Issue Brief: Nuclear Waste Disposal

The United States began accumulating spent nuclear fuel when it began to operate nuclear reactors as a power source. The problem of dealing with spent fuel increased dramatically in the 1950s when commercial nuclear power plants went into production. Spent nuclear fuel is dangerously radioactive for thousands, sometimes tens of thousands, of years. Because of expanding energy needs, the issue of disposing of spent nuclear fuel is important to the future of modern civilization.

Scope

Nuclear power is widely used to produce electricity. A sixth of the world's electricity (Deutch) comes from nuclear power. "…more than 20,000 megawatts of nuclear capacity have come on line since 2000…" (Deutch). Most of this growth is outside the United States. Because of the high cost of nuclear power, it has not become a growth industry in the U.S. That may be about to change as the energy industry and the government look for ways to deal with two vexing energy problems. They are first, the global difficulties surrounding acquisition on adequate supplies of oil, and secondly, concern for the effects of burning fossil fuel on climate change. Although their growth stopped in the 1990s, the large number of existing plants continues to produce nuclear waste in the form of spent fuel. At present there is 50,000 tons of spent fuel stored at reactor sites in the United States (Yucca).

Evolution

The energy industry and the government began building nuclear power plants in the 1950s. The United State's first full scale power plant devoted exclusively to peacetime uses came online in December 1957 (History). In 1959, the country's first full scale privately funded nuclear plant was brought on line (History). By 1991, 111 nuclear power plants had been built in the United States, generating almost 22 percent of the electricity commercially produced in the country (History). No new power plants have been ordered in this country since 1979 (Not). Growing demand for non-carbon polluting energy is likely to change this situation in the next decade.

Reactors are fueled with rods made up of a radioactive material, mainly Uranium 235 and Uranium 238. These rods are suspended in groups shielded from each other with lead. The shields are raised until enough of the material is exposed to cause a controlled low grade nuclear reaction that generates heat. The heat is used to generate steam and the steam is then used to generate electricity. The reaction is created when enough material is exposed and there is sufficient mass to cause a chain reaction that releases energy or heat. When the material is consumed the waste is a spent rod that is highly radioactive. The radioactivity is so high that direct exposure to the material will cause burns and sickness. Enough exposure will cause death. By the year 2008, 103 reactors in the United States will have produced an estimated 62,000 metric tons of these spent rods (Von Hippel).

Current Status

Nuclear waste is currently being stored at reactor sites around the country. It is stored in drums sealed with concrete and steel. The drums are stored in ponds. This method of storage, although considered safe for 100 years (Deutch), is temporary in terms of the life of the hazard. The NRC plan is to move all

this material to the Yucca Mountain site for long term storage. The Yucca Mountain site was chosen for the geologic storage of this material because of its geologic stability. The original Environmental Protection Agency standard was that the site had to be safe for 10,000 years. Recently courts have extended this to 1,000,000 years (United).

Another alternative under consideration is reprocessing. This involves the reprocessing of spent fuel so that it can continue to be reused in new technology reactors. Current reactors use about .07 percent of the potential energy, the amount of U235 in Uranium. Reprocessing would allow the use of the spent fuel in special fast breeder reactors (Von Hippel). "If, as supporters of reprocessing advocate, two fission products with a 30-year halflife, cesium137 and strontium-90, are separated and stored on the surface, the remaining fission products from perhaps 100 times as much spent fuel could be stored in the mountain" (Von Hippel). In addition to the reduced storage requirement, the new waste would not be a hazard for as long. "With this approach, the radioactivity from the generated waste could drop to safe levels in a few hundred years…" (Hannum).

There are concerns with reprocessing spent fuel. First the reprocessing of standard spent fuel produces a new fuel that includes weapons grade material (material sufficiently radioactive as to be able to create a nuclear detonation). The production of this fuel for peaceful generation of electricity threatens the United States' interest in preventing nuclear weapons proliferation. Secondly, the technology needs further research and development. This investment will only serve to increase the current high cost of nuclear power generation.

Some research is being done in the development of lasers as a way of eliminating nuclear waste, thus eliminating the disposal problem completely (Not). This research is new and may or may not provide solutions at some point in the future.

Stakeholders

Commercial power companies own and operate 104 power plants producing electricity in 43 states in the United States (Not). The utilities' customers pay fees for disposal of the spent fuel from these plants. To date, "States have paid a total of $28 billion in energy fees…" for the development of a permanent storage site at Yucca Mountain in Nevada (Maine's). The Nuclear Regulatory Commission (NRC) has not been able to license the disposal facility at Yucca Mountain. It has not accepted any spent fuel. This fuel is now accumulating at reactor sites stored in special containers submerged in ponds. In the mean time the companies' customers are paying for the disposal of the spent fuel, once when they pay the fee and again when the companies pay to operate their individual sites.

The NRC has put millions of dollars into building the central storage facility for nuclear waste at Yucca Mountain. This facility was scheduled to open in 1998 (Schute) but has not yet been licensed to accept material. The government developed this facility as a way to centrally control and to insure the safe management of nuclear waste.

There has been large scale political involvement in dealing with nuclear waste from a number of quarters. Many people in Nevada, not the least of which is senior Democratic Senator Reid, are opposed to building the Yucca Mountain storage facility. There are also groups that believe that the nuclear generating plants are not safe. This political opposition has slowed down the process of setting up a viable central storage location for spent fuel

Conclusions

Producing financially viable electricity for the nation's economy is crucial for its continued growth. This growth is important to prosper as a country. Nuclear power will become more viable as variables like emissions control and oil costs are factored into the world's economy. Research and development will add to the cost of nuclear power in the short run, but, in the long term, it may make the technology more viable by reducing its cost. Development of economically viable fast breeder reactors could solve the problem of nuclear waste by reprocessing spent fuel and using it all in these plants. Until this happens the issue of storing nuclear waste will have to be addressed on an on going basis.

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by William Kent Grainger

The United States began accumulating spent nuclear fuel when it began to operate nuclear reactors as a power source. The problem of dealing with spent fuel increased dramatically in the 1950s when commercial nuclear power plants went into production. Spent nuclear fuel is dangerously radioactive for thousands, sometimes tens of thousands, of years. Because of expanding energy needs, the issue of disposing of spent nuclear fuel is important to the future of modern civilization.

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