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THE IDAHO SPENT FUEL PROJECT UPATE—JANUARY 2003

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ABSTRACT

The Department of Energy awarded a privatized contract to Foster Wheeler Environmental Corporation in May 2000 for the design, licensing, construction and operation of a spent nuclear fuel repackaging and storage facility. The Foster Wheeler Environmental Team consists of Foster Wheeler Environmental Corp. (the primary contractor), Alstec, RWE-Nukem, RIO Technical Services, Winston and Strawn, and Utility Engineering.

The Idaho Spent Fuel (ISF) facility is an integral part of the DOE-EM approach to accelerating SNF disposition at the Idaho National Engineering and Environmental Laboratory (INEEL). Construction of this facility is also important in helping DOE to meet the provisions of the Idaho Settlement Agreement. The ISF Facility is a substantial facility with heavy shielding walls in the repackaging and storage bays and state-of-the-art features required to meet the provisions of 10 CFR 72 requirements. The facility is designed for a 40-year life.

The Idaho Spent Fuel Project Update – January 2003



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BACKGROUND TO THE ISF PROJECT

During the last 40 years, the United States Department of Energy (DOE) and its predecessor agencies have generated, transported, received, stored, and reprocessed spent nuclear fuel at several facilities in the DOE's nationwide complex. This spent fuel was generated from various sources, including production reactors; research and test reactors; special-case commercial power reactors; and foreign research reactors. Some of the DOE's spent fuel is in storage at the Idaho National Engineering and Environmental Laboratory (INEEL).

The DOE ended reprocessing of spent nuclear fuel in the USA in 1992. Partly due to this decision, 235 metric tons of heavy metal (MTHM) spent fuel is still stored at the INEEL in pools, dry wells and above ground storage pending disposal in a geologic repository. The current storage facilities are located over the Snake River aquifer, a major water source for the region. In addition, the INEEL is currently planning to receive an additional 70 MTHM of spent fuel from sources including foreign and domestic research reactor programs.

A Settlement Agreement signed on October 17, 1995 by the DOE, the U.S. Navy and the State of Idaho requires that all INEEL spent fuels be transferred to dry storage by December 31, 2023; and removed from Idaho by January 1, 2035. The agreement includes fuel from Peach Bottom and Shippingport reactors, and TRIGA fuel from various sources. Current spent fuel storage and handling facility capability is not considered adequate to meet this mission need for the next twenty to thirty years. The current contract scope includes the repackaging and storage of 20 MTHM of spent fuel. With future facility modifications, enhancements, and appropriate license amendments, the DOE is planning on handling the majority of the ultimate INEEL spent fuel inventory through the core capability provided by the ISF Project including load-out for shipment to the geologic repository.

THE IDAHO SPENT FUEL PROJECT

The contract for an additional interim handling and dry storage facility at the INEEL was awarded to Foster Wheeler Environmental Corporation (Foster Wheeler) on May 19, 2000. The contract is for the design, licensing, construction and operation of an Independent Spent Fuel Storage Installation (ISFSI) that will repackage and store Peach Bottom, TRIGA and Shippingport fuels. The project is known as the Idaho Spent Fuel (ISF) Project and the interior of the planned storage facility is shown in the figure below.

The ISF facility is being licensed for interim storage by Nuclear Regulatory Commission (NRC) to 10CFR72 requirements. In addition the fuel storage canisters and baskets are being designed for transportation to 10CFR71 requirements and also to meet repository requirements. The facility design is based around the Foster Wheeler/ALSTEC Modular Vault Dry Storage technology.

The ISF facility consists of three main functional areas: the Cask Receipt Area, the Transfer Area and the Fuel Storage Area. The Transfer Area consists of two main sub-areas: the Fuel Packaging Area and the Canister Closure Area. Fuel is delivered to the facility at the Cask Receipt Area and is repackaged into canisters within the Fuel Packaging Area. The canisters are then welded closed and inerted within the Canister Closure Area, and then placed into storage in the Storage Area.

The ISF facility uses the DOE standardized spent fuel storage canisters that are compatible with the requirements of the proposed national high level waste repository as currently defined in repository waste acceptance criteria. The preliminary canister specifications were designed by DOE and its contractors to accommodate a wide range of fuels currently being stored by DOE. The ISF will use two different diameter storage canisters, 18 inch and 24 inch. The 24 inch canisters are required to accommodate the Shippingport fuel assemblies, while the 18 inch canisters will be used for the remaining fuel types. The facility is designed to easily retrieve standard canisters from the storage area and deliver them to the load-out point for shipment to the geologic repository.

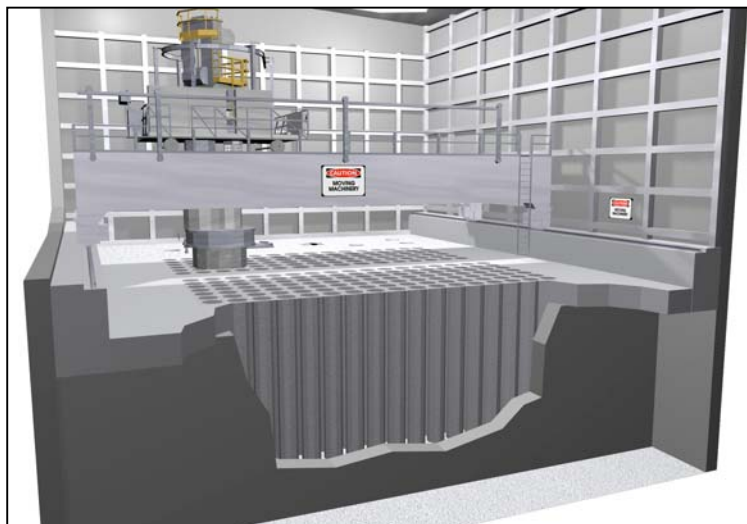


Fig. 1. The Idaho Spent Fuel project storage vault

As part of the contract, Foster Wheeler also provided a conceptual transportation system design compatible with the ISF facility and standard canisters. This provides a conceptual design of an NRC licensable shipping package for eventual offsite rail or road shipment to the geologic repository. Neither the detailed design nor manufacture of this shipping package nor retrieval of canisters and/or shipment to the geologic repository is in the scope of this project.

Current Status of the ISF Project

The ISF project contract has now completed the licensing design phase. The license application was submitted to the NRC on November 19, 2001, and after a pre-acceptance review of the license application the NRC formally accepted the documentation for licensing review in March 2002. The NRC issued their first Request for Additional Information (RAI) to Foster Wheeler on October 25, 2002 and these were returned to NRC for continuing review on January 24, 2003. A second round of RAIs will be issued in May 2003 if required. Detail design and preparation of fabrication information is currently underway in parallel with the NRC review of the license application.

Key dates for the project are:

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|---|---------------------------------|
| • Contract Award: | May 19, 2000 |
| • License Application submitted to NRC: | November 19, 2001 |
| • Part 72 license approval: | November 2001 through June 2004 |
| • NRC issue first round technical RAIs: | October 25, 2002 |
| • First round technical RAI responses to NRC: | January 24, 2003 |
| • NRC issue first round of Environmental RAIs | January 29, 2003 |
| • First round of Environmental RAI responses to NRC | March 14, 2003 |
| • NRC issue second round of technical RAIs (If required): | May 30, 2003 |
| • Second round of technical RAI responses to NRC: | August 29, 2003 |

- NRC issues SER and Part 72 License
- Start operations:

March 31, 2004

June 2005

The Modular Vault Dry Store System

The ISF facility utilizes the Foster Wheeler/ALSTEC Modular Vault Dry Storage (MVDS) system to provide interim storage for approximately 220 canisters. The MVDS has had an NRC Topical Report approved status since 1988. The Topical Report covers the interim storage of Light Water Reactor fuels, including both PWR and BWR, at any reactor sites in the USA.

The MVDS provides a simple passive design for dry fuel storage. The fuel assemblies are cooled by natural circulation, a self-regulating system in which higher spent fuel temperatures prompt increased air flow and thus heat removal. Criticality control is provided by the geometrical array of storage tubes within the vault array.



Fig. 2. Fort St Vrain MVDS

440 fuel elements. The Paks MVDS was built with an initial storage capacity for 1,350 fuel assemblies. In 1999 and 2002 two additional construction phases increased the Paks MVDS capacity by a further 3,600 assemblies. This brings the existing capacity of the Paks MVDS up to 4,950 assemblies and there are future plans to increase the storage capacity up to 15,000 assemblies.

The MVDS was employed for the first time in the U.S. at the Fort St Vrain plant for the storage of High Temperature Gas Reactor fuel elements. The Fort St Vrain ISFSI was licensed under 10CFR72 and the unit went into operation in 1991.

In 1998, ownership of the Fort St Vrain MVDS was transferred from Public Service Company of Colorado to DOE. DOE manages the Fort St. Vrain ISFSI under NRC regulatory authority.

The Paks MVDS went into operation in December 1997. This facility is in Hungary and is designed for the storage of VVER



Fig. 3. Paks MVDS – shown in 2000 after first extension vaults were added

The current status of Foster Wheeler/ALSTEC's MVDS facilities are shown in the table below:

Table I. Current Status of Foster Wheeler/ALSTEC MVDS Facility

Facility	Type of Reactor/Fuel	Dry Storage Method	Licensing Authority and Date of License Approval	Date of Operation
MVDS Topical SAR	PWR and BWR, anywhere in USA	Concrete vault – MVDS	USA NRC 1988	n/a
Wylfa dry fuel cells 1 to 3 Anglesey, UK	Gas Cooled Reactor Magnox fuel	Concrete vault, tube storage	UK NII 1969	1969
Wylfa dry fuel cells 4 to 5 Anglesey, UK	Gas Cooled Reactor Magnox fuel	Concrete vault, tube storage	UK NII 1979 and 1980	Cell 4: 1979 Cell 5: 1980
Fort St Vrain MVDS Colorado, USA	High temperature gas reactor HTGR fuel blocks	Concrete vault – MVDS	USA NRC 1991	1991
Paks MVDS Paks, Hungary	VVER 440 VVER 440 fuel	Concrete vault – MVDS	Hungary OAH Feb 1997	December 1997
Idaho Spent Fuel Facility Idaho, USA	DOE owned fuels: Peach Bottom Core 1 Peach Bottom Core 2 TRIGA aluminum clad TRIGA stainless clad Shippingport modules	Concrete vault – MVDS	USA NRC Planned 2003	Planned 2005

Description of the ISF Facility

The storage design of the ISF facility is based on a vault storage system. The vault design provides radiation shielding as well as a passive cooling system where spent nuclear fuel assemblies are cooled with natural circulation. This is a self-regulating system in which higher spent fuel temperatures prompt faster air flow and thus heat is removed within established design parameters. Criticality control is provided by the geometry of the storage canisters and vault array.

The ISF facility provides for year round operations. Due to the weather extremes in Idaho, all operations occur inside the facility. The ISF facility design provides for specific operations to occur within discrete areas of the facility. These areas include the Receipt Area, Fuel Packaging Area, and Storage Area.

The spent fuel storage canisters are shown in the sketch overpage. The design is compatible with the requirements of the proposed national high level waste repository. The ISF will use two different diameter storage canisters, 18 inch and 24 inch. The 24 inch canisters are required to accommodate the Shippingport modules, while the 18 inch canisters will be used for the remaining fuel types. After loading with spent nuclear fuel, the ISF Canisters are placed into sealed storage tubes within the vault. The vault storage tubes provide a secondary confinement boundary around the stored fuel, and also ensure future recoverability of the canisters for off-site transportation.

The canisters and storage tubes will be designed and fabricated to ASME Section III, Division 1; and N-stamped accordingly.

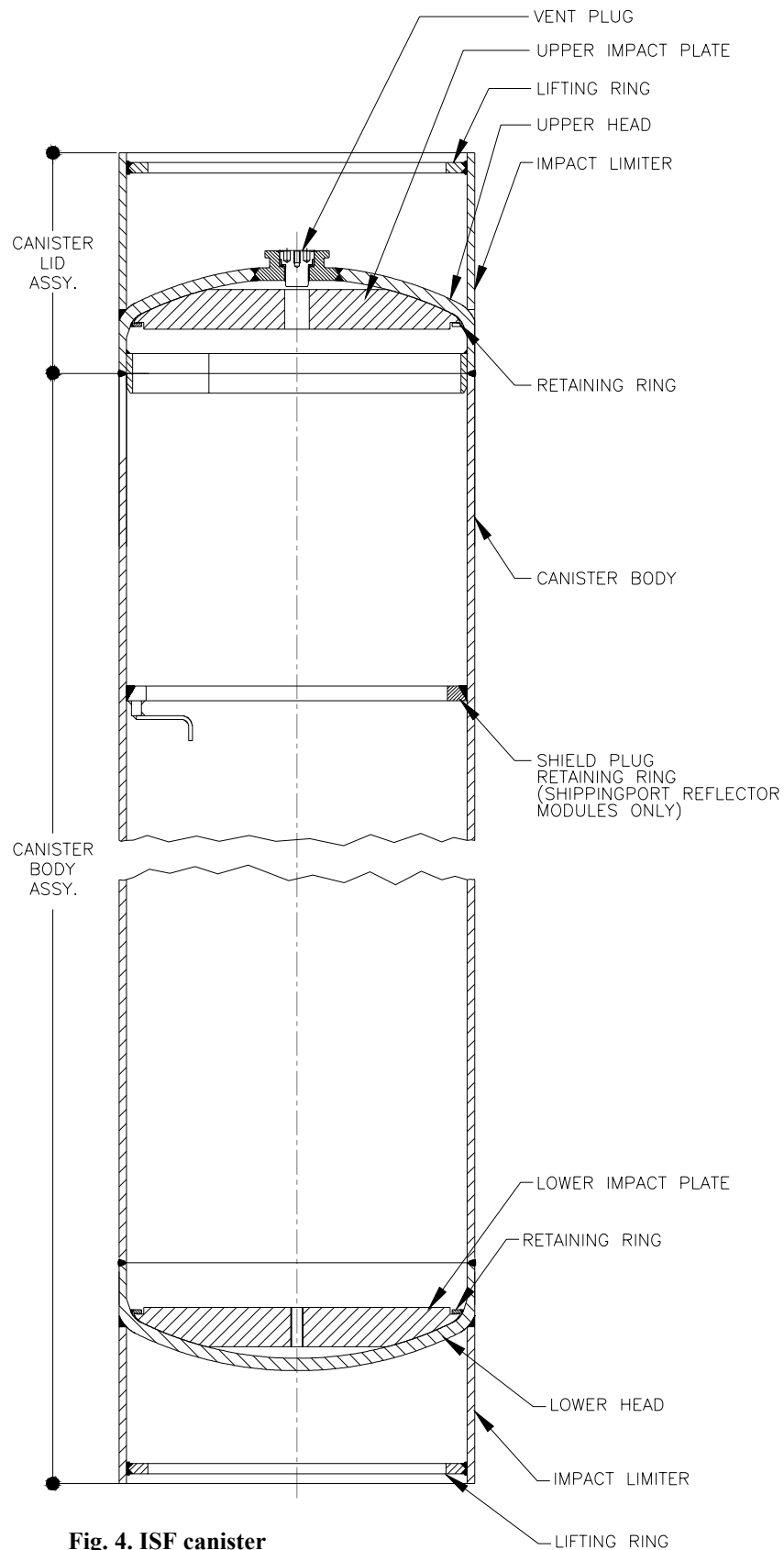


Fig. 4. ISF canister

Fuel Type Summary

The fuel to be stored in the ISF facility consist of the following types:

- Peach Bottom Core 1 and Core 2 Fuel Assemblies
- TRIGA Fuel elements
- Shippingport Modules

Each of the three fuel types has different physical, chemical and radiological characteristics that have been addressed in the facility design and license application. For example, the cladding material for each fuel type is:

Table II. Fuel Cladding Material

Fuel Type	Clad Material
Peach Bottom Core 1 and 2	Graphite
TRIGA	Aluminum or Stainless Steel
Shippingport Module	Zircalloy

Fuel Handling Process Flow

The ISF Facility is laid out to efficiently transfer incoming fuel to the Fuel Packaging Area, Canister Closure Area and into the Storage Area. This is achieved by a transfer tunnel that inter-connects these areas. In the future the ISF canisters will be transported offsite using a 10CFR71 licensed transport handled within the existing structure. The process flow diagram below depicts the typical evolution through the facility.

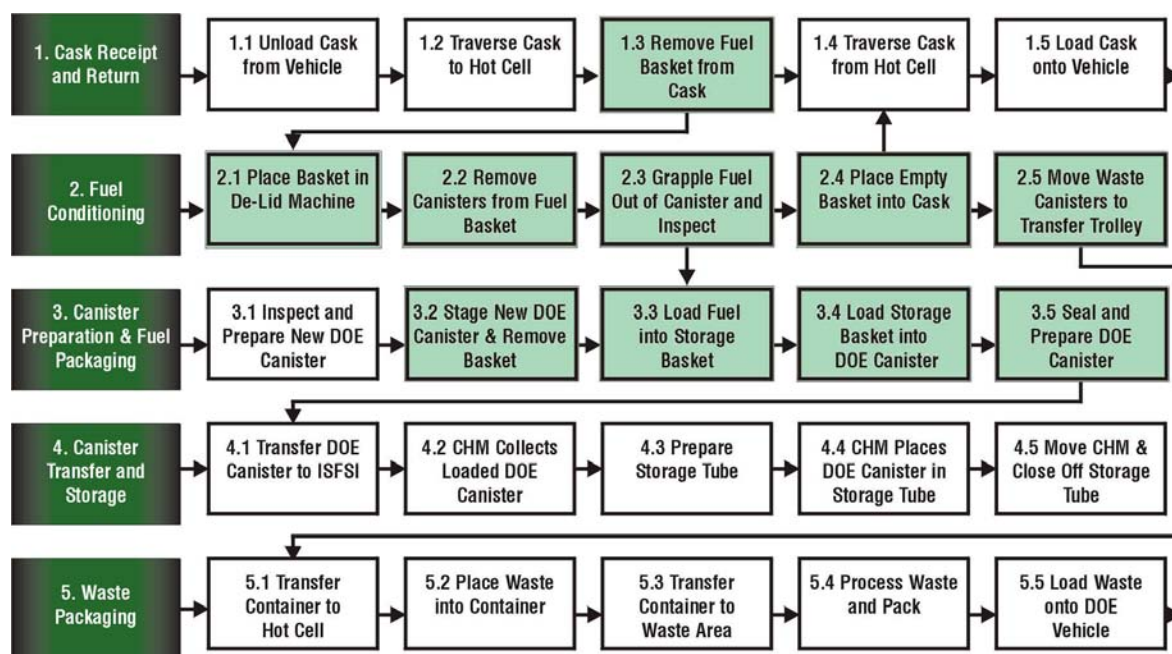


Fig. 5. Fuel handling process flow

Cask Receipt Area

The Cask Receipt Area houses the equipment necessary to receive shipments of spent fuel from DOE. The major equipment in this facility consists of an overhead hoist and a cask transfer trolley. The fuel arrives at the ISF facility in a transfer cask, which was formerly designed for transportation of Peach Bottom fuel. The transfer of the fuel to the ISF facility does not traverse public roadways since the transfer is from an adjacent DOE facility.

The Cask Receipt Area hoist is a single failure proof hoist in order to minimize the probability of drop accidents associated with cask handling. The transfer cask is lifted from the transport vehicle and placed in a rail-mounted trolley, which will restrain the cask from tipping even in the unlikely event of an earthquake. The transfer cask provides radiation shielding for the fuel to reduce personnel exposure. The cask trolley moves the cask from the Receipt Area down a tunnel to the Fuel Packaging Area.

Transfer Area

The Fuel Packaging Area within the Transfer Area is designed to allow remote handling and unloading of the transfer casks containing the spent fuel. The fuel will be remotely handled during inspection and repackaging into the storage canisters. The process involves removing the cask lid and removing the inner canister containing the spent fuel. This canister is placed in a port located in the floor of the fuel packaging area. The canister lid is removed to allow access to the spent fuel. The spent fuel assemblies are removed, inspected, and placed in a basket, which is designed to hold the fuel within a fixed configuration when placed inside an ISF canister.

The loaded storage canister is then transferred to the Canister Closure Area adjacent to the Fuel Packaging Area where a lid is welded to the canister. Once the canister lid is welded, an access port allows the interior volume of the canister to be evacuated. This vacuum drying process removes any residual moisture and air from the canister interior. The canister is then back-filled with helium to provide an inert atmosphere, which minimizes corrosion and improves heat transfer. Once the canister closure and inerting operations are complete, the canister is ready for storage.

Storage Area

The canister is transferred to the Storage Area in the canister trolley. This trolley is moved to the Storage Area and located underneath the Canister Handling Machine (CHM). The CHM provides shielding and remote handling of the canister to minimize personnel radiation exposure. The CHM is also designed to preclude credible drop accidents, as it is designed as a single failure proof crane in accordance with NRC guidance.

The ISF facility CHM is a close copy of the MCO Handling Machine (MHM) that was supplied by Foster Wheeler/ALSTEC for the Hanford Canister Storage Building project. The Hanford MHM has a bridge span of 126 feet 6 inches, while the ISF Project CHM has a bridge span of 73 feet.

The storage canister is placed within a mechanically sealed storage tube whose primary purpose is to provide a redundant confinement barrier for the stored fuel. The vault system provides for a self-regulating passive cooling of the fuel canisters as well as shielding to limit personnel exposure, and protection of the fuel canister confinement boundaries from all credible accident scenarios.

Off-site Transport of Casks

To prepare for the eventual transport of the fuel canisters to a national repository or other storage location outside the state of Idaho, Foster Wheeler has prepared a conceptual design for a transport system. This conceptual design is compatible with the storage canisters and integrated with the ISF facility operations and equipment. The



Fig. 6. Hanford MHM

conceptual transport cask design will provide for off-site shipment of the packaged spent fuel in accordance with the requirements of 10CFR71. To accommodate the transport system, the ISF facility has a staging area for loading off-site transportation casks onto either a truck or rail car. It is contractually designed to handle a cask envelope 128 inches in diameter, 308 inches long, and weighing up to 300,000 pounds. These parameters will accommodate all known shipping packages that are anticipated to be used to ship INEEL spent fuel to the geologic repository.

Summary

Foster Wheeler is contracted to design, license, construct and operate an Independent Spent Fuel Storage Installation adjacent to INTEC within the INEEL, approximately 50 miles west of Idaho Falls, Idaho. The ISF facility will receive, repackage, and store spent nuclear fuel provided by DOE. The ISF facility will be licensed and operated under NRC jurisdiction in accordance with 10 CFR 72.

Foster Wheeler will own and operate the ISF until the end of the contract when, in the absence of a contract extension, the facility and NRC license would be transferred to the DOE or its designated successor contractor. The ISF facility is being designed to provide for the interim storage of the spent fuel for a minimum of 40 years and accordingly will be NRC licensed for 20 years (with a 20 year license extension option).