Dear Mr. Scarpaleggia,

I am writing to you in your role as Chairman of the Standing Committee on Environment and Sustainable Development, in connection with the current hearings on nuclear waste governance. I am very glad to hear about this committee. Thank you for considering my comments.

While many only consider reactor waste under the nuclear waste umbrella, I would also consider uranium mine waste. The main distinctions between the two is the reactor creates highly toxic man made elements such as plutonium and the waste is radioactively hot - the reaction initiated in the reactor cannot be shut down and continues to create heat. Both waste streams contain extremely long lived materials that need to be isolated from the environment for a million years and monitored during this time. What the two also have in common is decommissioning. The actual decommissioning hearings of mines and mills and reactors does not take place until they have outlived their useful life. Both, when decommissioning is being considered, conduct an industry led risk assessment that determines the safest and most economic way to dispose of it. Usually the industry puts forward the option they favour. At this point, something has to be done with it. Knowing the risks involved, this is all wrong. We should be considering the ultimate decommissioning of the waste at the front end and public involvement is needed. If we do not have an acceptable solution to the waste, at the outset, we should not be creating it in the first place. It is in the industries' interests to create nuclear fuel, reactors, etc. The waste is a problem for them.

For mine and mill waste, standard procedure is to leave it at the surface, in a mine pit, or pushed into a lake. It is protected by a thin cover of material, The mine waste still contains about 85% of the radioactive material that was contained in the ore. *In the 1997 Report (from the Joint federal Provincial panel on mine development in northern Saskatchewan, concerning cumulative effects on operating mines as well as considerations for Midwest and Cigar Lake mines) it was concluded that the tailings are going to have to be monitored into perpetuity.* The milled ore is ground into a fine flour and chemically treated to release its treasure. Up to 95% 235 U and 238 U is removed. The rest is waste that is now much more highly mobile than the original ore. In such a state it should never be left at the surface, exposed to erosion over the geologic periods that must be considered. However, puting it underground where groundwater can percolate through it may not be a solution either. Putting this material back into the original fault zones through which water flows does not seem practical.

In addition to these tailings, there are the radioactive materials that are released in the effluent, 'accidents' and emissions. If monitoring is not done in a scientific way that uses predictive models as to where contamination ends up. If plans are not made to safely recover wayward contaminants the environment is not being protected. As stated, not all the Uranium is removed in the milling process, as well as 85% of the other radioactive material (including thorium) and in *2006 the CNSC reported the effluent being released into the environment, via the effluent pipe at Horseshoe Bay at the Rabbit Lake operations had averaged out at 1.7 metric tonnes of uranium per year, as well as amounts of molybdenum, selenium and likely many other elements. The CNSC asked them to clean up their act and,*

in the 2007 CNSC Annual Report, the findings stated Cameco had managed to reduce the uranium released back to 238 kg. – about an 80% reduction. Since 2006 the reduction in uranium has actually averaged out to about 61%, according to Cameco. In addition to begging the question of proper and responsible monitoring, this begs the question, why are we not monitoring for total loading into the environment, utilizing mass balance analysis, when dealing with radioactive materials (dilution is not a solution), instead of looking at concentrations released.

We need to look at pathways for radionuclides and heavy metals – air, surface water, ground water, vegetation, effects due to ingestion by humans, wildlife, and fish, public health, epidemiological studies of all miners, past, present and future. We should be looking at all the physical and chemical linkages to help determine aerial extent, frequency, duration and certainty in predictions.

As stated, reactor waste is hot, and will remain hot for a geologic time period, because of the chain reactions that have been initiated. When it is taken from the reactor, it is cooled in a pool for 10 years and then put into air cooled containers for another period of time. When we put it into permanent storage, it will continue to create heat **- and needs to cooled**. What is the result of this heat when it is contained within sealed containers? The original deep disposal concept would put the waste deep into pristine rock, packed in with bentonite clay, that would keep it dry**. It needs circulating water to keep it cool!!** Warm water moves outward, potentially spreading the risk into the environment. How long can the integrity of the containers be guaranteed? How will the properties of the bentonite (corrosive?) by this heat over extended periods of time. Even more heat will be created at various stages of radioactive decay. I think the **bentonite is a big problem!!** Dry bentonite will not do the job that is needed. It needs to be wet to be able to transfer heat to the surrounding rock. If it can not do this, the waste will heat up, resulting in a thermal pulse. The host rock also has to have certain heat conductive properties to assist the dispersal of the heat. Even if the clay is wet the heat will drive water away from the canisters, towards the rock, creating a dry layer next to the canister that will be affected by the heat. As water moves away silicification will occur, changing the properties of the clay.
https://www.researchgate.net/publication/261191774_Bentonite_A_Review_of_key_properties_processes_and_issues_for_consideration_in_the_UK_context

So do we leave it on the surface or do we bury it underground or do we stop creating the stuff, understanding that something has to be done with the waste we have already created and that inherent risks of any solution may **not** be acceptable.

As I write this, the unthinkable is happening. Fifteen active reactors in the Ukraine, not including the Chernobyl reactors, are now in a war zone. This puts Ukraine, and the rest of the world, in a terribly vulnerable position to threats and scenarios that might be presented by an aggressor such as Putin. It would now seem that not only the temporary storage of reactor waste, but the reactors themselves should be contained within "secure" containment facilities. Further to this, we now seem to be on the edge of approving so-called 'small' reactor designs that could be built anywhere. To me this forwards the ultimate disaster scenario.

Stop!!! the creation of more waste and settle for a less than perfect solution to whatever has been

created already. Future generations are going to have to deal with our lack of foresight.

Steve Lawrence