Comments on discussion in the IAAC webinar of 14 January 2026 on NWMO Initial Project Description, regarding used nuclear fuel radioactivity, IAAC registry reference number 88774.

Jaro Franta, 15 January 2026

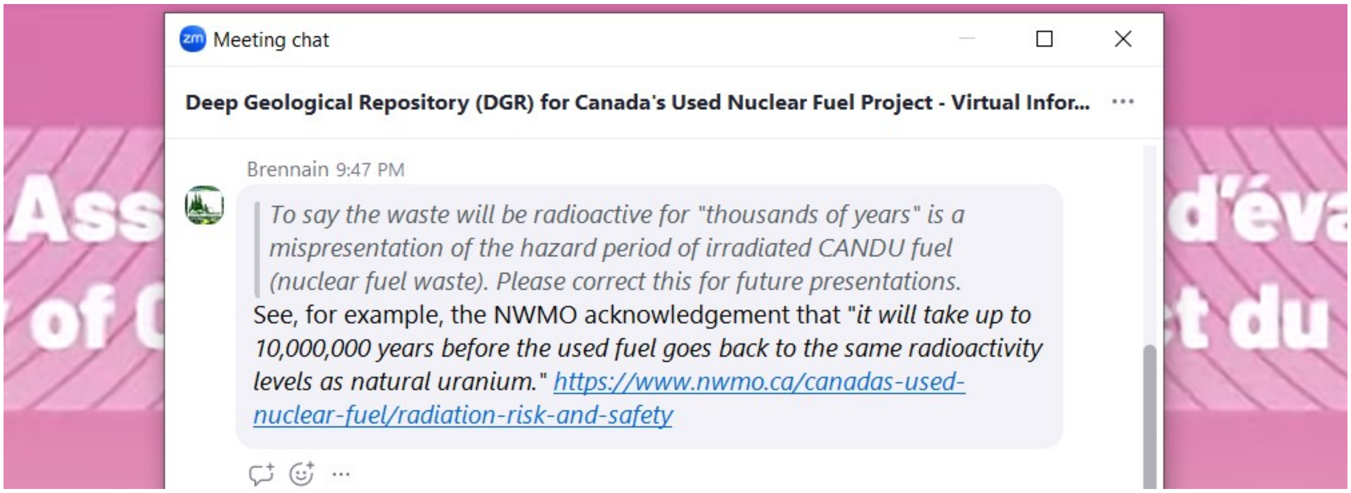
Thanks to the Impact Assessment Agency of Canada and the Canadian Nuclear Safety Commission for inviting comments on the Initial Project Description for the Deep Geological Repository for Canada's Used Nuclear Fuel Project, proposed by the Nuclear Waste Management Organization (the NWMO), per Canadian Impact Assessment Registry reference number 88774.

The second IAAC / CNSC webinar on 14 January (evening session) included a brief discussion of the radioactivity of used nuclear fuel.

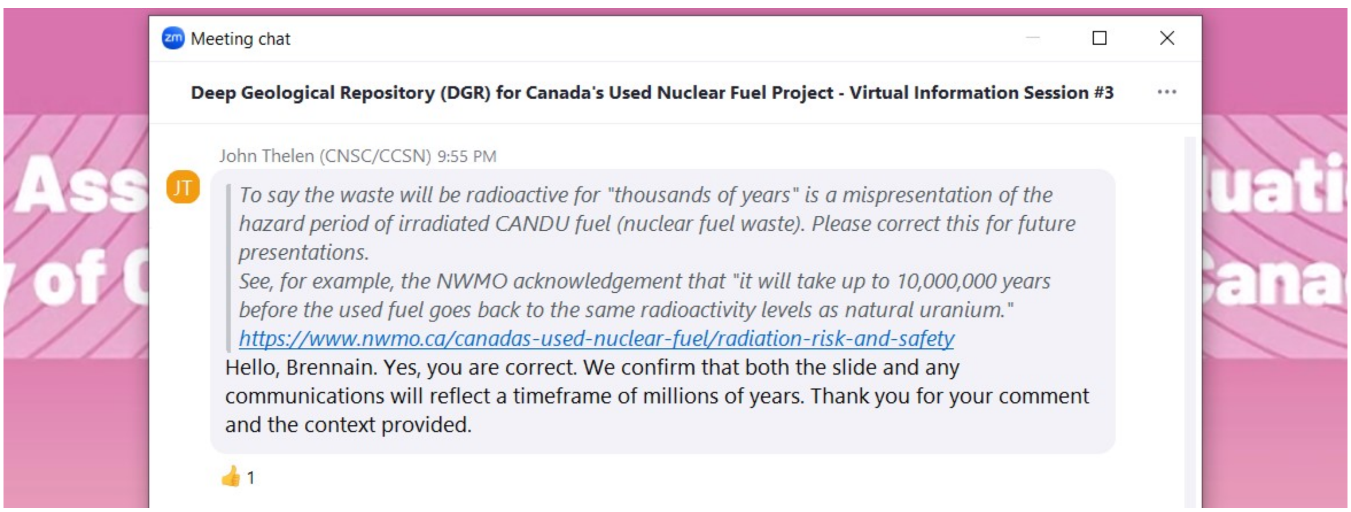
In particular, one of the virtual attendees, Brennain Lloyd (aka "Northwatch") objected to the characterization of the radioactivity of used nuclear fuel by one of the IAAC presenters.

As seen in a screen grab of the webinar comments window, Brennain wrote (time stamp 9:47 PM) as follows:

> To say the waste will be radioactive for "thousands of years" is a mispresentation of the hazard period of irradiated CANDU fuel (nuclear fuel waste). Please correct this for future presentations. See, for example, the NWMO acknowledgement that "it will take up to 10,000,000 years before the used fuel goes back to the same radioactivity levels as natural uranium." https://www.nwmo.ca/canadas-used-nuclear-fuel/radiation-risk-and-safety



Eight minutes later, CNSC's John Thelen replied with "Yes you are correct" and thanked Brennain "for your comment and the context provided."



The link posted by Brennain leads a NWMO website page titled "Radiation risk and safety". When we scroll down, we eventually get to a section titled "Radiation and used nuclear fuel" with a graphic subtitled as follows:

> This is a chart depicting the radioactive decay over time of used CANDU fuel. It uses natural uranium as a comparison and shows that it will take up to 10,000,000 years before the used fuel goes back to the same radioactivity levels as natural uranium.

So, what exactly is the context, and is Brennain's objection that "*waste will be radioactive for "thousands of years" is a mispresentation of the hazard period of irradiated CANDU fuel*" valid?

The answer lies in a proper understanding of the NWMO graphic and its caption: The reference is to "radioactivity levels as natural uranium" and nothing more.

Indeed, the radioactivity of natural uranium – essentially uranium 238 (U238) – is very low, when in the purified form. **In fact U238 is often used in radiation shielding applications in medical devices,** such as Brachytherapy machines used in cancer treatment, to protect hospital staff when the machines are not in use.

However, natural uranium never occurs in the pure form in nature, and the NWMO graphic and caption never referred to anything else, such as uranium ore found in the ground: Unpurified natural uranium ALWAYS contains a long series of decay products that significantly increase its radioactivity. The series of decay products of natural uranium is listed here, along with their half-lives, specific activity (in Becquerels per gram) and decay mode:

99.28%

Parent	Spec. Act Bq / g	Half Life	Decay Mode	Branching Fraction	Daughter	Branching Fraction	Daughter
U-238	1.2E+04	4.468E+9 y	α SF	1.0E+00	Th-234		
Th-234	8.6E+14	24.10 d	β -	1.0E+00	Pa-234m		
Pa-234m	2.5E+19	1.17 m	β -IT	1.6E-03	Pa-234	1.0E+00	U-234
Pa-234	7.4E+16	6.70 h	β -	1.0E+00	U-234		
U-234	2.3E+08	2.455E+5 y	α	1.0E+00	Th-230		
Th-230	7.6E+08	7.538E+4 y	α	1.0E+00	Ra-226		
Ra-226	3.7E+10	1600. y	α	1.0E+00	Rn-222		
Rn-222	5.7E+15	3.8235 d	α	1.0E+00	Po-218		
Po-218	1.0E+19	3.10 m	α β -	1.0E+00	Pb-214	2.0E-04	At-218
Pb-214	1.2E+18	26.8 m	β -	1.0E+00	Bi-214		
At-218	1.3E+21	1.5 s	α β -	1.0E+00	Bi-214	1.0E-03	Rn-218
Bi-214	1.6E+18	19.9 m	β -α	1.0E+00	Po-214	2.1E-04	Tl-210
Rn-218	5.5E+22	3.5E-2 s	α	1.0E+00	Po-214		
Po-214	1.2E+25	1.643E-4 s	α	1.0E+00	Pb-210		
Tl-210	2.5E+19	1.30 m	β -	1.0E+00	Pb-210		
Pb-210	2.8E+12	22.20 y	β -α	1.0E+00	Bi-210	1.9E-08	Hg-206
Bi-210	4.6E+15	5.013 d	β -α	1.0E+00	Po-210	1.3E-06	Tl-206
Hg-206	4.1E+18	8.15 m	β -	1.0E+00	Tl-206		
Po-210	1.7E+14	138.376 d	α				
Tl-206	8.0E+18	4.200 m	β -				

When making a comparison choice for a chart depicting the radioactive decay over time of used CANDU fuel, as NWMO have done, the question then becomes whether to use pure, artificial uranium as the reference radioactivity, or whether to use uranium ore naturally present in the ground.

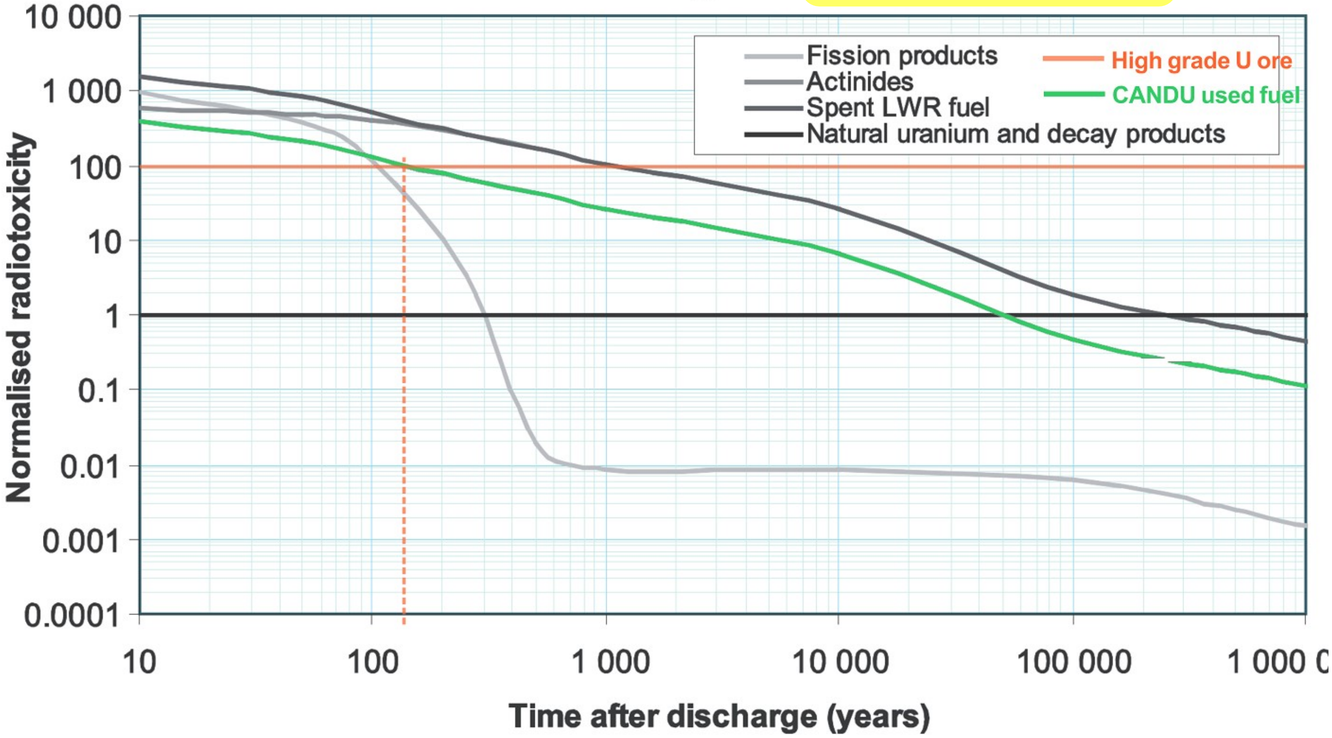
Since the concentration of uranium ore naturally present in the ground varies greatly, a comparison with the radioactivity of used CANDU fuel over time would need to reference a particular level of uranium ore concentration – which can be anything from near-zero to as high as 60% in certain geological occurrences. By contrast, using artificially purified uranium as reference radioactivity avoids any such complication, but it fails to give a realistic comparison with what is found in nature: The statement that "it will take up to 10,000,000 years before the used fuel goes back to the same radioactivity levels as natural uranium" is only correct in the case of artificially purified uranium, never in every other case of natural uranium ore in the ground.

Brennain certainly knows the difference between artificially purified uranium and natural uranium ore, but chooses to make a disingenuous claim instead.

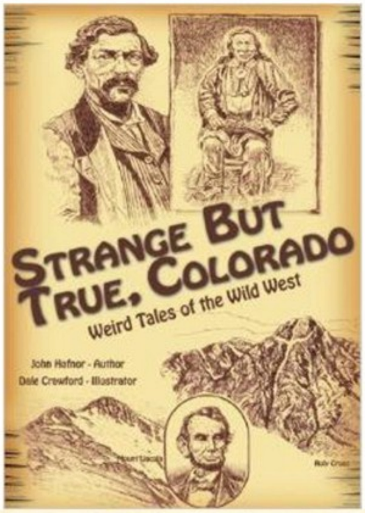
Since Canada's nuclear fuel is derived from natural uranium mined in northern Saskatchewan, it would make sense to compare the radioactivity of used nuclear fuel over time, to the radioactivity of uranium ore in those mines: The ore concentration varies considerably in those mines, with some as high as 60%, but the mining operation blends the various grades to obtain a consistent 20% feed to the ore processing mill.

It turns out that comparing the radioactivity of used CANDU fuel over time with the radioactivity of 20% natural uranium ore leads to the conclusion that the used fuel radioactivity drops to that of Canadian uranium ore in just a few hundred years, as illustrated below. Note that the horizontal black line refers to natural uranium ore with an typical global concentration of just 0.2%, which is a hundred times less than the 20% concentration of uranium ore mined in Saskatchewan – hence the 100 times higher level of the orange line labeled "High grade U ore" (Also note that even low-grade 0.2% uranium ore is still more radioactive than artificially purified uranium, without any decay products).

Figure 2.1. Ingestion radiotoxicity for spent LWR-UOX fuel, 51 GWd/MTIHM, normalised to natural uranium and decay products as occurs in natural uranium ore



For the sake of perspective on levels of radioactivity, it's worth recalling that uranium ore, which often occurs in colorful mineral types – typically yellow and red – has in the past been used by some first nations for ceremonial face and body paint:



Atomic Frenzy Grips Rockies

It was always Colorado's "other" yellow ore. But in time uranium would cause a stampede nearly as fervent as the Gold Rush of 100 years before.

Long before Europeans arrived in present-day Colorado, Indians knew about and gathered the soft golden mineral known today as uranium ore. It made for easily applied, bright yellow face paint! In those days, uranium ore could be found with relative ease in parts of the Western Slope.

As miners arrived, nearly all Indians were exiled to out-of-state reservations, and this peculiar yellow mineral was nearly forgotten. Forgotten, that is, until the early 1900s. That's when Madame Curie, a Polish-born French woman and first multiple recipient of a Nobel Prize, began her pioneering discoveries of radioactivity. Madame Curie needed uranium for her studies, and one of her sources was a mine near Paradox, Colorado. This uranium ore may have been destined for futuristic studies, but it was packed from mine to railhead on the backs of old-fashioned mules. Madame Curie is reputed to have subsequently visited Colorado to acquire still more uranium.

World War II's detonation of atomic bombs ushered in the true Atomic Age. Suddenly, uranium was in great demand. By the 1950s, Colorado's last great mineral rush was on—prospectors swarmed across the Four Corners area with their Geiger counters and army surplus jeeps. The U.S. government even guaranteed to buy all uranium production at a fixed price. Uranium was then thought of as the most strategic material ever found on American soil. Many believed that atomic power from uranium would provide everything from weapons for national security to all our electrical needs through nuclear generators, and even fuel for gas-free automobiles!

It's not certain, but there are suggestions that this practice continues to this day, in certain native tribes on islands in the western Pacific Ocean, as documented in this photo:

I know what you're thinking. This photo, below, looks fake, like we've stuck our heads through holes in a painted backdrop. Uh-uh. No. And the men's faces are painted, not masks. Through an unofficial translator, a wigman told that the yellow pigment is dug out from "between the gas and the oil." We'd asked because it looks so unnatural.

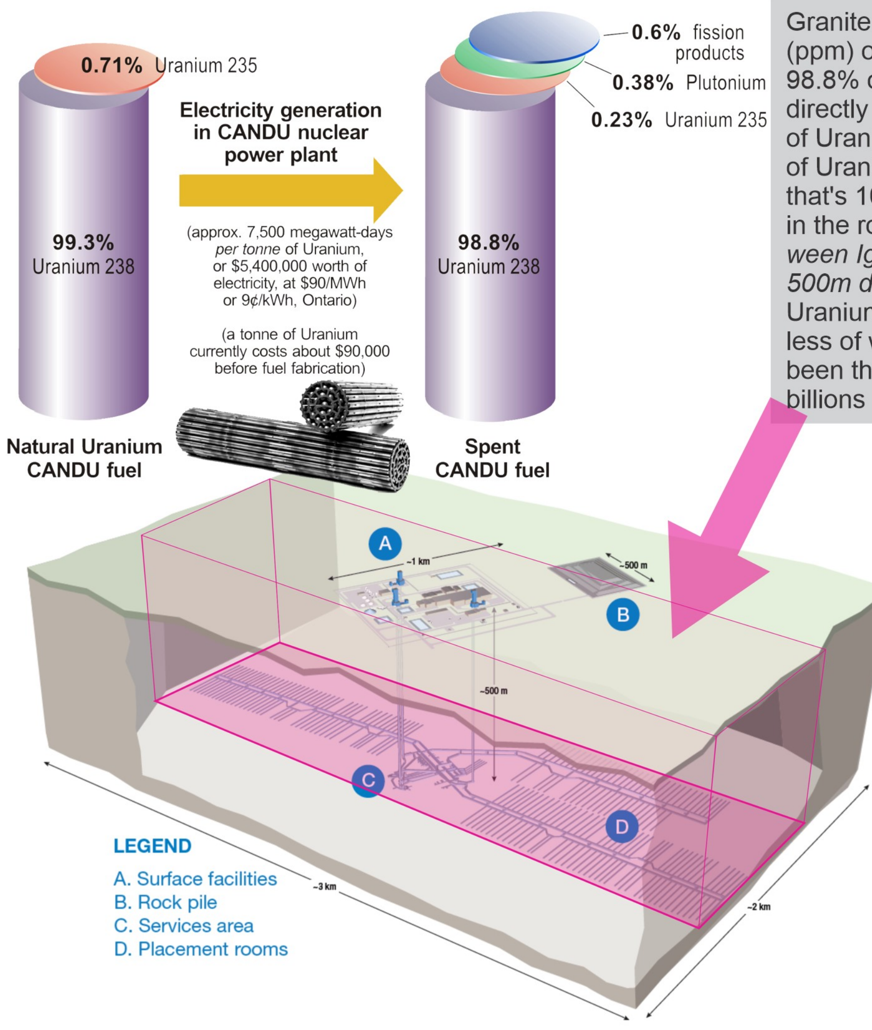
Yellowcake, uranium oxide

"What do they use for the yellow?" my mother, a painter, asked on seeing this photo. I explained what the wigman told me. "It doesn't look natural to me," my mother said.

"Let me Daddle that," I said. My sisters and I have always asked our brilliant chemist father whatever curiosity needed an answer. As he was already on the line, my father said it sounds like they use "yellowcake," a kind of uranium oxide. "Can't be too good to rub on the skin," he added.

Must read: Crime in Port Moresby

Perhaps more relevant, it’s also possible to compare the quantity of natural uranium ore in the rock above a 500-meter deep geological repository (DGR) for used nuclear fuel, with the radioactivity of that used nuclear fuel, over time:



Granite rock naturally contains about 5 parts per million (ppm) of Uranium. Same uranium as what makes up 98.8% of used nuclear fuel. Therefore, the 500m of rock directly above a DGR will contain about 20,000 tonnes of Uranium. Each used fuel bundle contains about 20kg of Uranium, so for a DGR with 5 million fuel bundles, that's 100,000 tonnes – or roughly five times the amount in the rock directly above. Similarly, *a strip of rock between Ignace and the DGR, 1km wide by 43km long by 500m deep*, contains about 300,000 tonnes of natural Uranium, or about three times that of the DGR – regardless of whether the DGR is actually built or not: It has been there for over a billion years, will remain there for billions more (unless it's mined).