# THE PROBLEM WITH NUCLEAR IS THE RADIATION

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**Ionizing radiation is something that you cannot touch, or see, or feel.** This type of radiation has enough energy to electrically charge the atoms that it hits, thereby creating ions. If it comes near you, the damage can be carcinogenic causing cancer, or teratogenic causing abnormalities in a fetus, or mutagenic causing defective genes to be passed on for several generations. When a uranium nucleus, or other radioactive elements of its series decays, there are possibly three types of ionizing radiation--alpha, beta and gamma.

Beta radiation is a fast moving electron ejected from a decaying nucleus. It has relatively low level impact on tissue. Gamma radiation is faster and can penetrate further in flesh doing more damage. Although alpha radiation barely penetrates tissue if outside the body, of the three types of radiation its high energy does the most damage to living tissue if a radioactive alpha emitting element is ingested or absorbed. That is why environmentalist are concerned about radon gas, one of the radioactive products of uranium decay, which can be absorbed by plants and animals from the air.

## 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 that low level doses of uranium are very .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 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 of 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 inhibit the radioactivity. This is a huge pit, four football fields wide, and thirty stories deep. Along with 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 meters of tailings.4 In the JEB pit, by 2006 there are approximately 790,073 cubic meters, 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 meters 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-238) has molecules which can be manipulated 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 U-238 is transposed in Saskatchewan into yellowcake (U308). The yellowcake is taken to Blind river, Ontario where it is refined to U03, an intermediate product. This is trucked to Port Hope, Ontario where the U03 is converted to uranium hexafluoride ( UF6), and also into natural uranium dioxide (U02) which is an enriched form used in making 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). These 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-235) which is used to make bombs and ammunition, and which also sprays radioactive par-tides 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 dose down several of its reactors during a heat wave and drought, because the hot water was dangerously hot for the health of 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." 8

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-235 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.

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 Chernobvl reveals the potential for danger in these reactors. The area for 30 kilometers around that city was totally Devastated by the high radiation released. Some 50,000people 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 particles 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, Finland, 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 Britain 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 terribly 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 thousand and thousand of years, for longer than recorded human history. The hal-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 the reactors, in pools of water for cooling, and some older wastes in dry storage. Over the last 60 years some 225 million tones have been accumulated in the world, some 34,000 tonnes in Canada alone. 12

Scientists have hoped to dispose of this waste 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 dear, 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 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:

1. Deep geological disposal.
2. Storage at nuclear reactor sites.
3. 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 $24 billion dollars! 14

## Depleted Uranium

When uranium yellowcake (U308) is processed into U-238. and U03. and U02, and UF6, and also into U-235, then this latter product is known as depleted uranium DU). Over the years of enrichment the USA has accumulated some 700,000 tonnes of the 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. Meanwhile, a special set of radiation filters had been set up in Aldermaston, England, at the Atomic Weapons Establishment (AWE). 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.

A report by Dr. Chris Busby stated that within 7 to 9 days 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 the globe. 15

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 recent news item stated that the USA has sold depleted uranium ammunition to 80 different countries. A Japanese physicist, Dr. Katsuma 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 to which Saskatchewan exports more and more uranium.

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