state & society

NRC takes a closer look at plutonium recycling

Should we recycle plutonium? Do economic, safety and health considerations make it feasible to reprocess spent fuel for reuse in light-water reactors? The Nuclear Regulatory Commission has recently announced a more cautious view of plutonium recycling than the one held by its predecessor, AEC—a view that would delay until 1978 the decision on whether to allow plutonium recycling and under what constraints. We spoke with several researchers concerned with plutonium issues and they outlined for us the importance of the new NRC stand and what a decision either way in 1978 would mean to the present nuclear-power industry and the infant breeder-reactor program.

The provisional view. NRC now feels that a cost-benefit analysis of safeguard alternatives should be considered before any decision is made on the wide use of recycled plutonium as fuel for light-water reactors. This analysis is needed, NRC officials say, to comply with requirements of the National Environmental Policy Act. In the meantime, no additional licenses would be granted for mixed (uranium and plutonium) oxide fuel, except for experimental purposes. For fuel cycle activities (other than nuclear-power reactor construction and operation), no further licenses should be granted, NRC says,

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that would foreclose future safeguard options.

The new NRC view is a welcome change in the eyes of Theodore B. Taylor (International Research and Technology Corp.). "I feel better about the new policy than about the old," he said. "The former AEC stand did not require them to go into gory detail about what the plutonium safety and safeguard modifications would be—they were proposing to go ahead and issue licences pending some probable modifications of the regulations . . . The AEC acted as though plutonium recycling *was* going to happen.

"Now that's been changed," he continued. "The implication in the NRC statement is that they expect to allow plutonium recycling at some time in the future, but they don't flatly say that it is going to happen. NRC hasn't said what the new licensing requirements would be if they allowed plutonium recycling—and I think they are being realistic in taking three years to decide on them." Taylor also told us that intensive NRC safeguard studies are underway and that detailed results will become available through the summer.

Effects on nuclear power. The question remains: What effect does this stand have on the nuclear-power industry? William Higinbotham (Brookhaven) emphasized that the waste disposal problem from light-water reactors is potentially a serious one. "If there is no breeder program and no plutonium recycling, we would have more spent-fuel rods than we could handle." He went on to explain, "Plutonium recycling *per se* is economically marginal. If we forget about plutonium recycling and go directly into recycling via the

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Standing in the limelight: the visible scientists

Energy problems, reactor safety, ozone depletion—all are issues that affect the public and thus pack the potential to elevate more physicists to the ranks of "visible scientists." These are the outspoken scientists, frequently in the news, who take stands on controversial issues and go straight to the public with their views.

In a doctoral dissertation submitted to the communications department at Stanford University, Rae Goodell (now a postdoctoral fellow at the Massachusetts Institute of Technology) has taken a hard look at the visible scientists and their influence on science communication. Questionnaires completed by a 24-member panel composed mostly of science news writers yielded the list of 39 visible scientists upon whom Goodell concentrated her study. (Thirteen are physicists or in physics-related fields.) It is the product of some five years work that includes 95 personal interviews as well as more traditional forms of research.

Citing "... activities in the messy world of politics and controversy" as the vehicle by which today's visible scientists become known, Goodell characterizes them as "knowledgeable, articulate, dramatic, persistent and sophisticated about press operations." While most were firmly established in the scientific community before venturing into public life, once there, Goodell notes, they speak out on science-related policy issues rather than science, "speaking from personal conscience, not group consensus."

Coming out. What factors contributed to the emergence of visible scientists? The needs and concerns of the public, the media, the government and the scientific community exerted selective pressures that produced today's scientific newsmakers. After development of the atomic bomb, Goodell believes, "Both the practical need for money and the moral sense of responsibility spurred scientists to get out of the laboratory and interact with government and public."

Behind-the-scenes science advising ("inside" activity) flourished during the 1950's, but by the late 1960's dissatisfaction with what was regarded as the advisory system's secrecy and ineffectiveness led scientists to involvement in lobbying, political campaigning, speaking out in the press and taking litigation to the courts ("outside" activity). In addition, public disenchantment with

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Shuttle. West Germany is providing over half of the $400 million in research and development costs. ESA will give NASA the first Spacelab and the US agency will probably purchase later units. The research effort at least for the first Spacelab flight will be a joint US–Europe venture—including the possibility of a European crew member, the first western European to fly into space. A second and somewhat larger project is Ariane, a launcher (of Atlas–Centaur size) to put satellites into synchronous orbit.

Several satellites are nearly ready or planned under ESA auspices. Celestial Observatory Satellite-B, scheduled for launch this month from California, carries instruments capable of detecting gamma rays with energies above 20 MeV. For 1976, there is GEOS, which will continue studies of the Earth's magnetosphere begun by earlier satellites. Also planned for that year is the International Ultraviolet Explorer, a joint venture with NASA and the UK Science Research Council. For 1977 there is the three-satellite International Sun Earth Explorer Project, also in partnership with NASA. EXOSAT, planned for 1979 will measure locations of x-ray sources using lunar occultation.

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breeder reactors of the 1980's, the interim waste problem becomes less serious."

Frank von Hippel (Princeton) agreed that it is economically close to breakeven and this is one reason why the plutonium-recycle industry has developed so slowly. He told us: "I would speculate that ultimately, the government might have to take over that part of the fuel cycle. The idea originally was that recovered uranium and plutonium would more than pay for the process, but this is coming into question now. There is no great incentive with the price of uranium what it is." Recycling of nuclear wastes would add only about 20–30% to the available fuel supply—a far cry from the 50-fold increase in fuel-use efficiency expected for breeder reactors.

In any event, many power plants are filling up their spent-fuel storage pools. Taylor outlined for us the options the utilities have:

- They can hope for relaxation of safety criteria thereby allowing more spent-fuel rods to be placed into the same volume (this, Taylor says, is not likely to happen).
- They can look for offsite storage capacity that now exists, either in someone else's reactor storage pool or in one of three other limited storage places (see box).
- They could possibly use temporary storage facilities that can be built, but it would take about three years for one to be ready for operation.
- They might make use of the hot storage facilities at Hanford, Washington and/or Savannah, Georgia; there has been serious consideration to reactivate these installations.

According to Taylor, it is not clear which, if any of these routes will be taken.

Effects on the breeder. According to the people we spoke to, plutonium recycling during the coming several years is not crucial to breeder-reactor development, although as Taylor put it, "The longer plutonium recycling is held off, the more it delays the time when more-or-less routine operating experience with plutonium fuel has been developed. And, of course, an NRC decision *not* to allow recycling, depending on how long the freeze lasts, could have a severe impact on the breeder, perhaps to exclude it altogether." He further mentioned the financial considerations involved: "At some point industry will have to consider fairly heavy investments in gearing up for the breeder and they may not want to make those investments if there is any danger that the safety and safeguards requirements will cause them not to want to go the breeder route at all."

Safeguards alternatives. Perhaps the most pressing problem with plutonium is its possible diversion by thieves. The recycling process is the first place in the commercial fuel cycle where plutonium is isolated and available for diversion, but there are several measures that can be taken. The first solution is not to process the spent fuel at all and perhaps bury it when it has cooled down. Second, a more on-line and accurate fuel-assay system is useful to tell quickly of a discrepancy in the amount of plutonium in the system.

A third possibility is more secure physical barriers: fences, alarms, heavy containers, and guard and reserve forces. Taylor commented about this: "In principle you could make a trade-off between physical barriers and guards. I think, generally, people are tending to want to rely on equipment and as little as possible on guards who have the authority to shoot at people."

Another safeguard Taylor told us about is the use of a hot isotope such as cobalt-60 mixed in with the plutonium to "spike" it—that is, make it too hot for a thief to handle. He noted, of course, that it is also too hot for authorized workers and the public. —RAS

Plutonium storage and recycling facilities

There are three plutonium recycling plants in the United States where utilities could send spent fuel rods should their own storage capacities fill up. None of these plants is recycling plutonium at the moment, but their storage areas are nonetheless potentially usable.

1. General Electric has invested in a small plant in Morris, Illinois, but there have been design difficulties and it probably will not be able to recycle plutonium.
2. At Barnwell, South Carolina, Allied Chemical and Gulf General Atomic have nearly completed construction of a facility that is more likely to be operable, although now it is likely to be caught in the NRC freeze.
3. The Nuclear Fuel Services Plant in West Valley, New York, has been shut down since 1972 because radiation doses to workers were exceeding permissible levels. An improved and expanded version of the plant is scheduled to open in 1979.

The storage capacity of these three plants, however, is relatively small compared with the rate at which light-water reactors are discharging spent fuel rods. It is expected by 1977 that storage capacity for 1170 metric tons of waste will be available—storage for 50 tons that was available as of March 1975 and 1120 tons that is expected to open up. For 1975, 1976 and 1977, projected spent-fuel discharges are 698, 1101 and 1402 tons, respectively. For more details, see *LWR Spent Fuel Disposition Capabilities, 1975–1984*, US ERDA report #25, March 1975.

in brief

A Consumers Guide to Instrumental Scientific Equipment, including the names of knowledgeable users to contact for each of the 2000 items listed, is available for $1.50 from the US Government Printing Office, Washington, D.C. 20402.

A bimonthly newsletter, *Atomic Data for Fusion*, published by the Holifield National Laboratory and NBS has appeared. Inquiries should be addressed to C. Barnett, Holifield National Lab, PO Box Y, Bldg. 9201-2, Oak Ridge, Tenn. 37830

Wave Electronics, a new bimonthly journal published by Elsevier, will cover the field of wave interactions used for communication purposes. Subscriptions are available for $48.50 from Elsevier Publishing Co, PO Box 211, Amsterdam, The Netherlands.

Energy Review, a bimonthly edited by A. I. Berman, is available for $18.00 a year from Energy Review, 200 West 57 Street, Suite 708, New York, N.Y. 10019. □