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THE GLOBAL NUCLEAR ENERGY PARTNERSHIP: A THREAT TO HUMAN LIFE AND HEALTH

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The Global Nuclear Energy Partnership: A Threat to Human Life and Health

Summary

The Bush Administration's Global Nuclear Energy Partnership (GNEP) would increase waste storage and proliferation concerns arising from the use and projected expansion of nuclear energy by legitimizing the use of reprocessing and enrichment technologies. GNEP is one of many fuel cycle initiatives in the global arena that aim to manage the spread of dual-use (energy and weapon) technology. GNEP plans to restart nuclear waste reprocessing in the United States and increase nuclear enrichment and reprocessing capacities abroad through the commercial use of these dual-use technologies.

Physicians for Social Responsibility (PSR) opposes a revival of nuclear waste reprocessing in the United States or its commercialization abroad. Reprocessing threatens human health by increasing the level of radioactivity in the environment and threatens human life by increasing stockpiles of weapons-usable plutonium.

The National Research Council's Committee on Biological Effects of Ionizing Radiation (BEIR) published seven reports since 1956 regarding radiation exposures. The latest report demonstrates that even very low levels of exposure to radiation can lead to cancer. No sustainable safe storage solutions exist for the current stockpile of more than 50,000 tons of commercially generated nuclear waste at 72 domestic sites. Reprocessing will exacerbate these problems and, surrounding communities will be at risk of exposure to low levels of radiation.

Reprocessing does not recycle nuclear waste, but separates it into different waste streams and increases the total volume of nuclear waste to be disposed of by a factor of twenty or greater. The Department of Energy (DOE) proposed classifying most of this waste stream as low level radioactive waste so it might be stored in tanks rather than in an underground repository.

These waste tanks can be an environmental hazard. The closed tanks at the reprocessing facility in Washington State have leaked more than one million gallons of radioactive waste into the ground near the Columbia River.

GNEP's international component expanded plans to commercialize reprocessing and enrichment technology globally. This raises great nonproliferation concerns, since these technologies are used for energy and nuclear weapon production. DOE will likely try to continue the international component of GNEP, re-framing it as a way for countries to meet and discuss safe and secure energy generation and waste storage options.

Although Congress appropriated far less than DOE requested for the initiative for 2008, what was appropriated ($179 million), allows for a continuation of research and development work. PSR believes that funding for any program leading to an expansion of reprocessing should be eliminated.

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Overly Ambitious Goals for GNEP in the United States

In February 2006 Secretary of Energy Samuel Bodman announced the Global Nuclear Energy Partnership as part of the Bush administration's Advanced Fuel Cycle Initiative, a program that began in 2003 to develop and demonstrate spent fuel (nuclear waste) reprocessing/recycling technology.[1] The domestic component of GNEP envisioned reprocessing in the United States in a revolutionary way that did not separate out pure plutonium, as in past U.S. reprocessing methods. DOE proposed that a futuristic reprocessing technology would keep plutonium mixed with actinides and then utilize a plutonium-actinide fuel in fast burner reactors.

DOE initially proposed three expensive facilities to create the domestic component of GNEP: an Advanced Fuel Cycle Research Facility, which would perform research and development as well as lab-scale and engineering-scale tests of advanced separations and transmutation fuels technologies; a Nuclear Fuel Recycling Center, for reprocessing and fuel fabrication ($35 billion to construct); and an "Advanced Recycling Reactor," a prototype for 40 to 75 fast burner reactors (which would require a $40-150 billion federal subsidy to construct).[2] Estimating that the GNEP facilities would have a life-cycle of approximately 40 years, the cost to construct and operate these GNEP facilities could start at $500 billion, and in the event that the unproven technology fails, billions more to clean up.

GNEP does not create, as DOE claims, an "economical" energy source.[3] DOE requested $405 million from Congress in fiscal year (FY) 2008 for GNEP. In the final 2008 bill, GNEP received $179 million, $216 million less than the President's request. According to the U.S. House of Representative's Committee on Appropriations Report, the decrease resulted because the "project will cost tens of billions of dollars and last for decades but it continues to raise concerns among scientists and has only weak support from industry."[4] Without passage of a FY2009 appropriation by Congress, GNEP's funding likely will remain $179 million (of which $30 million will be devoted to the international component) through a Continuing Resolution. Previously Congress authorized research and development for GNEP, but stipulated that no new facilities could be built.

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[1] Andrews, A., Anthony Andrews, Mark Holt, Jill Marie Parillo, Sharon Squassoni, and Coordinator; Mary Beth Dunham Nikitin, "Managing the Nuclear Fuel Cycle: Policy Implications of Expanding Global Access to Nuclear Power," *Congressional Research Service*, November 1, 2007, RL34234.

[2] Von Hippel, Frank, *Princeton University*, A Presentation of "Managing spent fuel in the United States: The illogic of reprocessing," Presented at a Congressional Staff Briefing, May 7, 2007, Washington D.C. and for DOE estimates for reprocessing capabilities see, Robert Alvarez, "Radioactive Wastes and the Global Nuclear Energy Partnership," *Institute for Policy Studies*, April 2007, Pg. 11. Note: The necessary number of fast reactors could not be located in one place, since the grid could not accept that amount of power in one location. Therefore, the cost may rise once these are distributed at four or five sites.

[3] Dennis Spurgeon, Assistant Secretary for Nuclear Energy, *US Department of Energy*, "ANS President's Special Session: DOE Perspectives on GNEP Implementation," November 13, 2006.

[4] U.S. House of Representatives Committee on Appropriations, "FY 2008 Omnibus Summary," Congressional Energy and Water Subcommittee. Available at [http://appropriations.house.gov/pdf/EnergyandWaterOmnibus.pdf]

In addition to false claims about GNEP's thriftiness, DOE falsely stated that GNEP is a net gain for nonproliferation, since the advanced fuel created by GNEP would be "proliferation resistant." According to top experts in the field, like Dr. Frank von Hippel of Princeton University, this is false. Rather, the material GNEP would separate out of nuclear waste would get terrorist one step closer to making a crude nuclear devise. This will be discussed in more detail below. Making DOE's argument even weaker for reprocessing, the "proliferation" resistant fuel is turning out to be too complex of a technology for the near future. DOE is now considering reprocessing as currently conducted in France, Britain, and Russia, where plutonium is blended with uranium to make mixed oxide (MOX) fuel, [5] an even easier mixture for terrorists to process.

More evidence for these false claims can in a report by the National Research Council in the U.S. (governed by board members from the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine). This Research Council produced a comprehensive report on GNEP that states, "all committee members agree that the GNEP program should not go forward and that it should be replaced by a less aggressive research program."[6]

Radioactive Waste: the Threat to Human Life and Health

Since the twin atomic explosions in Hiroshima and Nagasaki that killed more than 210,000 people by the end of 1945, there has been increased knowledge about the deleterious effects on human health from radiation. There have been several successive, comprehensive studies of chronic health impacts, including cancer, on Japanese survivors. The National Research Council's Committee on Biological Effects of Ionizing Radiation (BEIR) has published seven reports on these findings since 1956.

These reports address the potential health effects from exposure to low to high doses of radiation. Ionizing radiation in high-level doses (exposure to over 1 Sievert) produces immediate damage such as skin burns, hair loss, bone marrow destruction, and other grave systemic damage that can progress to short-term demise.[7] The health effects of exposure to low doses (less than 0.1 Sievert, or 40 times the average yearly background exposure) are not immediately visible and are far less predictable because they involve the cancerous transformation of cells.[8]

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[5] A separations technology that separates plutonium while keeping it mixed with a little uranium is also under consideration. This is similar to what the French plan to do and is called COEX. The COEX process is based on co-extraction and co-precipitation of uranium and plutonium together as well as a pure uranium stream. "Nuclear Power in France," *World Nuclear Association*. Available at [http://www.world-nuclear.org/info/inf40.html].

[6] National Research Council of the National Academies, "Review of DOE's Nuclear Energy Research and Development Program," *National Academy of Sciences*, 2007.

[7] Chivian E, McCally M, Hu H, Haines A. *Critical Condition: Human Health and the Environment*.Cambridge, Mass: MIT Press; 1993.pg. 95-96.

[8] McCally M, ed. *Life Support: The Environment and Human Health*. Cambridge, Mass: MIT Press; 2002. pg. 215.

Since 1990, the BEIR committee has supported the “linear no-threshold model” hypothesis. This hypothesis states that all exposure to radiation, no matter how small the dose, presents some risk to human health. The most recent committee report (BEIR VII) calculated the expected cancer risk from very low doses of radiation.[9] The committee found that in a lifetime approximately 42 out of 100 people will be diagnosed with cancer, and one cancer out of these 42 could result from a single exposure to 0.1 Sievert of low-level radiation above background.[10] There still is a lack of scientific consensus about what level of radiation exposure leads to cancer, mostly because of the difficulty in proving a causal link between a specific radiation exposure and adverse health effects. However, the likely risk gives sufficient cause for concern over negative health impacts of a GNEP facility, which could expose surrounding communities to low levels of radiation.[11]

Recent information has reinforced concerns that GNEP would increase the threat to human life and health by creating more carcinogenic waste. The Santa Susana Field Laboratory Panel, an independent team of researchers and health experts, released a report in October 2006 on health risks associated with experiments conducted at the Santa Susana Laboratory in Southern California, including a 1959 reactor meltdown at the facility.[12] After five years of research the panel concluded that 260 to 1,800 excess cancer cases were likely caused by the laboratory’s release of some of the same carcinogenic radionuclides that will be reprocessed, researched, and stored at GNEP sites, such as iodine-129, cesium-137, and strontium-90. The significance of these findings underscores the danger associated with large amounts of low-level radioactive wastes that would accrue at GNEP reprocessing facilities. After 30 years of operation, an estimated 7.5 to 12.4 billion curies of cesium-137 and strontium-90 would accumulate at a GNEP facility.[13]

The risk a low level radioactive release poses to surrounding communities can be compared to that experienced by people living near the Hanford reprocessing facility in the state of Washington. Communities surrounding Hanford have an unusually high number of various cancers, miscarriages, and other disorders.[14] Furthermore, the U.S. government estimates the health risk of low levels of ionizing radiation using “reference man” characteristics, which tend to underestimate impacts on more vulnerable people -- in particular, infants, children, pregnant women, immune compromised, and other

[9] This report was sponsored by the U.S. Departments of Defense, Energy and Homeland Security, The U.S. Regulatory Commission, and the Environmental Protection Agency.
[10] Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation, National Research Council. *Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII-Phase 2*. Washington, D.C.: The National Academies Press; 2006. Available at: http://books.nap.edu/catalog.php?record_id=11340. Accessed January 29, 2009.
[11] Ibid. McCally, Michael, “War and Public Health.”
[12] “59 Meltdown in California Kept Secret,” *Nukewatch Quarterly*, Spring 2007. pg.1. The Santa Susana Field Laboratory is located 30 miles north of downtown Los Angeles, California.
[13] Alvarez, Robert, “Reducing the Risks of High Level Radioactive Wastes at Hanford,” *Science and Global Security*, 13:43–86, 2005.Available at [http://www.princeton.edu/~globsec/publications/pdf/13%201-2%20alverez%2043%2086.pdf] pg. 15.
[14] Barry S. Levy, and Sidel, Victor, “War and Public Health,” *American Public Health Association*, 2000. Pg 129.

chronically ill persons who lack the anatomical and physiological characteristics of what DOE defines as an "average" individual. These individuals are likely to suffer more from exposures than those who fit the "reference man" criteria.

Transportation of the newly generated GNEP waste would compound the human health impacts. It is expected that shipment of the current stock of commercially generated nuclear waste to Yucca Mountain would entail one shipment every four hours, 24 hours a day, for 38 years, crossing the U.S. through 43 states.[15] Reprocessing would increase this threat by creating even more waste to be transported to storage facilities. DOE prepared a Draft Supplemental Environmental Impact Statement for Yucca Mountain in October 2007.[16] In this Statement, DOE estimated the number of cancers that could result during a 50-year period, assuming no accidents from transporting nuclear waste to a repository. The Statement reads that "the total estimated impacts of incident-free shipment of spent fuel and high-level radioactive waste would be about 5 fatalities." [17]

If there were an "incident," such as a severe transportation accident in an urban area, DOE reported that it "would result in an estimated 9 cancer fatalities." These projections are contradicted by State of Nevada estimates, based on the same computer programs that DOE developed and uses. Nevada's estimates shows that an accident of this type in an urban area would result in 13 to 40,868 latent cancer fatalities in the exposed population.[18]

DOE's projections also were drastically different in comparison to Nevada's when estimating the amount of casualties and injuries that would result if a truck or rail shipment were sabotaged by a terrorist with a High Energy Density Device (a weapon that could penetrate waste containers). DOE estimated in its Draft Environmental Impact Statement that such an attack on a truck shipment in an urban area would expose 47,000 people to radiation from the accident, killing an estimated 28 people. It also projected that a train accident would result in 32,000 exposures with 19 deaths. Nevada's estimates for such an attack on either a truck or train indicate that ten times that number of people would be exposed to radiation and killed.[19] Creating twenty times more radioactive waste through GNEP to be transported around the country to waste facilities would clearly increase these threats.

Reprocessing Under GNEP Will Generate More Radioactive Waste

Reprocessing does not recycle nuclear waste but rather separates the waste into different waste streams in preparation for the re-use of a small portion of the nuclear waste as

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[15] Sierra Club Nuclear Task Force, "Deadly Nuclear Waste Transport," *Sierra Club*. Accessed November 27, 2007. Available at [http://www.Sierraclub.org/nuclearwaste/yucca_factsheet.asp].

[16] "Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada," *U.S. Department of Energy*, Office of Civilian Radioactive Waste Management, October 2007, DOE/EIS-0250F-S1D.

[17] Ibid.

[18] Ibid.

[19] Ibid.

nuclear power fuel. The small portion of nuclear waste (approximately 1%) to be used for fuel is plutonium. This highly radioactive portion of the waste contaminates the other portions. After plutonium is separated from the nuclear waste, the rest is cooled in large tanks that in turn also become radioactive from contamination. Based on DOE's data, as much as 63 million curies of long-lived transuranic wastes, such as plutonium, americium, curium, and neptunium, could be separated through reprocessing U.S. commercially generated waste.[20] This is 45 times more radioactivity than in all transuranic wastes produced to make nuclear weapons since the 1940s.[21]

These highly radioactive wastes will require expensive remote handling and shielding. There are no definite plans for the safe transportation and storage of the existing or newly produced radioactive waste. A large GNEP reprocessing plant would likely process about 2,500 metric tons of spent fuel (nuclear waste) each year. The amount of radioactivity in the reprocessed spent fuel would remain approximately the same (the amount in curies), but a large quantity of low-density, high volume waste, like transuranic and low-level waste, would be generated with reprocessing, increasing the total volume of nuclear waste to be disposed of by a factor of 20 or greater.[22]

The experience of the government-owned reprocessing facility at the Hanford Site is illustrative of how nuclear waste storage problems would increase if the United States starts commercial reprocessing. Each kilogram of plutonium the Hanford facility reprocessed generated approximately 1,300 liters of liquid high-level waste, more than 200,000 kilograms of low to intermediate waste and almost ten million liters of contaminated cooling water.[23] This amount of waste would be dwarfed by operations of the envisioned GNEP reprocessing facility that would separate out 25 tons (25,000 kilograms) of plutonium annually. Such enormous volumes of waste pose significant explosive hazards, as witnessed in the 1957 explosion of a high-level liquid waste tank in the former Soviet Union.

The National Academy of Sciences has called the 131 million curies of Cs-137 and Sr-90 stored at the Hanford Site in Washington State “the nation’s most lethal single source of radiation other than inside an operating reactor.”[24] One third of the Hanford Site’s 67 waste tanks have leaked more than one million gallons of radioactive waste into the ground near the Columbia River.[25]

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[20] Robert Alvarez, Senior Scholar at *the Institute for Policy Studies*, in an email interview by Jill Parillo, *Physicians for Social Responsibility*, October 3, 2007. Mr. Alvarez served as senior policy advisor to the US Secretary of Energy from 1993 to 1999.
[21] Ibid.
[22] Dr. Edwin Lyman, “Nuclear Reprocessing: Dangerous, Dirty, and Expensive,” *Union of Concerned Scientist*, January 2006. Available at [http://www.ucsusa.org/global_security/nuclear_terrorism/extracting-plutonium-from-nuclear-reactor-spent-fuel.html]
[23] Barry S. Levy, and Sidel, Victor, “War and Public Health,” *American Public Health Association*, 2000. pg. 127.
[24] Alvarez, Robert, “Reducing the Risks of High Level Radioactive Wastes at Hanford,” *Science and Global Security*, 13:43–86, 2005.Available at [http://www.princeton.edu/~globsec/publications/pdf/13%201-2%20alverez%2043%2086.pdf]
[25] Ibid.

Creating More Waste without Safe Storage Solutions

Devising a policy that would generate significantly more radioactive and hazardous waste in the United States without a plan for storage of current nuclear waste stockpiles is a life- and health-threatening proposition. The U.S. political system is deadlocked over what to do with its current stockpile of more than 50,000 tons of commercially generated nuclear waste at 72 sites around the country.[26] The majority of this waste is stored onsite where it was generated by power plants during several decades of operation. Currently much of the waste resides in temporary storage containers.

DOE would like to see this waste stored in a proposed underground repository at Yucca Mountain in Nevada. However, because of major obstacles encountered in fulfilling Nuclear Regulatory Commission (NRC) licensing requirements, Yucca Mountain failed to open as originally planned in 1998, leaving DOE with a bill of approximately $7 billion in liability from utility companies for not taking their nuclear waste, as agreed to in previous negotiations between commercial operators and DOE.[27] DOE missed the 2000 deadline for applying for a NRC license but extended the deadline and submitted its application in September 2008. However, former Deputy Energy Secretary Clay Sell reportedly said that Yucca's new scheduled opening of 2017 may have to be put off until 2020.[28]

The anticipated delay in opening Yucca Mountain is due to numerous problems with conception, design and opposition by the State of Nevada. According to the Nuclear Waste Policy Act of 1982, the site is limited to accepting no more than 63,000 tons of civilian nuclear waste until a second repository is in operation.[29] With more than 50,000 tons of commercially generated waste already awaiting storage in the U.S. and a continual generation of 2,000 tons of civilian spent fuel a year, by 2014 there will be enough civilian waste to fill Yucca to its legal capacity.[30] Furthermore, the licensing process for Yucca Mountain is disputed because of health-protective environmental standards and opposition by the state of Nevada.[31] In addition, a district court ruling found the Environmental Protection Agency's 10,000-year safety standard on radiation containment at Yucca inconsistent with congressionally mandated National Academy of Sciences recommendations.[32] Surveys done by the State of Nevada report that 75 percent

[26] "DOE's Yucca Mountain Planned Nuclear Waste Repository Faces Quality Assurance and Management Challenges," Jim Wells, *United States Government Accountability Office, Natural Resources and Environment*, House of Representatives Congressional Testimony, April 25, 2006, GAO-06-550T.
[27] Lisa Mascaro, "Nuclear official's stark farewell: Scrap Yucca," *Las Vegas Sun*, February 7, 2007.
[28] Ibid.
[29] Currently, operating U.S. commercial reactors produce 2,152 tons of nuclear spent fuel annually. See, Anthony Andrews, "Radioactive Waste Streams: Waste Classification for Disposal," *Congressional Research Service* Report, RL32163, December 13, 2006. Pg. 8.
[30] Ibid.
[31] Ibid. Frank Von Hippel, "Managing Spent Fuel in the United States." Pg. 6.
[32] Ibid. Andrews, Anthony. Pg 31.

of the population is opposed to locating a high-level nuclear waste repository at Yucca Mountain.[33]

DOE has attempted to "fix" the problem by proposing that the vast quantities of waste that would result from reprocessing could be classified as low-level radioactive waste, allowing the government to store most of it in low-level waste facilities, rather than in a high-level repository like Yucca. U.S. law currently defines radioactive waste that is not high-level radioactive waste, transuranic waste, spent fuel, or byproduct material (uranium and thorium mill tailings and wastes), as low-level radioactive waste (LLRW).[34] Disposal of commercially generated LLRW also is regulated by the NRC.

Classifying reprocessed waste as LLRW would worsen storage problems that already are endemic. The NRC does not view current U.S. LLRW facilities as ideal storage options, since they store rather than dispose of LLRW.[35] Adding twenty times the LLRW to the U.S. inventory through reprocessing would increase the problem that this waste already poses. According to a comprehensive study completed in 2004 by the U.S. General Accounting Office, "as LLRW storage volume and duration increase in the absence of reliable and cost-effective disposal options, so might the safety and security risks."[36]

Between 1999 and 2003, the volume of LLRW to be shipped to commercial disposal sites increased by 200 percent.[37] An average of 73,800 cubic feet of LLRW per year must be disposed of in the U.S. That average will rise dramatically when U.S. nuclear power reactors start being decommissioned after 2010. By the end of 2020, the existing operating licenses for 59 of the 104 plants in the U.S. will expire and each nuclear generating plant that is retired will generate approximately 250,000 cubic feet of LLRW.[38] Creating more waste through reprocessing, even if it is re-classified as low-level waste, would only exacerbate U.S. waste storage problems.

GNEP Threatens to Facilitate Nuclear Terrorism in the United States

The plutonium mixtures separated out of U.S. spent fuel under GNEP would be easier to steal and process than plutonium within spent fuel rods, as currently stored. This will make U.S. plutonium stocks more vulnerable to theft by terrorists with ambitions to create nuclear or radiological ("dirty") bombs. Reprocessing through the current GNEP scheme would separate out approximately 25,000 kilograms of plutonium (or plutonium

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[33] "State of Nevada Yucca Mountain Survey Summary Report," *Nevada Office of the Governor, Agency for Nuclear Projects,* October 2004. Available at [www.state.nv.us/nucwaste/news2004/pdf/nv0410survey.pdf]

[34] "Low-Level Radioactive Waste (LLW), Guide to Greater than Class C Radioactive Waste," Environmental Management division of the *U.S. Department of Energy,* Available at [http://www.gtcceis.anl.gov/guide/llw/index.cfm]

[35] "Low-Level Radioactive Waste: Disposal Availability Adequate in the Short Term, but Oversight Needed to Identify Any Future Shortfalls," *U.S. General Accounting Office,* GAO-04-604, June 2004. Pg. 21.

[36] Ibid.

[37] Ibid.

[38] "Low-level Radioactive Waste," Report to the Chairman Committee on Natural Resources, *United States General Accounting Office,* September 1999, GAO/RCED-99-238.

mixtures) annually. According to an article co-authored by former U.S. nuclear weapon designer Theodore Taylor, a terrorist would need to acquire 5 to 6 kg of plutonium to create a crude nuclear weapon (one that could release radiation without reaching its full yield potential).[39] The atomic bomb which destroyed Nagasaki was made with 6.2 kilograms of plutonium and had a yield of 21-23 kilotons, although it is highly unlikely that a non-state actor would be able to achieve this great a yield.[40]

The high-level of radioactivity of plutonium present in spent fuel necessitates its ultimate storage in a secure underground repository to adequately protect public and environmental health. In the unlikely event that Yucca Mountain opened in spite of lingering issues regarding its adequacy and safety, it still would be at legal capacity from accumulated nuclear power waste by the time a new reprocessing facility was in full operation. Therefore, the 25 tons of plutonium which would be separated out each year from a GNEP reprocessing would have to be stored onsite at a U.S. reprocessing center for the foreseeable future, increasing the risk of theft or diversion of this material.

GNEP supporters claim that reprocessing under GNEP would not pose a proliferation threat because the envisioned technology would separate plutonium while keeping it mixed with actinides. DOE claims this mixture would be proliferation resistant.[41] However, close examination of DOE plans for mixing plutonium with other actinides undermines these assurances. For example, neptunium, one of the actinides under consideration, is much less radioactive than plutonium and yet still could be used directly in a nuclear weapon.[42] Unlike plutonium in unprocessed spent fuel, such a plutonium-actinide mixture that would be stored in light airtight containers could easily be transported without significant radiation exposure and subsequently processed in a glove box for weapons design, without incapacitating doses of radiation.[43]

When plutonium is stored as spent fuel, it is much less vulnerable to theft and use. Currently plutonium in nuclear waste is intimately mixed with fission products as well as with uranium-238. In this form, it cannot be used in a nuclear weapon.[44] Plutonium makes up one percent of nuclear waste from U.S. power reactors. The highly radioactive waste is stored in sealed twelve pound rods within fuel assemblies of 64 to 200 rods. Because of the heavy shielding required, one of these assemblies, weighing half a ton, would require a 20-ton transport container to move. The plutonium within this nuclear waste would require remote handling behind thick walls to process for weapons use.[45]

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[39] Carson Mark, Theodore Taylor, Eugene Eyster, William Maraman, Jacob Wechsler, “Can Terrorist Build Nuclear Weapons?,” *Nuclear Control Institute*, Washington D.C. Available at [http://www.nci.org/k-m/makeab.htm]

[40] “Nuclear Weapon Design,” *Federation of American Scientist*, October 21, 1998.

[41] DOE is also considering mixing plutonium with one actinide only, either neptunium or uranium.

[42] Steve Fetter and von Hippel, Frank, “Is U.S. Reprocessing Worth the Risk?,” *Arms Control Association*, December 2005.

[43] Ibid.

[44] John Holdren and Matthew Bunn, “Securing the Bomb,” for *the Nuclear Threat Initiative* produced by the Project on Managing the Atom, 2007.

[45] Von Hippel, Frank, Princeton University, A Presentation of “Managing spent fuel in the United States: The illogic of reprocessing,” Presented at a Congressional Staff Briefing, May 7, 2007, Washington D.C.

According to many experts, including former U.S. Senator Sam Nunn, "acquiring weapons and materials is the hardest step for terrorists to take."[46] Six kg of plutonium separated through reprocessing would be easier for a terrorist to acquire and divert towards weapons than an equivalent 6 kg of plutonium contained within approximately 600 kg of highly radioactive spent fuel.

If terrorists were able to steal 5 to 6 kilograms of separated plutonium from a reprocessing site for use in a small weapon, such as one with a 12.5 kiloton yield, and detonate it in a city like New York, the human destruction could be immense, and likely paralyze the nation. Physicians for Social Responsibility detailed the human consequence of this scenario in a 2006 study titled *Nuclear Terrorism*.[47] The study found that 52,000 people would die immediately from the initial explosion and fireball, while as many as 238,000 people would be exposed to radiation (10,000 of whom would receive lethal doses, with another 44,000 suffering from radiation sickness). Reprocessing under GNEP would increase this potential threat to human life by separating out significantly more weapons grade material and making this material more portable and, therefore, vulnerable to terrorist theft and use.

The security of nuclear material in the U.S. is plagued with problems. The National Nuclear Security Administration (NNSA) was established in order to ensure the safety and security of U.S. nuclear material and weapons. A 2007 GAO report found that NNSA fell short of its goals in several key areas, including a lack of leadership and direction for security activities at nuclear sites, staff shortages in the oversight of security contracting, and inadequate training of security staff. There were also cases of inadequate oversight of weapons inventories and "improprieties in the testing of the officers who protect NNSA's sites."[48] A public example of such problems came to light in 2007, when 6 nuclear warheads were mistakenly flown across the U.S.[49] Increasing the volume of nuclear waste and fissile material will exacerbate these problems.

Nuclear weapons are extremely difficult to make, but even if an improvised nuclear device "fizzled" by exploding without a fission reaction, it could kill hundreds of people and disperse radiation with long term carcinogenic effects throughout the surrounding environment. A diverse range of knowledge and skills in conjunction with much study and preparation would be necessary, but a terrorist group of 3 to 4 people with such knowledge but without nuclear bomb making experience could conceivably create a crude nuclear implosion device with widely available drawings depicting the earliest types of fission explosive devices.[50] Terrorists could also use plutonium to make potent

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[46] Sam Nunn, Co-Chairman of the Nuclear Threat Initiative, "Securing the Bomb and Assessing the G8 Partnership," July 13, 2006. Also see Tilman Ruff, an infectious diseases and public health physician, "Nuclear Terrorism," *EnergyScience.org.au*, November 2006.

[47] Ira Helfand, Lachlan Forrow, Jaya Tiwari, "Nuclear Terrorism," *British Medical Journal*, February 9, 2002.

[48] "National Nuclear Security Administration: Additional Actions Needed to Improve Management of the Nation's Nuclear Programs," *United States Government Accountability Office*, January 2007. Pg. 3.

[49] "Air Force investigates mistaken transport of nuclear weapons," *CCN.com*, September 6 2007.

[50] J. Carson Mark et al., "Can Terrorists Build Nuclear Weapons?" in *Preventing Nuclear Terrorism*, eds. Paul Leventhal and Yonah Alexander (D.C. Heath and Co., 1987).

radiological weapons. If a terrorist dispersed 10 kg of plutonium-oxide aerosol hundreds to thousands of cancer deaths could occur as a result of the plutonium inhaled.[51] Since 1993, substantial evidence has accumulated indicating that terrorists are trying to acquire nuclear material and nuclear weapons. For example, it is alleged that in 1993 al-Qaeda attempted to buy weapons grade uranium in Sudan, and seized documents from Afghanistan provide a record of al-Qaeda's efforts to acquire a nuclear weapon from 1996 to 2001.[52]

GNEP Threatens to Facilitate Nuclear Proliferation Abroad

With global nuclear energy capacity set to expand, GNEP's international component is increasing nonproliferation concerns by legitimizing the use of enrichment and reprocessing technology globally. There are now 21 GNEP partners including the U.S., and nearly 40 observer nations. GNEP's international component was originally developed to curb the spread of this technology, but after a change in its principles and objectives, GNEP may instead legitimize the technology's spread.

Former President George W. Bush outlined the original purpose of GNEP's international component in his speech at the National Defense University on February 11, 2004:

> The world's leading nuclear exporters should ensure that states have reliable access at reasonable cost to fuel for civilian reactors, so long as those states renounce enrichment and reprocessing. Enrichment and reprocessing are not necessary for nations seeking to harness nuclear energy for peaceful purposes.[53]

Throughout 2006 DOE presented the international component to the global community. DOE alleged that GNEP would curb the spread of enrichment and reprocessing technology by enticing nations, which did not yet have such capabilities, to give up their right to acquire such technology in return for an affordable and reliable supply of nuclear fuel. In theory, GNEP supplier states would sell nuclear reactors and nuclear fuel to GNEP receiver states for energy production. GNEP supplier states would then take back the resulting nuclear waste for reprocessing. These GNEP suppliers would reprocess spent fuel using revolutionary methods that did not separate out pure plutonium.[54]

However, GNEP's international component now threatens to increase proliferation by falling short in two major ways. First, DOE failed to convince countries lacking enrichment and reprocessing technology to join GNEP and forgo any such independent technology potential. Instead, GNEP provoked a number of nations to announce new policies that would resuscitate dormant or launch new nuclear energy and enrichment programs. As soon as the U.S. launched GNEP, several nations made clear that they

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[51] Steve Fetter and von Hippel, Frank, "Is U.S. Reprocessing Worth the Risk?" *Arms Control Association*, December 2005.
[52] Matthew Bunn, "Thwarting Terrorists: More to be Done," *The Washington Post*, September 26, 2007.
[53] President George W. Bush, "President Announces New Measures to Counter the Threat of WMD," Remarks by President George W. Bush, Fort Lesley J. McNair - *National Defense University*, February 11, 2004.
[54] Note: There was no clear plan for the large quantity of low level radioactive waste this would create.

would not give up their inalienable rights to nuclear technology as granted to them under the Nuclear Nonproliferation Treaty.

For example, after GNEP's launch seven countries formally told the International Atomic Energy Agency (IAEA) that they were not interested in giving up any potential enrichment capabilities for fuel supplies and assurances.[55] Tariq Rauf, head of the Verification and Security Policy Coordination in the Office of External Relations and Policy Coordination at the IAEA, explained that these nations "do not need enrichment technology today, but they might in the future and they do not want to foreclose that possibility."[56] South Africa and Argentina were two of the seven nations that wrote to the IAEA. Decision makers in both countries said that their drive to become uranium enrichment suppliers was motivated by rising uranium prices, anticipated higher demand for nuclear fuel, and a desire to be suppliers in the U.S. Global Nuclear Energy Partnership.[57] In August 2006, South Africa announced an initiative to revive its enrichment potential and Argentina announced plans to revive its gaseous diffusion plant.[58]

Recognizing that nations were not going to give up rights to nuclear technology development, DOE changed the rules and announced that potential receiver states could join GNEP without forgoing future enrichment and reprocessing capabilities. DOE budget documents from 2006 show that GNEP would provide nuclear fuel and fuel assurances to nations which "forgo their own investments in enrichment and reprocessing technologies." When DOE failed to bring on enough partners due to this restriction, the criteria for partnership changed and states could join without promising to forgo future development of this dual use technology. At the GNEP meeting in Vienna on September 16, 2007, Secretary of Energy Samuel Bodman assured potential partners that they should join, since "nobody is giving up their rights--nobody is giving up anything."[59]

The Gulf Cooperation Council (GCC) states (Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain and Oman) did not publicly state an interest in developing a nuclear energy program until after GNEP was announced in 2006. Foreign ministers of the GCC states issued a joint statement after GNEP's inception on the establishment of a joint GCC peaceful nuclear program. Since the announcement, GCC ministers have met with International Atomic Energy Agency officials in Saudi Arabia to discuss a recent IAEA joint study on the establishment of the cooperative nuclear program. Few details of the proposed program have materialized, but Director General Mohamed ElBaradei agreed to send a team of experts to discuss nuclear-related issues with GCC officials. An

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[55] Tariq Rauf, head of the IAEA's Verification and Security Policy Coordination in the Office of External Relations and Policy Coordination at *the International Atomic Energy Agency* (IAEA) speaking at the *Carnegie Endowment for International Peace* Nonproliferation Conference in a panel entitled, "Realizing Fuel Assurances: Third Time's the Charm?," June 26, 2007.
[56] Ibid. Rauf, Tariq.
[57] "Argentina, South Africa studying revival of enrichment programs," *Nucleonics Week,* August 31, 2006. Pg. 1 Vol. 47 No. 35.
[58] Ibid. *Nucleonics Week*, Pg. 1 Vol. 47 No. 35
[59] Rebecca Cooper, "More Countries Sign on to GNEP as U.S. Modifies Approach," *Nuclear Fuel Cycle Monitor*, Vol. 26 No.27.

eight-member IAEA team met with GCC ministers in Riyadh on May 19, 2007,to discuss the feasibility of establishing a research reactor for capacity building, isotopes production, and other research and development purposes as well as the feasibility of conducting an energy assessment for the GCC states.[60]

As DOE went out in the international community to broaden GNEP partnership, DOE officials met with several GNEP interested nations. Through these meetings the United States signed atomic energy cooperation memorandums with; Turkey, Saudi Arabia, the United Arab Emirates (UAE), and Bahrain. Turkey's memorandum was turned into law recently with the passage of a U.S.-Turkey nuclear trade agreement in Congress. The U.S. can now export nuclear components and nuclear fuel to Turkey. The U.A.E. agreement was signed by Secretary of State Condoleezza Rice in January 2009 and will likely go to the floor of Congress sometime in 2009 to be passed into law.

The second way in which DOE undermined the alleged nonproliferation aims of GNEP was by failing to convince potential GNEP supplier states to adopt revolutionary reprocessing methods that did not separate out pure plutonium. Instead, GNEP supplier states were told that they could take part in the Partnership without committing to the use, of what DOE called, "proliferation resistant" reprocessing methods. At GNEP's first ministerial-level meeting on May 21, 2007, the original GNEP partners (China, France, Japan, and Russia) made clear that they would not stop using methods that separated out pure plutonium. These nations each have ongoing reprocessing research and development programs, and refused to change them in order to join GNEP.

Secretary Bodman assured the original GNEP nations at the first meeting in May 2007 that "a variety of approaches and technical pathways" were necessary to "achieve the long-term vision of the future global civilian nuclear fuel cycle," according to the text of the meeting's joint statement. In a closed meeting before this text was agreed upon, Secretary Bodman told Alain Bugat, CEO and Chairman of the French Atomic Energy Commission, that France (as well as any other GNEP supplier state) could be part of the Global Partnership without abandoning PUREX, a long-standing reprocessing technology that separates out pure plutonium.[61] Through the use of PUREX, France currently reprocesses 850 tons of used fuel each year, producing 8.5 tons of plutonium annually.[62] GNEP is helping to promote the commercialization of reprocessing in France, which will lead to the separation of more plutonium.

The Partnership is also aiding GNEP partners in promoting plans to globally commercialize their reprocessing capabilities. Commercializing capabilities, will allow nations to reprocess fuel from nuclear energy producing nations Japan Nuclear Fuel, Ltd,

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[60] "IAEA Explores Establishment of Nuke Energy Program for Middle East States," *Nuclear Fuel Cycle Monitor*, Vol. 11 No.23.

[61] From an interview with Chairman of the French Atomic Commission Alain Bugat, conducted after the Global Nuclear Energy Partnership ministerial meeting in Washington D.C. May 21, 2007 by Ed Helminski, Jill Parillo, and Rebecca Cooper. Insert authors here, insert title of article here, *Nuclear Weapons and Material Monitor*, Exchange Monitor Publications, May 28, 2007, Vol. 26 No.15. pg 4 and 9.

[62] "Mixed Oxide Fuel (MOX)," *World Nuclear Association*, November 2006. Available at [http://www.world-nuclear.org/info/inf29.html].

built the Rokkasho plant (which uses PUREX technology) and will separate approximately 8 metric tons of plutonium annually.[63] GNEP partner South Korea is developing a method of reprocessing called pyroprocessing. Although the developers of this electrometallurgical technique argue that the technology is proliferation resistant, any spent nuclear fuel processing approach that is capable of separating fissionable materials from associated fission products and transuranic elements would itself be redirected to produce material with nuclear detonation capability.

GNEP Environmental Impact Statement and Next Steps

DOE's draft Programmatic Environmental Impact Statement (PEIS), released by DOE in October 2008, takes into account many of the concerns expressed in 14,000 public comments sent to DOE on GNEP, but leaves out others. Concerns over nonproliferation and the international component are not addressed. The National Environmental Policy Act does not require DOE to assess proliferation concerns in a PEIS, but so much concern surfaced during the initial public scoping period that DOE will now write a separate proliferation assessment (through the National Nuclear Security Administration). The public needs to understand the threat to human life that GNEP poses by separating nuclear bomb making material and making it more to vulnerable to theft and attack.

The PEIS does acknowledge how GNEP will threaten human life and health by creating highly radioactive waste with no safe and sustainable storage options. The document states that cesium and strontium, which are currently imbedded within spent fuel rods, would be separated out through reprocessing and "could be stored at the recycling center for 300 years." After 30 years of operation, an estimated 7.5 to 12.4 billion curies of these highly radioactive wastes would accumulate at a GNEP facility, and the National Academy of Sciences called the 131 million curies of cesium and strontium stored at the Hanford Site in Washington State "the nation's most lethal single source of radiation other than inside an operating reactor."

DOE is now assessing what parts of GNEP could survive in the new Obama administration and Congress. Since President Barack Obama and Congress show some support for nuclear energy, but no support for reprocessing as proposed under GNEP, DOE will likely try to separate reprocessing under the domestic component of GNEP from the international component, which will be touted as a way to safely and securely manage the spread of nuclear power. Congress may also be told that reprocessing will not be part of the international component. However, given DOE's track record of hiding the real human life and health threats of GNEP and using the international component to promote reprocessing, Congress will be dubious. President Obama has said that nuclear terrorism is our greatest security threat. Therefore, it is imperative that GNEP's funding is zeroed out. This will terminate efforts to build reprocessing centers in the United States and reinstate U.S. leadership on matters of nonproliferation and disarmament.

[63] Masako Sawai, "Rokkasho: A Troubled Nuclear Fuel Cycle Complex", *The Institute for Energy and Environmental Research*, September 10, 2001. Translated from the Japanese by Name of Translator here.

Conclusion

GNEP threatens human life and health by increasing the dangers associated with the threat of nuclear proliferation and terrorism. GNEP would increase U.S. stocks of commercially generated nuclear waste and encourage the increase of global stocks of commercially separated plutonium. DOE's claim that GNEP would set up technical barriers to prevent countries and terrorists from obtaining nuclear explosive materials, and eventually nuclear weapons, has been considerably undermined by experts on proliferation issues. Furthermore, DOE's claim that GNEP is an affordable way to minimize global nuclear waste problems flies in the face of the fact that GNEP will demonstrably increase the amount of waste to be stored and transported in the United States and abroad.

While it would be laudable for the United States to invest significant resources into development of a comprehensive policy addressing the world's most pressing problems associated with global stockpiles of plutonium, nuclear waste, the threat of nuclear proliferation and terrorism, and burgeoning global energy needs, GNEP will only exacerbate these problems. Funding for reprocessing through GNEP should be eliminated, so policy solutions for these global problems that are more sustainable and less threatening to human life and health can be devised and adequately funded.