

Speaking Notes

for

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Toronto Board of Trade

March 16, 2011

8:00 am

Good morning, everyone.

We have a lot to talk about today, but let me just say a quick thank you to Terry Maxey, the Global Lead for Nuclear Power Services at Accenture. And hats off to Accenture for sponsoring this energy series.

Also a special thank you to Carol Wilding, President and CEO of the Toronto Board of Trade, for inviting me to speak to you today.

First, our deepest sympathy, our thoughts and prayers go out to the people of Japan and their many relatives and friends in Canada during this dreadful time. In particular, my colleagues in Canada's nuclear community are thinking of the heroic efforts being made by nuclear power workers and managers at Fukushima and elsewhere, as well as the many emergency responders who are supporting them. We can't begin to imagine what kinds of sacrifices they must be making and what kinds of experiences they must be going through.

At the end of my address, I'll be inviting you to talk with some of the leaders of Canada's nuclear community.

Now, the facts are that Japan was struck by an earthquake measuring nine on the Richter scale, and major services including the electric grid were damaged. The subsequent tsunami caused vast destruction in coastal areas, including to the back-up power systems serving the Fukushima nuclear power plant.

There was no significant earthquake damage to the plant itself. Let me emphasize this. A forty year old reactor complex, that was designed to withstand a 7.8 or 7.9 earthquake, actually withstood a much larger quake without significant damage.

It was only because the tsunami ripped out power lines and contaminated the fuel of the backup power systems, that the situation deteriorated.

The plant shut down automatically, as it was designed to do. However, without their primary or secondary sources of electricity, the cooling systems have not functioned. The operators have had to resort to other methods to cool off the reactor cores in the period following shutdown. And hydrogen gas accumulating as a result of these steps has led to external explosions. Significant areas around the plant have been evacuated.

The resources and spirit of the Japanese people are being tested by events of which the reactor problems are only one part. They are facing their present challenges with preparation, enterprise, intellect, solidarity, and courage.

Before I return to Japan, let me state some facts about nuclear generating plants in Canada. All Canadian nuclear power plants have been designed to withstand earthquakes. Both the structures and the safety systems are designed and built to seismic standards – even though they are located in areas where major earthquakes and tsunami are NOT expected.

As for the reactors that provide Ontario with fifty percent of our electric power : Again, these reactors are at sites where major earthquakes are not expected, and the Great Lakes near which they are located are highly unlikely to produce a tsunami that would damage them. Even so, the reactors have been built to resist earthquakes stronger than those that are likely to occur in Ontario once in 1,000 years.

The containment structures in which the nuclear reactions take place consist of thick reinforced concrete with steel linings. The containment for every reactor is linked to a vacuum building. If steam builds up in a reactor's containment, it flows to a vacuum building, where a massive pool of water flows down from the top of the building and cools it.

Each reactor has two shutdown systems. The reactors also have considerable redundancy in back-up power supplies. Across our nuclear fleet there is a mix of standby generators, emergency power generators and auxiliary power generators with varying degrees of seismic qualification providing a safety net of redundant power supply.

Over the last several years, the plant operators have invested in upgrades to these systems, and also to fire suppression systems, as part of a comprehensive program of ongoing safety improvements. For major earthquakes, those occurring once every 1,000 to 10,000 years, all of the seismically qualified generators and some of the non-seismically qualified generators will be available.

We are proud of our safety record, but we are never complacent. The tragedy in Japan will of course be examined thoroughly for lessons we can apply to safety here in Ontario.

Japanese energy policy in recent decades has carefully sought a balance between efficiency and self-sufficiency. One result of that search has been a careful and informed decision to generate a substantial portion of their electric power – about thirty percent -- from nuclear. That's about twice the proportion we use in Canada, though somewhat less than the fifty percent that currently supplies Ontario.

Nuclear power generation requires financial capital and sophisticated engineering. It requires continuous improvement of safety and efficiency.

Nuclear plants also require minimal fuel, use relatively little real estate, and they have minimal emissions into the environment. These are all strong advantages in Japan's natural-resource-constrained society.

The Japanese – at least, nearly all of them – weren't born yesterday. They know the short- and long-term risks and effects of radiation. They know the relative costs of their energy options. They are absolutely top world leaders in energy efficiency. They have a

very good understanding of the risks to their society from such events as earthquakes and tsunamis.

No doubt a lot of Japanese have a lot to think about this week, and I can't read their minds. But somehow I do NOT think that when their working lives return to something like normality, many of them are going to say to themselves, "Well, I guess we were wrong about this whole nuclear thing. Let's crank up our efficiency programs, build some wind farms, and go back to burning coal."

No more than after 9/11, North Americans decided to stop working in tall office buildings, or to stop travelling by air.

Time will tell. But I can tell you this morning that that the events at Fukushima and Japan's other earthquake-affected plants are being studied exhaustively, as all nuclear incidents are.

They are being documented thoroughly and that data is being shared globally. The engineering of existing and planned power plants is already being reviewed. The process of continuous improvement will go on.

And nuclear plants will continue to get better and safer. Just like the engineering of natural gas pipelines, or high voltage power lines, or freight trains, or marine shipping, or any of the other complex and intrinsically risky systems on which our modern society relies.

By the way, in case you're wondering, all Canadian nuclear power plants have been designed to withstand earthquakes. Both the structures and the safety systems are designed and built to seismic standards – even though they are located in areas where major earthquakes and tsunami are NOT expected.

The plants currently in use in Canada are among the most robust designs in the world. Also, unlike most other reactor designs, they burn natural grade fuel, rather than enriched fuel. This not only reduces the radioactivity hazard in various ways, but also makes the fuel cycle more proliferation-resistant. That means it's more difficult to exploit by anyone wanting to acquire fissile material for illegitimate purposes.

Now, I know perfectly well, and so do most of you, that our friends in the anti-nuclear groups will use events in Japan to reinforce what they have to say. And that's fine; they can do that. I would just ask all of you listening, including those of you in the media, for two things.

First, do NOT accept just anyone with a microphone or a blog as being an expert on nuclear reactor technology. Please, please, talk to the qualified experts. Depending on what your technical question is, my organization can put you in touch with a wide range of the most knowledgeable people in Canada. Just give us a call.

My second request would be: do NOT be motivated, or manipulated, by fear. As a matter of general philosophy, fear is not a great basis for decision-making.

Instead, look for information that quantifies risk and makes it comparable. What is the known likelihood of an event? What is the known toxicity of a substance? How many people have actually been hurt or killed by an event? Those are the kinds of questions we need to ask. "How worried are you" is a perfectly legitimate question. But it is not the only question.

My colleagues and I will be happy to talk more about events in Japan, and more technical matters, after this. Let me just say that the world community of people involved in nuclear really is a community. There are about 71,000 of us in Canada alone. Because it's a highly skilled area, we attract talent from other parts of the world. So we have lots of international linkages as people.

And then there's the constant sharing of technical and management information that I mentioned earlier, whereby we all learn from each other's experiences, through such networks as the World Association of Nuclear Operators, the World Nuclear Transport Institute and of course the International Atomic Energy Agency. All of this is global knowledge, global expertise, based on global sharing of information, not the domain of any single country or company.

At the Canadian Nuclear Association's annual conference a few weeks ago, more than 700 delegates from over 15 countries joined us in Ottawa to discuss the future of nuclear in Canada and abroad. We heard about exciting developments in Canadian and worldwide nuclear research, and important commitments going forward here in Canada, such as Ontario's plans for new nuclear units and refurbishments.

We learned about new and emerging markets for Canada's uranium in China and around the world. Did you know that Saskatchewan has the richest deposits of uranium on earth? The energy potential of those reserves is equivalent to about twenty years of our country's current oil consumption.

Teams from India and Korea and Chile are coming to Canada looking for partners. New technologies, like small modular reactors, are starting to bloom. Yes, there are serious challenges, but the global nuclear community consistently rises to those challenges, in large part by working together.

I mentioned a minute ago some of the global organizations that share knowledge about nuclear. One I didn't mention is the Radiation Effects Research Foundation, based in Japan, which has some of the most advanced knowledge on the human health effects of nuclear. But did you know that Canada has also played a large role in this area?

Nuclear medicine really got its worldwide start in Canada in 1951 with the first uses of cobalt-60 radioisotopes to treat cancer. Canada has continued to lead in this area for six

decades – that’s six decades. Canadian-produced medical isotopes are used in over 50,000 procedures every day, worldwide, with 5,000 of those in Canada. Every day.

Medical isotopes are used in targeted cancer treatments for a variety of conditions, including liver and brain cancer, and non-Hodgkin’s lymphoma.

Isotopes are also used for medical imaging, and Canada supplies over half of that market worldwide. These images enable physicians to diagnose and treat all kinds of diseases including cardiac conditions and several types of cancers.

Another thing that’s noteworthy about this technology is that isotopes decay quickly – in a matter of days – and must be delivered within that timeframe, everywhere in the world that treatments take place. That means that the Canadian suppliers of these isotopes not only run a complex production and packaging operation for radioactive material. They also run a sophisticated, just-in-time global shipping operation to get that material across the globe every single day.

By the way, Canada also supplies three-quarters of the world’s Cobalt-60, which is a sterilizing agent. In fact, Cobalt-60 is used to sterilize nearly half of the world’s single-use medical supplies and devices—things like bandages, catheters and syringes.

This same technology is also used to sterilize a vast array of food and other consumer products, many of which we rely on in our everyday life – such as contact lens solution.

So there are benefits here – actual, quantifiable benefits from nuclear technology in terms of lives saved or extended, illnesses and infections avoided. And Canada is connected to a worldwide system of expertise that delivers those benefits consistently, and with excellence.

Now, let’s turn to another global community: the community of people working to address issues of atmospheric quality and climate change.

I mentioned earlier, in my discussion of Japan's energy policy choice, that nuclear power plants emit virtually no greenhouse gases.

The Canadian Energy Research Institute analyzed greenhouse gas emissions from various power generation sources and concluded that energy generated from nuclear power plants results in emission levels that are much lower than coal, oil, or natural gas. In fact, the emissions profile of nuclear energy is similar to those of wind, solar and hydro.

Our country is still, in 2011, generating more electricity from its more than fifty fossil fuel plants than it generates from its approximately twenty power reactors.

If we did not have the nuclear power plants we have in Canada today, and instead relied on fossil-based electricity for that output, our country would generate an additional 90 million tonnes of greenhouse gases every year. That would add about 12 percent to our annual greenhouse gas emissions.

Further replacing fossil-based energy with nuclear energy can have a very positive impact as we strive to lessen our country's, and the world's, carbon footprint.

Nuclear's low emissions, low fuel costs, and low real estate needs were already attractive to many countries before we started talking about either capping carbon emissions, or putting a price on them.

With each passing year, the global community of people who care about the environment have more and more in common with the global community of people who provide nuclear power generation – and who are continually striving to improve its safety, its economics, and its environmental performance.

Which brings me to the economics.

All of us want an economy where high paying, highly skilled jobs are plentiful, and a growing nuclear industry is helping to make that happen.

A recent report (July, 2010) by the Canadian Manufacturers & Exporters showed that just two projects alone—the refurbishment of nuclear facilities at Bruce and Darlington—will support 25,000 high-wage jobs for a decade, injecting \$5 billion annually into Ontario’s economy, and leaving us with better infrastructure that will serve our households and industries for another generation.

What about the cost, in terms of your power bill? The misleading perception that anti-nuclear groups want to leave you with is that costs are just too high.

As a business audience, you know that we could have a very long conversation about cost accounting. But instead, let me just sum up three reasons why comparing the costs of various sources of electricity can be misleading. Those three reasons are: longevity, stringency, and external costs.

Longevity refers to the time frame involved. Nuclear reactors can be made to run for fifty years or longer.

This is the first major reason why the costs of nuclear can be misinterpreted. Our fuel costs are a very low proportion of operating cost – and that lowers our risk. But our financing challenges are different.

Changes in interest rates can hurt our economics, in much the same way that changes in fuel costs hurt the economics of other sources of electric power. Reasonably priced capital and well-hedged financing arrangements have to be part of the nuclear picture.

The second reason is stringency. Because of the unique degrees of monitoring that our industry is subject to, our engineers design things for levels of safety and reliability that

go well beyond what is expected of other industries. And the degree of over-engineering keeps going higher and higher.

The third concept is external costs. Some economic activities simply do not cover, in their own cost structure, all the costs that they impose on society. The costs that don't get accounted for are called external costs. Atmospheric emissions are a classic example of the emitter not paying the full cost of environmental impacts. Such costs mean that the comparisons we make among competing industries may not be accurate. Now, nuclear is an example of an industry with very few external costs. That's because we occupy small pieces of real estate, we release virtually no emissions into the broader environment, and we produce spent fuel and other radioactive materials that are very small in volume, very strictly monitored, that we mostly keep and manage ourselves.

As a result, we account for the full costs of packaging, managing, storing and disposing of these materials. Which means that those costs are built into the price of nuclear power.

I promised not to get you into a long talk about cost accounting. So let me just leave you with the bottom line: fair comparisons can be a challenge. Longevity, stringency and external costs all tend to bias the comparisons of cost of power in ways that work against nuclear. Even so, when careful and comprehensive comparisons are made, nuclear comes out looking reasonably competitive.

According to studies conducted by the Organization for Economic Cooperation and Development – the OECD -- the overall cost to the consumer of nuclear power over the life of a nuclear power plant is similar to that of large-scale hydro, natural gas and coal, and much lower than wind and solar.

And that's before we start putting a price on carbon emissions. You can imagine what happens then: Every dollar that's put on a ton of carbon makes the economics of nuclear look better and better.

Toward all of the outcomes I've spoken about today that the global nuclear community is working toward and sharing... the continuous safety improvement . . . the medical advances ... and the clean energy ... research and development has played a fundamental role.

I think most of us have an appreciation for R&D, and how it advances our productivity and therefore our living standards, and how important the international exchange of talent and knowledge is in these advances. Let me just talk briefly about some of the more specific benefits of nuclear research and development.

Nuclear R&D provides facilities and services that are widely applicable to non-nuclear sectors, such as materials science. Neutron beam testing can only be done at major nuclear facilities. This testing is applied almost daily to new materials or new parts and products made from these materials. It's an irreplaceable source of insight into how parts and materials perform under certain kinds of stress. Neutron beam testing not only reveals this information, but does it without destroying or damaging the sample being tested.

In this way, nuclear R&D – particularly our larger facilities -- supports materials testing and product improvements, medical products and services, training and development of scientists and engineers, and other activities of high value to an advanced economy.

But to bring nuclear R&D down to earth, I want to touch upon examples of how it affects our daily lives.

Your computer hard drive for instance, which keeps safe your families' photos and other documents, was developed using nuclear technology.

Nuclear R&D helped the Quebec paper industry cut energy costs by ten percent. Our innovations have led Quebec's paper producers to reduce their energy use and save over six million dollars a year as a result.

And the bridge you might cross to get to work everyday was made more durable and reliable because of nuclear R&D and its applications.

It also contributes to the health sciences. To mention just one example, scientists are studying nanostructures to design carriers for therapeutic agents that can target cancer, Alzheimer's disease and more.

These advances are not just enjoyed in Canada. They are enjoyed everywhere in the world where we sell our products.

And in every country that sends samples to Canadian R&D facilities for testing and analysis. These advances offer opportunities for developing countries to raise their quality of life.

My friends, I began by addressing the crisis in Japan. Along the way I asked you to talk to the real and qualified experts, not the self-proclaimed experts, on nuclear technology. And I asked you not to be motivated only by worry, but by thought and inquiry.

The crisis is raising many questions and provoking discussion and dialog, which we welcome. But one of those questions is NOT, "should the world use nuclear technology?"

We know that nuclear technology is an integral part of our interconnected, sophisticated modern world. It is an integral part of modern medicine. It is an integral part of food safety. It is an integral part of advanced materials and manufacturing. It is an integral part of a balanced energy supply portfolio. And it is an integral part of the solution to the energy needs of a carbon-constrained world.

The 71,000 Canadians who work in nuclear are an integral part of all these things. We are providing a broad spectrum of products and services that benefit not just Canadians, but potentially all humanity.

Again, the hearts and thoughts of those 71,000 Canadians go out to the people of Japan today.

With that, I want to thank you again for inviting me to visit with you this morning.

I told you to talk to the experts, and in fact we've brought them to you. Several of the leaders of Canada's nuclear community are in the room with us right now. So we'd like to talk with you and hear from you.

Let me invite Duncan Hawthorne, CEO of Bruce Power, and one of the experts on our industry, to take the stage for a few minutes. Following the Q&A, we will be available - along with other leaders in our industry - in the lounge to do a media briefing for the journalists who have joined us this morning.