
# THE PROBLEM WITH NUCLEAR IS THE RADIATION

By Bill Adamson, Retired Faculty Member from the U.of S.
Saskatoon, October, 2006

Radiation is something that you cannot touch, or see, or feel. If it comes near you it can damage the DNA of both your body cells and your genetic cells. It may be carcinogenic (causing cancer) or teratogenic (causing abnormalities in a fetus), or mutagenic (causing defective genes to be passed on for several generations). There are three kinds of radiation—beta, gamma, and alpha.

Beta is short lived and low level. Gamma rays are like X-rays, they can penetrate flesh and do damage. Alpha radiation is different, consisting of tiny little, highly charged particles that float in the air. They do not penetrate very much, but if they float into the lung passages of a human or animal, the high charge can damage the chromosomes of the cells.

## Uranium Mines and Mills.

The large danger with uranium mining is the release of alpha radiation. The uranium rock or ore is crushed into fine dust and treated with strong chemicals to secure the desired “yellowcake.” Hence, nearly all the radioactivity is released. High grade ores at 21% such as at McArthur River or Cigar Lake , will give off 2,500 becquerels (disintegrations) per second for each gram of ore. That is a lot of radiation!

Modern mines use robotic methods, gravity, and large steel pipes to

keep the ore and radiation away from miners and mill workers. Still, workers are needed to repair or to unplug the systems. The workers are required to wear dosimeters to register the amount of radiation received. The companies try to keep the radiation levels low so as to reduce the risks.

However, there is a paradox here. Low levels of radiation are more dangerous than high levels. High exposures will kill cells, so that the body works to replace them. Low exposures damage the chromosomes a little, so that the body has difficulty in repairing them. Then, 10--15 years later, these damaged parts may turn into a cancer. There is a delayed action response! After the mine is closed, and the company moved away, then a worker may contract cancer. Many long-range studies have shown that uranium workers are prone to three times the normal rates of cancer, and low levels doses of radiation are very destructive(1).

For instance, an epidemiological study by John Hopkins University followed up the health of 13,570 workers encompassing 30 years, who had worked for the atomic energy of Canada, Ltd., and some 948 had died of cancer. Yet the company had monitored these workers to make sure that they only received low doses sof radiation! The paradox, the reverse logic is at work! (2). An epidemiological study of 12,000 mine workers over some 20 years was proposed for the Beaverlodge area of Saskatchewan recently, but the Canadian Nuclear Safety Commission decided to cancel the project. I think they were afraid of what they would find (3).

**Uranium Mine and Mill Tailings**

The tailings from seven different current mines are being placed in the JEB pit, under water to confine the radioactivity. This is a huge pit, four football fields wide, and thirty stories deep. Along with the uranium there is a lot of radium in the ore rock. It is very radioactive and disintegrates gradually into thirteen other substances—like thorium which has a half-life of 75,400 years (i.e. in that time it will become half disintegrated), and radium which has a half-life of 1600 years.

Most of the radium is separated out from the uranium in the mill process, and goes into the tailings pond. The Cluff Lake mine, now closed, left behind 2.6 million cubic metres of tailings (4). In the JEB pit, by 2006, there are approximately 790,073 cubic metres, corresponding to about 830,800 dry tonnes of radioactive tailings (5).

Currently, there are water pumps encircling this JEB pit to keep the ground water from flowing into the Fox Creek water system just 150 metres away. The tailings are something akin to toothpaste. The

question is: ”How long will the pumps keep working”? Governments change every four or five years, and in a few years the mining companies will move away. So, Saskatchewan will have the legacy of a huge pool of radioactive sludge ready to poison our northern waterways, if extreme vigilance is not maintained for thousands of years! This danger is nearly as bad as the burnt fuel from nuclear reactors, which scientists do not know what to do with after 60 years of research.

**Fabrication of Fuel Pellets**

Uranium (U) has molecules which can be separated by chemical processes to form various types of uranium. These processes of fabricating fuel pellets also release radioactivity. The fabricating factories also require large amounts of electrical energy in the first place, before the uranium fuel pellets generate any new energy.

For instance, uranium is transposed in Saskatchewan into yellowcake (U3O8). The yellowcake is taken to Blind River , Ontario , where it is refined to UO3, an intermediate product. This is trucked to Port Hope, Ontario where the UO3 is converted to uranium hexafluoride (UF6), and also into natural uranium dioxide (UO2), which is an enriched form used in making the fuel bundles for CANDU reactors.

The hexafluoride is shipped to the USA to be enriched for use in light water reactors. This process requires the use of chlorofluorcarbons (CFC's). The CFC's are banned in Canada , and are 1000 to 2000 times more damaging to the ozone layer than carbon gases. So, the preparation of nuclear fuel pellets in the USA cannot be rightfully claimed to be “clean” Moreover, a by-product of this enrichment process is depleted uranium (U-238) which is used to make bombs and ammunition, and which also sprays radioactive particles wherever it explodes. Each year Saskatchewan exports 4000 tonnes of uranium to the USA . Over the last 50 years the USA has accumulated 500,000 tonnes of this depleted uranium (6).

**Nuclear Reactors**

Nuclear reactors are huge, complex machines used to control nuclear fission. With the splitting of atoms they create tremendous energy and heat, used to boil water and to make steam and to turn large generators that produce electricity. There are 20 of them in Canada , 104 in the USA , and 430 in the whole world. They are generally built near a lake or river to secure water for cooling purposes. Many of the Canadian reactors are built along the Great Lakes . During the summer of 2006, France had to close down several of its reactors during a heat wave and drought, because the hot water was dangerously hot for the health of the nearby rivers. Recently, it has been found that the tritium levels in the

waters of the Great Lakes have been rising (7).

These reactors produce electricity, but they also give off carbon-14, tritium, and plutonium -239. Carbon-14 has a radioactive half-life of 5730 years, and tritium has a half-life of 12.3 years. These reactors do not give off carbon-dioxide gases, but they certainly cannot be designated as “clean” or “green.”

The core of the reactor, where the nuclear fission takes place, is terribly hot and radioactive. After the splitting of atoms, some 200 deadly radioactive elements remain—uranium -238 with a half-life of 710,000 years, iodine-129 with a half-life of 15.8 million years, and plutonium with a half-life of 24,400 years (8).

These powerful machines are capable of producing electricity, but they are also vulnerable to malfunction, human error, or terrorist attacks. The partial melt-down at Three Mile Island spread much radioactivity in the region. The journalist, Harvey Wasserman, writes that there has not been a proper accounting of the damaged animals, sick children, and premature deaths of adults in that region (9).

The explosion and meltdown at Chernobyl reveals the potential danger in these reactors. The area for 30 kilometers around that city was totally devastated by the high radiation released. Some 50,000 people fled the area. Some 140,000 square kilometers of farmland were contaminated in Belarus and Ukraine . It is predicted that there will be 270,000 cases of cancer arising from the radioactive fallout, of which some 93,000 will be fatal. A huge concrete sarcophagus was built over the demolished reactor plant to lessen the spread of radioactivity.

However, clouds of radioactive articles were carried on the air currents over the countryside. Over the first two days this radioactivity floated as far north as Sweden and Finland (April 26-28, 1986). On the next four days it floated over Germany , France and Britain . Over the next seven days it floated southward and east over Ukraine , Turkey , and Greece . This is shown on an interactive map on the internet by Der Spiegel International (10). Even today, farmers in Wales have to test their sheep for radioactivity before they can sell them to market (11).

**High Level Nuclear Waste**

The spent fuel from nuclear reactors is extremely radioactive and dangerous to all living things. It contains

some 200 deadly radioactive elements as byproducts of the fission process, such as uranium, cesium, strontium, and iodine. They are radioactive for thousands and thousands of years, for longer than recorded human history. The half-life of Plutonium-239 is 24,390 years,

and for Plutonium-242 the half-life is 387,000 years.

Currently, much of these wastes are stored on site near reactors, in pools of water for cooling, and some older wastes in dry storage. Over the last 60 years some 225 million tonnes have been accumulated in the world, some 34,000 tonnes in Canada alone(12).

Scientists have hoped to dispose of these wastes in deep rock caverns. However, deep gold mines in Yellowknife , Thompson, Sudbury , and Matagami, as well as in Europe, as well as in the experimental deep rock shaft at Pinawa , Manitoba , reveal brine water under extreme pressure underlying crystalline rock generally, and the Canadian Shield in particular. We are reminded of this fact by the major flood in the McArthur mine in Saskatchewan in 2005. Back in 1987, the research of two geologists, P.Fritz and S.K. Frape had made this fact clear, but their research has been ignored by the mining companies and the governments in Canada (13).

Atomic energy of Canada Ltd., (AECL) spent 15 years and $700 million dollars developing a plan for deep rock disposal. For 8 years the Seaborn Commission held hearings and gathered evidence, but decided in 1998 that the plan for such long lasting wastes was not satisfactory or socially acceptable.

The federal Government of Canada stepped in to give the problem back to the owners of the reactors under the Nuclear Waste Management Organization. The government gave instructions to the NWMO to select one of three options:

- Deep geological disposal.
- Storage at nuclear reactor sites.
- Centralized storage either above or below ground

After three years the NWMO came up with a plan named “Adaptive Phased Management,” wherein they recommended that all three of the options be used in stages, taking lots of time, up to 300 years if necessary, and spending money as necessary up to $24billion dollars! (14).

**Depleted Uranium**

When uranium yellowcake (U3O8) is processed into U-235 for reactors, then it leaves a by-product of U-238 which is known as depleted uranium(DU). Over the years of enrichment the USA has accumulated

some 700,000 tonnes of this material. The military found that it could be used to harden bullets and bombs, and to be very pyrophoric. So, a shell will slice through the steel wall of a tank and immediately burst into flames. With the explosion it sends a shower of radioactive particles into the region, thereby getting into the dust and water of the area. Following the Gulf War (1991), children playing around the burned out tanks and machines were radiated causing leukemia and thyroid cancers and sickness.

These special munitions and bombs were used in Yugoslavia (1990's—34 tons). In Afghanistan (2002—800 tons), and in the Gulf War (2003—800 tons). Again they were used in the Iraq War in March and April of 2003. In the “shock and awe” campaign of 2003, some 1500 bombs and missiles were dropped on Baghdad and region, and 300.000 rounds of DU ammunition were fired by A-10 warplanes.

Meanwhile, a special set of radiation filters had been set up in Aldermaston , England , at the Atomic Weapons Establishment (AWE). A report by Dr. Chris Busby stated that within 7 to 9 days after the bombardment of the Baghdad region, higher levels of uranium radiation were picked up at the five sites in Berkshire , England , some 2400 miles away. He believes that uranium aerosols were dispersed in the atmosphere and blown across Europe . Hence, the increase of radiation levels in this globe of ours (14).

After 14 years, the USA Dept. of Veteran Affairs reports that over 518,000 Gulf-War veterans are now on medical disability, although some 7,039 had been wounded on the battlefield. Many babies, since born to the veterans, have shown birth defects. Many children and adults in the region of the Gulf War have suffered leukemia and various illnesses.

The USA has seven factories manufacturing depleted uranium ammunition at Paducah , Ohio ; Portsmouth , Kentucky ; Oak Ridge , Tennesee; Aerojet Ordnance at Downey , Calif. ; Honeywell at Hopkins , Minnesota ; and Alliant Techsystems in Edina , Minnesota . Many planes, helicopters, tanks, ships, and missiles use this radioactive material (15). A Japanese physicist, Dr. Katsumaa Yakasaki, has estimated that the radiation fallout from weapons testing and the use of depleted uranium munitions, amounts to the fallout from 400,000 Nagasaki bombs (16).

The USA has an annual military budget of $500 billion, and continues the possession of 10,000 nuclear warheads, while Russia has some 7000 nuclear weapons, with some 4000 of them on high alert. Each warhead is capable of totally destroying any of the largest cities of the world, and a nuclear war would destroy our civilization. These are the situations into

which Saskatchewan exports more and more uranium.

**End Notes—Sources of Information**


• "Chemical Measures, Smoking, Radon Exposure and Lung Cancer Among Elliot Lake Miners," by Finkelstein and Kusiak , Ontario Ministry of Labour, May 1995, pp. *i* , 1,8.

• "Components and Modifiers of the Healthy Worker Effect," by Howe, Chiarelli, and Lindsay. American Journal of Epidemiology, Vol. 128, No. 6, 1986, p. 10.

• News Release, Canadian Nuclear Safety Commission, June 18, 2004.

• Comprehensive Study Report, Cluff Lake Decommissioning Project, Canadian Nuclear Safety Commission, Dec. 2003, Section 6, pp. 6-13.

• Letter from Kevin Scissons, Director of CNSC Office in Saskatoon , Sept. 28, 2006.

• "Why Nuclear Power Cannot be a Major Energy Source," by David Fleming. <www. Feasta.org>

Dublin , Ireland , April 2006, p. 3.

(7(E-Mail from Club Sierra of Canada-- <sierraclub.ca> 2006.p.1.

"European Heat Wave Shows Limits of Nuclear Energy," by Julio Godoy, July 28, 2006. <OneWorld.net>

"Proposed nuclear solution to energy crisis pollutes debate," by Adam Ma'amt, CCPA Monitor, Dec. 05-Jan. 06, p.11. Also, "Following the Path Backwards," by Gordon Edwards, Canadian Coalition for Nuclear Responsibility (CNNR). May 2005, pp. *iv* , 17.

(8) Sierra Club, e-mail article. 2006. p. 1.

(9) " Chernobyl kills while bought ex-Greenpeace shills," by Harvey Wasserman, The Free Press Speaking the Truth to Power, April 29, 2006, p.2. < www.freepress.org/columns/display/7/2006/1360 >

(10) Spiegel International-Online, April 24, 2006, Interactive Map. www.Spiegel,de/international/Spiegel/0,1518,41

(11) "Tried, tested and failed," by Chris Hune. The Guardian, June 20, 2006.

(12) Cited above, Fleming, "Why Nuclear Power Cannot...p.5.

Also, Briefing Paper #3, March 2005. Canadian Nuclear Association.

(13) P. Fritz and S.K. Frape, eds., Saline Waters and Gases in Crystalline Rocks. Geological Association of Canada , Special Paper 33, 1987, chap. 3

(14) "UK Radiation Jump blamed on Iraq shells," by Mark Gould and Jon Angoed-Thomas, The Sunday Times, Feb. 19, 2006. Also, "From Battlefield in the Middle East : Depleted Uranium Measured in British Atmosphere," by Leuren Moret, Global Research, March 2, 2006. Also, "Occasional Paper on Depleted Uranium," by Chris Busby and Saorise Morgan, Green Audit: Aberstwyth, January 1, 2006.

www.mindfully.org/Nucs/2006/DU-Europe-Contamination/jan06.html

Also, “Nuclear Depleted Uranium is WMD,” bu Leuren Moret, aug. 29, 2006.

www.globalresearch.ca/index.php?context=viewArticle

Also, “The Trojan Horse of Nuclear War,” by Leuren Moret, Global Research, July 2004. pp. 5,8,10,11,14.

www.globalresearch.ca/articles/MOR407A.html

(15) “ Canada Playing Our Part in the Business of War,” Coalition to Oppose the Arms Trade, Ottawa .

“Press for Conversion,” Issue # 52, October 2003.

(16) “ A Question of Survival,” by Dr. Ronald McCoy. President of International Physicians for the Prevention of War, Speech in Vancouver , June 26, 2006.

Also, “The Terrible and Rapidly Increasing Danger of a Nuclear Holocaust,” by Mel Hurtig. Speech given at Nathan Phillips Square , Toronto , August 9, 2006. < mhlist@vivelacanada.ca >

Also, Cited above, Leuren Moret, “From the Battlefields of the Middle East ..., “p. 4.