

There's been lots of talk about nuclear waste storage in northern Saskatchewan recently. Would a Saskatchewan location be a good place for a permanent waste disposal site? Such a site would bring great economic benefit to nearby communities and the region, but is it worth it?

From what Opportunity North has gleaned, not many people seem very sure about what kind of nuclear waste this conversation is about.

Some have visions of a mass of radioactive material, "dumped" somewhere underground, that leaks and leaches into surrounding groundwater, eventually emerging to poison the landscape and its people.

#### Low level waste

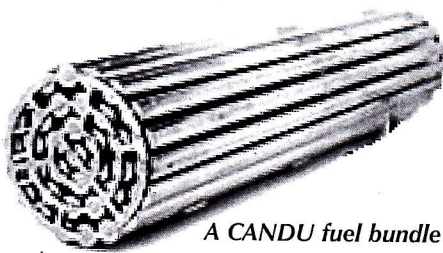
Radioactive waste, as its name implies, gives off varying levels of radiation. There are several types of radioactive waste. Low-level waste includes everything from discarded clothing or rags that have been used in contaminated areas in hospitals and other medical facilities as well as the mines and the reactor sites. Then there's the tailings from our northern uranium mills. The tailings contain most of the elements that were present in the original ore, plus some chemicals that were used to process the ore. These are not what this project is talking about.

#### High level waste

The "nuclear waste storage" we're talking about refers to spent reactor fuel.

In Canada, we have only one type of reactor, the Canadian-built CANDU (CANadian Deuterium Uranium) reactors. CANDUs use natural uranium fuel rather than the enriched uranium fuel required for other types of reactor.

CANDU reactor fuel consists of 0.7% U235. The fuel is produced by refining natural uranium into uranium dioxide. The fuel is formed into very dense, hard ceramic-like pellets about a centimetre in diameter. These pellets are inserted into a corrosion-resistant zircaloy tube, which is welded shut. A number of tubes are welded together, properly spaced, to form a "fuel bundle" about 50 cm long



A CANDU fuel bundle

and weighing about 23 kg.

A reactor core is loaded with about 4500 of these bundles, which live inside the reactor for 12-18 months. Once the fuel is spent, the bundles are highly radioactive – if you stood within a meter without protection, you would die within an hour.

#### What happens now?

The hot bundles (radioactively hot and physically hot) are removed from the core remotely, and stored in water-filled pools which cool them and shield the radiation. After about 10 years, they have cooled enough to be transferred robotically to temporary

## Nuclear waste: what are we talking about?

dry storage facilities, where they are placed in sealed containment vessels.

The dry storage facilities are safety rated for 50 years, and that is why the industry is now seeking a more permanent (but still potentially retrievable) storage solution.

As of 2004 there were 1.8 million spent fuel bundles in temporary storage.

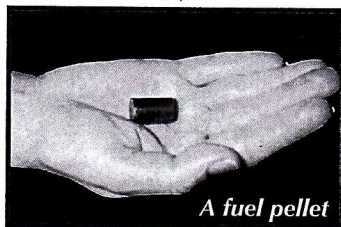
By 2033, an estimated 3.7 million bundles will need a permanent home. These will take up space equivalent to 10 hockey rinks packed to the top of the boards.

#### Permanent storage

It is these radioactive solid fuel bundles that we are talking about when we consider permanent storage of nuclear waste in northern Saskatchewan.

The insoluble pellets remain inside the zircaloy casing. There's no liquid, no sludge, nothing that could "leak".

Several hundred fuel bundles would be placed in sealed stainless steel containers with a thick outer copper layer, designed to last at least 100,000 years. So far, three layers of containment.



A fuel pellet

The sealed containers would be inserted into

solid rock in the floor of an underground tunnel about a kilometre below surface, where there's not much groundwater. They would be packed with sand, rock and bentonite clay pellets, which swell when wet and form a good seal. Now we have the clay mix and the rock as barriers. That's five layers.

Once all the holes in the floor were filled, the entire tunnel would be back-filled with concrete. Concrete is a prime shielding material; concrete tanks called pachucas are used to store high-grade slurry at our mine sites.

That's six layers of containment.

Some of the radioactivity would certainly escape the containment. But it would still have a kilometre of solid rock to penetrate before it ever reached surface. Think of a flashlight beam a kilometre underground: even if the beam was concentrated towards surface, how much of the light would you actually see?

You would get far more radiation from the sun or from medical investigations than you ever would from stored spent fuel bundles. Even when they're stored on surface, as now, there's no detectable radiation outside the containers.

#### No liquid, no slurry

So: the "nuclear waste" the current debate is about consists of solid pellets contained within metal tubes, placed inside stainless steel and copper containers, dropped into special holes drilled into solid rock, packed with clay and covered with concrete. The pellets are insoluble, which means they will not dissolve into water. There is nothing to spill during transport.

Does that change the picture for anyone?