

CCNR's Intervention on OPG's Proposal for a Deep Underground Dump [DUD]

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slightly edited from the official transcript

THE CHAIRPERSON: Welcome, Mr. Edwards. Please proceed.

DR. GORDON EDWARDS: Thank you very much, Madam Chair. I would like to thank the Panel for agreeing to hear our presentation.

Our presentation is going to be focusing on one specific aspect of this project -- which is really, we think, the most important and perhaps the most challenging for the Panel to deal with -- and that is the question of abandonment.

Right at the beginning of the Environmental Impact Statement from OPG, the fifth sentence in fact in the Executive Summary, reads, quote:

“The DGR project includes the site preparation and construction, operation, decommissioning, and abandonment, and long-term performance of the DGR.”
[As read.]

Now, it is our contention that it is one thing to talk about packaging and monitoring nuclear waste in as safe a fashion as possible. This is something that we all, without exception, desire. We definitely want to keep this material as safely packaged, and out of the environment, and out of danger for human beings and other species, as well as we can. No question about that.

But really, we're dealing here with two separate projects and I believe that these separate projects must be decoupled and judged separately. One of the projects is the Deep Geological Repository [DGR]. The other one is a Deep Underground Dump [DUD].

First, the Deep Geological Repository. A repository is a place where things are carefully stored and monitored to be consulted and retrieved. The Library of Congress has a repository for books. These books are not to be abandoned. They're not to be neglected. They are to be maintained.

And if we talk about a deep geological repository as a place to maintain, store, package, monitor, and retrieve if necessary, and repackage if necessary, that is a repository. When you talk about closing it up and abandoning it, then you're talking about a dump. And this is the Deep Underground Dump.

We believe that it is incumbent upon you as Panel Members to clearly separate these two concepts in your mind, and clearly separate these two concepts in your ultimate decision and advice to the Government of Canada.

I would like to point out that the term decommissioning, as normally applied to a nuclear facility, means restoring the site to its virginal state as much as possible. When we decommission a nuclear reactor fully we're talking about not only removing the irradiated fuel, but also removing all the radioactive components and removing whatever radioactive contamination may have resulted through operation, and as much as possible returning the site to a “greenfield” status.

Now, that is not what is meant here by decommissioning the DGR. In fact, in decommissioning the DGR, they're not returning the DGR to its original state at all. They are turning it into a Deep Underground Dump.

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So decommissioning the DGR is in fact commissioning a Deep Underground Dump. That's when the Deep Underground Dump actually begins to function as a nuclear facility, and the thing about this particular facility is that it is unmonitored, that the wastes are irretrievable, and that it is beyond human control, and that it has never any decommissioning unless nature decides to decommissioning it in its own way.

So I believe that this is a problem -- it really presents an unethical, unscientific, and untenable decision to be made by this Panel, based on existing scientific evidence. I simply do not believe that we have scientific evidence that allows us to predict the safe operation -- unmanned, unmonitored, and irretrievable -- over such enormous spans of time.

We have heard many times from participants in these hearings and elsewhere that we need a long-term solution to the nuclear waste problem. We want a long-term solution to the nuclear waste problem. I think I can fully subscribe to that on behalf of my organization. We need it, we want it. But where we differ is that we believe we do not have it.

Wanting is not the same thing as having. We want a cure for cancer. We need a cure for cancer. But we don't have a cure for cancer and to pretend that we do have a cure when we don't is fundamentally dishonest.

To pretend that we have a solution to the nuclear waste problem when we don't is fundamentally dishonest. And because of the potential danger of these materials over such a long period of time, it is unethical to proceed on that false assumption.

The Nobel Prize-winning physicist Hannes Alfvén, who was involved in the early phases of the Swedish nuclear program, is quoted as saying: "You cannot claim that a problem has been solved simply by pointing to all of the efforts that have been made to solve it." And this quotation was made specifically in the context of nuclear waste.

What I would like the Panel to consider is the fact that the Proponent in this case, OPG, has a serious conflict of interest in proposing a deep underground dump.

That conflict of interest is hinted at in their own document in Section 1.2.2. This is the first volume of the environmental impact statement. They say, and I quote:

"The Western Waste Management facility was originally developed with the concept that it would provide interim storage for the low and intermediate level waste until such time as a long-term management facility was developed." *[As read.]*

Notice: not 'dump', not 'disposal', but 'long-term management'.

"The current structures have been designed for a minimum life of 50 years. These structures could, with proper maintenance, continue to safely store the waste much longer than 50 years." *[As read.]*

And here is the key sentence:

"However, Canadians have indicated that they do not want to wait another generation for substantial progress to be made on developing long-term solutions for waste management." *[As read.]*

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What is this indication that Canadians are not willing to wait? I would put it to you that the reason Canadians are not willing to wait is because they have been told repeatedly that it is not a problem, that nuclear waste is not a problem.

My organization, the Canadian Coalition for Nuclear Responsibility came into being in 1975, and at that time I frequently raised the question of nuclear waste. And on public panels I was told by representatives from the nuclear industry that nuclear waste is not a technical problem, it's just a public relations problem.

I thought then and I think now that that's a very revealing statement. It's a public relations problem because the industry perceives that unless they can convince the public and the politicians that this problem has been solved, that they will not, perhaps, be allowed to build more reactors and to continue the nuclear enterprise.

So for them it is a life and death issue -- for the industry I mean -- to persuade people that they have a solution.

Now, I can understand that approach and I can understand sincere efforts made to find a solution. But once again, as Hannes Alfvén says: "You cannot claim that a problem has been solved simply by pointing to all the efforts that have been made to solve it."

By the way the nuclear waste problem that was framed at that time was the high-level radioactive waste, the irradiated nuclear fuel, largely because people were unaware of -- well, not only were they unaware of the high-level waste, but they were even more so unaware of the intermediate and low level waste which we're talking about at these hearings. I will return to the connection between them.

So the conflict of interest really started emerging around 1976. In 1976, there was a Royal Commission Report from Britain written by a British nuclear physicist, Sir Brian Flowers, who was involved in both the civilian and military nuclear programs in Britain, and one of the conclusions that they reached is -- quote (this is page 81, paragraph 181):

"...we are agreed that it would be irresponsible and morally wrong to commit future generations to the consequences of fission power on a massive scale unless it has been demonstrated beyond reasonable doubt that at least one method exists for the safe isolation of these wastes for the indefinite future."

That was in 1976, the Flowers Report.

In California, a couple of years later, under orders from the California Legislature, the California Energy Resources and Conservation Commission held extensive hearings on the subject of nuclear waste. The reason being that the California Legislature had said that they would ban any further nuclear reactors in California unless there was a demonstrated safe solution to the [nuclear waste] problem. So that's why these hearings were held. And when the California Energy Commission reported to the legislature, they said -- and I quote from the Commissioner, Emilio Varanini:

"Excessive optimism about the potential for safe disposal of nuclear waste has caused backers of nuclear power to ignore scientific evidence pointing to its pitfalls. That's the real crux of what we found -- that you have to weigh scientific evidence against essentially engineering euphoria."

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So at that time, which was, of course, some time ago, the message was sent out that California in fact would no longer license nuclear reactors based on the advice of the California Energy Resources and Conservation Commission.

Now, in that same year, in 1978, the Royal Commission on Electric Power Planning published a report called "A Race Against Time", [in which] they said -- quote:

"Continuous monitoring of waste disposal research should be undertaken by an independent panel of experts....If adequate progress is not being made by...1985, a moratorium...on additional nuclear stations should be considered."

That was, by the way, taken from the Principal Findings and Conclusions of the report, [it was] not just a passing comment.

So I think that these findings of various bodies -- oh, I should also mention 1977. That (1977) was the first year to my knowledge that the federal government ever issued a paper dealing with the nuclear waste problem, even though nuclear waste -- high level nuclear waste, and all the other nuclear waste -- had been already accumulating for 30 years in Canada as a result of operation of various reactors. That (1977) was the year that the Hare Report was published, entitled "The Management of Canada's Nuclear Waste", I believe.

And following that, the House of Commons had committee hearings on the Hare Report. They received over 300 submissions from interested parties. And one of the parties that submitted was Robert J. Uffen, Dean of Engineering at Queens University, who was at that time Vice-Chairman of Ontario Hydro, and he recommended that there be -- quote:

"No large nuclear program until it has been demonstrated beyond reasonable doubt that a method exists to ensure the safe containment of the long-lived highly radioactive waste for the indefinite future."

Essentially echoing the findings of the Flowers Commission.

So this was a very important date in the history of the Canadian nuclear program, because it basically sent a shocking message [to the nuclear industry] that they might not be able to continue if they didn't get on the job.

In fact, 1978, that same year, a very important year, was when the research program began, the 15-year research program into granite rock, granite plutons in Manitoba, which led to the Atomic Energy of Canada Limited [AECL] environmental impact document [on the Geological Disposal Concept] that was then studied by the Seaborn Commission for 10 years, from 1988 to 1998.

Well, here's the question. The question is: are we really dealing with a situation where we've solved the problem and now we're implementing it? or are we dealing with a situation where there is a public relations need to give the appearance that we've solved the problem?

What my organization would recommend to the Panel is that whatever decision you make regarding the Deep Geological Repository, that you should not approve the Deep Underground Dump at this stage.

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I don't believe that the Panel has the competent assurance, on the basis of the present state of knowledge, scientific and otherwise, to really say that these wastes are going to be safe for the periods of time being considered, which literally stretch into the millions of years.

Let me just give you a couple of specific examples.

As we have seen in this particular project, there has been a conflation of the waste, there has been a consolidation of what wastes are supposed to go into the repository. First, it was only going to be low level waste and short-lived intermediate level waste. That might be possibly a matter of decades or maybe centuries, I presume.

But then, having seen that they were getting community acceptance and so on, they expanded it to include all intermediate level wastes, which includes components which are far more radioactive than any of the original waste considered -- far more radioactive.

The refurbishment waste, for example, the pressure tubes and calandria tubes and other items that are removed from the core of the reactor, are much, much more radioactive than any of the originally planned waste to go into this repository, and yet now those are being considered as well.

Each CANDU reactor has 7 to 9 kilometres of these radioactively-contaminated and activated pipes that all of which is going to go into this repository now, not to mention the steam generators, which are 100 tonnes each.

There's eight steam generators in each of the Bruce reactors, that's eight times eight is 64 steam generators, each one 100 tonnes, and then they're replacing those steam generators. So we have 128 steam generators just from Bruce alone. And then we're going to have the steam generators from the other reactors.

I am not saying that the steam generators are the most problematic. I'm simply saying, what are we getting ourselves into here? Now, we hear that they're even considering including the decommissioning wastes. In other words, they're going for broke. They're including all the radioactive waste from the nuclear industry except the ones that are specifically handled by federal policy, which is the high level radioactive waste, namely the irradiated nuclear fuel.

They have not even dismantled one single power reactor in Canada, not even the Douglas Point reactor, which has been shut down for decades, not the Gentilly-1 reactor which has been shut down for 35 years. When we recently asked the federal government as to whether they were going to dismantle the Gentilly-1 reactor, they said, oh, no, we're going to wait for another 100 years perhaps.

So there is a problem here in trying to say that we have a solution to a problem they haven't even began to quantify or to actually explore as to what is the full scope of these decommissioning wastes.

Now, if we talk about the steam generators in particular. I happen to have data as a result of hearings that were held in Ottawa. And the steam generators, the pipes inside the steam generators -- there's 5,000 of them in [each of] the Bruce steam generators,

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5,000 small diameter pipes -- and they become contaminated because of the coolant that is circulating through them, the primary coolant.

We have a list of the radionuclides that were provided by Bruce Power, and we have americium-241, which has a 430 year half life; americium-243, which has a 7,000 year half life; plutonium isotopes, which includes, of course, plutonium-239 with a 24,000 year half life.... Twenty-four thousand years!

It turns out that 91 percent of the [mass of] radioactivity inside the pipes of the steam generators are plutonium isotopes. There are five plutonium isotopes. Question, how did they get there? Well, they got there because they were carried by the water that flushed them out of defecting fuel elements.

And although it's a very small quantity in grams -- we're only talking about less than 4 grams, it's actually 3.7 grams of radioactive material in one steam generator, which means that you have only 3.27grams of plutonium -- but that's enough to give 4 million overdoses to atomic workers, because the permissible level, the permissible body level for plutonium in an atomic worker is 0.7 micrograms.

So if you figure it out, just that small amount of plutonium in one steam generator, that's enough, theoretically, to give more than the body burden that is permissible for four million atomic workers.

I'm simply pointing this out because we have to really use our imagination to grasp the scale of what we're talking about. 24,000 years ago there were no Great Lakes. The Great Lakes were only formed about 10 or 15 thousand years ago, so there were no Great Lakes back then. So what are we talking about? The Pyramids of Egypt are only 5,000 years old.

And what's more, something that even people in the nuclear industry sometimes don't realize is that whenever a plutonium-239 atom disintegrates, it turns into a uranium-235 atom, which has a 700 million year half-life. So all the atoms of plutonium in the steam generators are going to turn into atoms of other materials which have half-lives measured in the [hundreds of] millions of years.

Enough said. I just feel that when we talk about a repository, what our organization advocates is a new concept based on honesty. And this new concept based on honesty is this. We cannot decide here and now not to burden future generations with this. We have, in fact, burdened future generations with this. And it's too late now to say we wish we hadn't done it.

So what we have to do is to adopt a forward-looking policy of rolling stewardship. And rolling stewardship means that we package this stuff as carefully as we know how to do, we monitor it continuously, as I hope we do, and we do repairs as necessary and take corrective measures as soon as possible to prevent any leakage or contamination from escaping.

Now, this burden has to be passed on to the next generation. And the next generation has to be prepared to repackage these wastes, to retrieve them and repackage them and to continuously monitor them. And they have to pass that on to the next generation.

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And so it has to roll forward from generation to generation with good documentation, with very good instructions as to what should be done with this waste. Now, whether that's done underground or above ground is of little consequence to me as long as we don't fool ourselves into thinking we have a solution to this problem once and for all. Because I don't believe we do.

Just before I move onto what we would like the Panel to consider recommending, I would like to point out a couple of other things. One of those things is the volume of waste involved.

I heard at a Canadian Nuclear Society meeting two years ago, from the man who is in charge of nuclear waste management at Point Lepreau nuclear station, that they had built two new buildings to house the refurbishment waste that they expected to get by refurbishing that reactor. They ended up with five times the volume of the waste they had anticipated. Five times the volume.

And he said the main reason for this was because, unfortunately, with radioactive waste, when it comes in contact with uncontaminated material, that becomes radioactive waste too. And so the amount -- the volume of radioactive waste, through imperfect management -- grows and grows and becomes larger and larger.

And of course, this happens too with containers. As OPG readily admits, the containers will disintegrate in the underground dump. Well when those containers disintegrate they too become radioactive waste. And even the surrounding environment. If it was a soil situation we were dealing with, the soil becomes radioactive waste.

In fact, there's one experience in the U.S.A. from this Department of Energy document called "Closing the Circle on the Splitting of the Atom". It's a U.S. Department of Energy publication. And on page 7 they refer to Pit Nine. Pit Nine is a radioactive waste burial ground. Quoting from the document:

"From 1964 to 1969, approximately 150,000 cubic feet of plutonium-contaminated and low-level radioactive waste was buried here. Record keeping that does not meet today's standards, and failed waste containment, have made Pit Nine a daunting remediation challenge for engineers, who must now sample these wastes, exhume them, and treat them [in a different fashion]."

Thermally it says here. I'm not sure exactly what that means -- "treat them thermally".

So you see, the danger is that if we're wrong about having a solution, then we're leaving to future generations the responsibility of Rolling Stewardship without the decency of telling them that that's their job.

I think we have to have the decency to tell future generations that, "Unfortunately, you are going to have to be prepared to spend time and energy and money on this. But it's not so onerous that it can't be done. We are doing it, and you can do it, and I'm afraid you must -- until such time as we actually do have a solution".

It's important to realize that as far as high level waste goes, the United States Government, the US DOE in this case, has in fact tried eight times in the United States to locate an underground waste repository for high level radioactive waste and they have failed all eight times, the most recent failure being Yucca Mountain.

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The first [failure] that I was aware of was in the 1950s when Milt Shaw from the Atomic Energy Commission went to the U.S. Congress and demanded funding to immediately start emplacing waste in a salt mine in Lyons, Kansas, which he assured the Congress was the safest place in North America for disposing of high level radioactive waste. It turns out it wasn't. Milt Shaw was fired and that was the first failure. Of course you know of other failures -- in Germany, the Asse II salt mine, and so on.

So what is it that our organization would like to see this Panel consider?

Whatever your decisions about the DGR -- and I think there are other concerns that we could have addressed there but we're not focusing on that -- we feel that the Panel should not, at this time, give approval to the Deep Underground Dump. We should say, "Look, this is not something that we can approve at this point in time". Although we need to keep working towards a solution, we're not there yet.

Secondly, we would like the Panel to consider that if the DGR proposal is in fact inevitably predicated on the assumption that it turns into a dump, then we think you should not approve the project at all.

Ontario Power Generation has said that the above ground storage is safe and it can be continued and there's no reason why repackaging could not occur and so on. So I don't believe, based on the evidence submitted to the Panel, that there's any reason why the Deep Geological Repository must be constructed. The only reason I can see for that is so that you can then abandon the waste.

And the final point is that we feel that the Panel should realize that when we come to talking about permanence, about infinity, about eternity, that we need to have a federal policy. And we do not have a federal policy. The only federal policy we have at the moment is governing highly radioactive waste.

But the stuff in the intermediate level waste and so on is really the same material in a more dilute form. These are the same radionuclides that are in the ion exchange resins, in the steam generator tubes, in the various components that have become contaminated. And therefore, we need a federal policy on all other forms of radioactive waste.

What are we going to do in Quebec with the low and intermediate level waste from Gentilly-2? What is New Brunswick going to do with its low and intermediate level waste? Are they going to be welcome here in Kincardine? So far, no. Ontario Power Generation says, "We're going it alone".

We feel that this is a wrong approach. Nuclear power has been a national program from the outset. This is a federal panel, I believe, and you're reporting to the federal government.

I think that one of your recommendations should be that Canada needs to have public hearings leading to a federal policy on all forms of radioactive waste other than the irradiated nuclear fuel.

Thank you very much.

THE CHAIRPERSON: Thank you. I would like to lead off the questioning and then I'll go to my fellow Panel Members. So Mr. Edwards, would you explain to the Panel how the risk would be lower with rolling stewardship?

What is your evidence for such a strategy working? For example, is there evidence for such a strategy working with other hazardous materials such as pesticides, for example? Do you have any evidence of successful rolling stewardship beyond one or two generations?

DR. EDWARDS: Well that's quite a challenging question. I'd certainly be willing to do that as an undertaking to search for such examples and submit them to the Panel. I don't have them up my sleeve.

But I would like to point out that in toxic waste dumps, I put it to you that the human race has never successfully disposed of anything. When we have dumped toxic waste -- as in the Love Canal example or poison gas left over from World War I or the injections of toxic waste by Dow Chemical into deep underground boreholes in Sarnia, which came up as toxic blobs in the St. Clare River -- when we have tried to pretend that we have solutions to these problems and just dumped things, they, in many cases, have come back to cause terrible problems.

Now, I feel that the present stewardship here at Bruce is a good example of rolling stewardship. I don't think the people who are managing it today are necessarily the same people who were managing it years ago. Rolling stewardship is simply a question of making sure that people are on guard, they're monitoring and when they see a problem, they take steps to correct it.

The difficulty with these disposal ideas -- or abandonment, rather -- is that nobody is there to monitor, nobody is there to correct, and so if it does leak seriously -- as, by the way, in the Asse II Mine in Germany -- apparently it was leaking for about, I believe, 10 years before it was actually reported as being a problem. So there is a danger. There's a difficulty there in terms of covering up, so one has to be careful about that. What we need here, and this is very important, we need to have independence.

You'll notice that one thing that I didn't emphasize in my presentation was that when the Royal Commission on Electric Power Planning recommended that there be a monitoring of research in waste disposal, they said "by an independent panel". And in the text, they make clear what they mean by that is independent of the nuclear industry and its regulator. That's what they mean by independent.

Similarly, when the Seaborn Panel published its report, they recommended a nuclear fuel waste agency that is at arm's-length from the nuclear industry. Independence is essential.

And the Nuclear Waste Management Organization is not. The Nuclear Waste Management Organization is a creature of the very industries that create the high level waste. So there is, unfortunately, in that situation, a built-in conflict of interest. What we need is independent monitoring.

I believe that we have, in our society, the capability to maintain this kind of legacy of environmental stewardship, to look after a problem as it goes through time and not to just forget about it. We can't afford amnesia.

I'm reminded of the findings of the environmental panel at Elliott Lake regarding the [radioactive] tailings that were being stabilized for long-term management. In their report, they said that it must be recognized that this is a never-ending environmental threat and it requires never-ending attention.

Now, I'm paraphrasing. I don't think they used the word "never-ending", but that was essentially their finding, that you can't say this is now solved, [you can't just] walk away from it. You have to regard it as a perpetual challenge; there is a need for perpetual monitoring and repair if necessary, [and] retrieval.

THE CHAIRPERSON: Mr. Edwards, I'm following your reasoning, but I really didn't hear much evidence for successful examples in human society for beyond one or two generations.

So I would like that as an undertaking from your organization, please. This will be Undertaking Number 21, for the Coalition for Nuclear Responsibility to provide the Panel with some evidence for, I would say, beyond two generation stewardship. And it doesn't have to be nuclear, just of anything. That would be very helpful.

UNDERTAKING NO./ENGAGEMENT No. U-21:

By the Canadian Coalition for Nuclear Responsibility to the JRP to provide examples of rolling stewardship beyond one or two generations. Examples need not be limited to the management of nuclear waste.

THE CHAIRPERSON: Dr. Muecke?

MEMBER MUECKE: Just for background for myself, could you tell me a little bit about your organization, size of membership?

DR. EDWARDS: Yes. It's a very low-budget organization. It was founded in 1975. I became involved myself in 1972 in the nuclear issues.

In 1975, there were 30 people who joined in the basement of 2010 Mackay Street in Montreal to form the Canadian Coalition for Nuclear Responsibility. And when it was formed, it was conceived of as a pan-Canadian coalition of groups.

Invitation letters were sent out across Canada to environmental groups to join the coalition. And the purposes were twofold. One was to provide a clearinghouse of information about nuclear issues to communities and to organizations. And the second was to present a united front to the Government of Canada requesting a public inquiry into the hazards and benefits of nuclear power for the benefit of the public and for the benefit of the decision-makers.

We felt that, since such a debate has never been held in our federal Parliament, an inquiry would be a good way to get all of the pro-nuclear and anti-nuclear evidence on the table and weigh the pros and cons, and it would be an educational experience for all concerned. So that's what we were involved in.

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Now, the Coalition lasted as an actual formal coalition up until about 1981. At that time, there were no more nuclear reactors being built in Canada because of the situation, and the result is that we had to retrench.

So we restructured and became fundamentally a core group based in Montreal which now maintains good relationships with groups across the country, about 100 of them, who are informal members of the coalition but not formally so because we can't afford to have national conventions where we bring everybody together, or annual public meetings.

So consequently, it has become primarily a kind of a Montreal-based think tank with a Board of Directors of about 12 people, varies from 10 to 12. And we have a lot of good connections with other groups across the country. Is that helpful?

MEMBER MUECKE: Yes, thank you. That was more than helpful.

DR. EDWARDS: We've also been intervenors at many, many hearings. And we maintain a Web site, which records a great deal of this intervention. In terms of the nuclear waste issue, I think we were intervenors in virtually all of the things that I referred to before.

MEMBER MUECKE: Thank you. Now, you emphasized abandonment. And on the other side of the coin, possibly, is retrieval. And we have heard from OPG a couple of days ago about retrieval, so I'm actually going to address my question to OPG because at that time, if I understood correctly, OPG's response about retrieval was that the waste would be retrievable even after closure of the DGR.

Now, my question is here: is this a theoretical statement? or is it based on what is known about current levels of technology? and what is the international experience about retrieval so far?

MR. FRANK KING: I believe when this came up the other day, Dr. Muecke, it was described as a continuum. When you put the waste in the repository, it's easier to retrieve. As the repository gets further and further in, I think it becomes more difficult.

I'll just mention a couple of the stages. When you put it in by forklift, you could -- if you wanted the next week to take it out by forklift, you back it out the same way. It's just reversing the process.

Once you put in closure plugs or access tunnel closure plugs -- which are about 10 metres long, concrete monoliths -- then, of course, it becomes more difficult. Either you have to remove it or bypass it to get back to the emplacement room.

After you put the shaft in, it becomes very much more difficult, of course, but is it impossible? No. It would be very expensive, but Canadians are pretty good at sinking shafts and going and getting minerals at great depths.

And it was in that context where I think Mr. Wilson responded to that question that it's physically possible, but at great difficulty.

MEMBER MUECKE: After closure, you have gas generation, disintegration of containers, obviously. Could you take us to that stage?

MR. KING: As I said, the longer you get away from the time that the waste was in place, the more difficult it gets. But it is not impossible.

And if the waste container -- the waste containers that have the highest activity waste, the retube waste, the ion exchange resins -- there's a presentation on Monday, I believe, on management of low level waste.

Ms. Morton will be going through that presentation showing pictures of waste containers and the ILW waste container, she has pictures of those. And they are very robust containers.

And at closure in the repository, 60 percent of the activity is retube waste. And these are in stainless steel, thick-walled, robust containers. Those would be easily retrievable for long periods of time.

The less active wastes are in thinner-walled containers, but it is not impossible to [retrieve] the lower activity waste. I think you've seen pictures of people carrying bags of waste. And it is not a remote handleable problem.

So I think that's all I can offer.

MEMBER MUECKE: What is the international experience in retrieving waste that has been stored in deep geologic repositories?

MR. KING: As of right now, there is only one existing in the world deep geologic repository. That's the WIPP [Waste Isolation Pilot Plant] facility. And there's been no need to retrieve of any of that waste, to my knowledge.

If you went to a shallower repository, then -- for facilities that were designed specifically for radioactive waste, and I would include in that the two repositories in Finland, the SFR facility in Sweden -- then I'm not aware of any need to retrieve wastes from those facilities, either.

There are some other facilities in the world, and Dr. Edwards had mentioned one of them in the Asse II facility in Germany, which was not designed as a waste repository. It was an old salt and potash mine from the 1960s where waste drums were put in at the beginning on an experimental basis, and they have a very significant retrieval issue with that repository.

MEMBER MUECKE: Thank you.

MEMBER ARCHIBALD: Dr. Edwards, just one small question, and this, again, concerns what Dr. Swanson had asked. In your opinion, is the rolling stewardship approach to waste control, where one -- or a group or whoever -- forwards the responsibility of risk and cost to future generations without their approval, a truly sustainable and ethical approach to managing wastes?

DR. EDWARDS: Yes, I believe it's the only one. I think it's the only one that's based upon sound ethical principles and sound scientific principles.

If you don't have a solution to a problem, you manage it as best you can. I'm reminded -- my field is mathematics; I'm a retired professor of mathematics. And there's an old saying in operations research that a manager would rather live with a problem he can't solve than accept a solution he doesn't understand or doesn't trust. I think that that's the situation we're in.

It's better for future generations to be well informed and [for us] to make no bones about it: "This stuff is dangerous. This is what it is. Here's the inventory. Here's a manifest. Here are instructions as to what we did. And you can probably do better because you may have better ways of packaging it. You may even work out a solution. You may find a way of neutralizing this waste or rendering it harmless.

But you won't have to, in the future, be faced with some environmental leakage which is intolerable which will lead you to break into an abandoned site knowing nothing about what was there, having no documentation, no inventory, such as they did at Pit 9 in the DOE." They didn't know what was buried there because nobody documented it.

So when we talk about abandonment -- and that's not my word, it is OPG's word; they are using the word abandonment, and they use it not just once; they use it several times, even in the opening summary -- abandonment is part of the plan. When you talk about abandonment, I think you are talking about washing your hands of responsibility because you are saying, "Nature, don't dig here. Men, don't dig here. We are finished."

Now, I believe that this is convenient for the nuclear industry. Whether it is, in fact, a solution, however, remains to be seen.

Being a mathematician, I'm aware of the limitations of mathematical models. The difficulty of getting nuclear waste into an undisturbed geological repository is, you can't do it without disturbing it. And when you disturb the repository, you can never restore it to the initial -- to its original integrity. There's no way that we know how to put a geological formation back together again.

We talked about our expertise in mining. Nobody doubts that you can dig a shaft and dig things out. The question is; can you restore the geology back to where it was as nature had it? And the fact is, we don't know how to do that. So of course, the shaft is one of the Achilles heels of the whole project.

There's also this question of gas generation, the chemical changes that are going to take place after abandonment. What it really amounts to is a vast uncontrolled scientific experiment.

Science has grown up with the idea that we do experiments that are replicable and that can be tested, and they have always a beginning, a middle, and an end. When the chemist does an experiment in the lab, he thinks the experiment is over when he flushes the chemicals down the toilet or the sink but, in fact, the experiment's not over. It's continuing in the pipes and perhaps in the river and perhaps in the ocean. The experiment's not over. We just stop paying attention to it, that's all.

So when you have indestructible materials, materials that we cannot wish out of existence, we are conducting a vast uncontrolled scientific experiment. And we're saying to the future generations, "Good luck. Hope it doesn't trouble you, but if it does, you're not going to have any guidance from us."

THE CHAIRPERSON: Thank you, Dr. Edwards. CNSC, I believe you wanted to provide some explanation around licensing, including abandonment?

DR. PATSY THOMPSON: Yes, if I could. And perhaps because of the questions that Dr. Muecke asked about retrieval, I would ask that Don Howard provide a couple of examples of situations where these activities are taking place.

And so for the context for licensing, what I wanted to say is that in the international literature from the IAEA, for example, or other organizations providing guidance for deep geologic repository, the terms that are usually used are closure and post-closure.

And so for the work that is being done for this project, that language was essentially transferred to the language in the licensing phases under the *Nuclear Safety and Control Act* and the Regulations.

And so the phases of licensing are site preparation, construction, operation, decommissioning, and abandonment. And so the example that Dr. Edwards provided in terms of nuclear power plants being decommissioned, actually, the last licence that a nuclear power plant operator would receive after decommissioning and demonstrating that the site is stable would be an abandonment licence.

And the abandonment licence is the equivalent of what is, in international documentation, the post-closure phase. And so it would be done at a stage where the site, after a long monitoring period, was demonstrated to be in a stable, safe condition and that the safety case would have been updated using all of the information that would have been acquired through all the previous phases of licensing.

And so perhaps Mr. Howard could talk about the question that Dr. Muecke asked about waste retrieval.

MR. HOWARD: Don Howard, for the record. I'd just like to add a little bit to Dr. Thompson's comments in that the CNSC has issued licences to abandon. Most recently, we did issue a licence to abandon to the -- Dalhousie 9 University for the SLOWPOKE reactor that was decommissioned.

The application for a licence to abandon is accompanied by the end-state decommissioning report; in other words, demonstrating that they have met their end state objectives and that they have cleaned up the site to pre-determined levels that were in their decommissioning plan which is verified, then, by the Canadian Nuclear Safety Commission. And then, based on that information, we would issue a licence to abandon.

Now, some examples of retrieval, two that come readily to mind -- and I'm afraid they're not like deep. They're more near surface, a few tens of metres. One project that we're currently undertaking is in the Port Hope area where we're taking the Welcome Waste Management Facility and the Port Granby Waste Management Facility where the waste will be retrieved in the next seven years and transported and put into an engineered long-term waste management facility.

Another example that comes to mind is up at the Chalk River facility. Back in the 1950s, approximately, for the operation of the NRX reactor, some of the waste which was put into 45-gallon drums, a series of four to six drums were put on a concrete pad and then encased in concrete and buried, and these are what we call cribs.

And which Atomic Energy of Canada has now undertaken a program and they have retrieved a few of those and they are continuing to retrieve the remainder of them at Waste Management Area B up at Chalk River.

So basically, they do present issues in retrieving but they're well-planned, well-executed, and under regulatory oversight. So basically the material can be retrieved if its well-planned and taking into considerations and analyzing that, you know, this material has been in the ground for 50 plus years, so -- yet they do present some challenges, but if they're well-planned and well-executed it can be done.

MEMBER MUECKE: And just to follow-up on that, if in these cases, retrieval had been pre-planned, in a sense, would it have made the present cleanup job easier, and is pre-planning of retrieval perhaps an option?

MR. HOWARD: Don Howard, for the record. Obviously, in the 1950s if the plan was to retrieve it 50, 60 years later and you plan that ahead, it's almost like using the example that if you were to develop a process and in designing that process you think about, okay, here's the process, here's what I want to accomplish, what waste am I going to produce; so then I have to think about what the wastes I'm going to produce in order I -- can I manage that when I produce it?

So if you bury something and the intent is to retrieve, then you take that into consideration.

Again, with the geologic repository that the DGR is proposing, in this case here is that -- my opinion is that it can be retrieved. You have to plan it out. You have to take into consideration some of the difficulties that you would encounter after -- depending on the length of time that this material has been underground and certain conditions that you may encounter, but it can be retrieved.

MEMBER MUECKE: Sorry, maybe it's semantics here, but in terms of what you're telling me . . . were you implying that pre-planning of retrieval may be an option? or are you saying what OPG presently presents the case is retrieval is possible?

MR. HOWARD: Don Howard, for the record. I guess what I'm saying is that retrieval is possible but is not being planned.

MEMBER MUECKE: Thank you.

DR. THOMPSON: Dr. Muecke, if I could just add some information in terms of what Mr. Howard has presented. One of the things he mentioned is that it's being done under regulatory oversight and there's a number of programs that the licensee had to put in place to meet regulatory requirements.

One of those programs is the radiation protection program. And so in the same fashion if retrieval in the Deep Geologic Repository was being considered, the issue that Dr. Edwards talked about in terms of the gas that's been generated -- you know, remember that one of the intrusion scenarios is drilling to the repository in the area, and the dose to the driller was 0.8 millisieverts per year. So that's not a very high dose. So we agree that gas will be produced. It's been taken into consideration, but the reality is it's not highly toxic. The dose is below the public dose limit.

But having said that, if we were to, at some time in the future, retrieval would be necessary, it would be done under regulatory oversight with the radiation protection program that would look at the conditions and the precautions that would need to be taken by workers. But with the information we have in the assessment the doses would not be significant.

THE CHAIRPERSON: Thank you. Dr. Edwards, we do have some questions for you from other participants.

DR. EDWARDS: Is it possible for me to make some comments following on what was just said by CNSC, or not? Because I do disagree with some of the things that were said.

THE CHAIRPERSON: I think it's really -- the purpose of your ---

DR. EDWARDS: Yeah, I understand.

THE CHAIRPERSON: --- presentation is to provide us with evidence, then ---

DR. EDWARDS: Right, I understand.

THE CHAIRPERSON: --- we test ---

DR. EDWARDS: --- Okay, I'm just --

THE CHAIRPERSON: --- your evidence.

DR. EDWARDS: --- asking.

THE CHAIRPERSON: Yeah. Mr. Bourgeois, did you have a question?

MR. EUGENE BOURGEOIS: Thank you, Madam Chair. I actually have two questions for Dr. Edwards, if I may.

The first is, does Dr. Edwards have any insight into how and when the definitions for high level waste and used fuel wastes came to be changed so that all high level wastes now are referred to as used fuel wastes, or as, in the 1980s, the IAEA identified high level waste separately from used fuel wastes, and the Province of Manitoba codified those definitions in its *Nuclear Waste Act*?

THE CHAIRPERSON: Dr. Edwards, you could try, but I think CNSC might be able to help out with this as well.

DR. EDWARDS: No, I can't cast much light on that. But I would like to say that I do believe that the classifications that we have of radioactive waste are woefully inadequate. Just classifying them as high level, low level, and medium level doesn't do any kind of justice to the problem.

I think that they were based on the problem of workers managing to store these wastes in the short-term. What the workers need in order to be able to transport the waste, what levels of protection they require, that's a totally different question as to how toxic these materials might be if they escaped into the environment.

And so I think that we have a need for a complete revision of our classification scheme of radioactive waste in Canada. It's very much inadequate.

THE CHAIRPERSON: CNSC, could you shed some light on this?

MR. HOWARD: Maybe I'll start off with the International Atomic Energy Agency's definitions. Essentially, internationally, when we talk about high level waste, we're talking about spent fuel, irradiated nuclear fuel. Reprocessing waste is also high level waste in the international area.

And basically the high level waste is material that contains long-lived isotopes, consideration for heat dissipation has to be taken into consideration, and [it] can go critical. So internationally, that is the scene and that's how the International Atomic Energy Agency has defined it.

In Canada, we do not reprocess waste or spent fuel. So therefore, we do not have reprocessing material. Maybe I'll quantify that a little bit. We have a bit up at Chalk River where they did do some research work on reprocessing, but it's very small in nature.

But generally, the bulk of the material in Canada is irradiated nuclear fuel, not reprocessing waste, and therefore, that's why we kind of make the link high level waste equals irradiated fuel for Canada. On the international scene, as I said, there are other types of wastes for reprocessing, which are classified as high level waste as well.

THE CHAIRPERSON: Mr. Bourgeois, did you have other questions?

MR. BOURGEOIS: Yes, and thank you for the answers. The other question I have concerns an experience I've had where the nuclear industry has made threats to me not to speak out publicly.

And I wondered has the nuclear industry made any threats, either in writing or warnings, to Dr. Edwards about speaking publicly?

THE CHAIRPERSON: Dr. Edwards, I'll leave it at your discretion if you would like to answer this question.

DR. EDWARDS: Well, I would say yes I have, but I don't think these are things that are easy to document and so I can only say that yes I have.

THE CHAIRPERSON: Ms. McFadzean?

MS. McFADZEAN: On Monday, I asked the question about the retrieval issue and I'm very happy to see that Mr. Muecke has picked up on that again because I did receive the same answer on Monday that he received today.

And you kindly asked me, Dr. Swanson, if I was satisfied with the answer and I said no, but that there were people behind me waiting to ask questions.

So I want to just go back since there's an opportunity today to talk about retrieval and say that my question is still on the floor and I don't feel that it has been adequately answered.

I'm understanding from today's answer that we may be looking at 50 years. There's some experience with 50 years in a pre-planned retrieval situation in another kind of waste repository other than the one we're talking about, so I guess my question still stands.

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Do we have sufficient evidence that, should there be an accident or malfunction, that we will be able to retrieve this waste over the long-term?

I need to put that out again. I don't feel that it has -- I don't feel comfortable that it's been answered.

THE CHAIRPERSON: So Ms. McFadzean, I think the key words in your question are "do we have sufficient evidence". Yes? OPG, would you like to address this?

MR. KING: Frank King, for the record. I really don't have too much additional to add to what I said earlier. Maybe there's just two points though. What is going into the DGR is waste. There isn't any intent to retrieve. There isn't an identified need to retrieve. If there was an intent, we would call it storage. But in international definition, disposal is where there is no intent to retrieve. That's the difference between storage and disposal.

If, at the time this facility gets licensed and goes ahead, at the time of decommissioning licence I think this would be looked at in great detail prior to getting authority from the CNSC to close the repository.

Society, at that time, would want to have an extremely high level of confidence that there would be no need foreseen at that time to retrieve because you are making it much more difficult, as I described earlier, by closing the shaft.

THE CHAIRPERSON: Thank you, Mr. King. Dr. Greer?

DR. SANDY GREER: Thank you. I have a question for Don Howard. You mentioned that in Port Hope the CNSC is involved with taking waste management, retrieving waste management from a facility there and putting it somewhere else in a long-term facility in the next seven years.

Could you please clarify how you would characterize that waste? Is it low, intermediate or high? Why is it being retrieved? Outline the process of retrieval and identify where is the long-term facility. Where it is going to be taken? Thank you.

MR. HOWARD: There are essentially two projects in Port Hope. I'll talk about Port Granby, which is the simpler one. Port Granby is located along the bluffs of Lake Ontario, and the bluffs are eroding, so basically the intent is to retrieve that material and move it inland to an engineered long-term facility. So that's the reason why that one is being looked at. Otherwise, there would have to be some major shoring of the bluffs and stabilization of the waste itself at Port Granby.

Now, the other thing is the Welcome Waste Management Facility -- and before I go on to that one, something came to mind. Basically, in answer to Dr. Greer's comment, we are not doing the work. This is Atomic Energy of Canada that's been contracted by the federal government to do this work. We are the regulatory agency. We are the licensing agency and the compliance agency to ensure that they do it safely and protect human health and the environment, so I want to make that clear. CNSC is not doing the work.

The Welcome Waste Management Facility: basically, there's two components to that.

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A lot of the uranium contaminated soil was deposited near surface and a very thin coat of overburden was placed on it, so that needs to be moved into a long-term waste management facility.

In addition to that, a lot of the material in and around the conversion facility in Port Hope -- there's some uranium-contaminated soil in that area in some of the municipal lands and in some back yards of some of the property owners -- so all of that is going to be retrieved and moved into a long-term waste management facility.

Now, all of this waste is what we would classify as low level, long-lived radioactive waste.

DR. GREER: Thank you. I'm sorry if I missed where you said it was going, or has that been identified yet?

THE CHAIRPERSON: Mr. Howard, can you clarify again just quickly where it's going in both instances, Welcome and Port Granby?

MR. HOWARD: For Port Granby, the material is going to be retrieved and is being moved on property that is owned by the federal government, if memory serves me right, about 700 metres inland away from the bluffs. And in the Welcome Waste Management Facility, the waste is going to be -- is going to remain on site, just retrieved and put into a more engineered facility. And as I said, the material in the town itself will be retrieved, transported to this facility.

DR. GREER: Thank you. I just wanted to know whether you're using a new process to undertake this activity of retrieval and storing it somewhere else, or has this been done before?

MR. HOWARD: Again, in moving this material, it's -- we're moving soil. Soil has been moved for quite a while. Under our regulatory framework -- basically Atomic Energy of Canada is moving soil, but this is radioactive soil, so basically, they have to have the proper programs and procedures in place, such as radiation protection, and they have to meet transportation requirements for moving radioactive soil.

THE CHAIRPERSON: Thank you. Okay, so that would conclude the questioning. Thank you very much, Dr. Edwards. Oh, yes. Could you give us an estimate for the date of the undertaking you agreed to, which is with respect to providing us with evidence on rolling stewardship?

DR. EDWARDS: I will provide the evidence as soon as I can. How soon would the Panel require it? by the end of the hearings? or earlier than that?

THE CHAIRPERSON: By the end of the hearings would be sufficient.

DR. EDWARDS: Okay. I would like to add that rolling stewardship is a relatively new idea, but I think it's a viable idea and it's really prompted by the failures of the human race to dispose of anything.

THE CHAIRPERSON: Thank you. So if we could suggest October the 11th, which is actually the day immediately before the final day, that would be very much appreciated. Thank you so much.