Locations of Spent
Nuclear Fuel and
High-Level
Radioactive Waste
Ultimately Destined
for
Geologic Disposal

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Office of Civilian Radioactive Waste Management (OCRWM)

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The table and map in this publication are intended to demonstrate the wide geographic distribution of spent nuclear fuel and high-level radioactive waste. Information was confirmed through reports and personal interviews and is valid as of July 29, 1994.

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Since the late 1950s, Americans have come to rely more and more on energy generated from nuclear reactors. Today, 109 commercial nuclear reactors supply over one-fifth of the electricity used to run our homes, schools, factories, and farms. When the nuclear fuel can no longer sustain a fission reaction in these reactors it becomes "spent" or "used" and is removed from the reactors and stored onsite.

Most of our Nation's spent nuclear fuel is currently being stored in specially designed deep pools of water at reactor sites; some is being stored aboveground in heavy thick-walled metal or concrete structures. Sites currently using aboveground dry storage systems include Virginia Power's Surry Plant, Carolina Power and Light's H.B. Robinson Plant, Duke Power's Oconee Nuclear Station, Colorado Public Service Company's shut-down reactor at Fort St. Vrain, Baltimore Gas and Electric's Calvert Cliffs Plant, and Michigan's Consumer Power Palisades Plant.

Defense high-level radioactive waste, which results from defense activities, is stored primarily in double-walled steel tanks located on Federal reservations at Idaho National Engineering Laboratory, Idaho; the Savannah River Site, South Carolina; and the Hanford Reservation, Washington.

Although the current methods of storage are safe, they are only temporary solutions.

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In 1982, Congress enacted the Nuclear Waste Policy Act (NWPA), which outlines a comprehensive plan for the safe disposal of spent nuclear fuel and other forms of high-level nuclear waste. It includes development of a mined geologic repository for disposal of these wastes. An amendment enacted in 1987 authorizes the development of a temporary, aboveground facility called a Monitored Retrievable Storage (MRS) facility, which could use storage technologies already in operation and demonstrated to be safe. An MRS would temporarily store a limited amount of spent nuclear fuel until it can

be shipped to an underground permanent disposal facility. OCRWM, under the NWPA, as amended, has been authorized to site, construct, and operate an MRS, subject to certain conditions.

The 1987 Amendments Act established the Office of the Nuclear Waste Negotiator. It is the responsibility of the Negotiator to attempt to find a State or Indian Tribe willing to host a repository or MRS facility at a technically qualified site on reasonable terms. OCRWM's preferred strategy for siting an MRS is through an agreement negotiated by the Negotiator.

OCRWM has also been charged with siting, building, and operating a Federal geologic repository. To date, no repository has been sited; however, in 1987, the NWPA

Amendments Act designated Yucca Mountain, Nevada, for site characterization to determine whether it is suitable for a repository. If the site meets licensing requirements, and is approved by the President and Congress, Yucca Mountain may become the repository site.

OCRWM is evaluating a standardized multipurpose canister (MPC) system for storage, transportation, and disposal of spent fuel. Such a system offers the potential for reduced handling of bare spent fuel, as well as standardization

across the system and compatibility among storage technologies. An MPC-based system will also simplify transfer of spent fuel from the utilities into the Federal system and facilitate transportation and disposal operations.

The following pages provide a matrix depicting the locations of spent nuclear fuel and high-level radioactive waste ultimately destined for geologic disposal. Each location will sooner or later need to transport its waste from its temporary storage facility to an MRS or a Federal geologic repository.

State	Commercial Reactors	Non-DOE Research Reactors	Navy Reactor Fuel	DOE-Owned Spent Fuel and High-Level Radioactive Waste
Hawaii			Pearl Harbor (Honolulu)	
Idaho		Idaho State University (Pocatello)	Idaho Naval Reactor (Idaho Falls)	Idaho National Engineering Laboratory/ (includes Argonne National Laboratory – West) (Idaho Falls)
Illinois	Clinton Plant 1 (Clinton) Quad Cities Nuclear Station 1, 2 (Cordova) Braidwood Plant 1, 2 (Braidwood) Zion Plant 1, 2 (Zion) Byron Plant 1, 2 (Byron) Dresden Station 1*, 2, 3 (Morris) LaSalle Station 1, 2 (Seneca) General Electric (Morris)**	University of Illinois 1, 2 (Urbana)		Argonne National Laboratory-East (Argonne)
Indiana		Purdue University (West Lafayette)		
Iowa	Duane Arnold 1 (Palo)	Iowa State University (Ames)		
Kansas	Wolf Creek Plant 1 (Burlington)	Kansas State University (Manhattan)		
Louisiana	Waterford Plant 3 (Taft) River Bend Plant 1 (St. Francisville)			
Maine	Maine Yankee Plant 1 (Wiscasset)		Portsmouth Naval Shipyard (Kittery)	

* shut-down reactors with spent nuclear fuel onsite

** commercial spent fuel storage site

State	Commercial Reactors	Non-DOE Research Reactors	Navy Reactor Fuel	DOE-Owned Spent Fuel and High-Level Radioactive Waste
Alabama	Browns Ferry Plant 1, 2, 3 (Decatur) Joseph M. Farley 1, 2 (Dothan)			
Arizona	Palo Verde Station 1, 2, 3 (Wintersburg)	University of Arizona (Tucson)		
Arkansas	Arkansas Nuclear One 1, 2 (Russellville)			
California	Diablo Canyon Plant 1, 2 (Avila Beach) Rancho Seco Plant 1* (Clay Station) San Onofre Plant 1*, 2, 3 (San Clemente) Humboldt Bay 3* (Eureka)	University of California (Irvine) General Electric (Pleasanton) McLellan Air Force Base†† (Sacramento) General Atomics 1, 2 (San Diego) Aerotest Research (San Ramon)	Mare Island (Vallejo)	
Colorado	Fort St. Vrain* (Platteville)	U.S. Geological Survey (Denver)		
Connecticut	Haddam Neck Plant 1 (Haddam Neck) Millstone Plant 1, 2, 3 (Waterford)		Knolls Atomic Power Laboratory (Windsor Locks)	
Florida	Crystal River Plant 3 (Red Laval) St. Lucie Plant 1, 2 (Hutchinson Island) Turkey Point Plant 3, 4 (Florida City)	University of Florida (Gainesville)		
Georgia	Edwin I. Hatch Plant 1, 2 (Baxley) Alvin W. Vogtle 1, 2 (Waynesboro)	Georgia Institute of Technology (Atlanta)		

* shut-down reactors with spent nuclear fuel onsite

†† status of spent fuel inventory to be determined

State	Commercial Reactors	Non-DOE Research Reactors	Navy Reactor Fuel	DOE-Owned Spent Fuel and High-Level Radioactive Waste
New Jersey	Oyster Creek Plant 1 (Forked River) Salem Generating Station 1, 2*** (Hancocks Bridge) Hope Creek Generating Station 1*** (Hancocks Bridge)			
New Mexico		University of New Mexico (Albuquerque)		Los Alamos National Laboratory/Omega West Reactor (Los Alamos) Sandia National Laboratory (Albuquerque)
New York	Nine Mile Point Plant 1, 2 (Lycoming) Indian Point Plant 1*, 2 (Buchanan) Indian Point Plant 3 (Buchanan) James A. FitzPatrick Nuclear Plant 1 (Lycoming) Robert E. Ginna Plant 1 (Ontario) Shoreham Station @ (Wedding River)	State University of New York (Buffalo) Cornell University 1, 2 (Ithaca) Mannhattan College (Bronx) Rensselaer Polytechnic Institute (Troy)	Knolls Atomic Power Laboratory (West Milton)	Brookhaven National Laboratory (Upton) (High-flux Beam Reactor) (Brookhaven Medical Research Reactor) West Valley Demonstration Project (West Valley)
North Carolina	Brunswick Plant 1, 2 (Southport) Shearon Harris 1 (Newhall) W. B. McGuire Plant 1, 2 (Huntersville)	North Carolina State University (Raleigh)		
Ohio	Davis Besse Plant 1 (Tolado) Perry Plant 1 (Perry)	Ohio State University (Columbus)		

* shut-down reactors with spent nuclear fuel onsite

*** Salem and Hope Creek Generating Stations, NJ, are located on the same site.

@ shut-down reactor/spent nuclear fuel has been shipped to Limerick Generating Station,

PA as of May 1994

State	Commercial Reactors	Non-DOE Research Reactors	Navy Reactor Fuel	DOE-Owned Spent Fuel and High-Level Radioactive Waste
Maryland	Calvert Cliffs Plant 1, 2 (Lusby)	University of Maryland (College Park) National Institute of Standards and Technology (Gaithersburg) Armed Forces Radiobiology Research Institute (Bethesda) U.S. Army Aberdeen Proving Grounds (Aberdeen) <i>††</i>		
Massachusetts	Pilgrim Plant 1 (Plymouth) Yankee Rowe Plant 1* (Rowe)	University of Massachusetts (Lowell) Massachusetts Institute of Technology (Cambridge) Worcester Polytechnical Institute (Worcester)		
Michigan	Enrico Fermi 2 (Newport) Donald C. Cook Plant 1, 2 (Bridgman) Palisades Plant 1 (South Haven) Big Rock Point Plant 1 (Charlevoix)	University of Michigan (Ann Arbor) Dow Chemical (Midland)		
Minnesota	Monticello Plant 1 (Monticello) Prairie Island Plant 1, 2 (Red Wing)			
Mississippi	Grand Gulf Station 1 (Port Gibson)			
Missouri	Callaway Plant 1 (Fulton)	University of Missouri (Columbia) University of Missouri (Rolla)		
Nebraska	Cooper Plant 1 (Brownsville) Fort Calhoun Plant 1 (Fort Calhoun)	Veterans Administration (Omaha)		
New Hampshire	Seabrook Station 1 (Seabrook)			

* shut-down reactors with spent nuclear fuel onsite

†† status of spent fuel inventory to be determined

State	Commercial Reactors	Non-DOE Research Reactors	Navy Reactor Fuel	DOE-Owned Spent Fuel and High-Level Radioactive Waste
Oregon	Trojan Plant 1* (Ranier)	Oregon State University (Corvallis) Reed College (Portland)		
Pennsylvania	Susquehanna Plant 1, 2 (Berwick) Limerick Generating Station 1, 2 (Linfield) Peach Bottom Station 2, 3 (Delta) Three Mile Island 1 (Middletown) Beaver Valley Plant 1, 2 (Shippingport)	Pennsylvania State University (State College)		
Rhode Island		Rhode Island Nuclear Science Center (Narragansett)		
South Carolina	H.B. Robinson Plant 2 (Hartsville) Catawba Plant 1, 2 (Clover) Oconee Plant 1, 2, 3 (Seneca) Virgil C. Summer 1 (Parr)		Charleston Naval Shipyard (Charleston)	Savannah River Site (Aiken)
Tennessee	Sequoyah Plant 1, 2 (Soddy-Daisy)			Oak Ridge National Laboratory (Oak Ridge)
Texas	Comanche Peak Plant 1, 2 (Glen Rose) South Texas Plant 1, 2 (Palacios)	Texas A&M University 1, 2 (College Station) University of Texas (Austin)		
Utah		University of Utah 1 (Salt Lake City)		
Vermont	Vermont Yankee 1 (Vernon)			
Virginia	North Anna Power Plant 1,2 (Mineral) Surry Power Plant 1,2 (Surry)	University of Virginia 1 (Charlottesville)	Norfolk Naval Shipyard (Portsmouth) Newport News Shipbuilding (Newport News)	B & W Nuclear Environmental Services, Inc. (Lynchburg)

* shut-down reactors with spent nuclear fuel onsite

State	Commercial Reactors	Non-DOE Research Reactors	Navy Reactor Fuel	DOE-Owned Spent Fuel and High-Level Radioactive Waste
Washington	Washington Nuclear Plant 2 (Richland)	Washington State University (Pullman)	Puget Sound Naval Shipyard (Bremerton)	Hanford Reservation (Richland)
Wisconsin	Point Beach Plant 1, 2 (Two Rivers) Kewaunee Plant 1 (Carlton) La Crosse* (Genoa)	University of Wisconsin (Madison)		
District of Columbia		Catholic University+		

+ spent nuclear fuel anticipated to be shipped to a DOE facility in 1994.

* shut-down reactors with spent nuclear fuel onsite

References

Berry, Robert, Texas A&M University Nuclear Engineering Department, College Station, TX. Interview.

Holm, Richard, University of Illinois Nuclear Engineering Department, Urbana, IL. Interview.

Hosticka, Bouvard, University of Virginia Reactor Facility, Charlottesville, VA. Interview.

Luster, Don, Catholic University Radiation Safety Office, Washington, D.C. Interview.

Ryan, Brendan, Kansas State University Nuclear Engineering Department, Manhattan, KS. Interview.

Slaughter, David, University of Utah, Mechanical Engineering Department, Salt Lake City, UT. Interview.

Idaho National Engineering Laboratory, "Spent Fuel Background Report," EGG-WM-11249, Vol. 1, Idaho National Engineering Laboratory EG&G Idaho, Inc., March 1994.

Nuclear Regulatory Commission, Nuclear Regulatory Commission Information Digest (1994 Edition), NUREG-1350, Vol. 6, Washington, DC, U.S. Nuclear Regulatory Office, March 1994.

O'Toole, Tara, "Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel and Other Reactor Irradiated Nuclear Materials and Their Environmental Safety and Health Vulnerabilities," Vol. 1, Washington, DC, U.S. Department of Energy, November 1993.

U.S. Department of Energy Energy Information Administration, "Spent Nuclear Fuel Discharges from U.S. Reactors 1992," Washington, DC, U.S. Department of Energy, SR/CNEAF/94-01. May 1994.

U.S. Department of Energy, Nuclear Fuel Data: Form RW-859 (electronic database), Washington, DC, U.S. Department of Energy, 1992.

U.S. Department of Energy, Office of Civilian Radioactive Waste Management, "Characteristics of Potential Repository Wastes," Vol. 4, Washington, D.C., U.S. Department of Energy, July 1992.

U.S. Department of Energy, Environmental Restoration and Waste Management Programs, Draft EIS, DOE/EIS-0203-D, June 1994.

References

Berry, Robert, Texas A&M University Nuclear Engineering Department, College Station, TX. Interview.

Holm, Richard, University of Illinois Nuclear Engineering Department, Urbana, IL. Interview.

Hosticka, Bouvard, University of Virginia Reactor Facility, Charlottesville, VA. Interview.

Luster, Don, Catholic University Radiation Safety Office, Washington, D.C. Interview.

Ryan, Brendan, Kansas State University Nuclear Engineering Department, Manhattan, KS. Interview.

Slaughter, David, University of Utah, Mechanical Engineering Department, Salt Lake City, UT. Interview.

Idaho National Engineering Laboratory, "Spent Fuel Background Report," EGG-WM-11249, Vol. 1, Idaho National Engineering Laboratory EG&G Idaho, Inc., March 1994.

Nuclear Regulatory Commission, Nuclear Regulatory Commission Information Digest (1994 Edition), NUREG-1350, Vol. 6, Washington, DC, U.S. Nuclear Regulatory Office, March 1994.

O'Toole, Tara, "Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel and Other Reactor Irradiated Nuclear Materials and Their Environmental Safety and Health Vulnerabilities," Vol. 1, Washington, DC, U.S. Department of Energy, November 1993.

U.S. Department of Energy Energy Information Administration, "Spent Nuclear Fuel Discharges from U.S. Reactors 1992," Washington, DC, U.S. Department of Energy, SR/CNEAF/94-01. May 1994.

U.S. Department of Energy, Nuclear Fuel Data: Form RW-859 (electronic database), Washington, DC, U.S. Department of Energy, 1992.

U.S. Department of Energy, Office of Civilian Radioactive Waste Management, "Characteristics of Potential Repository Wastes," Vol. 4, Washington, D.C., U.S. Department of Energy, July 1992.

U.S. Department of Energy, Environmental Restoration and Waste Management Programs, Draft EIS, DOE/EIS-0203-D, June 1994.