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SPENT NUCLEAR FUEL

Accumulating Quantities at Commercial Reactors Present Storage and Other Challenges

GAO Highlights

Accountability * Integrity * Reliability

Highlights of GAO-12-797, a report to congressional requesters

Why GAO Did This Study

Spent nuclear fuel, the used fuel removed from nuclear reactors, is one of the most hazardous substances created by humans. Commercial spent fuel is stored at reactor sites; about 74 percent of it is stored in pools of water, and 26 percent has been transferred to dry storage casks. The United States has no permanent disposal site for the nearly 70,000 metric tons of spent fuel currently stored in 33 states.

GAO was asked to examine (1) the amount of spent fuel expected to accumulate before it can be moved from commercial nuclear reactor sites, (2) the key risks posed by stored spent fuel and actions to help mitigate these risks, and (3) key benefits and challenges of moving spent nuclear fuel out of wet storage and ultimately away from commercial nuclear reactors. GAO reviewed NRC documents and studies on spent fuel's safety and security risks and industry data, interviewed federal and state government officials and representatives from industry and other groups, and visited reactor sites.

What GAO Recommends

To help facilitate decisions on storing and disposing of spent nuclear fuel over the coming decades, GAO recommends that NRC develop a mechanism for locating all classified studies. NRC generally agreed with the findings and the recommendation in the report.

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The amount of spent fuel stored on-site at commercial nuclear reactors will continue to accumulate—increasing by about 2,000 metric tons per year and likely more than doubling to about 140,000 metric tons—before it can be moved off-site, because storage or disposal facilities may take decades to develop. In examining centralized storage or permanent disposal options, GAO found that new facilities may take from 15 to 40 years before they are ready to begin accepting spent fuel. Once an off-site facility is available, it will take several more decades to ship spent fuel to that facility. This situation will be challenging because by about 2040 most currently operating reactors will have ceased operations, and options for managing spent fuel, if needed to meet transportation, storage, or disposal requirements, may be limited.

Studies show that the key risk posed by spent nuclear fuel involves a release of radiation that could harm human health or the environment. The highest-consequence event posing such a risk would be a self-sustaining fire in a drained or partially drained spent fuel pool, resulting in a severe widespread release of radiation. The Nuclear Regulatory Commission (NRC), which regulates the nation's spent nuclear fuel, considers the probability of such an event to be low. According to studies GAO reviewed, the probability of such a fire is difficult to quantify because of the variables affecting whether a fire starts and spreads. Studies show that this low-probability scenario could have high consequences, however, depending on the severity of the radiation release. These consequences include widespread contamination, a significant increase in the probability of fatal cancer in the affected population, and the possibility of early fatalities. According to studies and NRC officials, mitigating procedures, such as replacement water to respond to a loss of pool water from an accident or attack, could help prevent a fire. Because a decision on a permanent means of disposing of spent fuel may not be made for years, NRC officials and others may need to make interim decisions, which could be informed by past studies on stored spent fuel. In response to GAO requests, however, NRC could not easily identify, locate, or access studies it had conducted or commissioned because it does not have an agencywide mechanism to ensure that it can identify and locate such classified studies. As a result, GAO had to take a number of steps to identify pertinent studies, including interviewing numerous officials.

Transferring spent fuel from wet to dry storage offers several key benefits, including safely storing spent fuel for decades after nuclear reactors retire—until a permanent solution can be found—and reducing the potential consequences of a pool fire. Regarding challenges, transferring spent fuel from wet to dry storage is generally safe, but there are risks to moving it, and accelerating the transfer of spent fuel could increase those risks. In addition, operating activities, such as refueling, inspections, and maintenance, may limit the time frames available for transferring spent fuel from wet to dry storage. Once spent fuel is in dry storage, there are additional challenges, such as costs for repackaging should it be needed. Some industry representatives told GAO that they question whether the cost of overcoming the challenges of accelerating the transfer from wet to dry storage is worth the benefit, particularly considering the low probability of a catastrophic release of radiation. NRC stated that spent fuel is safe in both wet and dry storage and that accelerating transfer is not necessary given the small increase in safety that could be achieved.