COG PRODUCTS AT A GLANCE

COGonline.org
A one-stop virtual resource

Some of the resources free to you as members on COGonline

Weekly Screening Meeting Minutes: COG holds weekly OPEX screening meetings on items of significance and discuss follow-up actions. Approximately 800 events are reviewed annually.

CNO Quarterly Reports: These reports include conventional safety and performance data on a quarterly basis.

Questions and Answers Forum: A forum for members to ask the CANDU community specific questions.

OPEX Data Base: COG’s OPEX database of more than 40,000 entries provides members searchable information to help solve problems today based on past experience from COG members.

Annual KPI Reports including: Five Year Trend Comparisons, Individual Reactor Unit Reports, Status on WANO Targets, Station Outage and De-Rates reports.

News Groups: COG maintains more than 50 topical newsgroups on specific topic areas.

See Page 6 for more products and services available through COG’s Information Exchange program and through COGonline.

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COG Publications
A world of information about CANDU research and operations at the click of a mouse

COG has thousands of historical and current publications on COGonline.org:

• COG’s Quarterly Members Report on COG’s most recent activities;
• A bi-annual publicly-available magazine, COGnizant, filled with COG, member and industry information on all aspects of nuclear operations and projects from new innovations to decommissioning and waste management;
• An At A Glance Event Guide published twice annually;
• Research and Joint Project reports chronicling results of research conducted by COG members going back through COG’s 35-year history.
Who we are

The CANDU Owners Group (COG) is a private, not-for-profit corporation funded voluntarily by CANDU operating utilities worldwide, Canadian Nuclear Laboratories (CNL) and Supplier Participants.

COG’s vision is excellence through collaboration.

To achieve its vision, COG and its members work together with suppliers and other stakeholders to solve the industry’s most challenging technical problems, share operating experience and work toward regulatory acceptance. We do this through collaboration to enhance safety and reliability, strengthen human performance, reduce environmental impacts and reduce costs.

COG members

COG is comprised of Canadian and international nuclear utilities.

**Canadian Members:**
- Ontario Power Generation (OPG)
- Bruce Power
- New Brunswick Power (NBP)
- Canadian Nuclear Laboratories (CNL)

**International Members:**
- Korea Hydro and Nuclear Power (KHNP)
- Nucleoelectrica Argentina (NA-SA)
- Societatea Nationala Nuclearelectrica, Romania (SNN)
- CNNP Nuclear Power Operations Management, China - CNNO
- Nuclear Power Corporation of India (NPCL)
- Pakistan Atomic Energy Commission (PAEC)
- Hydro Québec is an Information Exchange program participant.
- Nuclear Waste Management Organization (NWMO) is an NSEA participant.

Supplier participants

COG’s Supplier Participant (SP) program provides opportunities for information exchange, training and interaction between operators and suppliers. Through collaboration, we strengthen common understanding of expectations, standards, issues and opportunities.

**Supplier Participants:**
- Acurren
- AECON
- Aecon
- Alithya
- ATS Automation
- BWXT Canada
- Cameco
- CPUS
- CNPO
- E.S. Fox
- Hatch
- Jensen Hughes
- KEPCO E&C
- Kinetics
- Lakeside Controls
- MDA Systems
- Nuvia Canada
- PCL Construction
- Promation
- RCM Technologies
- Rolls Royce
- SNC-Lavalin
- Stern Laboratories Inc.
- Weir Group
- Westinghouse
- Worley Parsons

Partners

COG also has several partnership agreements and strong working relationships with other organizations, worldwide.

**Partners:**
- Atomic Energy Canada Limited (AECL)
- Canadian Nuclear Association (CNA)
- Canadian Standards Association (CSA)
- Institute of Nuclear Power Operations (INPO)
- International Atomic Energy Agency (IAEA)
- Electric Power Research Institute (EPRI)
- Organization of Canadian Nuclear Industries (OCNI)
- OECD Nuclear Energy Agency (NEA)
- Nuclear Energy Institute (NEI)
- Nuclear Generation II and III Association (NUGENIA)
- University Network of Excellence in Nuclear Engineering (UNENE)
- World Association of Nuclear Operators (WANO)

What we do

**Joint Projects and Services (JP&S)** develops solutions to problems and issues common to COG members through shared resources; innovates new approaches for longer, more robust plant life; and provides cost effective auditing and qualification services.

**Research and Development (R&D)** is a mechanism for members to share the rewards, costs and risks of R&D projects in six program areas.

**Information Exchange (IE)** leverages experience across the industry and among CANDU utilities to share experience and best practices.

**Nuclear Safety and Environmental Affairs (NSEA)** facilitates industry alignment on industry and regulatory standards.

**Knowledge Management** develops the leaders of tomorrow with leadership, safety culture, regulatory and other nuclear-industry tailored programs.
### What we do

The COG JP&S program creates a collaboration forum where members can fund solutions to common issues and, together, innovate new approaches to design, operation, maintenance and refurbishment. As well JP&S tackles materials-related issues such as acquisition of obsolete parts, sharing of spare parts and obsolescence management.

### JP&S Program Areas

#### Fuel Channel Life Management

The FCLM program has allowed utilities to develop a solid technical basis to regain operating safety margin in aging reactors and to extend the number of years of continued operation. It has:

- Resulted in 4-5 years of life extension to Bruce Power’s Units 3, 4 and 5-8 and Pickering’s B-side units;
- Buy-in discussions are in progress with C6 utilities;
- Annual funding ~$20M at the current levels; and
- **Benefit-Cost Analysis:** Billions $$ gained through continued operations.

#### CANDU Procurement Audit Committee (CANPAC)

Joint quality assurance audits/assessments of direct (Tier 1) suppliers to COG’s utility members (all CANDU utilities except NASA, NPCIL and PAEC).

#### CANDU Industry Assessment Committee (CANIAC)

Joint quality assurance audits/assessments of sub-suppliers to nuclear power plants for enhanced quality and consistency of supplier audits, and reduced supply chain related costs through joint audits.

#### CANDU Inspection Qualification Bureau (CIQB)

A service to review and certify inspection procedures. Reviews are performed by qualified Subject Matter Experts.

#### Supply Chain, Obsolescence and Procurement (SCOP):

A program to provide better oversight and to develop a framework that will allow collaboration amongst CANDU utilities to mitigate and resolve common high risk procurement and obsolescence issues.
Joint Project Logistics

Getting involved

*Joint Projects can be:*:
- Initiated at any time of the year;
- Initiated by a single participant providing one other member commits to future buy-in;
- Set up to accommodate budget constraints of participating members where possible;
- Initiated as a sole vendor project (under certain conditions); and
- Address a wide range of common issues.

A successful project step-by-step

**INITIATION**
Go to COGonline.org and complete a project initiation form. COG will use it to create an Expression of Interest for all members and notify suppliers.

**ACTIVE STAGE**
COG manages the program working with a decision-making steering committee:
- The COG project manager acts as an advisor to the Committee;
- Any changes to cost, scope or schedule are put through a transparent review process and approved by the Committee; and
- Customized reports are provided for budget planning and schedule reporting internally within member organizations.

**SUCCESSFUL COMPLETION**
- All deliverables are accepted by the steering committee;
- COG maintains IP rights on behalf of participants;
- Buy-ins to completed projects require approval by all of the original participants; and
- Any unspent funds are returned to the participating members.

**SHARED SUCCESS:**
A JP to re-engineer a valve is saving millions of dollars for the JP participants over the life of their plants. And, it has created a template approach for countless other part and equipment requirements. It’s one more tool in obsolescence management.

**Are we there yet?**
We continually seek to be faster and better through graded internal approvals and enhanced member engagement. Send us your feedback on project completion so we can improve our services.
Information Exchange connects members for sharing of timely information, knowledge management and collaboration for operational, maintenance and refurbishment innovation.

Information Exchange Program Areas

An information management tool: COGonline.org

COGonline is a one-stop collaboration tool and information access portal with more than 45,000 OPEX data entries, a calendar of events, and a workspace for peer teams, forums and committees.

COG’s public website: www.candu.org provides information on COG, members and the industry for non-COG members. Both sites feature COGnizant, COG’s semi-annual e-magazine covering the latest in CANDU industry trends.

Operating Experience (OPEX) Database and Screening Meetings

With more than 30 years of operating experience in its records, there is a solution waiting to be found in the COG OPEX database. Weekly screening teleconferences keep participants up-to-date on the latest issues and resolutions.

Question and Answer Forum

The Q&A Forum online newsgroup provides an interactive space for COG members to post their questions and draw on the expertise of colleagues worldwide. It isn’t just for problems. Thinking of implementing something new? See what has been done elsewhere.

Connecting face-to-face: Workshops, peer teams and conferences

COG hosts more than 150 forums, peer groups, technical committee meetings, conferences and workshops, annually. Check the COG online calendar or the downloadable PDF on COGonline under EVENTS to get involved.

News Groups

COG maintains more than 50 topical newsgroups. Subscribers can get the latest information on specific topic areas for selected CANDU and industry activities.

Just-in-time (JIT) briefings and handbooks

JIT briefings, RapidOPEX and work group handbooks contain operating experience directly applicable during field activities. Each package concisely describes a significant problem, related industry experience, causes and lessons learned. Find the JIT packages on COGonline.org.

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COG Workshops and Events

In 2017 and 2018, COG hosted COG Collaboration Week; a conference filled with workshops, R&D exhibits and plenaries featuring leaders from across the industry. COG hosts more than 150 workshops, peer team meetings, conferences and other events for its members and industry partners, annually. These events provide rich opportunities for shared learning and networking. See all the COG event opportunities by visiting: www.COGonline.org/WCS/Pages/Events.aspx.

COGonline.org: A virtual resource

Take advantage of all COG Information Exchange products an services. Visit www.COGonline.org and go to the Information Exchange page.

Knowledge Transfer: From one generation to the next

In 2017, the University Network of Excellence in Nuclear Engineering (UNENE) and CANDU Owners Group, with the help of sponsors, published *The Essential CANDU*, which provides a full and detailed briefing on the CANDU system. A limited number of print copies have been distributed to members and it is available in a free online format at http://www.unene.ca/education/candu-textbook

The Essential CANDU

Ch 1 Introduction to Nuclear Reactors
Ch 2 Genealogy of CANDU Reactors
Ch 3 Nuclear Processes & Neutron Physics
Ch 4 Reactor Statics
Ch 5 Reactor Dynamics
Ch 6 Thermalhydraulic Design
Ch 7 Thermalhydraulic Analysis
Ch 8 Plant Systems
Ch 9 Plant Operations
Ch 10 Instrumentation and Control

Ch 11 Electrical Systems
Ch 12 Rad Protection & Environmental Safety
Ch 13 Reactor Safety / Safety Analysis
Ch 14 Nuclear Reactor Materials
Ch 15 Nuc Process Systems Chemistry & Corrosion
Ch 16 Regulatory Requirements and Licensing
Ch 17 Fuel
Ch 18 Fuel Cycles
Ch 19 Storage and Disposal of Irradiated Fuel
Ch 20 Fuel Handling and Storage
Ch 21 Incore Fuel Management
RESEARCH AND DEVELOPMENT

Research and Development

enables COG members to share the rewards, costs and risks of R&D projects in six research areas.

Five of these research areas support the members’ base program needs.

A sixth area, Strategic R&D was developed to set a long-term vision and create research that will help the CANDU industry remain sustainable and strong for future operations over the next several decades.

R&D Program Areas

Each year, COG’s R&D program teams collectively manage hundreds of work packages in six program areas. New R&D programs are considered annually and member company employees are invited to nominate projects.

1. Safety and Licensing

The Safety and Licensing program operates in six ‘centres of excellence’:

• Containment and severe accidents
• Physics
• Fuel and fuel channels
• Probabilistic Safety Assessment
• Thermal-hydraulics
• Fuel normal operating conditions

2. Fuel Channels

The Fuel Channel program develops predictive models for fuel channel aging. Its overarching goal is to reduce the conservatism in operating margin models so the margins can be increased. CSA standards are used to establish fuel channel fitness for service. One objective is to maintain expertise and facility availability.

3. Industry Standard Toolset (IST)

The IST program increases regulatory confidence, reduces costs and improves quality by consolidating the qualification, development and maintenance activities on computer codes used for design, safety analysis and operational support of CANDU reactors. The program administers 16 codes in four categories:

• Containment and severe accident
• Thermal-hydraulics
• Physics and
• Fuel and fuel channels

Get involved...

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As a member

• Participate in the R&D Technical Programs and Projects
• Attend technical committee meetings, workshops and conferences
• Participate in the R&D planning meetings and receive project proposals
• Receive indexes, abstracts of R&D reports and reports contributed by members
• Access the COG website (COGonline.org) for OPEX, R&D products, technical bulletins and more
4. Chemistry, Materials and Components (CM&C)

The continued safe operation of CANDU nuclear facilities, coupled with reliable electricity production are the overarching goals of the CM&C program. CM&C work includes:

- Chemistry
- Fields and dose reduction
- Non-destructive equipment tools for Steam Generators (SG) & Heat Exchangers (HX)
- Containment boundary degradation
- Improved components, materials, maintenance & processes
- Reactor vessel & piping degradation and
- SG & HX integrity & cleaning

5. Health Safety and Environment (HS&E)

The HS&E program addresses issues related to radiation monitoring and protection as well as dosimetry, including the establishment of the risks of radiation exposure to workers, the public and the environment. Both radiological and conventional contaminants are studied.

6. Strategic R&D

The Strategic R&D program focuses on developing the technologies and other solutions for the current and refurbished fleet of CANDU reactors to keep units operating safely, reliably and competitively for an extended plant life of 60 to 90 years. Focus areas include:

- Technology to reduce maintenance efforts during outages;
- Material properties of reactor core components to provide longer reactor life;
- Technology and infrastructure to support decommissioning and long-term waste including minimization of dose and radioactive waste; and
- Assessment of potential impacts of climate change on current and planned facilities, operations and nuclear activities.

As a supplier*

- Contribute to COG research efforts
- Join COG’s Supplier Participant program
- Participate upon invitation in COG R&D Technical Committee and working group meetings pursuant to COG Policies and Procedures
- Access COG’s member website (COGonline) for R&D projects opportunities

Download a program-specific R&D brochure from the R&D page at COGonline.org or contact us for a printed copy.
A collaborative learning environment
COG’s Knowledge Management line of business provides members and supplier participants opportunities to further their leadership and professional development within a nuclear environment. It also offers leaders programs to grow their expertise in managing specific function areas.

Program offerings include:

Nuclear Professional Development Seminar
NPDS is a three-week leadership program that takes place in the classroom and at a nuclear facility, where attendees examine leadership, management practices and performance at the plant. NPDS is not technology-specific and has been delivered in Canada with a mix of participants from Canadian and international COG membership. There have also been classes made up of participants from China and Korea. Additionally, classes have included participants from COG supplier participants and most recently participation from the UAE.

Other courses offered through Knowledge Management:

- Strategic thinking for maintenance managers
- Regulatory affairs training
- Instructional techniques
- Nuclear safety culture (customized programs)
- Personality profiles (using Myers-Briggs concepts)
- Specialized technical programs
- Leadership training (customized programs)
- Team leader, chair and facilitator workshops

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Achieving regulatory certainty and advancing industry initiatives

Nuclear Safety and Environmental Affairs (NSEA), working on behalf of members, promotes the adoption of common strategies to evolve policy and resolve issues for nuclear safety, regulatory affairs and the environment while furthering industry-level strategic initiatives.

This is accomplished through leadership forums:

- Chief Nuclear Officer Forum
- Regulatory Affairs VP Forum
- Radioactive Waste Leadership Forum
- SMR Technology Forum
- SMR Vendor Participant Group

And peer groups:

- The Nuclear Safety Peer Group
- Regulatory Affairs Managers Peer Group
- Nuclear Environmental Affairs Peer Group
- Human and Organizational Factors Peer Group
- Emergency Preparedness and Response Peer Group and
- Decommissioning and Waste Management Peer Group

NSEA at COG

International Collaboration
COG reviews and coordinates the interface with the IAEA, including participation on the IAEA Nuclear Safety Standards Committee (NUSSC). COG also participates in the Nuclear Energy Institute (NEI, Washington) Industry Group Coordination meetings.

Support to the CNO Forum
NSEA provides operational support to the Chief Nuclear Officer Forum (CNOF). This includes regularly scheduled meetings with executive staff at the Canadian Nuclear Safety Commission (CNSC).

Working with the regulator
All COG teams in the NSEA program are sponsored under the Forums. In several cases, the teams interface with their counterparts in the CNSC to clarify regulatory expectations and discuss progress on resolution of safety/licensing issues.

Some teams collaborate with other organizations such as the Canadian Nuclear Association and Canadian Standards Association. These activities also have potential to inform international member regulations.

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NSEA works on behalf of both Canadian and international members to achieve common industry approaches and best practices to CANDU operations and regulation, worldwide.
SECURE INFORMATION SHARING
COG continually upgrades its systems and evolves with technology to ensure a safe and secure online workspace and repository of CANDU IP and information.

EXTENSIVE DATA AND INFORMATION
The COGonline.org platform is continually updated with new information and stories to provide a good user experience with easy access to databases, peer team and workshop sites, events, performance tracking and industry information.

VIDEO CONFERENCING
COG offers video conferencing from each of our five in-house conference rooms and WebEx conferencing that includes content sharing, video calls and audio-only telecon bridges. Remote participants can join from their own computer or mobile device.

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