Rachel's Environment & Health News
#473 - The Fourth Horseman: Nuclear
December 20, 1995

It was another dismal year for the fourth horseman of the environment, the nuclear industry. During 1995, bad news rolled in from around the world, making it unmistakably clear that this technology is more dangerous, less controllable, and more damaging to democracy than even its severest critics had imagined. The end of the "cold war" has, if anything, heightened the danger that nuclear bombs will one day obliterate another city--by accident, by terrorism, or by political blunder.

Nuclear technology has two parts, which are barely separable: A-bombs, and civilian nuclear power plants. Both technologies use "nuclear fission" --the splitting of atoms of uranium-235 or of plutonium-239, releasing enormous quantities of energy. Inside nuclear power reactors, the fission reaction is controlled, producing a steady heat which makes steam, which makes electricity. In a nuclear bomb, the fission reaction is maximized to yield a tremendous explosion.

Bomb-grade uranium-235 can be made from natural uranium. There are well-known low-tech ways to do it, which the world learned in 1991 when Iraq was discovered making A-bombs using 50-year-old technology.[1]

The other A-bomb material, plutonium-239, is created inside nuclear power reactors, but it must be purified before it can be made into bombs. This step --called "reprocessing" --has been abandoned in the U.S., mainly to keep plutonium out of the hands of terrorists and lunatics. But reprocessing still goes on at numerous locations around the world. Furthermore, a kind of reactor called a "breeder" creates more plutonium than the nuclear fuel it consumes. The U.S. has abandoned breeder technology, but Britain, France, Japan, Germany, and Russia are all committed to it.[2] Several of these countries plan to build more breeders. By the year 2010, some 550 tons of plutonium will have been reprocessed from civilian nuclear reactors.

The official "nuclear club" (those who admit they have the bomb) now includes the U.S., Britain, France, China, Russia, and India. In addition, Israel is widely believed to have roughly 300 A-bombs. The former prime minister of Pakistan announced in 1994 that Pakistan has the bomb.[3] North Korea is said to have 5 A-bombs.[4] Others known to be aggressively acquiring A-bomb technology include Iraq, Libya, and Iran.

By far the easiest way to acquire material for a nuclear weapon is to steal it. The amounts needed are not large: one kilogram of plutonium (2.2 pounds) will do it, or 3 kilograms (6.6 pounds) of enriched uranium can make a bomb equivalent to 1000 tons of TNT.[5] The amount of plutonium needed to make a bomb is somewhere between the size of a hockey puck and a soda can.

Existing stockpiles of weapons-grade material are substantial. Here are known plutonium inventories, in kilograms (kg), as of 1990:[6] U.S.: 98,182 kg military (mil), plus 1209 kg civilian (civ); Russia: 104,545 to 127,273 kg mil, plus 22,727 kg civ; Britain: 4545 kg mil, plus 43,545 kg civ; France: 5455 kg mil, plus 35,364 kg civ; China: 1364 to 2273 kg mil; India: 254 kg mil, plus 455 kg civ; Israel: 363 to 636 kg mil; Belgium: 618 kg civ; Germany: 855 kg civ; Japan: 2636 kg civ; Pakistan: unknown; North Korea: unknown; Iraq: unknown; Libya: None yet; Iran: None yet.

Using the low estimates from the figures given above, the world total in 1990 was 322,117 kg of plutonium. This represents the capacity to make 322,117 small atomic bombs. And this is just the plutonium inventory. The world's inventory of enriched uranium, if it were known, would greatly increase our estimate of the capacity for trouble. For example, the Soviets had at least 120,000 to 130,000 kg of bomb-grade enriched uranium at the end of the cold war.[7]

The former Soviet Union provides an example of the insecurity that nuclear technology brings with it. At the end of the "cold war" the soviets had an estimated 32,500 individual nuclear weapons, held at 950 separate locations.[8] When political chaos overtook the land, soviet nuclear weaponry fell under the control of four governments: Russia, Ukraine, Kazakhstan and Belarus. Then civil war broke out in the Ukraine when Crimea declared its independence, and in Russia when Chechnya tried to secede. "Train loads of special radioactive freight often cross regions where armed interethnic conflicts are under way," says the Russian newspaper KOMSOMOLSKAYA PRAVDA, quoted in the TIMES. [9]

Now a different kind of political chaos has emerged in former soviet lands. According to studies by German investigators, about 5000 different criminal gangs, overseen by about 150 "godfathers," are now operating in the former Soviet Union; the total membership of this "Russian mafia" is estimated at 100,000 people. The K.G.B. (soviet secret police) and specialized military units, which worked to control the gangs, have now been substantially weakened, and "evidence exists that many highly-trained veterans of such agencies have themselves joined mafia bands," says the TIMES.[10]

Under such conditions, just keeping track of nuclear inventories is impossible. In mid-1994 the NEW YORK TIMES began a front-page story this way: "Russia has no way of knowing for sure if any of its vast supply of bomb ingredients is missing, many of its own nuclear officials and scientists admit." The story featured a front-page photograph of a Russian nuclear scientist saying, "It's possible to buy anything in our country, including weapons and samples."

Terrorists --and future nuclear club members --will pay millions of dollars for a few pounds of nuclear material. In early 1995, the NEW YORK TIMES reported that there had been 124 cases of actual or attempted nuclear smuggling from former communist countries during 1994, compared to 56 cases in 1993 and 53 in 1992. Citing as its source "a Western European intelligence report," the TIMES said "the smugglers themselves have become steadily more sophisticated." The TIMES described some of the smugglers as "a disaffected former Czech nuclear worker," and "officers of the Russian northern fleet in Murmansk." Other smugglers mentioned in the report were "a Polish dealer in used cars, meat and sausage," a "38-year-old Colombian who had spent years in Moscow as a student," two Spanish accomplices, and "a German businessman." The intelligence report said that Russian civilian nuclear research institutes often keep their inventories of radioactive materials on paper only, without checking them against actual stocks. [11]

Terrorists want even small amounts of nuclear materials because making an A-bomb is not the only way to terrorize the world with uranium or plutonium. Just blowing a chunk of plutonium to smithereens with dynamite in some city center would be sufficient to contaminate a large area, essentially permanently. Such an attack would strike dread into the hearts of local people, who would never know whether they had inhaled a lethal dose of plutonium. The real weapon in this scenario would be fear, and a permanent sense of insecurity throughout the city.

Even without terrorism, nuclear safety is impossible to assure. In the U.S. --thought to be a model of stability and technical prowess -- nuclear stockpiles are subject to human foibles.

** In December 1992, the U.S. Army mistakenly shipped a kilogram of plutonium by Federal Express, which transported it on an airplane.[12]

** In late 1994 at Oak Ridge National Laboratory in Tennessee, U.S. officials discovered that 2 kilograms of bomb-grade uranium --enough to make a small nuclear bomb --had leaked from a defunct Oak Ridge reactor. The uranium had escaped by turning into a gas "through an unexpected chemical reaction" and was found accumulating in a drain pipe. Officials expressed concern that if water entered the pipe, a nuclear chain reaction could ensue, showering radioactive material over a wide area.[13]

** On Dec. 6, 1994, the Department of Energy reported that U.S. plutonium inventories were being held at 35 locations in containers that were subject to leaks and ruptures. More than 64,000 plutonium containers included plastic bags, glass bottles, and metal canisters, "some of which were unlabeled and unmarked. Many of the containers were ruptured or broken; consequently plutonium was reported to have contaminated floors, walls, piping, and doors at several facilities. In all, the report characterized the nationwide network of weapons complexes as a dilapidated and hazardous system." In sum, even the wealthiest, most technically advanced nation in the world evidently does not have what it takes to manage these materials safely.

Plutonium is among the most toxic materials every discovered. When a small piece of it gets into a human lung, it is supremely efficient at causing cancer. Somewhere between 28 and 80 micrograms is thought to cause cancer in a human "with certainty." If we use 80 micrograms as a lethal dose, we can calculate that one kilogram (2.2 pounds) of plutonium contains 12.5 million deadly cancer doses.

Worse, recent scientific studies reveal that plutonium causes genetic damage to humans, but it's a new kind of damage which may not become evident for several generations. In other words, infinitesimal amounts of plutonium breathed today may not harm you, but may harm your grandchildren or great-grandchildren. The mechanism for this delayed genetic effect is poorly understood, but is the subject of numerous scientific papers confirming its existence.[14] Thus plutonium's toxicity is worse than scientists thought even five years ago.

Yes, this genie of death is out of the bottle. And every time we look, this genie is bigger and more full of diabolical surprises. It is time we put a cork in it. Stop making plutonium. Even more fundamentally: Stop mining uranium.

Happy New Year!

--Peter Montague

=====

[1] William J. Broad, "Iraqi Atom Effort Exposes Weakness in World Controls," NEW YORK TIMES July 15, 1991, pgs. 1, 6.

[2] Paul Leventhal and David Horner, "Peaceful Plutonium? No Such Thing," NEW YORK TIMES January 25, 1995, pg. A21.

[3] Reuters, "Pakistani Is Rebuked on A-Bomb Remark," NEW YORK TIMES August 25, 1994, pg. A7.

[4] James Sterngold, "Defector Says North Korea Has 5 A-Bombs and May Make More," NEW YORK TIMES July 28, 1994, pg. A7. And: Michael R. Gordon, "North Korea Said to Have A-Bomb Fuel," NEW YORK TIMES June 8, 1994, pg. A7.

[5] William J. Broad, "A Smuggling Boom Brings Calls for Tighter Nuclear Safeguards," NEW YORK TIMES August 21, 1994, pgs. 1, 24.

[6] Howard Hu and others, PLUTONIUM: DEADLY GOLD OF THE NUCLEAR AGE (Cambridge, Mass.: International Physicians Press, 1992), pgs. 40, 43.

[7] William J. Broad, "Deal for U.S. to Buy Bomb Fuel From Russia Said to Be in Peril," NEW YORK TIMES June 12, 1995, pgs. 1, 6.

[8] Jane Perlez, "Tracing a Nuclear Risk: Stolen Enriched Uranium," NEW YORK TIMES February 15, 1995, pg. A3.

[9] William J. Broad, "Russia Admits to Accidents at Nuclear Plants During Soviet Years," NEW YORK TIMES November 27, 1994, pg. 22.

[10] Stephen Kinzer, "The Long Shadow of the Russian Mob," NEW YORK TIMES Dec. 11, 1994, Section 4, pg. 1.

[11] Craig R. Whitney, "Smuggling of Radioactive Material Said to Double in a Year," NEW YORK TIMES February 18, 21995, pg. 2.

[12] "Plutonium Shipping Rules Violated," FACTS ON FILE WORLD NEWS DIGEST Dec. 22, 1994, pg. 958A2.

[13] "Uranium Leak Found at Tennessee Lab," FACTS ON FILE WORLD DIGEST Dec. 1, 1994, pg. 895G1.

[14] A sampling of recent papers: H. Nagasawa and others, "Cytogenetic effects of extremely low doses of plutonium-238 alpha-particle irradiation in CHO K-1 cells," MUTATION RESEARCH Vol. 244 (1990), pgs. 233-238. And: M.A. Kadhim and others, "Transmission of chromosomal instability after plutonium alpha-particle irradiation," NATURE Vol. 355 (February 20, 1992), pgs. 738-740. And: K. Holmberg and others, "Delayed chromosomal instability in human T-lymphocyte clones exposed to ionizing radiation," INTERNATIONAL JOURNAL OF RADIATION BIOLOGY Vol. 68, No. 3 (1995), pgs. 245-255. And: Munira A. Kadhim and others, "Alpha-particle-induced chromosomal instability in human bone marrow cells," THE LANCET Vol. 344 (October 6, 1994), pgs. 987-988. And: John B. Little, "Changing Views of Cellular Radiosensitivity," RADIATION RESEARCH Vol. 140, No. 3 (December 1, 1994), pgs. 299-311.

Descriptor terms: nuclear power; nuclear weapons; nuclear proliferation; terrorism; soviet union; germany; organized crime; russian mafia; russia; fission; plutonium; uranium; smuggling; lung cancer; delayed genetic damage; mining;

Rachel's Environment & Health News is a publication of the Environmental Research Foundation, P.O. Box 160, New Brunswick, NJ 08903-0160; Phone: (732) 828-9995; Fax (732) 791-4603; E-mail: erf@rachel.org; http://www.rachel.org. Unless otherwise indicated, Rachel's is written by Peter Montague.