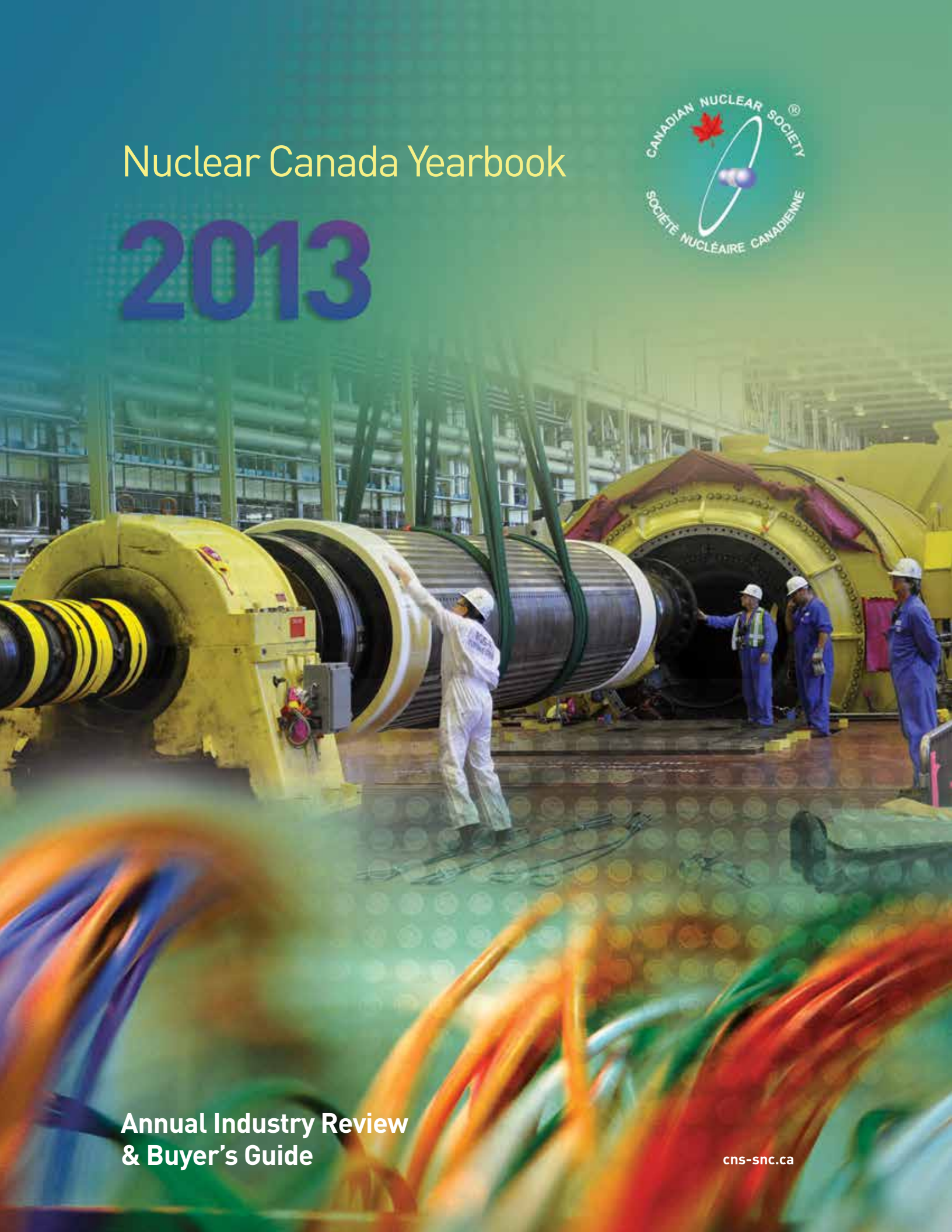
Nuclear Canada Yearbook

2013



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CNS President's Report

By John Roberts

John Roberts

The past year has been a challenging one for the Canadian Nuclear Society (CNS), marked by signficant achievements both by Canada's nuclear industry and the Society. Perhaps the most outstanding achievements during the past year were the return to service of Bruce A Units 1 and 2, and the Point Lepreau nuclear reactors. In the case of Bruce, this is the first time ever that nuclear reactors of any kind have been returned to service after a prolonged shutdown of more than 10 years.

By contrast, the CNS was disappointed by the partly-political decision to close Gentilly 2 rather than undertake refurbishment. While the CNS understands the economic decisions at play, we are of the view that isolating itself from operating nuclear technology may not serve the province of Quebec well in the years to come.

During the past year, the CNS has held a number of successful events, perhaps most notably the Annual Conference in Saskatoon. Attendance at the conference was strong; the number of technical papers was high. This was in large part due to strong support from our corporate sponsors and the Government of Saskatchewan.

Also during the year, the CNS launched a new series of courses, Nuclear 101, a training course intended for communicators in the nuclear industry. Demand for this course has proven to be so strong that the CNS is striving to increase the number of these course this year and for the years to come. There were a number of other successful conferences and courses during the year, details of which can be found in the Program Chair's report.

A new initiative on the part of the CNS began in 2012 with its participation in the federal government's request for expressions of interest in AECL. Based on that experience, CNS Council has decided that the Society shall become more active in participating in public hearings and licence procedings.

The CNS was also confronted during the year with the need to comply with new legislation – the Not For Profit Corporations Act. This statute requires some important changes in the CNS By-Laws. These changes will be proposed to the Membership during the 2013 Annual General Meeting and a special Meeting of the Membership during the fall.

The Society was greatly saddened by the death of Jim Harvie in 2012. Well known to all the Society's members, Jim was a Past President of the CNS and former Director of Reactor Regulation at the Canadian Nuclear Safety Commission.

For the past several years, the CNS has been striving to introduce new, younger members into Council coming from a wide variety of professional backgrounds. I would like to thank the new members for volunteering their time and services to the Society, and the support of their employers, particularly given the already extensive demands upon these members at the beginning of their professional careers.

In closing, I would like to thank the Council, Branch, Committee and Division Chairs, and the CNS Staff for their hard work and dedication during a demanding year. I would also like to thank Frank Doyle for his leadership in securing PBNC for Canada for 2014. And finally I would like to thank Jacques Plourde, incoming 1st Vice President, for his work in establishing the joint industry-Society task force.

Point Lepreau returns to service, October 23, 2012.

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2012 Year in Review

By Colin Hunt, Publisher and Editor
Nuclear Canada Yearbook

Colin Hunt

Overview

The past year has been a very successful one for Canada's nuclear industry. It marked the successful completion of a number of large nuclear reconstruction projects and the return to service of three of Canada's reactors, Bruce Units 1 and 2, and Point Lepreau in New Brunswick.

With respect to Canada's nuclear research infrastructure, the federal government started a process to reorganize the mandate of Atomic Energy of Canada Limited's (AECL) Chalk River Laboratories, following the 2011 sale of AECL's reactor design division to Candu Energy Inc.. When completed, CRL will have a renewed path for nuclear research and development.

Nuclear Power in Canada

Refurbishment Success

Perhaps the most important events for Canada's nuclear industry in 2012 were the return to service of three nuclear reactors, Bruce Units 1 and 2, and Point Lepreau. These represented first-of-a-kind events, not just for CANDU reactors but for all power reactors world-wide. On April 21, 2012, Bruce Unit 2 generated steam for the first time since October 8, 1995. Never before has any power reactor ever been successfully returned to service after being idle for nearly 17 years.

And the importance of the restart of Bruce Units 1 and 2 was that this was the first time that a CANDU reactor had been completely refurbished. The refurbishment program included a complete overhaul of the reactor itself with replacement of all pressure and calandria tubes. It also included replacement of the steam generators for the first time in any CANDU reactor as well as refit of the turbo-generator set.

Bruce 1 was resynchronized to the grid on September 19, and Bruce 2 was connected on October 16.

The return to service of Bruce Units 1 and 2 is also the first time that any of the large CANDU reactors designed by Ontario Hydro have undergone refurbishment. This technical first was made possible in a multi-unit reactor station by successfully isolating the two reactors under refurbishment from Bruce Units 3 and 4 which continued to operate throughout the construction program.

The CANDU 6 Reactor Fleet

Unit	In Service	Capacity (MW)	Performance In 2012 (%)	Lifetime Performance (%)
Point Lepreau	1983	680	0*	55.4
Gentilly 2	1983	675	71.9	76.9
Wolsong 1	1983	622	80.1	87.9
Wolsong 2	1997	730	92.7	94.1
Wolsong 3	1998	729	88.8	94.9
Wolsong 4	1999	730	98.6	96.1
Embalse	1984	648	65.8	83.8
Cernavoda 1	1996	706	87.5	89.7
Cernavoda 2	2007	705	98.8	94.8
Qinshan 4	2002	700	96.3	91.1
Qinshan 5	2003	700	90.5	91.2
Total		**7625**	**79.2**	**86.9**

COG CANDU/PHWR Performance Indicators, December 2012.
*These reactors were under reconstruction during part or all of 2012.

New turbine rotors for Unit 1 arrived in August. Existing rotors, previously refurbished, have been designated as spares for Units 2 and 4. (Bruce Power)

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It should also be observed that this was the first time that private, not public, capital was used for such an extensive reconstruction of a CANDU reactor. This project demonstrates that CANDU technology indeed can be attractive to the private sector.

The restart of the Bruce A reactors will be explored in more detail in this Yearbook.

In New Brunswick, Point Lepreau completed fuel loading on April 10. Following hydrostatic and other testing, NB Power received permission from the Canadian Nuclear Safety Commission (CNSC) to restart on July 23. The reactor was synchronized to the grid on October 23, almost precisely four years after it was taken out of service on October 28, 2008 for its refurbishment outage.

The return to service of Point Lepreau was of vital importance to the province of New Brunswick. When operating full power, it provides more than 30 per cent of the province's electricity.

The restoration of Point Lepreau was important for the CANDU nuclear industry as well. Point Lepreau represents the first of AECL's CANDU 6 reactors to commence a comprehensive refurbishment. It should be added that during the same period, the Korea Electric Power Company (KEPCO) refurbished its CANDU 6 reactor, Wolsong 1. KEPCO was able to draw extensively upon experience gained at Point Lepreau, as well as at Bruce Units 1 and 2 for proper calandria tube installation. Despite starting after Point Lepreau, the refurbishment of Wolsong 1was in fact completed before that of Point Lepreau.

The one significant disappointment during the year was the decision by Hydro-Quebec to cancel the planned refurbishment of its CANDU 6 reactor, Gentilly 2. The decision came after the election in Quebec of the Parti Quebecois earlier in the year. The government announced on September 20 that the reactor would be shut at the end of the year. Gentilly 2 produced its last electricity on December 28. The reactor was first synchronized to the grid on December 4, 1982, and was closed after just over 30 years in service.

It should be noted that Gentilly 2 was the only large thermal power station in service in Quebec and located near the principal load centres. Gentilly 2 was the only large electric generating facility remaining in service in the province for more than three weeks during the great ice storm in 1998.

The successful return to service of the three reactors noted above lends support to additional refurbishments of reactors in Canada. Ontario Power Generation (OPG) announced in December 2011 that it would refurbish all four Darlington reactors for a further 20-25 years of service. In March, 2012, it granted a contract to SNC Lavalin Nuclear Limited and Aecon Construction Group Inc. for the first of a series of contracts for the refurbishment of the station.

During the past year, the CNSC conducted an environmental review of the project. Public hearings were held on December 3-6 in Courtice, Ontario. Following these hearings, the CNSC issued its decision, concluding that the project was not likely to cause significant adverse environmental effects. The completion of the environmental review clears the way for an application by OPG to proceed with the refurbishment project.

When completed, it is expected that the refurbishment will allow all four reactors at Darlington to continue operations until approximately 2055.

New nuclear construction

Activity in nuclear power in Ontario was also involved with the potential construction of new reactors. OPG proposed to build two new reactors at the Darlington site in 2009. The environmental panel review was conducted in 2011.

On May 2, 2012, the federal government accepted and approved the recommendations of the report of the joint federal-provincial review panel. This decision represented the first approval of the construction of new nuclear reactors anywhere in Canada since the passage of the Canadian Environmental Assessment Act (CEAA) in the early 1990s. With the completion of the environmental review, OPG could then proceed to the next step in the construction of new reactors with an application to the CNSC for a site preparation license.

In June, OPG signed agreements with SNC Lavalin Nuclear Limited and Westinghouse to prepare detailed cost estimates, construction plans and schedules for two new reactors at the Darlington site. Two reactors are under consideration: the Enhanced CANDU 6 reactor from SNC Lavalin, and the AP 1000 reactor by Westinghouse. Both companies have been given 12 months to submit their reports.

On August 17, the Joint Review Panel of the CNSC issued a Nuclear Power Site Preparation Licence to OPG. The next step will be an application for construction, but this will wait until after the two suppliers have submitted their proposals and a decision has been made by the provincial government.

The final decision will be made by the Ontario government.

Restructuring of AECL

The structure and mandate of Atomic Energy of Canada Limited's (AECL) has been an area of interest for the federal government for several years. It launched a review in December 2007 to determine if AECL's structure as a crown corporation was best suited for supporting the Canadian nuclear industry in domestic and international markets.

The review was completed in 2009. It determined that the company should be divided into two parts: the CANDU reactor division, which should be privatized; and the research division centred on Chalk River Laboratories. The CANDU reactor division was sold to SNC Lavalin in 2011.

In 2012, Natural Resources Canada announced a Request for Expressions of

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AECL workers in the Retube Clean Room prepare the last of 480 new fuel channel sub-assemblies for transfer to the station and installation in Unit 1. The Unit 2 reactor was declared mechanically complete in January. (Bruce Power – Chris Mercanti photo)

Interest regarding the future of AECL's nuclear laboratories, principally Chalk River and Whiteshell. Administered by Public Works Canada, the Request solicited interest from stakeholders on their willingness to share in financial risks, managing, partnering and contracting. Following the submissions from stakeholders, the federal government announced that it will restructure AECL to:

- focus the mandate of the Laboratories on decommissioning and waste management; science and technology (S&T) to meet core federal responsibilities; and enabling the CANDU fleet and technology;
- support government programs and activities including that of the CNSC
- transition to full cost recovery for S&T services to third parties; and
- strengthen accountability and bring private sector rigour and efficiencies to the management of all facilities and services.

In early 2013, the government announced that it would adopt a management model of government-owned, contractor-operated, similar to that used in the United States and United Kingdom.

The Request was important for the CNS as well. This was the first occasion upon which the CNS had ever submitted an intervention to the government on any proposed nuclear project or activity. The CNS emphasized the continuing need for a research reactor in Canada. In its presentation, the CNS indicated that three management models were possible. The federal government subsequently chose to implement the first of the three choices.

During 2013, the federal government is expected to engage in a competitive procurement process for its management partner for AECL.

Uranium Mining

2012 was a highly successful year for Cameco Corporation, the world's largest uranium mining company. It started on January 3 with success in reaching the flooded main works of its Cigar Lake uranium mining project. Construction of the mine had been interrupted by a water inflow in October 2006.

By the end of 2012, Cameco had completed much of the underground development and commissioning work on the mine. It is expected that the mine will enter service in 2013.

Cigar Lake is very important for the future of uranium mining in Canada. It contains 108 million pounds of U3O8, at an average ore grade of 18.3 per cent. With a concentration of about 100 times the world average for uranium deposits, Cigar Lake will join McArthur River, also in Saskatchewan, as one of the richest uranum deposits ever discovered and mined. Cameco is 50 per cent owner of the project as well as the mine operator.

Permission was given on August 20 for the Midwest Joint Venture, a uranium project owned by Areva Resources and

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International developments were also strongly positive for Canada's uranium industry. On July 19, the Government of Canada signed a protocol agreement expanding the existing Nuclear Co-operating Agreement (NCA) with China. The new protocol allows for the export of Canadian uranium to China to meet that country's growing demand for uranium for its power reactors. Given that China has stated its intentions to have approximately 400 power reactors in service by 2050, this will be an important market for Canadian uranium and fuel services for decades to come.

The China agreement was followed by the completion of a Nuclear Co-operation Agreement with India on October 6. The original NCA was signed in 2010, but could not be implemented until agreement was reached on the administrative arrangements which were concluded in April 2013. This agreement also opens a large new market for Canadian uranium, along with fuel and reactor services. And it is to the credit of the current Canadian government that it has broken through the deadlock which has existed with India since 1974.

This agreement is extremely important for Canada's nuclear industry. India is the only other nation with a large nuclear infrastructure which relies principally on heavy water-moderated, fuel-channel reactors for its power reactor technology. India too is building a large nuclear generation sector. It has 20 reactors currently in service, with plans for an additional 64 reactors before 2050.

International Developments

For the first time in more than 30 years, construction has been started on new nuclear reactors in the United States. Work commenced on two new reactors at the Vogtle nuclear power station in Georgia. Permission ws granted by the Nuclear Regulatory Commission (NRC) following four years of environmental assessment and licencing reviews. Parent company Southern Nuclear applied to build Vogtle Units 3 and 4 in 2008. Construction is being carried out by Westinghouse and Shaw, and the reactors are expected to be in service by 2016 and 2017.

The NRC also granted permission to build two new reactors at the VC Sumner nuclear power station in South Carolina. These two reactors, also Westinghouse-designed AP1000 PWRs, are expected to be in service in 2017 and 2018.

However, another proposed reactor construction project in the United States was rejected. Unistar, a joint venture of Electricite de France (EdF) and Constellation Energy had proposed building a new European Pressurized Reactor (EPR) at Calvert Cliffs in Maryland, alongside the two existing reactors at the site. A second proposal was for an EPR to be located at the Nine Mile Point in New York State.

Both proposals were rejected because of foreign ownership restrictions contained in the 1954 Atomic Energy Act.

In the United Kingdom, the Office of Nuclear Regulation granted a site licence for EdF's planned Hinkley Point C in Somerset. EdF has planned for construction of the first EPR to be built in Britain. Also in process is Hitachi Ltd.'s plans for new reactors at the Oldbury near Bristol and Wylfa in north-western Wales. In the case of Hitachi, it is expected that the technology for which approval will be sought is that of GE-Hitachi's advanced boiling water reactor.

Not confined to new reactors, EdF has announced it will be seeking life extensions for all of its fleet of advanced gas-cooled reactors. At the same time as life extensions were being planned for some, others were closing. Britain's second-last Magnox reactor, Wylfa 2 was closed in 2012. Wylfa 1 will operate until 2014 when it will be closed with the exhaustion of its fuel supply. Also closing during the year was the world's oldest operating power reactor, Oldbury 1. The unit was in service for 44 years.

Development of new nuclear generating capacity in Britain was considerably complicated during the year by policy changes. Both German utilities EOn and RWE withdrew from their joint venture Horizon Nuclear Power formed in 2009. The joint venture was subsequently acquired by Hitachi.

In Germany, the country started to experience the consequence of the ordered closure of eight of the country's 17 reactors. The closure was ordered as a political response to the Fukushima accident in 2011. The large German utility EOn indicated that because of mandated right of way for renewables, much of its remaining generating capacity cannot be operated except at a loss. Only nuclear power returned net revenue to the company, and that was impacted by the mandated shutdowns and a newly-introduced tax on nuclear fuel. In total, southern Germany has lost about 5000 MW of nuclear generating capacity and has insufficient transmission to import coal- or gas-fired generation from northern Germany to southern Germany where most of the shutdown nuclear plants are located. As a result, these shutdowns have necessitated imports of electricity from both France and Poland.

Despite having more than 7000 MW of wind generation on its system, EOn produces less than one per cent of its electricity from wind. Moreover, the surcharge customers pay on their electricity bills to provide subsidies for renewable generation is expected to rise in 2013 by 47 per cent.

Not all continental European nations remained hostile to nuclear power. Swedish Vattenfall has applied to the government for permission to build two new reactors at its Ringhals station to replace older reactors at the site. And Poland has signed financial equity agreements with three private utilities and mining companies to provide financing for its first nuclear power station.

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In Ukraine, construction started on a permanent enclosure for the ruined Chernobyl Unit 4 reactor. The project was started in 1997 with a drive to collect financing. The project design was accepted in 2007, and site preparation started in 2010. It is expected that the new shelter will be in service in 2016, at which time real decommissioning of the Chernobyl nuclear power station can begin.

Turning to Asia, China ended its 18-month suspension of new nuclear projects during the year. The suspension was ordered by the Chinese government in the wake of the Fukushima accident in 2011. China completed safety checks at all its existing nuclear plants, and introduced a plan to meet all International Atomic Energy Agency (IAEA) safety standards in all its nuclear operations. Unprecedented for China, the government solicited public comment for the safety review. China resumed its process of new plant siting and approvals during the year.

In Japan, the country commenced restarting its idled nuclear fleet. Ohi Unit 3 was restarted on July 5, followed by Ohi Unit 4. At the same time the government began relaxing some restrictions on some areas within the 20 km evacuation zone around the Fukushima Daiichi plant.

In December, the Japanese government received the report from the expert investigative committee on the failures that led to the crisis at the Fukushima Daiichi plant during the March 2011 earthquake and tsunami. The report criticised both the government and the Tokyo Electric Power Company (TEPCO). TEPCO was critcised for two main failures:

- Misunderstanding the state of the Unit 1 cooling status, which operators thought initially was working normally but was not. By the time this was discovered, extensive damage had already been done;
- At Unit 3, an incorrect decision by operators left the unit without cooling for over six hours.

With respect to government failures, the report indicated that there were no measures in place to deal with very large tsunamis despite prior warnings that these were possible. The government had also introduced a new system to provide accurate dosimetry under accident conditions, but the information was neither disseminated nor acted upon. It was therefore unavailable in planning evacuations.

The shutdown of Japan's nuclear reactors had a profound effect on its economy in 2012. The largest such effect was the import of an additional $55 billion in fossil fuels to compensate for lost nuclear generation. Most of this came as liquefied natural gas from SE Asia and the Middle East.

Undeterred by events in Japan, two new reactors entered service in South Korea, Shin Wolsong 1 and Shin Kori 2. At the same time, eight additional reactors remained under construction in that country during the year.

Also during 2012, nuclear power came to the Middle East for the first time. The United Arab Emirates started construction on its first reactor, a 1400 MW Korean-designed PWR. The new reactor is being built at Barakah, approximately 300 km. west of Abu Dhabi.

More controversially, the first power reactor in Iran, Bushehr Unit 1 started operations in 2012. The reactor, a Russian-designed VVER 1000 PWR is the first of two at the site. Under safeguards, the reactor is not involved in Iran's disputed uranium enrichment program. The fuel for the reactor is supplied by and returned to Russia.

In Closing

2012 was a year of strong progress for Canada's nuclear industry. Three reactors were returned to service after refurbishment outages. Permission was given to move ahead with two new reactors in Ontario. As the statistics section later on in this Yearbook shows, Canada's operating reactors had strong performance throughout the year.

With respect to government policy, the federal government's initiative with respect to Chalk River Laboratories shows a clear path for renewal of its research mandate and a broader spectrum of partners in its operation.

And for the first time, Canada's uranium mining industry had two large new markets opened for it in China and India. The importance of this development for all aspects of Canada's nuclear industry cannot be understated.

It should be observed that despite the apparent chilling effects of the Fukushima accident in 2011, there has been little effect on nuclear operations, plans for new reactors or ongoing construction of new reactors. 548 new reactors were listed by the world's nations as under construction, planned or proposed at the end of 2012, a significant increase over the total of 518 at the end of 2011.

It would thus appear that Germany's shutdown response to the Fukushima accident is an exception and not the pattern for the world's nations with respect to nuclear power development and operation. It is not even the pattern in Europe, as both Swedish and Polish utilities have been planning new reactors during the year. And concrete steps have been taken for new nuclear reactors in Britain as well.

Cargo containers lined up outside of Units 1 and 2 at Bruce A hold tools and equipment demobilized from the Restart Project. (Bruce Power)

Bruce A Returns to Full Service in Ontario

By Rob Liddle, Bruce Power Communication Specialist

The construction of Bruce A began in 1969 during a period of rapid economic growth and rising demand for electricity in Ontario. Online within a decade, the four-unit nuclear station became an electrical workhorse, establishing world production records and providing more than 10 per cent of the province's power.

By the mid-1990s, electricity demand was wavering and Bruce A was beginning to feel its age. With several new nuclear units online in addition to the province's traditional fleet of hydroelectric and fossil-fueled stations, an economic downturn was challenging the investment required to keep the middle-aged Bruce A station running efficiently.

Bruce A's Unit 2 reactor was laid up on Oct. 8, 1995; Unit 1 followed in 1997 and Units 3 and 4 in 1998. It was a tough time for the workforce.

"The first time I arrived at the site, it was obvious we had a site with a lot of potential," said Duncan Hawthorne, President and CEO of Bruce Power. "Only half of the facility was in operation and you could see it in the workforce and in the communities around the site; it was a sad time for the community."

Outside the scope of the Restart Project, the installation of new turbine spindles is progressing in Unit 1. The original spindles, refurbished earlier in the project, will be used as spares in other units. (Bruce Power)

Bruce Power acquired a long-term lease for the Bruce generating assets on May 11, 2001. By then the demand for electricity was on the rise again, but this time the void was being filled by coal-fired generators, not nuclear. Subsequently, carbon emissions were increasing and the environment was paying the price. The timing was right for Bruce A.

"When we carried out an assessment of the Bruce A units, initially we knew that it would be possible to restart Units 3 and 4 without major component replacement," said Hawthorne. "Units 1 and 2 were a very different proposition. We knew it was complicated, first-of-a-kind technology and we knew it had a pretty big price tag associated with it. That decision wasn't taken lightly but it was transformational for

The Unit 1 generator recently received a new paint job to be ready for return to service. (Bruce Power)

the site because now we were extending the operational life of these units far beyond that which was originally contemplated."

The work to restart Units 3 and 4 began in early 2002. While much of it was routine, new safety enhancements included a secondary control room and independent seismically qualified power supply. The work was challenging but workers were motivated and both units were putting out power by early 2004.

Units 1 and 2 would require new fuel channels, new calandria tubes, new feeder tube segments, new steam generators, turbine generator overhauls, electrical system restorations, condenser upgrades, valve rebuilds and a multitude of other tasks before the units could return to service.

The Bruce A Units 1 and 2 Restart Project was launched on Oct. 17, 2005 after a long-term power agreement was reached between Bruce Power and the Ontario Power Authority. The deal was sanctioned by Revenue Canada 14 days later and, with an environmental assessment already underway, project preparations began.

A vacant school was leased in nearby Kincardine and renovated into an on-boarding centre for project workers.

Above: Operators load the first fuel bundle in the refurbished Unit 2 reactor on June 28, 2011. Right: Heliodoro Garcia, an Armature Winder with Siemens Canada, conducts flow testing on a Unit 2 stator bar in the Bruce A turbine. Five of the 40-foot components are visible at back. (Bruce Power)

A large complex with parking lots, cloakrooms, security centre, lunch room and offices was constructed on the west end of the station to provide amenities. Additional office space was commandeered in the station's Technical Building and in trailers and modules brought to site.

The old Douglas Point station on site, now a waste management facility, was pressed into service to stage reactor retube crews along with an adjacent mock-up facility. The retube crews also made use a Construction Retube Building between the Unit 1 and 2 reactor buildings. Warehousing was provided in a nearby facility that had been used for shipping and receiving when Bruce A was originally constructed.

Importantly, to minimize disruption in the operating units, a Construction Island was established to segregate Units 1 and 2 from the rest of the plant. With minimal time to get ready for hundreds of contract workers, the effort was extraordinary.

The project's environmental assessment was accepted by the Canadian Nuclear Safety Commission (CNSC) in July 2006 and construction advanced beyond the preparatory phase. Work schedules were enacted with Unit 2 as the lead unit; work in Unit 1 would follow by six months.

Authorized Nuclear Operators John Binnendyk and Brian Doose monitor system panels in the Bruce A Main Control Room as Unit 2 is synchronized to the provincial grid on Oct. 16. (Bruce Power)

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Bruce A Returns to Full Service in Ontario

By fall of 2006, with bulkheads in place to isolate the reactor vaults from the station's common containment system, retube crews were fully engaged in Unit 2. Remote controlled tooling operated by tradespeople in a nearby Retube Control Centre was used to dismantle the reactor's core.

Working around retube activites, steam generator replacement crews set about making Canadian nuclear history by changing out the boilers in Units 1 and 2. To prepare for the job, workers had to remove everything between the steam generators and temporary ports installed on top of the reactor buildings. This was a significant undertaking as the boilers at Bruce A are uniquely arranged in banks of four with a common steam drum secured to the top of each bank.

One of the world's largest cranes was employed for the lifts. Using laser metrology to ensure proper fit up, crews capitalized on experience in Unit 2 to reduce the duration of the job from 53 months to 47 months in Unit 1. The last big lift was completed on Feb. 3, 2008 when the crane lifted the east steam drum in Unit 1 back into position.

As retube progressed, the remote controlled tooling was challenged by the condition of the reactor, but the team persevered. The work in Unit 1, benefiting from experience gained in Unit 2, followed at a controlled pace to maximize the use of resources and equipment. By spring of 2011, the reactors were back together with new cores.

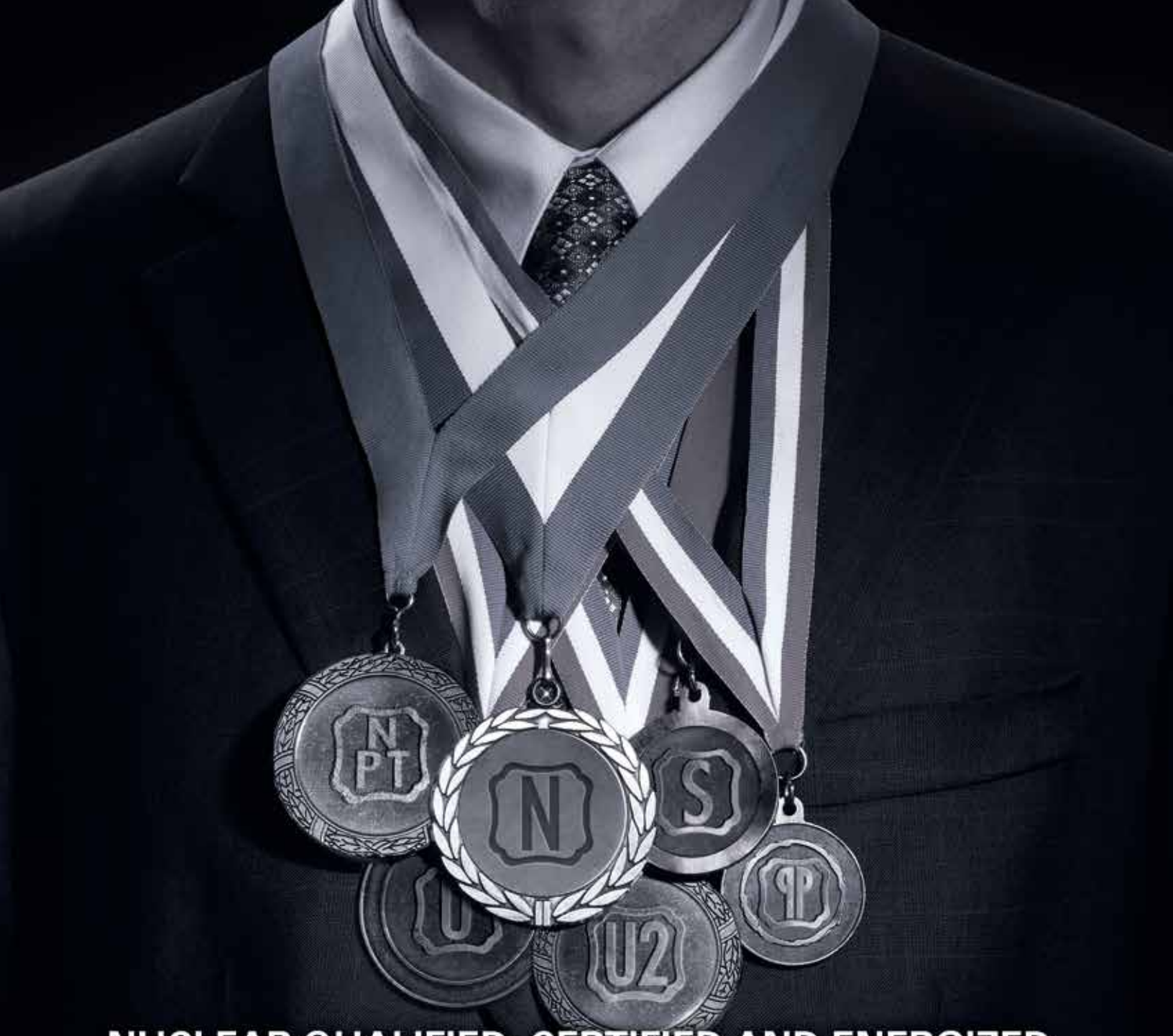
Inspections continue on the Unit 2 stator to determine the extent of required repairs after a fault was discovered in mid-May. (Bruce Power)

Feeder tubes were next. Early in the project, trades people removed the lower segment of each unit's 960 feeder tubes, severing them around the reactor face. Corroded from years of use, the segments were replaced with new sections once the reactors were reassembled. This was very exacting work with installation crews having to maneuver heavy segments that ranged in length from four to nine metres in very tight quarters for connection to existing upper segments.

Restart workers conduct contamination checks on materials slotted to be shipped from Bruce A during demobilization of the Units 1 and 2 Restart Project. (Bruce Power)

Nothing was easy. With so much going on in the two units, schedulers had to prioritize tasks on an hour to hour basis without leaving anything behind. Electrical crews worked to refurbish or replace power conversion equipment, motor control centres and transformers. Valve crews rebuilt or changed out more than 3,600 valves. Balance-of-plant crews restored condensers, feedwater heaters, heavy water upgraders and a host of other systems.

The work on the turbine generators started off to be just a routine overhaul with some remedial work on components and a few enhancements that included new excitation and governor systems. The job changed late



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Bruce A Returns to Full Service in Ontario

in the project to include new spindles and some other items when parts were required to replace worn-out components in Units 3 and 4. The exchange of parts would be returned in a way no one imagined.

Operators began fueling the Unit 2 reactor on June 28, 2011 and commissioning efforts escalated to ensure systems were ready for service. The lag between work in Unit 2 and Unit 1 narrowed from six months to three months and the project team became focused on demobilization.

On May 7, 2012 within an hour of synchronization, the Unit 2 generator experienced an electrical fault. Subsequent inspection revealed significant damage to the generator's stator assembly. Weighing all options, a decision was made to exchange the damaged assembly with the stator from Unit 4 during a scheduled maintenance outage. The tandem lift and transfer of the 418-ton assembly on Aug. 23, 2012 represented another first for Bruce Power.

Operators received permission from the CNSC to remove shutdown guarantees in Unit 1 on July 20, 2012 and final testing got underway. The unit synchronized with Ontario's electrical grid on Sept. 19, 2012. With generator repairs complete, Unit 2 followed on Oct. 13, 2012.

Above: The last of 5,760 new fuel bundles was loaded into the Unit 2 reactor on July 14 completing a task that began June 28. Right: The last of 5,760 new fuel bundles was loaded into the Unit 2 reactor on July 14 completing a task that began June 28. (Bruce Power)

"The restart represents a lot of technical success but one of the things I'm proudest of is the contribution of the staff," said Hawthorne. "There are many people that have a personal affinity to this site and to this project, some of who can retire happy in the knowledge they helped bring these units back to service. It's a personal story I think many of them can tell and that's what makes the whole project unique for me."

Nuclear Operators Chris Stephenson and Brian Maas were on the team that loaded the first fuel bundles in Unit 1 on Nov. 23. It was the first time fuel had been in the unit since its shutdown in 1997. (Bruce Power)

With Bruce A back on line, Bruce Power is capable of supplying more than one-quarter of Ontario's electricity. The balance of power has shifted once again with nuclear energy supplying more than half of the province's electricity. In 2012, coal-fired stations provided only 2.8 per cent of Ontario's demand, outstripped for the first time by wind generators which provided only three per cent.

With Units 1 and 2 now poised for commercial operation until 2043, Bruce Power is well positioned to extend the life of the remaining Bruce units as required to deliver safe, reliable and clean electricity for this generation of Ontarians and the next.

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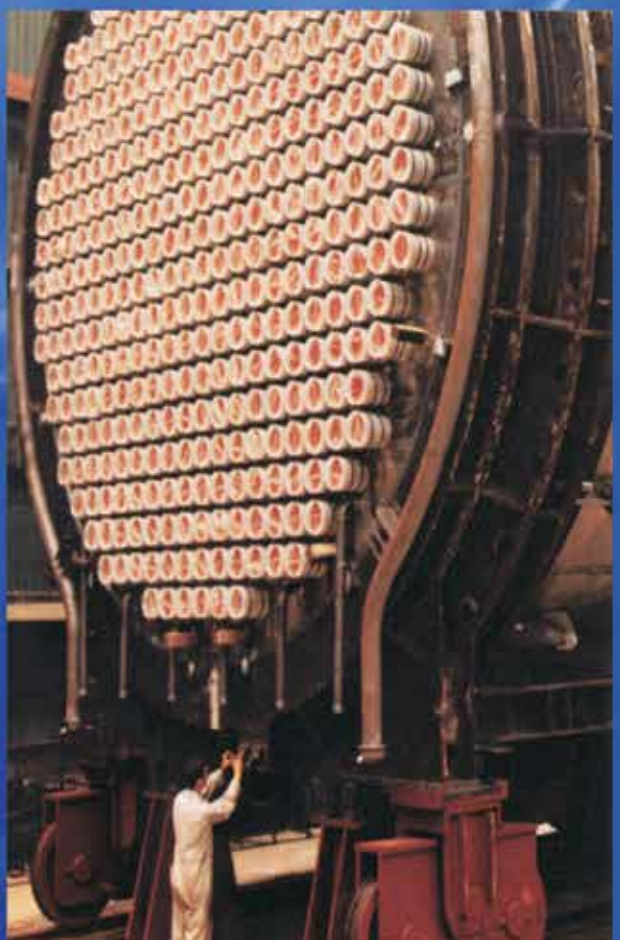

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2012 – CNS Program Review

By John Roberts, Acting Program Chair

The 2012 year for conferences and courses by the CNS was in general very successful. Except for one event, all of the conferences and courses were well attended

The combined CNS Annual Conference and CNS/CNA Annual Student Conference gathers together scientists, engineers, technologists, senior management, government officials, and students from across Canada, and from other countries. The central objective of this conference is to exchange views on how nuclear science and technology can best serve the needs of humanity, now and in the future. The 2012 Annual Conference was held in Saskatoon and attracted a large number of techncal papers and a very strong attendance. The 2013 CNS Annual Conference is to be held in Toronto.

In addition to its Annual Conference, the CNS organizes various other conferences (normally on a bi-annual basis) as well as courses. The following events were held during the past year:

2012 Annual CNS Conference/2012 Annual CNS-CNA Student Conference

The Annual Conference attracted a strong audience to Saskatoon in 2012. With more than 400 in attendance, the conference also attracted a large number of excellent technical papers. The Student Conference was heavily attended, with also a large number of technical papers.

The success of the conference was in large part the result of good sponsorship from nuclear industries in Canada, led by support from the Government of Saskatchewan.

The Annual Conference will be held in Toronto in 2013. There will be no Annual Conference in 2014, as the CNS will be hosting the Pacific Basin Nuclear Conference (PBNC) in August that year.

CANDU Fuel Technology Course

Held in the fall of 2012, this course is held annually. It attracted a large number of participants this year

24th Nuclear Simulation Symposium

The Simulation Symposium is an infrequent event, being held by the CNS every two years. This year's Symposium was very successful with higher than expected attendance. Nuclear Science and Engineering Division Chair Elizabeth Varin is to be strongly commended for her work in making this event a success.

2nd International Technical Meeting on Small Reactors

This event was a first of its kind for the CNS. It was held jointly with Atomic Energy of Canada (AECL). Holding a conference in co-operation was a new experience for the CNS, and the organization of this event proceeded smoothly.

The conference itself was over-subscribed. So large was the number wishing to attend that the CNS was compellled to close registration before the conference began. Such was its success, that both parties expressed strong interest in holding another such technical meeting on this topic in the future.

The CNS will also be exploring future opportunities for joint organizing of other nuclear events for Canada's nuclear industry.

7th International Steam Generators to Controls Conference (SGC2012)

Held in November, 2012, the Steam Generator Conference was the principal CNS technical conference for 2012. The conference was well supported by technical papers and presentations. However, attendance was relatively low for a topic of this magnitude. The principal reason for thiis was the large number of nuclear conferences over the previous 12 months.

In retrospect, the CNS has learned that this conference requires more time for and support provided to the organizing committee. The CNS also needs to increase the amount of promotion done for this event in the future.

Nuclear 101

The first of its kind, this course was designed to provide information to communicators within Canada's nuclear industry. Demand for this course proved to be extensive, including from organizations outside the industry. This has been indentified by the CNS as an area requiring more presentations of this course each year. At this time, the CNS is finding more venues and greater availability of instructors to meet this need.

Utility Engagement Initiative

The CNS Council recognized during the year that greater participation in the activities and direction of the Society from Canada's nuclear electric utilities and nuclear operators was both desirable and necessary. Then current 2nd Vice President Jacques Plourde undertook to create a plan of action for this.

The plan involves a high degree of contact and joint activity between nuclear powr stations and the local branches of the CNS, specifically Durham, Bruce, Chalk River and New Brunswick branches.

It is the expectation of the CNS that this program will over time result in stronger interest and participation in the CNS by the electric utilities and nuclear operators. Jacques will continue to lead this initiative in addition to his other responsibilities on behalf of the CNS Council.

The CNS Technical Divisions

Program Chair:	John Roberts (acting)
Design and Mateials:	Dan Gammage
Environment and Waste Management:	Ken Dormuth
Fuel Technologies:	Steve Palleck
Fusion:	Blair Bromley
Medical Applications and Radiation Protection:	Nick Sion
Mining and Processing:	John Roberts
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- OPG/BP Bruce (8 Units)
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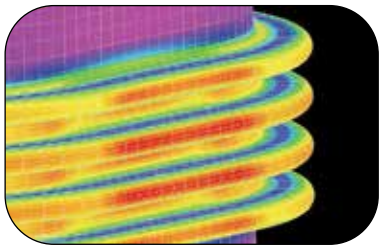

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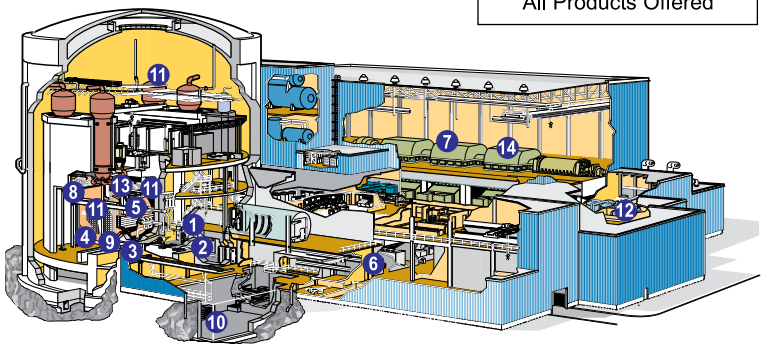

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2012 – CNS Committee Activities

The Education and Communications Committee (ECC) continued to embody the CNS' mandate in public outreach and education in 2012, overseeing a number of key programs and financial investments.

The Geiger donation program provides high-quality Geiger detectors to interested high-schools, along with educational information and NORM (Naturally Occurring Radioactive Materials) for measurement. In 2012 the CNS budget included funds for the donation of 22 CNS Geiger Kits to Canadian high schools by the ECC, and the Pickering Branch provided additional funds to expedite donation of another two Geiger Kits to high schools in its area.

The 24 Kits were completed and donated to the schools in the fall. Acsion Industries (www.acsion.com) performed the support services for 22 of these kits and hosted the CNS Ionising Radiation Workshop "Eastern Road Kit". In addition, updates were sent to the 25 schools that received Geiger Kits in 2011 which included unacceptable substitutions of some kit components. Aware Electronics (www.aw-el.com) provided the CNS with custom versions of their Windows®-compatible program. This simplifies installation and operation for the users.

The total number of CNS Geiger Kits donated to date is 141, with 2 considered lost. The list of outstanding requests for Kits exceeds 100 Canadian high schools or equivalents. In 2013 the CNA has offered to assist with the procurement of 17 Geigers + interfaces for donation in 2013.

In addition, two custom Geiger Kits were developed for use by Council members. These include many of the features of the "road kits" used to present the Ionising Radiation Workshop.

An important part of the Geiger program is the workshop offered to teachers to get them up to speed on how to use the detectors. In 2012 three of these workshops were held: two in February at the Toronto District School Board Secondary Science Teacher's Conference at Marc Garneau SS., and the Durham Region School Board Everything Science Conference at Maxwell Heights SS in Oshawa, plus one in November at the Alberta Teachers' Association Science Council Conference, Banff, AB. Invitations to present to the Ottawa-Carleton District School Board and the Association of Science Teachers in Halifax were declined due to budget constraints.

In August the third Nuclear Education and Outreach (NEO) Workshop was held at the Sheraton Hotel in Hamilton, with a tour of the McMaster Nuclear Reactor for participants, The fourth workshop, NEO-2013, is planned for August 2013, also in Hamilton, and will include a media training session on the second day.

2012 saw the introduction of a new CNS course, "Nuclear 101", providing background information on the nuclear industry to outreach personnel and anyone else who interacts with the public. The idea for "Nuclear 101" came from a knowledge gap identified at the first NEO workshop in 2010, and includes segments on Energy and the Fuel Cycle, Myths and Facts, and Radiation Health Effects. Two courses were offered in 2012, in Hamilton in April and Petawawa (near Chalk River) in December. Feedback from the course is positive and there appears to be a sizable demand for future courses.

Other important committees and their main activities are as follows:

1. The Branch Affairs Committee, chaired by Syed Zaidi, coordinates the activities of the various branches of the CNS, and supports them financially and administratively. The CNS Branches organised seminars for their members and interested members of the public. Several Branches supported student science fairs, provided scholarships for high school students, and participated in science fairs, science-teacher conferences and outreach events held in their regions.
2. The Membership Committee, chaired by Ben Rouben, manages all the membership activities, such as renewal notices, the membership database, membership drives, and membership communications. Members in good standing can update their profile online. They can also download and print their receipts and their CNS membership card. In addition they can view (and also download) the membership directory.
3. The Finance Committee, chaired by Mohamed Younis, manages the members' equity in the Society, following a conservative investment strategy.
4. The main task of the Past Presidents' Committee, chaired by the current Past President of the Society, Frank Doyle, is to establish the slate of candidates for election to Council at the next AGM.
5. The CNS/CNA Honours and Awards Committee, chaired by Murray Elston, manages the nomination and selection process for awards that are handed out to deserving individuals and teams in the Canadian nuclear industry and academia.
6. The International Liaison Committee, chaired by Kris Mohan, establishes and maintains ties with nuclear societies in other countries by means of formal agreements. Information is exchanged through the International Liaison Committee, and on occasion non-financial sponsorship is provided for events of common interest. The CNS is a member of the Pacific Nuclear Council and of the International Nuclear Societies Council, and participates in the meetings of these international bodies.
7. The Internet Committee, now chaired by Adriaan Buijs, oversees the internet services provided to the Society. The CNS website is maintained by a professional webmaster, Elmir Lekovic. It is the internet portal of the Society to the world. It provides information on the CNS' objectives, its organisational structure and activities, links to other nuclear organisations and a page on Canada's nuclear history. The CNS website includes full web pages for CNS conferences and courses, including links to paper-submission sites for CNS conferences and online registration pages.

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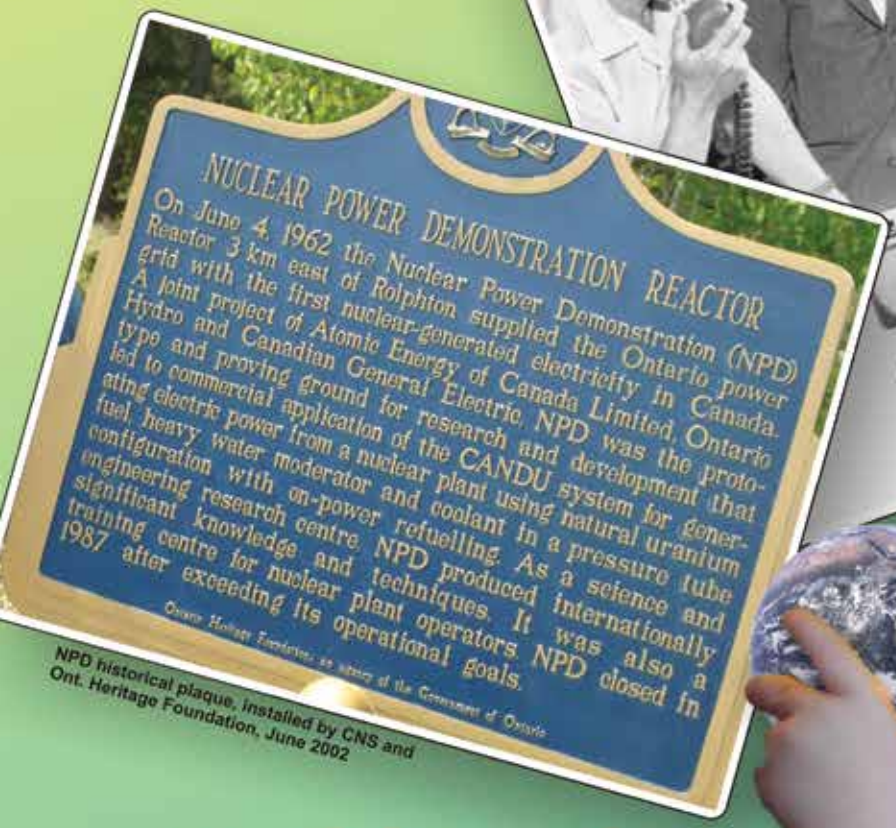

NPD historical plaque, installed by CNS and Ont. Heritage Foundation, June 2002

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8. The Universities Committee, chaired by John Luxat, maintains the ties of the Society with the Canadian universities and the University Network of Excellence in Nuclear Engineering (UNENE).
9. The Scholarships Committee, chaired by Mohamed Younis, manages the process of soliciting and judging proposals for summer and doctoral scholarships, and of administering the awarding of scholarships.
10. The Intersociety Committee, chaired by Eric Williams, maintains the ties with other learned societies in Canada, mainly in the context of the Engineering Institute of Canada (EIC). The CNS has a seat on the Council of the EIC and participates in common activities such as a career database and the organisation of conferences. The EIC also has a Fellows program and an Awards program for which several CNS members have been nominated successfully in recent years.

The Program Committee oversees the conference and course program of the CNS.

Another important activity of the CNS is to publish a quarterly Bulletin that outlines current activities and industry highlights. Fred Boyd and Ric Fluke manage all aspects of the Bulletin.

The interface committees are generally chaired by persons who are members of both the CNS and the other organisation. They are as follows (with the Chair shown in parentheses):

1. Canadian Nuclear Association (CNA, Heather Kleb)
2. Women in Nuclear Canada (WiN, Jad Popovic)
3. CANDU Owners' Group (COG, Frank Doyle)
4. Organisation of CANDU Industries (OCI, Frank Doyle)
5. Young Generation in Nuclear (NA-YGN, Mark McIntyre)
6. Partnership Group for Science and Engineering (PAGSE, Fred Boyd).

The purpose of the interface committees is to maintain the relationship with the other organisations and to report to Council on activities that are relevant to the activities of the CNS.

It should be stressed that all committees of the CNS have volunteer members and are chaired by volunteers. During 2012/2013, the Society had a most successful year - thanks to the efforts of the many volunteers serving on the various committees.

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Canadian Nuclear Association (CNA) President's Report

By Heather Kleb, Acting President, CNA

The Canadian Nuclear Association (CNA) is a non-profit organization established in 1960 to represent the nuclear industry in Canada and promote the development and growth of nuclear technologies. The CNA represents nearly 100 organizations working in the field, from universities and laboratory organizations through engineering and construction to power generation and mining. Our members account for the employment of over 30,000 Canadians directly and a similar number indirectly through their economic impact. These are jobs of high pay, long duration, good training, and high standards of workforce investment and safety.

CNA is more than fifty years old, and is now at the midpoint of a five-year Strategic Plan, *Dialogue for Understanding and Growth*. Major themes of our work for 2012 were:

- Working toward regulatory certainty
- Demonstrating the benefits of nuclear to Canadians
- Engaging members and increasing dialogue
- Building capacity for strategic risk communications
- Reaching out proactively to governments.

On regulatory certainty, the CNA continued working with the federal government in 2012 to harmonize and reduce duplication, and this converged early in 2012 with the major federal push for regulatory reform launched in the spring budget. Throughout the year the CNA formed industry positions, submitted comments, and made live and written hearing interventions. As a result we are continuing to earn influence with those in the regulatory structure at the federal level.

To demonstrate the benefits of nuclear in 2012, the CNA partnered with Canadian Manufacturers and Exporters (CME) beginning in April to update and expand our knowledge of the economic impacts of this important industry. We started by talking to the federal government about economic methodology – asking government economists what they most wanted to know and would find most credible. The results of the CME study emphasize our industry's growth potential and job quality. It supplies our advocacy efforts with great content for years to come.

We developed key public messages from the CME study for ongoing use in the CNA's advocacy activities, which as always include the full range of communications: conversations, press releases, interviews, websites, social media, speaking engagements, advertising, magazine articles, and the trade and professional press. The CME study also gave us constructive topics for our proactive outreach effort with government.

In proactive GR we approach government, not to address a crisis or a demand, but rather with a positive story and a sincere will to build relationships. In our proactive government relations activities in 2012 the CNA:

- Presented to Parliamentary committees
- Engaged our own government and Embassies in our Annual Conference and Trade Show
- Attracted 40+ government officials to Small Modular Reactor workshops in Ottawa and Calgary
- In our 2012 Parliament Hill Day, drew upon representatives from member organizations to do some of the direct, face-to-face government relations that helps to build meaningful dialogue.

And in issue-specific GR, we:

- Met with MPs, key staff and officials on the federal Budget Act
- Testified before Parliamentary Committees
- Advocated positions on reform of Canadian Environmental Assessment Act, Fisheries Act, and Species at Risk Act
- Reached out to the Prime Minister's Office and Foreign Affairs Canada on nuclear co-operation agreements, and
- Engaged regularly with NRCan Officials on anticipated reform of the Nuclear Liability Act.

For 2013, the CNA's overall workplan theme is "Extending our Reach," reflecting our strategic need to take our messages to different and broader audiences. We will do much of this through partnerships. For example, we have just launched a promotional partnership with the Canadian Cancer Society that positions us among millions of Canadians as a partner in research and support services in the battle against cancer. With Public Policy Forum, we are sponsoring a broadly based public policy discussion on the future of Canada's nuclear power industry. And CNA will step up efforts to harmonize our work with those of our fellow associations, like CNS, OCI, COG, WiN and others, that are working for the future of nuclear technologies in Canada.

Canadian Nuclear Society
Société Nucléaire Canadienne

12th International Conference on CANDU Fuel

"CANDU Fuel: Safe, Reliable and Flexible"
"Combustible CANDU: sûr, fiable, polyvalent"

Holiday-Inn Waterfront Hotel and Conference Centre, Kingston, Ontario, 2013 September 15-18

On behalf of Conference Organizing Committee, we would like to thank those who have submitted a paper abstract to the 12th International Conference on CANDU Fuel. Under the theme of *CANDU Fuel: Safe, Reliable and Flexible,* paper abstracts have been solicited for the following categories. This conference will be held with parallel technical sessions and a plenary session.

- **A.** ***Fuel Performance:*** PIE studies/techniques, fuel behaviour (normal operating conditions and extended burnup), and station experience.
- **B.** ***Fuel Safety:*** Licensing issues, accident studies, fission-gas release, fuel behaviour, LOCA initiative and experimental simulation, fuel acceptance criteria, and fuel deformation and dryout.
- **C.** ***Fuel Design & Development:*** Modifications to fuel designs and quality assurance in fuel design and development, MOX, inert matrices, DUPIC, slightly enriched uranium (SEU), recovered uranium (RU), thoria-based fuels, SCWR fuel, and economical and societal implications of fuel cycles.
- **D.** ***Fuel Code Development:*** Predictive capability for thermal, mechanical, irradiation and fission-gas release behaviour under normal operating and accident conditions, and predicting aerosol behaviour.
- **E.** ***Fuel Manufacturing:*** Fuel manufacturing experience, advances in manufacturing & inspection technologies, blending Recycled Uranium (RU) & Depleted Uranium (DU), and fuel manufacturing issues and improvements.
- **F.** ***Fuel Management:*** Fuel management schemes, load following, fuel physics analysis, and specific operational problems.
- **G.** ***Fuel Bundle Thermalhydraulics:*** CHF and CCP assessment and enhancement, reactor aging, crept pressure tube and fuel simulation and testing.
- **H.** ***Spent Fuel Management:*** Fuel handling technology, spent fuel storage, and in-storage fuel behaviour.
- **I.** ***Advanced Code Development:*** Development of models that support fuel performance and safety assessments.

We are now accepting nominations for a new award to recognize senior or retired individuals who have contributed greatly to the field of **Nuclear Fuel.** Please send your nomination letters to Dr. Paul K. Chan at Paul.Chan@rmc.ca by 31st May 2013. For further details on this award please visit our website at **http://www.cns-snc.ca/events/candufuel2013/**.

Full papers must be prepared and submitted to https://www.softconf.com/d/CANDU2013/ according to guidelines published on the conference website. Publication in the conference proceedings is not guaranteed if your final paper is received after 31st May 2013. For final papers to be accepted for publication, one of the authors of the paper must register for the conference and present the paper at the conference. If you are planning to submit a paper and it is pending internal (and/or customer) approval, please contact the Conference Chair (Dr. Paul Chan) directly.

This is a CNS conference that is being held in co-operation with the IAEA. The Conference Organizing Committee would like to take this opportunity to thank our sponsors. For more information and latest news, please visit the conference website.

Conference Chair:
Dr. Paul K. Chan
Chemistry & Chemical Engineering
Royal Military College of Canada
(613) 541-6000 x 6145
Paul.Chan@rmc.ca

Technical Program Co-Chair:
Dr. Hugues W. Bonin
Chemistry & Chemical Engineering
Royal Military College of Canada
(613) 541-6000x 6613
bonin-h@rmc.ca

Technical Program Co-Chair:
Mr. Mark R. Floyd
Atomic Energy of Canada Limited
Chalk River Laboratories
1-800-377-5995 x43899
floydm@aecl.ca

Women in Nuclear (WiN) President's Report

By Colleen Sidford, President, WiN-Canada

Women in Nuclear (WiN) is a world wide association of women working in various fields of nuclear energy and radiation applications. WiN-Canada formed in 2004, represents over 1,300 members and six chapters across Canada.

Our activities are focused on:

- Educating ourselves so we can educate the public.
- Providing career development to our members.
- Promoting career interest in engineering, science, technology, the trades and other nuclear-related professions, especially among women and young people.

In 2012, WiN completed its incorporation under federal statute and assumed responsibility for our own banking from the CNA, which acted as our secretariat from 2004.

We welcomed WiN-Saskatchewan as a new chapter in partnership with Women in Mining (WIM). A cooperation agreement between the two organizations was signed and a joint leading team was formed, after a successful launch at the CNS conference.

A new promotional video was produced in 2012, showcasing members discussing their experiences with WiN. The video will be used by chapters to highlight the work done by WiN members across Canada to support the nuclear industry.

As part of our strategy to strengthen the talent pipeline and our understanding of research that states you must attract young people very early to science, WiN purchased three Wings of Discovery science curriculum kits, which were placed in Kindergarten classrooms to connect science to everyday lives in a fun and interactive way.

WiN hosted eight GIRLS Science Clubs and two camp sessions in 2012. Over 100 girls participated, providing a hands-on science experience in a fun and safe environment. Led by female mentors who have been successful in the science being studied, the sessions are meant to spark a scientific curiosity in the girls so, one day they are better equipped to make informed decisions on topics such as climate change and energy sources.

Recognizing an estimated 40 per cent of skilled trades people are set to retire in Canada by 2020, WiN saw an opportunity to promote careers in the skilled trades to young women. Through our partnership with Skills Canada-Ontario, WiN provided mentors for the Young Women's Conference reaching over 325 students in Grades 7 to 12 to learn more about a day-in-the-life of a skilled tradeswomen in the industry. Through sponsorship from the industry, WiN sponsored Skills Work! for Women Networking Dinners across Ontario and New Brunswick and provided mentors for 10 dinners. WiN also organized two one-week Skills Work! Summer Day Camps for girls and boys in Grades 7 and 8.

In September, WiN participated in a Parliament Hill Day, organized with the Canadian Nuclear Association and North American Young Generation Nuclear (NAYGN). Over 36 WiN and NAYGN members participated in a professional development session and met with MPs, Senators and staffers to talk about our personal experiences in the industry.

In October, WiN-Canada's annual conference was hosted by WiN-Bruce with 175 delegates attending in Kincardine, ON. The conference, 'WiNspire the Future,' provided our members with an opportunity to re-energize their personal goals and career development.

WiN's Board of Directors will be charting a new course in 2013. We will be working on our second Strategic Plan for 2014 and beyond, as well as succession planning for key positions on the board. We have sent out a membership survey to better understand our members' needs as we move forward. WiN will continue to engage today's youth in science and promote career opportunities in our industry, while providing career development opportunities to our members.

WiN-Canada is proud to support the industry by strengthening the talent pipeline and developing the skills of our members to enhance their contributions to the industry.

You can visit us online at:
www.wincanada.org
www.facebook.com/WINglobal
https://twitter.com/win_canada

Prepared by Cheryl Cottrill, Executive Director of WiN-Canada on March 12, 2013.

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Canadian Nuclear Workers Council (CNWC) President's Report

By David Shier, President, CNWC

The Canadian Nuclear Workers Council (CNWC) is an umbrella organization of Unions representing workers in all sectors of the Canadian nuclear industry. Founded in 1993, it represents sectors including electric power utilities, uranium mining and processing, radioisotope production for medical and industrial purposes, and nuclear research.

CNWC activities are focused on the following objectives:

- Ensure that the interests and perspectives of nuclear workers are heard by decision-makers;
- Strengthen the collective role of nuclear workers as a partner in their industry;
- Enhance public knowledge and understanding of nuclear issues by providing factual information, and;
- Build support for the nuclear industry and its future potential.

During 2012, several presentations and briefs were made on behalf of the membership. In January, the CNWC and Local 13173 made a presentation to the Canadian Nuclear Safety Commission [CNSC] in support of Cameco's relicensing application for its Port Hope Conversion and Fuel Manufacturing facilities. On April 23rd, 2012 representatives from member unions of the CNWC toured the Chalk River laboratories in support of raising public awareness regarding the importance of retaining the facilities. In September, the CNWC submitted comments to the CNSC on the proposed Fitness of Duty proposal. In December, the CNWC made a submission to the CNSC in support of Ontario Power Generation's Environmental Assessment for the refurbishment of the Darlington Nuclear facility and licence renewal applications for the Darlington Station and Darlington Nuclear Waste Management facility.

The CNWC's 2012 education and outreach activities included attendance at the Canadian Nuclear Association's 2012 Annual Conference and meetings with the President and staff of the CNSC, and the International Nuclear Workers' Union Network (INWUN). Public communications included four newsletters issued each quarter during the year.

In 2013, CNWC education and outreach activities will focus on: expanding the membership with a focus on nuclear supply chain companies and local labour councils (the Durham & District Labour Council became an affiliate in February 2013); submissions in support of the licence renewal for the Pickering Nuclear plant, Key Lake Mill, McArthur River Mine, McLean Lake and, other applications as they are announced; continuing efforts to develop a national nuclear strategy in collaboration with other groups in the sector; and, implementing a tour program for labour leaders. Leadership changes in these groups create the need for the new leadership to be updated about current and emerging nuclear industry issues and opportunities.

The CNWC will publish four editions of the Nuclear Worker, update its information booklets and website and continue with its display booth activities in 2013. The CNWC will represent its membership at several conventions/conferences – the United Steel Workers' Policy Convention (Vancouver), CUPE National Convention (Quebec City), Ontario Federation of Labour (Toronto) and the Annual INWUN (Fukishima). As well, the CNWC will participate along with member Unions in the annual meeting with the CNSC. The CNWC's annual meeting is planned for September 14th-17th, 2013 in St. John, New Brunswick.

CNWC Member Unions:

- Canadian Union of Public Employees– Locals 1500 & 267
- Communication, Energy & Paper Workers Union – Local 599-O & Local 48 – S
- Canadian Auto Workers Union
- International Association of Firefighters
- International Association of Machinist & Aerospace Workers – Local 608
- Power Workers' Union
- Professional Institute of the Public Service of Canada (PIPS) – CRPEG & WRPEG
- United Steel Workers – Locals 8914, 8562, 7806, 14193, 13713
- Chalk River Technicians and Technologist Union
- Allied Trades Council
- Society of Professional Engineers & Associates (CANDU Inc.)
- Hydro Quebec Professional Engineers Union
- International Brotherhood of Boilermakers Local 37
- Grey Bruce Labour Council
- Durham & Region Labour Council

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Thorburn has total in-house capabilities to design and manufacture flexible hose assemblies, adapters, pipe connectors and swivel joints meeting the requirements of ASME Section III, class 1, 2, 3 and Class 6 systems.

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• HQ Gentilly (1 Unit) • Cernavoda Romania (2 Units) • Quinshan China (2 Units)
• Wolsong South Korea (4 Units) • Embalse Argentina (1 Unit)

Designers and OEM's:

• AECL, GE , SNC-Nuclear

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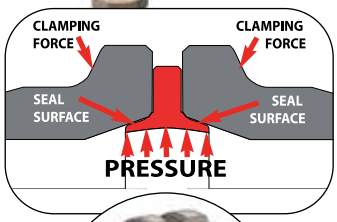
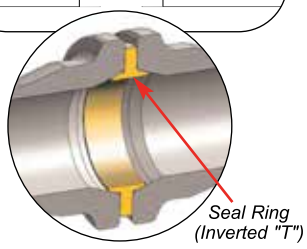
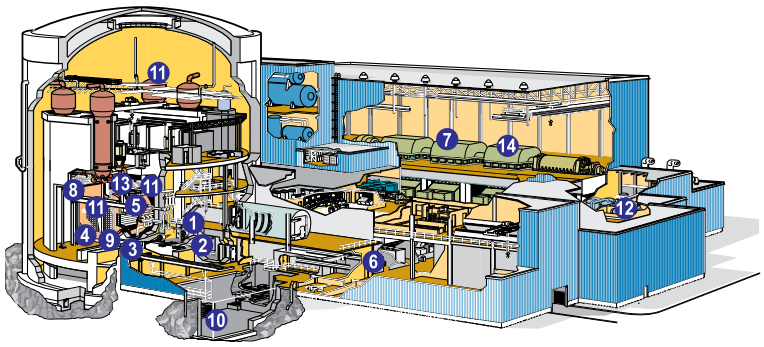
- 40% shorter than ANSI flanges
- Withstands external pipe loads







THORBURN'S NUCLEAR PRODUCT EXPERIENCE

1. D_2O Primary and Auxiliary System Hoses, Adapters and Quick Couplings
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4. F/M Head Fluid Quick Disconnects
5. Ion Exchanger Flexible Piping Systems and Quick Couplings
6. Water Treatment Flexible Piping Systems
7. Steam Metallic Braided Flexible Piping Systems
8. Core Feeder Flexible Piping Freezing Systems
9. Fueling Machine Flexible Piping Systems
10. Maintenance Gate, Transfer Canal Tube, Transition Piece & Containment Passage
11. Bellows Assemblies for F/C Annulus Seals Main Steam Penetration and Reactivity Mechanism Expansion Joints
12. Large Diameter Elastomeric and Metallic Expansion Joints for RSW, CWC and CWS Piping Systems
13. F/M Head Separator Assembly, Bellows Assembly and Linear Potentiometer Assembly
14. Pressure Balanced Crossover Expansion Joint

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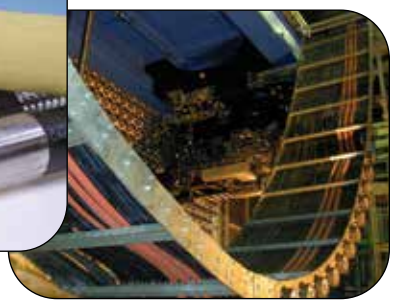
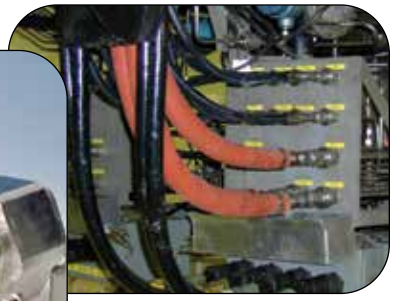


CUSTOM METALLIC & NON-METALLIC HOSE ASSEMBLIES

Rubber & Metallic Hose Assemblies For Catenary, Fueling Machine, D_2O Primary & Auxiliary Transfer Service.



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MADE IN CANADA

Organization of CANDU Industries (OCI) President's Report

By Ron Oberth, President, OCI

OCI is an industry association that as grown over the last year to now include more than 175 leading Canadian suppliers to the nuclear industries in Canada and offshore. OCI member companies employ collectively more than 30,000 highly skilled and specialized individuals, many of whom are dedicated to manufacturing equipment and components and providing engineering services and support to the 19 operating CANDU nuclear power plants in Canada as well as to CANDU and LWR reactors in offshore markets.

OCI also offers a variety of services and support to its member companies to help them become the suppliers of choice in the domestic nuclear market and to bring them opportunities in offshore CANDU markets and targeted LWR markets by organizing trade missions and market specific seminars.

In the last year OCI organized three very successful "Supplier Day" events with Ontario Power Generation, AECL Nuclear Laboratories and Candu Energy Inc. We are starting this year with a Supplier Day at the Bruce Site in May. These focused trade shows, with between 60 to 80 exhibitor booths, enable member companies to showcase and discuss their products and services with engineers and procurement specialists in our key domestic customer organizations. Our Supplier Days also create networking opportunities among member companies often leading to collaboration on specific project opportunities.

In the last year OCI also hosted workshops at UOIT on "Identification of Skills Gaps in the Supply Chain and Development of Training Options" and at AECL on "Supply Chain Innovation through S&T". We also arranged a workshop with the Canadian Standards Association on the CSA N290 Series Standards (nuclear safety systems) to help inform OCI suppliers on special requirements of these standards.

In support of an anticipated decision by the Government of Ontario to construct new reactors at the Darlington Site, OCI organized supply chain workshops with the two reactor vendors, Candu Energy and Westinghouse at which these companies met with OCI suppliers to outline their plans to maximize Ontario content in their June 2013 submissions to OPG and the Government of Ontario.

Turning to offshore markets, OCI hosted workshops to help members understand and prepare for the large emerging nuclear supply opportunities in China and India. OCI also led successful trade missions to Argentina in December 2012 and to the UK in March 2013 with excellent support from the Ontario Ministry of Economic Development, Trade and Employment and the Canadian Trade offices in Buenos Aires and London.

OCI has also launched a media campaign in the fall of 2012 with four months of radio ads on a Toronto area radio station with intent to raise public awareness of the important role of nuclear power in supplying more than half of Ontario's electrical energy needs while creating many high value and sustainable jobs in communities across Ontario.

OCI was invited to participate in several events at our members facilities at which successful project completions were celebrated in the presence of both provincial and local political leaders and local media. OCI is planning to organize more events and media tours at member facilities across Ontario in the coming months.

Finally OCI was pleased to contribute to workshops with Canadian nuclear industry leaders at which our collective vision of Canada as a "Tier one nuclear nation" was debated and confirmed.

April 10, 2013

Contacts:
Dr. Ron Oberth, President (ron.oberth@oci-aic.org or 905-839-0073)
Ms. Marina Oeyangen, Manager Member Services (marina.oeyangen@oci-aic.org or 905-839-0073).

The Benefits of Nuclear
Les avantages du nucléaire

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Nous ne compromettrons jamais la sûreté
suretenucleaire.gc.ca

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

2013 Conference Schedule

This programme lists events which are organized or co-sponsored by the Canadian Nuclear Society or considered to be of interest to its members.

The current listing of events is posted on the CNS website at **www.cns-snc.ca**

2013

2013 February 27 – March 1
CNA Nuclear Industry Conference and Tradeshow
Westin Hotel Ottawa, ON
Organized by: CNA
Website: www.cna.ca/news_events/cna_conference/2013-conference

2013 March 3 – 7
6th International Symposium on Supercritical-Water-Cooled Reactors (ISSCWR-6)
Shenzhen, Guangdong, China
Co-sponsored by CNS
Website: www.isscwr6.com

2013 Spring
CNS CANDU Reactor Safety Course
Toronto, ON
Organized by: CNS NSE Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2013 Spring
CNS Nuclear-101 Course
Organized by: CNS Education and Communication Committee
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2013 May 12 – 17
15th Conference on Nuclear Reactor Thermal Hydraulics (NURETH-15)
Pisa, Italy
Co-sponsored by CNS
Website: www.nureth15.org

2013 May 27 – 29
Third Climate Change Technology Conference
Concordia University,
Montreal, Qc, Canada
Organised by EIC, including CNS
Website: www.cctc2013.ca

2013 June 9 – 12
34th Annual CNS Conference & 37th Annual CNS/CNA Student Conference
Toronto Marriott Downtown Eaton Centre Hotel, Toronto, ON
Organized by: CNS
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: http://conf2013.cns-snc.ca/

2013 Spring
CNS Nuclear Education and Outreach (NEO) Workshop 2013
Organized by: CNS
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2013 June 16 – 20
ANS Annual Meeting
Atlanta, GA, USA
Website: www.ans.org/meetings

2013 July 29 – August 2
21st International Conference on Nuclear Engineering (ICONE-21)
Chengdu, China
Co-sponsored by CNS
Website: www.icone21.org

2013 August 11 – 15
16th International Conference on Environmental Degradation of Materials in Nuclear Power Systems-Water Reactors
Asheville, NC, USA
Co-sponsored by CNS
Website: http://events.nace.org/conferences/ed2013/index.asp

2013 August 18 – 23
22nd International Conference on Structural Mechanics in Reactor Technology (SMiRT-22)
San Francisco, CA, USA
Co-sponsored by CNS
Website: www.smirt22.org

2013 September 15 – 19
12th CNS International CNS Conference on CANDU Fuel
Holiday Inn, Kingston, ON
Organized by: CNS FT Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca/events/candufuel2013/

2013 Autumn
25th CNS Simulation Symposium
Organized by: CNS NSE Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2013 Autumn
CNS CANDU Reactor Safety Course
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Contact: Canadian Nuclear Society Office
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Website: www.cns-snc.ca

2013 Autumn
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Organized by: CNS Education and Communication Committee
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2013 November 10 – 14
ANS Winter Meeting
Washington, DC, USA
Website: www.ans.org/meetings

2014

2014 February
CNA Nuclear Industry Conference and Tradeshow
Westin Hotel Ottawa, ON
Organized by: CNA
Website: www.cna.ca/news_events/cna_conference

2014 Spring
CNS CANDU Reactor Safety Course
Toronto, ON
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Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
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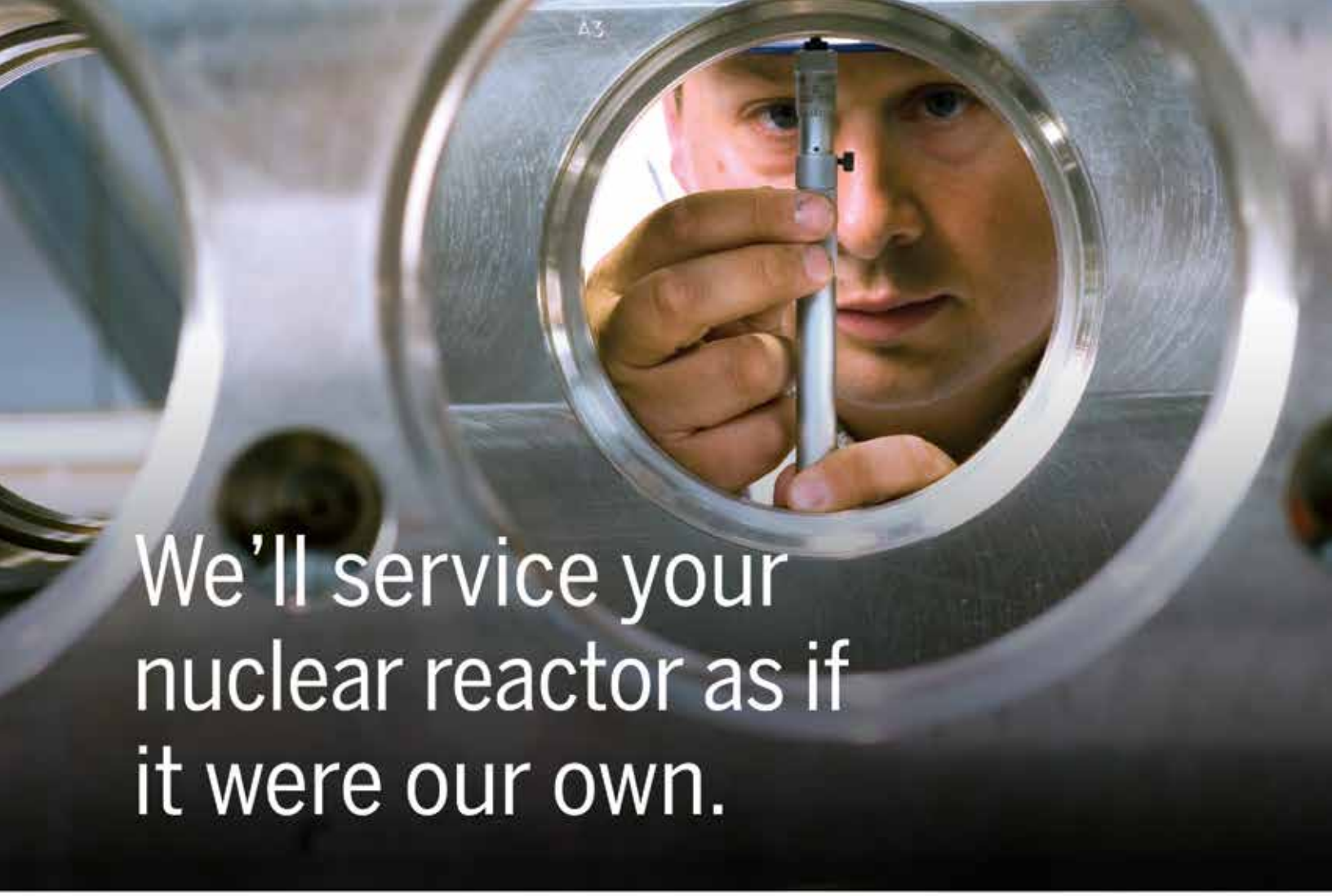
Website: www.cns-snc.ca



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We design and build nuclear reactors. It just makes sense that we're the best choice to service and maintain them.

Candu
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2013 Conference Schedule

2014 May 25 – 27
10th International CNS Conference on CANDU Maintenance
Metro Toronto Convention Centre, Toronto, ON
Organized by: CNS O&M Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2014 Spring/Summer
CNS Nuclear Education and Outreach (NEO) Workshop 2014
Organized by: CNS
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2014 June 15 – 19
ANS Annual Meeting
Reno, NV, USA
Website: www.ans.org/meetings

2014 August 24 – 28
19th Pacific Basin Nuclear Conference (PBNC-19)
Hyatt Regency Hotel, Vancouver, BC, Canada (with Student Poster Session)
Organised by: CNS
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.pbnc2014.org/

2014 October
CNS Conference on Nuclear Waste Management
Organized by: CNS E&WM Divisionn
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2014 Autumn
CNS CANDU Reactor Safety Course
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Contact: Canadian Nuclear Society Office
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E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

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Organised by: CNS FT Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2014 Autumn
3rd International Technical Meeting on Small Reactors
Organized by: CNS NSE Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2014 Autumn
26th Nuclear Simulation Symposium
Organized by: CNS; NSE division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2014 October 26 – 31
Nuclear Plant Chemistry Conference 2014 (NPC-2014)
Sapporo, Japan
Co-sponsored by CNS
Website: www.npc2014.net

2014 November 9 – 13
ANS Winter Meeting
Anaheim, CA, USA
Website: www.ans.org/meetings

2015

2015 February
CNA Nuclear Industry Conference and Tradeshow
Westin Hotel Ottawa, ON
Organized by: CNA
Website: www.cna.ca/news_events/cna_conference

2015 Spring
CNS CANDU Reactor Safety Course
Toronto, ON
Organized by: CNS NSE Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2015 Spring
CNS Nuclear-101 Course
Organized by: CNS Education and Communication Committee
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2015 May/June
35th Annual CNS Conference & 38th Annual CNS/CNA Student Conference
Organized by: CNS
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: http://conf2013.cns-snc.ca/

2015 Spring/Summer
CNS Nuclear Education and Outreach (NEO) Workshop 2015
Organized by: CNS
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: http://conf2013.cns-snc.ca/

2015 June 7 – 11
ANS Annual Meeting
San Antonio, TX, USA
Website: www.ans.org/meetings

2015 Autumn
CNS CANDU Reactor Safety Course
Organized by: CNS NSE Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
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Website: www.cns-snc.ca

2015 Autumn
CNS Nuclear-101 Course
Organized by: CNS Education and Communication Committee
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2015 Autumn
8th International CNS Conference on Steam Generators
Organized by: CNS D&M Division
Contact: Canadian Nuclear Society Office
Tel: 416-977-7620
E-mail: cns-snc@on.aibn.com
Website: www.cns-snc.ca

2015 November 8 – 12
ANS Winter Meeting
Washington, DC, USA
Website: www.ans.org/meetings

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Anchor down. Forge ahead.

World Reactor Performance

Top 25 units by capacity factor, December 31, 2012

Rank	Country	Plant	Type	Capacity (MW)	Capacity (%)
1	US	Millstone 3	PWR	1206	105.59
2	US	Dresden 2	BWR	909	103.77
3	Russia	Balakovo 4	PWR	1000	102.38
4	Taiwan	Kuosheng 2	BWR	985	101.83
5	Korea	Yonggwang 2	PWR	978	101.68
6	Ukraine	Rovno 2	PWR	415	101.55
7	US	Calvert Cliffs 2	PWR	880	100.97
8	Ukraine	Khmelnitski 1	PWR	1000	100.93
9	Ukraine	Zaporozhe 5	PWR	1000	100.81
10	US	Farley 2	PWR	928	100.64
11	US	Peach Bottom 3	BWR	1182	100.5
12	China	Daya Bay 4	PWR	984	100.4
13	Korea	Ulchin 5	PWR	1048	100.34
14	Korea	Kori 4	PWR	1042	100.07
15	India	Rajasthan 4	PHWR	220	99.91
16	US	Vogtle 2	PWR	1229	99.83
17	US	Callaway	PWR	1279	99.47
18	Finland	Olkiluoto 2	BWR	890	99.11
19	US	LaSalle 2	BWR	1207	98.67
20	Korea	Ulchin 2	PWR	1006	98.64
21	US	Commanche Peak 1	PWR	1250	98.6
22	**Korea**	**Wolsong 4**	**PHWR**	**730**	**98.5**
23	**Canada**	**Darlington 4**	**PHWR**	**934**	**98.26**
24	India	Rajasthan 6	PHWR	220	98.2
25	**Romania**	**Cernavoda 2**	**PHWR**	**706**	**98.08**

All figures taken from Nucleonics Week. All numbers have been rounded.

Nuclear Power and Uranium Resources

CANDU Nuclear Reactor Performance

December 2012 Reactor	In Service	Capacity (MW)	Performance In 2012 (%)	Lifetime Performance (%)
Point Lepreau	1983	680	0*	55.4
Gentilly 2	1983	675	71.9	76.9
Wolsong 1	1983	622	80.1	87.9
Wolsong 2	1997	730	92.7	94.1
Wolsong 3	1998	729	88.8	94.9
Wolsong 4	1999	730	98.6	96.1
Embalse	1984	648	65.8	83.8
Cernavoda 1	1996	706	87.5	89.7
Cernavoda 2	2007	705	98.8	94.8
Qinshan 4	2002	700	96.3	91.1
Qinshan 5	2003	700	90.5	91.2
Pickering 1	1971	542	64.7	64.2
Pickering 4	1973	542	73.6	65.7
Pickering 5	1983	540	98.0	74.0
Pickering 6	1984	540	96.8	78.6
Pickering 7	1985	540	66.2	77.9
Pickering 8	1986	540	65.6	76.5
Bruce 3	1978	750	51.6	64.0
Bruce 4	1979	750	57.5	64.4
Bruce 5	1985	817	98.4	84.5
Bruce 6	1984	817	99.7	81.5
Bruce 7	1986	817	99.7	84.5
Bruce 8	1987	787	85.6	82.6
Darlington 1	1992	934	94.9	85.1
Darlington 2	1990	934	93.6	79.3
Darlington 3	1993	934	83.3	86.6
Darlington 4	1993	934	98.2	86.8
Total/Average		**19,643**	**81.4**	**81.2**

COG CANDU/PHWR Performance Indicators, December 2012.
*These reactors were under reconstruction during part or all of 2012.

World Uranium Production – 2011

Country or area	Production (tU) 2008	2009	2010	2011
Australia	8 430	7 982	5 900	5 983
Brazil	330	345	148	265
Canada	9 000	10 173	9 783	9 145
China*	769	750	827	1599
Czech Rep	263	258	254	229
France	5	8	7	6
Germany	-	-	-	52
India*	271	290	400	400
Kazakhstan	8 521	14 020	17 803	19 451
Malawi	0	104	670	846
Namibia	4 366	4 626	4 496	3 259
Niger	3 032	3 234	4 198	4 351
Pakistan*	45	50	45	45
Romania*	77	75	77	77
Russia*	3 521	3 564	3 562	2 993
South Africa	566	563	583	582
Ukraine*	800	840	850	890
USA	1 430	1 453	1 660	1 537
Uzbekistan	2 338	2 429	2 400	3000
Other		112		
Total	**43 764**	**50 772**	**52 993**	**54 610**

* UI estimate
All figures taken from the World Nuclear Association

World Reactor Capacity

April 2013

Country	Operating (June 2011)		Planned or Under Construction		Electricity Generation (2010)	
	No	MW	No	MW	%	TWh
Argentina	2	935	4	2 145	5.0	5.9
Armenia	1	376	1	1060	39.4	2.3
Bangladesh			2	2000		
Belarus			2	2400		
Belgium	7	5 943			54.0	45.3
Brazil	2	1 901	5	5 405	3.2	14.8
Bulgaria	2	1 906	1	950	32.6	15.3
Canada	19	13 531	5	5 300	15.3	88.3
Chile	0	0	4	4 400		
China	11	8 587	197	208 120	1.8	70.1
Czech Republic	6	3 766	3	3 600	33	26.7
Egypt			2	2 000		
Finland	4	2 741	3	4 700	31.6	22.3
France	58	63 130	3	4 540	77.7	423.5
Germany	9	12 003			17.8	102.3
Hungary	4	1 880	2	2 200	43.2	14.7
India	20	4 385	64	65 400	3.7	28.9
Indonesia			6	6 000		
Iran	1	915	3	2 300	na	na
Israel			1	1 200		
Italy			10	17 000		
Japan	50	44 396	15	20 588	18.1	156.2
Jordan			1	1 000		
Kazakhstan			4	1 200		
Korea, N			1	950		
Korea, S	23	20 787	9	12 205	34.6	147.8
Lithuania			1	1 350		
Malaysia			2	2 000		
Mexico	2	1 310	2	2 000	3.6	9.3
Netherlands	1	485	1	1 000	3.6	3.9
Pakistan	3	725	4	2 680	3.8	3.8
Poland			6	6 000		
Romania	2	1 310	3	1 975	19.0	10.8
Russia	33	24 164	47	53 340	17.6	162.0
Saudi Arabia			16	17 000		
Slovakia	4	1 816	3	2 040	54.0	14.3
Slovenia	1	696	1	1 000	41.7	5.9
South Africa	2	1 800	6	9 600	5.2	12.9
Spain	7	7 002			19.5	55.1
Sweden	10	9 399			39.6	58.1
Switzerland	5	3 252	3	4 000	40.8	25.7
Taiwan	6	4 927	8	10 600	19.3	39.9
Thailand			5	5 000		
Turkey			8	10 400		
UAE			14	20 000		
UK	16	10 038	13	18 680	17.8	62.8
Ukraine	15	13 168	13	13 900	47.2	84.9
USA	103	101 355	27	38 473	19.2	790.4
Vietnam			10	10 000		
Total	**435**	**374,287**	**548**	**557,304**	**13.5**	**2,518**

Notes
All figures taken from the World Nuclear Association

CNS Council and Staff

CNS Executive

John Roberts
President

Adriaan Buijs
1st Vice-President

Frank Doyle
Past President

Jacques Plourde
2nd Vice-President

Mohamed Younis
Treasurer

Colin Hunt
Secretary

Benjamin Rouben
Executive Director

Ken Smith
Financial Administrator

The Canadian Nuclear Society

The Canadian Nuclear Society (CNS) was established in 1979 as an organization of individual members, paying membership dues. It was established as an independent section of the Canadian Nuclear Association in order to benefit from the office support structure of the CNA. In 1997, after twenty years of operation in this mode, and after building its own asset base, the CNS obtained a federal charter as an independent not-for-profit organization. The CNS, through its base of individual members, promotes the exchange of information on all aspects of nuclear science and technology – including uranium mining and refining, electricity generation by nuclear power, medical and industrial uses of radionuclides, management of radioactive wastes, and various associated research and development activities.

The activities of the CNS are managed by a Council that is elected by the CNS members at the Annual General Meeting, normally held in June. The Council term of office is one year. A group photo of Council Members at a recent meeting is provided on the next page. The elected Council consists of six Executive Officers plus up to nineteen Members-at-Large – all volunteers. Various members of Council are appointed to Chair Committees that look after specific issues. A list of Committee Chairs appears on the next page. The Council is supported by a full time Office Manager, and by other part-time specialists.

Elected Executive for June 2012 to June 2013:

John Roberts President	Adriaan Buijs 1st V-P	Jacques Plourde 2nd V-P	Colin Hunt Secretary	Mohamed Younis Treasurer	Frank Doyle Past President

Part-time Specialists and Office Staff:

Ben Rouben Executive Director	Ken Smith Financial Administrator	Brian Blosser Accountant	Amanda Blosser Bookkeeper	Denise Rouben Office Manager	Bob O'Sullivan Office Assistant

The CNS is organized into Branches and Technical Divisions, both directed towards involvement of the individual member. Branches are established on a geographical basis, and hold local meetings on issues of interest. Technical Divisions are established for specific technical areas of interest – and are responsible for organizing topical conferences, courses, and seminars.

The Chairs of the various Branches and Division are listed on the next page.

An outline of the activities of the CNS, including a list of upcoming conferences and courses, is provided elsewhere in this Yearbook.

CNS Members at Large


Parvaiz Akhtar


Parva Alavi


Vinod Chugh


Emily Corcoran


Shaun Cotnam


Ruxandra Dranga


Dan Gammage


Heather Kleb, Acting President, Canadian Nuclear Association Ex Officio


V.S. (Krish) Krishnan


Laurence Leung


Guy Marleau


Kris Mohan


E.M (Dorin) Nichita


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Schweizerische Vereinigung fur Atomenergie (SVA)
(Swiss Association for Atomic Energy)
Postfach 5032
Ch-3001 Bern
Tel: +41 31 32 065 25

TAIWAN

Atomic Energy Council
No, 67, Lane 144, Sec. 4,
Keelung Rd.
Taipei, Taiwan, R.O.
Tel: 886 2 2363 4180

TURKEY

Turkish Atomic Energy Authority (TAEK)
Eskisehir Yolu 9. km
Lodumlu, 06530 ANKARA
Tel: 90-312 287 1529
Fax: 90-312 285 1537

UNITED KINGDOM

British Nuclear Energy Society (BNES)
1-7 Great George Street
London SW1P 3AA
Tel: +44 20 7222-7722

British Nuclear Industry Forum (BNIF)
First Fl., Whitehall House
41 Whitehall
London, SW1A 2BY
Tel: +44 20 7766 6640
Fax: +44 20 7839 4695

British Nuclear Fuels PLC (BNFL)
Risley Warrington
Cheshire WA3 6AS
Tel: +44 925 832 000

CNSC-H&SE/NII
Railway Inspectorate
2nd floor SW, Rose Court
2 Southwark Bridge
London SE1 9HS
Tel: 44-171 717 6887
Fax: 44-171 717 6095

JET Joint Undertaking
Abingdon, Oxfordshire
United Kingdom OX14 3EA
Tel: +44 235 528 822
Fax: +44 235 464 755

Scottish Power (Head Office)
Cathcart House, Spean St.
Glasgow, Scotland G44 4BE
Tel: +44 41 637 7177

United Kingdom Atomic Energy Authority (UKAEA)
Marshall Bldg.
521 Downs Way
Harwell, Didcot, Oxfordshire
OX11 ORA
Tel: +44 1235 820 220

Women in Nuclear Global (WiN)
c/o World Nuclear Association
Carlton House
22a St. James' Square
London SW1Y 4JH
United Kingdom
Tel: +44 (0)207 451-1520
Fax: +44 (0)207 839-1501

World Association of Nuclear Operators (WANO)
King's Buildings,
16 Smith Square
London. United Kingdom
SW1P 3HQ
Tel: +44 71 828 2111
Fax: +44 71 828 6691

World Energy Council (WEC)
5th Floor, Regency House
1-4 Warwick St.
London, United Kingdom
SW1B 5LT
Tel: +44 20 7734 5996
Fax: +44 20 7734 5926

World Nuclear Association
22a St James's Square
London, United Kingdom
SW1Y 4JH
Tel: +44 (0)20 7451 1520
Fax: +44 (0)20 7839 1501

UNITED STATES

American Nuclear Society (ANS)
555 North Kensington Ave.
La Grange Park, Illinois 60526
Tel: (708) 352-6611

Argonne National Laboratory (East)
9700 South Cass Ave.
Argonne, Illinois 60439
Tel: (630) 252-2000

Argonne National Laboratory (West)
P.O. Box 2528
Idaho Falls, Idaho
83403-2528
Tel: (208) 533-7341

Brookhaven National Laboratory (BNL)
Upton, NY 11973-5000
Tel: (631) 344-8000

CNSC-USNRC Office of Public Affairs (OPA)
Washington, D.C. 20555
Tel: 301-415 0317
Fax: 301-415 2395

Edison Electric Institute (EEI)
701 Pennsylvania Ave. NW
Washington, D.C.
20004-2696
Tel: (202) 508-5000

Electric Power Research Institute (EPRI)
3412 Hillview Ave.
P.O. Box 10412
Palo Alto, California 94303
Tel: (415) 855-2000

Environmental Protection Agency (EPA)
1200 Pennsylvania Ave., NW
Washington, D.C. 20460
Tel: (202) 260-2090

Lawrence Livermore National Laboratory
P.O. Box 808
Livermore, CA 94551-0808
Tel: (925) 422-1100

Los Alamos National Laboratory (LANL)
P.O. Box 1663
Los Alamos, N.M. 87545
Tel: (505) 667-7000

National Council on Radiation Protection and Measurements (NCRP)
7910 Woodmont Ave.
Suite 800
Bethesda, Maryland
20814-3095
Tel: (301) 657-2652

Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington, D.C.
20006-3708
Tel: 202.739.8000
Fax: 202.785.4019

Nuclear Regulatory Commission (NRC)
Mail Stop TA-13
Washington, D.C. 20555
Tel: (301) 415-8200

Oak Ridge National Laboratory (ORNL)
P.O. Box 2008
Oak Ridge, Tennessee 37831
Tel: (615) 574-4160

Sandia National Laboratories
Albuquerque, N.M
87185-5800
Tel: (505) 844-5678

U.S. Department of Energy (DOE)
1000 Independence Ave., S.W.
Washington, D.C. 20585
Tel: (202) 586-5000

Yugoslavia Federal Secretariat for Energy and Industry
Bulevar AVNOJ-A 104 11070
Novi Beograd
Tel: (38-11) 195 244

Guide to Nuclear-Related Organizations

FEDERAL GOVERNMENT

Atomic Energy of Canada Limited (AECL)
Place de Ville, Tower B112 Kent St., Suite 501
Ottawa ON K1P 5P2
Tel: (613) 237-3270

AECL Chalk River Laboratories
Chalk River ON K0J 1J0
Tel: (613) 584-3311

AECL Low-level Radioactive Waste Management National Office
Suite 200
1900 City Park Drive
Ottawa ON K1J 1A3
Tel: (613) 998-9442

AECL Whiteshell Laboratories
P.O. Box 550
Pinawa MB R0E 1L0
Tel: (204) 753-2051

Canadian Nuclear Safety Commission
P.O. Box 1046
280 Slater Street
Ottawa ON K1P 5S9
Tel: (613) 995-5894

Department of Foreign Affairs and International Trade (DFAIT)
Lester B Pearson Bldg.
125 Sussex Dr.
Ottawa ON K1A 0G2
Tel: (613) 996-9134

DFAIT – Global Partnership Program (GPX)
Outreach and Communication
Department of Foreign Affairs and International Trade
125 Sussex Drive
Ottawa ON K1A 0G2
Tel: (613) 944-2536

Environment Canada
351 Joseph Blvd.
Hull QC K1A 0H3
Tel: (613) 997-2800

Health and Welfare Canada
A.L. 0900C2
Ottawa ON K1A 0K9
Tel: (613) 957-2991

Mine Environmental Neutral Drainage Program Canada Centre for Mineral & Energy Technology
Natural Resources Canada
555 Booth Street
Ottawa ON K1A 0G1
Tel: (613) 992-8736

National Energy Board
444 Seventh Ave. SW
Calgary AB T2P 0X8
Tel: (403) 292 4800

National Research Council
Canada Institute for Scientific and Technical Information (CISTI)
Bldg. M55, Room 148
Montreal Rd. Campus
Ottawa ON K1A 0S2
Tel: (613) 993-1600

Natural Resources Canada (Uranium, Nuclear Energy & Waste Management)
580 Booth Street
Ottawa ON K1A 0E4
Tel: (613) 995-0947

Natural Sciences and Engineering Research Council of Canada (NSERC)
350 Albert St., Tower 2
Ottawa ON K1A 1H5
Tel: (613) 995-5992

Nuclear Waste Management Organization (NWMO)
49 Jackes Avenue,
First Floor
Toronto ON M4T 1E2
Tel: 416-934-9814

PROVINCIAL ORGANIZATIONS

Hydro-Québec
75 René-Lévesque Blvd., West
Montréal QC H2Z 1A4
Tel: 514 289-2211

Hydro-Québec Gentilly 2 Nuclear Power Station
4900 Becancour Blvd.
Gentilly QC G0X 1G0
Tel: (819) 298-2943

New Brunswick Power
515 King Street
P.O. Box 2000
Fredericton NB E3B 4X1
Tel: 1-800-663-6272

New Brunswick Point Lepreau Generating Station
P.O. Box 600
Lepreau NB E5J 2S6
Tel: (506) 659-2220

Ontario Power Generation (OPG)
700 University Ave.
Toronto ON M5G 1X6
Tel: (416) 592-5111

Ontario Power Generation Darlington Generation Station
Information Centre
P.O. Box 4000
Bowmanville ON L1C 3Z8
Tel: (905) 623-7122

Ontario Power Generation Pickering Generating Station
Information Centre
1675 Montgomery Park Rd.
Pickering ON L1V 2R5
Tel: (905) 839-0465

ASSOCIATIONS

Association of Consulting Engineers of Canada
130 Albert St., Suite 616
Ottawa ON K1P 5G4
Tel: (613) 236-0569

Association of Major Power Consumers of Ontario (AMPCO)
P.O. Box 69, 595 Bay St.
Suite 1201
Toronto ON M5G 2C2
Tel: (416) 260-0225

Canadian Association of Medical Radiation Technologists
130 Albert St., Suite 1501
Ottawa ON K1P 5G4
Tel: (613) 234-0012

Canadian Association of Radiologists
1740 Cote Vertu Blvd.
Saint-Laurent QC H4L 2A4
Tel: (514) 738-3111

Canadian Electricity Association
66 Slater Street, Suite 1210
Ottawa ON K1P 5H1
Tel: (613) 230-9263

Canadian Standards Association (CSA)
178 Rexdale Blvd.
Rexdale ON M9W 1R3
Tel: (416) 747-4000

Engineering Institute of Canada
1295 Hwy 2 East
Kingston ON K7L 4V1
Tel: (613) 547-5989

Electricity Distributors Association
20 Eglinton Ave. W.
Suite 500
P.O. Box 2004
Toronto ON M4R 1K8
Tel: (416) 483-7739

Guide to Nuclear-Related Organizations

Institute de Recherche d'Hydro-Québec (IREQ)
1800, boul. Lionel-Boulet
Varennes QC J3X 1S1
Tel: (514) 652-1321

Radiation Safety Institute of Canada
1120 Finch Avenue W.
Suite 607
Toronto ON M3J 3H7
Tel: (416) 650 9090

UNIVERSITY/ EDUCATION

Association of Universities and Colleges of Canada
350 Albert St., Suite 600
Ottawa ON K1R 1B1
Tel: (613) 563-1236

Carleton University
1125 Colonel By Drive
Ottawa ON K1S 5B6
Tel: (613) 788-7400

Dalhousie University
1459 Oxford St.
Halifax NS B3H 4R2
Tel: (902) 494-2211

École Polytechnique
C.P. 6079 Centre-Ville
Montréal QC H3C 3A7
Tel: (514) 340-4711

Institut Armand-Frappier
531, boulevard des Prairies
C.P. 100
Laval QC H7V 1B7

Institut National de la Recherche Scientifique (INRS)
2600, boulevard Laurier
C.P. 7500
Ste-Foy QC G1V 4C7
Tel: (418) 654-2500

McGill University
845 Sherbrooke St. W.
Montréal QC H3A 2T5
Tel: (514) 398-4455

McMaster University
1280 Main St. W.
Hamilton ON L8S 4L8
Tel: (905) 525-9140

Queen's University
99 University Ave.
Kingston ON K7L 3N6
(613) 533-2000

Royal Military College of Canada
Station "Forces"
P.O. Box 17000
Kingston ON K7K 7B4
Tel: (613) 541-6000

Trent University
1600 West Bank Dr.
Peterborough ON K9J 7B8
Tel: (705) 748-1011

University of Alberta
114 Street – 89 Ave.
Edmonton AB T6G 2M7
Tel: (708) 492-3111

University of British Columbia
2329 West Mall
Vancouver BC V6T 1Z4
Tel: (604) 822-2211

University of Manitoba Department of Physics and Astronomy
Winnipeg MB R3T 2N2
Tel: (204) 474-8880

Université de Montréal
C.P. 6128, Succursale A
Montreal QC H3C 3J7
Tel: (514) 343-6111

University of New Brunswick
3 Bailey Dr.
P.O. Box 4400
Fredericton NB E3B 5A3
Tel: (506) 453-4864

University of Ontario Institute of Technology
2000 Simcoe Street North
Oshawa ON L1H 7L7
Tel: (905) 721-3190

University of Ottawa
550 Cumberland
P.O. Box, 450 Stn. A
Ottawa ON K1N 6N5
Tel: (613) 562-5700

University of Saskatchewan
Physics Department
116 Science Place
Saskatoon SK S7N 5E2
Tel: (306) 966-4343

University of Toronto – Centre for Nuclear Engineering
Contact: Brian C.
Wallberg Bldg.
184 College Street
Toronto ON M5S 3E5
Tel: (416) 978-2127

University of Victoria
Faculty of Engineering
PO Box 3055, EOW 248
Victoria BC V8W 3P6
Tel: (250) 721-8677

University of Western Ontario
1151 Richmond Street
Suite 2
London ON N6A 5B8

University Network of Excellence in Nuclear Engineering (UNENE)
For more information
please contact your local UNENE
representative

World Nuclear University (WNU)
Atoms for Sustainable
Development
For more information
please visit their website
at www.world-nuclear-
university.org

Nuclear Power Plant Operators
Bruce Power Inc.
P.O. Box 1540, B32
Tiverton ON N0G 2T0
Tel: (519) 361-7777

Hydro-Québec Gentilly 2 Nuclear Power Station
4900 Becancour Blvd.
Gentilly QC G0X 1G0
Tel: (819) 298-2943

New Brunswick Point Lepreau
Generating Station
P.O. Box 600
Lepreau NB E5J 2S6
Tel: (506) 659-2220

Ontario Power Generation Darlington Generation Station
Information Centre
P.O. Box 4000
Bowmanville ON L1C 3Z8
Tel: (905) 623-7122

Ontario Power Generation Pickering Generating Station
Information Centre
1675 Montgomery Park Rd.
Pickering ON L1V 2R5
Tel: (905) 839-0465

National Organizations
Canadian Nuclear Association
130 Albert Street
Suite 1610
Ottawa ON K1P 5G4
Tel: (613) 237-4262

Canadian Nuclear Society (CNS)
480 University Avenue
Suite 200
Toronto ON M5G 1V2
Tel: (416) 977-7620

Canadian Nuclear Workers Council
244 Eglinton Ave. E.
Toronto ON M4P 1K2
Tel: (416) 484-4491

CANDU Owners Group
480 University Ave.
Suite 200
Toronto ON M5G 1V2
Tel: (416) 595-1888

The Canadian Centre for Energy Information
201, 322 – 11 Avenue, SW
Calgary AB T2R 0C5
Tel: (403) 263-7722

Organization of CANDU Industries (OCI)
1 Yonge St., Suite 1801
Toronto ON M5W 1W7
Tel: (416) 363-7845

INTERNATIONAL ORGANIZATIONS

Commission of the European Communities Nuclear Safety Research Directorate
200, rue de la Loi
B-1049 Brussels, Belgium
Tel: +32 2 2299 11 11

European Nuclear Society
Rue Belliard, 15-17
1040 Brussels, Belgium
Tel. +32 2 505 30 50
Fax: +32 2 502 3902

FORATOM – European Atomic Forum
Rue Belliard, 15-17
1040 Brussels, Belgium
Tel: +32 2 502 4595
Fax: +32 2 502 3902

International Atomic Energy Agency (IAEA)
Wagramerstrasse 5
P.O. Box 100
A-1400 Vienna, Austria
Tel: +43 12600-0

International Energy Agency (IEA)
9, rue de la Fédération
75739 Paris, Cedex 15 France
Tel: +33 140 5765
Fax: +33 140 57 6559

International Radiation Protection Association (IRPA)
Route du Panorama
BP48-F92263
Fontenay-aux-Roses Cedex
France
Tel: +33 1 46 547 476
Fax: +33 1 40 849 034

(OECD) Organisation for Economic Cooperation and Development Nuclear Energy Agency (NEA)
Le Seine Saint-Germain
12, boulevard des les
F-92130 Issy-les-Moulineaux, France
Tel. +33 (1) 45 24 82 00
Fax. +33 (1) 45 24 11 10

United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)
P.O. Box 500
A-1400 Vienna, Austria
Tel: +43 1 211 31, ext. 4330

World Association of Nuclear Operators (WANO)
King's Buildings
16 Smith Square
London, United Kingdom SW1P 3HQ
Tel: +44 71 828 2111
Fax: +44 71 828 6691

World Council of Nuclear Workers
49 rue Lauriston
75116 Paris, France
Tel : +33 (0)1 53 70 88 99
Fax : +33 (0)1 53 70 01 08

World Energy Council (WEC)
5th Floor, Regency House
1-4 Warwick St.
London, United Kingdom SW1B 5LT
Tel: +44 20 7734 5996
Fax: +44 20 7734 5926

World Nuclear Association
12 Floor, Bowater House W.
114 Knightsbridge, London
SW1X 7LJ, UK
Tel: +44 20 7225 0303
Fax: +44 20 7225 0308

World Nuclear Transport Institute
Remo House
310-312 Regent Street
London, W1B 3AX
Tel: +44 (0) 207 580 1144
Fax: +44 (0) 207 580 5365
www.wnti.co.uk

Brian Smyth, Senior Vice President, Outage and Maintenance Services, and John Soini, Vice President, Operating Efficiency, mark the time – 10:30 p.m. – Unit 2 is synchronized with the province's electricity grid on Oct. 16. (Bruce Power)

Canada's Nuclear Facilities

This list contains, by licence type, power reactors, uranium mine/mill facilities, uranium refineries and fuel fabrication facilities, radioisotope management facilities, research reactors, particle accelerators and radioisotope uses licensed by the Canadian Nuclear Safety Commission in Canada.

Information is based upon Canadian Nuclear Safety Commission licensing information in 2013.

Power Reactor Licences

Facility and Location	Type and Number of Units/Capacity	Startup	Status
Pickering Nuclear Generating Station A Pickering, Ontario (Ontario Power Generation)	CANDU-PHW 2 x 500 MW(e)	1971	Operating
Pickering Nuclear Generating Station A Pickering, Ontario (Ontario Power Generation)	CANDU-PHW 2 x 500 MW(e)	1971	Shutdown To be decommissioned
Pickering Nuclear Generating Station B Pickering, Ontario (Ontario Power Generation)	CANDU-PHW 4 x 500 MW(e)	1983	Operating
Darlington Nuclear Generating Station Bowmanville, Ontario (Ontario Power Generation)	CANDU-PHW 4 x 850 MW(e)	1989	Operating
Bruce Nuclear Generating Station A Tiverton, Ontario (Bruce Power)	CANDU-PHW 4 x 750 MW(e)	1976	Operating
Bruce Nuclear Generating Station B Tiverton, Ontario (Bruce Power)	CANDU-PHW 4 x 840 MW(e)	1984	Operating
Gentilly-2 Nuclear Generating Station Gentilly, Québec (Hydro-Québec)	CANDU-PHW 1 x 600 MW(e)	1983	Shutdown To be decommissioned
Point Lepreau Generating Station Lepreau, New Brunswick (New Brunswick Power Corp.)	CANDU-PHW 1 x 600 MW(e)	1982	Operating

Non-Power Reactor Licences

Unit	Type	In Service	Status
University of Toronto, Toronto, Ontario	Subcritical Assembly	1958	Decommissioned
McMaster University, Hamilton, Ontario	Pool-Type 5 MW(T)	1959	Operating
École polytechnique, Montréal, Québec	Subcritical Assembly	1974	Operating
University of Toronto, Toronto, Ontario	SLOWPOKE-2 20 kW(t)	1976	Decommissioned
École polytechnique, Montréal, Québec	SLOWPOKE-2 20 kW(t)	1976	Operating
Dalhousie University, Halifax, Nova Scotia	SLOWPOKE-2 20 kW(t)	1976	Decommissioned
University of Alberta, Edmonton, Alberta	SLOWPOKE-2 20 kW(t)	1977	Operating
Saskatchewan Research Council, Saskatoon, Saskatchewan	SLOWPOKE-2 20 kW(t)	1981	Operating
Royal Military College, Kingston, Ontario	SLOWPOKE-2 20 kW(t)	1985	Operating
Atomic Energy of Canada Ltd., Chalk River, Ontario	Maple 1 & 2 Reactors 10 MW(t)		Shutdown pending decommissioning

Nuclear Research and Test Establishment Licences

Unit	Type	Status
Chalk River Laboratories (AECL)		
NRX Reactor	42 MW(t)	Decommissioning
NRU Reactor	135 MW(t)	Operating
Recycle Fuel Fabrication Laboratories	Manufacture of small quantities of mixed oxide fuel for research and demonstration	Operating
PTR Reactor	100 W(t)	Decommissioned and released
ZED-2 Reactor	200 W(t)	Operating

Nuclear Research and Test Establishment Licences (cont'd)

Unit	Type	Status
Universal Cells	3 isolation cells for examining radioactive material	Operating
Molybdenum-99 Production Facility	Production of Mo-99 and Xe-133	Operating
Health Physics Neutron Generator	Electrostatic accelerator 150 KeV	Operating
Gamma Beam Irradiator GC60	Irradiation Facility	Operating
Gamma Beam 150 C Irradiation Facility	Irradiation Facility	Operating
Waste Treatment Centre and Associated Facilities	Treatment of solid and liquid waste	Operating
Fuels and Materials Cells	12 isolation cells for examining radioactive material	Operating
Waste Management Areas	Storage and handling of waste	Operating/Shutdown
Nuclear Fuel Fabrication Facility	Production of low enriched uranium fuel for research reactors	Operating
Nuclear Fuel Fabrication Facility	Production of low and high enriched uranium fuel targets for research reactors	Operating
Heavy Water Upgrading Facility	Upgrading of heavy water	Dcommissioning
CECEUD Test Facility	Upgrade and detritiate heavy water	Shutdown pending decommissioning
Tritium Laboratory	Processing of tritium	Operating
Whiteshell Laboratories (AECL)		
WR-1 Reactor	Organically cooled experimental reactor	Decommissioning
WL Concrete Canister Storage Facilities	Storage of irradiated fuel	Operating
Van de Graaf Accelerator	Proton accelerator, >30 microamps	Decommissioned
14 MeV Neutron Generator		Decommissioned
Active Liquid Waste Treatment Centre	Treatment of liquid waste	Operating
WL Shielded Facilities	Post irradiated examination of fuels, reactor core components and other	Decommissioning
WL Waste Management Area	Storage and handing of waste	Operating
SLOWPOKE Demonstration Reactor	2 MW pool-type reactor	Decommissioned

Uranium Mine and Mill Facility Licences

Facility	Activity	Status
Beaverlodge, Saskatchewan (Cameco Corporation)	Long-term monitoring	Decommissioned
Cigar Lake Project, Saskatchewan (Cameco Corporation)	Construction	Construction
Cluff Lake, Saskatchewan (AREVA Resources Canada Inc.)	Long-term monitoring	Decommissioned
Key Lake Operation Saskatchewan (Cameco Corporation)	Milling	Operating
McArthur River Project, Saskatchewan (Cameco Corporation)	Mining	Operating
McClean Lake Project, Saskatchewan (AREVA Resources Canada Inc.)	Milling	Operating
Rabbit Lake Saskatchewan (Cameco Corporation)	Mining and milling	Operating
Denison Mines, Elliot Lake, Ontario (Denison Mines Ltd.)	Above-ground tailings	Decommissioned
Stanrock, Elliot Lake, Ontario (Denison Mines)	Above-ground tailings	Decommissioned
Madawaska Bancroft, Ontario (Madawaska Mines Ltd.)	Long-term monitoring	Decommissioned

Canada's Nuclear Facilities

Refinery and Fuel Fabrication Facility Licences

Facility	Annual Licensed Production Limit	Status
GE Hitachi Nuclear Energy Canada Inc., Toronto, Ontario	1,800 tonnes of uranium	Operating
GE Hitachi Nuclear Energy Canada Inc., Peterborough, Ontario	1,800 tonnes of uranium	Operating
Port Hope Fuel Manufacturing Facility, Port Hope, Ontario (Cameco)	125 tonnes of UO2	Operating
Blind River Uranium Refinery, Blind River, Ontario (Cameco)	24,000 tonnes of uranium as UO3	Operating
Port Hope Uranium Converstion Facility, Port Hope, Onatario (Cameco)	12,500 tonnes of uranium as uranium hexaflouride 3,800 tonnes of uranium as UO2 1,000 tonnes of uranium as ammonium diuranate 2,000 tonnes of uranium metals	Operating

Waste Management Licences

Facility	Activity	Status
Radioactive Waste Operations Site 1 Tiverton, Ontario (OPG)	Storage of intermediate level radioactive waste from the Douglas Point nuclear reactor in in-ground concrete trenches and tile holes. The licence was amended in July 2006 to include the Spent Solvent Treatment Facility as minor amounts of nuclear substances remain in the facility from the past processing of spent solvents Contaminated with nuclear substances. No new radioactive waste is accepted at the facility.	Storage with surveillance
Western Waste Management Facility, Tiverton, Ontario (OPG)	Processing and/or storage of low level radioactive waste and storage of intermediate level radioactive waste, and processing and storage of spent nuclear fuel from the Bruce NGS	Operating
Pickering Waste Management Facility Pickering, Ontario (OPG)	Processing and storage of spent nuclear fuel from the Pickering NGS and storage of retube components from the Pickering NGS	Operating
Bruce Heavy Water Plant Tiverton, Ontario (OPG)	Decommissioning of the heavy water plant and remediation of the site	Decommissioning
Douglas Point Radioactive Waste Storage Facility Tiverton, Ontario (AECL)	Storage of solid waste from Douglas Point Generating Station, spent fuel storage, no new waste accepted	Storage with surveillance
Gentilly-1 Radioactive Waste Storage Facility Gentilly, Quebec (AECL)	Storage of solid waste from Gentilly-1 NGS, spent fuel storage. No new radioactive waste is accepted.	Storage with surveillance
Gentilly-2 Radioactive Waste Storage Facility Gentilly, Quebec (Hydro-Quebec)	Storage of solid waste and spent fuel storage from Gentilly-2 NGS	Operating
Point Lepreau Solid Radioactive WMF Point Lepreau, New Brunswick (NB Power Nuclear Corporation)	Storage of solid waste and spent fuel storage from Point Lepreau NGS	Operating
Darlington Waste Management Facility Bowmanville, Ontario (OPG)	Processing and storage of spent nuclear fuel from the Darlington NGS	Operating
University of Toronto WMF Toronto, Ontario (University of Toronto)	Storage, handling and compaction of waste from university	Operating
Central Maintenance and Laundry Facility Tiverton, Ontario (Bruce Power)	Managing waste (slightly radioactive clothing materials) from decontamination activities	Operating
Energy Solutions WMF Brampton, Ontario (Energy Solutions Canada)	Storage, handling and compaction of waste from Ontario and Quebec	Operating
Nuclear Power Demonstration WMF Rolphton, Ontario (AECL)	Storage of solid waste from the partial decommissioning of NPD NGS. No new waste accepted.	Storage with surveillance
Port Granby Long-term (LT) WMF Clarington, Ontario (AECL)	Storage of historic waste and chemical treatment of drainage and run-off. No new waste is accepted. Currently undergoing construction.	Storage with surveillance and remediation
Port Hope Long-term (LT) WMF Port Hope, Ontario (AECL)	Storage of historic waste and treatment of drainage and run-off. No new waste is accepted. Currently undergoing construction.	Storage with surveillance and remediation

Waste Management Licences (cont'd)

Facility	Activity	Status
Elliot Lake WMF Elliot Lake, Ontario (Rio Algom Ltd.)	Multiple tailings management site, chemical treatment of effluent. No new waste accepted.	Decommissioned
Port Hope PSE TSS Port Hope, Ontario (Low-Level Radioactive Waste Management Office)	Storage of historic waste	Operating
Port Hope WMF Port Hope, Ontario (Low-Level Radioactive Waste Management Office, Pine St. Extension Temporary Storage Site)	Storage of historic waste no new waste accepted	Storage with surveillance
Roving Locations (Low-Level Radioactive Waste Management Office, decontamination projects)	Possession of historic waste on an as requested basis	Operating
Agnew Lake Idle Mine Site Nairn Centre, Ontario (Ontario Ministry of Northern Development and Mines)	Above-ground tailings	Decommissioned
Dyno Idle Mine Site Bancroft, Ontario (EWL Management Ltd)	Above-ground tailings	Decommissioned
Rayrock Idle Mine Site Northwest Territories (Department of Indian Affairs and Northern Development)	Above-ground tailings	Decommissioned
Port Radium Idle Mine Site Northwest Territories (Department of Indian Affairs and Northern Development)	Above-ground tailings	Decommissioned
Madawaska Bancroft, Ontario (EWL Management Ltd.)	Above-ground tailings	Decommissioned
Bicroft Tailings Storage Facility Bancroft, Ontario (Barrick Gold Corporation)	Above-ground tailings	Decommissioned

Particle Accelerator Licences

Facility	Type	Status
Health PEI Charlottetown, Prince Edward Island	2 linacs	Operating
Region Health Authority B Saint John, New Brunswick	3 linacs	Operating
Centre de santé et de services sociaux de Chicoutimi Chicoutimi, Québec	3 linacs	Operating
Centre universitaire de santé McGill Montréal, Québec	3 linacs	Operating
Hospital Maisonneuve-Rosemont Montréal, Québec	6 linacs	Operating
The Board of Governors of the Kingston General Hospital, Kingston, Ontario	4 linacs	Operating
Thunder Bay Regional Health Sciences Centre Thunder Bay, Ontario	3 linacs	Operating
Windsor Regional Hospital Windsor, Ontario	3 linacs	Operating
Cancer Care Manitoba Winnipeg, Manitoba	7 linacs	Operating
Saskatchewan Cancer Agency Regina, Saskatchewan	3 linacs	Operating
Saskatchewan Cancer Agency Saskatoon, Saskatchewan	3 linacs	Operating
Alberta Health Services Calgary, Alberta	6 linacs	Operating
Alberta Health Services Edmonton, Alberta	5 linacs	Operating
Alerta Health Services Lethbridge, Alberta	2 linacs	Operating
Hôpital Général Juif Montréal, Québec	3 linacs	Operating

Particle Accelerator Licences (cont'd)

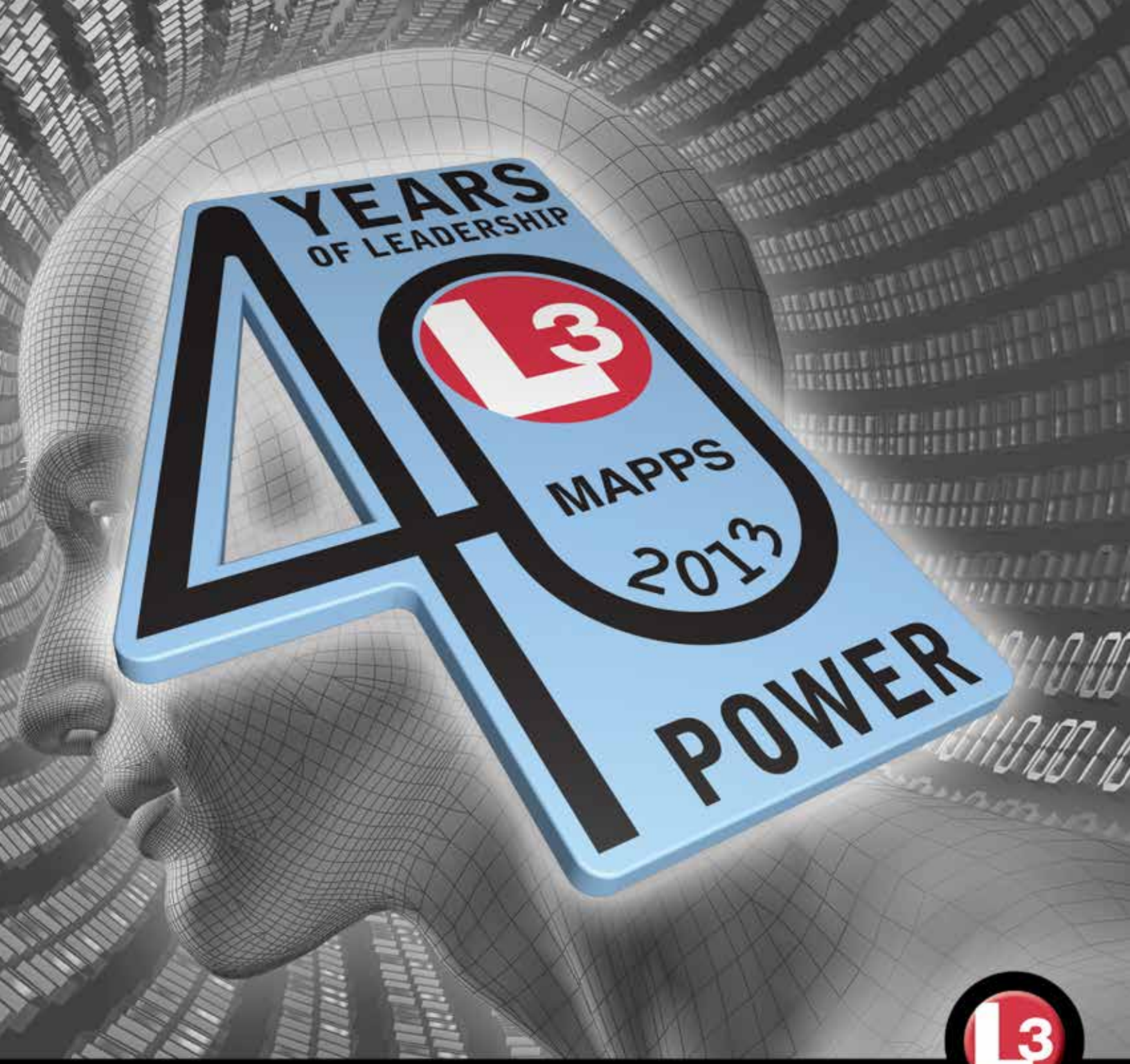
Facility	Type	Status
Cape Breton District Health Authority Sydney, Nova Scotia	2 linacs	Operating
Régie régionale de la santé (Beauséjour) Moncton, New Brunswick	3 linacs	Operating
British Columbia Cancer Agency Kelowna, British Columbia	3 linacs	Operating
British Columbia Cancer Agency Victoria, British Columbia	3 linacs	Operating
British Columbia Cancer Agency Prince George, British Columbia	2 linacs	Operating
British Columbia Cancer Agency Abbotsford, British Columbia	4 linacs	Operating
Cancer Care Ontario St. Catherines, Ontario	3 linacs	Operating
British Columbia Cancer Agency Vancouver, British Columbia	9 linacs	Operating
Eastern Regional Integrated Health Authority (Eastern Health) St. John's, Newfoundland	4 linacs	Operating
Centre hospitalier universitaire de Sherbrooke Sherbrooke, Québec	1 linacs	Operating
Centre hospitalier universitaire de Sherbrooke Fleurimont, Québec	3 linacs	Operating
Centre hospitalier universitaire de Québec Québec, Québec	4 linacs	Operating
Capital District Health Authority Halifax, Nova Scotia	3 linacs	Operating
Hamilton Health Sciences Corporation Hamilton, Ontario	10 linacs	Operating
Centre hospitalier de l'Université de Montréal Montréal, Québec	7 linacs	Operating
Centre de sante et services sociaux Champlain-Charles-Le-Moyne Greenfield Park, Québec	4 linacs	Operating
Hôpital régional de Sudbury Sudbury, Ontario	6 linacs	Operating
The Ottawa Hospital Ottawa, Ontario	9 linacs	Operating
Sunnybrook Health Sciences Centre Toronto, Ontario	10 Cyclotron	Operating
Sunnybrook Health Sciences Centre Barrie, Ontario	3 linacs	Operating
Ciment Québec Inc. Saint-Basile, Québec	2 Neutron Generator	Operating
General Fusion Inc. Burnaby, British Columbia	1 Plasma Injector	Operating
Hilliburton Group Canada Inc. Nisku, Alberta	1 Neutron Generator	Operating
Hunter Well Science Ltd. Calgary, Alberta	1 Neutron Generator	Operating
Centre de sante et de services sociaux de Gatineau Gatineau, Québec	3 linacs	Operating
University Health Network Toronto, Ontario	20 linacs	Operating
Grand River Hospital Corporation Kitchener, Ontario	4 linacs	Operating
London Health Sciences Centre London, Ontario	8 linacs	Operating
McMaster University Hamilton, Ontario	1 tandetron accelerator	Operating

Particle Accelerator Licences (cont'd)

Facility	Type	Status
McMaster University Hamilton, Ontario	1 cyclotron	Operating
McMaster University	1 Van de Graaff	Operating
Hamilton, Ontario University of Guelph	1 linacs	Operating
Guelph, Ontario		
University of Western Ontario	1 tandetron accelerator	Operating
London, Ontario		
Queen's University at Kingston	2 Neutron Generator	Operating
Kingston, Ontario		
Université de Montréal	1 Van de Graaff tandem accelerator	Operating
Montréal, Québec	1 tandetron accelerator	Operating
Centre de santé et services sociaux de Laval	2 linacs	Operating
Laval, Québec		
National Research Council Canada	2 linacs	Operating
Ottawa, Ontario		
Schlumberger Canada Limited	1 Neutron Generator	Operating
Calgary, Alberta		
Scientific Drilling International (Canada)	1 Neutron Generator	Operating
Calgary, Alberta		
Hotwell Canada Ltd.	1 Neutron Generator	Operating
Calgary, Alberta		
Montreal Neurological Institute and Hospital	1 Cyclotron	Operating
Montreal, Quebec		
Centre for Addiction and Mental Health	1 Cyclotron	Operating
Toronto, Ontario		
Centre hospitalier universitaire de Sherbrooke	1 Cyclotron	Operating
Sherbrooke, Québec		
Hamilton Health Sciences Corporation	1 Cyclotron	Operating
Hamilton, Ontario		
University of Ottawa Heart Institute	1 Cyclotron	Operating
Ottawa, Ontario		
Mervex Corporation	1 linacs	Operating
Stittsville, Ontario		
Lakeridge Health	6 linacs	Operating
Oshawa, Ontario		
PharamaLogic P.E.T. Services of Montreal Company	1 Cyclotron	Operating
Lachine, Québec		
Southlake Regional Health Centre	3 linacs	Operating
Newmarket, Ontario		
St. Joseph's Health Care	1 linacs	Operating
London, Ontario		
Vancouver Cancer Centre	1 Cyclotron	Operating
Vancouver, British Columbia		
Weatherford Canada Ltd.	1 Neutron Generator	Operating
Edmonton, Alberta		
Winnipeg Regional Health Authority	1 Cyclotron	Operating
Winnipeg, Manitoba		

Nuclear Substance Processing Facility Licences

Facility	Type	Status
New Processing Facility Chalk River Laboratories Chalk River, Ontario	Production and processing	Operating
Nordion (Canada) Inc., Ottawa, Ontario	Production and processing	Operating
SRB Technologies, Pembroke, Ontario	Processing	Operating
Shield Source Inc., Peterborough, Ontario	Processing	Shutdown



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Alarm Systems
Candu Energy Inc. 36

Alpha Spectroscopy
Canberra Co.
Radiation Safety Institute of Canada

Analyzers
Avensys Solutions
Axiom NDT Corporation 2

Architects, Engineers
Tetra Tech Wei Inc. 10

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McMaster Nuclear Reactor

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Canadian Nuclear Workers' Council
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Calibration Services
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Radiation Safety Institute of Canada

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Marshield-Division of Mars Metal Co.
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Cameco Fuel Manufacturing ..... IBC
Candu Energy Inc. 36
LND Inc. 70,79
Mirion Technologies (IST Canada) Inc. 58

Chambers, Ionization
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Tyne Engineering Inc. 64

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Unitech Services Group

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Compressors, Nuclear
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Tetra Tech Wei Inc. 10
Tyne Engineering Inc. 64

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E.S. Fox Limited 18
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Nuvia Canada
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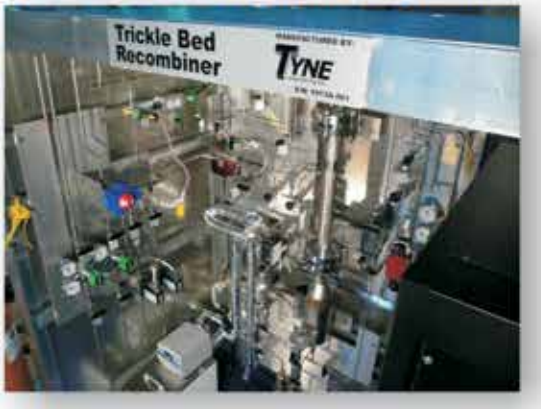

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- CSA-N286.2 (CANPAC)
- CSA-Z299.1 (CANPAC)
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Nuclear Products, Materials and Services

The Gentilly 2 nuclear power reactor (right) was closed by Hydro-Quebec on December 28, 2012 after 30 years in service.

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Suppliers' Addresses and Contacts

Working in the Bruce A turbine hall, members of the station's crane and turbine crews safely positioned the Unit 4 rotor into the newly installed stator core in Unit 2 on Sept. 6, 2012. (Bruce Power)

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