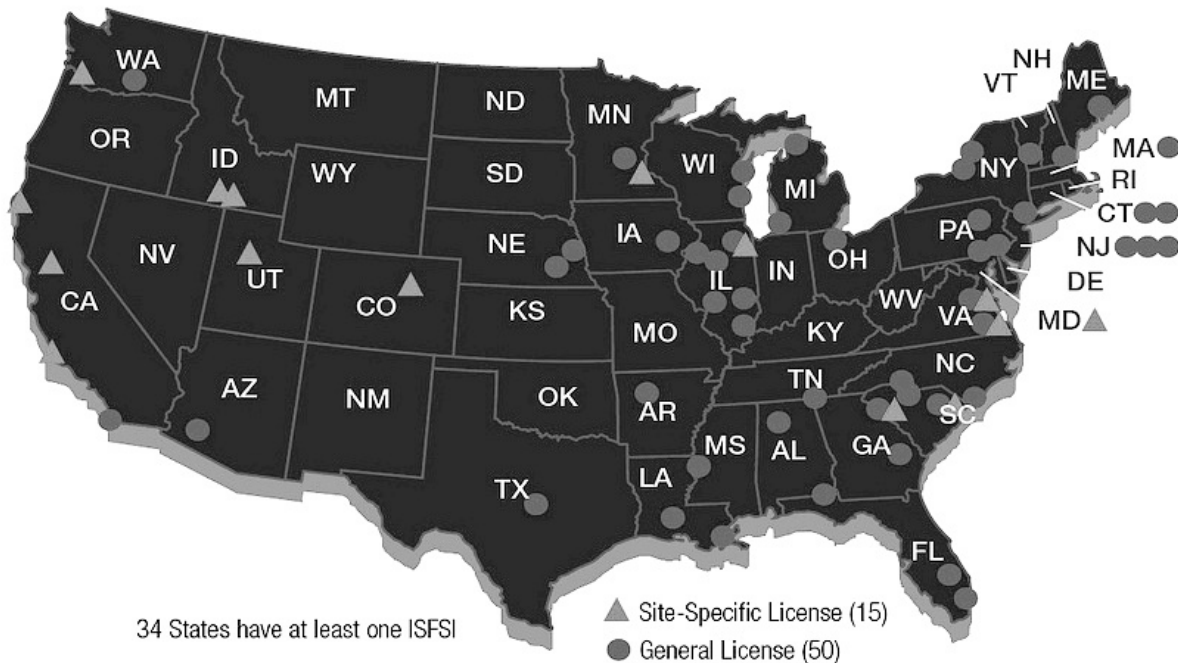


# Current Law and Regulation About Used Nuclear Fuel

By Alex S. Polonsky and Ray P. Kuyler<sup>1</sup>

There is a lot of nuclear waste piling up out there. I am not talking about the byproduct of nuclear weapons production from the Cold War. I am talking about the nuclear fuel that has been irradiated inside the 100+ commercial nuclear power plants located in the United States that have been generating about 20% of the electricity in this country for the past four decades. This “spent” or “used” nuclear fuel is now being stored at current and former commercial nuclear reactor sites, awaiting disposal or recycling.<sup>2</sup> The U.S. Nuclear Regulatory Commission—which regulates the safety of the nation’s commercial nuclear plants—estimates that there is approximately 67,000 metric tons of used fuel at commercial nuclear reactor sites awaiting disposal. This number grows every year. Any waste disposal or treatment solution is more than a decade away.

## Licensed/Operating Independent Spent Fuel Storage Installations by State



<sup>1</sup> Alex Polonsky is a Partner and Ray Kuyler is an Associate in the Nuclear Energy Practice Group at Morgan Lewis & Bockius LLP in Washington, D.C.

<sup>2</sup> The word “spent” suggests that the fuel cannot be recycled or reprocessed. Other countries, such as France, reprocess their nuclear fuel after it has been irradiated in a commercial nuclear power plant. And the United States is once again considering reprocessing nuclear fuel. See U.S. Nuclear Regulatory Commission, NUREG-1350, Vol. 24, Information Digest, 2012-2013 at 90, available at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1350/v24/sr1350v24.pdf> (NRC Information Digest). Accordingly, “used” may be a more accurate term.

Source: Figure 43, Licensed/Operating Independent Spent Fuel Storage Installation by State, NRC Information Digest at 88.

Should we be worried from a radiation dose perspective about all this used nuclear fuel? Not at all. Should we be concerned that a lack of a disposal or treatment option is preventing new nuclear plants from being built in the United States? Also, not at all. But should we be concerned from a policy perspective? Most certainly. Congress thought it addressed the waste disposal issue decades ago, but the federal government has not implemented a solution.

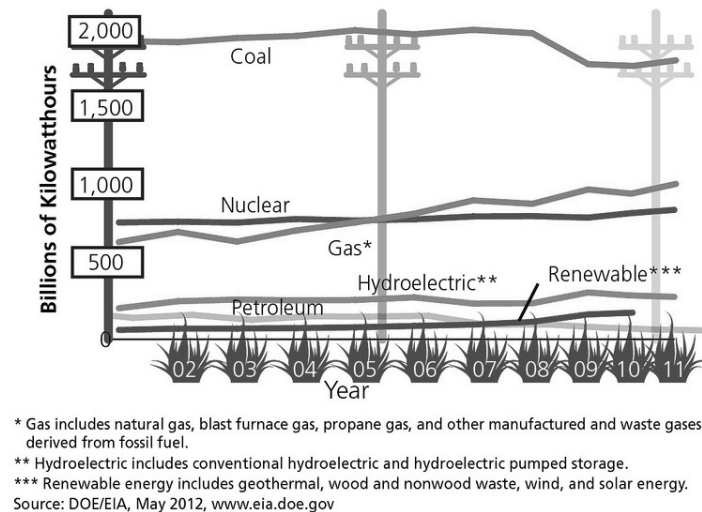
This article provides technical and legal background to understand the issues surrounding used nuclear fuel management in the United States, the history of the federal government's policies surrounding used nuclear fuel disposal, and current legal status.

### Some Technical Background

Where is all this used nuclear fuel coming from? Coal plants get their energy to produce electricity from burning coal. These plants produce coal ash and coal slag as waste products. The coal can be added to the furnace every day, and waste products are produced every day the plant operates.

Nuclear power plants get their energy to produce electricity from nuclear fission, primarily from low-enriched uranium. The uranium in fresh fuel is not highly radioactive: you can hold a fresh fuel pellet in your hand with no adverse radiation effects. The uranium fuel pellets are enclosed in metal rods, which are bundled together into fuel assemblies. Nuclear power plants produce used nuclear fuel as a waste product. Unlike coal plants, fresh nuclear fuel is typically added to the reactor only once every two years, so used nuclear fuel also is typically removed only once every two years.

### U.S. Net Electric Generation by Energy Source, 2002–2011



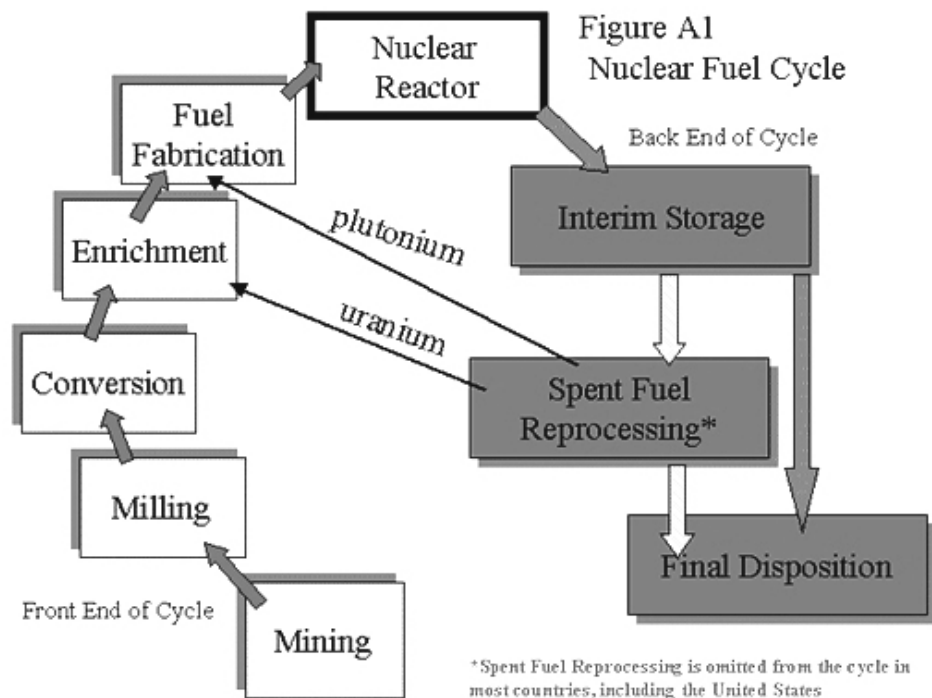
Source: Figure 7. U.S. Net Electric Generation by Energy Source, 2002-2011, NRC Information Digest at 19.

The used nuclear fuel, however, is highly radioactive and must be shielded to protect workers from radiation. The used nuclear fuel also is very hot when it leaves the reactor. Water is a very effective shield for radiation and effectively removes the heat generated by the used fuel, so the used fuel assemblies are transferred from the nuclear reactor core under water to “spent fuel pools.” They will remain in these pools for five years to cool down from a radiation and temperature perspective.

But the fuel can’t stay in the spent fuel pool indefinitely. The plant needs to make room in the spent fuel pool for new transfers of used fuel from the reactor. As an interim solution, many nuclear plants have installed higher density racks in their spent fuel pool. This allows them to store more fuel in the same space (akin to a supermarket narrowing the shopping aisles to add more shelving units to hold more items for sale). But even a re-racked spent fuel pool at an operating nuclear power plant eventually will run out of space.

The used fuel can be safely transferred to dry casks for longer storage. The NRC certifies dry casks for use by the commercial nuclear industry. The certified casks have an outer layer of concrete thick enough to shield workers and the public from harmful doses of radiation from the used fuel stored inside. The dry casks are typically stored at the same site as the nuclear power plant but in a separate, secure area referred to as an Independent Spent Fuel Storage Installation (or ISFSI).<sup>3</sup> The NRC also licenses and regulates the safety of ISFSIs, thereby providing reasonable assurance that there is no harm to the public from used fuel stored there. There, the used nuclear fuel awaits pickup by the federal government.

<sup>3</sup> See NRC Information Digest at 84.



Source: Figure A1 Nuclear Fuel Cycle, U.S. Energy Information Administration, *available at* [http://www.eia.gov/cneaf/nuclear/page/images/intro\\_fig1.jpg](http://www.eia.gov/cneaf/nuclear/page/images/intro_fig1.jpg).

### The Federal Government’s Responsibility

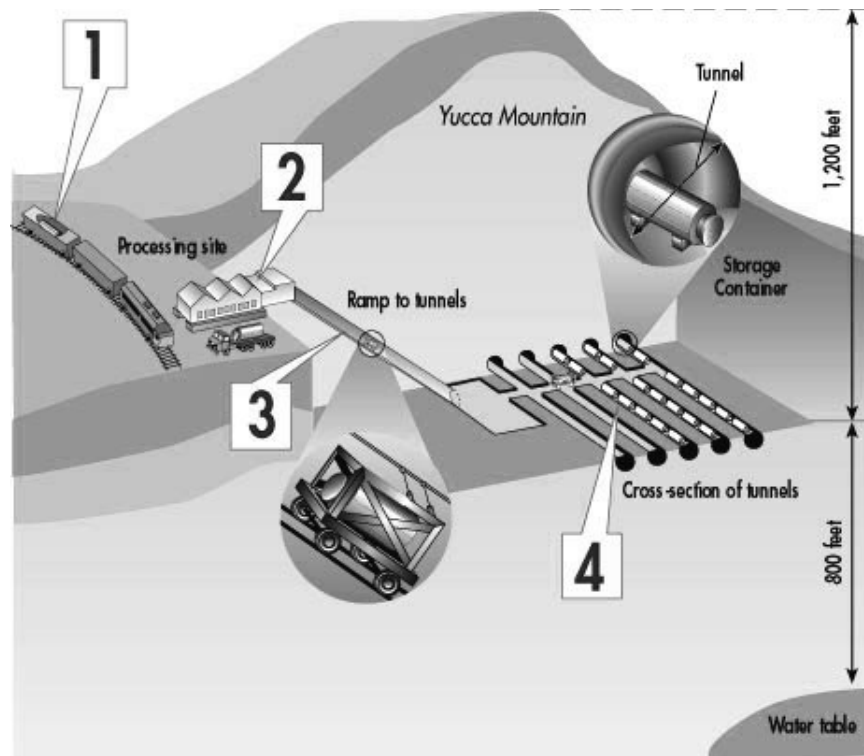
Decades ago, Congress decided that used nuclear fuel ought to be the responsibility of the federal government, and not the responsibility of private industry or individual States where commercial nuclear power plants resided. In 1982, Congress passed the Nuclear Waste Policy Act. That Act included a provision requiring the U.S. Department of Energy (DOE) to enter into contracts with commercial nuclear power companies. Under those contracts, DOE would take title to and dispose of the used nuclear fuel in exchange for payments by the power companies into a dedicated Nuclear Waste Fund intended to cover the costs of safe disposal. The payments amounted to 0.1 cents/kilowatt hour. The contracts specified that DOE would begin taking physical possession of the used fuel in 1998. But by 1995, the DOE knew that a government waste disposal site would not be ready in time.

### Yucca Mountain

The 1982 Nuclear Waste Policy Act directed the DOE to evaluate multiple sites for disposal of commercial used nuclear fuel deep below the ground surface. These “geologic repositories” were intended to entomb the waste for hundreds of thousands of years, keeping it isolated from the public until the radioactivity in the used fuel subsided significantly. In 1987, Congress amended the Nuclear Waste Policy Act to limit DOE’s evaluation of potential waste sites from multiple sites to only one site: an old volcanic formation in Nye County, Nevada, known as Yucca Mountain. Congress also directed in the Nuclear Waste Policy Act that DOE

prepare an application for a license to construct and operate a geologic repository at Yucca Mountain, and that the NRC be the licensing authority over most of DOE's activities there.

DOE completed a favorable site characterization for Yucca Mountain in 2002. The Nuclear Waste Policy Act authorized that if DOE determined that Yucca Mountain was a suitable location for a geologic repository, then DOE would recommend that site to the President of the United States. In turn, the President could approve that recommendation, the State of Nevada could veto that approval, and Congress could override Nevada's veto. All of these actions occurred between February and July 2002.



Source: Conceptual Design of Yucca Mountain Disposal Plan, NRC, available at <http://www.nrc.gov/waste/hlw-disposal/design.html>.

In 2008, the DOE submitted to the NRC a license application for a geologic repository at Yucca Mountain. NRC regulations allow interested members of the public, States and local governments, and Native American Tribes to request a hearing to challenge the license application. A dozen entities, including the State of Nevada, several counties, and Native American Tribes requested a hearing, raising a total of 319 alleged deficiencies with the DOE application. NRC judicial panels overseeing the litigation admitted about 300 of these issues for further litigation. Litigation was under way when DOE Secretary Chu announced in March 2009 that Yucca Mountain was no longer an option.<sup>4</sup>

<sup>4</sup> Steven Tetreault and Keith Rogers, *Official: Nuclear dump is out*, Las Vegas Review-Journal (Mar. 6, 2009, 10:00 PM), available at <http://www.lvrj.com/news/40836552.html>.

In February 2010, the DOE asked the NRC judicial panel for permission to withdraw its license application for Yucca Mountain. In June 2010, the panel rejected DOE's request, concluding that "the NWPA [Nuclear Waste Policy Act] does not give the Secretary the discretion to substitute his policy for the one established by Congress in the NWPA."<sup>5</sup> DOE appealed the decision of the NRC judicial panel to the NRC Commissioners, who issued a deadlocked decision in September 2011. Normally, a deadlocked Commission decision would affirm the underlying panel decision. However, in its decision, the Commission cut off funding for the NRC Staff's review of, and litigation over, the license application for Yucca Mountain.

In March 2012, several parties, including the States of Washington and South Carolina, appealed the Commission decision to Federal court. The court held oral argument in May 2012. On August 3, 2012, a divided court ordered that the case be held in abeyance until December 2012, when the parties must file updates on the status of Congressional appropriations. Two of the three judges on the panel—one concurring in the abeyance order and one dissenting—indicated that they would likely order the NRC to continue its review of the application. A final court decision in the States' favor could force the NRC to continue its technical review of the Yucca Mountain license application. Litigation before the NRC judicial panels also could resume. A court decision against the States would continue the indefinite suspension of litigation and the NRC's review of the application.

### The Used Fuel Lawsuits

In 1995, DOE informed the industry that a Government-run used nuclear fuel disposal site would not be available by the 1998 deadline stated in the used fuel contracts. Accordingly, the DOE would not be able to begin accepting used nuclear fuel from commercial nuclear plant sites in 1998. Most operators of commercial nuclear plants responded by taking DOE to court, arguing breach of contract and requesting damages for the costs to manage and store the used fuel. Over 70 such cases have been filed. The DOE has settled a few of them, but has litigated most. Federal judges have ruled that the DOE is in partial breach of its contracts and is responsible for reasonable mitigation damages. Accordingly, the DOE has lost the vast majority of those cases it has litigated. In February 2011, the U.S. Department of Justice (DOJ) reported that liabilities for these judgments and settlements exceeded \$2 billion. As of that date, the DOJ reported having spent \$170 million defending against these lawsuits. DOE has estimated total liabilities could exceed \$16 billion.

### Can Nuclear Plant Licensing Continue With No Yucca Mountain?

In addition to its responsibility to perform a safety review of nuclear plant license applications, the NRC also has a responsibility to perform an environmental impact review as required by the National Environmental Policy Act (NEPA). The environmental impact review includes an assessment of the impacts of long-term storage of used nuclear fuel for 60 years after the plant's operating license expires (known as the Waste Confidence Rule). In 2010, the NRC revised its rule issued under NEPA that generically declared for all plants that there is reasonable assurance that an offsite disposal solution would be available by the expiration of the plants'

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<sup>5</sup> U.S. Department of Energy (High Level Waste Repository), LBP-10-11, 71 NRC 609, 617 (2010).

operating licenses, and if not, that there is reasonable assurance that the used fuel could be stored safely at the sites beyond those dates.

In early 2011, the NRC's revision to the Waste Confidence Rule was challenged in Federal court on the basis that DOE's abandonment of Yucca Mountain undermined the basis for the rule. In June 2012, the Federal court agreed with the challengers, and vacated the rule. The court determined that the NRC failed to evaluate the environmental effects of failing to secure a permanent storage facility, or properly examine dangers and consequences associated with storing spent fuel at nuclear plants for 60 years after expiration of operating licenses. The NRC did not appeal this decision.

The NRC has embarked on a rulemaking to address the deficiencies articulated by the court. The NRC Commissioners have directed the NRC Staff to complete the rulemaking within 2 years, acknowledging that this is an ambitious schedule. In the interim, the NRC will not issue licenses for the construction or operation of new commercial nuclear power plants, renew the operating licenses for existing commercial nuclear power plants, or issue or renew specific licenses for ISFSIs. While this will prevent the NRC from issuing certain licenses, the Commissioners have been clear that the NRC Staff's technical and other environmental reviews will continue. Accordingly, for those plants that are affected by the licensing hiatus that accompanies the new rulemaking, there is little concern that the licenses won't be issued eventually.

### The Path Forward

In 2010, when DOE moved to withdraw the Yucca Mountain license application, the Secretary of Energy formed the Blue Ribbon Commission on America's Nuclear Future (BRC) at the request of the President of the United States. The BRC was tasked with a comprehensive review of policies for managing the back end of the nuclear fuel cycle and to recommend a new strategy. The BRC issued its report in January 2012, recommending the development of a new comprehensive strategy for used fuel, including: a new, consent-based approach to siting future repositories; establishing a new, chartered federal corporation, with access to the nuclear waste fund, dedicated solely to implementing the waste management program; prompt efforts to develop one or more storage facilities and repositories, and to prepare for waste transportation; and support for continued innovation and U.S. leadership in nuclear energy and non-proliferation.

Senator Jeff Bingaman (D-NM) introduced a bill—the Nuclear Waste Administration Act of 2012 (NWAA)—in the Senate on August 1, 2012 (S. 3469). The bill embraces many of the BRC recommendations. It would transfer most of DOE's responsibilities under the NWA to a new U.S. Government agency, the "Nuclear Waste Administration" or "NWA." The NWAA: covers DOE's repository and storage facility development obligations; provides for use of the Nuclear Waste Fund and for disposal contracts between generators and the NWA; establishes a separate "Working Capital Fund" (comprised of, among other things, fees paid after enactment of the NWAA) to carry out functions authorized by the NWAA; provides for Price-Anderson Act nuclear third party liability indemnification by DOE to persons conducting nuclear waste activities under a contract with the NWA Administrators; and retains DOE's authority to conduct

generic research on, among other things, “proliferation-resistant advanced fuel recycling . . . technologies.”

Finally, the proposed NWAA includes a comprehensive, lengthy and multi-stage governmental process for the development of a repository and storage facilities, much like the NWPA, that includes, among other things, site characterization; siting guidelines; identification of candidate sites; public consultations; final site suitability determination; “consent agreements” with governmental and Tribal entities prior to submission of a license application to the NRC; U.S. Environmental Protection Agency adoption of generally applicable radiation protection standards; and revision of NRC licensing regulations.

Sen. Bingaman is the outgoing Chairman of the Senate Energy and Natural Resources Committee, the committee of jurisdiction for nuclear power issues. However, Sen. Bingaman has announced his retirement and will no longer be a member of the U.S. Senate starting in January 2013. To date, S. 3469 has no cosponsors. A new champion for nuclear waste disposal issues will need to come forward during the next Congress for the BRC recommendations to be implemented in the near future.