3 OPERATION SYSTEMS

3.1 Conduct of Review

The operation systems review evaluates the description presented in the Idaho Spent Fuel (ISF) Facility Safety Analysis Report (SAR) (Foster Wheeler Environmental Corporation, 2003a) of all operations and determines if they fulfill the U.S. Nuclear Regulatory Commission regulatory requirements for clarity and completeness. Particular emphasis was placed on how operation systems relate to handling and storage of spent nuclear fuel (SNF), confinement of nuclear material, and management of expected and potential radiological dose. The review of the operation systems included selected sections of Chapter 4, “Installation Design;” Chapter 5, “Operation Systems;” Chapter 7, “Radiation Protection;” and Appendix A, “Safety Evaluation of DOE-ID Provided Transfer Cask,” of the ISF Facility SAR and documents cited in the SAR.

3.1.1 Operation Description

Operation description relates to the operations of the installation including storage functions. The description of the operating systems was reviewed for conformance with the following regulations:

- 10 CFR §72.24(b) requires a description and discussion of the Independent Spent Fuel Storage Installation (ISFSI) structures with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations.

- 10 CFR §72.40(a)(3) requires that at the site of a nuclear power plant or other licensed activity or facility, the proposed ISFSI would not pose an undue risk to the safe operation of such nuclear power or other licensed activity or facility.

- 10 CFR §72.40(a)(5) requires that the proposed operating procedures to protect health and to minimize danger to life or property are adequate.

- 10 CFR §72.40(a)(13) requires that there is reasonable assurance that (i) the activities authorized by the license can be conducted without endangering the health and safety of the public and (ii) these activities will be conducted in compliance with the applicable regulations of this chapter.

- 10 CFR §72.44(c)(1) requires that technical specifications must include requirements for functional and operating limits and monitoring instruments and limiting control settings. (i) Functional and operating limits for an ISFSI are limits on fuel handling and storage conditions that are found to be necessary to protect the integrity of the stored fuel container, to protect employees against occupational exposures and to guard against the uncontrolled release of radioactive materials, and (ii) monitoring instruments and limiting control settings for an ISFSI are those related to fuel handling and storage conditions having significant safety functions.

- 10 CFR §72.44(c)(2) requires that technical specifications must include limiting conditions. Limiting conditions are the lowest functional capability or performance levels of equipment required for safe operation.

- 10 CFR §72.44(c)(3) requires that technical specifications must include surveillance requirements. Surveillance requirements include (i) inspection and monitoring of spent fuel in storage; (ii) inspection, test and calibration activities to ensure that the necessary integrity of required systems and components is maintained; (iii) confirmation that operation of the ISFSI is within the required functional and operating limits; and (iv) confirmation that the limiting conditions required for safe storage are met.

- 10 CFR §72.104(b) requires that the operational restrictions must be established to meet as low as is reasonably achievable objectives for radioactive materials in effluents and direct radiation levels associated with ISFSI operations.

- 10 CFR §72.104(c) requires that the operational limits must be established for radioactive materials in effluents and direct radiation levels associated with ISFSI operations to meet the limits given in 10 CFR §72.104(a).

- 10 CFR §72.122(f) requires that systems and components that are important to safety must be designed to permit inspection, maintenance, and testing.

- 10 CFR §72.122(h)(1) requires that the spent fuel cladding must be protected during storage against degradation that leads to gross ruptures or the fuel must be otherwise confined such that degradation of the fuel during storage will not pose operational safety problems with respect to its removal from storage. This may be accomplished by canning of consolidated fuel rods or unconsolidated assemblies or other means as appropriate.

- 10 CFR §72.122(h)(3) requires that ventilation systems and off-gas systems must be provided where necessary to ensure the confinement of airborne radioactive particulate materials during normal or off-normal conditions.

- 10 CFR §72.122(h)(4) requires that the storage confinement systems must have the capability for continuous monitoring in a manner such that the licensee will be able to determine when corrective action needs to be taken to maintain safe storage conditions. For dry spent fuel storage, periodic monitoring is sufficient provided that periodic monitoring is consistent with the dry spent fuel storage cask design requirements. The monitoring period must be based upon the spent fuel storage cask design requirements.

- 10 CFR §72.122(i) requires that instrumentation and control systems for dry storage casks must be provided in accordance with cask design requirements to monitor conditions that are important to safety over anticipated ranges for normal conditions and off-normal conditions. Systems that are required under accident conditions must be identified in the SAR.

- 10 CFR §72.122(l) requires that storage systems must be designed to allow for ready retrieval of spent fuel for further processing or disposal.

- 10 CFR §72.124(c) requires that a criticality monitoring system shall be maintained in each area where special nuclear material is handled, used, or stored which will energize clearly audible alarm signals if accidental criticality occurs. Monitoring of dry storage areas where special nuclear material is packaged in its stored configuration under a license issued under this subpart is not required.

- 10 CFR §72.126(a) requires that radiation protection systems must be provided for all areas and operations where onsite personnel may be exposed to radiation or airborne radioactive materials. Structures, systems, and components for which operation, maintenance, and required inspections may involve occupational exposure must be designed, fabricated, located, shielded, controlled, and tested so as to control external and internal radiation exposures to personnel. The design must include means to (1) prevent the accumulation of radioactive material in those systems requiring access; (2) decontaminate those systems to which access is required; (3) control access to areas of potential contamination or high radiation within the ISFSI; (4) measure and control contamination of areas requiring access; (5) minimize the time required to perform work in the vicinity of radioactive components; for example, by providing sufficient space for ease of operation and designing equipment for ease of repair and replacement; and (6) shield personnel from radiation exposure.

- 10 CFR §72.126(b) requires that radiological alarm systems must be provided in accessible work areas as appropriate to warn operating personnel of radiation and airborne radioactive material concentrations above a given setpoint and of concentrations of radioactive material in effluents above control limits. Radiation alarm systems must be designed with provisions for calibration and testing their operability.

- 10 CFR §72.126(c) requires effluent and direct radiation monitoring. (1) As appropriate for the handling and storage system, effluent systems must be provided. Means for measuring the amount of radionuclides in effluents during normal operations and under accident conditions must be provided for these systems. A means of measuring the flow of the diluting medium, either air or water, must also be provided. (2) Areas containing radioactive materials must be provided with systems for measuring the direct radiation levels in and around these areas.

- 10 CFR §72.128(a)(1) requires that spent fuel storage must be designed to ensure adequate safety under normal and accident conditions. These systems must be designed with a capability to test and monitor components important to safety.

- 10 CFR §72.150 requires that the licensee, applicant for a license, certificate holder, and applicant for a Certificate of Compliance (CoC) shall prescribe activities affecting quality by documented instructions, procedures, or drawings of a type appropriate to the circumstances and shall require that these instructions, procedures, and drawings be followed. The instructions, procedures, and drawings must include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

- 10 CFR §72.166 requires that the licensee, applicant for a license, certificate holder, and applicant for a CoC shall establish measures to control, in accordance with work and inspection instructions, the handling, storage, shipping, cleaning, and preservation

of materials and equipment to prevent damage or deterioration. When necessary for particular products, special protective environments, such as inert gas atmosphere, and specific moisture content and temperature levels must be specified and provided.

As identified in SER Section 2.1.2, the ISF Facility is to be located on the same site as other nuclear facilities operated by the U.S. Department of Energy. The nuclear facilities identified by the applicant include the facilities at INTEC and Advanced Test Reactor in the Test Reactor Area. In Chapter 15 of this SER, the consequences of accidents at these other nuclear facilities on the operation of the ISF Facility have been evaluated. Potential interactions between these facilities and the ISF Facility have been evaluated in accordance with 10 CFR §72.40(a)(3) and have been determined to pose no undue risk to life or property.

In Section 5.1, "Operation Description," of the SAR, the applicant describes the general operating functions associated with receipt, loading, handling, and storage of the SNF at the Idaho Spent Fuel (ISF) Facility. The operation systems descriptions have been organized by the applicant into four general categories:

- Receipt Operations, which begin when the SNF shipment arrives in the cask receipt area (CRA) and end when the transfer cask has been placed below the cask port;

- Loading Operations, which begin when the transfer cask seismic lid restraint is released, and include fuel packaging in the fuel packaging area (FPA), and end when the ISF canister leak testing has been completed in the canister closure area (CCA);

- Canister Handling, which includes movement of the ISF canister from the CCA to the storage area and ends when the ISF Canister is in the storage tube and the storage tube leak testing has been completed; and

- Storage Operations, which begin upon completion of canister handling.

In addition, operating functions associated with description of handling of onsite generated solid and liquid waste are described. The ISF Facility SAR includes descriptions and discussions of the projected operating characteristics and safety considerations.

Transfer cask receipt operations, as described in Section 5.1.1.1, "Receipt Operations," of the SAR, begin when the SNF is received at the ISF Facility. These operations include: (i) acceptance of the SNF shipment in a U.S. Department of Energy transfer cask, (ii) offloading of the transfer cask onto the cask trolley, (iii) installation of the cask adapter remote release lid restraint, (iv) movement of the transfer cask into the cask decontamination zone for venting and sampling of the transfer cask atmosphere, and (v) movement of the transfer cask below the FPA cask port and inflation of the cask port inflatable seal. After the cask trolley is moved below the FPA cask port, the following activities are performed:

- Engaging the cask trolley seismic locking pins
- Inflating the cask port inflatable seal
- Removing the cask port plug

Security inspections of the transfer casks and transporter are conducted before allowing the transfer cask and transporter on the site. Radiological receipt surveys may either be conducted

prior to entry onto the site or may be performed after arrival in the CRA. . If the sample of the transfer cask atmosphere is found unacceptable the transfer cask is returned to the U.S. Department of Energy.

Loading operations, as described in Section 5.1.1.2, “Loading Operations,” of the SAR, include (i) release of the remote lid restraint of and removal of the transfer cask lid, (ii) removal of SNF containers from the transfer cask for loading into ISF Canisters, (iii) movement of the loaded ISF canisters between the FPA and CCA, and (iv) performing ISF canister lid closure welding, vacuum drying, inerting and leak testing. Before an ISF canister is loaded with SNF, the following activities are performed:

- Engaging the canister trolley seismic locking pins
- Inflating the FPA canister port inflatable seal
- Removing the FPA canister port plug

Prior to receipt of a type of the SNF, the FPA is configured to receive, handle, and temporarily store that type of fuel.

Loading operations for fuel-specific packaging activities are described in Sections 5.1.1.2.3 through 5.1.1.2.9 of the SAR. These operations are unique to each fuel type and the condition of the fuel. The canister trolley is used to transfer the full ISF baskets and canisters from the FPA to the CCA. Canister trolley seismic locking pins are engaged at both the FPA and CCA to ensure seismic stability during SNF transfer. The canister port seal is used to include the canister cask as part of the confinement boundary prior to removal of the port cover plates. Inside the CCA, the ISF canister lid is manually aligned and closure welding is automatically performed with remote operator supervision. Nondestructive examination of the closure weld is performed to ensure acceptable closure. The SNF is then dried to an acceptable moisture level, helium gas is used to purge and backfill the canister, helium leak checks are performed for the lid closure weld and vent plug seal, and the vent plug seal is welded in position. After the canister lid closure weld, the vent plug seal, and the vent plug seal weld are determined to meet the technical specification limits, the loading operations mode ends.

Canister handling, as described in Section 5.1.1.3, “Canister Handling,” of the SAR, includes (i) movement of the sealed ISF canister to the storage area, (ii) transfer of the ISF canister from the canister trolley to the canister handling machine (CHM), (iii) movement of the ISF canister to the storage tube, (iv) placement of the ISF canister in the storage tube, and (v) helium purge and backfill of the storage tube. Upon completion of the canister lid welding and preparation activities in the CCA, the sealed ISF canister is lowered into the canister cask, and the canister trolley is made ready for transfer. The canister trolley is then moved to the storage area port and the canister trolley seismic locking pin is engaged. With the CHM bridge-and-trolley seismic clamps applied, the CHM is used to (i) remove the port plug, (ii) remove the ISF canister from the canister trolley, and (iii) replace the port plug. Subsequently, the CHM is moved over the designated storage tube. After the storage tube plug is removed, the ISF canister is placed in the storage tube. The tube plug and storage tube lid are reinstalled after the ISF canister is placed in position. Finally, helium purge and backfill of the storage tube is performed, followed by leak testing of the storage tube lid seal rings and installation of the port cover plate.

Storage operations are described in Section 5.1.1.4, “Storage Operations,” of the SAR. The ISF Facility SNF storage system is a passive design. Outside air enters through fixed openings in the outside walls, cooling the SNF in the storage tubes as it circulates through the storage vault through natural convection, rises through openings in the charge face floor and exits the storage building through louvers in the upper sections of the storage area exterior walls. The storage tube lid interseal leak rates are periodically surveyed to verify storage tube integrity. Also, the storage vault air inlets and outlets are periodically surveyed to ensure that air flow for heat removal is maintained. In addition, the ports at the storage tube assembly are verified to be clear.

The staff reviewed the general operating functions described in Chapter 5, “Operation Systems,” of the SAR to ensure the applicant adequately described the appropriate procedures, equipment, and personnel requirements. The SAR identifies the specific equipment to accomplish the receipt, handling, and storage of the SNF at the ISF Facility. The description satisfies the requirements of 10 CFR §72.122(h)(1), (3) and (4); §72.122(i); and §72.166. The description and design of the ISF Facility and its various systems as described in Section 3.1.2 of this SER provide reasonable assurance for ready retrieval of the stored radioactive material from storage during normal, off-normal, and accident conditions in compliance with 10 CFR §72.122(l). The staff determined that the procedure descriptions for operating, inspecting, and testing are consistent with the operation systems. In addition, the applicant provided an adequate description and supporting documentation of the interface between the various operation systems and operational categories (personnel requirements are addressed in Chapter 10 of this SER). Consequently, the staff finds the general description of the proposed ISF Facility operations to be acceptable and has determined that the ISF Facility operations can be conducted without endangering the health and safety of the public and are, therefore, in compliance with 10 CFR §72.40(a)(5) and §72.40(a)(13). Additionally, the SAR provides technical specifications that include functional and operating limits, monitoring instruments, limiting control settings, and surveillance requirements as required by 10 CFR §72.44(c)(1)–(3). Requirements for additional technical specifications for specific systems are identified in subsequent sections of this Safety Evaluation Report. The SAR provides acceptable instructions, procedures, and drawings for functional and operating systems and monitoring instruments as required by 10 CFR §72.150. The staff finds that the design and procedures for the ISF Facility provide acceptable capability to permit inspection, maintenance, testing, and monitoring of components important to safety, in compliance with 10 CFR §72.122(f), 72.124(c), and §72.128(a)(1).

The applicant’s as low as reasonably achievable (ALARA) considerations are reviewed in Chapter 11 of this SER. Based on that review, the staff finds that the facility design and operations appropriately incorporate ALARA principles, as required by 10 CFR §72.104(b). Radiological alarm systems and direct radiation monitoring also are considered in the design in compliance with the requirements of 10 CFR §72.126(a)–(c).

As discussed in Section 5.1, “Operation Description,” of Appendix A of the SAR, loading of the Peach Bottom–1 and Peach Bottom–2 transfer casks will be done at the Idaho Nuclear Technology and Engineering Center (INTEC) dry fuel storage facilities. Loading of the SNF will be performed at Facility CPP–749 (U.S. Department of Energy–Idaho Operations Office, 2002a,b) and Building CPP–603 (U.S. Department of Energy–Idaho Operations Office, 2002c,d). The loading activities will be controlled by INTEC procedures. This review does not

address loading activities related to the Peach Bottom–1 and Peach Bottom–2 transfer casks at the INTEC dry fuel storage facilities.

3.1.2 SNF Handling Systems

the applicant's description of the SNF handling systems was reviewed for conformance with the following regulations:

- 10 CFR §72.24(b) requires a description and discussion of the ISFSI structures with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations.

- 10 CFR §72.24(f) requires identification of the features of ISFSI design and operating modes to reduce to the extent practicable radioactive waste volumes generated at the installation.

- 10 CFR §72.44(c)(1) requires that technical specifications must include requirements for functional and operating limits and monitoring instruments and limiting control settings. (i) Functional and operating limits for an ISFSI are limits on fuel handling and storage conditions that are found to be necessary to protect the integrity of the stored fuel container, to protect employees against occupational exposures and to guard against the uncontrolled release of radioactive materials, and (ii) monitoring instruments and limiting control settings for an ISFSI are those related to fuel handling and storage conditions having significant safety functions.

- 10 CFR §72.104(b) requires that the operational restrictions must be established to meet as low as is reasonably achievable objectives for radioactive materials in effluents and direct radiation levels associated with ISFSI operations.

- 10 CFR §72.124(c) requires that a criticality monitoring system shall be maintained in each area where special nuclear material is handled, used, or stored which will energize clearly audible alarm signals if accidental criticality occurs. Underwater monitoring is not required when special nuclear material is handled or stored beneath water shielding. Monitoring of dry storage areas where special nuclear material is packaged in its stored configuration under a license issued under this subpart is not required.

- 10 CFR §72.128(a) requires that spent fuel storage must be designed to ensure adequate safety under normal and accident conditions. These systems must be designed with (1) a capability to test and monitor components important to safety, (2) suitable shielding for radioactive protection under normal and accident conditions, (4) a heat-removal capability having testability and reliability consistent with its importance to safety.

- 10 CFR §72.150 requires that the licensee, applicant for a license, certificate holder, and applicant for a CoC shall prescribe activities affecting quality by documented instructions, procedures, or drawings of a type appropriate to the circumstances and shall require that these instructions, procedures, and drawings be followed. The instructions, procedures, and drawings must include appropriate quantitative or

qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

- 10 CFR §72.166 requires that the licensee, applicant for a license, certificate holder, and applicant for a CoC shall establish measures to control, in accordance with work and inspection instructions, the handling, storage, shipping, cleaning, and preservation of materials and equipment to prevent damage or deterioration. When necessary for particular products, special protective environments, such as inert gas atmosphere, and specific moisture content and temperature levels must be specified and provided.

As identified in NUREG–1567 (U.S. Nuclear Regulatory Commission, 2000), the ISF Facility SAR should provide an understanding of the functions, design bases, and pertinent design features of the operating systems including sketches to describe unique equipment or design features. In Section 5.2, “Spent Fuel Handling System,” of the SAR, the applicant described the functions and safety features of the systems that handle the SNF. Specific systems are identified and discussed in the following sections.

3.1.2.1 SNF Handling System

The staff reviewed Section 5.2.1, “Spent Fuel Receipt, Handling, and Transfer,” of the SAR and the supporting information provided in Chapter 4, “Installation Design,” of the SAR where the details of the SNF handing systems are discussed. The following systems are considered by the applicant to be part of the SNF handling system:

- U.S. Department of Energy transfer casks
- Cask receipt crane
- Cask trolley
- Transfer Tunnel doors
- Fuel handling machine (FHM)
- Decanning machine
- ISF canisters and ISF baskets
- Master/slave manipulators (MSMs)
- Worktable
- Bench containment vessels (BCVs)
- Canister trolley
- ISF canister welding system
- Vacuum dry, helium fill, and leak check system

With the exception of the decanning machine, ISF canister welding system, and vacuum dry, helium and leak check system, each system is considered important to safety. After reviewing the information, the staff agrees with the applicant’s categorization.

<u>U.S. Department of Energy Transfer Casks</u>

The transfer casks provided by the U.S. Department of Energy are used to transfer SNF from the INTEC facilities to the ISF Facility. The discussions about these transfer casks are provided in Sections 5.2.1.1.1 and 5.2.1.2.1 of the SAR. Additional information about the transfer casks is provided in Appendix A, “Safety Evaluation of DOE–ID Provided Transfer

Cask," of the SAR. The shielded transfer casks are used to transport all three identified fuel types. The safety features and procedures are provided to address passive cooling of the SNF, maintenance of subcriticality, and shielding to maintain ALARA conditions. Information about passive cooling of the SNF is discussed in Chapter 6 of this SER, and compliance with 10 CFR §72.128(a)(4) is addressed there. Criticality is discussed in Chapter 8 of this SER, and compliance with 10 CFR §72.124 also is addressed there. Shielding to maintain ALARA conditions is discussed in Chapter 11 of this SER, and compliance with 10 CFR §72.128(a)(2) and §72.104(b) is addressed there.

Operational performance and safety of the U.S. Department of Energy transfer casks are assured by inspections performed prior to acceptance at the ISF Facility. Transfer cask shipping papers are first reviewed for proper quality control inspections, closure reports, shipping manifests, and custody forms. Radiological surveys are performed according to written procedures. Also, security inspections are completed before the transfer cask is accepted in the ISF Facility. These inspections ensure the transfer casks meet technical specifications and the ISF Facility radiological protection requirements. The staff reviewed the general descriptions of the operational characteristics of the transfer casks and finds they satisfy the requirements of 10 CFR §72.24(b), §72.24(f), §72.44(c)(1), §72.128(a)(1), and §72.150. The staff also finds the safety and security inspection procedures, which will be performed at the ISF Facility prior to acceptance of the transfer casks, satisfy 10 CFR §72.166.

Cask Receipt Crane

The cask receipt crane, as discussed in Sections 4.7.1.2, 4.7.3.2.1, 5.2.1.1.2, and 5.2.1.2.2 of the SAR, is used to lift the transfer cask from the transporter when it is received in the CRA and to place it on the cask trolley. The cask receipt crane is also used to lift the empty transfer cask from the cask trolley back onto the transporter. This crane is a 141 tonne [155 ton] rated 136 tonne [150 ton] working, fixed-position hoist that has been sized to accommodate an anticipated fully loaded transfer cask. The cask receipt crane is designed to be single-failure-proof and to withstand the design earthquake (DE). An operator controls the crane through visual observation with a pendant control box to minimize the operator exposure and, therefore, ALARA is considered in the design as required by 10 CFR §72.104(b). All pendant controls are the push-to-operate, nonlatching type for safety. Load cells on the crane will provide indications of crane loads and will stop crane operation in case of an overload situation. Also, safety interrupts are provided for unbalanced load, overspeed, overtravel, or excessive load conditions. Emergency stop pushbuttons are provided at working areas around the crane. Crane operations are administratively restricted to facility temperatures between 0 and 40 EC [32 and 104 EF] to ensure crane operation is within the design limits. In case of off-normal events such as a power failure or earthquake, power to the crane is interrupted and hoist brakes are automatically applied.

A 9.1 tonne [10 ton] auxiliary receipt crane is also located in the CRA. This auxiliary receipt crane has long-travel and cross-travel capabilities and will be used for miscellaneous tasks associated with cask transfer operations such as removing cask impact limiters or shipping restraints. This crane is also controlled by an operator using a pendant. Similar emergency stop and operational safety features are provided for this crane as those for the cask receipt crane. The auxiliary crane has an additional interlock that prevents operation in the cask receipt crane hoist area unless the cask receipt crane hoist is in the fully raised position.

The staff finds that the general descriptions of the operational characteristics of the cask receipt cranes are provided with sufficient detail to satisfy the requirements of 10 CFR §72.24(b), §72.44(c)(1), §72.128(a)(1), §72.150, and §72.166.

Cask Trolley

As discussed in Sections 5.1.1.1.3, "Movement of Transfer Cask into Cask Decontamination Zone;" 5.1.1.2.1, "Movement of the Transfer Cask to FPA;" and 4.7.1.3, 4.7.3.2.2, 4.7.3.3.5, 5.1.1.5.1, 5.2.1.1.3, and 5.2.1.2.3, "Cask Trolley," of the SAR, a cask trolley system has been designed for the ISF Facility to move transfer casks from the CRA to the FPA and to return empty casks to the CRA. The cask trolley is motor driven and operates on the same rail system as the canister trolley. The cask trolley is operated from a control console in the CRA. Operators select the desired trolley position, start and stop the drives, and control Transfer Tunnel doors from the console. The operation of the cask trolley is monitored using closed-circuit television (CCTV).

Section 5.2.1.1.3 of the SAR states the operational safety of the cask trolley system is enhanced by the programmable logic controller (PLC) system. The PLC controls the trolley speed in defined zones throughout the tunnel. The PLC also stops the trolley precisely at the desired position selected by the operator. PLC interlocks prevent travel of the cask trolley if the canister trolley is in the way and the appropriate tunnel door is not fully open. Also, the PLC safety interlocks prevent trolley motion if the seismic locking pins are engaged. Details about the design of the seismic locking pins were provided in ISF–FW–CALC–0168 (Foster Wheeler Environmental Corporation, 2001). Information about the function and interlocks associated with the Transfer Tunnel PLC controls is also provided in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b). Safety of the trolley is demonstrated during off-normal and accident conditions. Limit switches prevent overtravel of the cask trolley, and rail end stops and bumpers prevent overtravel if limit switches fail. Alarms and console lamps indicate trolley position, direction of travel, tunnel door status, and fault status. Video cameras also provide a remote display of the trolley position in the tunnel. If the trolley axle should break, the drop is limited to 2.54 cm [1 in], so the cask is not likely to tip over. During a DE, seismic restraints prevent the cask from tipping, the trolley power is deenergized, and motor brakes are automatically applied. Interfaces between the various operational systems during normal, off-normal, and accident conditions are identified in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b).

The design of the cask trolley and access within the Transfer Tunnel permits recovery from postulated failures. The response to the U.S. Nuclear Regulatory Commission (Foster Wheeler Environmental Corporation, 2003b) identifies the plans to recover from damage to various components to the cask trolley if it breaks down in the Transfer Tunnel. The time to respond is not an issue, therefore, development of plans for unforeseen failures at the time of occurrence is acceptable. Consequently, the design of the cask trolley is such that recovery from off-normal and accident conditions is possible and is in compliance with the requirements of 10 CFR §72.24(b).

The staff reviewed the information presented in the SAR about the design and safety of the cask trolley system. Descriptions of the functions of these systems are found to be acceptable and satisfy the requirements of 10 CFR §72.24(b), §72.44(c)(1), §72.128(a)(1), and §72.150. The flow diagram and additional information provided in the applicant's responses to the staff's

request for additional information (Foster Wheeler Environmental Corporation, 2003b) are sufficient to provide understanding of the operations sequence. In addition, the responses provide sufficient information about the interlocks for each item controlled by the PLC to satisfy the requirements of 10 CFR §72.166.

Transfer Tunnel Doors

Motor-operated Transfer Tunnel doors are discussed in Sections 4.7.2.3, “Confinement Features;” 4.7.3.1.2, “Transfer Tunnel;” and 5.2.1.1.4 and 5.2.1.2.4, “Transfer Tunnel Doors,” of the SAR. Two motor-operated Transfer Tunnel doors provide ventilation and pressure control to ensure air flow from the CRA toward the FPA. The outer door is rated as a 1-hour fire barrier, and provides protection from design basis tornado missiles. The Transfer Tunnel doors are operated from the cask trolley control console. PLC logic provides assistance to the operator for proper door control. The PLC logic helps ensure safe operation of the Transfer Tunnel doors by preventing the opening of the inner door during fuel transfers between the CCA and FPA or storage area, or during high radiation conditions in the SNF transfer areas. This logic ensures ALARA conditions for operators and other personnel during SNF transfers are maintained and satisfies the requirements of 10 CFR §72.104(b).

The staff reviewed the information presented in the ISF Facility SAR and the applicant’s response to the staff’s request for additional information (Foster Wheeler Environmental Corporation, 2003b) about the design and safety of the Transfer Tunnel doors. The staff finds the preliminary design of the Transfer Tunnel doors satisfies the requirements of 10 CFR §72.24(b), §72.44(c)(1), §72.128(a)(1), and §72.150. The controls are described in sufficient detail to satisfy the requirements of 10 CFR §72.166.

Fuel Handling Machine

The applicant addressed the operation of the FHM in Sections 4.7.3.2.5, “Fuel Handling Machine and Power Manipulator System;” and 4.7.1.5, 4.7.3.3.7, 5.2.1.1.5, and 5.2.1.2.5, “Fuel Handling Machine,” of the SAR. The FHM is designed to provide remote handling of SNF within the FPA. The FHM is a motor-driven bridge-and-trolley crane with a 4,539-kg [10,000-lb] single-failure-proof hoist and a power manipulator system (PMS). The FHM is used to lift canisters or baskets of SNF into the FPA and to move SNF and equipment within the FPA. The PMS is a robotic, telescopic arm that provides remote handling capabilities necessary for operations within the FPA.

The FHM is designed to remain in position and continue to support the critical load in the event of a design earthquake (DE). It incorporates a single-failure-proof hoist. The speed of the FHM is limited when it is within operating zones. Operator alerts are provided when loads are out of expected ranges or during the development of off-normal conditions such as stuck or broken fuel elements. Limit switches prevent overtravel during operations, and overspeed switches are provided to prevent hoist overspeed. Bumpers are provided in case limit switches fail at the end of travel. During an off-normal event, electrical power is shut off, and the bridge-and-trolley brakes are engaged. The SAR states the holding brake on either of the hoist motors on the FHM will stop at 125 percent of the maximum critical load during a power failure. Section 5.1.1.6.1 of the SAR states that, with a single failure of a bridge or trolley component, the remaining motors are capable of moving the disabled bridge or trolley to a position where the load can be secured and the FHM moved to the maintenance area for repairs. Therefore, the

design is such that the FHM can be moved into a location within the FPA for inspection, testing, and maintenance and, consequently, satisfies the requirements of 10 CFR §72.128(a)(1). Seismic uplift restraints are provided to capture the rails and limit vertical motion during a seismic event.

Section 5.1.1.6.1 of the SAR states the PMS is not designed to operate following a single-point failure. In the case of a failure that prevents the PMS from disengaging the fuel load, the MSMs could be used to disengage the load from the hook. As identified, the recovery time from this type of failure is not critical, and recovery plans can be developed before the health and safety of the workers and public are compromised. The SAR states a load cell is included in the PMS to prevent overloading by tripping an interlock if the load rating is exceeded.

Section 5.2.1.1.5 of the SAR states the FHM and the PMS are operated by a portable control console at operator workstations by visual observation through shielded windows using the FPA CCTV system. Lifting operations are confirmed by a combination of visual observations and status readout from load cells on the hoist. Video cameras assist the operator in positioning the FHM. The CCTV camera system will be used to position and grapple fuel with the FHM system during loading and unloading operations. As indicated in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b), operator visibility and control will be impaired if any one of the cameras fails, but will not prevent safe handling of the SNF.

Controls for the FHM are the "hold-to-operate" type for safety. Section 5.2.1.1.5 of the SAR describes a FHM PLC that assists the operator in controlling the FHM, controls the speed and operating zones, and provides X-Y coordinate indications during SNF transfer. The controller allows only one motion of the FHM at a time. In other words, combinations of bridge travel, trolley travel, or hoist travel will be prevented during operations. In addition to indication of hoist loading, the PLC provides coordinate indications that assist the operators in positioning loads. The PLC also prevents bridge and trolley travel when the hoist is below an established height limit, so that the load is unlikely to hit or snag on other equipment. The PLC does not independently control important to safety operations that are under direct operator control. The staff concludes that 10 CFR §72.166 requirements are satisfied for the handling, storage, and shipping controls for the SNF.

The staff reviewed the information presented in the SAR about the design and safety of the FHM, and finds the descriptions of the functions of this system to be acceptable. The flow diagram for operation of the FHM was supplemented by information provided in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b). This information provides a sufficient understanding of the operations sequence for the FHM. Consequently, the staff finds that the requirements of 10 CFR 72.24(b), §72.24(f), §72.44(c)(1), and §72.150 are satisfied. ALARA is considered in the design of the FHM and PMS as required by 10 CFR §72.104(b).

The specific requirements for shielding for radioactive protection, nuclear criticality, and heat removal for the FHM and PMS are accounted for in the design of the FPA. These design features are reviewed in Chapters 6, 7, and 8 of this SER with respect to the requirements of 10 CFR §72.124, §72.128(a)(2), and §72.128(a)(4).

Decanning Machine

As identified in Sections 5.2.1.1.6 and 5.2.1.2.6 of the SAR, the decanning machine is provided at the ISF Facility to remove tops from Peach Bottom–1 fuel cans or salvage cans so the fuel elements can be accessed. During normal conditions, operational safety is ensured by the decanning machine design. Mechanical stops control depth of cut during can cutting. The cutting process is slow and controlled; the position of the cut is precisely controlled by the clamping position of the can within the machine. Equipment and alarm status are displayed on the control console. By design, the position of the SNF is well below the cutting location of the decanning machine. The staff reviewed the information presented in the SAR about the design and safety of the decanning machine, and finds the descriptions of the functions of this system to be acceptable and, therefore, the requirements of 10 CFR §72.24(b), §72.24(f), §72.44(c)(1), and §72.150 are satisfied.

Section 5.2.1.1.6 of the SAR indicates that the decanning machine is controlled from a control console in the operating gallery. Operator feedback is provided visually through shield windows and by the FPA CCTV. Control commands are manually initiated from pushbuttons and indicators on the control console. As indicated in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b), operator visibility and control will be impaired if any one of the cameras fails, but will not prevent safe handling of the SNF. Section 5.2.1.1.6 of the SAR also identifies a PLC, which is used to control the motor drives that will be used to assist the operator in controlling the decanning machine. The decanning machine is anchored to withstand a DE while loaded with a fuel can. Power is automatically shut off during a design seismic event. In the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b), the applicant provided additional details about the operations to demonstrate that the control system is robust, reliable, and resistant to operator error to the best extent possible. Consequently, the staff finds that the requirements of 10 CFR §72.166 are satisfied.

<u>ISF Canisters and ISF Baskets</u>

The applicant discusses the ISF canisters and ISF baskets in Sections 4.2.1.3, "ISF Canister;" 4.2.1.4, "ISF Basket;" 4.2.3.2.3, "Description of the ISF Canister Assembly;" 4.2.3.2.4, "Description of the ISF Basket Assembly;" 4.2.3.3.1, "ISF Canister Structural Evaluation;" 4.2.3.3.2, "ISF Canister Internals Structural Evaluation;" and 5.2.1.1.7 and 5.2.1.2.7, "ISF Canisters and ISF Baskets," of the SAR. The ISF canister and fuel basket provide a primary confinement boundary and structural support for SNF during storage operations. Fuel-specific ISF baskets are provided for the spent fuel from the Peach Bottom Unit 1 reactor; Training, Research, and Isotope reactors built by General Atomics (TRIGA); and the Shippingport reactor. Fuel-specific ISF baskets and an internal shield plug are used with the ISF canister to provide a storage and transfer system vessel for SNF at the ISF Facility. Supporting documentation about the design of the ISF canisters and ISF baskets was provided in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b), which identifies the necessary drawings for these components.

Safety is provided in the design during normal conditions by the design of the fuel basket and through the loading procedures. Empty storage positions within the basket are filled with dummy fuel elements to ensure maximum moderator displacement. Internal shield plugs above each fuel basket protect the operators during canister closing operations. The baskets are designed to ensure that the fuel remains subcritical during normal or off-normal conditions.

Finally, fuel canisters are designed to protect the fuel in the event of a design basis drop accident or a side impact.

The staff reviewed the information presented in the SAR about the design and safety of the ISF canister and finds it acceptable. The staff determines that the requirements of 10 CFR §72.24(b), §72.24(f), §72.44(c)(1), and §72.150 are satisfied. Shielding for radioactive protection, consideration of nuclear criticality, and head removal are provided by the design to satisfy the requirements of 10 CFR §72.124, §72.128(a)(2), and §72.128(a)(4), as addressed further in Chapters 6, 7, and 8 of this SER.

Master/Slave Manipulators

The applicant described the FPA remote manipulation capabilities in Sections 3.3.2.1.2, “Fuel Packaging Area;” 4.7.2.3, “Confinement Features;” and 4.7.3.2.6, “Master Slave Manipulators,” of the SAR. Remote manipulation capabilities are provided in the FPA by the MSMs. The MSMs consist of a master arm located outside the FPA, a through-wall tube with radiation seals, and a slave arm. These electrically powered MSMs reproduce the movements of the human hand within the confined areas to protect operators from radiation during SNF transfer, packaging, and broken fuel recovery operations. The operator uses the master arm to control the slave arm in the FPA based on visual observation through the shielded windows and CCTV monitoring. As indicated by the applicant’s response to the staff’s request for additional information (Foster Wheeler Environmental Corporation, 2003b), the operator visibility and control will be impaired if any one of the FPA cameras fails, however, this failure will not prevent safe handling of the SNF.

Safe operation of the MSMs is ensured by seals and liners that prevent the spread of radioactive contamination from the FPA and provide shielding equivalent to the 1.22-m [4-ft]-thick concrete walls. Therefore, the requirements of 10 CFR §72.128(a)(2), that the design provides suitable shielding for radioactive protection, are satisfied for the MSMs. The MSMs have a powered boom to provide extended reach if necessary. During a seismic event or other off-normal condition, the control system will deenergize the MSMs; all circuits are fail-safe during power shut down. To ensure operator safety, shielding and seals are designed to remain in position during a design basis seismic event.

The staff reviewed the information presented in the SAR regarding design and safety of the MSMs and finds the descriptions of the functions of the MSMs and their design acceptable. Consequently, the staff determined that the MSM design is in compliance with the requirements of 10 CFR §72.24(b), §72.24(f), §72.44(c)(1), and §72.150.

Worktable

Sections 4.7.3.2.9, 5.2.1.1.9, and 5.2.1.2.9 of the SAR indicate that a worktable with ancillary equipment is provided within the FPA. This worktable is used for nonstandard fuel packaging operations including removing stuck fuel elements from fuel cans and packaging broken fuel element pieces. The worktable equipment also is used to decontaminate and section fuel canisters, liners, buckets, and other contaminated fuel packaging items. The worktable equipment is designed to provide for operational safety during normal and off-normal conditions. A fence around the worktable will contain any loose contamination in the area. Operations on the worktable are controlled from two workstations positioned next to shield

windows adjacent to the table for optimum viewing of the procedures. Worktable equipment includes the following:

- Tipping Machine: Used to clamp and rotate Peach Bottom–1 fuel cans from vertical to horizontal position in preparation for cutting off the can bottom. Limit switches in the tipping machine control the extent of actuator travel. The tipping machine, including hard stops, will prevent overtravel of the actuator should limit switches fail. Overtightening of the fuel can clamps is prevented by a fixed stop that also centers the fuel can in the tipper sleeve.

- Can Cutting Machine: Used to cut the bottom from the Peach Bottom–1 and TRIGA fuel cans. The cutting depth of the can cutting saw is controlled by an adjustable slide on the machine. The slide prevents the saw from cutting into the fuel element. The motor has been sized so if the saw blade becomes jammed in the cut, the motor protection circuit will trip and shut off.

- Jacking Attachment: Used to push stuck fuel elements from the fuel can baffle pipe and can sleeves. The jacking attachment is a screw-type linear actuator just long enough to push a fuel element clear of a fuel can baffle pipe. It is controlled by operating between hard fixed stops. The operator can control the stall torque through the control system, which also provides a torque indication. The operator can then use the torque readout information to determine when the stuck fuel element has been pushed free.

- Rodding Attachment: Used to push broken fuel elements out of a fuel can into a broken element can. This attachment will also be used to pull full broken fuel elements into the tipping machine for transfer to a full basket and to decontaminate the inside of used fuel cans in preparation for waste processing. The rodding attachment is a rack-and-pinion device; the rack pushes a broken fuel element free from the fuel can when the motor-driven pinion advances the rack.

All worktable equipment is designed to fail safe during an off-normal power shut down. Operation is remotely controlled by operators from a console in the operating gallery area to minimize radiation exposure. The staff reviewed the information presented in the SAR about the design and safety of the worktable and the associated equipment and finds that the information provided is acceptable. The staff further determined that the design of the worktable equipment is in compliance with the requirements of 10 CFR §72.24(b), §72.24(f), §72.44(c)(1), and §72.150.

Bench Containment Vessels

The staff reviewed Sections 4.7.3.2.7, “Bench Vessels;” and 5.2.1.1.11 and 5.2.1.2.11, “Bench Containment Vessels,” of the SAR. The BCVs provide temporary storage of fuel, baskets, canisters, waste, and other components during fuel-packaging operations. The BCVs are accessed through ports in the workbench and are configured with the appropriate required adapters, inserts, equipment, and covers prior to loading a specific fuel type. Safety is maintained because the BCVs are sized to prevent insertion of enough fuel elements to achieve critical conditions. Unused BCVs will be kept covered to prevent contamination. No off-normal conditions have been identified for the BCVs.

The staff reviewed the information presented in the SAR about the design and safety of the BCVs. The staff finds the descriptions of the functions of the BCVs acceptable and in compliance with the requirements of 10 CFR §72.24(b), §72.24(f), §72.44(c)(1), and §72.150.

Canister Trolley

The staff reviewed Sections 4.7.1.6, 4.7.3.2.3, 5.2.1.1.10, and 5.2.1.2.10, "Canister Trolley;" 5.1.1.2, "Loading Operations;" and 5.1.1.3, "Canister Handling," of the SAR. A canister trolley system has been designed for the ISF Facility to move ISF canisters in the cask between the FPA, CCA, and storage areas. The canister trolley is motor driven and uses the same rail system as the cask trolley. Section 5.2.1.1.10 of the SAR states that the operator controls the canister trolley by use of an operator console while visually aided through a display showing video images inside the Transfer Tunnel. The canister trolley is operated from a control console whereby operators select the desired trolley position, start and stop the drives, and control the Transfer Tunnel doors.

Section 5.2.1.1.10 of the SAR indicates a PLC is used to control system interlocks and to assist in controlling the trolley by stopping the trolley precisely at programmed positions. The PLC also stops the trolley precisely at the desired position selected by the operator. PLC interlocks prevent canister trolley travel if the cask trolley is in the way or the appropriate tunnel door is not fully open. PLC safety interlocks prevent trolley motion if the seismic locking pins are engaged. Additional information about the function and interlocks associated with the Transfer Tunnel PLC controls is provided in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b). Alarms and console lamps are used to indicate trolley position, direction of travel, tunnel door status, and fault status. Video cameras provide a remote display of the trolley position in the Transfer Tunnel.

The trolley is safe during off-normal and accident conditions. Limit switches prevent overtravel of the canister trolley, and rail-end stops and bumpers prevent overtravel if limit switches fail. If the trolley axle should break, the drop is limited to 2.54 cm [1 in], so the canister should not tipover. During a DE, seismic restraints prevent the canister from tipping, the trolley power is deenergized, and motor brakes are automatically applied. Interfaces between the various operational systems during normal, off-normal, and accident conditions are discussed further in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b).

The design of the canister trolley and access within the Transfer Tunnel permits recovery from postulated failures. Recovery plans in the event various components of the canister trolley are damaged in the Transfer Tunnel are discussed in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b). As the SNF will remain in a safe configuration if the canister trolley is damaged or malfunctions, the timing of recovery actions is not critical; therefore, the operators would have sufficient time to develop appropriate plans for specific failures at the time of occurrence. Consequently, the design of the canister trolley, which allows for recovery from off-normal and accident conditions, satisfies the requirements of 10 CFR §72.24(b).

The staff reviewed the information presented in the SAR about the design and safety of the canister trolley system. The staff finds that the applicant's descriptions of the functions of these systems are acceptable and satisfy the requirements of 10 CFR §72.24(b), §72.44(c)(1),

§72.128(a)(1), and §72.150. The flow diagram and additional information provided in the response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b) is sufficient to provide understanding of the operations sequence. In addition, the applicant's response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b) provides sufficient information about the interlocks for each item controlled by the PLC. Based on the review of previous information, the staff determined that the requirements of 10 CFR §72.166 are met.

ISF Canister Welding System

A canister welding system will perform welding operations on the ISF canisters. The system includes two remotely controlled welding heads; one welds the canister lid and the other seal welds the canister vent plug. A filtered CCTV camera will be fitted to the lid welding head to allow the operators to monitor weld formation. The welding operation will be controlled remotely from the operator's desktop computer, which will also provide a real-time display and record welding system parameters. The system is remotely controlled to minimize operator exposure to canisters loaded with fuel. Alarms will be installed to warn operators of the accumulation of welding gasses. Emergency stops will be provided to stop the welding process immediately if necessary. Power to the welding equipment will be cut off automatically during a design basis seismic event.

Section 5.2.1.1.12 of the SAR indicates a desktop Personal Computer (PC) control system is used to remotely control the canister welding system heads. The response to the staff's request for additional information (Foster Wheeler Environmental Corporation, 2003b) provides additional details about the ISF canister welding system. The welding system will be procured as commercial grade items and inspected consistent with standard nuclear industry practices. Acceptance testing of the canister welding system is required prior to use. Welds will be inspected and tested in accordance with ASME Article NB–5000 (ASME International, 2001a). Inspection of the welds and the ISF canister welding system provides the assurance of the acceptability of the closure weld.

The staff reviewed the information presented in the SAR about the design and safety of the ISF canister welding system. The staff finds the descriptions of the functions of the canister welding system acceptable and in compliance with the requirements of §72.24(b), §72.44(c)(1), and §72.150.

Vacuum Dry, Helium Fill, and Leak Check System

The vacuum dry, helium fill, and leak check system is described in Sections 5.2.1.1.13 and 5.2.1.2.13 of the SAR. The system is to perform the following operations:

- Vacuum dry the SNF canisters to acceptable moisture levels
- Fill the canister with helium to the required pressure
- Enable placement of the canister vent plug while maintaining the helium environment within the canister
- Perform a leak test after welding the plug and lid to ensure compliance with ASME Section V standards (ASME International, 2001d)

Individual components of this system include (i) the canister connection tool, (ii) vacuum dry system, (iii) helium fill system, (iv) leak detection system, and (v) the operator's computer. The system is designed to protect the canister from overpressurization due to the failure of helium pressure regulators through use of a pressure relief device set to less than the design pressure. The operator monitors the system remotely during operations using the FPA CCTV system. Operations will be administratively prohibited below 0 EC [32 EF]. Power to the system will automatically be cut off during off-normal or accident events.

The staff reviewed the information presented in the SAR about the design and safety of the vacuum dry, helium fill, and leak detection system. The staff finds descriptions of the functions of this system acceptable and in compliance with the requirements of 10 CFR §72.24(b), §72.44(c)(1), and §72.150.

3.1.2.2 SNF Storage

The following major equipment is used to transfer and store SNF assemblies at the ISF Facility:

- ISF canister trolley (described in the previous section)
- ISF canister and basket (described in the previous section)
- Canister Handling Machine (CHM)
- Storage tube assemblies
- Charge face cover plate
- Storage vault

This section describes the design and safety features of the CHM, storage tube assemblies, charge face cover plate, and storage vault.

Canister Handling Machine

The staff reviewed Sections 5.2.2, "Spent Fuel Storage;" and 4.7.1.7, 4.7.3.2.13, 4.7.3.3.8, 5.2.2.1.1, and 5.2.2.2.1, "Canister Handling Machine," of the SAR for a description of the CHM.

The CHM retrieves loaded ISF canisters from the canister trolley in the Transfer Tunnel and places them into the storage tubes in the storage vault. The CHM is a rail-mounted crane bridge-and-trolley system that operates above the face floor of the storage area (Figures 4.7-5 and 4.7-6 of the SAR). A cask turret system is mounted on the trolley, which is shielded to minimize operator exposure during canister transfer. The turret system features a single-failure-proof canister hoist for moving the canister and a dedicated tube plug hoist-and-grapple system for opening the tubes. A CCTV system is used for positioning the canisters over the storage tubes during emplacement or retrieval. The system is controlled by the operator control station mounted on the trolley. The CHM system includes locking pins and seismic clamps to prevent movement of the system during a design basis seismic event. Pins and locks are interlock controlled and must be in place during operations when the ISF canister is in a transfer mode. The lower ends of the canister and tube plug cavities automatically close when the upper turret/cask is rotated to the navigation position so a canister cannot accidentally drop on the charge face while in transit.

The CHM is designed to withstand a design basis seismic event and shield operators from excess radiation exposure. The CHM is equipped with a retractable shield skirt that is lowered to provide personnel shielding during canister transfer operations. The CHM canister hoist has a working capacity of 4,536 kg [10,000 lb] and a load capacity of 6,123 kg [13,500 lb]. This single-failure-proof hoist is designed to withstand the design basis seismic event. Load cells on the CHM indicate when hoist loads are within the expected ranges or trip interlocks if loads exceed safe ranges. Interlocks on the CHM ensure fuel canisters are not dropped or damaged by impact during handling operations. During a seismic event, power to the CHM is cut off and all circuits fail safe.

The industry-recognized codes and standards used in the design, fabrication, and construction (including materials) are identified in Section 4.7.1.7 of the SAR. Functional and design features of the CHM are provided in Section 4.7.3.2.13 of the SAR. The design bases, design loads, load combinations, and structural analyses are provided in Section 4.7.3.3.8 of the SAR.

The staff reviewed the information presented in the SAR regarding design and safety of the CHM. The staff finds that the functional description, major components, design, safety criteria, and operation limits for the CHM are adequately identified and are in compliance with the requirements of 10 CFR §72.24(b) and §72.44(c)(1). Radiation protection is provided in the design, satisfying the ALARA requirements of 10 CFR §72.104(b). Shielding for radioactive protection to meet requirements of 10 CFR §72.128(a)(2) is discussed in Chapter 8 of this SER. In addition, 10 CFR §72.166 requirements are satisfied for handling, storage, and shipping controls for the SNF.

<u>Storage Tube Assemblies</u>

The staff reviewed Sections 4.2.1.2, “ISF Storage Tube Assembly;” 4.2.3.2.2, “Description of the Storage Tube Assembly and Associated Equipment;” 4.2.3.3.3, “Storage Tube Assembly Structural Evaluation;” 5.2.2.1.2, “Storage Tube Assemblies and Storage Vault;” and 5.2.2.2.2, “Storage Tube Modules and Vault,” of the SAR. As indicated in Section 4.2.1.2 of the SAR, the storage tube assembly consists of the storage tube body, storage tube lid and seals, and the internal storage tube plug. The storage tube assembly is an ASME Section III Division 1, Subsection NC, Class 2 vessel (ASME International, 2001b). The storage tube body, lid, bolts, and seals are designed in accordance with Article NC–3000 (ASME International, 2001c). The pressure boundary components of the storage tube assembly are classified as important to safety because they provide the secondary confinement boundary for the SNF. The ISF canisters are loaded into the ISF storage tubes using the CHM. An inert helium atmosphere is established within the ISF storage tube after the ISF canister is loaded to provide a dry inert atmosphere around the ISF canister and thereby prevent degradation of the canister during storage. Metal seal rings are used to create redundant seals between the ISF storage tube body and the lid. Test ports on the ISF storage tube lid are provided to allow testing of the seals during storage.

The storage tube assemblies provide for operator safety by providing a secondary confinement boundary for SNF. The integrity of the storage tubes are periodically surveyed according to requirements in the technical specifications. A passive heat removal system is incorporated that does not require external power or intensive maintenance. Periodic surveillance is required to ensure there is no blockage of the storage tube assembly air inlets and outlets. The pressures in the storage tubes will be periodically surveyed in accordance with technical

specifications. The outside surfaces of the storage tubes are sealed and radiologically clean. Therefore, no contamination is transferred to the cooling airflow or to the inside surface of the vault modules.

The staff reviewed the information presented in the SAR about the design and safety of the storage tube assemblies. The staff finds that the functional description of the major components, design, safety criteria, and operation limits for the storage tube assemblies are adequate, and that the requirements of 10 CFR §72.24(b) and §72.44(c)(1) are satisfied. Radiation protection is provided in the design, satisfying the ALARA requirements of 10 CFR §72.104(b). Shielding for radioactive protection to meet requirements of 10 CFR §72.128(a)(2) is discussed in Chapter 8 of this SER. Nuclear criticality is considered in the design based on the spacing of the storage tubes, and, therefore, the requirements of 10 CFR §72.124 are satisfied. The requirements of 10 CFR §72.128(a)(4) are satisfied because the storage tubes have a passive heat removal capability. 10 CFR §72.166 requirements are satisfied for handling, storage, and shipping controls for the SNF.

Charge Face Cover Plate

The staff reviewed Section 4.2.3.3.4, "Charge Face Cover Plate Structural Evaluation," of the SAR. The ISF storage tubes are protected from tornado missile strike by the charge face structure and the charge face cover plate placed directly above each storage tube. The charge face cover plate is a thick steel disc located in a recess inside the charge face encast (Figure 4.2-11 of the SAR). The top surface of the charge face cover plate is level with the charge face surface. An annular gap between the outside diameter of the cover plate and the bore of the charge face is established by four equally spaced pads in the encast to provide a flow passage for the storage tube cooling air. The charge face cover plate is designed in accordance with the American Institute of Steel Construction (AISC) Manual (1989). The charge face cover plate is bolted to the charge face encast to resist tornado uplift. The charge face cover plate is classified as important to safety.

The staff reviewed the information presented in the SAR about the design and safety of the charge face cover plates. The staff finds that the functional description, design, safety criteria, and operation limits for the charge face cover plates are acceptable, and the requirements of 10 CFR §72.24(b) and §72.44(c)(1) are satisfied. Radiation protection is provided in the design, satisfying the ALARA requirements of 10 CFR §72.104(b). Shielding for radioactive protection to meet requirements of 10 CFR §72.128(a)(2) is discussed in Chapter 8 of this SER. Nuclear criticality is considered in the design based on the spacing of the storage tubes, and, therefore, the requirements of 10 CFR §72.124 are satisfied.

Storage Vault

The staff reviewed Sections 4.2.1.1, "ISF Storage Vault;" 4.2.3.2.1, "Description of the Storage Vault;" 4.2.3.3.5, "Storage Vault Structural Evaluation;" 5.2.2.1.2, "Storage Tube Assemblies and Storage Vault;" and 5.2.2.2.2, "Storage Tube Modules and Vault," of the SAR. As stated in Section 4.2.1.1, the storage vault consists of reinforced-concrete walls, floor, and charge face structure. A support stool assembly is located at the bottom of each storage tube to provide vertical and lateral support of the storage tube. The support stool is bolted to the floor of the storage vault. Thick concrete walls provide radiation shielding for the SNF. The storage vault

is classified as important to safety because it provides tornado missile protection for the stored fuel and the vault structure maintains the subcriticality of the array.

The storage vault is designed to withstand the design basis seismic event. The vertical loads from the storage tubes are transmitted through the base of the storage tube to the support stools. The storage tubes do not apply any vertical load to the charge face structure. The lateral loads for the storage tubes are transmitted at the top end through the charge face encast in the charge face structure and at the bottom end through the support stool into the vault floor. The steel storage area building that covers the storage and transfer tunnel is classified not important to safety, but was designed with additional features to ensure safe storage of the SNF.

The applicable codes and standards, materials of construction, and fabrication and inspection codes are identified in Section 4.2.1.1 of the SAR.

The vault structural elements are designed of reinforced concrete to provide radiation shielding, structural and seismic stability without loss of function, and tornado protection for the stored SNF. The vault foundation slab is designed to support the load of the vault modules including structural weight, facility operations, and off-normal and accident conditions. The storage vault provides for operator safety by providing radiological shielding for the SNF. Periodic radiological surveys to assess the integrity of the storage vault are performed as required by the technical specifications. The storage vault is passive in nature and requires no routine maintenance. Periodic surveillance is required only to prevent blockage of the storage vault air inlets and outlets.

The staff reviewed the information presented in the SAR about the design and safety of the storage vault. The staff finds that the functional description of the major components, design, safety criteria, and operation limits for the storage vault are acceptably identified, and that the requirements of 10 CFR §72.24(b) and §72.44(c)(1) are satisfied. Radiation protection is provided in the design satisfying the ALARA requirements of 10 CFR §72.104(b). Shielding for radioactive protection to meet requirements of 10 CFR §72.128(a)(2) is discussed in Chapter 8 of this SER. The storage vault has a passive heat removal capability, and, therefore, the requirements of 10 CFR §72.128(a)(4) are satisfied.

3.1.3 Other Operation Systems

The descriptions of the other operation systems were reviewed for conformance with the following regulations:

- 10 CFR §72.24(b) requires a description and discussion of the ISFSI structures with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations.

- 10 CFR §72.44(c)(1) requires that technical specifications must include requirements for functional and operating limits and monitoring instruments and limiting control settings. (i) Functional and operating limits for an ISFSI are limits on fuel handling and storage conditions that are found to be necessary to protect the integrity of the stored fuel container, to protect employees against occupational exposures, and to guard against

the uncontrolled release of radioactive materials; and (ii) monitoring instruments and limiting control settings for an ISFSI are those related to fuel handling and storage conditions having significant safety functions.

- 10 CFR §72.104(b) requires that the operational restrictions must be established to meet as low as is reasonably achievable objectives for radioactive materials in effluents and direct radiation levels associated with ISFSI operations.

- 10 CFR §72.122(i) requires that instrumentation and control systems for dry storage casks must be provided in accordance with cask design requirements to monitor conditions that are important to safety over anticipated ranges for normal conditions and off-normal conditions. Systems that are required under accident conditions must be identified in the SAR.

- 10 CFR §72.124(c) requires that a criticality monitoring system shall be maintained in each area where special nuclear material is handled, used, or stored which will energize clearly audible alarm signals if accidental criticality occurs. Monitoring of dry storage areas where special nuclear material is packaged in its stored configuration under a license issued under this subpart is not required.

- 10 CFR §72.126(b) requires that radiological alarm systems must be provided in accessible work areas as appropriate to warn operating personnel of radiation and airborne radioactive material concentrations above a given setpoint and of concentrations of radioactive material in effluents above control limits. Radiation alarm systems must be designed with provisions for calibration and testing their operability.

- 10 CFR §72.126(c) requires effluent and direct radiation monitoring. (1) As appropriate for the handling and storage system, effluent systems must be provided. Means for measuring the amount of radionuclides in effluents during normal operations and under accident conditions must be provided for these systems. A means of measuring the flow of the diluting medium, either air or water, must also be provided. (2) Areas containing radioactive materials must be provided with systems for measuring the direct radiation levels in and around these areas.

- 10 CFR §20.1301 requires that (a) each licensee shall conduct operations so that (1) the total effective dose equivalent to individual members of the public from the licensed operation does not exceed 1 mSv [0.1 rem] in a year, exclusive of the dose contributions from background radiation, from any administration the individual has received, from exposure to individuals administered radioactive material and released under §35.75, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with §20.2003, and (2) the dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with §35.75, does not exceed 0.02 mSv [0.002 rem] in any one hour. (b) If the licensee permits members of the public to have access to controlled areas, the limits for members of the public continue to apply to those individuals. (c) Notwithstanding paragraph (a)(1) of this section, a licensee may permit visitors to an individual who cannot be released, under § 35.75, to receive a radiation dose greater than 1 mSv [0.1 rem] if (1) the radiation dose received does not exceed 5 mSv [0.5 rem]; and (2) the

authorized user, as defined in 10 CFR Part 35, has determined before the visit that it is appropriate. (d) A licensee or license applicant may apply for prior U.S. Nuclear Regulatory Commission authorization to operate up to an annual dose limit for an individual member of the public of 5 mSv [0.5 rem]. The licensee or license applicant shall include the following information in this application: (1) demonstration of the need for and the expected duration of operations in excess of the limit in paragraph (a) of this section; (2) the licensee's program to assess and control dose within the 5 mSv [0.5 rem] annual limit; and (3) the procedures to be followed to maintain the dose as low as is reasonably achievable. (e) In addition to the requirements of this part, a licensee subject to the provisions of U.S. Environmental Protection Agency's generally applicable environmental radiation standards in 40 CFR Part 190 shall comply with those standards. (f) The Commission may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee may release in effluents in order to restrict the collective dose.

The staff reviewed the discussion of other operation systems in Section 5.3, "Other Operating Systems," of the SAR. These operation systems include:

- Heating, ventilation, and air conditioning (HVAC) system
- Electrical power distribution system
- Integrated data collection system (IDCS)
- Liquid waste system
- Solid waste system
- Radiation monitoring system
- Fire protection/communication and alarm systems
- Compressed air system
- Breathing air system
- Potable water system
- Sewage treatment system

Of these systems, the confinement boundary components of the HVAC system, the seismic cutoff switch (including the associated circuits) in the electrical power distribution system, and the confinement boundary penetrations of the breathing air system are considered important to safety. This information agrees with Table 3.4-1 of the SAR, which identifies structures, systems, and components classified as important to safety.

The staff identified the following additional operation systems:

- CCA crane
- Port seals
- FPA shield door
- Shield windows

Of these additional systems, the confinement boundary components of the cask and canister port seals and the confinement boundary and radiation shield components of the shield windows are considered important to safety. The shield windows also allow the operators to see operations they are controlling. This information, again, agrees with Table 3.4-1 of the SAR, which identifies structures, systems, and components classified as important to safety.

The staff reviewed the descriptions of other operating systems described in the SAR and finds the descriptions acceptable. The applicant's ALARA considerations for compliance with 10 CFR §72.104(b) are reviewed in Chapter 11 of this SER. Criticality monitoring systems are provided for compliance with 10 CFR §72.124(c) and reviewed in Chapter 8 of this SER. Radiological alarm systems and direct radiation monitoring are considered in the design for compliance with 10 CFR §72.126(b)–(c) and reviewed in Chapter 11 of this SER.

<u>HVAC System</u>

The staff reviewed Section 5.3.1.1, "HVAC System," of the SAR. The ISF Facility HVAC systems include three major subsystems. These subsystems are located in (i) the CRA, (ii) the storage area, and (iii) the transfer area. As indicated, the HVAC systems are not required to provide decay heat removal in any area. Rather, these systems provide environmental conditions for habitability and reliable component operation. The subsystem in the transfer area is also required to provide containment during the SNF handling process and to maintain personnel exposure ALARA. The subsystem in the transfer area is considered important to safety.

The transfer area HVAC system is further subdivided into four airborne contamination control zones. Differential pressures between these zones are maintained to direct airflow from lower to higher areas of potential contamination. Air flows through redundant banks of high-efficiency particulate air (HEPA) filters prior to exhaust through the stack. The FPA and FHM areas are maintained at maximum negative air pressure with respect to atmosphere because they are considered the highest potential for contamination.

Major operating components of the HVAC system including exhaust fans, HEPA filter banks, and supply fans are redundant so the system will remain operational during routine maintenance activities. Although the HVAC system operation is not required during off-normal events to maintain ALARA, certain passive components of the system are identified as important to safety. These components include selected sections of HVAC ductwork, dampers, and filters because these are required to maintain confinement barriers during off-normal and accident conditions and are designed to withstand design basis tornado and seismic events.

The HVAC system is designed with a 10-percent load margin to account for unforeseen conditions. The staff investigated commercial HVAC capacity requirements and found various sources in industry state overcapacity between 0 and 15 percent is reasonable. Because only duct confinement components, dampers, and filters are classified as important to safety, the staff considers acceptable a 10-percent overcapacity for the HVAC system.

The staff reviewed the information presented in the SAR about the design and safety of the HVAC system. The staff finds that the functional description, design, safety criteria, and operation limits for the HVAC system are acceptable and satisfy the requirements of 10 CFR §72.24(b), §72.44(c)(1), and §72.122(i).

<u>Electrical Power Distribution System</u>

The staff reviewed Section 5.3.1.2, "Electrical Power Distribution," of the SAR. The electrical power distribution system provides electrical power to the ISF Facility through a unit stepdown transformer that converts the utility 13.8 kV power to 480 V. Major components include the unit

substation, a 500-kW [671-hp] standby diesel generator, motor control centers, the seismic switch, and the uninterruptible power supply (UPS). The power is divided into three power sources for the ISF Facility: a normal source, a standby source, and a UPS source. The standby source is supplied from the substation and routed through the standby generator automatic transfer switch. The UPS source is supplied from the standby source and routed through the UPS before distribution within the ISF Facility. The UPS source is a battery-backed system, rated at 25 kVA, that provides clean electrical power in the event of a power failure for as long as 90 minutes.

The staff also reviewed Sections 4.3.2.1.1, “Power Distribution System,” and 4.3.2.2, “Safety Considerations and Controls,” of the SAR. The electrical system is designed to deenergize during design basis seismic events to ensure all fuel handling equipment is in a known safe state. A seismic switch, consisting of seismic sensors in conjunction with redundant load interrupter switches, is installed in the 13.8-kV feed to the stepdown transformer. When a design basis seismic event is detected, this switch opens the load interrupters to isolate the normal and normal/standby power sources to the ISF Facility. The switch also initiates a signal to prevent the standby diesel generator from starting. This switch is the only part of the electrical power distribution system considered important to safety. In accordance with the Quality Program Plan, periodic surveillance of the seismic switch will be performed on a routine basis. The schematic layout of the seismic sensor system was reviewed, which confirmed

- UPS supply to backup sensors
- Best two-of-three event detection
- Double redundant relay output for event detection

The staff determined that the design of the seismic sensor system is acceptable, based on the presented documentation. The ISF Facility’s design philosophy is that equipment should fail safe when deenergized, which ensures that fuel handling equipment enters a passive, safe state when loss of power occurs by providing mechanical safety features independent of the electrical systems.

The staff reviewed the information presented in the SAR about the design and safety of the electrical power distribution system and finds the design and functions of the electrical power distribution system acceptable.

The staff reviewed the information presented in the SAR about the design and safety of the UPS system. The staff estimated the UPS power requirements as follows:

UPS System Total Power Estimates

Rad Monitors	=	629 W [0.84 hp]
HVAC Control	=	1,500 W [2.01 hp]
IDCS	=	1,500 W [2.01 hp]
CCA PC	=	1,500 W [2.01 hp]
E-Stops	=	100 W [0.13 hp]
CCTV	=	5,100 W [6.84 hp] (17 cameras, 13 video monitors)
Facility Interlocks	=	1,000 W [1.34 hp] {2 PLCs @ 500 W [0.67 hp] each}
Total	=	11,329 W [15.18 hp]

Therefore, the staff concludes that the stated capacity of 25 kW [33.53 hp] specified in the SAR is adequate.

The proposed design of the ISF Facility does not require utility systems during SNF storage. Also, as stated previously, the proposed design of the ISF Facility does not include systems and subsystems that require continuous electric power to permit continued functioning, and the design of the ISF Facility does not require emergency power.

The electrical power distribution systems are not important to safety, and, therefore, the requirements of 10 CFR §72.122(k)(1) and §72.122(k)(2) are not applicable. Additionally, the requirements of 10 CFR §72.122(k)(3) are not applicable because the design of the ISF Facility does not require emergency power for systems essential to safe storage, and there are no systems essential to safe storage requiring electrical power. Limited UPS power is provided for some systems as shown in Figure 4.3-12 of the SAR.

The staff finds that the functional description, design, safety criteria, and operation limits for the electrical distribution system are acceptable and that the requirements of 10 CFR §72.24(b) and §72.44(c)(1) are satisfied.

Integrated Data Collection System

The staff reviewed the information presented in the SAR about the design and function of the IDCS. The IDCS, as described in Section 4.3.2.1.2, "Instrumentation and Controls," of the SAR, provides centralized data acquisition, processing, and data storage for the ISF Facility. The IDCS will receive data from equipment, systems, and personnel in the ISF Facility such as radiation monitors, fire alarm systems, HVAC control systems, liquid waste collection system, daily operator inputs and reports, and major handling and transport systems. The IDCS is powered by the UPS power source and is located in the operations monitoring room.

The staff agrees the IDCS is used only to assist a qualified operator to effectively and efficiently perform designated activities. The IDCS system does not initiate any activities nor perform any function important to safety. The staff agrees that the IDCS is appropriately classified as not important to safety and is in compliance with 10 CFR §72.24(b), §72.44(c)(1), and §72.122(i).

Liquid Waste System

The staff reviewed the information presented in the SAR about the design and safety of the liquid waste system. The liquid waste system, as described in Sections 5.3.1.4, "Liquid Waste Processing System," and 6.3, "Liquid Waste Treatment and Retention," of the SAR, collects waste from local sumps located in the ISF Facility. The system consists of a 22,731-L [5,000-gal]-liquid waste tank, a 2,273-L [500-gal]-liquid waste tank, drain lines to the tank, a mobile pump unit, associated plumbing, and a cartridge filtration unit. Liquid waste is collected from decontamination areas, eyewash stations, and work areas where liquid waste generation is expected. The mobile pump unit is used to pump liquid waste to the tank from sump areas or where spills occur after the waste has been sampled for contamination levels. Liquid wastes are transported offsite by a licensed contractor when necessary; the waste tank has been sized based on assumed liquid waste generation rates and volume constraints of typical waste transporter tanks.

The applicant estimates no more than 23,467 L [5,162 gal] of radioactive waste will be generated each year from decontamination activities (Table 6.3-2 of the SAR). The capacity of the tanks, 25,004 L [5,500 gal], is in excess of this amount. The particulate filters are checked after waste transfer operations and changed when the dose rate exceeds 0.05 mSv/hr [5 mrem/hr] at 0.3 m [1 ft] from the tank. Rainwater, snow, and ice melt runoff do not come into contact with the interior of the ISF Facility and, therefore, are not expected to mix with or increase the volume of collected liquid radioactive waste. Spills up to 36,666 L [9,700 gal] can be contained within the waste storage tank area.

The staff finds that the functional description, design, safety criteria, and operation limits for the liquid waste system are acceptable and that the requirements of 10 CFR §72.24(b), §72.44(c)(1), and §72.122(i) are satisfied.

Solid Waste System

The staff reviewed the information presented in the SAR about the design and functions of the solid waste system. The solid waste processing system, as stated in Section 6.4, "Solid Waste," of the SAR, will safely handle, prepare, and package low-level radioactive waste for delivery to the Idaho National Engineering and Environmental Laboratory (INEEL) Radioactive waste management complex (RWMC). The system is designed and operated to ensure radiation exposure to the general public and operating personnel is ALARA and is classified as not important to safety. The system is located in the solid waste processing area (SWPA) and the solid waste storage area, on the ground level of the transfer building. The radiological processing equipment in these areas consists of a radiological enclosure, overhead chain hoists, semiautomatic band saw, roller conveyors, canister tipping hopper, drum compactor and crusher, area radiation monitoring equipment, and an electrically powered forklift.

The solid waste system is designed to process three types of solid waste generated at the ISF Facility: (i) large canister waste, (ii) small canister waste, and (iii) process-generated waste. Canister waste is from the Peach Bottom and TRIGA fuel handling unit canisters, and Shippingport canisters. Process-generated waste includes other materials generated in the process of operating the ISF Facility. The maximum amount of primary solid waste (e.g., cut up canister waste) produced in 1 year is expected to be 138 m^3 [4,870 ft^3]. Primary waste will be temporarily stored in 1.22- × 1.22- × 2.44-m [4- × 4- × 8-ft]-steel storage bins. The estimated annual volume of process-generated waste from the ISF Facility is expected to be 37 m^3 [1,306 ft^3], which will require approximately 178 drums {250 L [55 gal]} for disposal. The staff confirmed these estimates. Packaged waste material is temporarily stored at the ISF waste storage area, until it is picked up for disposal by personnel of the RWMC. There is no need for long-term waste storage facilities at the ISF Facility and, therefore, no need to monitor corrosion effects on waste containers.

The staff finds that the functional description, design, safety criteria, and operation limits for the solid waste system are acceptable, and that the requirements of 10 CFR §72.24(b), §72.44(c)(1), and §72.122(i) are satisfied.

Radiation Monitoring System

The staff reviewed the information presented in the SAR about the design and functions of the radiation monitoring system in Sections 5.3.1.6, "Radiation Monitoring System," and 7.3.4,

“Area Radiation and Airborne Radioactivity Monitoring Instrumentation,” of the SAR. The system will be designed to ensure that radiation exposure and release limits do not exceed those specified in 10 CFR §20.1301. All fixed radiological instrumentation will be serviced by the UPS system to ensure operation when building power is lost. Radiation monitoring throughout the ISF Facility will be composed of criticality monitors, area radiation monitors, and personnel contamination monitors. The locations, numbers, and monitoring of the instrumentation have been evaluated to maintain exposures ALARA. In addition to locations inside the ISF Facility, a continuous air monitor will be located inside the ISF Facility stack to monitor effluents.

Criticality monitoring systems are provided to satisfy the requirements of 10 CFR §72.124(c) and are reviewed in Chapter 8 of this SER. Radiological alarm systems and direct radiation monitoring are considered in the design to satisfy the requirements of 10 CFR §72.126(b) and §72.126(c) and are reviewed further in Chapter 11 of this SER.

Fire Protection/Communication and Alarm Systems

The staff reviewed the fire protection/communication and alarm systems described in Sections 5.3.1.7, “Fire Protection/Communication System;” 4.3.7, “Communication and Alarm Systems;” and 4.3.8, "Fire Protection System,” of the SAR. The fire detection system is considered a subsystem of the communication and alarm system. The communication and alarm system consists of three subsystems:

- A nonemergency communications system that includes telephones, fax machines, and voice paging devices within the ISF Facility.

- A fire detection, alarm, and emergency communication system that includes fire detection devices and audio/visual fire alarms throughout the ISF Facility. A central fire alarm panel is included in the operations monitoring room. Emergency fire phone sets connect the main entry to the ISF Facility operations area, and a fiber-optic cable network connects the ISF Facility to the INEEL central fire alarm station. The system components provide comprehensive protection against fire hazards throughout the ISF Facility, with greatest emphasis on the risk of fire in the component’s immediate location. The fire protection system is designed in accordance with American Nuclear Society (ANS) ANS 57.9 (American National Standards Institute/American Nuclear Society, 1984), National Fire Protection Association (NFPA) NFPA 801 (1998) and other applicable NFPA codes and standards, NUREG–1567, and NUREG–0800 Branch Technical Position 9.5-1 (U.S. Nuclear Regulatory Commission, 2000,1996).

- A data communication system that includes a broadband LAN throughout the ISF Facility that connects the operational areas of the ISF Facility to the INTEC network through a T-1 line.

Although the communication systems are classified as not important to safety, the fire detection, alarm, and emergency communication system is powered by standby power in the event that outside power is temporarily lost. This system also is powered by a dedicated UPS, sized to ensure a full 15-minute alarm capability in the event of loss of power from the standby generator as well.

The plausible scenarios for a fire in any location inside and outside of the ISF Facility building have been analyzed, and the analyses determined the postulated fires would not compromise the functions intended for the structures, systems, and components important to safety. Automatic fire suppression is not installed inside areas with high potential exposure to radiation to prevent radiological contamination and criticality issues in these areas. Structural and nonstructural barrier components in areas with structures, systems, and components important to safety, however, have a minimum 1 hour fire rating to ensure protection from fire loading.

The staff finds that the functional description, design, safety criteria, and operation limits for the fire protection/communication and alarm systems are acceptable, and that the requirements of 10 CFR §72.24(b) and §72.122(c) are satisfied.

<u>Compressed Air System</u>

The staff reviewed the compressed air system described in Sections 5.3.1.8, "Compressed Air System," and 4.3.3.1, "Compressed Air," of the SAR. The system provides compressed air for building operations, maintenance activities, and operation of pneumatic tools inside the ISF Facility. Compressed air connections will be located in the following operational areas of the ISF Facility:

- CRA
- Mechanical equipment room
- Workshop
- Operator's office and equipment area
- Operating gallery
- HEPA filter and HVAC exhaust room
- New canister receipt area
- Solid waste storage area
- SWPA
- Liquid waste storage tank area
- CCA
- Transfer Tunnel

The major components of the compressed air system are an air compressor, after cooler, refrigerant dryer, air receiver, coalescing filter, and service header. The compressed air system components are classified as not important to safety. The compressor is commercially available and designed in accordance with ASME B19.3 (ASME International, 1991). The compressed air system piping is designed in accordance with ASME B31.9 and ASME B31.1 (ASME International, 1996; 2001e).

The staff finds that the functional description and design criteria and standards for the compressed air system are acceptable, and that the requirements of 10 CFR §72.24(b) are satisfied.

<u>Breathing Air System</u>

The staff reviewed the breathing air system described in Sections 5.3.1.9, "Breathing Air System," and 4.3.3.2, "Breathing Air," of the SAR. This system provides personnel breathing air for areas inside the ISF Facility that may have the potential for airborne radioactive

contaminants. The system consists of a high-pressure air compressor, pressure reducing stations, air dryer, and self-contained breathing apparatus (SCBA) cylinder charging equipment and breathing air manifolds. The breathing air manifolds are located in the following areas:

- Transfer Tunnel
- Transfer Tunnel decontamination zone
- SWPA
- Solid waste storage area
- Liquid waste storage tank area
- Operating gallery
- FHM maintenance area
- Operator’s office and equipment area
- CCA
- New canister receipt area

The breathing air compressor, located in the mechanical equipment room, is powered by the 480-VAC electrical distribution standby system, which can be energized by the standby diesel generator if necessary. The compressor is capable of delivering a minimum of 254 standard L/min [9 standard ft^3/min] of compressed air at 34,475 kPa [5,000 psig]. The compressor and related purification equipment are capable of processing air to a quality verification level of at least Grade D in accordance with Compressed Gas Association Inc. (CGA) CGA G–7–1990 (1990). The breathing air flow rate available at each manifold station shall be at least 680 standard L/min [24 standard ft^3/min]. In the event of a power failure or compressor failure while the breathing air system is in use, high-pressure storage bottles provide continuous air for as long as 60 minutes. The system also is capable of charging SCBA cylinders that will be contained within a Class 2 containment enclosure during filling for personnel safety. The breathing air system is classified as not important to safety. The penetrations of the breathing air system piping into the FPA confinement boundary, on the other hand, are classified as important to safety, (see Table 3.4-1 of the SAR). The penetrations will be designed to ensure that the confinement boundary is maintained.

The staff finds that the functional description and design criteria and standards for the breathing air system are acceptable, and that the requirements of 10 CFR §72.24(b) are satisfied.

<u>Potable Water System</u>

The staff reviewed the potable water system described in Sections 5.3.1.10, “Potable Water Supply,” and 4.3.5, “Water Supply System,” of the SAR. The system provides drinking water, domestic needs, and makeup water for the chilled water loop in the HVAC system at the ISF Facility site. Potable water is provided to the system from the INTEC. The system is designed to meet the water needs for the ISF Facility, administration center, and guardhouse. The system is not relied on to mitigate any accidents. The system does not support any functions that are important to safety and it is classified as not important to safety.

The staff finds the functional description of the potable water system to be acceptable, and that the requirements of 10 CFR §72.24(b) are satisfied.

Sewage Treatment System

The staff reviewed the sanitary wastewater system described in Sections 4.3.6 and 5.3.1.11, "Sewage Treatment System," of the SAR. The sewage treatment system collects drainage and sewage from the operations area, administration center, guardhouse, and visitor center and is fed by gravity to the INTEC sanitary sewer line. The sewage treatment system at the ISF Facility is designed in accordance with the Uniform Plumbing Code and is classified as not important to safety. Decontamination area drains and equipment drains in potentially contaminated areas do not drain into the sewage treatment system. Bathroom fixtures are outside of potentially contaminated areas. The staff confirmed bathroom facilities are only in the second floor office area; none are located in potentially contaminated areas. Therefore, contamination of the sewage treatment system is not likely to occur.

The staff finds that the functional description and design criteria and standards for the sewage treatment system are acceptable, and that the requirements of 10 CFR §72.24(b) are satisfied.

CCA Crane

The staff reviewed the information in Section 5.1.3.5.12, "Canister Closure Area," of the SAR. The CCA crane is not used to handle SNF, is a commercial grade component, and will be maintained in accordance with commercial practice. The staff finds that the functional description for the CCA crane is acceptable, and that the requirements of 10 CFR §72.24(b) are satisfied.

Port Seals

The staff reviewed the information in Section 4.7.2.3, "Confinement Features," of the SAR for the port seals of the cask and canister ports in the floor of the FPA that opens to the Transfer Tunnel. An inflatable seal on the underside of the cask port mates with the cask adapter plate mounted to the transfer cask to provide a confinement barrier extension into the transfer cask (Figure 4.7-11 of the SAR). A similar arrangement is used at the canister port (Figure 4.7-12 of the SAR). The canister port seal is inflated to form a seal with the canister cask body.

The inflatable seals ensure that the integrity of the confinement barrier is maintained, when the port lugs are removed, and prevent a radiological release in the Transfer Tunnel in the event of a failure of the HVAC system. The inflatable seals are classified as important to safety and are designed to maintain a seal in the event of a loss of offsite power or seismic event. The port seals are inflated by the ISF Facility compressed air system. Seal deflation is avoided during transfer operations through the use of a pilot valve and check valves. A relief valve prevents overinflation, and pressure switches monitor the minimum and maximum inflation pressure with indication in the operation gallery. The pilot valve, check valves, relief valve, and the associated connecting tubing to the seals are classified as important to safety and are seismically designed.

The staff finds that the functional description for and the design of the port seals are acceptable, and that the requirements of 10 CFR §72.24(b) and §72.44(c)(1) are satisfied.

FPA Shield Doors

The staff reviewed Section 4.7.3.2.4, “Fuel Packaging Area Shield Doors,” of the SAR. The FPA shield doors consist of one vertical and one horizontal sliding door (Figures 4.7-18 and 4.7-19 of the SAR). The doors are opened to allow the FHM to pass through and then closed to enable maintenance of the FHM in the FHM maintenance area. The vertical door is raised and lowered using two jack screws mounted on the roof of the FHM maintenance area. The jacks are driven by a single-braked motor that fails safe on loss of electrical power. Two lock assemblies are mounted on the roof of the FHM maintenance area to lock the door in the fully raised position. The horizontal door runs on rails mounted on the wall inside the FHM maintenance area. Attached to the bottom of the door is a seismic restraint that acts to keep the door on its rail during and following a seismic event. The horizontal door moves by a rack mounted on the door and a pinion driven by a braked motor gear unit. The shield doors are operated by manual pushbutton on a control station. The FPA shield doors are classified as not important to safety. The FPA shield doors are seismically designed, nonetheless, to withstand the DE when the doors are closed.

The staff finds that the functional description and the design of the FPA shield doors are acceptable, and that the requirements of 10 CFR §72.24(b) and §72.44(c)(1) are satisfied.

Shield Windows

The staff reviewed Section 4.7.3.1.3, "Fuel Packaging Area,” of the SAR that contains a description of the shield windows. There are four shield windows on the south wall and three shield windows on the north wall to provide visual observation stations for the operators during SNF handling. The shield window has a sealed-glass plate fixed to the window liner on the inside of the FPA. The sealed-glass plate maintains the confinement boundary if the shield window is removed from the window liner for maintenance. The shield windows are classified as important to safety (Table 3.4-1 of SAR) because they provide a confinement boundary and radiation shielding. The shield windows have been evaluated to demonstrate they can withstand accident events.

The staff finds that the functional description for and the classification of the shield windows are acceptable, and that the requirements of 10 CFR §72.24(b) and §72.44(c)(1) are satisfied.

3.1.4 Operation Support Systems

The descriptions of the operation support systems were reviewed for conformance with the following regulations:

- 10 CFR §72.24(b) requires a description and discussion of the ISFSI structures with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations.

- 10 CFR §72.44(c)(1) requires that technical specifications must include requirements for functional and operating limits and monitoring instruments and limiting control settings. (i) Functional and operating limits for an ISFSI are limits on fuel handling and storage conditions that are found to be necessary to protect the integrity of the stored fuel

container, to protect employees against occupational exposures and to guard against the uncontrolled release of radioactive materials; and (ii) monitoring instruments and limiting control settings for an ISFSI are those related to fuel handling and storage conditions having significant safety functions.

- 10 CFR §72.122(i) requires that instrumentation and control systems for dry storage casks must be provided in accordance with cask design requirements to monitor conditions that are important to safety over anticipated ranges for normal conditions and off-normal conditions. Systems that are required under accident conditions must be identified in the Safety Analysis Report.

The staff reviewed the proposed operation support systems described in the SAR. Section 5.4, “Operation Support Systems,” describes the instrumentation and controls (I&C) for the cask receipt crane, cask trolley, FHM, canister trolley, worktable, and CHM. The I&C systems provide the operational information, the indications, and the controls for an operator so the equipment can function according to its importance to safety classification. Command functions occur according to operator demands or active confirmation in conjunction with protective and command interlocks. Operational interlocks, along with operator demand or confirmation, determine equipment operation, not the I&C systems. The SAR states that system overrides for maintenance or testing will rely on administrative controls (e.g. key switches, authorization requirements). All operations, maintenance, or testing require operator commands.

In addition, the staff evaluated the appropriate sections in the SAR that identify the structures, systems, and components important to safety. The operating characteristics of the I&C systems are contained in Sections 5.1, “Operation Description,” and 5.2, “Spent Fuel Handling Systems,” of the SAR. The operating characteristics include functional and operating limits, monitoring instruments, and limiting control settings during fuel handling. In addition, administrative controls and overrides, the nature of the overrides (password or key switch), redundant control, and indicating mechanisms (some mechanical, some electrical) are identified.

The storage of the SNF is a passive and self contained operation. The storage canisters do not require any instrumentation or control systems to ensure safe operation when they are placed into storage. During storage operation of the ISF Facility, however, the storage canisters in the storage tubes will be inspected periodically. These inspections will provide a means to assess the performance of the storage components.

A CCTV monitoring system is used as a secondary aid in viewing. As indicated in the response to the staff’s request for additional information (Foster Wheeler Environmental Corporation, 2003b), the CCTV system is not used to perform or control any safety-related activities or functions.

The staff agrees that the I&C and CCTV systems are to be used only to assist a qualified operator to effectively and efficiently perform designated activities. The I&C systems do not initiate any activities nor perform any important to safety function, and any control signals issued by an I&C system are subject to applicable hardware interlocks. The staff agrees that the I&C and CCTV systems are appropriately classified as not important to safety; therefore, 10 CFR §72.24(b), §72.44(c)(1), and §72.122(i) are satisfied.

3.1.5 Control Room and Control Area

The descriptions of the control room and control area were reviewed for conformance with the following regulation.

- 10 CFR §72.122(j) requires that a control room or control area, if appropriate for the ISFSI design, must be designed to permit occupancy and actions to be taken to monitor the ISFSI safely under normal conditions, and to provide safe control of the ISFSI under off-normal or accident conditions.

The staff reviewed the control room and control areas described in the SAR. Section 5.5, “Control Room and Control Areas,” of the SAR states that all activities at the ISF Facility are commanded, controlled, and monitored from local control stations. Accordingly, a centralized control room is not required. The control room and control area are not necessary to maintain the conditions required to operate the ISF Facility safely, store SNF safely, prevent damage to the SNF during handling and storage, or provide reasonable assurance the SNF can be received, handled, packaged, stored, and retrieved without undue risk to the health and safety of the public.

The staff agrees with the applicant’s assessment that a central control room or control area is not needed for this facility. The ISF Facility is a self-contained, passive storage facility that requires no permanent control room or control area to ensure safe operation; therefore, the requirements of 10 CFR §72.122(j) are not applicable.

3.1.6 Analytical Sampling

The description of the analytical sampling capability was reviewed for conformance with the following regulations:

- 10 CFR §72.24(b) requires a description and discussion of the ISFSI structures with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations.

- 10 CFR §72.44(c)(3) requires that technical specifications must include surveillance requirements. Surveillance requirements include (i) inspection and monitoring of spent fuel in storage; (ii) inspection, test, and calibration activities to ensure that the necessary integrity of required systems and components is maintained; (iii) confirmation that operation of the ISFSI is within the required functional and operating limits; and (iv) confirmation that the limiting conditions required for safe storage are met.

- 10 CFR §72.122(i) requires that instrumentation and control systems for dry storage casks must be provided in accordance with cask design requirements to monitor conditions that are important to safety over anticipated ranges for normal conditions and off-normal conditions. Systems that are required under accident conditions must be identified in the SAR.

The staff reviewed the analytical sampling described in the SAR. Section 5.6, “Analytical Sampling,” of the SAR states analytical sampling is not required at the ISF Facility to verify that

operation is within prescribed limits. Instead, other methods are used to verify that operations are within prescribed limits. Evaluation findings about general radiation and airborne radioactivity monitoring, area-specific radiation surveys, and effluent monitoring are discussed in Chapter 11 of this SER. As indicated in Section 5.1.1.1.3, “Movement of Transfer Cask into Cask Decontamination Zone,” of the SAR, proper operation of the ventilation system in the cask decontamination zone ensures that potential airborne contaminants are confined, and that personnel are protected against radiation. Section 8.1.1.1, “Misventing of Transfer Cask,” of the SAR states that the cask atmosphere is vented in the cask decontamination zone by attaching the cask vent to a portable continuous air monitor and flammable gas monitor. The cask atmosphere is filtered, monitored, and released through the continuous air monitor into the building HVAC system. As stated in the response to the staff’s request for additional information (Foster Wheeler Environmental Corporation, 2003b), the acceptance criterion for the cask atmosphere is a flammable gas concentration below an established action level (50 percent of the lower explosive limit). If explosive gas concentrations are above this action lever, purging of the cask interior will be accomplished by continued operation of the sampling system until concentrations are below the action level.

The staff finds that the methods proposed to verify operations within prescribed limits are appropriate and acceptable, and that the requirements of 10 CFR §72.24(b), §72.44(c)(3), and §72.122(i) are satisfied.

3.1.7 U.S. Department of Energy–Idaho Operations Office Transfer Cask Repair and Maintenance

The transfer cask repair and maintenance activities were reviewed for conformance with the following regulation:

- 10 CFR §72.128(a)(1) requires that spent fuel storage must be designed to ensure adequate safety under normal and accident conditions. These systems must be designed with a capability to test and monitor components important to safety.

The staff reviewed the transfer cask repair and maintenance activities described in the SAR. The transfer cask to transport the SNF to the ISF Facility is identified as being supplied by the U.S. Department of Energy–Idaho Operations Office. As described in Section 5.1.3.5.1, “DOE Transfer Cask,” and Appendix A, Section 4.5, “Transfer Casks Repair and Maintenance,” of the SAR, the ISF Facility will not maintain or repair the transfer cask and transporter. During visual inspection, if deficiencies are observed in the transfer cask, DOE-ID staff will be informed, and the fuel transfer operation may be rejected. The staff finds that the repair and maintenance activities of this government-furnished equipment by U.S. Department of Energy–Idaho Operations Office will be performed outside of this facility license, and, therefore, the requirements of 10 CFR §72.128(a)(1) are satisfied.

3.1.8 Pool and Pool Facility Systems

The pool and pool facility systems were reviewed for conformance with the following regulation:

- 10 CFR §72.24(b) requires a description and discussion of the ISFSI structures with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations.

The ISF Facility uses dry cask storage technology, which houses SNF inside sealed, inerted canisters rather than in a spent fuel pool. Therefore, neither the use of a pool nor any system supporting a pool is incorporated into the ISF Facility design and no description is required. Therefore, the requirements of 10 CFR §72.24(b) are satisfied.

3.2 Evaluation Findings

After reviewing the information provided by the applicant about the operations and operation systems at the proposed facility, the staff made the following findings:

- The ISF Facility is to be located on the same site as other nuclear facilities operated by the U.S. Department of Energy. Potential interactions between these facilities and the ISF Facility have been acceptably evaluated in accordance with 10 CFR §72.40(a)(3) and have been determined to pose no undue risk to life or property.

- The SAR includes acceptable descriptions and discussions of the projected operating characteristics and safety considerations. The proposed ISF Facility operations can be conducted without endangering the health and safety of the public and therefore demonstrate compliance with 10 CFR §72.24(b). Additionally, the SAR provides technical specifications that include functional and operating limits, monitoring instruments, limiting control settings, and surveillance requirements as required by 10 CFR §72.44(c)(1)–(3), §72.104(b) and (c), and §72.122(h)(1) and (3). In addition, the requirements for handling, storage, and shipping controls for the SNF of 10 CFR §72.166 are satisfied. A detailed discussion about technical specifications is provided in Chapter 19 of this SER.

- The design and operation of the ISF Facility adequately consider the ALARA requirement as required by 10 CFR §72.104(b). The use of criticality monitoring systems complies with the requirements of 10 CFR §72.124(c). The criticality evaluation is discussed in detail in Chapter 8 of this SER. The design and safety of the ISF Facility and transfer casks are acceptable and satisfy the requirements of 10 CFR §72.24(b), §72.24(f), §72.44(c)(1), §72.128(a)(1), and §72.150.

- The design of the ISF Facility and transfer casks provides (i) a capability to test and monitor components important to safety, (ii) suitable shielding for radioactive protection during normal and accident conditions, and (iii) a heat-removal capability in compliance with 10 CFR §72.128(a)(1), (3), and (4).

- The radiological alarm systems and direct radiation monitoring are considered in the design to meet 10 CFR §20.1301 dose limits for individual members of the public and

are in compliance with the requirements of 10 CFR §72.126(a)–(c). A detailed discussion about the radiological alarm systems and direct radiation monitoring is provided in Chapter 11 of this SER.

- The SAR provides reasonable assurance that the activities to be authorized by the license can be conducted without endangering the health and safety of the public, and the activities are in compliance with 10 CFR §72.40(a)(5) and §72.40(a)(13).

- An acceptable capability to test and monitor components important to safety is provided in the design and procedures for the ISF Facility in compliance with 10 CFR §72.122(f) and §72.122(h)(4).

- The design of the ISF Facility, the operating procedures, and the schedule for operations provide acceptable controls for security, monitoring, and surveillance during loading, transfer, unloading, and storage operations and are in compliance with 10 CFR §72.122(i).

- The design of the ISF Facility provides reasonable assurance for ready retrieval of the stored radioactive material from storage during normal, off-normal, and accident conditions in compliance with 10 CFR §72.122(l).

- The ISF Facility is a passive storage facility that requires no control room or control area to ensure safe operation; therefore, the requirements of 10 CFR §72.122(j) are not applicable.

3.3 References

American Institute of Steel Construction. *Manual of Steel Construction, Allowable Stress Design*. Ninth Edition. Chicago, IL: Institute of Steel Construction. 1989.

American National Standards Institute/American Nuclear Society. *Design Criteria for an Independent Spent Fuel Storage Installation (Dry Storage Type)*. ANSI/ANS 57.9-1984. La Grange Park, IL: American Nuclear Society. 1984.

ASME International. *ASME International Boiler and Pressure Vessel Code, Article NB–5000*. New York City, NY: ASME International. 2001a.

ASME International. *ASME Section III–Division 1, Subsection NC, Class 2 Vessel*. New York City, NY: ASME International. 2001b.

ASME International. *ASME International Boiler and Pressure Vessel Code, Article NC–3000*. New York City, NY: ASME International. 2001c.

ASME International. *ASME Section V Nondestructive Examination*. New York City, NY: ASME International. 2001d.

ASME International. *Power Piping*. ASME B31.1. New York City, NY: ASME International. 2001e.

ASME International. *Building Services Piping*. ASME B31.9. New York City, NY: ASME International. 1996.

ASME International. *Safety Standard for Compressors for Process Industries*. ASME B19.3. New York City, NY: ASME International. 1991.

Compressed Gas Association, Inc. *Compressed Air for Human Respiration*. CGA G–7–1990. Chantilly, VA: Compressed Gas Association, Inc. 1990.

Foster Wheeler Environmental Corporation. *Idaho Spent Fuel Facility Safety Analysis Report*. ISF–FW–RPT–0033. Docket 72-25. Amendment 3. Morris Plains, NJ: Foster Wheeler Environmental Corporation. November 2003a.

Foster Wheeler Environmental Corporation. *Response to Request for Additional Information*. Idaho Spent Fuel Facility License Application. FW–NRC–ISF–03–0010. Richland, WA: Foster Wheeler Environmental Corporation, Idaho Spent Fuel Facility Project. January 22, 2003b.

Foster Wheeler Environmental Corporation. *Cask Trolley, Structural Calculation*. ISF–FW–CALC–0160. Idaho Spent Fuel Project. Project No. DE–AC07–00ID13729. Prepared by BERGER/ABAM Engineers Inc. Richland, WA: Foster Wheeler Environmental Corporation, Idaho Spent Fuel Facility Project. 2001.

National Fire Protection Association. *Standard for Fire Protection for Facilities Handling Radioactive Materials*. NEPA–801. National Fire Protection Association. 1998.

U.S. Department of Energy–Idaho Operations Office. *Peach Bottom Core 1 Shipping Configuration for Transfer from CPP–749 to Spent Nuclear Fuel Dry Storage Project (Reg Dwg. 518304)*. Engineering Design File 2873. Rev. 2. Idaho Falls, ID: U.S. Department of Energy–Idaho Operations Office. June 19, 2002a.

U.S. Department of Energy–Idaho Operations Office. *Shippingport LWBR Spent Nuclear Fuel Data for Transfer from CPP–749 to Spent Nuclear Fuel Dry Storage Project (Reg Dwg. 518305)*. Engineering Design File 2875. Rev. 1. Idaho Falls, ID: U.S. Department of Energy–Idaho Operations Office. June 20, 2002b.

U.S. Department of Energy–Idaho Operations Office. *Peach Bottom Core 2 Shipping Configuration for Transfer from CPP–603 Irradiated Fuel Storage Facility (IFSF) to Spent Nuclear Fuel Dry Storage Project (Reg Dwg. 518306)*. Engineering Design File 2874. Rev. 2. Idaho Falls, ID: U.S. Department of Energy–Idaho Operations Office. June 20, 2002c.

U.S. Department of Energy–Idaho Operations Office. *TRIGA Spent Nuclear Fuel Data for Transfer from IFSF to Spent Nuclear Fuel Dry Storage Project (Reg Dwg. 518307)*. Engineering Design File 2876. Rev. 1. Idaho Falls, ID: U.S. Department of Energy–Idaho Operations Office. June 20, 2002d.

U.S. Nuclear Regulatory Commission. NUREG–1567, *Standard Review Plan for Spent Fuel Dry Storage Facilities.* Washington, DC: U.S. Nuclear Regulatory Commission. 2000.

U.S. Nuclear Regulatory Commission. NUREG–0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*. Washington, DC: U.S. Nuclear Regulatory Commission. 1996.