

Advances in Social Aspects of Nuclear Waste Management

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It is a pleasure to be here with you today and to talk a little bit about a broader view of repository programs around the world and maybe focus in on some issues that are of relevance to Canada.

When I got to the airport here in Ottawa and got into the taxi cab a couple of days ago and asked the driver as I usually do, "So, how you doing?", and his response was, "I'm doing great! I'm always happy when the weather is good!" I smiled for a minute. As a fellow from California who grew up in Miami, Florida, that's an interesting perspective and one that I wouldn't naturally come to. But of course, what he was saying I believe was as long as that airport is open and planes are coming in and out, and as long as the roads are good and I can conduct my business, the weather is just great.

That's an important point believe it or not, in the repository world and one of the things that we've come to learn, is that it's really important not just to talk at people. I think this is true more broadly in the nuclear community in general, it's as important to ask the right questions and to listen to people and to respond in order to be successful. I think that's particularly true in repositories and it's probably taken us a long time and some real agony in a variety of countries to come to that understanding.

What does a repository world look like? We have heard a bit of this and I'm going to skip over a few slides because both Ken and Kathryn have mentioned a number of these things. Beginning with 1957 - So now for more than fifty plus years, there has been a general consensus around the world that the most favorable way of thinking about disposing of high-level radioactive waste (whether it's un-reprocessed or reprocessed) is to find a stable deep geologic repository formation somewhere in the earth., drill down there, put the waste down there, watch it for a little bit to make sure it's not going anywhere, then put the plug back on.

The technical communities around the world have great confidence that if you find a suitable site, they can do the science and technology and engineering in order to demonstrate to themselves, to the regulator, to the public, that indeed this site will keep the waste from the accessible environment for essentially forever. These wastes are potentially hazardous as we see them now for hundreds of thousands of years, some would say even longer and therefore maintaining its isolation from the accessible environment is the objective.

It is interesting to note around the world that there are a whole variety of different kinds of rock types that had been investigated. Different countries have different suitable formations and by and large, we have been fortunate to find that many, many different types of rock (whether its granite, as in the Canadian Shield, or salt, or tuff, which is a volcanic rock in the U.S, or clays...) all seem to hold promise if we find suitable sites. Nevertheless with this consensus in this great scientific and technical work, almost all programs have experienced great difficulties over the last decades and particularly with the most important issue being siting. You know the first law of physics is that everything has got to be somewhere and eventually this waste has to be somewhere. For the time being that waste is being held most places, where it was produced. In

some countries it's brought into centralized storage. In a few countries it's brought to central locations and being reprocessed, but in all cases finding the site for the ultimate disposal of that waste is problematic because of a number of things. That waste is hazardous for essentially forever as I said, or for extremely long periods of time. People are concerned about their safety, people are concerned about the credibility; people are concerned about the social stigma attached to this. In Nevada, for example, people are very concerned about the image of the tourism industry upon which Nevada rests (Much of its economic benefit), so those kinds of things come very much into play.

As a result, what we have seen over the last (let me say) 20 years, is that a number of new ideas have become prominent in the repository world. I've listed some of them here: The idea that you should go where there is a voluntary community. We hear that in Canada, we're hearing that more and more. That is not always the case. In the case of the United States, we look for what was seen to be scientifically the most promising site and then we tried to select that and figured that we would convince local communities. In retrospect, that probably wasn't such a terrific way of looking at it. It seemed at the time, to be good. That's not so much the case. The idea of retrievability is something that has come to the forefront recently. In the beginning, the idea was, you would find a suitable formation, put the waste down there, watch it for awhile, put the plug back on, put a sign on top that says, "Don't dig here" and walk away. That kind of idea is no longer prominent - more often than not, most countries are talking about extended retrievability.

The idea of monitoring -Most scientific people will tell you that there is no need to monitor; this waste is not going to go anywhere. Well that doesn't deal with the social implications and the societal implications that people want to be sure that what you say is so, is indeed so. This idea of after-closure monitoring, even though they will probably not find much to report, has become more prominent. As Kathryn just described this idea of sequential decision making, phased-management, taking a stop along the way and asking yourself whether the path you're on still makes sense from time to time, is now very much appropriate. Even with all of these problems, hope continues to spring eternal. We see programs going forward even in countries where they have the experience lots of difficulty. So, let me just give you the short version and Claudio may return to some of this because he is very well informed on these.

Where do we stand with regard to repositories? I would say an enormous percentage of these programs have, at one point or another, either been abandoned, or the siting processes stopped because of opposition. Usually societal and political opposition occasionally because a site was chosen that was found to be technically insufficient. You see a list of countries here including Canada, where those programs essentially had a halt and some of them had not restarted as a result. In several countries we've already heard those mentioned, including Canada, re-reviews have been undertaken with a much more reflective nature on what it will take to be successful. Almost everywhere schedules have been delayed and with that, costs have risen.

Now a number of countries have continued to move forward, whereas others have re-started and we heard the talk this morning where the presenter talked about their affection for Finland and I have to tell you that when it comes to repository programs, Finland is probably the leader in the world. They have been doing things extremely well and as a result, have been quite successful.

Let's talk just for a minute about in the beginning. I think some of these lessons have applied more broadly to the nuclear industry as well and so we can see some of the things that happened. In the beginning, there were lots of different siting approaches taken, but a number of them took

what we affectionately call the “Decide Announce Defend”, Which was a group of people responsible for a program, got into a room and said, “Hmmm, lets do this” and then went out there and announced it to the public. Then when they got criticism or comments, they basically felt a need to defend the decisions that were made. They were made with very little involvement of stakeholders, very little transparency of how they reached those decisions and often they were made, because they were seen to be politically expedient (We’ll go wherever we can make this happen). Lots of political and societal backlashes occurred, understandably, now predictably, and so fresh reviews were undertaken and a number of societal decisions started to inform the way in which programs were put together and i’ve already mentioned what some of those are.

Where do we stand now? I put optimistic in there, because at any point in time these programs can, and will have difficulties. There is no formula for guaranteed success in siting a repository program. It is a difficult, time-consuming, iterative process to get to success.

There are some countries that have candidate sites. Finland has a site, Olkiluoto. It seems to be going extremely well. Sweden actually has two sites competing (both at reactor sites) for the privilege of being the host repository site. The U.S of course now has Yuka Mountain, I can’t think of a time in the last twenty years where Yuka Mountain hasn’t felt within 6 months of going over the edge. It’s like the Perils of Pauline, they’re tied to the railroad tracks and the train is coming around the bend, constantly. So that has led to continuing short-term, sub-optimal decisions in order to survive in the U.S and once again we see ourselves facing this situation and it’s quite serious in the U.S. We may indeed see Yuka Mountain coming apart in a variety of ways with the new administration, we’ll have to see.

A number of countries have programs underway as we speak. Other countries are kind of thinking about it. Some of these countries had moved forward, had opposition, like Spain, and said, “I think we’ll go into a Hiatus for the time being”, and a number of countries are starting out with their repository programs. They are insipient, nuclear countries. We have heard a number times about thirty countries with nuclear power in the world. Half of those countries have five or fewer power plants right now. There is one plant that is shared by two countries, so they own a half of a power plant. Are all these countries going to go through the cost and agony of building their own repository? It’s not clear so one of the things that is being considered now, are multi-national or regional facilities.

A few current issues, and we’ve heard this in the meeting here today, this idea of the linkage between disposal and new build. If a community is going to volunteer for a site, one of the things they are going to want to know is, what are they volunteering for? Therefore, the question of, “Is there going to be a new generation of nuclear power and how much more waste will be created and will I then have the obligation to take this never-ending increase in waste?” is a legitimate question. It is very important to define for people what the issue is and what it is you’re attempting to do.

This issue of direct disposal vs. reprocessing – It’s important to recognize that whether or not you reprocess, you will have high-level waste, you will need a repository. If some of these advanced nuclear concepts, Gen4 concepts, other concepts come into play, you may be able to reduce the amount and maybe the toxicity of the waste. In the end, there will be lots of waste that will be unsuitable for burning it in nuclear power plant that will require disposal and a repository. I think it’s important that we not lose sight of that and think that somehow we don’t need a repository. I think that puts the cart before the horse. If you want to have a nuclear industry, you better be able to demonstrate you know how to deal with the waste, rather than telling people, “I don’t know how to deal with the waste, but if you simply let me build yet more

nuclear power plants, yet more advanced power plants, I promise you I will solve it then". I don't think that works.

There's a lot of attention for regional and international facilities as i've mentioned. There are a lot of reasons for doing that. Among which is this growing perception (we heard some comments about GNEP earlier) about this growing linkage between the growth, but more importantly, the spread of nuclear power, the waste that's consumed and possible national security implications. If you think about not one, five, or ten years out, but twenty, thirty and even fifty years out, and the possibility of the spread of these facilities and countries wanting to develop their own energy security and therefore wanting their own nuclear fuel cycle supply. One can't imagine a spread of enrichment and/or reprocessing technology that would take every one of those countries to the doorstep of the nuclear weapon. If I had more time, I'd be happy to go into more detail with you about how every barrier between us and a nuclear weapon for a country is pretty well gone now with the exception of the access to the material. So, it's a very serious and growing issue.

Some key piece of the Canadian approach ...I'm not going to go through these because Kathryn has done a marvelous job. I just want to commend the Canadian Nuclear Waste Management Organization and the Canadian Nuclear Community because I really think this program has now moved to the forefront. I am asked all the time around the world to talk about this program. I come from the United States, I was in the Yuka Mountain program (I have the scars on my back to prove it) (laughter) and I get asked to go to Japan to give a talk. I said i'd be happy to talk. They say then by the way, we want you to talk about Canada.

I think that's a real tribute to the way this program is being run and hopefully your support will continue to allow it to be run that way. You're not the only ones, but you are pretty eminent in putting these things together right, particularly this focus on "process" being as important as "product". This is not just about building a facility and putting it in the ground. It is about building, understanding, awareness, and acceptance both within the Canadian society and within certain select locations that will actually have the facility and the transportation running through it. It's going to be a long term program. Even if it stays on schedule, a program like this will last a century.

This slide comes right out of the Canadian report. It was just lifted out by someone else and I've been asked to talk about this next week in Vanderbilt University, where they're doing a study to try and figure out what is coming next in the United States with the next administrations. The way the repository objectives have been described, that there is an obligation by this generation (which is benefiting from that nuclear power and thereby creating the waste), to begin to solve this problem and at the same time the recognition that this program will take a long time and that it is the intent of this program and the desire to maintain the flexibility for people in the future to choose what they see as in their best interest at the appropriate time.

You can't do that so well with most nuclear facilities. Most, you turn on a reactor and it's on. If you have a problem it's pretty hard to say, "Hmm...I wish I hadn't built that". Now you've got the problem, same with the repository plant. With the repository plant (because of its unique nature) you have the ability to do certain things to both developing the answer to the solution and provide the flexibility for people in the future to determine how they want to use it.

Let's talk about what makes nuclear waste management special? There are two issues: There's the technical issue, and the institutional issue. First of all, from a technical point of view, you have to demonstrate to a skeptical public and a regulator that indeed you can isolate this waste for geologic time periods. People will tell you that that's easy to do I don't think it's

so easy to do. I think it's a very difficult thing to demonstrate that you know how the waste will be isolated for a period of, let's say, a million years. Proof in the classical sense is not possible, you cannot do the experiment, and you've got to extrapolate. It requires the central role of what I call "iologists" Hydrologists, geologists, volcanologists, seismologists, climatologists, sociologists. It requires them all into work, in order to be successful.

On the institutional side, you have this extraordinary time-frame. People recognize this. We talk about how successful France is - they have fifty-nine nuclear power plants. 75% of the nuclear power has been exemplary program. When they tried to site their repository the first time, they had ten thousand protesters and a fatality. That program came to a stop. The Battai Commission was formed and they re-energized their program much more successfully by taking on many of the principles that we're talking about here.

Obviously, there are a number of other agendas that are linked to the repository. There are a number of people- we were all given martial badges that were environmentalists yesterday, but here are parts of the environmental movement, who would like to see a program like this NOT succeed. They see it as the Achilles' heel to the return to nuclear power. Those folks, who would rather not see nuclear power, would rather not see this program any time in the near future. People's values and ethics are in conflict here. The balance between the needs of our society and our generation vs. future societies and future generations is a very difficult one. We are indeed, taking the burden of nuclear waste from a variety of places and going to put it in one place. These ethical issues and these value issues are very important and need to be taken seriously.

Lastly this issue of Nuclear stigma is not just for nuclear waste (although it's enhanced by nuclear waste)...people are afraid of being afraid. It's like when you get on an airplane; there are people who are just afraid of getting on an airplane, not because the plane is going to crash, but because they are afraid of being afraid.

One needs to deal with these kinds of issues very, very straightforwardly. As I mention here, repositories are not like other facilities. They are passive - when you are finished, you can sit there and nothing happens. Anything that would happen will happen very, very slowly over geologic times and you ought to be able to create monitoring programs in place, to watch it for at least the early parts of the program to make sure that nothing is happening. It's not going to detonate like a nuclear weapon, it's not going to have an exothermic reaction, and the material if you design the facility appropriately, is retrievable. Therefore, it is only a repository when people in the future are comfortable in closing it.

No matter what we do or how much we wave our arms, unless we do something inappropriate, we can't decide when to close that facility. It'll be our grandchildren's grandchildren, who will decide when to close that facility and only when they are comfortable and confident that it's the right thing to do. These are virtues that can be exploited for good reasons.

I just want to talk about some key enduring features that I believe are necessary. I think these are necessary in management in general and in nuclear business, but particularly for the repository. It is very important that there be a convincing need established for the facility. When people tell you that you can store this waste safely for decades, it's absolutely true. There is no question about it, and therefore it is easy to push this pebble down the road. Many countries do that. That, I believe, is not a responsible thing to do and it is not consistent with the objectives that have been laid out by NWMO and other countries. It's very important to recognize why this program is being conducted, why countries need a repository program in

order to move forward. People will not accept things if they think it's being done for less than legitimate reasons.

You need a core stable goal, that's part of the problem in the U.S. Somebody mentioned about GNEP. Absolutely right – GNEP is in trouble. I was involved and still am, I am on an advisory committee, the GNEP. . GNEP is in trouble because from the outside point of view, from the Canadian point of view and from other countries' point of view, it's just the next set of initiatives coming out of the U.S, but the next set of ideas that will change with the next administration. We have a great deal of difficulty. What's the saying, "Never ended, often wrong?" That right there is a perception of some of that.

GNEP has some very laudable goals. It's really important for the reasons I briefly mentioned before, about this coming spread of nuclear power. GNEP is the attempt to do what Eisenhower did in 1953 with the Atoms for Peace speech. When he saw a growing Soviet threat, and tried to galvanize the world in a way to deal with that. A lot of what he proposed didn't come into place, but out of that came discussions that lead to the IAEA and International inspections lead to the Non-proliferation Treaty and so forth.

Some bad things came out of it to like the spread of reprocessing technology but that's what GNEP is intended to do. It may or may not succeed, it will probably morph - that is my prognostication for it.

It is very important to continue this clear, open and transparent process that NRC has undertaken. It's very important to recognize that whatever fairness and societal consent means, you need it. It won't be successful in a program like this, (we've seen data point after data point in that regard) and it's also important to recognize that the communities need to be partners in this. Not just given money, but partners in decision making and given the kind of compensation that will allow them to lead lives in the way that they think is best for them. It's like the taxi driver thinking what definition of good weather is.

I will finish by just talking about a few potential lessons learned. There's a famous coach named John Wooden, who was a basketball coach for UCLA for a long time. He's ninety-seven right now and still going. He had a number of wonderful statements and one of the wonderful statements he made was, "Be quick, but don't hurry". That is what you have to do in programs like this. You have to be quick, you have to be ready to move forward, but you cannot move too fast or you will pay the consequences and we've seen that a number of ways.

The societal aspect - This is a really exciting thing when you talk about involving the youth. This is really an exciting program for people to spend their careers in because it has technical, scientific, cutting-edge issues, societal issues, policy issues, security issues, and this whole issue of understanding all of those dimensions is really important in order to be successful.

I'm going to skip some of the rest of these because I think that they are already been covered but I just want to end by saying that the most important thing in the nuclear business and in the repository business and in particular to be successful is trust and confidence. We have to develop and earn the trust and confidence of the people who we are serving in this regard.

There's three basic ways that I believe you earn trust and confidence. First, you demonstrate your competence – you know what you're doing and you have a track record of what you're doing. Second, you make decisions that are clearly in the best interest of the people that you're serving. Third, you listen. Listen to their concerns, you make promises that are directly responsive to their concerns, you deliver on that and then you do it over, and over again.