

WHAT IS REPROCESSING?

In nuclear power plants, the highly radioactive fuel rods are removed from the reactor after about five years of fissioning and are replaced with fresh rods. Reprocessing involves physically chopping up the irradiated rods and then dissolving them in acid to extract plutonium and uranium. Separated plutonium can be used to make nuclear weapons. Commercial reprocessing currently takes place in five countries — France, India, Japan, Russia, and the United Kingdom.

- ▶ No permanent waste repository exists on the planet — and none may ever exist — for the disposal of the fuel rods currently in reactors or those that have already been removed. Irradiated rods are therefore being stored at every reactor site. They remain vulnerable to terrorists and accidental releases, and they increase the radiation exposure of workers. The U.S. nuclear industry is promoting reprocessing as its latest illusion of a solution to the high-level radioactive waste problem.

MORE WASTE CREATED, NOT LESS

- ▶ A fraction of the separated plutonium from reprocessing is intended for use in new reactor fuel. When used, though, the new fuel would then itself generate more plutonium and other long-lived radioactive wastes. Plutonium-239 continues releasing harmful particles and rays for at least 240,000 years.
- ▶ No safe technology or disposal site exists to isolate the radioactive wastes that reprocessing generates. Especially because the solid irradiated rods are transformed into high-level radioactive liquids and sludges, reprocessing increases rather than decreases the volume of homeless radioactive waste. The waste byproducts cannot be re-used. They have to be abandoned on-site or dumped elsewhere. For example, French uranium wastes left over from reprocessing



The atom bomb that destroyed Nagasaki (pictured above, shortly after the blast and fire) used reprocessed plutonium. It killed 40,000 people right away and an additional 100,000 within five years — from radiological and physical injuries.

have been shipped to Siberia for indefinite storage. Reprocessing plant structures and components also become radioactively contaminated and corroded during operations, turning them into radioactive waste, as well.

THE WEAPONS LINK

- ▶ Both Presidents Ford and Carter banned commercial reprocessing in the U.S. because they feared that the technology's spread would be used for the worldwide proliferation of nuclear weapons. In addition to the use of extracted plutonium in nuclear weapons, the left-over reprocessing wastes can be used to turn an ordinary bomb into a dirty bomb that is designed to disperse radioactivity. President Reagan overturned the reprocessing ban, but the exorbitant cost of building and operating such plants has kept reprocessing from being revived in the U.S. since 1972.



“During my eight years in the White House, every nuclear weapons issue we dealt with was connected to a nuclear reactor program.”

— Al Gore

- ▶ The U.S. invented reprocessing in the 1940s to separate plutonium from irradiated nuclear fuel for use in the Trinity bomb test in New Mexico and in the atomic bomb that destroyed Nagasaki in

1945. The Soviet Union in 1949, the U.K. in 1952, and France in 1960 also tested atomic weapons using reprocessed plutonium. In the 1960s, Israel began to reprocess research reactor fuel to extract plutonium for its atomic arsenal. By 1967, China began to extract weapons-grade plutonium via reprocessing. In 1974, India detonated a nuclear device by using plutonium reprocessed from its research reactor fuel. (The reactor came from Canada; the reprocessing technology came from the U.S.) For at least the past decade, evidence has mounted that Pakistan may be pursuing plutonium-based weapons to add to its highly-enriched uranium arsenal. In 2006 and 2009, North Korea tested atomic weapons triggered by reprocessed plutonium extracted from a small research reactor's fuel.

- ▶ Japan already has a large stockpile of separated commercial plutonium, which will grow substantially when its new Rokkasho reprocessing facility becomes operational. If it so chose, Japan would have the technical capability to manufacture nuclear weapons within months. But fortunately, Japan — the only country ever attacked by atomic weapons — continues to renounce them.

- ▶ France and the U.K. alone have already extracted and stockpiled enough commercial plutonium to make over 30,000 Nagasaki-type atomic weapons.

- ▶ America's abstinence from commercial reprocessing since the 1970s has no doubt helped to avert the proliferation of atomic arsenals in other countries — most notably in Argentina, Brazil, South Korea, and Taiwan.

RADIOACTIVE RELEASES

- ▶ Radioactive wastes are released directly into the environment during the routine operation of reprocessing plants. The British Sellafield plant has dumped its waste liquids, laced with a total of over 1,000 pounds of plutonium, into the Irish Sea. The French La Hague plant discharges tens of millions of gallons of liquid radioactive waste into the English Channel every year. Such discharges would be illegal if dumped overboard in barrels from ships. But France and the U.K. have circumvented a decades-old international treaty against ocean dumping by using underwater discharge pipes. If located in the U.K., the sea beds adjacent to the French discharge pipe could themselves qualify as intermediate-level radioactive waste, requiring deep geologic disposal under British law and regulation. These radioactive poisons continue to contaminate the food chain. Liquid wastes from La Hague have been traced as far away as the Arctic Ocean. Plutonium, almost certainly originating at Sellafield, has been found in teeth of children living hundreds of miles downstream.

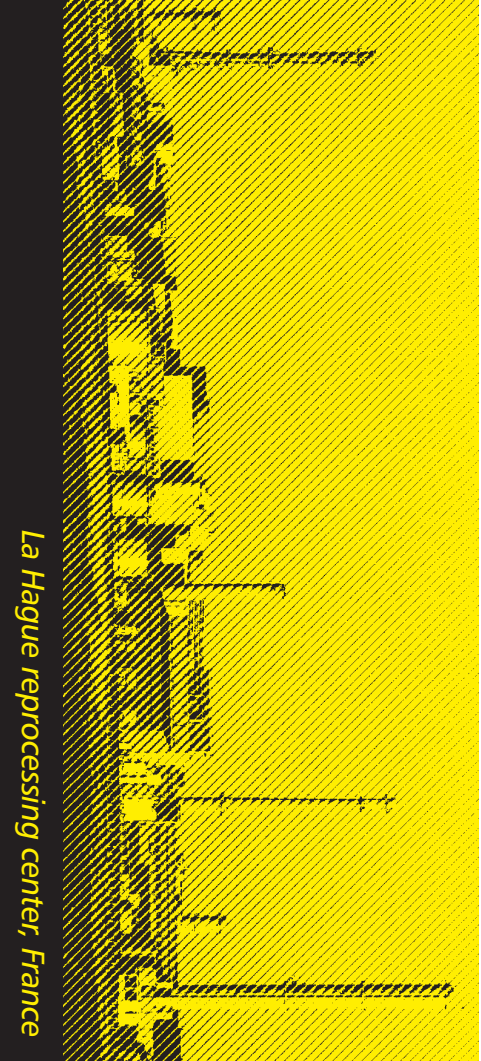
A TYPICAL 1,000-MEGAWATT REACTOR GENERATES ENOUGH PLUTONIUM EVERY YEAR TO MANUFACTURE AT LEAST 40 NUCLEAR BOMBS

- ▶ Reprocessing plants also routinely discharge radioactive gases. For example, La Hague discharges more radioactive krypton-85 gas into the air in one year than was released by the more than 500 atmospheric atomic weapons tests detonated worldwide over the course of decades. Some of the krypton-85 discharged today will continue to release dangerous radioactive beta particles for more than 100 years.

- ▶ The global-warming gas, carbon dioxide, released from reprocessing plants contains radioactive carbon-14, an extremely harmful isotope that persists for more than 50,000 years.

RADIATION EXPOSURE

► Reprocessing is hazardous for workers and for people living downstream and downwind. Radiation can cause birth defects, mutations, cancer, and other diseases. Studies near La Hague have found elevated rates of leukemia. Studies at Sellafield have found that children of fathers who work there suffer increased risks of leukemia and non-Hodgkin's lymphoma. Stillbirths have also increased.



La Hague reprocessing center, France

► One of the world's worst nuclear accidents occurred in 1957 at a former reprocessing plant at Mayak in the Ural Mountains of Siberia. A radioactive waste storage tank exploded, exposing 272,000 people to harmful radiation. More than half a century later, Mayak remains one of the most radioactive places on Earth.

HUGE COSTS

► The operation of reprocessing plants is not only hazardous but also extremely expensive. Given the severe and widespread radioactive contamination, effective post-closure cleanup of the plants and their surroundings may not even be possible. The price tag for cleanup may be incalculable.

► Between 1943 and 1990, reprocessing of U.S. military reactor fuel was carried out at Hanford WA, Savannah River SC, West Valley NY, and the Idaho National Lab. As a result, Lake Erie and Lake Ontario, the Columbia, Savannah and Snake rivers, and the Tuscaloosa and Snake River aquifers remain at risk of continuing severe radioactive contamination. The

cleanup will likely cost taxpayers many hundreds of billions of dollars, or more. The only reprocessing of U.S. commercial reactor fuel took place at West Valley from 1966 to 1972. Initiation of that plant's cleanup has been deferred repeatedly, and is already estimated to cost from \$10 billion to \$27 billion, or more.

► Reprocessing plants large enough to handle current U.S. irradiated fuel inventories would cost an estimated \$40 billion to \$60 billion each to build, and at least \$3 billion each

year to operate. Taxpayers and/or electric ratepayers would almost certainly bear those added cost burdens, not the nuclear power industry.

► While no safe storage or disposal options exist for irradiated nuclear fuel, reprocessing would cost two to ten times more than continued on-site storage of rods at reactor sites, and from \$65 billion to \$130 billion more than geologic disposal, assuming a site were ever located. As wastes mount with continued reactor operations, reprocessing costs could at least double.

► As many as 40-75 liquid-sodium-cooled, fast neutron "advanced burner" reactors (formerly known as "breeders") would be needed to fission the new plutonium-based fuel and its transuranic constituents into shorter-lived radioactive isotopes (although yet more long lasting radioactive poisons would also be generated). These reactors could cost U.S. taxpayers yet another \$40 billion to \$150 billion, or more.

REPROCESSING IN THE U.S.

► Because of the 2010 cancellation of the proposed geologic disposal facility for irradiated fuel rods at Yucca Mountain, Nevada, nuclear power promoters are again advocating reprocessing.

► The U.S. nuclear industry, the national nuclear labs, and the French government's atomic giant Areva

successfully lobbied the George W. Bush administration in 2006 to launch the Global Nuclear Energy Partnership, designed to revive reprocessing and expand nuclear power worldwide. Although President Obama has cancelled GNEP's environmental review, funding for reprocessing is continuing within the Energy Department's "Fuel Cycle Research and Development" program.

WHAT YOU CAN DO

► Please contact your U.S. Senators and Representative via the Congressional switchboard, **(202) 224-3121**. Urge them to oppose funding for the research and development of reprocessing.

► Please contact President Obama's office at **(202) 456-1111**. Urge the White House to renew the Ford/Carter ban on reprocessing. President Obama has called for a world free of nuclear weapons. This goal will be unattainable if reprocessing were to be re-authorized.

► Please use this pamphlet to help encourage the public to write to government officials and the media. You may reproduce this pamphlet, download it from our Web site, or contact **BEYOND NUCLEAR** to request copies.

NUCLEAR POWER IS DIRTY, DANGEROUS, AND EXPENSIVE. ITS WASTES REMAIN DEADLY VIRTUALLY FOREVER. SAFE ALTERNATIVES EXIST NOW.

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