WM'01 Conference, February 25-March 1, 2001, Tucson, AZ

MANAGING THE LEGACY: THE INEEL SNF PROGRAM

Denzel L. Fillmore, Ph.D.
Idaho National Engineering and Environmental Laboratory

Robert G. Pahl, Ph.D.
Argonne National Laboratory – West

ABSTRACT

Since it was first founded in 1949, fifty-two nuclear reactors have been built and operated at the site now known as the Idaho National Engineering and Environmental Laboratory (INEEL). Most of the spent fuel from these reactors has remained at the INEEL. In addition, nuclear fuel has also been brought to the INEEL from other sites for testing and uranium reprocessing. When reprocessing of spent nuclear fuel was ended at the INEEL in 1992, a different management strategy had to be developed to manage the legacy of spent nuclear fuel. This management strategy involves characterizing the fuel, resolving storage vulnerabilities, consolidating fuel, closing facilities, managing fuel receiving, developing new technologies, and ensuring that the SNF inventory or its treatment byproducts can be accepted in a federal repository.

INTRODUCTION

The Idaho National Engineering and Environmental Laboratory (INEEL) was established in 1949 as the National Reactor Testing Station. Its mission was to test reactor designs. Over the years since it was established, 52 reactors have been designed, built, and operated by a variety of organizations for a variety of programs. Most of the spent nuclear fuel (SNF) generated by these reactors remained at the INEEL.

In 1950, a chemical reprocessing facility was built at the INEEL to recover fissile materials from SNF. SNF has been sent to the INEEL from many other locations (including Naval Reactors, DOE and university test reactors, and some commercial reactors) for testing, examination, and reprocessing. Much of the fuel was reprocessed for the recovery of enriched uranium. Today, over 300 different types of SNF containing 257 metric tons of heavy metal (MTHM) are stored in 12 facilities at the INEEL awaiting final dispositioning. This SNF is the legacy of the INEEL. This paper will address the management of all of the SNF at the INEEL (including the ANL-W site), except for the naval fuel.

INEEL CURRENT STATUS

Spent Nuclear Fuel Description

Many characteristics of SNF are important to its management. The chemical characteristics of the fuel meat, cladding, and other constituents determine how it can be stored and what treatment may be needed to meet geologic repository acceptance criteria. Physical characteristics (such as length, weight, heat generation rate, radiation level, fissile content and enrichment, and physical condition) also dictate storage and handling requirements.

The INEEL has a large inventory of diverse types of SNF, possibly the most diverse and varied inventory in the world. Table I lists some of the materials of construction and Table II describes the physical characteristics of the fuel. The fuel consists of several different fissile materials of varying enrichments. Much of the SNF is highly enriched in uranium-235 (greater than 60%), and was sent to the INEEL because uranium-235 recovery was part of the INEEL mission. A significant quantity of typical commercial light water reactor fuel was brought to the INEEL for examination and testing. The INEEL also stores fuel that contains uranium-233 and thorium. Specialized test reactor fuel such as the sodium-bonded fuel used in Experimental Breeder Reactor II is also stored at the INEEL.

Table I. Typical INEEL SNF materials of construction

Cladding material	**Fuel Meat Composition**	**Other Material**
Aluminum	Uranium metal	Stainless steel
Stainless steel	Uranium oxide	Thorium carbide
Zirconium	Uranium alloy	Beryllium oxide
	Uranium carbide	Metallic sodium
		Thorium oxide

Table II. INEEL SNF physical characteristics

Characteristic	**Range**
Weight	0.01 to 1600 kg
Length	10 to 410 cm
Heat generation rate	0 to 600 w
Radiation field	0 to 10,000 R/hr
Physical condition	Scrap to excellent

The SNF is stored in several configurations. Some is stored under water, and some is stored dry in casks, caissons, underground silos, or vaults. Some fuel is stored as bare units, either intact or having some of the structural material removed. Some of the fuel has been disassembled for destructive examination or security and has been stored in containers (called "cans"). Some intact fuel has also been canned. The cans were originally dry inside, but some of them have leaked. Some of the cans have been recanned underwater to retain the fuel handling capability. Some fuel has been in storage for over 40 years, and the physical condition of some fuel has deteriorated.

In order to understand the inventory and quantity of the SNF, the inventory (including projected fuel receipts) was placed into 16 groups, as shown in Table III.

Table III. INEEL SNF inventory groups

Group	Group Description	Quantity	Representative Fuel
1	Intact, Low enriched (<5%), uranium oxide clad with zirconium or stainless steel	31 types 30 cubic meters 76.8 MTHM	Typical commercial
2	Intact, medium enriched (5 to 20%), uranium oxide clad with zirconium or stainless steel	8 types 1.4 cubic meters 4 MTHM	PBF
3	Intact, highly enriched (>20%) uranium oxide clad with zirconium or stainless steel	21 types 9.3 cubic meters 8.7 MTHM	Shippingport PWR
4	Disrupted, low enriched, uranium oxide	34 types 145 cubic meters 87.5 MTHM	TMI-2
5	Disrupted, highly enriched, uranium oxide	44 types 24 cubic meters 6.2 MTHM	TORY
6	Intact medium enriched uranium zirconium hydride clad with aluminum, zirconium, or stainless steel	97 types 6.6 cubic meters 1.8 MTHM	Standard TRIGA
7	Some disrupted, highly enriched uranium zirconium hydride clad with zirconium or stainless steel	24 types 1.3 cubic meters 0.2 MTHM	TRIGA Flip
8	Low enriched, uranium metal or uranium alloy or zirconium or molybdenum with various claddings	14 types 0.8 cubic meters 2.0 MTHM	HWCTR
9	Highly enriched, uranium metal or uranium alloy or zirconium or molybdenum with various claddings	6 types 2 cubic meters 3.9 MTHM	Fermi
10	Highly enriched uranium carbide in silicon carbide coated particles in a graphite matrix	1 type 196 cubic meters 23 MTHM	Fort St. Vrain
11	Highly enriched uranium carbide in non-silicon carbide coated particles in a graphite matrix	7 types 35 cubic meters 3 MTHM	Peachbottom graphite
12	Highly enriched uranium carbide in a non-graphite matrix	2 types 5 cubic meters 0.06 MTHM	SRE

Group	Group Description	Quantity	Representative Fuel
13	Highly enriched uranium-233 with thorium in zirconium cladding	1 type 52 cubic meters 39 MTHM	Shippingport LWBR
14	Metallic sodium bonded	33 types 15 cubic meters 60 MTHM	Fermi blanket EBR-II
15	Aluminum clad uranium compounds	14 types 43 cubic meters 3.4 MTHM	ATR
16	Other, not included above	5 types 4.3 cubic meters 0.2 MTHM	none

Storage Facility Description

Both wet and dry storage are used at the INEEL. Wet storage is in concrete pools, some of which are stainless steel lined. Some pool facilities are at the reactor site, and others are at non-reactor facilities such as Test Area North (TAN) and the Idaho Nuclear Technology and Engineering Center (INTEC). The pool in building CPP-666 (at INTEC) is the most modern storage pool in the DOE complex. It is lined with stainless steel and has modern leak detection and water purification systems. The pool at TAN-608 was built in 1955 to support the development of the Aircraft Nuclear Propulsion (ANP) program. Today, it stores fuel from Three Mile Island Unit 2 (TMI-2). Additional storage pools are located at the Materials Test Reactor (MTR), the Advanced Test Reactor (ATR), and the Power-Burst Facility (PBF). These pools were built to support operations at those reactors.

Dry storage facilities are located at TAN, INTEC, ANL-W, and Fort St. Vrain Colorado. The TAN storage pad has four dry storage casks, each of a different design. Commercial light water reactor fuel, bare and consolidated assemblies, has been in storage for up to 15 years under a joint DOE and Nuclear Regulatory Commission (NRC) project. The Fort St. Vrain facility in Colorado is an NRC-licensed facility that is storing the Fort St. Vrain SNF. INTEC has four different types of dry storage. The Irradiated Fuel Storage Facility (IFSF) is an air-cooled vault, originally built to store the Fort St. Vrain SNF. It presently stores many different types of SNF. The first generation of storage caissons, CPP-749, consists of steel-lined below-grade individual vaults, built to store the Peachbottom graphite SNF. The second-generation storage caissons used a significantly better design and were built to store fuel from the Shippingport light water breeder reactor. ANL-W operates a below-grade silo storage facility (Radioactive Scrap and Waste Facility) which was built in 1965. This facility stores spent fuel and remotely-handled mixed and radioactive waste. The newest dry storage facility is a modified NUHOMS ® design built to store the TMI-2 fuel removed from the damaged core after the accident. This was only the second DOE facility to be licensed by the NRC, and the first one for which DOE actually prepared the license application.

Receipt and Transfer

The INEEL has an active program for generating and receiving SNF. The ATR, scheduled to operate through 2025, is one of the few reactors in the DOE complex that is still operating. The ATR will produce over 30 spent assemblies each year. The SNF is cooled in the reactor pool for a short time and then transferred to INTEC for interim management.

The DOE programmatic environmental impact statement (EIS) (1) and the foreign research reactor EIS (2) both identify the INEEL as the receiving location for non-aluminum-based SNF from DOE sites and from foreign, domestic, and university reactors. The INEEL is scheduled to receive SNF from sixteen universities, eight domestic sites, eighteen foreign sites, and five DOE sites. This includes all of the SNF that contains metallic sodium. According to the EIS record of decision, the

INEEL will ship all of its aluminum-based SNF to the Savannah River Site (SRS). ANL-W will receive and treat sodium-bonded fuel removed from the Fast Flux Test Facility at the Hanford site.

INEEL SHORT TERM OBJECTIVES

Safe Interim Storage

Some of the INEEL SNF facilities have been in operation for over 40 years, even though they had an expected operating lifetime of only 20 years when they were constructed. These facilities do not meet present standards and need to be shut down and decommissioned. Some of these older facilities contain SNF that has been in storage for over 40 years. The condition of the older SNF has deteriorated and presents problems in safe management. Both of these situations have been identified as vulnerabilities to the INEEL, and corrective actions have been identified to eliminate the vulnerabilities. The DOE reached an agreement with the State of Idaho (3) in 1995 to move the SNF to safe dry storage by 2023 and to remove it from the state by 2035.

Consolidate SNF and Shut Down Older Facilities

The INEEL has several older wet SNF storage facilities that do not meet present standards (4). When the SNF is removed from these facilities, the facilities can be shut down and decommissioned. The first facility targeted for this activity was CPP-603 basin.

The CPP-603 basin actually consisted of three bare concrete basins that contained a large variety of SNF. The north and middle basins stored SNF hanging from a monorail on hangers that kept the fuel in the proper location. Over the years, the carbon steel hangers and the SNF containers corroded significantly. The south basin kept the SNF units in racks that sat on the basin floor. By 1996, all fuel had been removed from the north and middle basins by transferring the SNF that was still in good condition to the new pool at CPP-666, and by consolidating the fuel that needed additional treatment into the south basin. The remaining fuel in the CPP-603 basin was repackaged into new storage cans or buckets and transferred to CPP-666 or to IFSF. Between 1994 and April 2000, 1,340 units of SNF were transferred. The project was completed eight months ahead of schedule. The decontamination and decommissioning of the facilities is now being planned.

The SNF storage pool at TAN is also a bare concrete pool that stores fuel in metal racks. Most of the fuel in the TAN pool is the debris from TMI-2, stored in stainless steel containers. Some fuel from commercial reactors and from the Loss of Fluid Test reactor is also in the pool. The TAN facilities are located 20 miles from INTEC. The INEEL plans to move the SNF to INTEC by 2002.

The MTR pool that was constructed to support the operation of the MTR reactor and has been maintained to store SNF that was left over from the research and testing programs at the INEEL. This bare concrete pool contains SNF in storage racks. The INEEL plans to move this SNF to INTEC by the end of 2001.

The PBF pool is a small stainless-steel-lined pool that was built to support the operation of the PBF reactor, which has now been shut down and defueled. Only PBF fuel is in this pool. The INEEL plans to move this SNF to INTEC by 2002.

The INEEL SNF management plan calls for moving the SNF from these older, remote facilities into modern wet or dry storage, and eventually moving all of the fuel into dry storage. Significant cost savings have been projected from shutting down these facilities.

The IFSF plays an important part in INEEL consolidation plans. Transferring all of the INEEL SNF from wet storage to dry storage is an important step in reducing storage costs, as well as in meeting the State of Idaho agreement. The IFSF was constructed to store all of the SNF from the Fort St. Vrain reactor in Colorado. Because two-thirds of the fuel planned for this facility will remain in Colorado until it is prepared for repository dispositioning (5) there is excess room in the IFSF that can be used for storing other types of SNF. SNF can be moved from the older facilities to IFSF, and the wet storage facilities can be shut down without having to wait for a new facility to be constructed. Much of the SNF that was moved out of the CPP-603 pools was moved into IFSF. The foreign research reactor (FRR) fuel that is now being received is being put into the IFSF, and the fuel from the MTR and PBF facilities is scheduled to be stored in the IFSF.

The Radioactive Scrap and Waste Facility (RSWF) is used for the bulk of interim fuel storage at ANL-W. Spent fuel is stored dry, below grade, in passively cooled cathodically protected carbon steel liners or silos. All of the sodium-bonded fuel destined for electrometallurgical treatment will pass through RSWF, and the resulting high-level waste will be stored there awaiting geological disposal.

The INEEL awarded a contract to Newport News to construct a NRC-licensable facility (6) for the dry storage of the TMI-2 SNF. DOE decided to make this facility the first NRC-licensed facility at a DOE site. An existing NUHOMS ® design owned by Vectra was modified and adapted for the TMI-2 SNF.

DOE recently authorized the construction of a privatized SNF storage facility. The project is called the Spent Nuclear Fuel Dry Storage Project (SNFDSP), and the contract has been award to Foster Wheeler Environmental Corporation (7). This facility will initially accept three types of INEEL SNF, but it can be expanded to accept the entire SNF inventory at the INEEL. The facility will be able to dry SNF and characterize it to meet the repository acceptance criteria.

Maintaining Capabilities

There is enough variability and unpredictability in the SNF legacy that it is prudent to maintain certain analytical and handling capabilities to cope with unforeseen conditions that might arise. For example, ANL-W has two large argon-filled hot cells, the Fuel Conditioning Facility, and the Hot Fuels Examination Facility (HFEF), which should be maintained in their current operational status. The Fuel Conditioning Facility is used for electrorefining fuel, and the HFEF produces the final waste form. In addition, HFEF is actively characterizing spent fuel for both DOE and non-DOE customers.

The TAN hot shop is the largest hot shop in the free world. It was constructed as part of the ANP program. Today it is used to service the dry storage casks located on the SNF dry storage pad at TAN. It is also used to examine fuel and to dry debris from the Three Mile Island reactor that has been stored underwater at TAN for over 20 years.

It is also extremely important to maintain the support structure for low- and high-level waste that will be generated during the treatment of the SNF for final dispositioning.

Technology Development

The technology needed to characterize the INEEL SNF and prepare it to meet repository acceptance criteria did not exist when reprocessing was shut down. The INEEL began a technology development program to ensure that the technology would be available when it was needed. The program focused on three major areas: drying, conditioning, and non-destructive characterization. The first technology developed and implemented at the INEEL was an ultrasonic system to non-destructively look inside sealed stainless steel can to determine if there was water inside and also to determine the condition of the fuel inside the cans. Many research projects investigated the effects of water on the SNF for long periods of time, and the methods to ensure water removal from the SNF. The technologies needed for long term dry storage and dispositioning include:

1. removing the free and bound water
2. determining the effects of hydrogen from the radiolysis of water on the materials
3. material interactions between the SNF and the containers
4. material corrosion modeling for all of the SNF and container materials.

The technologies needed for conditioning the fuel for repository dispositioning include:

1. removal and stabilization of metallic sodium
2. removal of metallurgical mount epoxy
3. methods to ensure that the condition of the fuel after 40 years of dry storage will still meet the transportation and repository acceptance criteria.

The technology needed for characterization included non-destructive assay to determine the radionuclide inventory of the container, including the fissile material inventory, and non-destructive examination of the condition of the SNF.

Prepare Fuel to Meet Storage Criteria

Most of the INEEL SNF inventory has been stored underwater for many years. Some of the fuel has been bare assemblies and some of it has been in cans. For the fuel that has remained intact, the drying should be fairly simple. For the fuel that is not intact or that is stored in cans that are not intact, the drying may be more involved. One example of the dry process is that designed for fuel being moved into the IFSF from CPP-603 basins. The fuel needed to be hot vacuum dried. The SNF was not hot enough to generate its own heat for drying, so it needed to be heated and vacuum dried. However, the SNF included aluminum-clad SNF that could not be dried at high temperatures. In addition, a drying system had to be designed to fit within the existing IFSF SNF receiving area.

A second example of a unique drying station is the one designed for the TMI-2 SNF. The debris, including fuel and low-density concrete, was stored in stainless steel cans full of water for over 20 years. During that time, the debris became saturated with water. It was necessary to design a vacuum

drying system that would heat the debris to over 800°C to drive off all of the water, including that which was bound within the debris.

INEEL LONG TERM OBJECTIVES

Repository and Transportation Requirements

The SNF and its container will need to meet strict transportation and repository acceptance criteria in order to be transported and dispositioned in the repository. The existing transportation criteria are contained in 10 CFR 71. The INEEL assumes that these requirements will not change significantly over the next 30 years. We would like to package the SNF now so that it will meet these requirements and will not have to be re-packaged before it can be shipped to the repository. This involves treating the fuel and ensuring the structural and criticality control features employed during packaging will meet the 10 CFR 71 criteria.

The repository acceptance criteria (10) are still evolving as the design of the repository is being developed. Many of the criteria are firm enough that design solutions to address them can be developed and implemented now.

Treatment to Meet Repository Requirements

Nuclear criticality in the repository was an issue that surfaced early in the repository planning. The initial repository design called for waste packages with large diameters. For HEU fuel, however, it was impossible to show that no criticality would occur with large-diameter packages. Putting only small quantities of HEU in each waste package would simplify the criticality analysis, but the idea of handling a very large number of small waste packages did not appeal to the repository operators. A concept known as co-disposal (8, 9) has been identified to address these issues. Under this concept, SNF and the HLW glass logs would be packaged together. This would allow the repository to use large diameter waste packages, but would limit the quantity of fissile material in each waste package. A waste package has been designed with a ring of five HLW glass logs around the out side and one SNF canister in the middle. Using this "extra" space in the waste package would allow small quantities of HEU to be disposed, but would not increase the number of waste packages or increase the handling costs. The original design has been expanded, and the concept has been adopted by the DOE-Office of Civilian Radioactive Waste Management (RW).

The co-disposal concept would also simplify the handling of the INEEL SNF in the surface facility. Because of the diversity of SNF sizes, DOE-RW felt that it would be impossible to design an effective means to handle all of the SNF assemblies one at a time. The original RW design for a surface facility to handle SNF included moving one assembly at a time from the transportation cask to the waste package. This is still the plan for commercial SNF, which has handling fixtures of compatible designs. A standard canister design for DOE SNF has simplified the handling process. Four standard canisters have been designed with diameters of 18 inches and 24 inches and with lengths of 10 feet and 15 feet.

Forty years of research, development, and operation of liquid-metal-cooled fast breeder reactors have generated about 60 MTHM of sodium-bonded spent nuclear fuel. Most of the fuel is from the EBR-II reactor (~25 MTHM) and the Fermi reactor (34 MTHM) and is stored at the INEEL. This fuel is distinguished from commercial uranium oxide fuel by its metallic fuel meat and its metallic sodium cladding. The presence of sodium could complicate disposal certification and licensing for geological

disposal, since the draft waste acceptance criteria do not allow explosive, pyrophoric, or chemically reactive materials (10). The Record of Decision for managing this fuel chose electrometallurgical treatment at the ANL-W site as the means to stabilize the sodium. An electrorefiner, using a molten salt electrolyte, separates the sodium and fission products from the fuel meat, resulting in highly radioactive ceramic and metallic waste forms, which will be qualified for geological disposal. Treatment of the Fermi fuel has been postponed pending further studies of the electrometallurgical and alternative treatment technologies.

A number of INEEL SNF types consist of small quantities of unique fuel, sometimes referred to as "dogs and cats." A few of these SNF types consisted of only a few quart-sized cans of severely disrupted SNF. In one of the INEEL SNF task team meetings, it was mentioned that "if we could just make this fuel be as durable as naval fuel it would be acceptable." The idea of a high integrity canister (HIC) was born (9). A HIC would be constructed out of extremely corrosion resistant materials, such as zirconium, with a small diameter that would be critically safe by its geometry. The HIC as designed will not corrode over the life of the repository, will not break open (even under beyond-design-basis accidents), and will not go critical. Nuclear criticality analysis will still be necessary, however, because several HICs might be placed into a standard canister.

The presence of organic material in the repository is a potential problem that is still unanalyzed (10). Several scenarios have been hypothesized. For example, some SNF has been mounted in epoxy for metallurgical examination. This epoxy might be considered an organic material. The INEEL is presently evaluating technologies to remove epoxy as part of a treatment program to meet repository requirements.

The chemical reactivity of uranium in spent fuel is another issue being addressed by researchers at the INEEL. Uranium hydride can form as a byproduct of aqueous corrosion. Its pyrophoric nature is well known. Experiments sponsored by the National SNF Program (NSNFP) at ANL-W have resulted in a clearer understanding of the oxidation kinetics of uranium hydride under repository conditions (11).

Repository Dispositioning

Soon after the decision was made by DOE to terminate reprocessing of SNF for the recovery of enriched uranium and plutonium the INEEL began exploring other options for treatment and final dispositioning of the SNF. Initial contacts were made with DOE-RW in 1996, and a task team was set up with INEEL and DOE-RW to evaluate possible options for dispositioning the SNF. This task team prepared a report that outlined the direct disposal options for SNF at the INEEL. The National SNF Program (located at the INEEL) has also been working very closely with the INEEL and other DOE sites to ensure that all Yucca Mountain planning, recommendations, requirements and licensing activities be properly integrated with the spent fuel management activities. The INEEL has also opened contacts with the NRC through DOE-RW and the NSNFP (8, 9).

Because of the diversity of the INEEL inventory, it was concluded that each type of SNF could not be individually addressed in the repository analysis. An evaluation was performed which determined that SNF could be grouped by characteristics important to the particular analysis. The group could then be represented by one fuel. This approach greatly simplified the repository analysis (9).

INEEL SNF was included in the Yucca Mountain Environmental Impact Statement as part of the SNF inventory, and the ANL-W electrometallurgical products were included as high-level waste (HLW) products. The data included chemical, physical, and radiological properties of the material. The INEEL inventory was included in the analysis of all of the potential impacts. No adverse impacts were attributed to the INEEL SNF.

The INEEL SNF is also included in the Yucca Mountain Site Recommendation report that is presently being prepared by DOE-RW and will be included in the repository license application that will be submitted to the NRC in 2002. The same grouping approach is being used in these two documents that was used in the EIS, with additional in enhancements in the characterization data.

Key Milestones

The following key milestones relate to the Consent Order and Settlement Agreement between the State of Idaho and the DOE. These milestones, if not met, could result in halting all shipments of spent nuclear fuel into the State of Idaho per the terms of the Settlement Agreement.

- Beginning TMI-2 fuel debris movement from TAN wet basins - **Completed** 03/31/1999
- Removing all SNF from CPP-603 wet storage by 12/31/2000 – **Completed** 04/28/2000
- Removing TMI-2 fuel debris from TAN wet basins by 06/01/2001
- Beginning loading spent fuel into dry storage (excluding TMI-2 fuel debris covered separately) by 07/01/2003
- Removing all SNF from wet storage by 12/31/2023 (including Navy SNF)
- Completing shipment of SNF from the State of Idaho by 01/01/2035.

CONCLUSIONS

The legacy of the INEEL is a large, diverse inventory of SNF being stored in a large number of aging facilities. With the termination of reprocessing there was no path forward to disposition the SNF. The management of this legacy has included characterizing the SNF and facilities, resolving SNF storage vulnerabilities, consolidating SNF and closing facilities, managing domestic and foreign assigned fuel receipts, developing technologies needed, and ensuring that the SNF inventory or its treatment byproducts are acceptable in a federal repository.

This work funded by the Department of Energy office of Environmental Management under DOE contract number (DE-AC07-99ID13727).

REFERENCES

1. Department of Energy's Record of Decision for Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs, (60 FR 28680) May 30, 1995 and Amendment, March 1996

2. Department of Energy's Record of Decision for Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, (61 FR 25092), May 13, 1996.

3. Settlement Agreement, State of Idaho and the Department of Energy, October 16, 1995 re: Public Service of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0054-S-EJL (D. Id.)

4. Defense Nuclear Facilities Safety Board Recommendation 94-1 to the Secretary of Energy, May 1994 and DOE Implementation Plan, February 28, 1995

5. Settlement Agreement, Contract No. DE-AC07-96ID13425, February 9, 1996, between the United States Department of Energy and Public Service Company of Colorado, Modifying Contract at (04-3)-633, as amended, and Agreement No. DE-SC07-79ID01370, as amended.

6. INEEL ISS Facility Project DE-AC07-99ID13727

7. Spent Nuclear Fuel Dry Storage Project DE-AC07-00ID13729

8. Technical Strategy for the Treatment, Packaging, and Disposal of Aluminum Plate Fuels, June 1996

9. Technical Strategy for the Management of INEEL Spent Nuclear Fuel, Volume I, March 1997

10. Civilian Radioactive Waste Management System, MGDS Waste Acceptance Criteria, B00000000-01717-4600-00095, Rev. 00, Draft A, September 1997

11. "Oxidation Kinetics of Hydride-Bearing Uranium Metal Corrosion Products," T.C. Totemeier, R.G. Pahl, and S.M. Frank, Journal of Nuclear Materials 265 (1999) 308-320.