Inventory and Description of Commercial Reactor Fuels within the United States

Fuel Cycle Research & Development

Prepared for
U.S. Department of Energy
Campaign or Program
Dennis Vinson
Ron Kesterson
Adrian Mendez-Torres
Savannah River National Laboratory

March 31, 2011

FCRD-USED-2011-000093
SRNL-STI-2011-00228

SUMMARY

There are currently 104 nuclear reactors in 31 states, operated by 51 different utilities. Operation of these reactors generates used fuel assemblies that require storage prior to final disposition. The regulatory framework within the United States (U.S.) allows for the licensing of used nuclear fuel storage facilities for an initial licensing period of up to 40 years with potential for license extensions in 40 years increments. Extended storage, for periods of up to 300 years, is being considered within the U.S. Therefore, there is an emerging need to develop the technical bases to support the licensing for long-term storage. In support of the Research and Development (R&D) activities required to support the technical bases, a comprehensive assessment of the current inventory of used nuclear fuel based upon publicly available resources has been completed that includes the most current projections of used fuel discharges from operating reactors.

Negotiations with the nuclear power industry are ongoing concerning the willingness of individual utilities to provide information and material needed to complete the R&D activities required to develop the technical bases for used fuel storage for up to 300 years. This report includes a status of negotiations between DOE and industry in these regards. These negotiations are expected to result in a framework for cooperation between the Department and industry in which industry will provide and specific information on used fuel inventory and the Department will compensate industry for the material required for Research and Development and Testing and Evaluation Facility activities.

This Page Intentionally Left Blank

CONTENTS

FIGURES

TABLES

ACRONYMS

AFR	Away-From-Reactor
BWR	Boiling Water Reactor
EBWR	Experimental Boiling Water Reactor
DOE	U.S. Department of Energy
FBR	Fast Breeder Reactor
ID	Inner Diameter
ISFSI	Independent Spent Fuel Storage Facility
HTGR	High-Temperature Gas-Cooled and Moderated Reactor
NRC	U.S. Nuclear Regulatory Commission
OMR	Organic-Cooled and Moderated Reactor
PCI	Pellet Clad Interaction
PHWR	Pressurized Heavy Water Reactor
PWR	Pressurized Water Reactor
R&D	Research and Development
TEF	Testing and Evaluation Facility
UFD	Used Fuel Disposition
U.S.	United States of America
U.K.	United Kingdom

This Page Intentionally Left Blank

UFD/R&D OPPORTUNITIES INVENTORY AND DESCRIPTION OF COMMERCIAL REACTOR FUELS WITHIN THE UNITED STATES

1 INTRODUCTION

In the United States, nuclear energy provides approximately 20 percent of the total energy production. This makes nuclear power plants the number one source of emission-free electricity in the U.S. There are currently 104 nuclear reactors in 31 states, operated by 51 different utilities.

Operation of these reactors generates used fuel assemblies that require storage prior to final disposition. With the issuance of the policy decision to eliminate Yucca Mountain for consideration as the repository for final disposition of more than 70,000 MTIHM of used nuclear fuel, the storage times required for storage prior to disposition have been greatly increased. There remains no solution for final disposition of used nuclear fuel and no candidates have been identified. The expectation is that used nuclear fuel would remain in prolonged interim storage for up to 300-years.

The regulatory framework within the U.S. allows for the licensing of used nuclear fuel storage facilities for an initial licensing period of up to 40 years with potential for license extensions in 40 years increments. With the expectation shifting from storage for a couple of decades to storage for several millennia, there is an emerging need to develop the technical bases for such extended storage time periods. Development of these technical bases will require research and development (R&D) activities directed at filling specific data and technology gaps that are identified in the technical bases for what has been termed "very long-term storage" (120 → 300 years storage). The purpose of the current work is to develop a comprehensive inventory of used nuclear fuel within the U.S. and to identify potential opportunities for, barriers to, and conditions of collaboration between the current (the utilities) and future (U.S. Department of Energy) owners of the used fuel to conduct the necessary R&D to fill the data gaps.

2 BACKGROUND

The discovery of nuclear fission in Germany was first announced 1939. Initial research in nuclear fission technologies were aimed at development of nuclear weapons. However, this research provided for the development of enrichment technologies and research into the reactor development at the University of Chicago, where the first self-sustaining chain reaction was reported in December 1942. Research at the Chicago Pile experimental reactor lead to the development of the first production reactors at Hanford, Washington and Oak Ridge, Tennessee.

The first reactor for large- scale commercial production of power was the $20MW_e$ Calder Hall reactor, started in 1956 in U.K. The first reactor power project in the U.S. started in 1946. In 1955, the BORAX-III became the first U.S. reactor to put power into a utility on a continuous basis. The Experimental Boiling Water Reactor (EBWR) was commissioned in 1957 and is considered the first commercial-scale reactor in the U.S. From the mid sixties through the early seventies, the number and size of commercial power reactors rapidly increased in the U.S. This trend reversed in the late seventies as orders for new reactors ceased and current projects were cancelled as the demand failed to live up to the projected growth and cost of licensing increased. Accidents in March 1979 and in April of 1986 contributed to the cessation of orders for new nuclear power reactors.

During the forty years between 1956 and 1996, the U.S. nuclear power industry experienced the startup of 134 reactors, including a few early prototype reactors (see Table 1). Of these, there are 104 commercial reactors currently producing electric power, while the other 30 reactors have been shutdown. The existing reactor base is generating approximately 100,000 MW_e and supplying around 20% of the U.S. electric demand. With the production of power, reactor fuel is consumed or converted and discharged from the operating reactors at end of life and during the downtime between the 12-24 month operating cycles. The discharged, or used, reactor fuel must be managed prior to final disposition.

From the beginning of the commercial nuclear power program in the U.S., used commercial power reactor fuel was intended to be removed from the operating reactor sites for final disposition. However, indecision over the final disposition of this material has plagued the nuclear industry to date. Original expectations were that the used fuel would be reprocessed in order to sustain the nuclear industry without exhausting what was thought to be limited natural uranium deposits. Therefore, the reactors were designed with limited storage capacity in fuel pools while awaiting the reprocessing option to materialize. In the early eighties, the official U.S. policy shifted away from reprocessing and adopted a once-through fuel cycle. The Nuclear Waste Policy Act of 1982 provided a framework through which the government, through the U.S. Department of Energy (DOE), would take possession of the used fuel and arrange for a permanent disposal facility. To date, a national facility for permanent disposal of used fuel has not been realized due to technical and political challenges. Current legislation precludes DOE from taking possession of the used fuel, necessitating extended storage periods for used fuel at individual reactors and at independent spent fuel storage facilities (ISFSI).

3 DESCRIPTION OF U.S. COMMERCIAL REACTORS AND REACTOR FUELS

3.1 Reactor Types

Currently, there are 104 operating light water reactors within the United States operated by 51 utilities. Table 2 provides a list of the utilities in the U.S. with the number of reactors owned by each. Of the 104 operating reactors, 69 are pressurized water reactors (PWRs), and the remaining 35 are boiling water reactors (BWRs). Following is a description of these two reactor types. In addition to PWRs and BWRs, the U.S. has some commercial (small-scale) and experimental reactor experience with several other reactor designs including a pressurized heavy water reactor (PHWR), a few fast breeder reactors (FBRs), a couple high-temperature, gas-cooled reactors (HTGRs), a couple sodium-graphite (Na-graphite) reactors, and an organic cooled and moderated reactor (OMR). Table 3 provides a listing of reactors in the U.S. by type. These reactors have all been shut down, and the used fuel associated with these reactors does not contribute significantly to the U.S. used fuel inventory. As such, these reactor types are not discussed further in the current report.

3.1.1 Pressurized Water Reactors

A pressurized water reactor is a light water moderated reactor and is the primary reactor type operating in the U.S. today. For PWRs, the primary coolant loop contains light water that is used to remove heat from the core that is transferred to a secondary coolant loop in a steam generator. The primary coolant loop is maintained at high pressure to prevent the boiling within the loop. The primary coolant also functions as the neutron moderator that slows the neutrons to thermal energies. Figure 1 is a representation of a typical commercial PWR.

The primary coolant transfers heat to the water of the secondary loop in large heat exchangers, called steam generators. Water within the secondary loop is held at lower pressure and allowed to boil to generate steam. The steam is then used to generate electricity through steam turbines, before being condensed and directed back to the steam generators again.

3.1.2 Boiling Water Reactors

The boiling water reactor is the second major type of light water reactor operating in the U.S. In these reactors, the pressure in the single coolant loop is maintained at a much lower pressure than that of a PWR. This lower pressure allows for boiling of the light water coolant/moderator to create steam to drive steam turbines. The steam is subsequently cooled in a condenser and returned as a liquid back to the core to complete the cycle. Figure 2 is a representation of a typical commercial BWR.

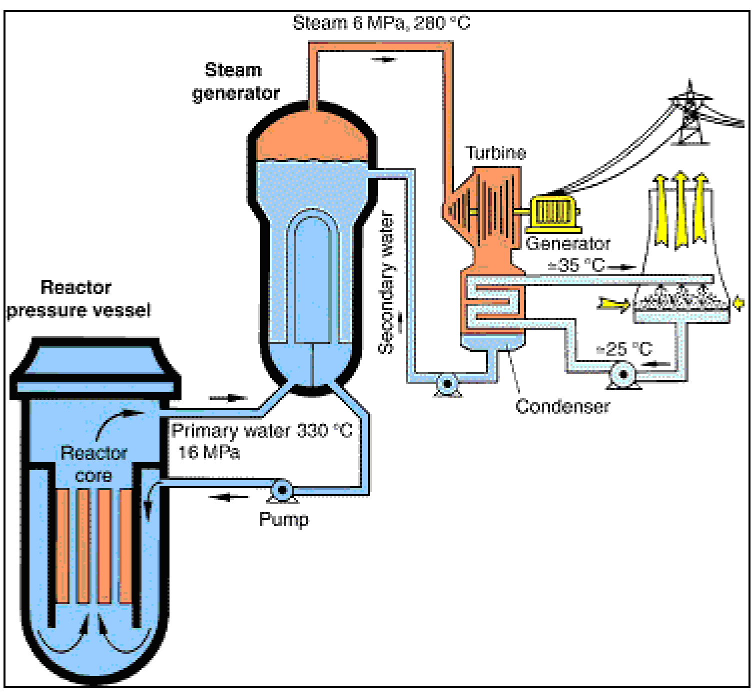


Figure 1 Schematic of a Pressurized Water Reactor (PWR).[1]

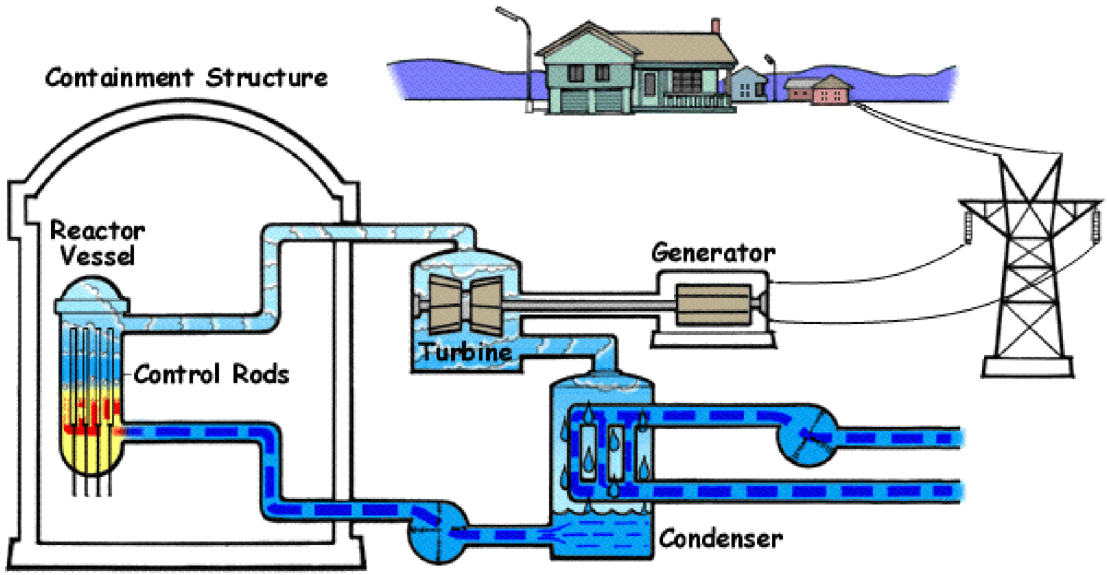


Figure 2 Schematic of a Boiling Water Reactor (BWR).[2]

The design of a boiling water reactor differs significantly from that of a pressurized water reactor in that the boiling water reactor has a single coolant loop that boils within the reactor vessel. The cooling water in the boiling water reactor is generally maintained at about 75 atm (7.6 MPa, 1000–1100 psi) so that it boils in the core at about 285 °C (550 °F). For comparison, the PWR primary coolant is maintained at significantly higher pressure (158 atm) to preclude boiling.

3.2 Fuel Types

Uranium is the conventional reactor fuel in the U.S. For use as nuclear fuel in commercial reactors, the uranium in UF_6 gas enriched in U^{235} to a value of 3-5%. The enriched UF_6 is converted into uranium dioxide (UO_2) powder that is processed into pellet form and fired in a high-temperature, sintering furnace to create hard, ceramic pellets of enriched uranium. The cylindrical pellets are ground to consistent size and clad in corrosion-resistant alloy tubes of approximately 1-cm diameter. The majority of U.S. used fuel inventory is clad in an alloy of zirconium and aluminum due to the high corrosion resistance and low affinity for absorbing neutrons. The loaded tube is sealed and backfilled with helium, for improved thermal heat transfer between the fuel and the cladding and reduce pellet clad interaction and internal cladding degradation. The finished fuel rods are grouped into fuel assemblies that are used to build the core of a power reactor. Figure 3 provides images of some U.S. reactor fuel. Table 4 provides geometry data for fuel assemblies by assembly design type.

3.2.1 Pressurized Water Reactor Fuel

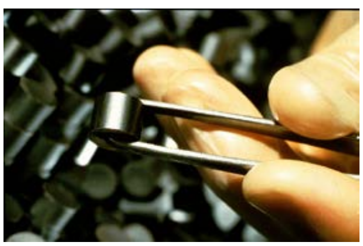
Typical pressurized water reactor fuel bundles/assemblies contain 179-264 rods each and between 125 to 250 such bundles/assemblies makes up a typical reactor core. In general, each fuel bundle is comprised of 14 × 14 to 17 × 17 array of fuel rods that are approximately 4 meters in length. A typical PWR reactor core would contain about 80-100 tonnes of uranium and produce 800 to 1300 MW_e.[3]

3.2.2 Boiling Water Reactor Fuel

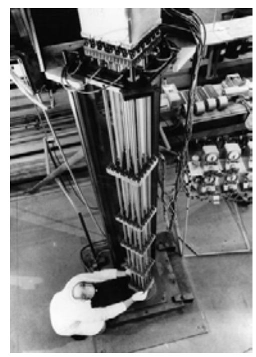
Boiling water reactor fuel is similar to pressurized water reactor fuel, except that boiling water reactor fuel bundles are enclosed a channel made typically of Zircaloy 2 for neutron and thermal hydraulic purposes. In general, each BWR fuel bundle contains 60 to 100 fuel rods per bundle and between 368 to 800 bundles per reactor core.

3.3 Fuel Cladding

Cladding is the outer layer of the fuel rods, separating the coolant and the nuclear fuel pellets. It is made of a corrosion-resistant material with low absorption cross section for thermal neutrons. The older clad alloys are usually Zircaloy 2 or 4 and some of the newer assemblies incorporate advanced zirconium based alloys. Below is a discussion of the various fuel cladding alloys.



Pre-irradiated Fuel Pellets.[4]



A Fuel Assembly.[5]

Zirconium Fuel Tubes.[5]

Pre-irradiated Fuel Pellets ready for assembly.

New (pre-irradiated) U.S. fuel being inspected.[4]

Figure 3 U.S. Nuclear Fuel Assembly.

3.3.1 Initial Cladding Alloys

3.3.1.1 Stainless Steel

Until the late-1970s commercial fuel rods used austenitic stainless steel that was primarily Type 304 as cladding with some Type 348H.[6] Issues with stress corrosion cracking in the stainless steel cladding resulted in a shift to Zircaloy 2 for BWR applications.[7] In PWR reactors the SS cladding performed well regarding fabricability and corrosion resistance during operation, but it had a relatively high thermal neutron absorption cross section. Because of this negative neutron economy impact, the stainless steel cladding was phased out and replaced by Zircaloy-4. With this early phase-out of SS cladding, there exists in storage only a small fraction of SS clad commercial spent fuel assemblies.

3.3.1.2 Zircaloy 2

Zircaloy 2 was chosen to replace SS in BWR cladding applications. The Zircaloy 2 alloy has about 98% zirconium with alloy additions of tin, iron, chrome and nickel. Zircaloy 2 is generically categorized as grade R60802 in ASTM B811 and B353 and is used extensively for BWR cladding. Prior to 1991 the applicable ASTM specification was B353 before being replaced by ASTM B811. Table 5 lists the nominal alloy element levels for Zircaloy 2.

3.3.1.3 Zircaloy 4 (high tin)

Zircaloy 4 is defined by ASTM B811 grade R60804, although some vendors produce Zircaloy 4 cladding per their own specifications which provide for more specific controls. Prior to 1991, the applicable ASTM specification was B353 before being replaced by ASTM B811.

Zircaloy 4 is similar to Zircaloy 2 except Zircaloy 4 has the nickel removed to reduce hydrogen absorption in the PWR environment. To offset the strength reduction more iron was added to the Zircaloy 4 version.[7]

The Zircaloy 4 specification has a tin range of 1.25 to 1.7%. The initial versions of Zircaloy 4 were produced with tin levels at 1.55% or nearer the upper tin limit. Also the level of carbon was permitted to be 270 ppm maximum. Carbon is an impurity, but it has positive effects in microstructure control and at high levels has negative effects on corrosion resistance and growth. In the late 1980s, improved versions of Zircaloy 4 were introduced that provided tighter controls on tin and carbon in addition to other parameters, such as annealing. The typical alloy element levels for Zircaloy 4 are shown in Table 5.

3.3.2 Current Domestic Cladding Alloy Types

There are primarily four cladding alloy types currently operating in large quantities and in multiple fuel regions of commercial reactors. They are lined Zircaloy 2, improved Zircaloy 4, M5® and, ZIRLO™. Optimized ZIRLO™ is also being introduced for very high duty applications and is present as multiple regions in a few reactors. The typical alloy element levels for these alloys are also shown in Table 5.

3.3.2.1 Zircaloy 2 – Lined

The bulk of the BWR fuels are now operating with lined Zircaloy 2 cladding. The Zircaloy 2 clad is similar to the earlier versions but has iron and nickel adjusted towards the upper limits and tin adjusted towards the lower limit of the ASTM range.[8]

The ID liner which is "softer" than the base clad is pure zirconium or zirconium with small alloy additions. The liner is designed to accommodate the strains resulting from pellet expansions with reactor core power level changes along with mitigating stress corrosion assisted cracking on the clad ID surface; a condition referred to as PCI (pellet clad interaction) failures.

3.3.2.2 Low Tin – Improved Zircaloy 4

With the increase in fuel duty and burn up more margins to the corrosion and hydrogen design limits were needed for cladding. For PWRs applications Zircaloy 4 was improved with a reduction in the tin level aim, improved controls over some impurity/alloy elements such as carbon and nitrogen and an optimization of the anneal process to produce a consistent and desirable microstructure, referred to as A-Time control. The improved versions of Zircaloy 4 were introduced by fuel vendors starting in the late 1980's. The improved corrosion resistance of this material supported use to higher burn-up and with higher duties thus while a more robust alloy than the standard Zircaloy 4, at the EOL some of the fuel rod cladding has oxide and hydrogen levels near the design limits.[9-11]

3.3.2.3 M5® [12]

AREVA introduced the Alloy M5® for fuel applications in the 1990's with 16 U.S. commercial reactors having used or are using M5® clad fuel which is now considered the AREVA PWR reference alloy. M5® is an alloy from the Zr – 1% Nb family having no alloy additions of tin and chrome like the Zircaloys and only minor amounts of iron (400 ppm) and oxygen (1400 ppm). Sulfur at about 25 ppm is also added to improve the creep strength. Performance data indicates that in reactor operation the clad oxidation is significantly reduced compared to Zircaloy 4 for the same burn up conditions.

3.3.2.4 ZIRLO™ [13]

ZIRLO is a Zr -1% Nb - 1% Sn - 0.1% Fe alloy with the typical addition of 0.12 % O. Westinghouse introduced ZIRLO in early 1990's as a replacement for Improved Zircaloy 4 for higher duty operations and it has become the reference alloy for Westinghouse fuel cladding with most if not all of the Westinghouse fueled domestic reactors using ZIRLO cladding. ZIRLO has enhanced corrosion resistance and lower hydrogen levels compared to Zircaloy 4 for equivalent burn ups and fuel duties. With the tin and iron additions ZIRLO is a robust alloy that is resistant to coolant chemistry variation effects. ZIRLO and M5 are also resistant to oxide spalling which is observed in some high burn up Zircaloy 4 fuel.

3.3.2.5 Optimized ZIRLO[tm 14]

Westinghouse developed Optimized ZIRLO to provided added performance margin for high duty fuel applications. Optimized ZIRLO has the basic characteristics of standard ZIRLO but has a 35% reduced tin level to a range of 0.6 % to 0.8 % while maintaining the niobium at 1% and iron at 0.1% levels. The reduced tin has shown improved corrosion resistance compared to standard ZIRLO with peak oxides less than 40 microns at discharge burn ups of 62 GWD/MTU. In 2005, the NRC approved optimized ZIRLO for use in reactor fuel and as of 2010 the alloy is in use as regions in a few commercial reactors.

3.3.2.6 Potential New Advanced Metal Alloy Cladding

The fuel vendors are evaluating other advanced alloys for future applications. Currently the new alloys are being used in reactor in test assemblies and thus do not represent a significant quantity for storage consideration. As new alloys are developed it is appropriate that their dry storage characteristics be included as part of their data generation scope.

4 COMMERCIAL STORAGE OF DISCHARGED FUEL

Used nuclear fuel is stored predominantly at 83 locations throughout the United States. These locations include reactor storage pools, independent spent fuel storage installations, national laboratories, and defense sites. These locations are detailed on Table 6 and shown graphically in Figure 4.

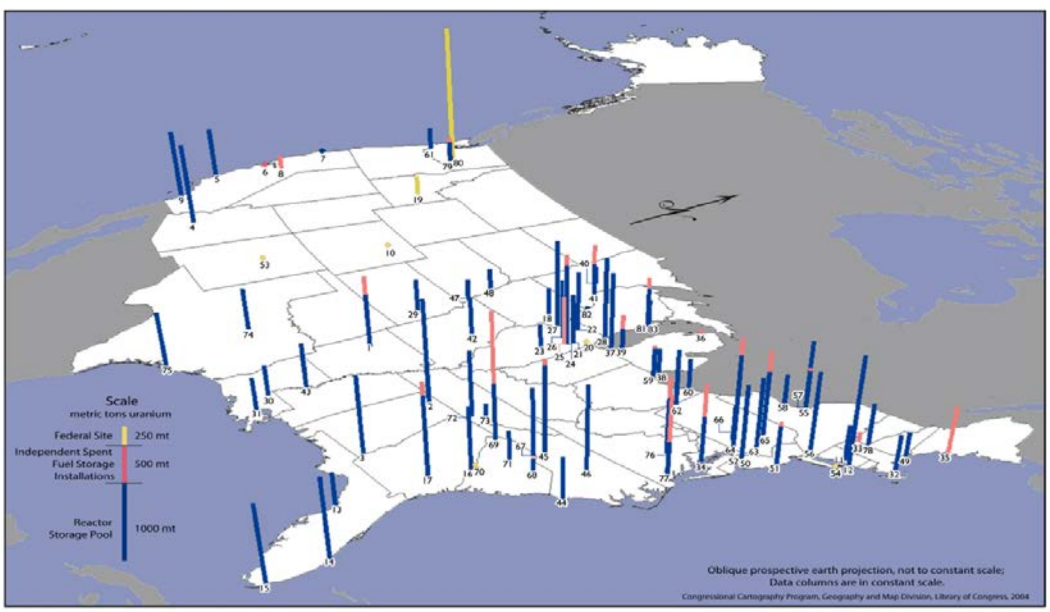


Figure 4 Reactor Storage Pools, Independent Spent Fuel Storage Installations, Federal, and Other Sites.[15]

4.1 Commercial Wet Storage in Fuel Pools

Every operating reactor has a fuel pool for temporary storage of used assemblies discharged from the reactor. Figure 5 presents a picture of the used fuel pool at Yankee Rowe. During operation, about one-quarter to one-third of the total fuel load from the reactor is spent and removed from the reactor every 12-18 months and replaced with fresh fuel. The discharged fuel assemblies will each have experienced different exposure conditions (e.g., power, temperature, neutron flux, burnup, etc.) dependent upon its location within the core during exposure and total exposure time. Each assembly will therefore be unique in composition and mechanical characteristics. Table 7 provides the range of used fuel burnup for the assemblies discharged by the reactor.

Over the last few decades of commercial reactor operation has resulted spent fuel pools that have been reaching capacity. Reracking of the spent fuel pool grids and fuel rod consolidation operations undertaken by the utilities has significantly increased fuel pool capacity at existing reactor fuel pools. However, these activities have only postponed the inevitable situation of having full fuel pools.

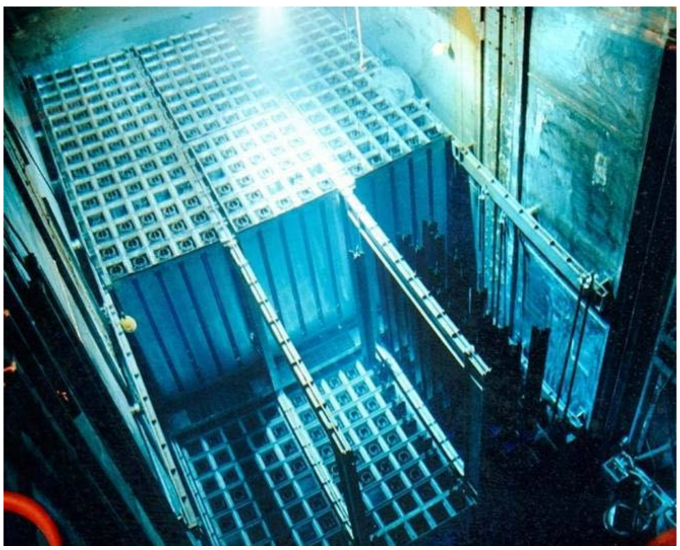


Figure 5 Used Fuel Pool at Yankee Rowe.

Table 8 lists the fuel pool types and capacities by utility, and Table 9 provides the year that each of the commercial nuclear plants in the United States will run out of on-site storage space in their fuel pools for discharged nuclear fuel. Figure 6 shows the number of operating reactors are already storing used fuel quantities that exceed their capacity with time. As reactor fuel pool inventories have approached capacity, utilities have been forced to utilize alternative used fuel storage strategies. These used fuel storage strategies include expansion of existing fuel pools, construction of new fuel pools, and the incorporation of independent wet or dry storage facilities. These storage facilities have been constructed both at operating reactors and at other facilities that are not collocated with operating reactors. The lone away-from-reactor (AFR) storage facility that utilizes wet storage technology for storage of used nuclear fuel in the U.S. is the GE Morris Operation in Illinois. The Morris facility, operational since 1972, was designed to receive one year cooled used uranium dioxide fuel. The storage capacity of the facility was increased from 100 to 750 tonnes heavy metal in 1976 by installation of high density fuel storage racks and changes in fuel handling and support systems.

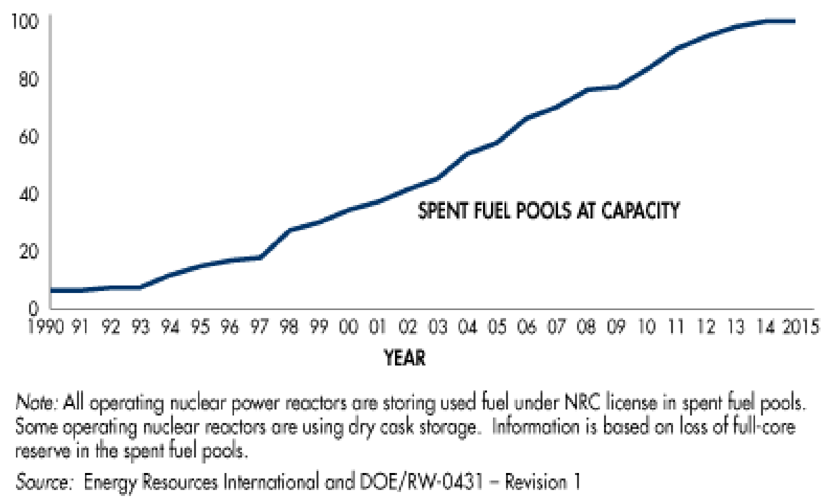


Figure 6 Cumulative Number of Filled Fuel Pools

The remainder of away from reactor storage facilities in the U.S. utilizes one of a number of licensed dry storage system technologies. Reference 17 provides an excellent description of licensed dry storage systems. These dry storage systems are generally incorporated in ISFSIs. The ISFSIs may be collocated with operational reactors, located independent of any reactor, or located on the site of shutdown or decommissioned reactor facilities. Figure 7 provides a map of the ISFSIs located in the U.S. as of May 2009.

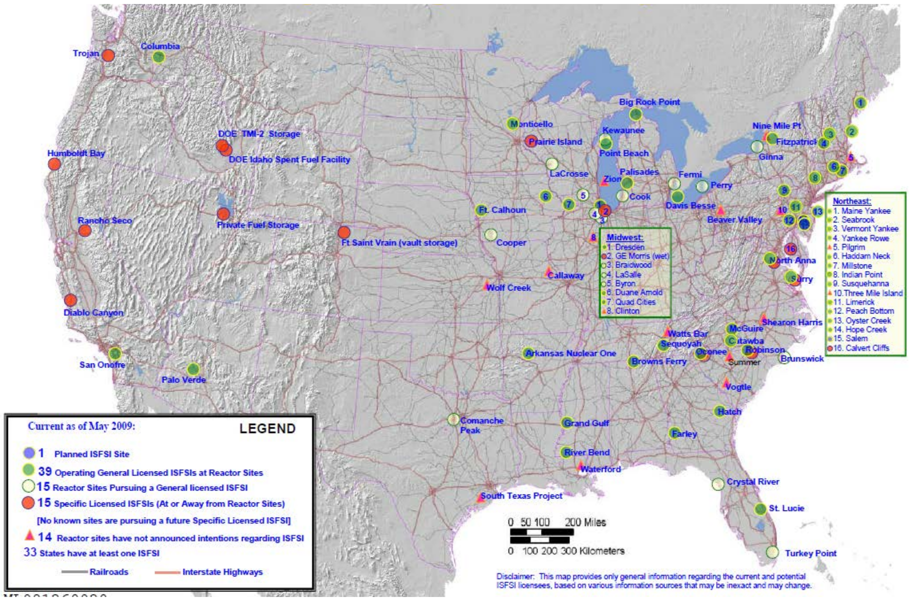


Figure 7 U.S. Independent Spent Fuel Storage Installations.

4.2 Commercial Dry Storage of Discharged Fuel

As the number of reactor fuel pools that has reached capacity has increased, the number and types of dry storage facilities in operation and under construction has increased. The past 10-15 years has seen a significant increase in the development and construction of dry storage capacity. This increasing need for dry storage systems has lead to development of new concepts for dual-purpose (storage and transport) or multi-purpose (storage, transport and disposal) applications. Dry storage systems allow for a scalable solution to the problem of used fuel storage. These systems generally have lower operating costs. Capital costs for these systems may be dispersed over time by allowing additional storage capacity to be constructed on an as-needed basis. Figure 8 shows the dual-purpose dry-storage facility at Connecticut Yankee. This concept utilized individual dry storage cask in overpacks that are stored vertically on a pad, while Figure 9 shows the vault storage concept in which the dry storage cask is stored horizontally in individual vaults. Tables 10 and 11 provide the current inventory of used fuel in dry storage cask by cask vendor and by utility, respectively.

Figure 8 Connecticut Yankee Dual-Purpose Dry Storage Facility.

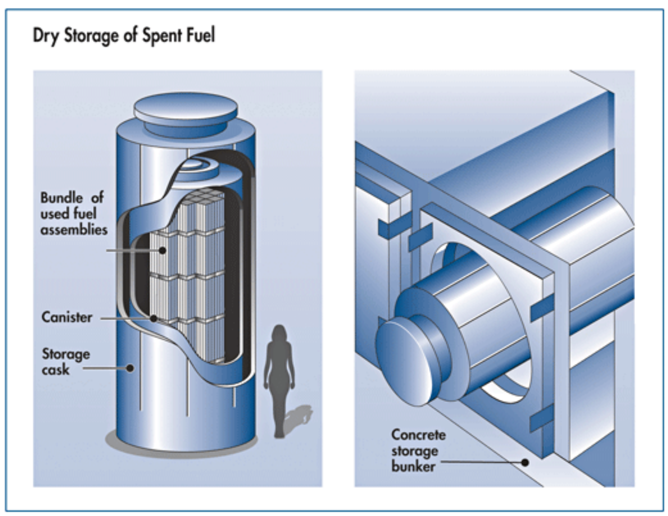


Figure 9 Used Fuel Dry Storage Systems[18]

4.3 Used Nuclear Fuel Storage at Shutdown Reactors

As the U.S. reactors reach their license termination date, the utility owner may apply for a license extension for the reactor. Table 12 provides general license termination data for U.S. commercial power reactors. Data is provided on the initial license termination dates along with information on the status of license extension applications, where applicable. Those reactors that are not granted a license extension, or those for which a license extension has not been sought, are then placed in a shutdown mode awaiting decommissioning.

There are fifteen shutdown reactors at fourteen sites in ten states that are currently storing used nuclear fuel in either wet or dry storage conditions. Table 13 provides a list of shutdown reactors that had a power rating greater than 100 MW. After shutdown, the reactors are scheduled for decommissioning. Table 14 provides the decommissioning status of shutdown power reactors. In some cases, shutdown reactors are decommissioned without complete deinventory of the used fuel stores at the site. The data in Table 14 includes the quantities and locations (in metric tons uranium) of the stored used fuel at the shutdown reactors. Four of these locations have operating reactors and two of these locations utilize pool storage. There are currently six facilities that have been completely decommissioned, sans deinventory. These facilities are termed “orphan” sites, due to the presence of independent spent fuel storage installations, without a collocated reactor or a fuel pool in which to unload the storage casks.

5 FEDERAL STORAGE OF DISCHARGED COMMERCIAL FUEL

Spent nuclear fuel at federal storage is principally stored at 4 locations throughout the United States. These include defense and non defense federal facilities (national laboratories and defense weapons sites[19]). Commercial nuclear fuel at us facilities includes scrap or segmented rods in canister, assembly, rods and rod array, element, and debris. Depending upon the facility, the spent fuel may either be pool or dry stored. With the exception of Savannah River Site that maintains and operates a wet storage facility, all the fuel throughout the federal facilities is kept in dry storage system. Detailed information by federal facility, type of fuel, cladding and others is included in Tables 16 - 19.

In addition to national laboratories and defense weapons sites, the B&W Lynchburg Technology Center facility and a number of universities that have reported small quantities of used fuel material that has been discharged from commercial power reactors. Tables 20 & 21 details the current inventory of used fuel from commercial power reactors and Table 22 provides a list of utilities reporting used fuel from commercial power reactors.

6 POTENTIAL COLLABORATION BETWEEN THE DEPARTMENT AND INDUSTRY

The UFD Campaign requires information from industry on the inventory of used nuclear fuel and material for R&D effort and for a long-term demonstration effort. The information needed includes specific data on the exposure, storage, and treatment of used fuel rods and assemblies from power reactors in the U.S. The materials needs are two-fold. The R&D effort requires small quantities of used fuel materials, on the order of a couple to a few rods. These fuel rods will be extracted from high-burnup used fuel assemblies and from both PWRs and BWRs. The rods will be destructively examined and tested to provide data on the physical, mechanical, structural, chemical, and radiochemical characteristics of used in conditions consistent with extended dry storage of the fuel. The full-scale demonstration effort, named the Testing and Evaluation Facility (TEF), will require a number of complete used fuel assemblies, sufficient to fill multiple, up to ~4, dry storage casks. These will be both high and low burnup fuel assemblies taken from both PWRs and BWRs. The assemblies will be loaded in instrumented dry storage cask to allow for a long-term demonstration effort. The instrumented cask will provide data that is crucial to demonstrating the condition of used high burnup fuel during extended dry storage.

A framework is being developed for cooperation between the nuclear power industry and the Department of Energy through which both information and material related to used nuclear fuel may be shared. This framework will provide the mechanisms by which the information on used fuel inventory presented in the current report may be updated and expanded. In addition, the framework will provide the mechanisms by which DOE will secure both lab-scale quantities necessary for the UFD R&D efforts and large-scale quantities necessary for the full-scale demonstration project, TEF, from nuclear power industry.

Negotiations between DOE and industry are ongoing. Currently, no additional inventory information has been exchanged. In addition, no commitment has been secured from any utility concerning the provision of material, either rods or assemblies, for use in the UFD campaign. However, it is expected that continued efforts in these negotiations will result in a mutually beneficial framework for cooperation between DOE and the fuel owners.

7 CONCLUSION

This report provides the inventory of used nuclear fuel being stored in the United States based upon publicly available resources. It includes the most current projections of used fuel discharges from operating reactors. It includes a status of negotiations between DOE and industry. These negotiations are ongoing and are expected to result in a framework for cooperation between the Department and industry in which industry will provide and specific information on used fuel inventory and the Department will compensate industry for the material required for R&D and TEF activities.

8 REFERENCES

[1] Courtesy of EuroNuclear, *"What is a Nuclear Reactor? European Nuclear Society,"* webpage, **http://www.euronuclear.org/info/energy-uses.htm**

[2] Courtesy of NRC. http://www.nrc.gov/reading-rm/basic-ref/students/animated-bwr.html

[3] Glasstone & Sesonske 1994, pp. 21

[4] Courtesy of NRC. http://www.nrc.gov/reading-rm/basic-ref/students/animated-bwr.html

[5] Courtesy of Princeton University: http://blogs.princeton.edu/chm333/f2006/nuclear/05_fuel_fabrication/01_types_of_fuel/

[6] Reich, W.J., Moore, R.S., and Notz, K.J. *Distribution of Characteristics of LWR Spent Fuel* ORNL/TM – 11670, January 1991.

[7] Schemel. J.H. *Zirconium Alloy Fuel Clad Tubing Engineering Guide,* Sandvik Special Metals Corporation , December 1989.

---

[8] Graham, R.A. and Eucken, C.M., *Controlled Composition Zircaloy-2 Uniform Corrosion Resistance,* ASTM STP 1132, 9th International Symposium on Zirconium in the Nuclear Industry; 1991 pp. 279-303.

[9] Garde, A.M.et.al., *Corrosion Behavior of Zircaloy-4 Cladding with Varying Tin Content in High-Temperature Pressurized Water Reactors;* ASTM STP 1245, 10th International Symposium on Zirconium in the Nuclear Industry; 1994 pp. 760-778.

[10] Mardon, J.P. et.al., *Optimization of PWR Behavior of Stress-relieved Zircaloy-4 Cladding Tubes by Improving the Manufacturing and Inspection Process;* ASTM STP 1245, 10th International Symposium on Zirconium in the Nuclear Industry; 1994 pp. 328-348.

[11] Sabol, G. et.al. *In-Reactor Corrosion Performance of ZIRLOtm and Zircaloy 4;* ASTM STP 1254 , 10th International Symposium on Zirconium in the Nuclear Industry, 1994 pp. 724-744.

[12] Mardon, J.P., Garner, G.L., and Hoffmann, P.B. *M5®, a Breakthrough in Zr Alloy* 2010 LWR Fuel Performance Meeting Top Fuel ; September 2010 Orlando Florida.

[13] Sabol, G. et.al.; *Development of a Cladding Alloy for High Burnup* ; ASTM STP 1023 8th International Symposium on Zirconium in the Nuclear Industry, 1989 pp 227-244.

[14] Wikmark, G. et.al., *Cladding to Sustain Corrosion, Creep and Growth at High Burn-ups;* Nuclear Engineering and technology, Vol 41 No.2 March 2009-Special Issue on the Water Reactor Fuel Performance Meeting 2008.

[15] CRS RS22001, updated 2004.

[16] Courtesy of www.nukeworker

[17] Industry Spent Fuel Storage Handbook, EPRI Report Number 1021048 (July 2010).

[18] Courtesy of NRC; **http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/dry-cask-storage.html.**

[19] **Spent Nuclear Fuel Storage Locations and Inventory ,** Anthony Andrews Specialist in Industrial Engineering and Infrastructure Policy Resources, Science, and Industry Division, CRS Report to Congress Order Code RS22001 Updated 2005.

Appendix A

Tables

TABLES

Table 1 Commercial Power Reactors in the U.S.

Facility	Process	Capacity MW_e net	Current Status	Start Year	Owner
Allens Creek-2	BWR	1150	Suspended indefinitely/Cancelled		
Argonne EBWR	BWR	5	Shut down	1956	US Department of Energy (DOE)
Arkansas Nuclear-1	PWR	836	Operating	1974	Entergy Nuclear
Arkansas Nuclear-2	PWR	965	Operating	1980	Entergy Nuclear
Bayside	BWR	1000	Suspended indefinitely/Cancelled		Atlantic City Electric
Beaver Valley-1	PWR	810	Operating	1976	First Energy
Beaver Valley-2	PWR	833	Operating	1987	First Energy
Bellefonte-1	PWR	1213	Suspended indefinitely/Cancelled		Tennessee Valley Authority (TVA)
Bellefonte-2	PWR	1213	Suspended indefinitely/Cancelled		Tennessee Valley Authority (TVA)
Big Rock Point	BWR	67	Shut down	1963	Consumers Energy
Bonus (Demo)	BWR	17	Shut down		US Department of Energy (DOE)
Braidwood-1	PWR	1120	Operating	1988	Exelon Nuclear Co
Braidwood-2	PWR	1120	Operating	1988	Exelon Nuclear Co
Browns Ferry-1	BWR	1065	Operating	1974	Tennessee Valley Authority (TVA)
Browns Ferry-2	BWR	1118	Operating	1975	Tennessee Valley Authority (TVA)
Browns Ferry-3	BWR	1118	Operating	1977	Tennessee Valley Authority (TVA)
Brunswick-1	BWR	820	Operating	1977	Progress Energy Corp
Brunswick-2	BWR	811	Operating	1975	Progress Energy Corp
Byron-1	PWR	1105	Operating	1985	Exelon Nuclear Co
Byron-2	PWR	1105	Operating	1987	Exelon Nuclear Co
Callaway-1	PWR	1235	Operating	1984	Ameren
Calvert Cliffs-1	PWR	825	Operating	1975	Constellation Energy
Calvert Cliffs-2	PWR	825	Operating	1977	Constellation Energy
Carolinas CVTR	PHWR	17	Shut down	1963	CVNPA
Catawba-1	PWR	1129	Operating	1985	Duke Power Co
Catawba-2	PWR	1129	Operating	1986	Duke Power Co
Cherokee-1	PWR	1280	Construction suspended		Duke Power Co
Cherokee-2	PWR	1280	Construction suspended		Duke Power Co
Clinch River	FBR	350	Suspended indefinitely/Cancelled		Tennessee Valley Authority (TVA)
Clinton-1	BWR	930	Operating	1987	AmerGen Energy Co
Columbia (WNP-2)	BWR	1150	Operating	1984	Energy Northwest
Comanche Peak-1	PWR	1150	Operating	1990	TXU Electric Co
Comanche Peak-2	PWR	1150	Operating	1993	TXU Electric Co
Cooper	BWR	764	Operating	1974	Nebraska Public Power District (NPPD)
Crystal River-3	PWR	868	Operating	1977	Progress Energy Corp
Crystal River-4	PWR	910	Suspended indefinitely/Cancelled		Progress Energy Corp
Davis Besse-1	PWR	877	Operating	1978	First Energy
Diablo Canyon-1	PWR	1130	Operating	1985	Pacific Gas and Electric Co (PG&E)

Facility	Process	Capacity MW_e net	Current Status	Start Year	Owner
Diablo Canyon-2	PWR	1160	Operating	1986	Pacific Gas and Electric Co (PG&E)
Donald Cook-1	PWR	1020	Operating	1975	Indiana Michigan Power Co
Donald Cook-2	PWR	1108	Operating	1978	Indiana Michigan Power Co
Dresden-1	BWR	200	Shut down	1960	Commonwealth Edison (CommEd)
Dresden-2	BWR	912	Operating	1970	Exelon Nuclear Co
Dresden-3	BWR	794	Operating	1971	Exelon Nuclear Co
Duane Arnold-1	BWR	600	Operating	1975	FPL Group
EBR-II (test)	FBR	17	Shut down	1964	Argonne National Laboratory (ANL)
Elk River	BWR	22	Shut down	1964	US Department of Energy (DOE)
Enrico Fermi-1	FBR	61	Shut down	1966	PRDC
Enrico Fermi-2	BWR	1139	Operating	1988	Detroit Edison Co
Farley-1	PWR	828	Operating	1977	Alabama Power
Farley-2	PWR	838	Operating	1981	Alabama Power
FitzPatrick	BWR	780	Operating	1975	Entergy Nuclear
Fort Calhoun-1	PWR	485	Operating	1974	Omaha Public Power District (OPPD)
Fort St Vrain	HTGR	330	Shut down	1979	Public Service Co of Colorado (PSCC)
Grand Gulf-1	BWR	1204	Operating	1985	Entergy Nuclear
H B Robinson-2	PWR	683	Operating	1971	Progress Energy Corp
Haddam Neck	PWR	590	Shut down	1968	Northern Utilities
Hallam	Na-graphite	75	Shut down	1963	DOE/NPPD
Hartsville-A1	BWR	1206	Suspended indefinitely/Cancelled		Tennessee Valley Authority (TVA)
Hartsville-A2	BWR	1206	Suspended indefinitely/Cancelled		Tennessee Valley Authority (TVA)
Hatch-1	BWR	863	Operating	1975	Southern Nuclear Operating Co
Hatch-2	BWR	878	Operating	1979	Southern Nuclear Operating Co
Hope Creek-1	BWR	1031	Operating	1986	Public Service Electric and Gas Co (PSEG)
Humboldt Bay	BWR	63	Shut down	1963	Pacific Gas and Electric Co (PG&E)
Indian Point-1	PWR	255	Shut down	1962	Entergy Corp
Indian Point-2	PWR	975	Operating	1974	Entergy Nuclear
Indian Point-3	PWR	979	Operating	1976	Entergy Nuclear
Kewaunee	PWR	545	Operating	1974	Dominion Resources
LaCrosse	BWR	50	Shut down	1969	DPC
LaSalle-1	BWR	1078	Operating	1984	Exelon Nuclear Co
LaSalle-2	BWR	1078	Operating	1984	Exelon Nuclear Co
Limerick-1	BWR	1200	Operating	1986	Exelon Nuclear Co
Limerick-2	BWR	1200	Operating	1990	Exelon Nuclear Co
Maine Yankee	PWR	870	Shut down	1972	Maine Yankee Atomic Power Co
McGuire-1	PWR	1100	Operating	1981	Duke Power Co
McGuire-2	PWR	1100	Operating	1984	Duke Power Co
Midland-1	PWR	492	Suspended indefinitely/Cancelled		Consumers Power Corp
Midland-2	PWR	816	Suspended indefinitely/Cancelled		Consumers Power Corp
Millstone-1	BWR	660	Shut down	1971	Northern Utilities
Millstone-2	PWR	875	Operating	1975	Dominion Virginia Power

Facility	Process	Capacity MW_e net	Current Status	Start Year	Owner
Millstone-3	PWR	1152	Operating	1986	Dominion Virginia Power
Monticello	BWR	593	Operating	1971	Xcel Energy
Nine Mile Point-1	BWR	610	Operating	1969	Constellation Energy
Nine Mile Point-2	BWR	1143	Operating	1988	Constellation Energy
North Anna-1	PWR	925	Operating	1978	Dominion Virginia Power
North Anna-2	PWR	917	Operating	1980	Dominion Virginia Power
Oconee-1	PWR	846	Operating	1973	Duke Power Co
Oconee-2	PWR	846	Operating	1974	Duke Power Co
Oconee-3	PWR	846	Operating	1974	Duke Power Co
Oyster Creek	BWR	610	Operating	1969	AmerGen Energy Co
Palisades	PWR	789	Operating	1971	Consumers Energy
Palo Verde-1	PWR	1243	Operating	1986	Arizona Nuclear Power Project (ANPP)
Palo Verde-2	PWR	1243	Operating	1986	Arizona Nuclear Power Project (ANPP)
Palo Verde-3	PWR	1247	Operating	1988	Arizona Nuclear Power Project (ANPP)
Pathfinder test reactor	BWR	59	Shut down	1966	Northern States Power (NSP)
Peach Bottom-1	HTGR	40	Shut down	1967	PEC
Peach Bottom-2	BWR	1110	Operating	1974	Exelon Nuclear Co
Peach Bottom-3	BWR	1110	Operating	1974	Exelon Nuclear Co
Perry-1	BWR	1265	Operating	1987	First Energy
Perry-2	BWR	1205	Construction suspended		First Energy
Pilgrim-1	BWR	670	Operating	1972	Entergy Nuclear
Piqua	OMR	11	Shut down	1963	US Department of Energy (DOE)
Point Beach-1	PWR	485	Operating	1970	Wisconsin Electric Power Co
Point Beach-2	PWR	485	Operating	1972	Wisconsin Electric Power Co
Prairie Island-1	PWR	530	Operating	1973	Xcel Energy
Prairie Island-2	PWR	530	Operating	1974	Xcel Energy
Quad Cities-1	BWR	789	Operating	1973	Exelon Nuclear Co
Quad Cities-2	BWR	789	Operating	1973	Exelon Nuclear Co
R E Ginna	PWR	495	Operating	1970	Constellation Energy
Rancho Seco	PWR	913	Shut down	1975	Sacramento Municipal Utility District (SMUD)
River Bend-1	BWR	936	Operating	1986	Entergy Nuclear
Salem-1	PWR	1106	Operating	1977	Public Service Electric and Gas Co (PSEG)
Salem-2	PWR	1106	Operating	1981	Public Service Electric and Gas Co (PSEG)
San Onofre-1 (SONGS-1)	PWR	436	Shut down	1968	Southern Calfornia Ed.(80%), SDGE(20%)
San Onofre-2	PWR	1070	Operating	1983	Southern California Edison
San Onofre-3	PWR	1080	Operating	1984	Southern California Edison
Santa Susana SRE	Na-graphite	8	Shut down	1957	DOE leased to SoCalEd
Seabrook-1	PWR	1162	Operating	1990	Florida Power and Light Co (FPL)
Sequoyah-1	PWR	1147	Operating	1981	Tennessee Valley Authority (TVA)
Sequoyah-2	PWR	1142	Operating	1982	Tennessee Valley Authority (TVA)
Shearon Harris-1	PWR	860	Operating	1987	Progress Energy Corp
Shippingport	PWR	60	Shut down	1957	US Department of Energy (DOE)

Facility	**Process**	**Capacity MW_e net**	**Current Status**	**Start Year**	**Owner**
Shoreham	BWR	809	Shut down	1985	Long Island Power Authority
South Texas-1	PWR	1268	Operating	1988	STP Nuclear Operating Co
South Texas-2	PWR	1268	Operating	1989	STP Nuclear Operating Co
St. Lucie-1	PWR	839	Operating	1976	Florida Power and Light Co (FPL)
St. Lucie-2	PWR	839	Operating	1983	Florida Power and Light Co (FPL)
Surry-1	PWR	810	Operating	1972	Dominion Virginia Power
Surry-2	PWR	815	Operating	1973	Dominion Virginia Power
Susquehanna-1	BWR	1100	Operating	1983	Pennsylvania Power and Light Co (PP&L)
Susquehanna-2	BWR	1103	Operating	1985	Pennsylvania Power and Light Co (PP&L)
Three Mile Island-1	PWR	786	Operating	1974	AmerGen Energy Co
Three Mile Island-2	PWR	905	Shut down	1978	Pen/JCPL/MetEd
Trojan	PWR	1095	Shut down	1976	PortGE/PAcPL/EWEB
Turkey Point-3	PWR	693	Operating	1972	Florida Power and Light Co (FPL)
Turkey Point-4	PWR	693	Operating	1973	Florida Power and Light Co (FPL)
Vallecitos VBWR	BWR	5	Shut down	1957	General Electric
Vermont Yankee	BWR	510	Operating	1972	Entergy Nuclear
Virgil C Summer-1	PWR	885	Operating	1984	South Carolina Electric and Gas Co
Vogtle-1	PWR	1148	Operating	1987	Southern Nuclear Operating Co
Vogtle-2	PWR	1149	Operating	1989	Southern Nuclear Operating Co
Vogtle-3	PWR	1000	Construction		Southern Nuclear Operating Co
Vogtle-4	PWR	1000	Construction		Southern Nuclear Operating Co
Waterford-3	PWR	1075	Operating	1985	Entergy Nuclear
Watts Bar-1	PWR	1128	Operating	1996	Tennessee Valley Authority (TVA)
Watts Bar-2	PWR	1177	Under construction		Tennessee Valley Authority (TVA)
WNP-1	PWR	1259	Construction suspended		WPPSS
WNP-3	PWR	1240	Construction suspended		WPPSS
WNP-4	PWR	1259	Construction suspended		WPPSS
WNP-5	PWR	1240	Construction suspended		WPPSS
Wolf Creek	PWR	1135	Operating	1985	KGE/KCPL/KEPC
Yankee Rowe	PWR	167	Shut down	1961	Yankee Atomic Electric Co
Yellow Creek-1	PWR	1285	Suspended indefinitely/Cancelled		Tennessee Valley Authority (TVA)
Yellow Creek-2	PWR	1285	Suspended indefinitely/Cancelled		Tennessee Valley Authority (TVA)
Zion-1	PWR	1040	Shut down	1973	Commonwealth Edison (CommEd)
Zion-2	PWR	1040	Shut down	1974	Commonwealth Edison (CommEd)

Table 2 Total Number of U.S. Reactors by Utility

Alabama Power	2	Nebraska Public Power District (NPPD)	1
Ameren	1	Northern States Power (NSP)	1
AmerGen Energy Co	3	Northern Utilities	2
Argonne National Laboratory (ANL)	1	Omaha Public Power District (OPPD)	1
Arizona Nuclear Power Project (ANPP)	3	Pacific Gas and Electric Co (PG&E)	3
Atlantic City Electric	1	PEC	1
Commonwealth Edison (CommEd)	3	Pen/JCPL/MetEd	1
Constellation Energy	5	Pennsylvania Power and Light Co (PP&L)	2
Consumers Energy	2	PortGE/PAcPL/EWEB	1
Consumers Power Corp	2	PRDC	1
Dominion Resources	1	Public Service Co of Colorado (PSCC)	1
Dominion Virginia Power	6	Public Service Electric and Gas Co (PSEG)	3
DPC	1	Sacramento Municipal Utility District (SMUD)	1
Duke Power Co	15	South Carolina Electric and Gas Co	1
Energy Northwest	1	Southern Calfornia Ed.(80%), SDGE(20%)	1
Entergy Corp	1	Southern California Edison	2
Entergy Nuclear	10	Southern Nuclear Operating Co	4
Exelon Nuclear Co	14	STP Nuclear Operating Co	2
First Energy	5	Tennessee Valley Authority (TVA)	14
Florida Power and Light Co (FPL)	5	TXU Electric Co	2
FPL Group	1	US Department of Energy (DOE)	5
General Electric	1	Wisconsin Electric Power Co	2
Indiana Michigan Power Co	2	WPPSS	4
KGE/KCPL/KEPC	1	Xcel Energy	3
Long Island Power Authority	1	Yankee Atomic Electric Co	1
Maine Yankee Atomic Power Co	1		

Table 3 Total Number of Reactors in U.S. by Type

Process	Number of Reactors
BWR	51
FBR	3
HTGR	2
Na-graphite	2
OMR	1
PHWR	1
PWR	94

Table 4 Fuel Assembly Geometry by Assembly Design Type

Design	Assembly Length (in)	Assembly Width (in)
B&W-15	173.5	8.54
BIG-PT	84.8	6.81
CE-14	169.6	8.11
CE-16	190.8	8.14
DRES-1	135.7	4.57
FT.-CAL	158.5	8.12
GE-2	173	5.61
GE-3	173	5.61
GE-4	177.8	5.61
GE-5	177.8	5.61
GE-6	177.8	5.61
HAD-NECK	139.9	8.5
HUM-BY	96	4.8
IND-PT1	139.1	6.27
LACROS	103.5	5.91
PALIS	148.9	8.31
SAN-1	139.9	7.76
SOU-TX	201.1	8.4
ST-LUC2	170.6	8.13
SYS-80	194.8	8.16
WE-14	166.3	7.76
WE-15	166.9	8.42
WE-17	168.8	8.42
YANK-RW	112.9	7.61

Table 5 Nominal Compositions of Alloys Used as Nuclear Fuel Cladding

Alloy	Sn (wt%)	Fe (wt%)	Cr (wt%)	Nb (wt%)	Ni (wt%)	O (wt%)	C (wt%)	Si (wt%)	Zr (wt%)
Zr- 2 (BWR)	1.5	0.12	0.1		0.05	0.13			Balance
Zr- 2 (BWR) Improved	1.3	0.17	0.1		0.06	0.13			Balance
Zr -4 (PWR) High Tin	1.55	0.22	0.12			0.12	0.015	0.01	Balance
Zr -4 (PWR) Improved	1.3	0.22	0.12			0.12	0.012	0.01	Balance
M5 ®		0.04		1		0.14			Balance
ZIRLO™	1	0.1		1		0.12			Balance
Optimized ZIRLO ™	0.7	0.1		1		0.12			Balance
Zircaloy 2 Specification ASTM B811	1.2 - 1.7	0.07 - 0.20	0.05 - 0.15		0.03 - 0.08	0.09 - 0.16	0.027 max	0.012 max	Balance
Ziracloy 4 Specification ASTM B811	1.2 - 1.7	0.18 - 0.24	0.07 - 0.13			0.09 - 0.16	0.027 max	0.012 max	Balance

Table 6 Reactor Storage Pools, Independent Spent Fuel Storage Installations, Federal, and Other Sites

	Facility			Assemblies	MT
1	Arkansas Nuclear One	AK	P	1,517	666.7
			I	552	241.4
2	Browns Ferry Nuclear Plant	AL	P	6,696	1230.2
3	J M Farley Nuclear Plant	AL	P	2,011	903.8
4	Palo Verde Nuc Gen Station	AZ	P	2,747	1157.8
5	Diablo Canyon Power Plant	CA	P	1,736	760.9
6	GE Vallecitos Nuc Center	CA	I	fragments	0.2
7	Humboldt Bay Power Plant	CA	P	390	28.9
8	Rancho Seco Nuc Gen Station	CA	I	493	228.4
9	San Onofre Nuc Gen Station	CA	P	2,490	1013.3
10	Fort St. Vrain Power Station	CO	F	1,464	14.7
11	Connecticut Yankee Atom Pwr	CT	P	1,019	412.3
12	Millstone Nuc Power Station	CT	P	4,558	1227.9
13	Crystal River Nuc Power Plant	FL	P	824	382.3
14	St. Lucie Nuc Power Plant	FL	P	2,278	870.7
15	Turkey Point Station	FL	P	1,862	851.7
16	AW Vogtle Electric Gen Plant	GA	P	1,639	720.8
17	EL Hatch Nuclear Plant	GA	P	5,019	909.3
			I	816	151.2
18	D Arnold Energy Center	IA	P	1,912	347.9
19	Idaho National Eng & Env Lab	ID	F	93,522	299.3
20	Argonne National Lab East	IL	F	78	0.1
21	Braidwood Generating Sta	IL	P	1,485	628.7
22	Byron Generating Station	IL	P	1,786	756.4
23	Clinton Power Station	IL	P	1,580	288.8
24	Dresden Generating Station	IL	P	5,698	1,009.2
			I	1,155	146.9
25	GE Morris Operation	IL	I	3,217	674.3
26	LaSalle County Gen Sta	IL	P	4,106	744.6
27	Quad Cities Gen Station	IL	P	6,116	1106.5
28	Zion Generating Station	IL	P	2,226	1019.4
29	Wolf Creek Gen Station	KS	P	925	427.3
30	River Bend Station	LA	P	2,148	383.9
31	Waterford Gen Sta	LA	P	960	396.4
32	Pilgrim Nuclear Station	MA	P	2,274	413.9
33	Yankee Rowe Nuc Power Sta	MA	I	533	127.1
34	Calvert Cliffs Nuc Pwr Plt	MD	P	1,348	518.0
			I	960	368.1
35	Maine Yankee Atomic Pwr Plt	ME	I	1,434	542.3
36	Big Rock Point Nuc Plt	MI	I	441	57.9
37	D C Cook Nuclear Plant	MI	P	2,198	969.0
38	Enrico Fermi Atomic Pwr Plt	MI	P	1,708	304.6
39	Palisades Nuclear Pwr Sta	MI	P	649	260.7
			I	432	172.4
40	Monticello Nuclear Gen Plant	MN	P	1,342	236.1
41	Prairie Isl. Nuc Gen Plt	MN	P	1,135	410.3
			I	680	262.3
42	Callaway Nuclear Plant	MO	P	1,118	479.0
43	Grand Gulf Nuclear Station	MS	P	3,160	560.2
44	Brunswick Stm Elec Plt	NC	P	2,227	477.4
45	W B McGuire Nuc Sta	NC	P	2,232	1001.1
			I	160	68.6
46	Shearon Harris Nuc Pwr Plnt	NC	P	3,814	964.5
47	Cooper Nuclear Station	NE	P	1,537	278.6
48	Fort Calhoun Station	NE	P	839	305.0
49	Seabrook Nuclear Station	NH	P	624	287.2
50	Hope Creek Gen Station	NJ	P	2,376	431.5
51	Oyster Creek Generating Sta	NJ	P	2,556	455.9
			I	244	47.6
52	Salem Nuc Generating Sta	NJ	P	1,804	832.7
53	Sandia National Laboratory	NM	F	503	0.3
54	Brookhaven National Lab	NY	F	40	<0.1
55	JA Fitzpatrick Nuc Pwr Plant	NY	P	2,460	446.5
			I	204	37.2
56	Indian Point Energy Center	NY	P	2,073	903.6
57	Nine Mile Point Nuclear Station	NY	P	4,456	801.6
58	R E Ginna Nuclear Power Plant	NY	P	967	357.4
59	Davis-Besse Nuclear Pwr Sta	OH	P	749	351.3
			I	72	33.9
60	Perry Nuclear Power Plant	OH	P	2,088	378.4
61	Trojan Nuclear Power Plant	OR	P	780	358.9
62	Beaver Valley Power Station	PA	P	1,456	672.9
63	Limerick Generating Station	PA	P	4,601	824.0
64	Peach Bottom Atm Pwr Sta	PA	P	5,905.0	1,062.7
			I	1,020	190.3
65	Susquehanna Steam Elec Sta	PA	P	4,240	738.4
			I	1,300	238.5
66	Three Mile Island Nuc Station	PA	P	898	416.1
67	Catawba Nuclear Station	SC	P	1,780	782.4
68	HB Robinson Steam Elec	SC	P	344	147.9
			I	56	24.1
69	Oconee Nuclear Station	SC	P	1,419	665.8
			I	1,726	800.4
70	Savannah River Defense Site	SC	F	9,657	28.9
71	VC Summer Nuclear Station	SC	P	812	353.9
72	Sequoyah Nuclear Power Plant	TN	P	1,699	782.6
73	Watts Bar Nuclear Plant	TN	P	297	136.6
74	Comanche Peak Steam Elec Sta	TX	P	1,273	540.7
75	South Texas Project	TX	P	1,254	677.8
76	North Anna Power Station	VA	P	1,410	652.7
			I	480	220.8
77	Surry Power Station	VA	P	794	365.4
			I	1,150	524.2
78	Vermont Yankee Gen Station	VT	P	2,671	488.4
79	Columbia Generating Station	WA	P	1,904	333.7
			I	340	61.0
80	Hanford Defense Site	WA	F	110,140	2128.9
81	Kewaunee Nuclear Power Plant	WI	P	904	347.6
82	La Crosse Nuclear Gen Station	WI	P	333	38.0
83	Point Beach Nuclear Plant	WI	P	1,353	507.4
			I	360	144.1
Other:	University & Industry		F	4,834	1.7
	Combined Total			383,653	49,401.2
	Reactor Pool		P	145,589	41,564.1
	ISFSI		I	17,826	5,363.2
	Federal and Other		F	220,238	2,473.9

Sources: Energy Information Administration, and DOE National Spent Nuclear Fuels Program

MT: metric ton (1,000 kg)

Table 7 Range of Burnup for Used Nuclear Fuel by Reactor

Reactor Name	Burnup (MWd/MTIHM)		Average Enrichment (%)
	Minimum	Maximum	
Arkansas Nuclear One	14,338	71,300	3.56
Arkansas Nuclear Two	1	69,490	3.98
Beaver Valley-1	16,550	67,172	3.82
Beaver Valley-2	15,292	66,697	4.25
Big Rock-1	1,642	34,001	3.44
Braidwood-1	15,774	64,024	4.16
Braidwood-2	15,614	63,374	4.18
Browns Ferry-1	5,750	58,158	3.23
Browns Ferry-2	8,580	62,292	3.17
Browns Ferry-3	11,347	63,320	3.33
Brunswick-1	4,365	65,550	3.23
Brunswick-2	2,426	60,377	3.22
Byron-1	15,472	62,796	3.97
Byron-2	15,770	64,007	4.13
Calloway-1	15,304	67,494	4.20
Calvert Cliffs-1	12,219	69,276	3.70
Calvert Cliffs-2	16,840	68,349	3.78
Catawba-1	12,032	69,088	3.85
Catawba-2	12,396	68,707	3.91
Clinton-1	2,813	65,550	3.02
Comanche Peak-1	12,000	66,320	4.47
Comanche Peak-2	14,000	65,875	4.59
Cook-1	5,845	64,394	3.68
Cook-2	14,640	68,039	4.14
Cooper Station	7,507	65,550	3.09
Crystal River-3	8,652	68,183	3.75
Davis Besse-1	15,806	64,153	4.16
Diablo Canyon-1	15,463	62,761	4.44
Diablo Canyon-2	15,559	67,683	4.37
Dresden-1	3,389	29,000	2.16
Dresden-2	8,870	64,802	3.01
Dresden-3	4,278	65,550	3.02
Duane Arnold	3,709	58,884	3.68
Enrico Fermi-1	2,372	65,550	3.50
Farley-1	7,409	69,455	4.02
Farley-2	14,103	68,072	4.17
Fitzpatrick	7,262	65,550	3.81
Fort Calhoun	8,039	69,116	3.89
GE Morris	177	4,764	1.90
Ginna	5,856	64,149	3.98

Reactor Name	Burnup (MWd/MTIHM)		Average Enrichment (%)
	Minimum	Maximum	
Grand Gulf-1	3,353	65,550	3.34
Haddam Neck	8,193	42,956	3.92
Harris-1	15,999	64,938	4.12
Hatch-1	5,508	65,550	3.04
Hatch-2	1,830	65,550	2.92
Hope Creek	1,901	65,550	2.84
Humboldt Bay	1,307	22,617	2.37
Indian Point-1	3,713	27,048	4.00
Indian Point-2	12,034	60,368	4.24
Indian Point-3	15,900	66,608	4.34
Kewaunee	15,499	62,907	4.16
Lacrosse	4,683	20,988	3.77
LaSalle-1	2,639	65,550	3.08
LaSalle-2	2,624	65,550	2.87
Limerick-1	2,379	65,550	2.82
Limerick-2	0	65,550	3.49
Maine Yankee	2,768	49,241	2.97
McGuire-1	14,500	68,589	3.82
McGuire-2	13,632	70,356	3.85
Millstone-1	4,697	36,760	2.73
Millstone-2	15,155	71,300	3.59
Millstone-3	16,132	65,479	4.22
Monticello	7,388	65,170	3.26
Nine Mile Point-1	5,244	51,284	3.06
Nine Mile Point-2	2,805	65,550	3.74
North Anna-1	12,166	66,914	4.15
North Anna-2	12,915	66,864	4.25
Oconee-1	4,286	71,300	3.37
Oconee-2	12,524	71,300	3.40
Oconee-3	13,960	67,927	3.39
Oyster Creek-1	4,493	65,493	3.10
Palisades	5,139	68,523	3.42
Palo Verde-1	16,049	67,402	4.11
Palo Verde-2	16,572	67,754	4.10
Palo Verde-3	14,216	67,479	4.15
Peack Bottom-2	3,886	65,550	3.15
Peack Bottom-3	1,371	65,550	3.23
Perry-1	5,000	65,550	4.00
Pilgrim-1	2,625	65,550	3.62
Point Beach-1	10,864	68,885	3.82
Point Beach-2	12,412	68,421	3.86
Prairie Island-1	15,893	69,452	4.17
Prairie Island-2	16,070	65,226	4.19

Reactor Name	Burnup (MWd/MTIHM)		Average Enrichment (%)
	Minimum	Maximum	
Quad Cities-1	7,573	63,279	2.92
Quad Cities-2	7,140	65,550	2.96
Rancho Seco-1	10,000	38,054	2.81
Robinson-2	13,561	68,993	3.68
River Bend-1	1,969	65,550	3.83
Salem-1	8,910	69,039	4.05
Salem-2	16,983	68,932	4.15
San Onofre-1	6,905	38,935	3.86
San Onofre-2	11,053	67,525	4.08
San Onofre-3	14,290	67,676	4.08
Seabrook-1	12,781	68,142	4.31
Sequoyah-1	14,723	68,213	4.31
Sequoyah-2	14,683	66,582	4.33
South Texas-1	10,825	70,896	3.83
South Texas-2	11,402	67,483	4.02
Saint Lucie-1	2,000	70,807	3.71
Saint Lucie-2	9,908	71,300	3.97
Summer-1	14,037	65,698	4.47
Surry-1	14,963	68,428	3.85
Surry-2	11,008	71,300	3.86
Susquehanna-1	3,000	65,550	3.64
Susquehanna-2	3,000	65,550	3.59
Trojan	5,000	42,033	3.07
Turkey Point-3	12,665	67,956	3.82
Turkey Point-34	8,381	68,532	3.80
Vogtle-1	15,301	67,576	4.42
Vogtle-2	16,815	68,248	4.47
Vermont Yankee-1	1	44,669	3.76
Washington Nuclear-2	1,710	65,550	3.64
Waterford-3	11,725	65,091	4.16
Watts Bar-1	11,817	67,459	4.57
Wolf Creek-1	16,515	67,033	3.95
Yankee Rowe-1	4,244	35,221	3.95
Zion-1	14,529	54,964	3.17
Zion-2	17,082	48,319	3.25
3 Mile Island-1	13,536	65,666	3.67

Table 8 Pool types and Capacity by Utility

Utility	Pool Name	Capacity	Fuel Core Reserve	Fuel Type
Southern Nuclear Operating Co	FARLEY 1	1407	157	PWR
	FARLEY 2	1407	157	PWR
	HATCH 1	6026	560	BWR
	VOGTLE 1	3574	193	PWR
Arizona Nuclear Power Project (ANPP)	PALO VERDE 3	1329	241	PWR
	PALO VERDE 1	1329	241	PWR
	PALO VERDE 2	1329	241	PWR
Entergy Nuclear	INDIAN PT 3	1345	193	PWR
	ARK NUCLEAR 1	941	177	PWR
	ARK NUCLEAR 2	937	177	PWR
	GRAND GULF 1	4331	800	BWR
	PILGRIM 1	3404	580	BWR
	VT YANKEE 1	3335	368	BWR
	WATERFORD 3	1880	217	PWR
	RVR BEND 1	3172	624	BWR
	INDIAN PT 1	756	0	PWR
	INDIAN PT 2	1374	193	PWR
	FITZPATRICK	3108	560	BWR
Constellation Energy	CALVERT CLF 1	1830	217	PWR
	NINE MILE PT1	3910	532	BWR
	NINE MILE PT2	4000	764	BWR
Duke Power Co	CATAWBA 1	1419	193	PWR
	OCONEE 1	1550	177	PWR
	MCGUIRE 2	1229	193	PWR
	MCGUIRE 1	1236	193	PWR
	OCONEE 3	887	177	PWR
	CATAWBA 2	1418	193	PWR
	HARRIS - BWR	9999	0	BWR
	HARRIS 1	5228	157	PWR
	ROBINSON 2	1292	157	PWR
	BRUNSWICK 2	3508	560	BWR
	BRUNSWICK 1	3258	560	BWR
	CRYSTAL RVR 3	1474	177	PWR
	BRUNS 1 - PWR	160	0	PWR
	BRUNS 2 - PWR	144	0	PWR
	HARRIS- ROBIN	9999	0	PWR
First Energy	BEAVER VALLEY 1	1627	157	PWR
	BEAVER VALLEY 2	1088	157	PWR
	DAVIS-BESSE 1	1624	177	PWR
	PERRY 1	4020	748	BWR

Utility	Pool Name	Capacity	Fuel Core Reserve	Fuel Type
Exelon Nuclear Co	QUAD CITIES 1	7523	724	BWR
	PEACHBOTTOM 3	3816	764	BWR
	PEACHBOTTOM 2	3807	764	BWR
	BRAIDWOOD 1	2972	193	PWR
	LASALLE 1	7669	764	BWR
	DRESDEN 3	3534	724	BWR
	ZION 1	3012	0	PWR
	3 MILE ISL 1	1989	177	PWR
	BYRON 1	2955	193	PWR
	DRES 1 IN 2	102	0	BWR
	DRES 1 IN 3	104	0	BWR
	CLINTON 1	4060	624	BWR
	OYSTER CRK 1	2997	560	BWR
	DRESDEN 1	889	0	BWR
	DRESDEN 2	3536	724	BWR
	LIMERICK 1	7373	764	BWR
Consumers Energy	BIG ROCK 1	441	0	PWR
	PALISADES	773	204	PWR
DPC	LACROSSE	440	0	BWR
Detroit Edison Co	ENRICO FERMI2	3588	764	BWR
Florida Power and Light Co (FPL)	SEABROOK 1	1227	193	PWR
	ST LUCIE 2	1585	217	PWR
	TURKEY PT 4	1535	157	PWR
	ST LUCIE 1	1849	217	PWR
	TURKEY PT 3	1535	157	PWR
STP Nuclear Operating Co	SOUTH TEXAS 1	1969	193	STP
	SOUTH TEXAS 2	1969	193	STP
FPL Group	DUANE ARNOLD	2411	368	BWR
KGE/KCPL/KEPC	WOLF CREEK 1	2642	193	PWR
Maine Yankee Atomic Power Co	MAINE YANKEE	2019	0	PWR
Nebraska Public Power District (NPPD)	COOPER STN	3705	548	BWR
	Cooper at MORRIS	9999	0	BWR
Northern Utilities	HADDAM NECK	1172	0	PWR
	HadNck at MORRIS	9999	0	PWR
Dominion Virginia Power	MILLSTONE 1	2884	0	BWR
	MILLSTONE 2	1339	217	PWR
	MILLSTONE 3	1689	193	PWR
	NORTH ANNA 1	1737	157	PWR
	SURRY 1	1042	157	PWR
Xcel Energy	PRAIRIE ISL 1	1386	121	PWR
	MONTICELLO	3310	484	BWR

Utility	Pool Name	Capacity	Fuel Core Reserve	Fuel Type
	Montic at MORRIS	9999	0	BWR
Omaha Public Power District (OPPD)	FORT CALHOUN	1083	133	PWR
Pacific Gas and Electric Co (PG&E)	HUMBOLDT BAY	487	0	BWR
	DIABLO CANYON 1	1324	193	PWR
	DIABLO CANYON 2	1324	193	PWR
Pennsylvania Power and Light Co (PP&L)	SUSQUEHANNA 1	5680	764	BWR
PortGE/PAcPL/EWEB	TROJAN	1408	0	PWR
Department of Energy	ISF1-HLW	No Pool	0	
	MGR1-Bare B	No Pool	0	
	ISF1-DOE	No Pool	0	
	HANFORD-HLW	No Pool	0	HLWL
	INEEL-HLW	No Pool	0	HLW
	HANFORD WA P	No Pool	0	PWR
	HANFORD WA B	No Pool	0	BWR
	SAVAN RIV	No Pool	0	
	ISF1-Bare P	No Pool	0	
	SRS-DSNF-15'	No Pool	0	DSNFL
	ISF1-Bare B	No Pool	0	
	INEEL-DSNF-10'	No Pool	0	DSNF
	INEEL-DSNF24-15'	No Pool	0	DSNFL
	SRS-DSNF24-10'	No Pool	0	DSNF
	SRS-PU-HLW	No Pool	0	HLWL
	SRS-HLW	No Pool	0	HLW
	MGR1-Bare P-Store	No Pool	0	
	INEEL-DSNF-15'	No Pool	0	DSNFL
	MGR1-Bare B-Store	No Pool	0	
	INEEL-B	No Pool	0	BWR
	INEEL-P	No Pool	0	PWR
	MGR1-Bare P	No Pool	0	
	MGR1-DOE	No Pool	0	
	INEEL-NAVY-15'	No Pool	0	NAVYL
	MGR1-HLW	No Pool	0	
	HANFORD-DSNF-MCO	No Pool	0	MCO
	HANFORD-DSNF-15'	No Pool	0	DSNFL
	SRS-DSNF-10'	No Pool	0	DSNF
	INEEL-NAVY-10'	No Pool	0	NAVY
	HANFORD-DSNF-10'	No Pool	0	DSNF
Public Service Electric and Gas Co (PSEG)	SALEM 1	1632	193	PWR
	SALEM 2	1632	193	PWR
	HOPE CREEK	4006	764	BWR
Constellation Energy	RE GINNA	1321	121	PWR

Utility	Pool Name	Capacity	Fuel Core Reserve	Fuel Type
Sacramento Municipal Utility District (SMUD)	RANCHO SECO 1	1080	0	PWR
South Carolina Electric and Gas Co	VC SUMMER 1	1712	157	PWR
Southern California Edison	SAN ONOFRE 2	1542	217	PWR
	SAN ON 1 IN 2	70	0	PWR
	SAN ONOFRE 1	216	0	PWR
	SAN ONOFRE 3	1542	217	PWR
	SOnfo1 at MORRIS	No Pool	0	PWR
	SAN ON 1 IN 3	118	0	PWR
Tennessee Valley Authority (TVA)	BROWNS FERRY1	6942	764	BWR
	WATTS BAR 1	1610	193	PWR
	BROWNS FERRY3	3471	764	BWR
	SEQUOYAH 1	2091	193	PWR
TXU Electric Co	COMANCHE PK 1	3373	193	PWR
Ameren	CALLAWAY 1	2642	193	PWR
Energy Northwest	COLUMBIA	2654	764	BWR
Wisconsin Electric Power Co	POINT BEACH 1	1502	121	PWR
Dominion Resources	KEWAUNEE	1196	121	PWR
Yankee Atomic Electric Co	YANKEE-ROWE 1	721	0	PWR
Indiana Michigan Power Co	DONALD COOK 1	3613	193	PWR

Table 9 Status of Used Fuel Storage at Commercial Nuclear Power Plants. (NEI)

(* Facility with Dry Cask Storage as of 1/2010,
 # Facility Dry Storage in planning/licensing/construction)

Dry Storage Availability	Plant	Year	State	Type
*	Robinson 2	1987	SC	PWR
*	Surry 1	1987	VA	PWR
*	Surry 2	1987	VA	PWR
*	Oconee 1	1990	SC	PWR
*	Oconee 2	1990	SC	PWR
*	Oconee 3	1990	SC	PWR
*	Palisades	1992	MI	PWR
*	Calvert Cliffs 1	1994	MD	PWR
*	Calvert Cliffs 2	1994	MD	PWR
*	Prairie Island 1	1994	MN	PWR
*	Prairie Island 2	1994	MN	PWR
*	Arkansas Nuclear One 1	1995	AR	PWR
*	Davis-Besse	1995	OH	PWR
*	Point Beach 1	1995	WI	PWR
*	Point Beach 2	1995	WI	PWR
*	Arkansas Nuclear One 2	1996	AR	PWR
*	Hatch 1	1998	GA	BWR
*	Hatch 2	1998	GA	BWR
*	North Anna 1	1998	VA	PWR
*	North Anna 2	1998	VA	PWR
*	Susquehanna 1	1998	PA	BWR
*	Susquehanna 2	1998	PA	BWR
*	Columbia Generating Station	2000	WA	BWR
*	Oyster Creek	2000	NJ	BWR
*	Peach Bottom 2	2000	PA	BWR
*	Dresden 2	2001	IL	BWR
*	Peach Bottom 3	2001	PA	BWR
*	J.A. FitzPatrick	2002	NY	BWR
*	McGuire 1	2002	NC	PWR
*	McGuire 2	2002	NC	PWR
*	Dresden 3	2003	IL	BWR
*	Palo Verde 2	2003	AZ	PWR
*	Palo Verde 3	2003	AZ	PWR
*	Duane Arnold	2004	IA	BWR

Dry Storage Availability	Plant	Year	State	Type
*	Millstone 2	2004	CT	PWR
*	Palo Verde 1	2004	AZ	PWR
*	Quad Cities 1	2004	IL	BWR
*	Quad Cities 2	2004	IL	BWR
*	Browns Ferry 3	2005	AL	BWR
*	Sequoyah 1	2005	TN	PWR
*	Sequoyah 2	2005	TN	PWR
*	Farley 1	2006	AL	PWR
*	Fort Calhoun	2006	NE	PWR
*	Hope Creek	2006	NJ	BWR
*	River Bend	2006	LA	BWR
#	Brunswick 2	2007	NC	BWR
*	Grand Gulf	2007	MS	BWR
*	Indian Point 2	2007	NY	PWR
*	Monticello	2007	MN	BWR
*	San Onofre 2	2007	CA	PWR
*	Vermont Yankee	2007	VT	BWR
*	Browns Ferry 1	2008	AL	BWR
*	Browns Ferry 2	2008	AL	BWR
#	Brunswick 1	2008	NC	BWR
*	Catawba 1	2008	SC	PWR
*	Limerick 1	2008	PA	BWR
*	Limerick 2	2008	PA	BWR
*	San Onofre 3	2008	CA	PWR
*	St. Lucie 1	2008	FL	PWR
*	Catawba 2	2009	SC	PWR
#	Ginna	2009	NY	PWR
*	Kewaunee	2009	WI	PWR
*	Seabrook	2009	NH	PWR
*	Diablo Canyon 1	2010	CA	PWR
*	Farley 2	2010	AL	PWR
#	Fermi 2	2010	MI	BWR
*	Indian Point 3	2010	NY	PWR
*	St. Lucie 2	2010	FL	PWR
#	Byron 1	2011	IL	PWR
#	Byron 2	2011	IL	PWR
#	Cooper	2011	NE	BWR

Dry Storage Availability	Plant	Year	State	Type
*	Diablo Canyon 2	2011	CA	PWR
#	Perry	2011	OH	BWR
*	Salem 1	2011	NJ	PWR
#	Waterford 3	2011	LA	PWR
#	Braidwood 1	2012	IL	PWR
#	Braidwood 2	2012	IL	PWR
#	LaSalle 1	2012	IL	BWR
#	LaSalle 2	2012	IL	BWR
#	Nine Mile Point 1	2012	NY	BWR
#	Pilgrim	2012	MA	BWR
#	Turkey Point 4	2012	FL	PWR
#	Turkey Point 4	2012	FL	PWR
#	D.C. Cook 1	2013	MI	PWR
#	D.C. Cook 2	2013	MI	PWR
#	Clinton	2014	IL	BWR
#	Nine Mile Point 2	2014	NY	BWR
#	Beaver Valley 1	2015	PA	PWR
#	Crystal River 3	2015	FL	PWR
*	Salem 2	2015	NJ	PWR
#	Vogtle 2	2015	GA	PWR
#	Commanche Peak 1	2017	TX	PWR
#	Commanche Peak 2	2017	TX	PWR
#	Vogtle 1	2017	GA	PWR
#	V.C. Summer	2018	SC	PWR
#	Watts Bar	2018	TN	PWR
#	Callaway	2019	MO	PWR
#	Wolf Creek	2025	KS	PWR
#	Beaver Valley 2	2026	PA	PWR
#	South TX Project 1	2026	TX	PWR
#	South TX Project 2	2026	TX	PWR
*	Millstone 3	End of Life	CT	PWR
	Shearon Harris	End of Life	NC	PWR
#	Three Mile Island 1	End of Life	PA	PWR
*	Big Rock Point	Shutdown 1997	MI	BWR
*	Dresden 1	Shutdown 1978	IL	BWR
	Fermi 1	Shutdown 1972	MI	--
*	Fort St. Vrain	Shutdown 1989	CO	--

Dry Storage Availability	Plant	Year	State	Type
*	Haddam Neck	Shutdown 1996	CT	PWR
*	Humboldt Bay	Shutdown 1976	CA	BWR
*	Indian Point 1	Shutdown 1974	NY	PWR
#	LaCrosse	Shutdown 1987	WI	BWR
*	Maine Yankee	Shutdown 1997	ME	PWR
*	Millstone 1	Shutdown 1998	CT	BWR
	Peach Bottom 1	Shutdown 1974	PA	--
*	Rancho Seco	Shutdown 1989	CA	PWR
*	San Onofre 1	Shutdown 1992	CA	PWR
	Three Mile Island 2	Shutdown 1979	PA	PWR
*	Trojan	Shutdown 1992	OR	PWR
*	Yankee Rowe	Shutdown 1991	MA	PWR
#	Zion 1	Shutdown 1998	IL	PWR
#	Zion 2	Shutdown 1998	IL	PWR

* = Facilities with dry cask storage as of January 2010.
# = Facilities with dry cask storage under construction or planning/licensing.

Table 10 Dry Cask Storage in the U.S. by Vendor

Vendor	Systems	Type	Reactor	Type	Utility	Casks	Assemblies
BFS/ES	FuelSolutions	VSC-24	ANO	PWR	Entergy	24	576
	FuelSolutions	W150	Big Rock Point[1,3]	BWR	Consumers	8	441
	FuelSolutions	VSC-24	Palisades	PWR	Entergy	18	432
	FuelSolutions	VSC-24	Point Beach	PWR	FPL	16	384
Total BFS/ES						**66**	**1833**
DOE	Foster Wheeler	MVDS	Ft. St. Vrain	HTGR	PS Colorado		1464
GNB	Castor	V/21 and X33	Surry	PWR	Dominion	26	558
Holtec	HI-STORM	MPC-24	ANO	PWR	Entergy	22	528
	HI-STORM	MPC-32	ANO	PWR	Entergy	16	512
	HI-STORM	MPC-32	Byron	PWR	Exelon	6	192
	HI-STORM	MPC-68	Browns Ferry	BWR	TVA	25	1700
	HI-STORM	MPC-68	Columbia	BWR	Energy Northwest	27	1836
	HI-STORM	MPC-32	Diablo Canyon	PWR	PG&E	16	512
	HI-STORM	MPC-68	Dresden	BWR	Exelon	45	3060
	HI-STAR	MPC-68	Dresden	BWR	Exelon	4	272
	HI-STORM	MPC-32	Farley	PWR	Southern Nuclear	12	384
	HI-STORM	MPC-68	Fitzpatrick	BWR	Entergy	15	1020
	HI-STORM	MPC-68	Grand Gulf	BWR	Entergy	12	816
	HI-STORM	MPC-68	Hatch	BWR	Southern Nuclear	39	2652
	HI-STAR	MPC-68	Hatch	BWR	Southern Nuclear	3	204
	HI-STORM	MPC-68	Hope Creek	BWR	PSE&G	16	1088
	HI-STAR	MPC-80	Humboldt Bay[1,3]	BWR	PG&E	5	390
	HI-STORM	MPC-32	Indian Point 1[3]	PWR	Entergy	5	160
	HI-STORM	MPC-32	Indian Point 2	PWR	Entergy	12	384
	HI-STORM	MPC-68	LaSalle	BWR	Exelon	4	272
	HI-STORM	MPC-68	Quad Cities	BWR	Exelon	25	1700
	HI-STORM	MPC-68	River Bend	BWR	Entergy	15	1020
	HI-STORM	MPC-68	Vermont Yankee	BWR	Entergy	5	340
	HI-STORM	MPC-32	Salem	PWR	PSE&G	4	128
	HI-STORM	MPC-32	Sequoyah	PWR	TVA	26	832
	TranStor cask	MPC-24E/EF	Trojan	PWR	Portland GE	34	780
Total Holtec						**393**	**20782**
NAC	NAC-MPC	MPC-26	Conn Yankee[2,3]	PWR	Ct. Yankee	43	1019
	NAC-MPC	MPC-36	Yankee Rowe[2,3]	PWR	YAEC	16	533
	NAC-UMS	UMS-24	Maine Yankee[2,3]	PWR	Maine Yankee	64	1434
	NAC-UMS	UMS-24	Catawba	PWR	Duke	16	384
	NAC-UMS	UMS-24	McGuire	PWR	Duke	28	672
	NAC-UMS	UMS-24	Palo Verde	PWR	APS	79	1896
	NAC-I28	NAC-I28	Surry	PWR	Dominion	2	56
Total NAC						**248**	**5994**
TN	NUHOMS	61BTH	Brunswick	BWR	Progress	6	366
	NUHOMS	24P	Calvert Cliffs	PWR	Constellation	48	1152
	NUHOMS	32P	Calvert Cliffs	PWR	Constellation	18	576
	NUHOMS	61BT	Cooper	BWR	NPPD	8	488

Vendor	Systems	Type	Reactor	Type	Utility	Casks	Assemblies
	NUHOMS	24P	Davis-Besse	PWR	FirstEnergy	3	72
	NUHOMS	61BT	Duane Arnold	BWR	FPL	10	610
	NUHOMS	32PT	Fort Calhoun	PWR	OPPD	10	320
	NUHOMS	32PT	Ginna	PWR	Constellation	4	128
	NUHOMS	12T	INEEL	PWR	DOE	29	177
	NUHOMS	32PT	Kewaunee	PWR	Dominion	4	128
	NUHOMS	61BT	Limerick	BWR	Exelon	12	732
	NUHOMS	32PT	Millstone	PWR	Dominion	14	448
	NUHOMS	61BT	Monticello	BWR	Xcel Energy	10	610
	NUHOMS	32PTH	North Anna	PWR	Dominion	10	320
	NUHOMS	24PHB	Oconee	PWR	Duke	34	816
	NUHOMS	24P	Oconee	PWR	Duke	84	2016
	NUHOMS	61BT	Oyster Creek	BWR	Exelon	19	1159
	NUHOMS	24PTH	Palisades	PWR	Entergy	7	168
	NUHOMS	32PT	Palisades	PWR	Entergy	11	352
	NUHOMS	32PT	Point Beach	PWR	FPL	14	448
	NUHOMS	24PT	Rancho Seco[1]	PWR	SMUD	22	493
	NUHOMS	24PTH	Robinson	PWR	Progress	8	192
	NUHOMS	7P	Robinson	PWR	Progress	8	56
	NUHOMS	32PTH	Seabrook	PWR	FPL	6	192
	NUHOMS	24PT1	SONGS 1[1,3]	PWR	Southern Cal Edison	18	395
	NUHOMS	24PT4	SONGS 2 & 3	PWR	Southern Cal Edison	22	528
	NUHOMS	32PTH	St. Lucie	PWR	FPL	11	352
	NUHOMS	32PTH	Surry	PWR	Dominion	12	384
	NUHOMS	52B	Susquehanna	BWR	PPL	27	1404
	NUHOMS	61BT	Susquehanna	BWR	PPL	40	2440
	TN Metal Casks	TN-32	McGuire	PWR	Duke	10	320
	TN Metal Casks	TN-32	North Anna	PWR	Dominion	27	864
	TN Metal Casks	TN-68	Peach Bottom	BWR	Exelon	49	3332
	TN Metal Casks	TN-40	Praire Island	PWR	Xcel Energy	29	1160
	TN Metal Casks	TN-32	Surry	PWR	Dominion	26	832
Total TN						**670**	**24030**
Westinghouse	MC-10	MC-10	Surry	PWR	Dominion	1	24
Overall Totals:						**1404**	**54685**

[1]One cask is storing GTCC waste is in use

[2]CY has 3 casks storing GTCC waste; Yankee Rowe has one and Maine Yankee has four casks

[3]All spent fuel from the shutdown plant.

Source: StoreFUEL 2011.

Table 11 Dry Cask Storage in the U.S. by Utility

Utility	Reactor	Type	Vendor	Cask System	Canister Type	Total Loaded	Assemblies Stored
APS	Palo Verde	PWR	NAC	NAC-UMS	UMS-24	79	1896
Constellation	Calvert Cliffs	PWR	TN	NUHOMS	24P	48	1152
Constellation	Calvert	PWR	TN	NUHOMS	32P	18	576
Constellation	Ginna	PWR	TN	NUHOMS	32PT	4	128
Consumers	Big Rock Point[1]	BWR	BFS/ES	FuelSolutions	W150	8	441
Ct. Yankee	Conn Yankee[1]	PWR	NAC	NAC-MPC	MPC-26	43	1019
DOE		INEEL	TN	NUHOMS	12T	29	177
Dominion	Kewaunee	PWR	TN	NUHOMS	32PT	4	128
Dominion	Millstone	PWR	TN	NUHOMS	32PT	14	448
Dominion	North Anna	PWR	TN	TN Metal Casks	TN-32	27	864
Dominion	North Anna	PWR	TN	NUHOMS	32PTH	10	320
Dominion	Surry	PWR	GNB	Castor	V/21 and X33	26	558
Dominion	Surry	PWR	NAC	NAC-I28	NAC-I28	2	56
Dominion	Surry	PWR	TN	NUHOMS	32PTH	12	384
Dominion	Surry	PWR	TN	TN Metal Casks	TN-32	26	832
Dominion	Surry	PWR	W	MC-10	MC-10	1	24
Duke	Catawba	PWR	NAC	NAC-UMS	UMS-24	16	384
Duke	McGuire	PWR	NAC	NAC-UMS	UMS-24	28	672
Duke	McGuire	PWR	TN	TN Metal Casks	TN-32	10	320
Duke	Oconee	PWR	TN	NUHOMS	24P	84	2016
Duke	Oconee	PWR	TN	NUHOMS	24PHB	34	816
Energy Northwest	Columbia	BWR	Holtec	HI-STORM	MPC-68	27	1836
Entergy	ANO	PWR	BFS/ES	FuelSolutions	VSC-24	24	576
Entergy	ANO	PWR	Holtec	HI-STORM	MPC-24	22	528
Entergy	ANO	PWR	Holtec	HI-STORM	MPC-32	16	512
Entergy	Fitzpatrick	BWR	Holtec	HI-STORM	MPC-68	15	1020
Entergy	Grand Gulf	BWR	Holtec	HI-STORM	MPC-68	12	816
Entergy	Indian Point 1	PWR	Holtec	HI-STORM	MPC-32	5	160
Entergy	Indian Point 2	PWR	Holtec	HI-STORM	MPC-32	12	384
Entergy	Palisades	PWR	BFS/ES	FuelSolutions	VSC-24	18	432
Entergy	Palisades	PWR	TN	NUHOMS	24PTH	7	168
Entergy	Palisades	PWR	TN	NUHOMS	32PT	11	352
Entergy	River Bend	BWR	Holtec	HI-STORM	MPC-68	15	1020
Entergy	Vermont Yankee	BWR	Holtec	HI-STORM	MPC-68	5	340
Exelon	Byron	PWR	Holtec	HI-STORM	MPC-32	6	192
Exelon	Dresden	BWR	Holtec	HI-STORM	MPC-68	45	3060
Exelon	Dresden	BWR	Holtec	HI-STAR	MPC-68	4	272
Exelon	LaSalle	BWR	Holtec	HI-STORM	MPC-68	4	272
Exelon	Limerick	BWR	TN	NUHOMS	61BT	12	732
Exelon	Oyster Creek	BWR	TN	NUHOMS	61BT	19	1159
Exelon	Peach Bottom	BWR	TN	TN Metal Casks	TN-68	49	3332
Exelon	Quad Cities	BWR	Holtec	HI-STORM	MPC-68	25	1700
FirstEnergy	Davis-Besse	PWR	TN	NUHOMS	24P	3	72
FPL	Duane Arnold	BWR	TN	NUHOMS	61BT	10	610

Utility	Reactor	Type	Vendor	Cask System	Canister Type	Total Loaded	Assemblies Stored
FPL	Point Beach	PWR	BFS/ES	FuelSolutions	VSC-24	16	384
FPL	Point Beach	PWR	TN	NUHOMS	32PT	14	448
FPL	St. Lucie	PWR	TN	NUHOMS	32PTH	11	352
FPL	Seabrook	PWR	TN	NUHOMS	32PTH	6	192
Maine Yankee	Maine Yankee[1]	PWR	NAC	NAC-UMS	UMS-24	64	1434
NPPD	Cooper	BWR	TN	NUHOMS	61BT	8	488
OPPD	Fort Calhoun	PWR	TN	NUHOMS	32PT	10	320
Portland GE	Trojan	PWR	Holtec	TranStor cask	MPC-24E/EF	34	780
PPL	Susquehanna	BWR	TN	NUHOMS	52B	27	1404
PPL	Susquehanna	BWR	TN	NUHOMS	61BT	40	2440
Progress	Brunswick	BWR	TN	NUHOMS	61BTH	6	366
Progress	Robinson	PWR	TN	NUHOMS	7P	8	56
Progress	Robinson	PWR	TN	NUHOMS	24PTH	8	192
PS Colorado	Ft. St Vrain	HTGR	DOE	Foster Wheeler	MVDS		1464
PSE&G	Hope Creek	BWR	Holtec	HI-STORM	MPC-68	16	1088
PSE&G	Salem	PWR	Holtec	HI-STORM	MPC-32	4	128
PG&E	Diablo Canyon	PWR	Holtec	HI-STORM	MPC-32	16	512
PG&E	Humboldt Bay[1]	BWR	Holtec	HI-STAR	MPC-80	5	390
SMUD	Rancho Seco[1]	PWR	TN	NUHOMS	24PT	22	493
Southern Cal Edison	SONGS 1[1,2]	PWR	TN	NUHOMS	24PT1	18	395
Southern Cal Edison	SONGS 2	PWR	TN	NUHOMS	24PT4	22	528
Southern Nuclear	Farley	PWR	Holtec	HI-STORM	MPC-32	12	384
Southern	Hatch	BWR	Holtec	HI-STORM	MPC-68	39	2652
Southern	Hatch	BWR	Holtec	HI-STAR	MPC-68	3	204
TVA	Browns Ferry	BWR	Holtec	HI-STORM	MPC-68	25	1700
TVA	Sequoyah	PWR	Holtec	HI-STORM	MPC-32	26	832
Xcel Energy	Prairie Island	PWR	TN	TN Metal Casks	TN-40	29	1160
Xcel	Monticello	BWR	TN	NUHOMS	61BT	10	610
YAEC	Yankee Rowe[2]	PWR	NAC	NAC-MPC	MPC-36	16	533
Overall Totals:						**1404**	**54685**

[1]Includes GTCC waste
[2]All the spent fuel from the shuttered Unit 1

Table 12 General License Termination data†

Reactor	License Termination (Yr)			Reactor	License Termination (Yr)		
	Initially	Extended	Status		Initially	Extended	Status
ARKANSAS NUCLEAR 1	2014	2034	G	MILLSTONE 3	2025	2045	G
ARKANSAS NUCLEAR 2	2018	2038	G	MONTICELLO	2010	2030	G
BEAVER VALLEY 1	2016	2036	A	NINE MILE POINT 1	2009	2029	G
BEAVER VALLEY 2	2027	2047	A	NINE MILE POINT 2	2026	2046	G
BRAIDWOOD 1	2026	2046	No	NORTH ANNA 1	2018	2038	G
BRAIDWOOD 2	2027	2047	No	NORTH ANNA 2	2020	2040	G
BROWNS FERRY 1	2013	2033	G	OCONEE 1	2013	2033	G
BROWNS FERRY 2	2014	2034	G	OCONEE 2	2013	2033	G
BROWNS FERRY 3	2016	2036	G	OCONEE 3	2014	2034	G
BRUNSWICK 1	2016	2036	G	OYSTER CREEK	2009	2029	A
BRUNSWICK 2	2014	2034	G	PALISADES	2011	2031	G
BYRON 1	2024	2044	No	PALO VERDE 1	2025	2045	A
BYRON 2	2026	2046	No	PALO VERDE 2	2026	2046	A
CALLAWAY	2024	2044	No	PALO VERDE 3	2027	2047	A
CALVERT CLIFFS 1	2014	2034	G	PEACH BOTTOM 2	2013	2033	G
CALVERT CLIFFS 2	2016	2036	G	PEACH BOTTOM 3	2014	2034	G
CATAWBA 1	2024	2043	G	PERRY 1	2026	2046	No
CATAWBA 2	2026	2043	G	PILGRIM 1	2012	2032	A
CLINTON 1	2026	2046	No	POINT BEACH 1	2010	2030	G
COMANCHE PEAK 1	2030	2050	No	POINT BEACH 2	2013	2033	G
COMANCHE PEAK 2	2033	2053	No	PRAIRIE ISLAND 1	2013	2033	A
COOK 1	2014	2034	G	PRAIRIE ISLAND 2	2014	2034	A
COOK 2	2017	2037	G	QUAD CITIES 1	2012	2032	G
COOPER STATION	2014	2034	A	QUAD CITIES 2	2012	2032	G
CRYSTAL RIVER 3	2016	2036	No	RIVER BEND 1	2025	2045	No
DAVIS-BESSE	2017	2037	No	ROBINSON 2	2010	2030	G
DIABLO CANYON 1	2024	2044	No	SALEM 1	2016	2036	No
DIABLO CANYON 2	2025	2045	No	SALEM 2	2020	2040	No
DRESDEN 2	2009	2029	G	SAN ONOFRE 2	2022	2042	No
DRESDEN 3	2011	2031	G	SAN ONOFRE 3	2022	2042	No
DUANE ARNOLD	2014	2034	A	SEABROOK	2030	2050	No
ENRICO FERMI 2	2025	2045	No	SEQUOYAH 1	2020	2040	No
FARLEY 1	2017	2037	G	SEQUOYAH 2	2021	2041	No
FARLEY 2	2021	2041	G	SOUTH TEXAS 1	2027	2047	No
FITZPATRICK	2014	2034	G	SOUTH TEXAS 2	2028	2048	No
FORT CALHOUN	2013	2033	G	ST LUCIE 1	2016	2036	G
GINNA	2009	2029	G	ST LUCIE 2	2023	2043	G
GRAND GULF 1	2024	2044	No	SUMMER UNIT 1	2022	2042	G
HARRIS 1	2026	2046	G	SURRY 1	2012	2032	G
HATCH 1	2014	2034	G	SURRY 2	2013	2033	G
HATCH 2	2018	2038	G	SUSQUEHANNA 1	2022	2042	A
HOPE CREEK	2026	2046	No	SUSQUEHANNA 2	2024	2044	A
INDIAN POINT 2	2013	2033	A	THREE MILE ISLAND 1	2014	2034	A
INDIAN POINT 3	2015	2035	A	TURKEY POINT 3	2012	2032	G
KEWAUNEE	2013	2033	A	TURKEY POINT 4	2013	2033	G
LASALLE COUNTY 1	2022	2042	No	VOGTLE 1	2027	2047	A
LASALLE COUNTY 2	2023	2043	No	VOGTLE 2	2029	2049	A
LIMERICK 1	2024	2044	No	VT YANKEE	2012	2032	A
LIMERICK 2	2029	2049	No	COLUMBIA	2023	2043	No
MCGUIRE 1	2021	2041	G	WATERFORD 3	2024	2044	No
MCGUIRE 2	2023	2043	G	WATTS BAR 1	2035	2055	No
MILLSTONE 2	2015	2035	G	WOLFCREEK 1	2025	2045	G

Note: Status terms are G =Granted LE. A = Applied for LE. and No = No application for LE has been submitted.

† Source 2009 Projection of Future Nuclear Fuel Discharges

Table 13 List of Shutdown Reactors Greater than 100 MW

Zion 1 & 2	IL	1973-1998
Millstone 1	CT	1970-1998
Maine Yankee	ME	1972-1997
Connecticut Yankee	CT	1967-1997
Trojan	OR	1976-1993
San Onofre 1	CA	1968-1992
Yankee Rowe	MA	1961-1992
Shoreham	NY	1989-1989
Fort St. Vrain	CO	1979-1989
Rancho Seco	CA	1975-1989
TMI-2	PA	1978-1979
Dresden 1	IL	1960-1978
Indian Point 1	NY	1962-1974

Table 14 Decommissioning Status for Shutdown Power Reactors

Reactor	Location	Shutdown	Status	Fuel Onsite	Storage Type	Quantity (MTUs)
Big Rock Point	Charlevoix, MI	8/97	ISFSI Only	Yes	Dry Cask	58
CVTR	Parr, SC	1/67	License Terminated	No	—	—
Dresden 1*	Morris, IL	10/31/78	SAFSTOR	Yes	Dry Cask	69
Fermi 1	Monroe Co., MI	9/22/72	SAFSTOR/DECON	No	—	—
Fort St. Vrain	Platteville, CO	8/18/89	License Terminated	Yes	Dry Cask	25
GE VBWR	Alameda Co., CA	12/9/63	SAFSTOR	No	—	—
Haddam Neck	Haddam Neck, CT	7/22/96	ISFSI Only	Yes	Dry Cask	414
Humboldt Bay 3	Eureka, CA	7/02/76	DECON	Yes	Dry Cask	31
Indian Point 1*	Buchanan, NY	10/31/74	SAFSTOR	Yes	Dry Cask	33
LaCrosse	LaCrosse, WI	4/30/87	SAFSTOR	Yes	Pool	38
Main Yankee	Bath, ME	12/96	ISFSI Only	Yes	Dry Cask	542
Millstone 1*	Waterford, CT	11/04/95	SAFSTOR	Yes	Dry Cask	522
N.S. Savannah	Norfolk, VA	1970	SAFSTOR	No	—	—
Pathfinder	Sioux Falls, SD	9/16/67	DECON NRC Part	No	—	—
Peach Bottom 1	York Co., PA	10/31/74	SAFSTOR	No	—	—
Rancho Seco	Sacramento, CA	6/7/89	ISFSI Only	Yes	Dry Cask	228
San Onofre 1*	San Clemente, CA	11/30/92	DECON	Yes	Dry Cask	146
Saxton	Saxton, PA	5/72	License Terminated	No	—	—
Shoreham	Suffolk Co., NY	6/28/89	License Terminated	No	—	—
Three Mile Island 2	Middletown, PA	3/28/79	SAFSTOR*	No	—	—
Trojan	Portland, OR	11/9/92	ISFSI Only	Yes	Dry Cask	345
Yankee Rowe	Franklin Co., MA	10/1/91	ISFSI Only	Yes	Dry Cask	122
Zion 2	Zion, IL	2/98	SAFSTOR	Yes	Combined Pool	1,019
Zion 1	Zion, IL	2/98	SAFSTOR	Yes		
Total MTUs						**3,567**

*Collocated with operating reactors.

Sources: ACI Nuclear, NEI, and NRC 2011.

Table 15 Cumulative Commercial Reactor Discharges

Reactor Name	Year First discharge	Discharge Date By Year 2011*	Estimated Cumulative Discharges 2011		Projected Cumulative Discharges 2021		Projected Cumulative Discharges 2031	
			MTHM	# Assm	MTHM	# Assm	MTHM	# Assm
3 Mile Island 1	1976	2011	584	1242	740	1564	899	1891
Arkansas Nuclear 1	1977	2011	647	1398	797	1721	952	2054
Arkansas Nuclear 2	1981	2011	652	1555	893	2119	1089	2576
Beaver Valley 1	1979	2011	598	1294	802	1736	983	2129
Beaver Valley 2	1989	2011	442	956	628	1359	1564	3392
Big Rock 1	1968	1997	69	526	Final Discharge in 1997			
Braidwood 1	1989	2011	522	1238	707	527	986	2345
Braidwood 2	1990	2011	531	1260	766	1819	964	2293
Browns Ferry 1	1977	2011	501	2754	852	4742	1176	6580
Browns Ferry 2	1978	2011	853	4787	1143	6495	1390	7956
Browns Ferry 3	1978	2011	619	3489	930	5322	1209	6966
Brunswick 1	1979	2011	604	3350	815	4526	185	1038
Brunswick 2	1976	2011	647	3581	834	4628	1018	5660
Byron 1	1987	2011	604	1430	839	1988	1040	2468
Byron 2	1989	2011	572	1354	769	1823	998	2370
Callaway 1	1986	2011	712	1677	923	2183	1141	2705
Calvert Cliffs 1	1977	2011	623	1598	800	2033	959	2422
Calvert Cliffs 2	1978	2011	594	1525	762	1940	916	2321
Catawba 1	1986	2011	645	1446	913	2034	1143	2541
Catawba 2	1987	2011	506	2796	250	1401	470	2629
Clinton 1	1989	2011	598	1346	866	1933	1133	2521
Comanche Peak 1	1991	2011	537	1266	742	1758	955	2270
Comanche Peak 2	1994	2011	436	1047	672	1617	857	2062
Cook 1	1976	2011	787	1746	1017	2250	1190	2631
Cook 2	1979	2012	659	1548	838	1975	1026	2422
Cooper Station	1976	2010	604	3308	732	4024	853	4700
DB 1	1982	2011	514	1085	722	1513	904	1888
Crystal River 3	1978	2011	569	1213	741	1569	895	1889
Diablo Canyon 1	1986	2010	587	1359	785	1827	976	2280
Diablo Canyon 2	1987	2011	557	1281	726	1678	882	2044
Dresden 1	1969	1978	91	892	Final Discharge in 1978			
Dresden 2	1974	2011	744	4207	930	5282	1158	6604
Dresden 3	1973	2011	696	3930	887	5039	1151	6572
Duane Arnold	1975	2011	500	2766	619	3434	741	4120
Enrico Fermi 2	1989	2011	510	2907	724	4153	925	5326
Farley 1	1979	2011	651	1468	827	1886	984	2256
Farley 2	1982	2011	598	1358	752	1721	912	2100
Fitzpatrick	1977	2011	623	3440	789	4364	936	5183
Fort Calhoun	1975	2011	398	1088	492	1340	562	1529
GE Morris	1970	1972	145	753	Final Receipt in 1972			

Reactor Name	Year First discharge	Discharge Date By Year 2011*	Estimated Cumulative Discharges 2011		Projected Cumulative Discharges 2021		Projected Cumulative Discharges 2031	
			MTHM	# Assm	MTHM	# Assm	MTHM	# Assm
Ginna	1971	2011	468	1284	582	1611	693	1933
Grand Gulf	1986	2011	815	4598	1026	5786	1255	7074
Haddam Neck	1970	1996	447	1102	Final Discharge in 1996			
Harris 1	1998	2011	431	952	619	1363	799	1755
Hatch 1	1977	2011	721	3984	907	5025	1070	1106
Hatch 2	1980	2011	700	3881	876	4879	1033	5762
Hope Creek	1988	2010	656	3637	898	4997	1115	6211
Humboldt Bay	1971	1976	29	390	Final Discharge in 1976			
Indian Point 1	1972	1974	31	160	Final Discharge in 1974			
Indian Point 2	1976	2011	648	1428	864	571	1115	1130
Indian Point 3	1978	2011	585	1284	784	1724	983	2164
Kewaunee	1976	2011	454	1171	566	1451	674	1720
Lacrosse	1972	1987	38	333	Final Discharge in 1987			
LaSalle 1	1985	2011	598	3325	824	4605	1024	5735
LaSalle 2	1987	2011	639	3560	885	4946	1101	6167
Limerick 1	1987	2011	607	3386	827	4627	1028	5757
Limerick 2	1981	2011	645	3623	856	4814	1060	5964
Main Yankee	1974	1996	542	1434	Final Discharge in 1996			
McGuire 1	1984	2011	713	1590	961	2136	1245	2760
McGuire 2	1985	2011	677	1510	929	2065	1148	2545
Millstone 1	1971	1995	526	2884	Final Discharge in 1995			
Millstone 2	1977	2011	560	1417	729	1843	858	2166
Millstone 3	1987	2011	506	1104	706	1544	929	2034
Monticello	1973	2011	557	3117	689	3893	861	4900
Nine Mile Point 1	1971	2011	593	3319	718	4053	881	5013
Nine Mile Point 2	1990	2011	537	3075	766	4421	968	5609
North Anna 1	1980	2011	578	1249	760	1641	927	1999
North Anna 2	1982	2011	619	1336	772	1666	937	2021
Oconee 1	1974	2011	725	1557	887	1906	1022	2196
Oconee 2	1976	2011	699	1504	839	1810	980	2117
Oconee 3	1976	2011	685	1465	868	1853	1026	2188
Oyster Creek 1	1971	2011	622	3488	748	4219	923	5241
Palisades	1975	2011	588	1440	748	1812	951	2283
Palo Verde 1	1987	2011	663	1551	922	2144	1189	2755
Palo Verde 2	1988	2011	662	1549	937	2181	1147	2660
Palo Verde 2	1989	2011	629	1469	928	2153	1188	2750
Peach Bottom 2	1976	2011	851	4725	1086	6041	1287	7160
Peach Bottom 3	1976	2011	853	4730	1080	6004	1273	7092
Perry 1	1989	2011	643	3561	879	4882	1091	6063
Pilgrim 1	1973	2011	553	3069	685	3826	797	4468
Point Beach 1	1972	2011	437	1138	515	1335	630	1626
Point Beach 2	1974	2011	396	1035	494	1281	577	1493
Prairie Island 1	1976	2011	423	1155	518	1424	605	1673
Prairie Island 2	1976	2011	421	1149	517	1422	612	1692

Reactor Name	Year First discharge	Discharge Date By Year 2011*	Estimated Cumulative Discharges 2011		Projected Cumulative Discharges 2021		Projected Cumulative Discharges 2031	
			MTHM	# Assm	MTHM	# Assm	MTHM	# Assm
Quad Cities 1	1975	2011	778	4360	960	5407	1119	6319
Quad Cities 2	1974	2011	704	3925	898	5050	1081	6113
Rancho Seco 1	1977	2011	228	493	228	493	228	493
Robinson 2	1973	2011	656	1509	791	1820	971	2235
RVR Bend 1	1987	2010	569	3204	200	1138	366	2086
Salem 1	1979	2011	658	1431	845	1842	1040	2272
Salem 2	1983	2011	572	1244	778	1694	939	2048
San Onofre	1970	1992	245	665	Final Discharge in 1992			
San Onofre 2	1984	2011	666	1581	899	2117	1115	2613
San Onofre 3	1985	2011	664	1578	889	2096	1069	2508
Seabrook 1	1981	2011	513	1121	748	1638	938	2057
Sequoyah 1	1982	2011	583	1273	799	1749	997	2185
Sequoyah 2	1983	2011	626	1365	863	1888	1051	2302
South Texas 1	1989	2011	578	1076	798	1491	973	1820
South Texas 2	1990	2011	563	1050	769	1437	993	1860
Saint Lucie 1	1978	2011	703	1817	861	2212	1024	2622
Saint Lucie 2	1984	2011	517	1336	695	1784	854	2182
Summer 1	1984	2011	518	1206	697	1634	847	1995
Surry 1	1974	2011	630	1373	797	1736	931	2026
Surry 2	1975	2011	625	1362	809	1760	958	2084
Susquehanna 1	1985	2011	719	4070	972	5497	1196	6755
Susquehanna 2	1985	2011	707	3999	954	5393	1172	6621
Trojan	1978	1992	359	780	Final Discharge in 1992			
Turkey Point 3	1974	2011	586	1284	751	1648	886	1948
Turkey Point 4	1976	2011	575	1261	733	1608	848	1863
Vogtle 1	1988	2011	612	1408	834	1933	1012	2353
Voglte 2	1990	2011	552	1280	762	1775	980	2291
VT Yankee 1	1973	2011	637	3503	786	4336	934	5161
Washington Nuclear	1986	2011	641	3644	863	4904	1059	6013
Waterford 3	1986	2011	634	1518	901	2143	1108	2628
Watts Bar 1	1997	2011	359	780	581	1263	761	1655
Wolf Creek 1	1986	2011	653	1419	893	1945	1077	2348
Yankee Rowe	1972	1991	127	533	Final Discharge in 1991			
Zion 1	1976	1991	524	1143	Final Discharge in 1991			
Zion 2	1977	1996	495	1083	Final Discharge in 1996			
Total*			**66,876**	**232,656**	**86,240**	**295,386**	**105,323**	**355,849**

Table 16 Commercial Inventory of Uranium Oxide Fuel being Stored Dry at Argonne National Laboratory – East

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
COMMERCIAL BWR & PWR SNF	SCRAP RODS IN CANISTER	19	CANISTER OF SCRAP	ZIRC	0.038	60,000				ANL-E-AGHCF-DOE TEST
DRESII, HBR, BR-3, BRP, TMI	SCRAP IN CANISTER	1	CANISTER OF SCRAP	ZIRC	0.02		40,000	9/1/79		ANL-E-AGHCF
SURRY (T11 SCRAP RODS)	SCRAP RODS IN CANISTER	15	ROD SECTIONS	ZIRC	0.006	35,722	35,722	11/6/81	02/22/01	LIMERICK ROD SECTION SHIPPING TUBE

Table 17 Commercial Inventory of Uranium Oxide Fuel being Stored Dry at Hanford Reservation

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
HANFORD COMMERCIAL TEST SCRAP	CANISTER OF SCRAP	6	CANISTER OF SCRAP	ZIRC	0.064			1/9/82		1) EBR-II PIPE CONTAINER 2) EBR-II CASK
GE TEST	CANISTER OF SCRAP	22	CANISTER OF SCRAP	ZIRC-2	0.045			12/31/74		GE TEST-200 WEST BG-CASK
MIXED PLUTONIUM & URANIUM TEST[a]	CANISTER OF SCRAP	32	CANISTER OF SCRAP	SST	0.2			1/9/82		1) EBR-II PIPE CONTAINER 2) EBR-II CASK
POINT BEACH	ASSEMBLY	3	14 X 14 ROD ARRAY	ZIRC-4	1.162	32,300	32,300	10/9/81	12/31/02	1) LWR CANISTER 2) NAC-1 CASK

[a] Pu alloy

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
COOPER NUCLEAR	RODS	95	ROD	ZIRC-2	0.357	27,842	28,000	5/21/82	12/31/02	1) CONSOLIDATED ROD CONTAINER 2) LWR CANISTER 3) NAC-1 CASK
HANFORD LWR SCRAP	CANISTER OF SCRAP	3	CANISTER OF SCRAP	ZIRC-2	0.064	35,768	42,700	9/30/82		1) HANFORD ENGINEERED CONTAINER 2) GNS-12 CASK
CALVERT CLIFFS 1 (PARTIAL ASSEMBLIES)	ASSEMBLY	2	14 X 14 ROD ARRAY	ZIRC-4	0.649	35,768	42,700	4/17/82	12/31/02	1) LWR CANISTER 2) NAC-1 CASK
SEGMENT ROD PROGRAM (RODS)	ROD SEGMENTS	6	ROD SEGMENTS	ZIRC	0.004	23,476	23,700	9/30/82	12/31/02	1) CONSOLIDATED ROD CONTAINER 2) LWR CANISTER 3) NAC-1 CASK
SP-100 FUEL	CANISTER OF SCRAP	2	CANISTER OF SCRAP	N/A	0.003			1/1/92		1) EBR-II PIPE CONTAINER 2) EBR-II CASK
CALVERT CLIFFS (RODS)	RODS	17	ROD	ZIRC-4	0.034	38,106	42,700	4/17/82	12/31/02	1) CONSOLIDATED ROD CONTAINER 2) LWR CANISTER 3) NAC-1 CASK

Note- Fuel composition – all the fuel is U oxide unless indicated

Table 18 Commercial Inventory of Uranium Oxide Fuel being Stored Dry at Idaho National Laboratory

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
DRESDEN I (E00161)	ASSEMBLY	1	6 X 6 ROD ARRAY	ZIRC-2	0.1	21,808	21,808	2/1/73	07/24/78	1) DRESDEN OVERPACK 2) REA 2023 DRY STORAGE CASK
BRPb - F/PU and E-G/PU	ASSEMBLY	4	9 X 9 ROD ARRAY	ZIRC-2	0.54	14,518	16,630	6/2/74	11/01/74	TN-BRP CASK
BRP E-G & E-G/F	ASSEMBLY	35	9 X 9 ROD ARRAY	ZIRC-2	4.69	13,349	18,362	3/23/74	11/01/74	TN-BRP CASK
H. B. ROBINSON RODS	RODS	12	ROD	ZIRC-4	0.021	28,000	31,400	6/1/74	12/01/85	1) LOFT/COMMERCIAL SURRY BASKET 2) REA 2023 DRY STORAGE CASK
BRP-B	ASSEMBLY	2	11 X 11 ROD ARRAY	ZIRC-2	0.25	20,218	20,247	3/18/72	11/01/74	TN-BRP CASK
H. B. ROBINSON (ASSEMBLY)	ASSEMBLY	1	ASSEMBLY	ZIRC-4	0.239	28,000	31,460	6/1/74	12/01/85	1) H B ROBINSON OVERPACK 2) REA 2023 DRY STORAGE CASK
BRP-C	ASSEMBLY	4	11 X 11 ROD ARRAY	ZIRC-2	0.46	24,094	24,997	3/18/72	03/21/68	TN-BRP CASK
BRP-D1	ASSEMBLY	4	7 X 7 ROD ARRAY	ZIRC-2	0.508	1,643	1,690	6/21/68	09/01/73	TN-BRP CASK
CONNECTICUT YANKEE	ASSEMBLY	1	15 X 15 ROD ARRAY	SST (304L)	0.382	32,151	32,151	5/18/75	11/01/87	1) CONN. YANKEE OVERPACK 2)REA 2023 DRY STORAGE CASK
BRP-D2	ASSEMBLY	2	8 X 8 ROD ARRAY	ZIRC-2	0.217	4,546	7,027	6/21/68	11/01/74	TN-BRP CASK
BRP-E	ASSEMBLY	18	9 X 9 ROD ARRAY	ZIRC-2	2.421	11,934	13,792	3/18/72	11/01/74	TN-BRP CASK
DRCT	RODS	6936	ROD	ZIRC-4	15.006	29,330	35,440	11/6/81	12/01/85	1) DRCT-TAN-791-CANISTER (17) 2) TN 24P CASK
DRCT	RODS	2856	ROD	ZIRC-4	6.145	29,330	35,440	11/6/81	12/01/85	1) DRCT-TAN-791-CANISTER (7) 2) TN 24P CASK
BRP-EP[b]	ASSEMBLY	3	9 X 9 ROD ARRAY	ZIRC-2	0.352	17,859	19,275	3/23/74	11/01/74	TN-BRP CASK

[b] Pu/U oxide

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
BRP-F	ASSEMBLY	13	9 X 9 ROD ARRAY	ZIRC-2	1.757	10,510	14,339	3/23/74	11/01/74	TN-BRP CASK
LOFT FUEL RODS	RODS	2	ROD	ZIRC-4	0.002	1,420	1,420	12/19/84	01/01/75	1) LOFT/COMMERCIAL SURRY BASKET 2) REA 2023 DRY STORAGE CASK
DRESDEN I (UN0064)	ASSEMBLY	1	6 X 6 ROD ARRAY	ZIRC-2	0.053	26,201	26,201		07/24/78	1) DRESDEN OVERPACK 2) REA 2023 DRY STORAGE CASK
TURKEY POINT	ASSEMBLY	5	15 X 15 ROD ARRAY	ZIRC-4	2.222	27,587	27,863	11/19/77	12/01/85	MC-10 DRY STORAGE CASK
SURRY (T11 RODS)	RODS	9	ROD	ZIRC	0.019	35,722	35,722	11/6/81	10/17/04	1) LOFT/COMMERCIAL SURRY BASKET 2) REA 2023 DRY STORAGE CASK
SURRY	ASSEMBLY	20	15 X 15 ROD ARRAY	ZIRC	8.832	32,315	35,722	6/30/83	10/15/04	GNS CASTOR V/21 CASK
LOFT CENTER FUEL MODULE FP-2 REMAINS	SCRAP IN CANISTER	15	CANISTER OF SCRAP	ZIRC-4	0.079	430	430	7/9/85	01/01/75	1) LOFT FP-2 CANISTER 2) REA 2023 DRY STORAGE CASK
SURRY	ASSEMBLY	12	15 X 15 ROD ARRAY	ZIRC	5.314	29,776	31,551	11/6/81	10/19/04	MC-10 DRY STORAGE CASK
TMI-2 CORE DEBRIS (D-153 & 388)	CANISTER OF SCRAP	2	DEBRIS	ZIRC-4	0.019	3,175	5,965	3/28/79	07/01/85	1) TMI CANISTER D-153 & D388 2) NUPAC 125B-2 DRY STORAGE CASK
PEACH BOTTOM RODS	RODS	21	ROD	ZIRC-2	0.071	10,250	11,900	3/1/76	04/01/77	1) LOFT/COMMERCIAL SURRY BASKET 2) REA 2023 DRY STORAGE CASK
PEACH BOTTOM (ASSEMBLY)	ASSEMBLY	2	7 X 7 ROD ARRAY	ZIRC-2	0.285	10,250	11,900	3/1/76	04/01/77	1) PEACH BOTTOM OVERPACK 2) REA 2023 DRY STORAGE CASK
SURRY (T11 ASSEMBLY)	ASSEMBLY	1	15 X 15 ROD ARRAY	ZIRC	0.414	35,722	35,722	11/6/81	10/15/04	GNS CASTOR V/21 CASK
LWR SNF SCRAP	SCRAP RODS IN A	9	CANISTER OF SCRAP	ZIRC OR SST	0.154			1/1/85		SNF-ORNL (LWR 7827)

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
	CANISTER									
ROBERT E. GINNA	ASSEMBLY	40	14 X 14 ROD ARRAY	ZIRC-4	15.127	10,117	14,293	4/15/72	06/01/73	TN-REG
TURKEY POINT 3 (TP3) B-17	ASSEMBLY	1	15 X 15 ROD ARRAY	ZIRC-4	0.412	27,577	27,577	10/31/75	10/28/87	MC-10 DRY STORAGE CASK
LOOSE FUEL ROD STORAGE BASKET (LFRSB)	CANISTER OF SCRAP	1	CANISTER OF SCRAP	ZIRC	0.312			12/23/87	10/01/87	1) LFSRB OVERPACK 2) REA 2023 DRY STORAGE CASK
LOFT SQUARE FUEL MODULE	ASSEMBLY	4	15 X 15 ROD ARRAY	ZIRC-4	0.813	6,200	6,200	7/9/85	01/01/75	TN-24P DRY STORAGE CASK
LOFT CORNER FUEL MODULE	ASSEMBLY	4	12 X 12 ROD ARRAY	ZIRC-4	0.279	6,200	6,200	7/9/85	01/01/75	TN-24P DRY STORAGE CASK
LOFT CENTER FUEL MODULE (FP-1)	ASSEMBLY	1	15 X 15 ROD ARRAY	ZIRC-4	0.202	1,420	1,420	12/19/84	01/01/75	1) LOFT FP-1 CANISTER 2) REA 2023 DRY STORAGE CASK
LOFT CENTER FUEL MODULE (A1,A2,A3,F1)	ASSEMBLY	4	15 X 15 ROD ARRAY	ZIRC-4	0.809	1,413	2,400	3/5/84	01/01/75	TN-24P DRY STORAGE CASK
TMI-2 CORE DEBRIS	CANISTER OF SCRAP	341	DEBRIS	ZIRC-4	81.588	3,175	5,965	3/28/79	06/30/01	1) TMI CANISTER (IN DSC'S) 2) DRY SHIELDED CASK

Note- Fuel composition – all the fuel is U oxide unless indicated

Table 19 Commercial Inventory of Uranium Oxide Fuel being Stored Wet at the Savannah River Site

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
VBWR	ELEMENT	7	ROD	ZIRC-2	0.004			12/1/62	01/01/66	BWL-B Canister
SAXTON	RODS	25	ELEMENT	SST	0.096		1.000	4/30/72	04/30/74	
SAXTON	RODS	20	ELEMENT	SST	0.01		1.600	4/30/72	04/30/74	
SAXTON	RODS	43	ELEMENT	ZIRC	0.24		1.000	4/30/72	04/30/74	
HWCTR OT	ELEMENT	8	TUBE	ZIRC	0.14		1.500	2/14/64	01/01/66	
N.S. SAVANNAH	ELEMENT	12	UNKNOWN	ZIRC	0.021		1.500	11/5/65	01/01/66	
DRESDEN[c] I	RODS	1.273	ROD	SST	2.543	10.951	11.700	3/29/65	01/01/66	DRESDEN TS CAN
LWR SAMPLES[d] (MOX)	RODS	5	ROD	ZIRC OR SST	0.013			8/20/81	01/01/66	
H. B. ROBINSON	SCRAP RODS IN CANISTER	1	CANISTER OF SCRAP	ZIRC-4	0.001		30.000	8/4/83		P-214
SAXTON	RODS	9	ELEMENT	ZIRC	0.041		1.600	4/30/72	04/30/74	
SHIPPINGPORT	RODS	127	ROD	ZIRC-2	0.017		18.000	1/1/64	1981	

Note- Fuel composition – all the fuel is U oxide unless indicated

Table 20 Commercial Fuel Inventory of Uranium Oxide Fuel being Stored Dry at B&W Lynchburg Technology Center

Fuel Unit Name/ DOE Facility	Fuel Unit Type	Number of Fuel Units	Fuel Configuration	Cladding	Total MTHM	Avg Burnup	Max Burnup	Date Removed from Reactor	Storage Date	Storage Container(s)
ARKANSAS	ELEMENT	3	SCRAP	ZIRC-4	0.012	47,000		9/1/86	07/19/87	
TMI-2	CANISTER OF SCRAP	1	CANISTER OF SCRAP	ZIRC-4	0	3,175	5,965	7/1/85		TMI-B&W-NESI-DEBRIS
OCONEE	ELEMENT	14	ROD	ZIRC-4	0.032	33,835	50,000	9/1/86		

[c] Th/U oxide

[d] Pu/U oxide

Table 21 Supplemental Information on Commercial Fuel Inventory at B&W Lynchburg Technology Center

Date Received	Assembly Number	Power Station	Unit No./ Cycle No	MWD/T Burnup	No of Rods on Site (Sectioned)	Uranium % Enrichment or Depleted	Depleted Uranium Grams	Enriched Uranium Grams	Grams Isotope (U-235)	Owner
8/23/1976	1C56	Oconee	1/2	18,686	0.333	0.8	0	531	4	Private
1/25/1978	1D40	Oconee	1/2	24,080	1	1.3	0	2159	28	Private
3/15/1978	1C66	Oconee	1/3	26,480	3	0.51	6482	0	34	Private
1/18/1978	2B40	Oconee	2/2	27,500	5	0.98	0	10711	105	Private
5/31/1980	1D54	Oconee	1/3	31,160	2	0.96	0	4275	41	DOE
12/5/1980	1D13	Oconee	1/4	39,180	5	0.52	10554	0	55	DOE
						7.8	0	706	55	Private
3/1/1966		Indian Point		33,000		52.75 Av.	0	91	48	Private
10/27/1983	TMI-2 Fuel Debris					2.36	0	16	*	DOE
2/4/1984	1D45	Oconee	1/8	50,000	4	0.353	8250	0	29	DOE
2/4/1984	1D45	Oconee	1/5	50,000	1	0.353	2063	0	7	Private
7/13/1985	NJ037P	Oconee	1/1	15,000	4	1.3 (a)	0	7886	102	DOE
9/19/1986	LJG764	CECO	2/7	29,523	2	0.6271	5422	0	34	Private
9/19/1986	LJG769	CECO	2/7	29,524	2	0.4485	5427	0	24	Private
3/13/1987	TMI-2 Fuel Debris					2.98	0	32	1	Private
7/19/1987	NJ023Q	Arkansas	1/3	47,000	6	0.3923	11752	0	45	DOE
12/10/1988	NJ01jE	Oconee	2/2	31,000	3	0.6691	0	6412	57	Private
12/10/1988	NJ01P	Oconee	2/3	36,000	1	0.7049	1999	0	14	Private
10/1/1989	NJ037K	Oconee	1/4	59,300	8	.3232 (a)	14543	0	36	Private
3/25/1994	NJ044J	McGuire	1/3	42,984	3	0.497	5001	0	24	Private
				45,000		31.00 (a)	0	2126	659	Private
8/3/2006	NJ092T	North Anna	1&2/4	70,000	Residue	0.439 Av.	647	0	3	DOE
Total					50.333		72,140	34,945	1,405	

Table 22 University Research Reactors Reporting Spent Fuel (CRS)

University	State	University	State
University of Arizona [O]	AZ	North Carolina State University [O]	NC
University of California (Irvine) [O]	CA	State University of New York (Buffalo) [S]	NY
University of California (Davis) [O]	CA	Cornell University [O]	NY
University of Florida [O]	FL	Ohio State University [O]	OH
University of Illinois (Urbana) [D S]	IL	Oregon State University [O D]	OR
Purdue University [O]	IN	Reed College [O]	OR
Kansas State University [D]	KS	Pennsylvania State University	PA
Massachusetts Institute of Technology [O]	MA	Rhode Island Nuclear Science Center [O]	RI
University of Massachusetts (Lowell) [O]	MA	University of Texas (Austin) [D]	TX
Worcester Polytechnic Institute [*]	MA	Texas A&M [O D]	TX
University of Michigan [*]	MI	University of Utah [O]	UT
University of Missouri [S]	MO	University of Wisconsin [O]	WI
[O] Operating [D] Decommissioned [S] Shutdown [*] Unknown Status			