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IEER: FRENCH-STYLE NUCLEAR REPROCESSING WILL NOT SOLVE U.S. NUCLEAR WASTE PROBLEMS

France Uses Less than 1 Percent of the Natural Uranium Resource, Has Higher Waste Volume; Reprocessing Still Requires a Repository and Increases Costs, Proliferation Risks.

WASHINGTON, D.C., April 8, 2010: Contrary to some prevailing opinion, reprocessing would not eliminate the need for a deep geologic disposal program to replace Yucca Mountain. It aggravates waste, proliferation, and cost problems. The volume of waste to be disposed of in deep geologic repository is increased about six times on a life-cycle basis in the French approach compared to the once-through no-reprocessing approach of the United States.

A new report by the Institute for Energy and Environmental Research (IEER), a nonprofit scientific research group, shows that France uses less than 1 percent of the natural uranium resource, contrary to an impression among some policy makers. The report has several recommendations for President Obama's Blue Ribbon Commission on America's Nuclear Future, which was created to address U.S. nuclear waste issues after the administration's cancellation of the Yucca Mountain program.

IEER President Dr. Arjun Makhijani, the author of the report: **"In recent years, a 'French fever' has gripped the promoters of nuclear power in the United States. Praise of France's management of spent fuel by reprocessing, including its use of the extracted plutonium as fuel in its nuclear power reactors, is now routinely heard. But it is a fantasy on the scale of the 1950s "too cheap to meter" mythology about nuclear power to imagine that 90 or 95 percent of the "energy value" of U.S. spent fuel can be extracted by reprocessing."**

Key IEER report findings include the following:

• *On a life-cycle basis, French-style reprocessing and recycle increases the volume of waste that would have to disposed of in a geologic repository.* Reprocessing results in high-level radioactive waste and large volumes of Greater than Class C waste, both of which must be managed by deep geologic disposal. Their combined volume on a life-cycle basis is estimated to be about six times more than the no-reprocessing approach that is current U.S. policy, according to Department of Energy estimates. Low-level waste volume and waste transportation shipments are also estimated to increase several-fold.

• *France spends about two cents per kilowatt-hour more for electricity generated from reprocessed plutonium compared to that generated from fresh uranium fuel.*

• *Attempting to combine reprocessing with breeder reactors to convert uranium in U.S. spent fuel in plutonium will create intolerable costs and risks.* Reprocessing plus breeder reactors are much more expensive than light water reactors today, which are themselves expensive. Such a system is required to convert most of the uranium in spent fuel into a reactor fuel. Even a single penny in excess generation cost per kilowatt-hour in a breeder reactor-reprocessing system would lead to an added $8 trillion in costs to convert nearly all of the uranium in the 100,000 metric tons of U.S. spent into usable fuel. It would take hundreds of years to accomplish the task and require separation of tens of thousands of bombs equivalent of fissile material each year. The proliferation risks will be far greater than today.

• *Adoption of French-style reprocessing program would not eliminate the need for a deep geologic repository.* Even complete fissioning of all actinides – an unrealistic proposition – will leave behind large amounts of very long-lived fission and activation products like iodine-129, cesium-135, and chlorine-36 that will pose risks far into the future -- much beyond the 24,100-year half-life of plutonium-239. In fact, France needs a geologic repository and opposition to one has been intense there. The French appear to dislike nuclear waste in their backyards as much as people in the United States.

• *Proliferation risks are inherently part of the French (and any other) approach to reprocessing.* Even advanced reprocessing technologies will not significantly reduce proliferation risks. For instance a study authored by scientists from DOE laboratories, including Los Alamos and Sandia, concluded that it would take only a few days or a few weeks for proliferant country to make material for nuclear bombs once it had reprocessing plants. It found that new technologies, including electrometallurgical processing, resulted in "only a modest improvement in reducing proliferation risk over existing PUREX technologies and these modest improvements apply primarily for non-state actors." The IEER report concluded that electrometallurgical increases risks in other ways. For instance, it is far less difficult to conceal a plant than the present PUREX technology.

Other key findings include the following:

• *Six decades of sodium cooled breeder reactor development has so far resulted in failure.* Historical experience indicates no learning curve for the sodium cooled fast breeder reactor, which is the breeder technology that has received the most development. In fact, the two most recent large scale demonstration reactors, Superphénix in France and Monju in Japan, have been failures. Superphénix had a cumulative capacity factor of less than 8 percent before it was shut. Monju has been closed for almost 15 years, following a sodium fire, and has not generated a significant amount of electricity. Sodium cooled breeder reactors are not commercial today despite global expenditures on the order of $100 billion over six decades. They face a host of safety, proliferation and cost hurdles to overcome, some arising from the fact that they use liquid sodium for cooling. They are unlikely to be commercial in the near future. For instance, Japan's estimated date for commercialization of the sodium cooled fast breeder is 2050.

• *Storage of liquid high-level wastes creates some risk of catastrophic releases of radioactivity.* For instance, the Norwegian Radiation Protection Authority has estimated that a severe accident at the liquid waste storage facility in Sellafield, Britain, could result in cesium-137 contamination between 10 percent and 5,000 percent of that created in Norway by the 1986 Chernobyl nuclear reactor accident, which is the worst commercial accident to date, by far. A catastrophic release of radioactivity from a military high-level waste tank occurred in the Soviet Union in 1957.

• *Using more than 1 percent of the uranium resource in a light water reactor system is technically impossible even with reprocessing and re-enrichment.* In light water reactor systems, almost all the uranium resource winds up as depleted uranium or in spent fuel. Even with repeated reprocessing and re-enrichment, use of the natural uranium resource cannot be increased to more than 1 percent in such a system. A corollary is that the use of 90 to 95 percent of the uranium resource or of the material in the spent fuel is impossible in a light water reactor system even with reprocessing. These are physical constraints that go with the system and also apply to France's system.

The IEER report also sets out a number of recommendations for the Blue Ribbon Commission on America's Nuclear Future appointed by Energy Secretary Steven Chu:

• Spent fuel from existing reactors should be slated for direct geologic disposal without reprocessing of any kind; a suitable path for a scientifically sound program should be set forth.

• In the interim, spent fuel should be stored on site as safely as possible – in low density configurations while in pools and in hardened storage when moved to dry casks.

• Breeder reactors and reprocessing are not commercial after six decades of development of sodium cooled breeder reactors, and enormous expenditures. Given the long time frame for commercialization estimated even by some promoters, the proliferation risks, and efforts already made, it does not appear to be a good investment to spend

more R&D money in that direction. Rather energy supply R&D resources should be focused on development and deployment of renewable energy technologies and energy efficiency.

• The Commission should request the French company AREVA and/or the French government to supply it with data on the present use of the natural uranium resource purchased for French nuclear reactors, including, specifically, the increases in fission fraction that have actually been achieved by reprocessing and recycling.

• The Commission should also request official data on Greater than Class C waste equivalent expected to be generated on a life-cycle basis in France, and the total volumes and heat generation of packaged waste expected to be disposed of in a deep geologic repository, including estimates of decommissioning waste.

• The Commission should investigate the public support or lack thereof for repository programs in France and Britain, the countries with the longest history of commercial spent fuel reprocessing.

• The Commission should make the same requests regarding the British reprocessing program.

• Official analyses of the mechanisms, probability, and consequences of large accidental releases of radioactivity to the atmosphere from liquid high-level waste storage in tanks should be requested from the French and British governments.

ABOUT IEER

On March 24, 2010, IEER held a news conference to release documents acquired under the Freedom of Information Act (FOIA) showing that the outgoing Bush Administration inked 11th-hour agreements with more than a dozen utilities involving 21 proposed nuclear reactors. As IEER noted, between the output of existing commercial nuclear reactors and the 21 proposed nuclear reactors covered by the agreements quietly signed by the outgoing Bush Administration, the U.S. already has agreed to store enough spent (used) reactor fuel to fill the equivalent of not one, but two, Yucca Mountain high-level radioactive waste repositories. For more information on the March 24th news event, go to http://216.250.243.12/ieer/032410.cfm.

The Institute for Energy and Environmental Research provides policy-makers, journalists, and the public with understandable and accurate scientific and technical information on energy and environmental issues. IEER's aim is to bring scientific excellence to public policy issues in order to promote the democratization of science and a safer, healthier environment.

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EDITOR'S NOTE: A streaming audio recording of the news event will be available on the Web as of 5 p.m. EDT on April 8, 2010 at http://www.ieer.org.

Find the full report: **The Mythology and Messy Reality of Nuclear Fuel Reprocessing**, at http://www.ieer.org/reports/reprocessing2010.pdf and the audio recording at http://www.ieer.org/reports/reprocessing2010-04-08.mp3.