REPORT: UNSUCCESSFUL "FAST BREEDER" IS NO SOLUTION FOR LONG-TERM REACTOR WASTE DISPOSAL ISSUES

After Over $50 Billion Spent by US, Japan, Russia, UK, India and France, No Commercial Model Found; High Cost, Unreliability, Major Safety Problems and Proliferation Risks All Seen as Major Barriers to Use.

PRINCETON, N.J. – February 17, 2010 – Hopes that the "fast breeder"– a plutonium-fueled nuclear reactor designed to produce more fuel than it consumed -- might serve as a major part of the long-term nuclear waste disposal solution are not merited by the dismal track record to date of such sodium-cooled reactors in France, India, Japan, the Soviet Union/Russia, the United Kingdom and the United States, according to a major new study from the International Panel on Fissile Materials (IPFM).

Titled "Fast Breeder Reactor Programs: History and Status," the IPFM report concludes: "The problems (with fast breeder reactors) … make it hard to dispute Admiral Hyman Rickover's summation in 1956, based on his experience with a sodium-cooled reactor developed to power an early U.S. nuclear submarine, that such reactors are 'expensive to build, complex to operate, susceptible to prolonged shutdown as a result of even minor malfunctions, and difficult and time-consuming to repair.'"

Plagued by high costs, often multi-year downtime for repairs (including a 15-year reactor restart delay in Japan), multiple safety problems (among them often catastrophic sodium fires triggered simply by contact with oxygen), and unresolved proliferation risks, "fast breeder" reactors already have been the focus of more than $50 billion in development spending, including more than $10 billion each by the U.S., Japan and Russia. As the IPFM report notes: "Yet none of these efforts has produced a reactor that is anywhere near economically competitive with light-water reactors … After six decades and the expenditure of the equivalent of tens of billions of dollars, the promise of breeder reactors remains largely unfulfilled and efforts to commercialize them have been steadily cut back in most countries."

The new IPFM report is a timely and important addition to the understanding about reactor technology. Today, with increased attention being paid both to so-called "Generation IV" reactors, some of which are based on the fast reactor technology, and a new Obama Administration panel focusing on reprocessing and other waste issues, interest in some quarters has shifted back to fast reactors as a possible means by which to bypass concerns about the long-term storage of nuclear waste.

Frank von Hippel, Ph.D., co-chair of the International Panel on Fissile Materials, and professor of Public and International Affairs, Woodrow Wilson School, Princeton University, said: "The breeder reactor dream is not dead but it has receded far into the future. In the 1970s, breeder advocates were predicting that the world would have thousands of breeder reactors operating by now. Today, they are predicting commercialization by approximately 2050. In the meantime, the world has to deal with the legacy of the dream; approximately 250 tons of separated weapon-usable plutonium and ongoing — although, in most cases struggling — reprocessing programs in France, India, Japan, Russia and the United Kingdom."

Mycle Schneider, Paris, international consultant on energy and nuclear policy, said: "France built with Superphénix, the only commercial-size plutonium fueled breeder reactor in nuclear history. After an endless series of very costly technical, legal and safety problems it was shut down in 1998 with one of the worst operating records in nuclear history."

Thomas B. Cochran, nuclear physicist and senior scientist in the Nuclear Program at the Natural Resources Defense Council, said: "Fast reactor development programs failed in the: 1) United States; 2) France; 3) United Kingdom; 4) Germany; 5) Japan; 6) Italy; 7) Soviet Union/Russia 8) U.S. Navy and 9) the Soviet Navy. The program in India is showing no signs of success and the program in China is only at a very early stage of development. Despite the fact that fast breeder development began in 1944, now some 65 year later, of the 438 operational nuclear power reactors worldwide, only one of these, the BN-600 in Russia, is a commercial-size fast reactor and it hardly qualifies as a successful breeder. The Soviet Union/Russia never closed the fuel cycle and has yet to fuel BN-600 with plutonium."

M.V. Ramana, Ph.D., visiting research scholar, Woodrow Wilson School and the Program in Science, Technology, and Environmental Policy, Princeton University, said: "Along with Russia, India is one of only two countries that are currently constructing commercial scale breeder reactors. Both the history of the program and the economic and safety features of the reactor suggest, however, that the program will not fulfill the promises with which it was begun and is being pursued. Breeder reactors have always underpinned the DAE's claims about generating large quantities of cheap electricity necessary for development. Today, more than five decades after those plans were announced, that promise is yet to be fulfilled. As elsewhere, breeder reactors are likely to be unsafe and costly, and their contribution to overall electricity generation will be modest at best."

OTHER KEY FINDINGS

The IPFM report also found:

* The rationale for breeder reactors is no longer sound. "The rationale for pursuing breeder reactors — sometimes explicit and sometimes implicit — was based on the following key assumptions: 1. Uranium is scarce and high-grade deposits would quickly become depleted if fission power were deployed on a large scale; 2. Breeder reactors would quickly become economically competitive with the light-water reactors that dominate nuclear power today; 3. Breeder reactors could be as safe and reliable as light-water reactors; and, 4. The proliferation risks posed by breeders and their 'closed' fuel cycle, in which plutonium would be recycled, could be managed. Each of these assumptions has proven to be wrong."

* Significant safety issues are unresolved. "Sodium's major disadvantage is that it reacts violently with water and burns if exposed to air. The steam generators, in which molten-sodium and high-pressure water are separated by thin metal, have proved to be one of

the most troublesome features of breeder reactors. Any leak results in a reaction that can rupture the tubes and lead to a major sodium-water fire. …. a large fraction of the liquid-sodium-cooled reactors that have been built have been shut down for long periods by sodium fires. Russia's BN-350 had a huge sodium fire. The follow-on BN-600 reactor was designed with its steam generators in separate bunkers to contain sodium-water fires and with an extra steam generator so a fire-damaged steam generator can be repaired while the reactor continues to operate using the extra steam generator. Between 1980 and 1997, the BN-600 had 27 sodium leaks, 14 of which resulted in sodium fires … Leaks from pipes into the air have also resulted in serious fires. In 1995, Japan's prototype fast reactor, Monju, experienced a major sodium-air fire. Restart has been repeatedly delayed, and, as of the end of 2009, the reactor was still shut down. France's Rapsodie, Phénix and Superphénix breeder reactors and the UK's Dounreay Fast Reactor (DFR) and Prototype Fast Reactor (PFR) all suffered significant sodium leaks, some of which resulted in serious fires."

* Downtime makes the breeder reactor unreliable. "… a large fraction of sodium-cooled demonstration reactors have been shut down most of the time that they should have been generating electric power. A significant part of the problem has been the difficulty of maintaining and repairing the reactor hardware that is immersed in sodium. The requirement to keep air from coming into contact with sodium makes refueling and repairs inside the reactor vessel more complicated and lengthy than for water-cooled reactors. During repairs, the fuel has to be removed, the sodium drained and the entire system flushed carefully to remove residual sodium without causing an explosion. Such preparations can take months or years.

* Proliferation risks have not been addressed. "All reactors produce plutonium in their fuel but breeder reactors require plutonium recycle, the separation of plutonium from the ferociously radioactive fission products in the spent fuel. This makes the plutonium more accessible to would-be nuclear-weapon makers. Breeder reactors – and separation of plutonium from the spent fuel of ordinary reactors to provide startup fuel for breeder reactors – therefore create proliferation problems. This fact became dramatically clear in 1974, when India used the first plutonium separated for its breeder reactor program to make a 'peaceful nuclear explosion.' Breeders themselves have also been used to produce plutonium for weapons. France used its Phénix breeder reactor to make weapon-grade plutonium in its blanket. India, by refusing to place its breeder reactors under international safeguards as part of the U.S.-India nuclear deal, has raised concerns that it might do the same."

* Most breeder reactors are being shut down. "Germany, the United Kingdom and the United States have abandoned their breeder reactor development programs. Despite the arguments by France's nuclear conglomerate Areva, that fast-neutron reactors will ultimately fission all the plutonium building up in France's light-water reactor spent fuel, France's only operating fast-neutron reactor, Phénix, was disconnected from the grid in March 2009 and scheduled for permanent shutdown by the end of that year. The Superphénix, the world's first commercial-sized breeder reactor, was abandoned in 1998 and is being decommissioned. There is no follow-on breeder reactor planned in France for at least a decade."

For the full text of the IPFM study, go to http://www.fissilematerials.org on the Web.

ABOUT THE IPFM

The International Panel on Fissile Materials (IPFM) was founded in January 2006. It is an independent group of arms-control and nonproliferation experts from 17 countries, including both nuclear weapon and non-nuclear weapon states. The mission of the IPFM is to analyze the technical basis for practical and achievable policy initiatives to secure, consolidate, and reduce stockpiles of highly enriched uranium and plutonium. These fissile materials are the key ingredients in nuclear weapons, and their control is critical to nuclear disarmament, halting the proliferation of nuclear weapons, and ensuring that terrorists do not acquire nuclear weapons.

The IPFM is co-chaired by Professor R. Rajaraman of Jawaharlal Nehru University in New Delhi and Professor Frank von Hippel of Princeton University. Its members include nuclear experts from Brazil, China, France, Germany, India, Ireland, Japan, South Korea, Mexico, the Netherlands, Norway, Pakistan, Russia, South Africa, Sweden, the United Kingdom and the United States. Princeton University's Program on Science and Global Security provides administrative and research support for the IPFM. IPFM's initial support is provided by a five-year grant to Princeton University from the John D. and Catherine T. MacArthur Foundation of Chicago.

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EDITOR'S NOTE: A streaming audio recording of IPFM's news event will be available on the Web as of 5 p.m. EST/2200 GMT on February 17, 2010 at http://www.fissilematerials.org.