uranium processing areas are filtered by HEPA filters and continuously monitored for radioactivity before being discharged through the stack. The ventilation system maintains the face velocity of the uranium handling hoods in the facility above 125 linear feet per minute (LFPM) and the ventilation exhaust rate in contaminated areas to at least seven air changes per hour. The performance capabilities are checked on a monthly basis. The staff has reviewed the SPC ventilation system, as it relates to the internal exposure control, and finds it sufficient to keep workers' doses below the limits of 10 CFR Part 20, consistent with good industry practice, and acceptable.

2.5.3.2 Air Sampling

The licensee routinely monitors air samples in areas where unencapsulated radioactive materials are handled or processed, and/or where air concentrations are likely to exceed 10 percent of the derived air concentration (DAC). Sampling points will be located at points representative of workers' intakes or at points likely to provide higher readings. The frequency of air sampling in contaminated areas is based on historical experience in each sampling area and is currently once per shift. The licensee also has specialized air sampling or monitoring equipment, such as continuous air monitors, portable high-volume air samplers, and lapel air samplers available, as needed, to supplement the normal air sampling system.

Permanently mounted air sampling equipment used to determine air concentrations at work stations are evaluated after significant process or equipment changes, to ensure sampling remains representative of personnel exposure. Reevaluation is conducted at least every 12 months for those work stations that average 10 percent or greater of DAC the previous calendar year, and at least every 24 months for the remaining work stations. Flow rates through air samplers are checked at the start and end of each sampling period. Rotameter accuracies are confirmed/calibrated at least annually. The staff has evaluated the air sampling program for internal exposure control, and finds it is sufficient to meet the requirements of 10 CFR Part 20, consistent with good industry practice, and acceptable.

SPC has requested approval, in accordance with 10 CFR 20.1204(c)(2), to adjust DACs and annual limits on intake (ALIs) based on the results of particle size distribution measurements. The particle size distribution measurements will be taken using an Anderson 1 (ACFM) non-viable ambient particle sampler with a pre-separator and eight stages (Model #20-830). The licensee has committed to using the chi-square test to determine appropriate activity median aerodynamic diameter (AMAD) values. In addition, the Health Physics component will also apply conservative analysis in determining the AMADs and the appropriate DAC and ALI adjustments. SPC has also committed to performing at least three particle size measurements for each location or grouping of locations where DACs and ALIs are adjusted by particle sizes. The particle size analysis and DAC and ALI adjustments will be performed at least semi-annually in each location or group of locations. If, after 1 year, the data for a location does not differ significantly from previous measurements, the SPC Health Physics Component may change the frequency to once per calendar year. Particle size will also be reassessed after significant process changes that are deemed likely to change the particle size distribution.

The staff has evaluated SPC's request using the requirements of 10 CFR 20.1204(c)(2) and the guidance in Regulatory Guide 8.25, "Air Sampling in the Work Place," and finds the request acceptable because it is consistent with the regulatory guide and satisfies the regulatory requirement.

2.5.3.3 Bioassay

At SPC, the bioassay program is used to verify the adequacy of contamination control in work areas and to evaluate and control workers' internal exposures. Routine urine sampling frequencies for all operators and maintenance personnel routinely assigned to work in areas where transportable uranium compounds are

processed are at least monthly. Samples from workers are scheduled throughout the month, to provide a continuous overview of facility environment. Routine urine sampling frequencies for all operators and maintenance personnel routinely assigned to areas where only non-transportable uranium compounds are processed are at least every 6 months.

Routine lung-counting frequencies for all operators and maintenance personnel assigned to work in areas where non-transportable compounds are processed are at least semiannually for personnel working in areas exceeding 10 percent of DAC the previous quarter. The licensee has established higher lung-counting frequencies for those individuals working in higher DAC environments. The licensee has also committed to performing fecal analyses in lieu of lung-counting for personnel, such as claustrophobics, who cannot go though lung counting.

The staff has review Siemens' bioassay program and finds it is sufficient to meet the requirements of Part 20 and acceptable.

2.5.3.4 Respiratory Protection

The licensee has established a respiratory protection program in accordance with 10 CFR 20.1703. The primary objectives of SPC's respiratory protection program are to limit the inhalation of airborne radioactive materials and harmful air contaminants, to comply with permissible exposure limits, and to protect employees in oxygen-deficient atmospheres. The licensee has committed to using respirators only when engineering controls are not feasible. The licensee will also use procedures for the use and maintenance of respiratory equipment, as listed in Regulatory Guide 8.15. The staff has reviewed the licensee's proposed respiratory protection program, has determined that it meets the requirements of 10 CFR 20.1703, and, thus, the program is acceptable.

2.5.4 Contamination Control

The restricted areas of the SPC plant are classified as clean areas, intermediate areas, and contaminated controlled areas. In the contaminated areas, protective clothing must be worn, and individuals must monitor for possible contamination on exiting the area. Using an instrument that is calibrated, each defined area is surveyed routinely for contamination. The frequency of this survey is determined by past history, the extent to which the area is occupied, and the potential hazard posed by the presence of surface contamination. In general, contaminated areas will be surveyed weekly, clean areas will be surveyed monthly, and intermediate areas will be surveyed daily. Action levels that SPC uses for cleanup of the various areas, to control surface contamination, are 200 dpm/1200cm^2 (alpha) for intermediate areas; and 10,000 dpm/100cm^2 (alpha) for contaminated control areas. The licensee's criteria for release of contaminated equipment or material to clean areas are equivalent to those found in NRC's "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted use or Termination of Licenses for Byproduct, Source, or Special Nuclear Materials," April 1993.

The staff has reviewed SPC's contamination control program and has determined that it meets the requirements of Part 20 and is, therefore, acceptable.

2.5.5 Effluent Controls

Effluent controls and environmental monitoring are discussed in Section 2.7, "Environmental Safety."

2.5.6 Conclusion

On completion of the Radiation Protection review of the licensee's renewal application, the staff has concluded that SPC has the necessary technical staff and procedures to administer an effective radiological safety program that meets the requirements of Part 20.

2.6 Nuclear Criticality Safety

The staff has reviewed the SPC Nuclear Criticality Safety (NCS) program described in Chapter 4 of the renewal application. This review consisted of a review of the following programs and practices: (1) NCS organization; (2) double contingency; (3) facility procedures and posting; (4) training; (5) audits and inspections; (6) Criticality Alarm System; (7) Technical Criteria; and (8) Criticality Safety Analysis. Each of these areas is discussed below.

2.6.1 NCS Organization

The SPC Organization, including the Nuclear Criticality Organization, has been reviewed in Section 2.4 of this report.

2.6.2 Double Contingency

SPC has committed to the following double contingency principle:

It is SPC's policy that the Double Contingency Principle (ANSI/ANS-8.1-1983 (R1988)) will be the basis for design and operation of processes within the Richland Fuel Fabrication Facility using special nuclear materials. Where practicable, all process designs will incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. In those instances where at least two independent controls are utilized to prevent changes in one control type parameter, sufficient redundancy and diversity of controls will be utilized. For each significant portion of the process, a defense of one or more system parameters will be employed and documented within the Criticality Safety Analysis. The defense is comprised of the set of bounding assumptions, criticality safety limits, and criticality safety constraints that, as a set, are uniquely sufficient to maintain the minimum subcritical margin against an initiating event.

To implement the double contingency principle and provide sufficient redundancy and diversity SPC has established three general approaches to controlling parameters that directly affect the reactivity of the system. These are listed in the order of preference along with a brief discussion of each:

1. Controlling two different parameters that directly affect K_{eff} for each specific critical excursion scenario (diverse independent control).

Examples of two different parameters that directly affect K_{eff} are mass of fissile material contained in a system and mass (or concentration) of moderating material in a system.

2. Controlling a single parameter that directly affects K_{eff} for each specific critical excursion scenario using two independent and differently designed means of control (independent control). An example would be ensuring dry product from a process by controlling the process within specified ranges and then confirming dry product by laboratory analysis of the product samples.

3. Controlling a single parameter that directly affects K_{eff} for each specific critical excursion scenario using two independent but like or identically designed means of control (redundant control). An example would be ensuring a safe concentration by using two independent density-measuring devices that are independently interlocked to two different fail-closed block valves that would each prevent a transfer to unfavorable geometry vessels if the allowed uranium concentration were exceeded.

The staff has reviewed SPC's proposed double contingency policy and has concluded that it provides reasonable assurance for safety, because the controls utilized for NCS have been established based on the double contingency principle or sufficient redundancy and diversity to preclude a nuclear criticality accident from occurring.

2.6.3 <u>Facility Procedures and Posting</u>

Activities at SPC involving licensed material are conducted in accordance with written, approved, and controlled procedures. Process specifications together with the applicable criticality safety specification (CSS) and/or Criticality Safety Limit Cards are part of the basis for written operating procedures. These procedures are reviewed and revised, if appropriate, annually by the NCS component. Furthermore, SPC commits to daily checks and monthly audits, which serve as a mechanism to identify deficiencies in procedures and posting. In addition, activities at SPC involving special nuclear material are conducted in accordance with limits and controls established by NCS. The administrative limits and controls are provided to the operating areas via NCS posting and/or operating procedures. Engineering limits and controls are provided in operating and maintenance procedures as necessary.

NCS postings describe the administrative limits and controls for a particular area, operation, work station, or storage area in order to provide workers a ready reference for verifying conformance and safe operation. NCS limits and controls are posted according to procedural requirements and instructions maintained by NCS. NCS postings provide the following information:

- Type of material permitted.

- Form of material.

- Allowable quantity (number of containers, weight, or volume) and restriction on the presence of moderation required.

- Spacing of fuel units, if required.

NCS has procedures that describe the activities conducted, such as:

- NCS analyses;
- NCS audits;
- Measurement of new or replacement equipment for NCS;
- NCS inspections;
- Verification of poison material for poison fixture fabrication and disposal;
- Criticality safety limits sign program (posting); and
- NCS training.

An inspection of operations at the plant found that NCS limits were included as part of procedures and were posted in the work areas where fissile material was handled. This is also consistent with commitments in the application and administrative policies and procedures.

The staff concludes that these commitments provide reasonable assurance that: (a) operations involving SNM are performed in a predictable and reliable manner via approved procedures, and (b) safety information is effectively communicated to workers via facility posting.

2.6.4 <u>Training</u>

SPC has committed to training all employees in NCS safety requirements and procedures. This NCS training incorporates the pertinent training elements contained in ANSI/ANS-8.20-1991, Nuclear Criticality Safety Training. The degree of NCS training is commensurate with the employee's contact with fissile materials. All NCS training is developed and provided by the nuclear criticality safety component of SPC. The effectiveness of NCS training is documented, and records maintained by SPC. The effectiveness of NCS training is verified by a combination of written examinations and the continuous surveillance program to assure overall plant safety.

To ensure that employees are cognizant of impending changes to plant operations which may affect safety, each employee in the affected area is promptly informed and instructed regarding such changes. In addition, to assure continual effectiveness of NCS training, annual refresher training is provided.

The staff concludes that the NCS training program is acceptable because:

1. It contains the essential features of ANSI-8.20 and,
2. Discussions with the Regional Inspector confirm that the program is effective.

2.6.5 Audits and Inspections

To assure the effectiveness of the NCS program, SPC has committed to perform audits, inspections, and investigations. First, SPC has committed to conduct monthly audits of the various criticality safety control systems; e.g., moderation control, enrichment control, neutron absorber inspections, process alarms, and trips related to criticality safety. Second, the criticality safety component of the SPC safety organization will perform audits of new installations and modifications to equipment and processes prior to their operation with special nuclear material in accordance with a plan [found in EMF-30, Chapter 3]. Third, SPC has committed to report audit findings to the respective facility management and to follow-up on each detected infraction in subsequent audits until there is satisfactory resolution. Finally, SPC has committed to audit each area of the plant at least biennially.

SPC also has implemented a daily inspection program to detect nuclear criticality safety infractions. This inspection function is performed by the Health and Safety Technicians. Detected infractions are communicated to the criticality safety component of the SPC safety organization.

The staff concludes that the audit and inspection programs are adequate from an NCS standpoint because the program provides reasonable assurance that:

1. All elements of the NCS program are reviewed on a timely basis, thus identifying potential problems areas before incidents occur;

2. The reviews are performed by trained personnel including the Criticality Safety Specialist;

3. Records of such examinations and evaluations are maintained; and

4. Action items are brought to the attention of management.

2.6.6 Criticality Alarm System

SPC has committed in the license renewal application to provide nuclear criticality alarm coverage for all SNM, except underwater monitors at the lagoons, such that two detectors in the alarm system are capable of detecting a criticality originating in the material. The alarm system is described in Section 10.6 of the renewal application. The system is capable of detecting, with two detectors, a criticality that provides an absorbed dose in soft tissue of 20 rads of combined neutron and gamma radiation at an unshielded distance of two meters from the reacting material within one minute. The staff has reviewed the proposed criticality alarm system and concludes that it meets the requirements of 10 CFR 70.24(a)(1) and is, therefore, acceptable.

2.6.7 Technical Criteria

To implement the double contingency principle or to provide sufficient redundancy and diversity to assure safety, SPC has committed to several methods of criticality control. These methods are referred to as control parameters. When evaluating an SNM-bearing system for criticality safety, each of these parameters will be assumed to be at its optimum condition; i.e., most reactive condition, unless specified and acceptable controls are

implemented to limit the parameters to certain values. These control parameters are:

Favorable Geometry: Is the most preferred means and is achieved by increasing the neutron leakage by limiting dimensions of a piece of equipment or fuel arrangement.

Geometry Control: Another means of providing control of the geometric dimensions of fissile material. Geometry control relies on active engineered/administrative features to assure safe dimensions and/or volumes.

Fixed Neutron Absorber: A means of increasing neutron absorption in material by placing a solid absorber (poison) in the system.

Soluble Neutron Absorber: A means of increasing neutron absorption in material by placing a soluble absorber (poison) in the system.

Concentration: Achieved by knowing and controlling the SNM concentrations in hydrogenous liquids to an acceptable value.

Moderation: Achieved by limiting, or excluding either interstitial (within the SNM) or interspersed (between SNM units) moderating materials, or both.

Spacing: Almost always needed to specify relative locations of SNM. It is a means of limiting interaction between SNM accumulations by separation.

Mass: A means of limiting the amount of SNM at a given location to an acceptable value.

Process Parameter Control: A means of control in which process parameters which may affect the neutronic properties of the SNM are controlled to limit the reactivity of the system.

Uranium Enrichment: Utilizes the inherent differences in critical attributes (critical dimensions, mass, etc.) of uranium at different enrichments of U-235.

Reflector: A means which limits neutron return back into a process parameter. Control is achieved by controlling process parameters; e.g., temperature, pressure, etc., that affect the moisture content or other characteristic of the SNM which affects the reactivity of the SNM bearing system.

These control parameters are implemented through the use of the following methods:

1. Passive engineering: A way of ensuring a limit by control over dimensions, fixed material composition, or absolute exclusion of undesired materials. Passive engineered controls rely on the human element for proper design, initial installation, verification while in service, and repairs. Geometry control is usually a passive engineered control.

2. Active engineering: A way of preventing an inadvertent criticality that relies upon a detector/feedback control mechanism to regulate a process parameter. Active engineering approaches rely on the human element for

proper design, initial installation, calibration/testing while in service, and repairs. Active engineered mechanisms may be electrical, mechanical, hydraulic, or some combination of these.

3. Administrative Procedures: Those actions taken to avoid an inadvertent criticality that are procedurally implemented and, therefore, are highly dependent on the human element.

Where practical, SPC uses passive engineering features, such as favorable geometry equipment, as the preferred method of criticality control in order to reduce the dependence on the human element. When necessary, active engineering features and administrative procedures are used for criticality control. In these cases, controlled parameters are clearly specified and approved by management.

To ensure that controls utilized for safety are effective and reliable, SPC has committed to design objectives which are in the next discussion.

2.6.8 Design Objectives:

A. Favorable Geometry

Favorable Geometry may be utilized if the following conditions are met:

1. Equipment relying upon favorable geometry for NCS control includes an allowance for fabrication tolerance and/or potential dimensional changes from corrosion or mechanical distortion.

2. The mechanical design of equipment in which deformation or rearrangement can occur is reviewed by a person competent in mechanical engineering.

3. Safe dimensions are established in accordance with design criteria for safety limits.

B. Neutron Absorbers

Criticality safety may be assured through the use of neutron absorbers such as cadmium or boron. Neutron absorbers may be fixed or blended/mixed into the SNM such as is the case with soluble absorbers or absorbers blended into uranium powders.

- Fixed Neutron Absorbers

Fixed neutron absorbers may be used provided the following conditions have been met:

1. Neutron absorbers are designed and fabricated as an integral part of the equipment.

2. Inspections to verify the continued integrity of the equipment and neutron absorber structure are performed on established time frequencies sufficient to insure their effectiveness.

3. Results of these inspections and the basis for the inspection frequencies are recorded and audited.

4. Viable alternatives to the use of fixed neutron absorbers to assure criticality safety do not exist.

5. Borosilicate glass Raschig rings are employed in solutions of fissile material in a manner consistent with ANSI/ANS Standard 8.5.

- Soluble or Blended Neutron Absorbers

Soluble/blended neutron absorbers may be used provided the following conditions have been met:

1. Neutron absorbers are shown to be uniformly distributed in the SNM.

2. The required minimum content is confirmed by analysis.

3. The process does not have any credible mechanisms to selectively remove the neutron absorber from the SNM.

C. Concentration

The concentration of the SNM dispersed or dissolved in another medium may be limited to prevent criticality, provided that the following conditions have been met:

1. Safety limits are developed in accordance with the design criteria for safety purposes.

2. The concentration limit shall not exceed 50 percent of the minimum critical concentration in the system being evaluated.

3. The following conditions are evaluated.

   a. Precipitation of solid SNM to the most reactive credible extent.

   b. Increasing the concentration of the SNM to the maximum credible extent due to effects such as evaporation.

   c. For arrays of units with concentration control, additional abnormal conditions to be evaluated (as applicable) include array size, unit spacing, and interspersed moderation effects.

D. Moderation

Control of moderators are of two general types: (1) control of the amount of moderator within SNM to a small percentage by weight of the SNM and (2) control of the total mass of moderator present in equipment or workstations.

The concentration of hydrogenous material within the SNM may be limited to a small percentage by weight of the SNM (moderation control) to prevent criticality, provided that the following conditions are met:

1. The permitted concentration of hydrogenous material shall be equal to or less than 50 percent of the critical concentration for the system in question.

2. The maximum reactivity of the system full of the material in question, under the worst credible accident conditions, shall be limited by the guidelines given in Section 4.2.2 of the license.

3. The material shall be contained within a fireproof barrier or in a process area containing limited sources of hydrogenous material. In the absence of a fireproof barrier, special controls shall be used to prevent fires and to control the use of moderators for fire fighting in such process areas.

The concentration of hydrogenous material between and within discrete units of SNM such as fuel rods and bundles may be limited to a small percentage by volume of the space between the units of SNM (moderation control) to prevent criticality, provided that:

1. The maximum credible concentration of hydrogenous material shall be equal to or less than 50 percent of the critical concentration for the system in question;

2. The maximum reactivity of the system full of the material in question, under the worst credible accident conditions, shall be limited by the guidelines given in Section 4.2.2 of the license renewal application;

3. The fuel rods and bundles are stored or processed in such a manner that water is free draining if it is present; and

4. Controls on the presence and use of other moderators in the area are evaluated and appropriately implemented.

E. Spacing

The spacing between units within an array shall be limited by mechanical means such that the following requirements are met:

1. The mechanical design of equipment or storage arrays in which deformation or rearrangement could result in the loss of a controlled parameter shall be reviewed by a person competent in mechanical engineering.

2. The K_{eff} of the array under the maximum credible accident conditions shall be limited by the guidelines given in Section 4.2.2 of the license renewal application.

3. For multi-unit arrays where K_{eff} is not used as a basis, the number of units in the array shall not exceed 50 percent of the calculated critical number.

F. Mass Limits

The use of mass as a criticality control parameter is acceptable if the following conditions are met:

1. Safety limits are established in accordance with the design criteria for safety limits.

2. The work station is limited to one safe batch, where a safe batch is defined as no more than 0.45 of the minimum critical mass of the material in process.

3. No more than one safe batch may be moved at one time when introducing or removing material from a workstation.

4. Individual safe batches are placed a specified minimum distance apart.

5. Records are maintained of the SNM inventory at each mass limited workstation.

6. SNM inventory control assures material buildup over time will not cause the batch limit to be exceeded.

7. Where engineered controls preclude overbatching, a mass 75 percent of a minimum critical mass shall not be exceeded.

G. Process Parameter Control

Reliance on process parameters to assist in criticality control is acceptable if the following conditions are met:

1. Safety limits are developed for process parameters in accordance with the acceptance criteria for safety purposes.

2. Process parameters which are relied upon for criticality safety are identified in CSAs and in operating procedures.

H. Enrichment

The use of enrichment as a control parameter is acceptable if the following conditions are met:

1. Safety limits are developed in accordance with the design criteria for safety purpose.

2. Nuclear criticality safety limits that utilize the fissile isotope content (enrichment) of all incoming SNM shall be verified by nondestructive analysis or laboratory analysis of representative samples prior to the conduct of any activity other than storage.

3. Except for waste, materials of different enrichment shall be kept segregated until combination of different materials is required in the process.

I. Reflection

Critical parameters for units and arrays of units shall be based on full water reflection, unless other reflectors in the immediate

vicinity could result in higher reactivities or other controls on reflection are established to ensure that the K_{eff} meets the limits in Section 4.2.1 of the license.

J. Nuclear Criticality Safety Limits

Critical parameters used to establish primary criticality safety limits will be based on one or more of the following conditions:

1. Criticality parameters obtained directly from experimental measurements.

2. Criticality parameters derived from experimental measurements.

3. Calculations using methods validated in accordance with Section 4.3 of ANSI/ANS-8.1-1983 (reaffirmed in 1988).

When safety limits are not based on calculational methods, safety factors are based on criteria in Tables 2.1 and 2.2.

TABLE 2.1 SAFETY FACTORS FOR HOMOGENEOUS SINGLE UNITS		
Safety Parameter	**Critical Parameter**	**Safety Factor**
Safe Mass SNM, M_s	Critical Mass SNM, M_k	0.45
Safe Mass SNM, M_{sl} (Exceeding of M_{sl} is excluded by engineering controls)	Critical Mass SNM, M_k	0.75
Safe Mass Moderator, M_{smod}	Critical Mass of Moderator, M_{kmod}	0.50
Safety Spherical Volume, V_s	Critical Spherical Volume, V_k $V_k \leq 5$ liters $V_k > 5$ liters	 0.75 0.80
Safe Infinite Cylinder, D_s	Critical Infinite Cylinder, D_k	0.85
Safe Infinite Slab, S_s	Critical Infinite Slab, S_k $S_k < 3$ cm $S_k > 3$ cm	 0.75 0.85
Safe Concentration, C_s	Critical Concentration, C_k	0.50

TABLE 2.2 SAFETY FACTORS FOR HETEROGENEOUS SINGLE UNITS		
Safety Parameter	**Critical Parameter**	**Safety Factor**
Safe Mass SNM, M_s	Critical Mass SNM, M_k	0.45
Safe Mass SNM, M_{sl} (Exceeding of M_{sl} is excluded by engineering controls)	Critical Mass SNM, M_k	0.75
Safe Mass Moderator, M_{smod}	Critical Mass of Moderator, M_{kmod}	0.50
Safety Spherical Volume, V_s	Critical Spherical Volume, V_k	0.75
Safe Infinite Cylinder, D_s	Critical Infinite Cylinder, D_k	0.85
Safe Infinite Slab, S_s	Critical Infinite Slab, S_k	0.85

When the neutron multiplication factor is utilized to determine the safety of a given system, the calculational method utilized shall be validated in accordance with the acceptance criteria for analytical methods. In addition, the multiplication factor determined by the analysis shall satisfy the following inequality.

$$k_a \leq k_c - \Delta K_{ku} - \Delta K_m$$

Where:

k_c = The value of K_{eff} that results from the calculation of benchmark experiments using a particular calculational method. The value represents a combination of theoretical techniques and numerical data.

ΔK_{ku} = The uncertainty in the benchmark experiments, including random and systematic errors (bias) within the range of parameters encountered in the equipment design.

ΔK_m = A safety margin to assure subcriticality. A value of 0.05 shall be used for normal conditions. A value as low as 0.03 may be used for abnormal conditions if justified by a sensitivity analysis.

The staff has reviewed the methodology for establishing nuclear criticality safety limits presented in the license application and has concluded that these limits are acceptable because they will ensure that an adequate safety margin will exist. Furthermore, when calculational methods are used, the licensee validates computational methods in accordance with ANSI/ANS-8.1, which gives the staff reasonable assurance that the methods used have been properly employed to establish safety limits.

K. Analytical Methods

Computer codes are used extensively to model the many processes required to manufacture fuel at SPC. The analysis of the calculations leads to the established nuclear safety limits posted at SPC. Nuclear safety calculations may be done using benchmarked and verified computer codes and techniques and cross section data sets. These codes, methods and cross section sets are validated in accordance with ANSI/ANS-8.1-1983.

Most reactivity calculations for non-elementary geometries or SNM compositions are performed using cross-sections and computer codes from the SCALE 4.2 system of codes. This system of codes includes CSAS, BONAMI, NITAWL, XSDRN-PM, ICE, and several cross-section libraries. These cross-sections and codes have been extensively benchmarked against data from critical experiments.

KENO-V.a, a 3-D Monte Carlo computer code, is the most frequently used code for estimating system K_{eff}.

When the SCALE system of codes is used to calculate K_{eff}, key items checked by the analyst and second-party reviewer include:

1. Verifying that the appropriate resonance self-shielding corrections have been applied to the cross-sections used.

2. Verifying that the nuclides and the atom densities in the mixing table conservatively represent the media in the system.

3. Ensuring that dimensions and media are appropriate for the conditions being tested. To help verify the geometry model, computer plots of the KENC geometry model are routinely made. These plots are used to ensure that the overall model and the units in the model are appropriate.

4. Verifying that the solution is well converged. If significant trends in K_{eff} between generations are present, or if the generation K_{eff} distribution is abnormal, determine if additional generations or a different start type (source distribution) is needed.

5 Examining the data on flux, fission density, and by-group absorption, leakage, and fission for anomalies. Assure that the most reactive region was adequately sampled and, if necessary, replicate the case with all or most first-generation neutrons starting in the most reactive region.

The staff has reviewed the applicant's use of analytical methods to calculate nuclear safety limits and concludes that there is reasonable assurance that these methods are acceptable. The basis for this conclusion is the licensee's commitment to validate analytical methods in accordance with ANSI/ANS-8.1 and to provide second-party reviews.

L. Neutron Interaction

To ensure the overall nuclear safety of the facility, neutron interaction (exchange between individually subcritical units) shall be considered. In this evaluation of neutron interaction all equipment within 10 feet that contains SNM will be considered. Equipment and facilities may be considered to be neutronically isolated if they are separated by either of the following:

1. A 12-inch thick slab of water.

2. A 10-inch thick slab of concrete.

3. Ten feet of air.

Interaction between units may be established utilizing either:

1. Calculational methods that meet the design criteria for analytical methods described in this report, or

2. The solid angle method.

When the solid angle method is applied, the constraints in the "Nuclear Safety Guide," TID-7016, Revision 2, will be utilized except for the use of the nominally reflected solid angle acceptance criteria. The nominally reflected solid angle acceptance criteria are used to limit the allowable solid angle for arrangements of individually subcritical units provided that the following conditions have been met:

1. Boundary conditions for the spacing between concrete walls and the array are as stated in Table I of Reference 21 of Section 4.2.8 except that a minimum separation of six inches shall be required.

2. Concrete walls are less than or equal to seven inches in thickness.

3. Separation distances given in Table I of Reference 21 are measured from the outermost vessel in the array to the closest wall.

4. The array shall be limited in both number and size of vessels to arrays that are reasonable extrapolations of the conditions assumed in Section 4.2.8 of Reference 21.

5. All vessels within the array shall be subcritical when fully reflected by water and shall have a minimum edge-to-edge separation of 12 inches.

The staff has reviewed the criteria for establishing neutron interaction and concludes that the criteria are acceptable. The basis for this conclusion is that the methods used to calculate neutron interaction are validated in accordance with ANSI/ANS-8.1. In addition, the staff approves the licensee's criteria for neutronic isolation.

M. Instrumentation and Maintenance

To ensure that the controls used to protect against an inadvertent nuclear criticality are both available and reliable, SPC has committed to preventative maintenance and calibration programs. Preventative maintenance for testing or verification of a criticality safety function is identified by a unique numbering system and by an appropriate cautionary statement identifying it as being criticality safety related. Preventative maintenance falling into this category must be performed as scheduled or the affected equipment may not be operated until such a time that the preventative maintenance has been completed. In addition, within the SPC instrument calibration program, certain instruments related to safety or product quality are identified with a special label. Instruments with this label may not be used beyond the calibration due date. Instruments without this label may be allowed a grace period with proper approvals.

The staff acknowledges the need for preventative maintenance and calibration of controls used to protect against an inadvertent nuclear criticality as a means to ensure the controls are both available and reliable. As such, SPC's commitment to perform preventative

maintenance and calibration of controls used to protect against an inadvertent nuclear criticality provides reasonable assurance that criticality safety will not be adversely affected by loss of these controls.

2.6.9 Criticality Safety Analysis

Before changing or beginning an operation or process with SNM, SPC has committed to determine that the entire operation or process will be subcritical under both normal and credible abnormal conditions. This requirement is met by an additional commitment to perform CSAs on all applicable operations. SPC has also identified assumptions and analytical techniques that may be applied to CSAs in the license application. The license application states that CSAs are performed by a multi-disciplinary team of personnel from the criticality safety component, plant engineering, and operating user organization to jointly evaluate credible accident conditions. SPC has also included examples of possible contingencies that are typically considered in the CSAs. The SPC application commits to the documentation of CSAs. The application identifies a list of the minimum items to be reviewed by the second party reviewer. These include verification that: (1) the methodology is clearly defined and applicable, (2) the assumptions are reasonable and applicable, (3) referenced sources are applicable and available, (4) the double contingency principle is met, (5) K_{eff} limits are met, (6) locations of unfavorable geometry equipment are identified and justified, (7) credible accident scenarios are developed and two independent or redundant barriers are present, (8) all calculations are checked including input and output when computer codes are used, (9) sensitivity analyses are performed, and (10) all required limits and controls are clearly specified.

This discussion also states that technical comments made by the reviewer are documented in the CSA along with acceptable resolutions.

Once the failure scenarios have been identified, nuclear criticality safety limits are established. These limits can be based on a variety of calculational methods with associated safety factors or margins as discussed in Section 2.6, 7.J above. SPC has committed to prepare CSS's based on limits established in CSAs.

A variety of analytical techniques are identified in the application including the use of safety factors to be applied to critical dimensions for single units, buckling conversion, surface density method, solid angle method, and computer codes for calculating K_{eff}. The application states that at the present time K_{eff} calculations are performed using SCALE 4.2. The application also presents calculational results comparing SPC-calculated K_{eff} with sample problems provided by the Radiation Shielding Information Center (RSIC) and with critical experimental data reported by Battelle Pacific Northwest Laboratory and by Babcock and Wilcox. The results demonstrate an ability to utilize the code along with the various cross section libraries and to analyze the results to determine bias and uncertainty.

In addition to the commitments pertaining to the preparation of CSAs, SPC has made commitments for the type of nuclear safety controls that would be used in specific parts of the plant operations. These commitments were made in Chapter 4, Table I-4.1 of the license renewal application. The commitments

presented in Table I-4.1 were compared with the process description in Chapter 15, Process Description and Safety Analysis, to determine if there was consistency between the general controls identified in Table I-4.1 and more specific controls identified in the Chapter 15 discussion. For those sections where detailed information is presented in Chapter 15, the NRC staff concluded there was consistency between the information in the two portions of the application.

The following provides a review of the systems analyzed to confirm that the double contingency principle or sufficient redundancy/diversity is present and that an acceptable license commitment has been made which defines the basis of safety for each process.

A. Receipt and Storage of UF_6 Cylinders

Receipt and storage of UF_6 cylinders begins with delivery of cylinders and ends with the storage of cylinders either at the storage facility or at the Line 1 or Line 2 storage docks at the UO_2 Building.

To assure criticality safety in conversion and subsequent processing, each cylinder is checked for U-235 content using a gamma counter to verify that the enrichment is less than 5 weight percent U-235. For cylinders containing greater than 4.7 weight percent U-235, a UF_6 sample, taken at the point the cylinder is filled, is analyzed by mass spectrometry at SPC or by another laboratory independent of the supplier.

SPC has committed to provide moderation control to preclude a nuclear criticality in the UF_6 cylinders. Any number of 30 inch diameter cylinders of UF_6, each containing up to 5.0 weight percent U-235, may be safely stored in any configuration as long as the content of the cylinders remains essentially unmoderated (at least 99.5 percent UF_6).

SPC has provided the staff with a summary of the accident analysis for the UF_6 cylinders. All the accident scenarios involving loaded UF_6 cylinders are predicated upon moderator entering a cylinder. In order for moderator to enter, the cylinder must be breached. Breaching can happen as a result of corrosion, fire, puncture, broken valve or drain plug, or sabotage. Although very unlikely, it is also possible that SPC could receive a cylinder which contained more moderating material than allowed by shipping specifications. The content of the cylinders remains unmoderated by ensuring the structural integrity of the cylinders and by implementing various engineering and administrative controls (e.g., limiting full cylinders to a single tier array to reduce the possibility of damage, limiting nearby combustibles and using special firefighting techniques, cylinder inspection and testing programs). In addition, purchase specifications for 30B cylinders require conformance to ANSI Standard ANSI-4.1 which includes certification by the vendor that cleanliness requirements specified therein have been met. Recertification and maintenance of cylinders is also performed within the requirements of ANSI-4.1.

The staff has reviewed the SPC accident analysis for the UF_6 cylinders and concludes that there is reasonable assurance via the mechanical

properties of the cylinder and the administrative procedures taken to preclude cylinder breaching that the commitment to provide moderation control is sufficient to ensure a nuclear criticality will not occur.

B. Cylinder Wash

UF_6 "heels" are periodically washed out of cylinders and transferred to favorable geometry tanks and, after the uranium concentration is verified to be a maximum of 140 gU/liter, to 55 gallon drums. Criticality safety in the cylinder being washed is maintained by a commitment to limit the amount of water added to the cylinder to five gallons, and by ensuring, through weighing, that the cylinder contains less than 15.8 kg U. Before it is transferred from favorable geometry storage tanks to storage in 55 gallon drums the cylinder wash solution concentration is independently checked by at least two of the following three methods: (1) specific gravity measurement, (2) calculation of the U mass in the tank vs. the tank liquid volume, and (3) laboratory analysis to confirm a safe maximum uranium concentration of 140 g U/liter.

The staff has reviewed the safety of the UF_6 wash operation and concludes that the double contingency principle has been implemented. Therefore, the staff concludes that there is reasonable assurance that the cylinder wash operation will be safely performed.

C. Line 1 Vaporization Room

The Line 1 vaporization system begins with the two vaporization chests in Room 132 of the UO_2 Building and ends at the primary/secondary header input to the hydrolysis tank. The major pieces of equipment comprising the system are the UF_6 cylinders, vaporization chests, and emergency scrubbers.

Criticality safety of UF_6 cylinders is assured by a commitment to utilizing moderation control and enrichment limitations (equal to or less than 5 weight percent U-235) as previously described in Section A above, Receipt and Storage of UF_6 Cylinders.

Criticality safety in the UF_6 cylinder vaporization chests is assured by a commitment to control the amount of moderator which can enter a loaded cylinder through the UF_6 headers and by a commitment to control the depth of any uranium-bearing solution that could leak into the vaporization chest.

The accident scenarios discussed in the application that could initiate a nuclear criticality in the cylinders housed in the vaporization chests are all predicated on more than five gallons of water entering a loaded cylinder through the primary header, the secondary header, or as a result of a cylinder being breached. There are various scenarios by which liquids could possibly enter cylinders. They involve plugging, overflows, or mistakes which result in liquid backflow through a primary or secondary header toward the cylinder. There are independent valves in the primary and secondary headers designed to close if the header temperature or pressure drops below

preset limits (2200°F and 22 psig, respectively). These defenses would have to be breached before water could get in through the header system. There is also a valve in the water line to the UF_6 water contactor which automatically shuts off water if the pressure exceeds 20 psig, thus ensuring that the water pressure is below cylinder pressure. These controls are sufficient to ensure that multiple failures are required before a nuclear criticality is possible in the UF_6 cylinder. Therefore, the staff concludes that there is reasonable assurance that a nuclear criticality will not occur in the cylinders in the vaporization chest.

While the vaporization chests are not geometrically safe, the amount of SNM which may be present is controlled by six one-inch diameter holes in the floor of each chest which allow any solution that accidentally could enter a chest to leak out, thus preventing the depth from exceeding a safe depth of UO_2F_2 solution at the maximum credible concentration. In addition, sources of solutions containing fissile material are isolated from the vaporization chests by knock-out pots and overflow drains. The staff has reviewed the safety of the vaporization chests and concluded that the commitment to controlling the geometry of the SNM (volume) and the measures taken to preclude fissile solutions from entering the vaporization chests are sufficient to ensure that multiple failures are required before a nuclear criticality is possible. Consequently, the staff concludes that there is reasonable assurance that the vaporization chests may be safely operated.

An emergency scrubber system is connected to the vaporization chests. The emergency system may be activated manually by emergency push buttons mounted at the area exits and in the conversion area control rooms located on the floor above the vaporization room, and automatically from smoke alarms mounted in the vaporization room. Activation of the emergency scrubber system causes the UF_6 vapor to be drawn into the scrubber and converted to uranyl fluoride.

The emergency scrubbers have unfavorable geometry if completely filled. However, SPC has committed to limit the amount of SNM solution which may be present in the scrubber (volume control) by ensuring engineered features (drains and level switches) are in place. These features that are currently in place include three drains and a level switch that is interlocked to shut off the scrubber if the solution depth in the bottom of the scrubber reaches 2 inches.

The staff has reviewed the safety of the scrubber system and concludes that multiple failures would have to occur before a nuclear criticality is possible in the scrubber system. Therefore, the staff concludes that there is reasonable assurance that the scrubber system may be operated safely.

D. ADU Process

The Line 1 ADU process begins at the hydrolysis tank and ends at the discharge of the ADU dryer. The major pieces of equipment comprising the system are the hydrolysis tank and heat exchanger, the ADU

precipitation tank and heat exchanger, the flocculation tank, the ADU centrifuge, and the dryer. In the ADU process, UF_6 gas interacts with water in a contactor, and the resultant UO_2F_2 solution is collected in a cylindrical hydrolysis tank. The uranyl fluoride produced in the hydrolysis tank is transferred to a precipitation tank where it is mixed with ammonium hydroxide to produce ADU. The precipitation tank is vented to the Process Offgas (POG) system to prevent release of ammonia vapors to the operating area. Continuous centrifuges are then used to separate solid ADU from the liquid stream. The solids are dried in a ventilated, oil-heated dryer, and the ammonia and water vapors are removed from the offgas stream by scrubbing in the POG system.

Criticality safety for the hydrolysis, precipitation, and flocculation tanks and associated heat exchangers is assured by a commitment to provide favorable geometry vessels and to limit the amount and concentration of UO_x material from entering these vessels. The licensee has stated that there are no pathways for UO_x material to enter the hydrolysis, or precipitation tanks, and, therefore, it is not credible for UO_x material to be present in these tanks. Although UO_x material could enter the flocculation tank, this tank is a favorable geometry vessel even for the presence of UO_2-H_2O.

The staff has reviewed the nuclear criticality safety for the hydrolysis, precipitation, and flocculation tanks and concludes that the licensee's commitment to provide favorable geometry vessels and the commitment to exclude UO_x material from the tanks provides reasonable assurance that a nuclear criticality will not occur.

Criticality safety for the bulk Aqueous Ammonia (AA), Dilute Nitric Acid (DNA) and deionized water (DIW) supply tanks is provided by multiple engineered features to ensure that fissile material from adjoining tanks does not backflow into these systems. Currently, these engineered features include the use of level controls on adjoining tanks (with redundant alarm systems) to ensure that an air gap is maintained in those tanks which contain SNM. In addition, vented favorable geometry supply tanks are utilized to isolate the unfavorable geometry bulk storage tanks. The staff has reviewed the bulk storage tanks and concludes that the backflow controls and favorable geometry supply tanks provide reasonable assurance that a nuclear criticality will not occur as a result of backflow.

E. ADU Centrifuge and Dryer

ADU slurry is pumped from the precipitator tank to the ADU centrifuge, and wet ADU goes from the centrifuge through a chute into the dryer. Criticality safety for the ADU centrifuge and dryer is assured for optimum ADU concentrations by the commitment to utilize geometry control to limit the amount of ADU which may be present in the dryer and centrifuge.

The introduction of significant amounts of UO_2 upstream of the dryer that could also potentially lead to unsafe conditions has been reviewed by the licensee. The calciner offgas scrubber solution was

found to be the only identified potential source of UO_x upstream of the dryer. The amount of UO_2 available for introduction into the ADU feed stream is less than 5 kg at any one time; amounts greater than 5 kg were considered not credible. An amount less than 5 kg was considered by the licensee as an insignificant amount for producing a criticality in the system.

The staff has reviewed the nuclear criticality safety for the centrifuge and dryer and concludes that the commitment to provide geometric control and to limit the amount of UO_x material from entering these operations is sufficient to provide reasonable assurance that a nuclear criticality will not occur.

F. Powder Production

Line 1 UO_2 Powder Production System

The UO_2 powder production system starts at the output of the ADU dryer and ends at the discharge of the powder storage slab hoppers. The major pieces of equipment comprising the system are the feed hopper, the calciner, the calciner download hood and powder transfer system, the slab hoppers, and the calciner offgas scrubber.

ADU is fed, via the feed hopper, from the hot oil dryer or powder recycle system to the feedscrew assembly of the calciner, where it reacts with a reducing atmosphere of hydrogen or ammonia to produce UO_2 powder.

UO_2 powder is passed through a rotary airlock at the discharge end of the calciner. An in-line moisture analyzer is installed at the discharge end of the calciner as a method of monitoring the calciner operation for the production of dry powder. The powder can also be sampled by the autosampler below the rotary airlock as it drops to the diverter valve. The autosampler periodically samples the powder being discharged from the calciner and drops it via a 1½-inch inside diameter (I.D.) hose into a catch pan at the calciner discharge hood. The diverter valve can direct the powder flow either to the calciner bucket drop or the Vac-U-Max transfer line in the calciner discharge hood. The Vac-U-Max transfer line transports the powder to slab hoppers or to the poisoned 45 gallon drum loadout station. Powder in the slab hoppers is sampled, and the samples are analyzed for moisture. Only when the powder is verified to be dry ($<$ 10,000 ppm moisture) may the powder be transferred to a blender.

Line 1 Feed Hopper

Criticality safety in the feed hopper is assured by a commitment to utilize favorable geometry. A bounding model was used for the feed hopper which was considered to conservatively model any potential changes and interactions, making loss of geometry control not a credible event.

The staff has reviewed the nuclear criticality safety for the feed hopper and concludes that the commitment to maintain a favorable

geometric feed hopper in conjunction with the analysis which reveals that there are no credible means for the loss of geometric control to occur is sufficient to provide reasonable assurance that a nuclear criticality will not occur.

Powder spills out of the feed hopper inspection port due to pressurization were analyzed as a means of accumulating more than a safe batch of moderated uranium material in an unsafe configuration. SPC identified only two events for producing a powder spill out of the inspection port. These two events were (1) introduction of oxygen into the system to react with hydrogen, which could only occur if there was a small amount of ADU present, or (2) hydrostatic pressurization of the system. As a result of the minimal amount of ADU material for the oxygen-hydrogen reaction, this was not considered a credible means for producing a powder spill that would impact criticality safety. In regards to hydrostatic pressurization, the relatively high moisture content of ADU and the low pressures available to pressurize the system were not considered credible means of producing a powder spill.

The staff has reviewed the nuclear criticality safety for potential powder spills out of the feed hopper inspection port and concludes that, based on the following two unlikely events: (1) the capability of producing a spill and (2) the likelihood that the powder spill would then be of such an amount and configuration to produce a criticality, there is a reasonable assurance that a nuclear criticality will not occur.

Line 1 Calciner

Criticality safety in the calciner is assured by a commitment to utilize the neutron absorber properties of the material used for construction of the calciner in combination with geometry control to prevent a nuclear criticality. The material properties of construction (the inconel alloy contains molybdenum which acts as a neutron poison), in combination with the geometry of the calciner, ensure criticality safety. These features ensure that any concentration of SNM entering the calciner will be subcritical.

The staff has reviewed the safety of the calciner and concludes that the geometric configuration and credit for neutron poison present in the material are sufficient to provide reasonable assurance that a nuclear criticality will not occur.

During normal operation of the calciner system, the discharge material from the calciner has been shown by test to be less than 0.17 weight percent moisture. There are two conditions of calciner operation which conceivably could result in UO_2 produced in the calciner exceeding a water content of one weight percent. These conditions are: (1) increasing the amount of ADU feed into the calciner to an amount that surpasses the calciner's ability to dry it, and (2) adding or condensing moisture at the discharge end of the calciner. These conditions will be prevented, detected and/or mitigated by the in-line real time moisture analyzer or by periodic sampling, by maintaining N_2

flow through the rotary airlocks, and by controlling and monitoring calciner pressure, temperature, and feed rate.

Experimental data has been collected to determine the actual conditions under which the calciner would generate certified dry (~1.0 weight percent water) powder. Analysis of this data provided the following set of conditions to ensure that the calciner discharges dry powder:

1. Conduct real time measurement of moisture content of powder at the discharge end of calciner.

2. Maintain cover gas on the discharge end of calciner to prevent steam from condensing on cold surfaces and contaminating dry material.

3. Maintain calciner temperature and pressure such that any water added will be turned to steam and removed by the POG system.

Line 1 Calciner Download Powder Transfer System

UO_2 powder is passed through the rotary airlock at the discharge end of the calciner. The powder may be sampled (as it drops to the diverter valve) by an autosampler located below the rotary airlock. Use of the autosampler is not required, but is used as a backup for the in-line moisture analyzer. The autosampler periodically samples the powder being discharged from the calciner and drops it via a 1½-inch I.D. hose into a catch pan at the calciner discharge hood. The diverter valve can direct the powder flow either to a 5-gallon bucket or a Vac-U-Max transfer line, each located in the calciner discharge hood.

Criticality safety in the calciner download and powder transfer system is assured by commitments to utilize favorable piping geometry in the transfer system, volume control in the buckets, and neutron poisons in the storage drums.

The only potential for a spill inside the hood that could result in an accumulation of a significant amount of material is at the bucket download station. Such spills are prevented by the use of a through-beam sensor which is interlocked to the rotary airlock to prevent powder transfer if a bucket is not in the proper position. In addition, a simultaneous water leak would have to occur for a nuclear criticality to be possible. These two unlikely events provide the staff with reasonable assurance that a nuclear criticality will not occur.

Introduction of moderator resulting in powder with greater than 1.0 weight percent moisture being transferred to the slab hoppers or the 45-gallon poisoned drum could occur due to failure of friction connections and/or rubber boots or lines in the transfer system. This potential accident requires simultaneous leaks in both a water source and the powder transfer equipment. The powder transfer lines from the diverter valve below the calciner to the slab hoppers are designed and

operated such as to prevent the undetected introduction of moisture to the slab hoppers. Specifically, the following conditions exist:

1. All connections provide a positive seal such that water spraying on the transfer lines will not leak into the powder.

2. Opening or reconfiguring powder transfer lines requires Criticality Safety approval.

3. Spray shields are in place, where appropriate, to provide a barrier between known sources of moderators and potential leak sites in the powder transfer system (wear points, connectors, etc.).

4. As a substitute requirement for 1 and 3 above, an operator, whose only responsibility is to watch for and prevent the intrusion of moderators into the powder transfer lines, is continuously present during equipment operation.

Additional assurance that moderator has not entered the powder during transfer is also provided by moisture analyses which are performed at the powder's destination (slab hoppers or 45-gallon poisoned drums).

The staff has reviewed the nuclear criticality safety for the calciner download and powder transfer system and concludes that the commitment to implement moderation controls to preclude a nuclear criticality provides the staff with reasonable assurance that a nuclear criticality will not occur.

Line 1 Slab Hoppers

The Line 1 slab hoppers store "potentially moderated powder." SPC defines "potentially moderated powder" as having at least one assurance that the powder is dry. After a lab analysis, which verifies that the powder is dry, the powder is then transferred to blenders for additional processing. Criticality safety in the slab hoppers is assured by a commitment to maintain geometry control.

The staff has reviewed the criticality safety of the Line 1 slab hoppers and has concluded that the commitment to maintain favorable geometry provides reasonable assurance that a nuclear criticality will not occur.

Calciner Offgas Scrubber

Criticality safety in the calciner offgas (COG) scrubber is assured by a commitment to use a favorable geometry scrubber. The staff has reviewed the criticality safety of the calciner offgas scrubber system and has concluded that the commitment to maintain favorable geometry provides reasonable assurance that a nuclear criticality will not occur.

G. UNH Processing

Receiver Bells

Oxidized scrap powder, which is not dry-blended with virgin powder, may be processed in Room 101A of the UO_2 Building. In this room, UO_2 is pneumatically transported from drums or buckets using a negative pressure conveyance system to powder receiver bells located above each dissolver with a feed hopper in between. The powder receivers operate in conjunction with a scale system to control the quantity of powder batched into the dissolvers.

A nitric acid/water mixture is heated in the dissolver and pumped over the uranium oxide powder which is held in a perforated metal basket until the oxide is dissolved. Uranium batch size and tank placement are controlled to assure criticality safety within the UNH room.

The UNH is filtered and pumped to geometrically safe storage tanks, located in Room 102A, where it is held until it is processed through a uranium conversion line.

The nuclear criticality safety limit in the receiver bell is 20 kg of UO_2 powder verified to be dry (<1 percent water plus <1 percent water equivalent additives). The receiver bell is connected to a load cell which shuts off the pneumatic powder feed when 20 kg has been received. Because the hoods where the receiver bells are located are enclosed, the only way to transfer water into the bells is through the transfer system. If this were to happen, the 20 kg shutoff feature on the load cell would limit the amount of "moderated" UO_2 which could be received.

The staff has reviewed the criticality safety for the UNH processing receiver bells and concludes that the commitments to limit the quantity of SNM mass and moderator, thus ensuring double contingency, provide reasonable assurance that a nuclear criticality will not occur.

Feed Hoppers

Criticality safety of the feed hoppers is based on uranium mass control and moderator control.

The receiver bell dumps through a valve into the hopper. There is a weight limitation of 20 kg UO_2 per batch in the receiving bells. There is an interlock which requires the feed hopper feed screw to run a preset length of time, prior to allowing a new batch to be transferred to the receiving bells. The presence of a technician in the area along with the weight limit and feed screw interlock makes over batching highly unlikely. Before transferring UO_2 into the feed hoppers, the operator must manually open the feed hopper lid and inspect the feed hopper for possible hold up of UO_2. If over batching were somehow to take place, the powder would have to be saturated with water (13-14 percent) and the room completely flooded to initiate a nuclear criticality.

The staff has reviewed the nuclear criticality safety of the feed hoppers and concludes that the licensee has implemented the double contingency principle by controlling both moderator and mass. Therefore, the staff concludes that there is reasonable assurance that a nuclear criticality will not occur in the feed hoppers.

The analysis for the feed hoppers also conservatively bounds the scrubber surge tanks, heat exchanger and filter basket.

Dissolver Tanks

The dissolvers contain nitric acid, the level of which is raised to cover and dissolve baskets containing 20 kg batches of UO_2 powder in the dissolver tanks. Criticality safety of the dissolver tanks is provided by a commitment to use favorable tank geometry.

The staff has reviewed the nuclear criticality safety for the dissolver tanks and concludes that the licensee's commitment to maintain favorable geometry provides a reasonable assurance that a nuclear criticality will not occur.

H. Powder Receiver Slab Hoppers and Hoods

Criticality safety in the slab hoppers and hoods is assured by controlling the moderator concentration in the UO_2 powder.

The vacuum transfer system contains slab hoppers which collect any powder carried over from the receiver bells. The powder transferred via the vacuum transfer system is certified dry by two independent means. The only way for the powder to take on moisture is during the transfer process which is carried out in a hood located in a moderator-controlled area. Even if optimally-moderated UO_2 completely fills the slab hopper, it would take full reflection (the room totally flooded and more than double batching) to result in an unacceptable K_{eff}. There is also a technician present who could shutdown the process if flooding occurred.

The staff has reviewed the nuclear criticality safety in the slab hoppers and hoods and concludes that the licensee's commitment to control the moderator concentration provides reasonable assurance that a nuclear criticality will not occur.

2.6.10 Other Processes

NRC staff have reviewed the CSA summaries provided by the applicant and have determined that they are adequate to provide a reasonable safety basis for those systems that have been analyzed. However, CSA summaries have not been provided for all processes at the facility. During a site visit on April 16-18, 1996, by NRC staff (trip report dated April 26, 1996), SPC committed to provide the remainder of the CSA summaries on the following schedule: SPC will finish Chapter 15 write-ups and provide category II CSA summaries by March 1, 1997; complete category III CSA's by March 31, 1997; and complete the last Chapter 15 updates by September 30, 1997.

2.6.11 NCS Conclusion

Upon completing the review of the NCS Program, the staff concludes that SPC has an adequate NCS organization, facility procedures and postings, staff training, and audit and inspection program, and that SPC has sufficient controls to guard against an inadvertent criticality for the processes reviewed. The applicant has thus provided reasonable assurance of safe operation for the processes reviewed. The adequacy of the criticality safety controls for other processes will be determined as the remaining CSA summaries are submitted and reviewed.

2.7 Environmental Safety

NRC staff reviewed SPC's commitments to environmental safety. The applicant conducts business in accordance with a system of Standard Operating Procedures, Company Standards, and Policy Guides. The applicant is committed to controlling activities involving special nuclear materials, including activities related to environmental safety, in accordance with these procedures, standards, and guides. Environmental safety activities are performed in accordance with Environmental Safety Standards.

2.7.1 Environmental Safety Standards

Environmental Safety Standards (Standards) are prepared by the Environmental Engineering Component, and are initialed by the Health Physics Component if the Standard has an effect on radiation safety. The Standards are subject to the concurrence of the Manager, Regulatory Compliance; the Manager, Safety,

Security, and Licensing; and the Vice President, Engineering, in accordance with the Approval and Responsibility Matrix, Figure I-2.3 of the renewal application.

2.7.2 Staff Qualifications

The applicant has provided minimum qualifications for personnel who are responsible for implementing the environmental safety programs; for performing environmental sampling, inspections, and audits of the environmental safety program; and for supervising the staff. The positions for which minimum qualifications are specified include the following:

- Manager, Waste Management Engineering.
- Manager, Safety, Security, and Licensing.
- Manager, Regulatory Compliance.
- Manager, Safety.
- Industrial Safety and Health Component.
- Health Physics Component.
- Supervisor, Radiological Safety Component.

- Health and Safety Technicians.
- Environmental Engineering Component.
- Manager, Inspection Services.
- Manager, Analytical Services.

NRC has reviewed the applicant's minimum staff qualifications and has determined that there is reasonable assurance that staff with these qualifications will adequately perform their duties with respect to environmental safety.

2.7.3 Organization and Authority

2.7.3.1 Operation

The operation of environmental control systems, including the stack scrubber and high-efficiency particulate air (HEPA) filter systems, the lagoon uranium recovery and ammonia recovery systems, the solid waste uranium recovery facility, and the containerized waste storage areas are the responsibility of the Manager, Plant Operations.

The Manager, Waste Management Engineering, is responsible for implementing projects and recommending process changes to support waste treatment and environmental compliance.

The design and/or modification of new and existing equipment and facilities, including those to control releases of radioactive materials to the environment, is the responsibility of the Manager, Plant Engineering.

NRC has reviewed the applicant's designation of responsibility for operation and modification of equipment and systems related to environmental safety. NRC has determined that the responsible managers are qualified and have adequate authority to direct the operation of the environmental control systems in accordance with the license, and that the designation of authority is, therefore, acceptable.

2.7.3.2 Monitoring

The Environmental Engineering Component is responsible for monitoring the levels of regulated material released to the environment. The Environmental Engineering Component reports to the Manager, Regulatory Compliance. Health and Safety Technicians are responsible for field sampling under the guidance of the Industrial Safety and Health Component. The Health and Safety Technicians and Industrial Health and Safety Component report to the Manager, Safety. These two managers in turn report to the Manager, Safety, Security, and Licensing.

The Manager, Safety, Security, and Licensing, is wholly independent with no manufacturing responsibility, and reports directly to the Vice President, Engineering and Manufacturing. If the Manager, Safety, Security, and Licensing, or the Manager, Safety, judges any operation as unsafe, he has the authority to request management to shut down the affected operation.

NRC has reviewed the applicant's designation of responsibility and authority for environmental safety programs and has determined that it contains sufficient separation of duties, adequate oversight, and independence from manufacturing responsibility, and is, therefore, acceptable.

NRC has reviewed the applicant's commitments to perform activities related to environmental safety in accordance with Safety Standards. NRC has determined that: (1) the Safety Standards are prepared by qualified staff and reviewed by applicant management; (2) the activities are performed by qualified staff with appropriate supervision; (3) these activities are audited and inspected by independent staff; (4) the data and records are provided to applicant management; and (5) problems and necessary corrective actions are brought to the attention of management, the ALARA Committee, and the Health and Safety Council; therefore, the commitments are acceptable.

2.7.4 Effluent Control and Monitoring

SPC controls effluents to air and releases to the city sewer to levels that are within the limits in 10 CFR Part 20 and are as low as is reasonably achievable. SPC also manages solid wastes in a manner protective of the environment. These effluents are controlled through an environmental program that includes established procedures, qualified staff, engineering controls, inspections and audits, and management oversight.

The staff has concluded that there is reasonable assurance that SPC's environmental protection program is adequate to maintain doses to the public that are in compliance with 10 CFR Part 20 Subpart D. The bases for this conclusion are discussed in the following sections.

2.7.4.1 Air Effluents

SPC controls and monitors effluents to the atmosphere, and has established action levels for these effluents.

2.7.4.1.1 Controls

All ventilation systems that serve areas of the facility where airborne radioactive materials could be present, including manufacturing areas, laboratories, and waste treatment facilities, are equipped with scrubbers and/or HEPA filters that meet industry standards and control the emission of radioactive materials to the atmosphere.

2.7.4.1.2 Monitoring

Continuous isokinetic sampling is provided at all exhaust air stacks servicing areas where uncontained radioactive materials are used, processed, or otherwise handled. These samples are analyzed for radioactive material (gross alpha) on a weekly basis. Effluent concentrations, stack flow volumes, and total quantities of radionuclides released are reported to NRC in semiannual effluent reports required by 10 CFR 70.59.

SPC also holds a permit from the Benton County Clean Air Authority that regulates fluoride and nitrogen dioxide in ambient air and forage.

2.7.4.1.3 Action Levels and Corrective Actions

SPC has set air effluent ALARA goals that are specified as action levels in Table I-5.1 in the license. The table specifies six incremental action levels, at which increasingly aggressive investigations and process shutdowns would be performed. The action levels are specified as seven-day sample results in μCi/ml of alpha radiation as a calculated concentration at the site boundary based on individual stack concentrations. Potential doses at the site boundary are calculated using International Commission on Radiation Protection (ICRP) 30 methodology and a conservative, site-specific CHI/Q value of 0.114×10^{-4}.

2.7.4.1.4 Air Effluent Control and Monitoring Conclusion

NRC staff has determined that the applicant's commitments to air effluent controls, monitoring program, action levels, and corrective actions provide reasonable assurance of compliance with the effluent limits and ALARA requirements of 10 CFR Part 20 and are, therefore, acceptable.

2.7.4.2 Sewer Releases

SPC controls and monitors liquid releases to the city sewer and has established action levels for these releases.

2.7.4.2.1 Controls

All liquid effluents from manufacturing processes are held in wastewater lagoons on site prior to treatment and discharge to the Richland city sewer. The lagoon liquids containing only low concentrations of uranium are treated by sand filtering and ion exchange in the ARF to remove ammonia prior to discharge. High-uranium wastewaters are stored in Lagoon 3 prior to treatment in the LUR facility and discharged to Lagoon 5A, from which they go through the ARF. The ARF effluents are combined with sanitary wastewater, laundry wastewater, and non-contact cooling water prior to discharge.

The wastewater lagoons have double liners to prevent the migration of lagoon contents to adjacent subsurface soil and ground water. The liners consist of double layers of impervious material separated by a layer of sand or other material to maintain spacing between the liners. A system of sampling tubes is installed between the liners to provide sampling capability to permit detection of upper liner leaks.

2.7.4.2.2 Monitoring

The lagoon liner systems are monitored for leaks on a monthly basis. If a significant volume of liquid is pumped from between the liners, the liquid is analyzed for uranium and fluoride content. If uranium and fluoride are present above previously measured levels, a further investigation is initiated. If a leak in an upper liner is confirmed, the liner will be repaired, and a report will be forwarded to the NRC regional office.

NRC has reviewed the commitments to lagoon monitoring and corrective actions, and has determined that they are sufficient to detect and stop any leakage to the environment in a timely manner, and are acceptable.

These lagoons have also been designated as dangerous waste treatment and storage units by the Washington Department of Ecology (WDOE) and are regulated under Washington's Dangerous Waste regulations.

Since most of the uranium discharged by SPC is routed to the lagoons and then through the ARF, the ARF effluent is monitored for uranium to estimate the total amount of uranium discharged to the sewer. The combined effluent is continuously sampled and monitored, and the flow measured at the effluent monitoring station at the plant boundary. The combined effluent is analyzed for uranium and regulated chemicals. Effluent concentrations, flow volumes, and total quantity of radioactive material released are reported to NRC in semiannual effluent reports required by 10 CFR 70.59.

SPC holds a Waste Discharge permit from WDOE for the discharge to the sewer. This Permit Number ST-3919, issued April 1995, contains daily maxima and monthly average limits for flow, ammonia nitrogen, nitrate nitrogen, fluoride, pH, and total suspended solids, and includes monitoring requirements. The monitoring requirements include annual chronic bioassay testing on lagoon effluent. The NPDES permit does not address radioactive materials.

2.7.4.2.3 Action Levels and Corrective Actions

Table I-5.3 of the application proposes action levels of 1.6×10^{-7} µCi/ml-uranium in a sample for investigation of probable cause, and 1.6×10^{-6} µCi/ml-uranium in a sample for shutdown of discharge to the sewer. These proposed action levels were reviewed against the following three criteria: (1) the concentration limits for releases to sewers in Table 3 of Appendix B to 10 CFR Part 20, (2) the prohibition on the discharge of insoluble uranium to a sewer in 10 CFR 20.2003, and (3) the ALARA provisions of 10 CFR 20.1301(c).

Effluent Concentration Limits

The proposed action levels are sufficiently low to indicate potential violation of the concentration limits for uranium in Table 3 of Appendix B to 10 CFR Part 20, Releases to Sewers. These effluent limits are 3×10^{-6} µCi/ml for U-234, U-235, and U-238 as a monthly average concentration. The shutdown action level is higher than the monthly average limit; however, the samples are analyzed with sufficient frequency to provide adequate warning that the limit is being approached. In addition, the effluent limits apply to each of the uranium isotopes, and the action levels are low enough to indicate that concentrations at the licensed enrichments are below the limits. The licensee monitors the effluent as described in Section 2.7.4.2.2 above, and reports the data to the NRC as required by 10 CFR 70.59.

Prohibition of Discharge of Insoluble Licensed Material to Sanitary Sewer

New standards for protection against radiation in 10 CFR Part 20 became effective on January 1, 1994. These standards included criteria for the discharge of licensed material to a sanitary sewer. These criteria, in 10 CFR 20.2003(a), specify that the licensed material must be readily soluble in water or readily dispersible biological material. The discharge also must comply with the sewer release limits in Appendix B of Part 20. On January 24, 1994, NRC issued Information Notice (IN) 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage under the Revised 10 CFR

Part 20," which provided a definition of "soluble" for the purpose of this rule. The IN presented several alternatives for determining solubility, including a determination of particle size using standard laboratory procedures (American Society for Testing and Materials [ASTM] Method D 1888-78 "Standard Test Methods for Particulate and Dissolved Matter, Solids, or Residue in Water" and the American Public Health Association's Method 7110, "Gross Alpha and Gross Beta Radioactivity (Total, Suspended, and Dissolved)" from Standard Methods for the Examination of Water and Wastewater). According to these procedures, any particle that would pass through a 0.45 micron filter would be considered soluble.

In April 1994, SPC applied for an exemption to this rule for their laundry retention tank wastewater, based on the costs of filtering the wastewater, increased occupational exposure, and filter disposal costs. SPC determined that approximately 60 percent of the uranium discharged from the laundry retention tanks was insoluble according to the particle size criterion.

NRC staff reviewed the exemption application, and, in a letter dated July 5, 1994, NRC requested additional information (RAI) on the application. SPC replied to the RAI in a letter dated August 25, 1994. NRC determined that SPC was in compliance with 20.2003(a) and no exemption was necessary, and informed SPC of the determination in a letter dated February 2', 1995. The basis for this determination was that the concentration of insoluble uranium in the sewer discharge at the lift station where it leaves the plant and enters the city sewer was undetectable at a detection sensitivity of 0.1 pCi/ml.

The applicant's proposed action levels are adequate to provide warning of potential violation of the prohibition on the discharge of insoluble uranium to the sanitary sewer. As described in Sections 1.3.3 and 2.7.4.2.1 above, the licensee has a number of wastewater streams that are combined prior to discharge to the city sewer, including treated Lagoon 5A and laundry retention tank discharges. In the August 25, 1994, RAI reply, the licensee stated that approximately 60 percent of the uranium from the laundry retention tanks was insoluble; however, the discharge from the laundry retention tanks is only about 4,000 gallons per day. This is mixed with approximately 225,000 gallons per day of treated Lagoon 5A effluent, non-contact cooling water, and sanitary wastewater. These other wastewater streams contain only soluble uranium, or none. When the wastewater streams are combined on site prior to release to the city sewer, the proportion of insoluble uranium contributed by the retention tanks is less than 5 percent of the total uranium. Therefore, the proposed action levels are low enough to detect concentrations of insoluble uranium approaching the detection limit of 0.1 pCi/ml.

ALARA

The applicant provides containment and treatment of liquid waste streams to recover as much uranium as possible and to reduce the amount of uranium released to the sewer to the extent possible using appropriate treatment technology. The implemented treatment methods have demonstrated that they are capable of reducing the concentration of uranium in sewer releases to levels significantly less than the release limits in 10 CFR Part 20.

2.7.4.2.4 Liquid Effluent Control and Monitoring Conclusion

NRC staff has determined that the applicant's commitments to liquid effluent controls and monitoring provide reasonable assurance of compliance with the effluent limits, sewer release limits, and ALARA requirements of 10 CFR Part 20, and are, therefore, acceptable.

2.7.4.3 Solid Wastes

SPC has established controls for the management of solid wastes generated on the facility.

Solid wastes are segregated on site into nonradioactive solid wastes, non-radioactive dangerous wastes, combustible radioactive wastes, noncombustible radioactive wastes, and mixed radioactive and dangerous wastes.

Nonradioactive solid wastes are surveyed prior to transport to the Richland city landfill. Nonradioactive dangerous wastes and mixed radioactive/dangerous wastes are stored in containers in a covered container storage area onsite. This dangerous waste storage area is permitted by the WDOE under Washington's Dangerous Waste regulations.

Combustible radioactive wastes are burned in the SWUR incinerator, and the ash is stored in drums for uranium recovery. Non-combustible radioactive wastes are sent to Allied Technologies Group (ATG) in Richland for compaction and repackaging into drums for disposal at the U.S. Ecology radioactive waste disposal facility on the Hanford Reservation.

In early 1994, SPC developed a comprehensive waste management engineering plan, with the objectives of reducing the inventory of wastes accumulated and stored onsite and of improving the management of wastes as they are generated. This plan includes compaction and disposal of waste inventory, and operation of the SWUR incinerator. SPC has made significant progress in compaction and disposal of waste inventory.

NRC staff has reviewed SPC's solid waste management program and has determined that it provides reasonable assurance that radioactive wastes will be handled safely and disposed of properly. The program is, therefore, acceptable.

2.7.5 Environmental Monitoring

SPC monitors ambient air, offsite soils, vegetation, ground water, and Richland sewage plant sludge to measure the operation's effect on the environment outside the manufacturing facility.

2.7.5.1 Air, Soils, Vegetation

SPC has established six sampling stations outside the plant that are monitored for effects of SPC's operations on the environment. Sampling Stations 1 and 2 are located east of the plant, and soil samples collected from these stations are analyzed quarterly for uranium. Sampling Stations 3 and 4 are located east and south of the plant, and continuous air samples from these locations are analyzed monthly for fluoride. Sampling Stations 5 and 6 are located east

of the plant, and vegetation samples from these locations are analyzed for fluoride monthly during the growing season of April through October.

NRC has determined that it is acceptable for SPC to monitor the air and vegetation for fluoride, and not for uranium, because air and vegetation are monitored for radionuclides by the Department of Energy (DOE). DOE has a number of air and vegetation monitoring stations within the Hanford Reservation, at its perimeter, and at distant locations. DOE's analyses indicate that air and vegetation on and near the Reservation do not contain uranium at levels greater than those at distant locations (reference: Hanford Site Environmental Report for Calendar Year 1993, PNL-9823). Therefore, additional uranium monitoring of air and vegetation by SPC would provide no additional benefit.

The joint frequency distribution of wind speed and direction applicable to the SPC site (Table 2.3-1 of the Supplement to Applicant's Environmental Report, July 1994) shows that the prevailing wind is from the southwest, and secondary direction frequency maxima are from the northwest and the southeast. The lowest frequencies are from the east and northeast. The six sampling stations are appropriate because they are generally downwind and are located in the directions of human populations in the city of Richland.

Fluoride is an appropriate indicator of effluents from the plant because a major fraction of uranium effluents are in the form of uranium fluoride compounds emitted from the uranium hexafluoride conversion processes. NRC staff have determined that analysis of air and forage samples for fluoride is an acceptable indicator of emissions and accumulation in the environment.

NRC staff have reviewed the environmental monitoring program and have determined that it, in conjunction with stack monitoring, is adequate to indicate the impact of plant emissions on the environment and is, therefore, acceptable.

2.7.5.2 Ground Water

An unconfined shallow aquifer system underlies the site and is monitored by the applicant. SPC has installed a number of groundwater monitoring wells around the lagoon system to monitor for leaks. Water level measurements from the wells show that groundwater occurs at depths ranging from 3 to 11 meters (10 to 35 feet) below ground surface and that it flows generally in a northeast direction. NRC staff have determined that the monitoring wells are appropriately located downgradient of the lagoon system, except for one upgradient background well, and that they are screened at the appropriate depths and intervals to intercept the shallow aquifer.

An initial series of test wells, designated TW, were monitored under conditions of the previous license. The license was amended in September 1993 (Amendment 18, September 3, 1993) to add new Wells GM-1, GM-5, GM-6, GM-7, and GM-8 to the monitoring program. The amendment also deleted all but three TW wells; those remaining are TW-6, TW-7, and TW-21. The amendment also increased the number of parameters for which the well samples were analyzed. In addition to gross α and β, the samples are analyzed for pH, ammonia nitrogen, nitrate nitrogen, and fluoride.

2.7.5.3 Sewage Plant Sludge

As described above, SPC controls and monitors the amount of uranium discharged to the Richland city sewer system. Uranium has been known to concentrate in sewage plant sludge, and SPC is recognized as the major source of uranium discharged to the city sewer. SPC monitors the sludge generated by the Richland Wastewater Treatment Plant on a monthly basis. Sewage plant sludge is removed from the treatment plant on a daily basis and is trucked to the city landfill, where it is landfarmed on landfill property prior to burial in the landfill trenches. SPC collects a monthly sample of sludge at the treatment plant and analyzes it for uranium content. If the running average of the analyses over a six-month period exceeds 25 pCi/g, or if a single confirmed analysis exceeds 30 pCi/g, SPC will perform an investigation of the cause, and will institute a plan of action. This plan of action will, as a minimum, require a reduction of discards to the sewer system until the sludge contains less than 25 pCi/g uranium. SPC will also report to the NRC any confirmed monthly sludge sample result of 25 pCi/g or higher.

In July 1994, the NRC regional inspector collected a sample of the Richland sewage plant sludge, at the same time and from the same sludge batch as did SPC. The inspector sent the sludge sample to the Radiological and Environmental Sciences Laboratory (RESL) at Idaho National Engineering Laboratory for uranium analysis. The results of RESL's analysis indicated a significantly higher concentration of uranium (64.1 pCi/g) than did SPC's analysis (7.86 pCi/g), because SPC reported the concentration on a wet weight basis, and RESL reported the concentration on a dry weight basis. When corrected for a water content of about 85 percent, the results of the analyses were comparable.

NRC has determined that the concentration of uranium in the sludge should be able to be related to a dry weight basis, because of the variability of water content in sludge. SPC is authorized to continue to analyze the sludge samples on a wet-weight basis, and has committed to determine and record the moisture content of the sludge with the uranium analysis results.

NRC staff reviewed the process of disposal of sewage plant sludge containing small amounts of uranium. The sewage plant sludge is thickened at the plant to about 15-20 percent solids, and is trucked to the city landfill where it is placed on one of four sections of a 36-acre landfarm. The sludge is left to dry in the landfarm, and is mixed weekly with clean dirt. Every 2 months, about 500 cubic yards of this mixture is removed from the landfarm and used as intermediate cover material in the landfill. Municipal trash is added to the landfill in layers separated by cover material. Using this information, NRC staff performed a pathway analysis using the RESRAD code to estimate a projected dose rate to an individual residing on the closed landfill in the future. NRC staff determined that the projected dose using conservative assumptions would be approximately 0.1 mrem/year from all pathways up to about 70 years after landfill closure. The dose rate then starts to rise and peaks at approximately 2.5 mrem/year at 800 years from landfill closure, and decreases thereafter. Based on these results, NRC staff concluded that the action level of 25pCi/g uranium in sewage plant sludge is sufficiently low to protect public health. The applicant is, therefore, authorized to continue operations without any changes in the permissible levels of uranium in the sludge.

2.7.6 Audits and Inspections - Environmental Safety

The Manager, Plant Engineering, is responsible for all plant maintenance activities, including performing inspection, calibration, preventive maintenance and testing of safety-related equipment and systems.

NRC staff has determined that the applicant's commitments to plant maintenance provide reasonable assurance that equipment and systems related to environmental safety will be inspected, calibrated, maintained, and tested, and that the commitments are, therefore, acceptable.

The Health Physics Component performs quarterly audits of environmental protection practices in accordance with a written plan.

NRC staff has determined that the applicant's commitment to performance of environmental audits is adequate to assure that the effluent monitoring and environmental monitoring programs will be carried out, and that this commitment is, therefore, acceptable.

2.7.7 Event Notification and Reporting

Events that result in gaseous releases to the atmosphere and liquid releases to the sewer that are in excess of action levels specified in the license will be reported to the NRC regional office.

The staff concludes that the gaseous release notification and reporting commitment is acceptable for the purpose of the environmental review because it ensures that unlicensed releases are identified, addressed, and reported in accordance with 10 CFR 70.50.

2.7.8 Environmental Safety Program, Conclusion

NRC staff have reviewed the applicant's Environmental Safety Program and has concluded that there is reasonable assurance that it will protect public health and safety and the environment, and that it will comply with the applicable requirements of 10 CFR Part 20. The program is, therefore, acceptable.

2.8. Chemical Process Safety

2.8.1 Background

2.8.1.1 Chemical Process Safety at the NRC

As stipulated in the Memorandum of Understanding (MOU) between the NRC and the Occupational Safety and Health Administration (OSHA) dated October 21, 1988, the NRC maintains jurisdiction over various categories of hazards at NRC-licensed facilities. In addition to radiological hazards, chemical hazards associated with the storage, handling, use, and processing of radiological materials or other materials which may affect radiological safety are under the jurisdiction of the NRC. Accordingly, the NRC has devoted efforts to ensure that SPC is taking appropriate measures to identify, understand, and control chemical hazards which may affect radioactive materials.

SPC is already required to implement the OSHA Process Safety Management of Highly Hazardous Chemicals (PSM) rule (29 CFR 1910.119) for their processes which involve chemical quantities that exceed the OSHA threshold limits (currently only anhydrous ammonia). The NRC has determined that licensees should maintain similar chemical process safety (CPS) programs for chemicals that could result in a release of, contamination from, or personnel exposure to radioactive material.

It should be noted that NRC staff does not have and was unable to obtain the necessary information and commitments from SPC to ensure that SPC is implementing an adequate CPS program which promotes the overall chemical safety of the facility - the NRC does not have regulatory requirements for how CPS should be addressed at its licensed facilities. While the licensee has programs in place to aid in maintaining control over various chemical hazards throughout the site, NRC staff cannot be certain that the licensee has identified all the chemical hazards that may be present and has considered them in their programs.

2.8.1.2 The CPS Review

NRC staff used NRC draft documents on CPS as guidance for reviewing the SPC CPS program. NRC staff determined that insufficient information was provided by the licensee in the renewal application to determine if CPS was adequately addressed by the licensee.

In an attempt to get further information from the licensee concerning their CPS program, a request for additional information was sent to the licensee on July 27, 1994. Questions were developed which reflected NRC's Division of Fuel Cycle Safety and Safeguards (FCSS) views on how the licensee should address CPS where chemical hazards could affect radiological safety. The licensee responded to the request on October 31, 1994. Although the response provided significantly more information concerning their practices with regard to CPS (which is not defined in SPC programs, but rather is a practice which is incorporated and addressed in various programs throughout the site), there was still insufficient information to make the determination as to the safe operation of the facility with respect to CPS.

Since NRC has no defined guidelines to inform licensees what they should address in their CPS program, the NRC staff visited SPC during the week of December 11 through 15, 1995, in an attempt to get the remainder of the information that the staff needed to perform the review. Additional information and a better understanding of what the licensee has in terms of CPS was obtained as a result of this trip.

Based on the SPC license renewal application and subsequent amendments; the SPC response by letter dated October 31, 1994, to the July 27, 1994, request; and the site visit made to SPC during the week of December 11 through 15, 1995, the following are comments and observations concerning the licensee's CPS program:

2.8.2 Program Elements

2.8.2.1 Chemical Hazard Identification

In reviewing this aspect of CPS, the reviewer focused on the licensee's identification of hazardous material inventories, including quantities and locations of material in process or in storage and the licensee's regard for the risks associated with each hazardous material as they could affect the safety of operations involving licensed material (i.e., affect radiological safety).

SPC appears to have identified the significant hazardous materials stored and used on site. This includes anhydrous ammonia (NH_3) and ammonia solutions, UF_6 and various other uranium compounds, nitric acid (HNO_3), propane, hydrofluoric acid (HF), hydrogen (H_2) and various organics.

The licensee indicates in its response that UF_6, HF, NH_3, HNO_3 and H_2 are included in their chemical inventory system. This system gives the location of the chemical, the quantity and other pertinent information. These chemicals are also included in a list of "hazardous chemicals stored at SPC in large quantities." This list includes a map containing the location and amount of each chemical and is given to the local, county, and state emergency response organizations as part of SPC's emergency plan.

Discussions with plant personnel and observations made during the site visit confirmed that records of chemical inventories (even chemicals in relatively minute amounts) are being kept with the effects of inadvertent mixing considered.

2.8.2.2 Chemical Hazard Assessment

The reviewer examined the licensee's system for performing hazard assessments (HAs). Attention was given to the licensee's practices with respect to the identification of chemical hazards that could affect radiological safety; performing detailed evaluations of related operations to determine the likelihood or consequences of a hazard; and developing recommendations and implementing corrective actions for reducing the risk of radiological events associated with the identified hazards.

While the licensee is not explicitly required to perform HAs on their process systems according to NRC regulations, they have performed HAs in the past and are required to perform HAs in accordance with the OSHA PSM rule, EMF-858, Procedure No. 1.18, "Hazards Analysis," and EMF-858, Procedure No. 1.13, "Engineering Change Notice (ECN)," all of which the licensee commits to following in their application and/or response.

As mentioned in the SPC response, HAs specifically related to OSHA PSM compliance are addressed in EMF-P65,539, "Management of Highly Hazardous Chemicals." A HA was conducted on the licensee's anhydrous ammonia storage and distribution system to comply with the OSHA PSM rule. The reviewer found no problems with the HA performed on this system. Findings and recommendations with regulatory compliance implications were tracked using the manufacturing regulatory commitment tracking system. (This system assigns and tracks the commitment with due dates and completion dates.) The licensee has

addressed all recommendations that resulted. The HA was performed by an outside contractor and various SPC staff members in December 1994.

Regarding what the licensee has in terms of completed HAs conducted on non-OSHA PSM systems, a HA was conducted on the dry conversion process line in the UO_2 building. The licensee also takes credit for possessing what they call Industrial Hygiene (IH) exposure assessment logs which are performed under the SPC IH program by IH staff from the Safety, Security & Licensing (SS&L) group. These were described in the SPC response and observed during the site visit. The logs include a process hazards analysis that looks at the chemicals used in the process, giving some consideration to possible process upsets, process equipment failure, and employee activities. The logs also include a section called "Safety Observations," where findings and recommendations are documented. IH tracks the recommendations to completion and records the final resolution in the logbook. Recommendations are implemented by the process's responsible manager.

The exposure assessment logs are reviewed yearly as part of the IH audit program. While they are not the programmatic, in-depth HAs that would be typical of good industry practice, we need to consider the following:

1. There are no NRC regulations which require the performance of HAs.

2. None of the processes, other than the anhydrous ammonia system, involve chemicals that meet the criteria to fall under the OSHA PSM rule.

3. The SPC procedures mentioned above (Nos. 1.13 and 1.18) do call for HAs to be performed when there is an upgrade to any of the critical systems or if there is a new system/process installed.

Regarding the manner in which the licensee commits to performing HAs on an OSHA PSM system, when there is an upgrade to any of the critical systems, or if there is a new system/process installed, discussions with the licensee during the site visit and review of EMF-858, Procedure No. 1.18, reveal that the licensee will ensure the following when performing HAs: (1) the appropriate HA methodology is selected (the licensee will select from various methods, including What-if, Checklist, Haz-Op, Fault Tree Analysis, and failure modes and effects analysis (FMEA), depending on the complexity of the process and the hazards involved); (2) the HA is performed by a qualified team, including a team leader, process expert, hourly employee, production employee, and relevant specialists; (3) training is provided to the team; (4) fully up-to-date process safety information (PSI), especially piping and instrumentation diagrams (P&IDs), is available; (5) senior plant management is made aware of significant findings from each HA study; (6) there is a system to resolve and close HA recommendations; (7) HAs are periodically revalidated and updated; and (8) updates are made to other CPS elements (e.g., PSI, Standard Operating Procedures, Training).

NRC staff has determined that the performance of in-depth HAs would enhance the safe operation of the facility. The assessments would help to ensure that all safety issues have been considered and addressed in the SPC CPS program. However, there are currently no NRC requirements for SPC to perform these assessments.

2.8.2.3 Process Safety Information

As mentioned in the SPC RAI response, PSI requirements related to OSHA PSM compliance are addressed in Section 6.0 of EMF-P65,539. Currently, this would apply only to the anhydrous ammonia system. Additional PSI relating to this and other systems is maintained in the Chemical Inventory and Material Safety Data Sheet (MSDS) Program, the Plant Safety Manual, the Emergency Plan (EP) and Procedures, the Plant Operations Standard Operating Procedures, the Radiological Work Procedures, and the Industrial Hygiene Exposure Assessment Logs.

Discussions with the licensee and observations made during the site visit, indeed revealed pertinent forms of PSI were available for the major processes at the facility. MSDSs, equipment diagrams, process flow diagrams, chemistry information, and site plans were all available. In addition, the licensee just completed an extensive upgrade of the as-built drawings (P&IDs) at the site. Current, detailed P&IDs are available, and they are easily accessible and well organized.

As stipulated in EMF-858, Procedure No. 1.13, the ECN procedure, process changes and new process installation call for updating of P&IDs and other process safety information.

2.8.2.4 Operating Procedures

The licensee conducts its business in accordance with a system of Standard Operating Procedures (SOPs) that address various phases of operations (i.e., initial start-up, normal, temporary and emergency operations, and emergency and normal shutdowns). The licensee commits to controlling activities involving special nuclear material (SNM) in accordance with these approved written procedures as stated in Part I, Section 2.5, of their license renewal application.

Operations SOPs are developed or revised by the Operations Group for all new or changed processes and are filed in the SOP manual. Operators are included in the procedure development or revision depending on how involved the change is. Assurance that procedures are developed or revised for new processes or changes in the process is ensured by the ECN procedure; procedure revisions must be completed before process changes can be approved.

Training in new or revised procedures is assured by each area supervisor. Completion of training is assured through the ECN procedure; training must be completed before process changes can be approved. Affected operators must read and sign off on the SOP. Records of this are kept by the training specialist in the training database. Current SOP revisions and related training can be tracked through the SOP tracking system. The reviewer verified this during his visit, by randomly selecting a few operators and checking to see that they were indeed trained in the current procedure revision.

All new SOPs and SOP changes are reviewed within Plant Operations by the user group and are reviewed for concurrence by Quality Control, Manufacturing Engineering, Product Mechanical Engineering, and SS&L.

Review of selected procedures during the site visit indicated that SOPs are up-to-date and reflect current plant practices and conditions; checked by technically competent personnel for content and approved by management; appear to be sufficiently detailed to be effective and useful; and are readily accessible.

2.8.2.5 Site-Wide Safety Procedures

Safety considerations for routine operations were examined by the reviewer under the Operating Procedures and Training element above.

This element was reviewed to determine if the licensee has implemented site-wide safety procedures to protect the health and safety of SPC workers and contractors performing nonroutine tasks within the facility.

The licensee implements procedures to protect operations, maintenance and contract workers from the risks of handling, using, and storing hazardous chemicals during nonroutine tasks performed at the facility. These procedures address access controls, hotwork permits, confined space entry permits, lockout/tagout procedures, and a procedure for safe opening of process equipment. Procedures for access control are documented in the Physical Protection Plan. The other procedures are documented in Chapter 1 of SPC's Safety Manual.

To ensure that contractors are aware of potential hazards associated with their jobs at the licensee's facility, a representative from each contractor is given information on SPC's CPS program and of the hazardous chemicals their employees may come into contact with. These representatives, in turn, train their employees. SPC does, however, give each and every contractor indoctrination training in accountability and access, emergency response, and radiological safety. SPC assigns an engineer from Manufacturing Engineering to monitor the contractor's access control and adherence to procedures such as lockout/tagout and confined space entry.

2.8.2.6 Detection and Monitoring

This element was reviewed to determine if the licensee has adequately addressed its detection and monitoring needs in support of its CPS efforts. Environmental concerns were not considered here. Particularly, systems to detect and monitor UF_6, HF, NO_3/NO_2, H_2 and NH_3 were considered. The licensee has and maintains continuous monitors to detect UF_6, HF, H_2, and NH_3 releases at various locations throughout the facility. In addition to continuous monitoring, periodic sampling and monitoring for NO_2, HF and NH_3 is performed to determine if material is released during operations for those operations where there is the potential for employee chemical exposure. Employee exposure is monitored and recorded in the IH exposure assessment logs. From the results of this testing, follow-up monitoring is determined as appropriate.

2.8.2.7 Training

This element was reviewed to determine whether the licensee has an effective program to provide training to employees with regard to CPS.

The licensee's training program can be broken down into three basic categories: (1) general orientation, (2) work specific health and safety training (or initial area training), and (3) specialized training. The extent of an employee's training depends on his/her work assignment. All employees receive general orientation training which addresses among other areas, emergency response, industrial safety, lock and tag, PPE use and selection, and hazard communication/dangerous waste handling. Depending on the employees work assignment, the supervisor will continue further chemical safety training which includes: (1) respiratory training, (2) job specific hazard communication training, (3) expanded lock and tag training, (4) lab chemical hygiene training, and (5) confined space entry training and first aid training. Still further chemical safety training is given as part of each employee's SOP training, as applicable. Select employees will take the 24 hour treatment storage and disposal (TSD) training and/or 24 hour plant emergency response training. This training and employee and contractor requirements are further described in Procedure EMF-P65,541 of EMF-30.

The minimum CPS related training requirements and course content for various employee positions is established by SS&L. The training is also provided by the technical training staff of SS&L knowledgeable in the various training topics. Initial instruction is adequate to allow employees to start on-the-job training (OJT) and full instruction is provided within two weeks after starting work. After the two week period and prior to assignment to independent operation, employees are instructed in, among other areas, hazardous chemical safety, emergency requirements and the operating procedures appropriate to their positions. Most chemical safety training classes have a test after completion.

Training in all SOP's is done by Plant Operations Training Specialists. All operators must pass a test, go through OJT and pass a competency exam before being allowed to work on a process alone. Elements of this SOP training was observed during the site visit. All tests and certification are entered into SPC's training database, which was also observed during the site visit.

In the license renewal application (Part I, Section 2.4 and Part II, Section 11.5) the licensee commits to documenting all formal training with records maintained by SS&L.

Safety topics are also routinely discussed in monthly and quarterly safety meetings.

The training program was discussed with the reviewer during the site visit. SOP revisions and subsequent training in those revisions was discussed. This included the process for reviewing the procedure; the manner in which current procedure revisions were tracked; training for the revised procedure and tracking the completion of this training; the actual training requirements for specific areas and positions (this is currently being revised and upgraded); and tracking to make sure an employee has all the required training (including general, specific, specialized and SOP training. No significant problems were noted.

The SPC RAI states that reviews and audits of chemical safety training efforts are performed and recorded. Refresher training on SOPs covering process safety management programs are provided every three years.

Health and Safety (H&S) technicians are given special training related to their CPS assignments and are required to become proficient in SPC's CPS programs, criteria specifications, procedures, and routines. They must demonstrate this proficiency by passing a SPC certification exam within six months after employment as a H&S Technician. Refresher training is provided to H&S Technicians annually.

The license renewal application states the following regarding training:

1. Employee awareness of and conformity to safety requirements and procedures, as well as the effectiveness of safety training programs shall be evaluated monthly by the Industrial Safety Component for hazardous chemical safety. Specialists in these components have the authority to require retraining of employees. These evaluations shall be documented along with actions required as a result.

2. When changes are made to processes involving special nuclear material, each employee affected is promptly informed and properly instructed by his/her manager or supervisor.

3. Plant Emergency Response Team (PERT) members are offered training in incipient fire fighting techniques, advance first aid, self contained breathing apparatus in a smoke-filled environment and chemical incident stabilization techniques on an annual basis.

NRC staff had no concerns with the licensee's training program as it relates to CPS.

2.8.2.8 <u>Maintenance and Inspection</u>

For this element, the reviewer focused on the licensee's program to ensure that equipment used to process, store, or handle highly hazardous materials is properly maintained so that the risk of releasing such materials or affecting licensed material, due to equipment failure, is minimized.

In addition to corrective maintenance activities, the licensee has programs for Instrument Repetitive Maintenance (IRM) and Preventive Maintenance (PM). These programs are described in, respectively, EMF-858, Procedure Nos. 1.22 and 1.24. IRM is the licensee's program used to assure select instruments are properly calibrated on a periodic basis. The PM program covers plant equipment, facilities, systems, and support activities to insure a safe working environment and safe and efficient operation of plant equipment.

The licensee has a tracking system to keep track of completed and upcoming IRMS and PM and to flag maintenance engineers of upcoming maintenance items. This system also provides procedures or references procedures for maintenance workers to perform the maintenance.

Maintenance schedules have been developed. Maintenance schedules for equipment follow OSHA's requirement as to which safety-related components need to be on a PM program and SPC includes other components as the responsible engineer may deem necessary or as recommended by the manufacturer. The frequency of PM is based on regulatory recommendation and manufacturer's recommendations, past experience with equipment and/or good engineering

practices. PM activities are prioritized in the following manner. Safety issues, followed by licensing, production and support (non-process equipment) issues.

During the site visit, discussions were held with personnel concerning the maintenance program. An overview of the IRM and PM programs was presented as well as an overview of the maintenance tracking system. Through this, it was revealed that H_2 monitors, UF_6 detectors, UF_6 vaporization shutdown systems are among some of the key components under the maintenance program. The licensee's response to NRC's RAI indicates that regular preventative maintenance is performed on various pressure vessels and storage tanks, piping systems, relief and vent systems and devices, emergency shutdown systems, controls, and pumps.

In order to ensure that the maintenance program functions adequately, the licensee assigns maintenance responsibilities to various individuals. This ensures that equipment and system maintenance activities are completed as scheduled; procedures are developed, reviewed, approved, and updated as necessary; equipment is reviewed to determine the need for maintenance; spare parts are specified in procedures and are stocked in the spare parts inventory; someone is responsible for planning and scheduling manpower and equipment availability; outstanding/delinquent maintenance activities are tracked; appropriate actions have been taken to act on any noted unusual conditions; someone directs craftsmen and ensures safety requirements are being followed; completed maintenance activities are approved; and someone maintains and interacts with the maintenance tracking system.

The licensee's "Work Order" (WO) procedure, EMF-858, Procedure No. 1.21, is used for requesting craft and maintenance shop services for all types of work. It is also used for authorizations and control of work where required. Work orders are for repair, like equipment replacement and changes that do not alter the process, environmental protection or other safety issues of the system. The actual WO addresses issues such as lockout/tagout, and various work permit attainment.

2.8.2.9 <u>Management of Change</u>

Management of Change (MOC) is addressed in Manufacturing Engineering's Procedures and Practices Manual, specifically in EMF-858, Procedure No. 1.13, the ECN procedure. The procedure does a paramount job in describing their MOC program. It defines the types of changes that require an ECN. It discusses, among other things, the applicability to the ECN of Fire Marshall inspections, Building Wall/Floor Penetration Permits, Excavation Permits, Property/Waste Disposal (radioactive or chemical) requests, criticality safety reviews, lockout/tagout (EMF-P65,513), pressure vessel code review, hazards analyses (1.18), RWPs, MWPs (1.27), spare parts, IRM/PM procedures, maintenance, and training. Operator re-training, SOP revision and as-built drawing revisions are all considered prior to start-up and final approval. Various engineers and Quality Control (QC), Safety, and Operations Managers concur prior to work start-up and for final approval.

The licensee commits to following the ECN Procedure 1.13, in Part I of their license application, Section 2.5.

2.8.2.10 Incident Investigation Program

As stated in the SPC RAI response, the licensee has an administrative procedure that defines a formal program to investigate accidents, abnormal events, or conditions of potential adverse health, safety, or environmental consequence. The procedure identifies different levels of investigation and includes criteria for categorization of events into those levels.

The licensee considers issues such as timeliness of initiation of investigations, investigation team composition, documentation, incident causes, corrective action tracking and implementation, incident reports and distribution, and management/staff involvement/awareness.

2.8.2.11 Audits and Inspections

Part I, Section 2.6, of the licensee's renewal application states that audits and inspections shall be conducted to determine that plant operations are conducted in compliance with regulatory requirements, license conditions, and formal procedures. These audits and inspections apply to hazardous chemical safety as well as other programs. Subjects of the Audits and Inspections (A&I) program include Lock and Tag, Confined Space Entry, Chemical Hygiene and Safety Plan, Fire Protection (which includes extinguishers), PSM of Highly Hazardous Chemicals, Respirator Program, Industrial Hygiene Program (quarterly and annually), EP Plan and relevant procedures. The frequency of the audits range from monthly to triennially with most being performed on an annual basis.

The licensee states in its response that the audits program is described in EMF-P81,004 and the audit guide for each type of audit specifies the requirements for the auditor, the audit protocol, the requirements for documentation and recordkeeping, the scope and frequency. The audit program requires that findings (non-compliances) and concerns (weaknesses) be formally documented and assigned unique identifiers to facilitate tracking/reporting. Findings or concerns that cannot be closed prior to completion of the audit activity become open items and must be tracked to closure usually via the licensee's Manufacturing Commitment Tracking System.

2.8.2.12 Chemical Process Safety Conclusion

NRC staff have reviewed information provided by the applicant concerning chemical process safety at the Richland facility. The NRC staff has concluded that while the licensee has programs in place to maintain control over identified chemical hazards throughout the site, NRC staff cannot be certain that the licensee has identified all potential chemical hazards, particularly all accident condition chemical interactions. This level of analysis would be accomplished through an Integrated Safety Analysis, which is not currently required by regulation, and which the licensee has not agreed to perform.

2.9. Fire Protection

The renewal application was reviewed against the NRC Technical Position, "Guidance on Fire Protection for Fuel Cycle Facilities," dated August 10, 1992. In addition, a site visit was made February 20 through 22, 1996. The site visit included a walkdown of the facility, review of fire protection

programmatic activities and discussions with representatives from the off-site fire department. A review of the October 21, 1994, submittal regarding the Dry Conversion Building was also performed.

Structures at the facility were found to be of noncombustible or limited combustible construction. The buildings are provided with manual pull stations and fire extinguishers. The UO_2 Building is provided with heat detectors and hydrogen detectors near hydrogen atmosphere furnaces. The Ammonia Dissociator Building is remote from the UO_2 Building and excess flow shut-off valves are provided for the downstream lines.

The facility is provided with fire hydrants throughout. Discussions with the municipal fire department indicated that water supply volume and pressure was adequate to mitigate any anticipated fire. The fire department also indicated that there were multiple feeds to the facility fire main system.

The renewal application stated that areas where water may present a criticality concern are properly marked and that, for those areas, carbon dioxide, dry chemical or high expansion foam would be used to combat a fire. The staff was concerned whether the licensee had properly evaluated the affects of foam since it consists of a foam/water solution. In their response to the request for additional information (RAI), the licensee stated that "the safety analysis assumes optimum moderator interspersed between discrete units of fissile material and process equipment." Also, the licensee states that foam would be less likely than water to enter process equipment. Given the analysis, and since the areas that may present a criticality concern are marked and also identified in the Pre-Emergency Plan, the use of foam under controlled conditions is considered acceptable.

Pre-Emergency Plans are provided for every significant structure at the site. These plans identify the construction of each structure, expected occupancy, radioactive materials that may be present and fire protection systems and equipment. Copies of these Pre-Emergency Plans are available at the emergency rally point and the emergency operations facility. The Plans have also been provided to the local fire department. These Pre-Emergency Plans were found to be consistent with Section III.10, "Pre-Fire Plan" of the NRC Technical Position.

During an earlier site visit in December 1993, a meeting was held with the Assistant Fire Chief for the City of Richland, to determine if there was adequate interface and planning with the licensee. It was determined that the licensee cooperated with the off-site fire department and that an adequate level of coordination existed and therefore was consistent with staff guidance.

The renewal application states that administrative procedures are in place to control combustibles and flammable materials. During the site visit, these procedures were reviewed and the plant was inspected to evaluate the adequacy of their implementation. Based on this review, it was determined that the accumulation of combustibles was being limited and flammable liquids were properly controlled.

Specific fire scenarios are evaluated in the Emergency Assessment Resource Manual (EARM). This document is primarily intended to predict off-site

consequences and is not intended to evaluate the consequences of credible fire scenarios within various fire areas as discussed in Section III.9, Fire Hazard Analysis, of the NRC Technical Position on fire protection. This concern was addressed to the licensee in the June 14, 1994, RAI. The September 12, 1994, response by the licensee stated that the EARM does identify credible fire scenarios and additional information discussed in Section III.9 of the guidance, which is provided in the Pre-Emergency Plan. The staff believes, however, that this information provided by the licensee does not fully meet the guidance of Section III.9 because the fire safety of each fire area is not evaluated. The current rule (Part 70) does not explicitly address fire safety and the technical position on fire protection only constitutes guidance. The staff is, however, developing the regulatory basis for explicit fire safety requirements (which was proposed to the Commission to be consolidated in a revision to Part 70) along with specific fire protection criteria that will be incorporated into an approved Standard Review Plan. The staff will revisit the acceptability of the licensee's fire protection program, including requirements for a fire hazards analysis, if the regulatory basis as defined in 10 CFR Part 70 is revised.

The proposed Dry Conversion Building design was evaluated based on information provided in the October 21, 1994, submittal and a June 23, 1995, response to an RAI. The submittal stated that the office areas of the facility will be provided with a wet-pipe sprinkler system. The specifications for the sprinkler system was reviewed and found acceptable. The remainder of the building is to be provided with rate-of-rise/heat detectors which will alarm locally and at the local fire department. A deluge system will be installed in the main HVAC exhaust duct. The system is activated by rate-of-rise/heat detection. The deluge system is installed to protected the integrity of the final filter bank in the event of a fire. NRC guidance states that building construction should meet the NFPA 220 Type I classification. The June 23, 1995, response stated that the facility was designed in accordance with the Uniform Building Code (UBC) Type 2N classification and not NFPA 220, Type I. UBC Type 2N construction is defined as noncombustible. It differs from NFPA 220 Type I in that load-bearing walls are not required to be fire rated. The proposed facility is primarily of pre-stressed concrete panel construction.

At the February 20 through 22, 1996, meetings at the site, the licensee management informed the NRC staff that the Building will be upgraded to approximately NFPA Type II-222 standard. The staff considers that the proposed modifications would greatly enhance the fire safety of the building. Considering that the combustible loading will be low and the off-site Richland City Fire Department is reliable, the staff's concern regarding this building is resolved satisfactorily.

General administrative procedures for control of combustibles and ignition sources and emergency response are in place for the existing facility. The licensee stated in their June 23, 1995, response that a Pre-Fire Plan for the Dry Conversion Building will be in place prior to the introduction of radioactive material. This is considered acceptable.

In the absence of a Fire Hazard Analysis as recommended in Section III.9 of the NRC Technical Position, the staff could not make conclusive judgements as to the advisability of installing sprinklers in certain other buildings of the facility, including the "ELO Building" and one warehouse storing radioactive

material. However, these could be marginal cases. Furthermore, the proximity of the off-site fire department and the observed close cooperation between the licensee facility and the fire department gives the staff reasonable assurance that an accidental fire will be quickly dealt with.

In sum, considering all of the above observations, the staff concludes that the facility as a whole is adequately protected against accidental fires.

2.10. Emergency Plan

Section 70.22(i)(1) requires SPC to have an Emergency Plan (EP) for responding to the radiological hazards of an accidental release of special nuclear material and any associated chemical hazards. Specifically, the regulations require: (1) a facility description, (2) a list of possible types of accidents, (3) classification of possible accidents, (4) methods used to detect accidents, (5) procedures for the mitigation of accidents, (6) procedures for assessments of release of material, (7) a description of plant personnel responsibilities, (8) a notification and coordination procedures, (9) a training criteria, (10) an internal and external communication procedures, (11) safe shutdown procedures, (12) provisions for exercises, and (13) a list of hazardous chemicals onsite. Regulatory Guide 3.67 provides general guidance for the above requirements and a standard format for submitting an EP.

SPC has developed an EP documented in EMF-32 Part 1 entitled "Siemens Power Corporation Richland Engineering and Manufacturing Facility Emergency Plan, Part 1." This document has been incorporated by reference in Chapter 8 of the renewal application and is considered a condition of the license. No changes that decreases the effectiveness of the Plan can be made without NRC approval. Other changes must be provided to the NRC within six months of the change. The applicant has committed to maintaining implementing procedures.

The staff has reviewed SPC's EP through Revision 20, dated July 1995, and has determined that it contains all the elements required by 70.22(i)(1) and is, therefore, acceptable.

2.11. Plant Decommissioning

10 CFR 70.25 requires that SPC have an approved Decommissioning Funding Plan (DFP), which includes a cost estimate for decommissioning and a description of the method for assuring funds for decommissioning, including means of adjusting cost estimates and associated funding levels periodically over the life of the facility.

SPC submitted a DFP and financial instruments to NRC in July 1990, as required by the rule. NRC reviewed the documents and prepared a request for additional information (RAI) in October 1992. SPC responded to the RAI in letters dated November 10 and December 14, 1992, and March 25, 1993. NRC reviewed these documents and prepared a second RAI dated March 14, 1994. SPC responded with a letter and revised DFP dated August 15, 1994. NRC staff reviewed the revised DFP and prepared a third RAI dated January 25, 1995. SPC responded on February 24, 1995, with a letter and revisions to the DFP. NRC reviewed the letter and revisions and approved the DFP in a letter dated June 26, 1995.

Chapter 7 of the license application contains a commitment by SPC to decommission the facility according to the approved Plan. SPC is using Standby Letters of Credit payable to standby trusts to provide assurance that sufficient funding will be available for plant decommissioning. SPC also commits to update the cost estimate every five years.

The DFP and cost estimate include the costs of decommissioning the on-site wastewater lagoons. These lagoons are regulated by the Washington Department of Ecology (WDOE) under the state's Dangerous Waste regulations, as well as by NRC under the terms of the license. WDOE also requires financial assurance for closure of the lagoons. Therefore, SPC has provided two standby trusts, one to NRC for decommissioning of facilities contaminated with radioactive materials only, and one to WDOE for closure of facilities used for the treatment and storage of wastes that have been designated as "dangerous" in the state's rules. NRC has accepted this division of the financial assurance mechanisms, recognizing that NRC does not have exclusive status as payee of a trust large enough to decommission the entire facility.

2.12. Exemptions and Special Authorizations

2.12.1 Criticality Accident Alarm System Authorization at Lagoons

In accordance with 10 CFR 70.24(a), an underwater monitoring system at the waste storage lagoons is not required.

2.12.2 Plutonium Storage Authorization

SPC is in possession of plutonium as PuO_2 and PuO_2-UO_2 in the form of contaminated solid waste in drums. These containers are stored in the SF Building Room 162 autoclave pit with the following controls:

1. The containers are sealed with gaskets.

2. The pit is exhausted by the SF Building HVAC system. Two stages of HEPA filtration are provided prior to exiting the exhaust stack.

3. The air exiting the pit is continuously monitored and sampled, and the samples analyzed weekly for radioactive material content.

4. Assurance of containment is verified at least once every six months by visual observation and smear survey of the drums. The inspection and surveys are documented, and all indications of drum leakage are investigated and appropriate action taken. If it is necessary to repackage a container, this work is done using a special Radiation Work Procedure.

5. Alpha contamination discovered by smear surveys or air sampling within the pit area is assumed to be plutonium contamination unless proven otherwise.

NRC staff has reviewed the applicant's proposed continued management of the stored plutonium and has determined the following:

1. Any potential plutonium emissions will be appropriately controlled and monitored,

2. The containers are inspected on a frequency that is often enough to detect any deterioration of the containers, but not so often as to cause excessive worker exposure,

3. Contingency plans in case of detection of a release of plutonium are adequate to control further releases.

For these reasons, NRC staff has concluded that the plans for management of stored plutonium are acceptable.

2.12.3 Labeling Exemption

Pursuant to 10 CFR 20.1904(a), and 20.1905(b) and (e), a sign bearing the legend, "Every container or vessel in this area, unless otherwise identified, may contain radioactive material," may be posted at entrances to each building in which radioactive materials are used, stored, or handled, in lieu of the requirement to have a label affixed to each container of radioactive material. The licensee has a large restricted area with large quantities and high throughput of packages containing radioactive material. Requiring each separate area and package containing radioactive material to be posted or labeled separately would be labor intensive and would cause a significant increase in total radiation dose to workers without increasing worker safety.

The existing WP authorizes this labeling exemption, and the licensee has applied this practice for the entire term of the previous license. The staff has determined that continuing this practice is in accordance with the regulations and is appropriate for this facility, and that continuing the exemption is acceptable.

2.12.4 Waste Disposal Authorization

The applicant has requested authorization to dispose of solid waste material at other than a licensed disposal site, provided that the waste contains less than 30 pCi/g of uranium in dry solid waste material and the uranium is essentially uniformly dispersed throughout the material. This solid waste will be transported to a solid waste disposal facility, where it will be mixed with other municipal solid wastes and buried under intermediate and final soil covers, i.e., diluted and shielded. NRC staff have determined that this practice is sufficient to protect public health and safety and the environment, is in accordance with the regulations, and is acceptable.

2.12.5 Special Nuclear Material Safeguards

SPC has prepared a Physical Security Plan that has been reviewed and approved by NRC, titled ANF-538(P), "Physical Protection Plan for Material of Low Strategic Significance," and has committed to providing physical security for licensed materials in accordance with this approved plan.

SPC has also prepared a Fundamental Nuclear Material Control (FNMC) Plan titled EMF-12(P), "Nuclear Materials Safeguards Procedures Description for the Fuels Fabrication Plants," and has committed to maintaining and implementing this Plan in accordance with 10 CFR 74.31(b). The most recent revisions to the FNMC Plan are dated June 1996 (Rev. 28) and November 1996 (Rev. 29).

Changes that do not decrease the effectiveness of the applicant's Material Control and Accounting (MC&A) Program can be made by the applicant in accordance with 10 CFR 70.32(c).

As indicated in Section 1.1 above, the safeguards conditions, issued pursuant to 10 CFR Parts 70 and 73, are affected by this licensing action only to reflect the most recent revisions to the FNMC Plan and remain in effect as a part of the license. Safeguards Conditions SG-1.1 through SG-1.4, SG-2.1, SG-2.2, SG-3.1, and SG-3.2 remain in effect.

2.12.6 Authorization at Reactor Sites

The applicant has requested authorization to possess fuel assemblies or fuel rods at reactor sites for the purpose of loading them into shipping containers and delivering them to a carrier for transport. Although the application does not indicate any specific additional conditions under which these operations would be performed, NRC staff considers that all safety commitments for the handling of SNM at the Richland Engineering and Manufacturing Facility are also implemented for the handling of SNM at reactor sites. NRC staff thus finds this authorization acceptable.

2.12.7 Authorized Release Guidelines

The applicant has requested authorization to release equipment, scrap, or facilities for unrestricted use, or for termination of license according to NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material" dated April 1993. The NRC staff finds this commitment acceptable.

2.12.8 Authorized Criticality Alarm System Outage Exemption

The applicant requested continuance of exemption from 10 CFR 70.24(a) for the purpose of performing maintenance on the criticality alarm system. Sections of the criticality alarm system may be taken out of service provided that (1) all movement or processing of fissile material in affected areas is halted for the duration of the outage, and (2) Health and Safety Technicians conduct continuous surveys of the areas during the criticality alarm system outage. NRC staff have determined that performing continuous surveys is an adequate compensatory measure during maintenance shutdown of the alarm system, and that this exemption is acceptable.

2.12.9 Authorized Workplace Air Sampling Adjustments

The applicant requested authorization to adjust Derived Air Concentration (DAC) limits and Annual Limits on Intake (ALI) values in process areas to reflect actual physical characteristics of the airborne uranium. This adjustment is specifically authorized by 10 CFR 20.1204(c)(2) and is, therefore, acceptable.

2.12.10 Authorized Release Guidelines for Hydrofluoric Acid

The applicant has requested authorization to release hydrofluoric acid manufactured by the dry conversion process for unrestricted commercial use providing the following three conditions are met:

1. A representative sample of each batch of hydrofluoric acid product shall be obtained and analyzed for uranium;

2. A batch shall be no larger than 20,000 liters; and

3. The activity of any batch released for unrestricted use shall be less than or equal to 3 picocuries per milliliter (≤3 pCi/ml).

SPC requested this authorization in an amendment application dated June 28, 1994, and supplement dated July 7, 1994. The environmental and public health risks of the release of the hydrofluoric acid were evaluated and described in an Environmental Assessment prepared by NRC, and a Finding of No Significant Impact (FONSI) was published in the Federal Register on September 14, 1994, (59 FR 47190). NRC determined that doses to a maximally exposed individual resulting from release and subsequent commercial use of the acid will not exceed the standards for protection against radiation set forth in 10 CFR Part 20 and are ALARA. NRC staff has, therefore, determined that this authorization is acceptable under the commitments of the license.

2.12.11 Authorized Release Guidelines for Ammonia

In a letter dated August 10, 1995, SPC proposed a uranium release limit for ammonium hydroxide (NH_4OH) to be sold under the renewed license. This limit is 0.05 mg/l of 5% enriched uranium, equivalent to 0.13 pCi/g. This ammonium hydroxide could be used in the manufacture of ammonia fertilizer, or for other industrial uses.

The risk to human health was evaluated for the use of this ammonium hydroxide as fertilizer. Information on application rates for ammonia were obtained from the Walla Walla Farmers Co-op in Kennewick, Washington. An average application of nitrogen is 30-40 pounds per year, injected into the top 3" of soil. SPC's ammonium hydroxide is approximately 25 percent by weight; therefore a farmer would apply 120-160 pounds per year to obtain the desired amount of nitrogen. If this amount of ammonium hydroxide were applied to a field every year for the 10-year term of the license, and if none was removed via leaching, erosion, or other natural processes, it would result in a concentration of less than 2×10^{-5} pCi/g in the top 3 inches of soil. Offsite uranium concentrations in soil, as reported in Hanford Site Environmental Report 1993, Table A.19, indicate averages of 0.75, 0.73, and 1.29 pCi/g for 1988, 1989, 1990, respectively. The increase in uranium concentration caused by application of fertilizer containing 0.05 ppm uranium, under the conservative assumptions indicated, is insignificant compared to these background concentrations.

Based on the above analysis, the NRC staff has determined that sale of ammonium hydroxide containing not more than 0.05 ppm uranium will have no significant effect on public health or the environment and is therefore acceptable.

2.13. Conclusion

The NRC staff have reviewed the applicant's request for possession of special nuclear materials; the description of the facilities at the Richland Engineering and Manufacturing Facility; the table of requested authorized activities; and the applicant's organization and administration, radiation protection program, criticality safety program, chemical safety practices, fire protection program, Emergency Plan, Decommissioning Funding Plan, and requests for exemptions and special authorizations, and has determined that they are acceptable subject to the following condition:

S-1. Authorized use: For use in accordance with the statements, representations, and conditions of Part I of the licensee's application dated October 28, 1996, and revised pages submitted by letter dated November 11, 1996.

3.0 ENVIRONMENTAL REVIEW

An Environmental Assessment (EA) has been prepared for the licensing action. The EA concluded that renewal of the license will have no significant impact on the environment, and a Finding of No Significant Impact (FONSI) was published in the Federal Register on June 27, 1995 (60 FR 33243). The Federal Register Notice included a summary of the EA and a notice of opportunity for a hearing in accordance with 10 CFR Part 2, Subpart L. No requests for a hearing or other comments from the public were received.

4.0 CONCLUSION

The NRC staff have reviewed the applicant's commitments to safety programs in Part I of the license renewal application, the applicant's compliance history, and the applicant's decommissioning funding plan and have determined that, based upon information contained in these documents, the applicant meets the following conditions, set forth in applicable sections of 10 CFR 70.23(a), for approval of the license renewal application:

1. The special nuclear material for which the applicant is requesting a license is to be used for an activity licensed by the Commission under the Atomic Energy Act.

2. The applicant is qualified by reason of training and experience to use the material for the purpose requested in accordance with 10 CFR Part 70.

3. The applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property.

4. The applicant's proposed procedures are adequate to protect health and minimize danger to life or property.

5. The applicant appears to be financially qualified to engage in the proposed activities in accordance with 10 CFR Part 70.

6. The applicant's fundamental nuclear materials controls are adequate.

7. The applicant's Physical Security Plan is adequate.

8. The applicant's Emergency Plan is adequate

The review staff has discussed the renewal and proposed license conditions with the Region IV project inspector. The inspector has no objections to renewal of the license.

The staff has concluded that there is reasonable assurance that the activities to be authorized by the renewal of the Special Nuclear Material license to Siemens Power Corporation will not constitute an undue risk to the health and safety of the public. The staff, therefore, recommends that the SPC license be renewed in its entirety, in accordance with the statements, representations, and conditions in SPC's application dated October 28, 1996, and revised pages submitted by letter dated November 11, 1996.

Principal Contributors
Mary Adams
Michael Lamastra
Amar Datta

Acronyms and Abbreviations

A&I - Audit and Inspections
AA - Aqueous Ammonia
AIT - Augmented Inspection Team
ALARA - As low as is reasonably achievable
ALI - Annual limits on intake
AMAD - Activity median aerodynamic diameter
ANSI - American National Standards Institute
ARF - Ammonia Recovery Facility
ASTM - American Society for Testing and Materials
ATG - Allied Technologies Group
CG - Company guides
COG - Calciner Offgas
CPS - Chemical process safety
CSA - Criticality Safety Analysis
CSS - Criticality Safety Specifications
DAC - Derived air concentration
DFP - Decommissioning Funding Plan
DIW - Deionized water
D_k - Critical infinite cylinder
DNA - Dilute Nitric Acid
DOE - Department of Energy
DPM - Disintegrations per minute
D_s - Safe infinite cylinder
EARM - Emergency Assessment Resource Manual
ECN - Engineering Change Notice
ELO - Engineering Laboratory Operations
EP - Emergency Plan
°F - Degree fahrenheit
FMEA - Failure modes and effects analysis
FONSI - Finding of No Significant Impact
G - Gram
gU - Grams of Uranium
H&S - Health and Safety
H_2 - Hydrogen
HA - Hazard Assessments
HEPA - High-efficiency particulate air
HF - Hydrofluoric acid
HNO_3 - Nitric acid
HVAC - Heating, ventilation, and air conditioning
I.D. - Inside diameter
ICRP - International Commission on Radiation Protection
IH - Industrial Hygiene
IN - Information Notice
IRM - Instrument Repetitive Maintenance
K_a - Neutron multiplication factor
K_c - K effective that results from calculation of benchmark experiments
ΔK_{ku} - Uncertainty in benchmark experiments
ΔK_m - Safety margin to assume subcriticality
LFPM - Linear feet per minute
LUR - Lagoon Uranium Recovery
MC&A - Material control and accounting
M_k - Critical Mass
M_{kmod} - Critical Mass of moderator
ml - milliliter
MOC - Management of Change
MOU - Memorandum of Understanding
MREM - Millirem
M_s - Safe Mass
MSDS - Material Safety Data Sheet
M_{sl} - Safe Mass Limit
M_{smod} - Safety mass of moderator
MWP - Maintenance Work Procedure
N_2 - Nitrogen gas
NCS - Nuclear Criticality Safety
NFPA - National Fire Protection Association

NH_3 - Anhydrous ammonia
NO_2 - Nitrogen dioxide
NPDES - National Pollutant Discharge Elimination System
NRC - U.S. Nuclear Regulatory Commission
OJT - On-the-job training
OSHA - Occupational Safety and Health Administration
P&ID - Piping and instrumentation diagram
pCi - Picocuries
PDTF - Product Development Test Facility
PERT - Plant Emergency Response Team
pH - Negative log of hydrogen ion concentration
PM - Preventive Maintenance
POG - Process Offgas
PPE - Personal Protective Equipment
PPM - Parts per million
PSI - Process Safety Information
psig - Pounds per square inch gauge
PSM - Process Safety Management
PuO_2 - Plutonium dioxide
QC - Quality Control
RAI - Request for additional information
RESL - Radiological and Environmental Sciences Laboratory
RSIC - Radiation Shielding Information Center
RWP - Radiation Work Procedures
SER - Safety Evaluation Report
SF - Specialty fuels
S_k - Critical infinite slab
SNM - Special nuclear material
SOP - Standard Operating Procedures
SPC - Siemens Power Corporation
S_s - Safe infinite slab
SS&L - Safety, Security & Licensing
SWUR - Solid Waste Uranium Recovery
TSD - Treatment Storage and Disposal
U-235 - Uranium-235
UBC - Uniform Building Code
UF_6 - Uranium hexafluoride
UO_2 - Uranium dioxide
UO_x - Uranium oxide
UO_2F_2 - Uranyl Fluoride
V_k - Critical spherical volume
WDOE - Washington Department of Ecology
WO - Work Order