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Plutonium Disposition EIS. General Comments

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The disposition of plutonium is a complex decision for all Americans because of the uncertainties derived from plutonium's very long 24,000 year half-life. Other factors add to this complexity:

1. The uncertain threat of global warming from the burning of hydrocarbon fuels (e.g., coal, natural gas, gasoline, fuel oil, etc.).

2. The uncertainty of environmental effects from wind, solar, and hydroelectric power.

3. The uncertainty of the proliferation of weapons material from commercial reactors that generate electricity with plutonium fuels in Russia, Japan, and Europe.

To moderate the threats from proliferation, the U.S. has decided to dispose of its approximately 50 MT of excess weapons grade plutonium in one of three forms: in deep bore holes, contaminating it with fission products, and burning it up in reactors. The first option is an unattractive safeguard against proliferation, the second option recovers no energy, and the last option recovers a minor amount of energy as it passes once-through commercial reactors. The last two options comply with the spent fuel standard, i.e., they are as resistant to proliferation as the 1000 MT of spent fuel now scheduled for disposal at Yucca Mountain. But there are uncertainties with the spent fuel standard.

4. The uncertainty of safeguarding the plutonium after the fission products have decayed; the uncertainty of heat damage to Yucca Mountain during the first few hundred years; and the

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uncertainty from the radiotoxicity of plutonium and from the possibility of criticality events during the next 1,000,000 years at Yucca Mountain .

In contrast to the spent fuel standard, however, the SRS vitrified high level waste will be dangerous only during the time required for the decay of its fission products.

Mindful of the above facts, the options in the EIS overlook an environmentally better option. Before U-235 is used to produce electricity in the U.S., it is diluted with U-238, but U-238 exposed to U-235 creates plutonium. Thus, plutonium is a key ingredient of spent fuel. Even in the plutonium-disposition option three noted above, plutonium will be diluted with U-238 to create more plutonium as it burns up (NAS, p. 143n). Because of the uncertainties, DOE should include a fourth option.

5. The fourth option is to demonstrate the recovery and extraction of plutonium from excess weapons material and from spent mox fuel made from the excess weapons plutonium, to dilute it with non-fertile material instead of U-238 (e.g., Th-232 would generate fissile U-233; an aluminum or silicone mixture would not generate a fissile end-product), and to burn the plutonium in commercial reactors. The end result would be an environmentally safer standard for disposal at Yucca Mountain that could become known as the vitrified high-level waste standard. It would not only remove the threat of plutonium from the biosphere, but it would also reduce environmental threats (e.g., global warming, the mining of uranium, or the heat stresses at Yucca Mountain), recover the maximum amount of energy available from plutonium, and not generate new plutonium. 1/14.00.00

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Comment noted. Reprocessing is not an option, as stated in the President's Nonproliferation and Export Control Policy.

While the PEIS discusses the generation of spent fuel as an indirect result of potential disposition actions, any subsequent reprocessing and extraction of Pu from that spent fuel is beyond the scope of the PEIS and the fundamental nonproliferation purpose of the disposition effort. The PEIS evaluates disposition of surplus weapons Pu through MOX fuel but does not propose or further evaluate reprocessing of the spent fuel. The PEIS does not prejudice future decisions regarding the management or disposition of the spent fuel.

Specific Comments

1. Even if free, plutonium fuel relative to uranium fuel in a LWR is expensive (NAS, 1994, p. 24-5) and will require a subsidy (p. 164). Pu fuels are more economic for new advanced reactor concepts (for LMR's, see pp. 182, 186; for ALMR's, see p. 185). Fuel costs will be offset by the recovery of energy, utility repository subsidies, and the reduction of safeguard concerns (in WSRC, 1996).

2. A. Maktijani: "The United States is the only leading country that has wisely rejected the use of civilian plutonium because of its proliferation dangers and its high costs. It is therefore the only country that is in a position to exercise the leadership to persuade other countries to forgo civilian plutonium production, at least for the time being, and to put all separated plutonium into non-weapons-usable form." (Report, 1995, p. 15)

M. Lawrence: "Plutonium can be made into power reactor fuel and burned up in a reactor. Ample experience exists in the fabrication and use of mixed oxide fuels containing plutoinum. While the economics of using mixed fuels are not considered favorable, at least by the U.S. and especially in the near term, several countries use or plan to recycle plutonium as a matter of strategic national policy." (Report, 1995, p. 31)

N. Egorov, Russia Federation on Atomic Energy: "I would say that we, in both countries, have paid too high a price sometime ago to generate and create that material and that is why we must choose the most efficient way of disposition of this material. That is why the general position of the Russian Federation in terms of plutonium disposition is that we should use, in the longer-term, that material as a component of the mixed oxide fuel for commercial power plants." (Report, 1995)

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Currently, seventeen European and two Japanese commercial reactors burn plutonium MOX fuels (NAS, 1994, p. 186). By the year 2000, more are planned for Europe, Japan, and Russia.

3. U-235/U-233 plus U-238 produces plutonium (NAS, 1994, p. 205). Non-fertile fuels do not contain U-238 (NAS, p. 156).

4. Plutonium stocks, from the burning of U-235/U-238 in commercial reactor fuels, are increasing at about 60-70 MT per year (NAS, 1994, p. 28).

5. Low quality weapons grade (WG) plutonium and reactor grade (RG) plutonium are both explosive (NAS, 1994, p. 32-33).

6. Plutonium is difficult to handle because it is radioactive and toxic (NAS, 1994, p. 68).

7. Americium content is higher in RG rather than WG plutonium (NAS, 1994, p. 121-2).

8. Spent fuel rods destined for the repository are contaminated with fission products and plutonium. This spent fuel standard is safe from proliferation for the first few hundred years, however, as the fission products decay, proliferation risks increase proportionately (NAS, 1994, p. 151; p. 191; the spent fuel standard is described on p. 143).

9. "Options for near-total elimination of plutonium may have a role to play in the longer-term effort to reduce the risks posed by global plutonium stocks." (NAS, 1994, p. 143)

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10. "Institutional issues in managing plutonium disposition may be more complex and difficult to resolve than the technical ones. The process must be carefully managed to provide adequate safeguards, security, transparency, and protection for environment, safety, and health; to obtain public and institutional approval, including licenses; and to allow adequate participation in the decision making by all affected parties, including the U.S. and Russian publics and the international community." (NAS, 1994, p. 144)

11. "...as long as civilian plutonium exists and continues to accumulate, options that went further than the spent fuel standard and sought to eliminate the excess weapons plutonium entirely would provide little additional security, unless the same were done with the much larger amount of civilian plutonium." (NAS, 1994, p. 148; p. 155)

12. U.S. policy under President Clinton: "On September 27, 1993, the Clinton administration announced a nonproliferation initiative that makes clear that, while the United States will not interfere with reprocessing in Japan and Europe, "the United States does not encourage the civil use of plutonium and, accordingly, does not itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes."" (NAS, 1994, p. 149)

13. Greater than 100 years may be necessary to destroy existing plutonium stocks (NAS, 1996, p. 209-219). The Academy does not recommend plutonium fuels (NAS, p. 221), but does recommend additional research on their use (NAS, p. 222), including high plutonium loadings to reduce the production of plutonium (NAS, p. 211). The NRC's Separations Technology and Transmutation Systems (STATS) is studying the burning of all actinides (NAS, p. 210).

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14. The estimate by SRS to reprocess 40,000 MTHM of commercial spent fuel at SRS and dispose of the remains in a repository is about $8.6 billion versus $11.3 billion for dry disposal in the repository; the total costs for spent fuel, excess weapon materials, and spent Naval fuels is $15.5 billion to reprocess and dispose versus $28.8 billion to only dispose (WSRC, 1996). By comparison, T. Pigford estimates a cost of about $100 billion to reprocess 630 MTHM (telephone call, April 1, 1996; he figured $800-$2,000 per kg of heavy metal to reprocess, $1,200 per kg to fabricate, and $400 per kg to recover energy; see also the Academy "STATS" report). Including reprocessing and fabrication fuel costs, Eichholz (1985) estimated that u-235/plutonium fuels were competitive with coal and oil-fired utilities in 1981 (p. 627).

15. The age of the facilities at SRS, and the radioactive releases from them, have been raised as issues if spent fuels are to be reprocessed at SRS. The separations canyons at SRS are more than 40 years old, however, their equipment has been upgraded and is functional.

These issues regarding the canyons can be related to other man-made structures. The Eiffel Tower, the Douglas DC-3 aircraft, and the Empire State Building are all older than the SRS canyons. Technology is not necessarily dated by its age; the Titanic, which sunk on its maiden voyage, is a good example. When the Empire State Building opened in 1931, the life-span of the average American was around 47. In 1988, according to the U.S. Bureau of the Census, the average life-span of Americans had increased to about 75. During this period, at the rate of about 2 million visitors annually, 75 million visitors had toured the Empire State Building. If each visitor toured the Empire State Building within about one hour, because some tall concrete buildings are radioactive at about 5 μrads per hour (Eichholz, 1985, p. 108), the collective annual radioactive dose from the Empire State Building would be much greater than the dose to the population exposed to reprocessing releases from SRS.

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References

Eichholz, G.G. (1985). Environmental aspects of nuclear power. Chelsea, MI: Lewis Publ.

National Academy of Sciences (NAS). (1994). Management and disposition of excess weapons plutonim. Washington, DC. National Academy Press.

Report. (1995). Plutonium Roundtable: Risks and solutions. A public education project on policy choices for nuclear weapons disposal.

Westinghouse Savannah River Company (WSRC). (1996). Chemical stabilization of defense related and commercial spent fuel at the Savannah River Site. Document No. NMP-PLS-950239.

U.S. Department of Energy (DOE). (1996, February). Storage and disposition of weapons-usable fissile materials draft programmatic environmental impact statement. Summary. Washington, DC: Office of Fissile Materials Disposition.

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