Reprocessing of Nuclear Fuel - 1960's through Present

Reprocessing involves mechanical and chemical processes in order to extract the unused uranium and plutonium from the spent fuel. Wikipedia provides a good explanation of the available reprocessing methods:

- PUREX
- UREX
- TRUEX
- DIAMEX
- SANEX
- PYRO-A
- PYRO-B

Historical Perspective

In the 1960's when nuclear power was appearing on the horizon as a potential power source, reprocessing was viewed as a way of recovering unused fuel. At the same time, breeder reactor technology was being developed. The breeder reactors (fast fission) which would use uranium-238 would be used to produce plutonium-239, which could then be recovered then used in mixed oxide fuel to fuel thermal fission reactors.

Spent fuel from government plutonium production reactors at Savannah River and Hanford has been reprocessed onsite. Fuel from US Navy surface ship and submarine reactors has been reprocessed at the Idaho Chemical Processing Plant near Idaho Falls, Idaho. The unfortunate result of the reprocessing has been the generation of enormous volumes of highly radioactive liquids. Hanford tank leaks resulted in releases to the local environment. Plutonium has been found at the mouth of the Columbia River near Astoria, Oregon. Although both ICPP and Hanford reprocessing stopped in the 1990 timeframe, almost 90 million gallons of high level waste still remain in storage tanks on government reservations (See Table 3 of *An International Spent Nuclear Fuel Storage Facility -- Exploring a Russian Site as a Prototype: Proceedings of an International Workshop*).

The early commercial reactors built in the 70's were initially designed to hold spent fuel in the onsite storage pool for 1-1.5 years, then have the fuel sent to a reprocessing facility (e.g.West Valley, NY) . That facility commercially reprocessed spent fuel until concern about nuclear proliferation brought on by the Indian explosion of a plutonium fission device resulted in presidential executive orders by Ford and Carter to defer reprocessing. West Valley was then shutdown. Although Reagan rescinded the order during his presidency, the process in the US has been considered uneconomical. Two planned reprocessing facilities at Barnwell, SC and Morris, IL never became operational.

Meanwhile, France's COGEMA, Britain's British Nuclear Fuels (BNFL), and the Russian and Indian governments started up and continued to operate spent fuel reprocessing

facilities during the US abstention. The Sellafield facility in the United Kingdom has had storage tank and leak issues as the US facilities. Less information has been available about the facilities in France, Russia, and India.

In the United States, there appears to be renewed political interest in reprocessing, likely spurred by the ongoing political debate about Yucca Mountain as the spent fuel repository. Reprocessing has disdavantages and advantages.

The Future

If reprocessing is to be successful in the future, the following must happen:

1. Processes must be developed and used that do not produce large amounts of highly radioactive liquid waste.
2. The chemical processes must be thoroughly understood so that dangerous conditions do not develop which could produce leaks to the environment (e.g. explosions due to unexpected chemical reactions).
3. The complete cycle should be developed and characterized ahead of time. Engineering on the fly is unacceptable and costly.
4. There needs to be community, political, and scientific agreement beforehand so that history does not repeat itself. Local communities are still paying for the secrecy, short-sightedness, and disregard of the impact on the environment and public by the management of government weapons production facilities, e.g. Hanford and Savannah River, from World War II and the Cold War.

Related Searches

- Nuclear Reprocessing
- *An International Spent Nuclear Fuel Storage Facility -- Exploring a Russian Site as a Prototype: Proceedings of an International Workshop* (2005), National Academies Press, Glenn E. Schweitzer and A. Chelsea Sharber, Editors, Committee on the Scientific Aspects of an International Spent Fuel Repository in Russia, Office for Central Europe and Eurasia, National Research Council, Russian Academy of Sciences.
