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Excellence Through
Collaboration

CANDU Owners Group (COG)

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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 and program participants such as the Nuclear Waste Management Organization and Hydro-Québec.

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.

Canadian Members

- Bruce Power – BP
- Canadian Nuclear Laboratories – CNL
- New Brunswick Power – NBP
- Ontario Power Generation – OPG

International Members





- CNNP China National Nuclear Power Operations Management – CNNO
- Korea Hydro & Nuclear Power – KHNP
- Nucleoeléctrica Argentina Sociedad Anónima – NA-SA
- Nuclear Power Corporation of India Limited – NPCIL
- Pakistan Atomic Energy Commission – PAEC
- Societatea Nationala Nuclearelectrica, Romania – SNN



What We Do

“ We generate powerful synergies for our members and nuclear partners to help them create solutions, transform and achieve performance excellence – **better, faster, and at a lower cost than they could on their own.** ”

Tangible Results – Cost and risk reduction, revenue generation

-  Fuel channels ~15 years of work enabling life extension generates **+\$350M value per year** past original design life
-  Record-breaking operations made possible by innovations and development in inspection and maintenance outage technologies~**\$1M per day**
-  Plant design improvements such as 37M fuel design **improve safety margins**; strong performance in domestic fleet resulted in adoption by KHNP
-  Industry alignment and action on critical issues prevents de-rating and **protects/enhances CANDU safety reputation**



Supplier participants

COG's Supplier Participant Program (SPP) currently has over 30 members; it provides opportunities for information exchange, training and interaction between operators and suppliers.

“ **Through collaboration, we strengthen common understanding of expectations, standards, issues and opportunities.** ”

Partners

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

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



COG is a well-established organization of expert talent in

- › Management of complex, multi-member projects
- › Nuclear science and engineering – largest industry R&D program
- › Nuclear safety, environmental and regulatory affairs
- › Training
- › Procurement of goods and services across international jurisdictions
- › Peer group/workshop facilitation
- › Management of industry-wide OPEX and best practices to support continuous improvement and international benchmarking

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.

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, inspection and qualification services.

Nuclear Safety and Environmental Affairs – NSEA

facilitates industry alignment on industry and regulatory standards.

Information Exchange – IE

leverages experience across the industry and among CANDU utilities to share experience and best practices.

Learning and Development – LD

develops the leaders of tomorrow with leadership, safety culture, regulatory and other nuclear-industry tailored programs.



Research and Development

COG's R&D program 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.

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.

Safety and Licensing

The Safety and Licensing Program operates in six centres of excellence:

- ✓ Containment and severe accidents
- ✓ Probabilistic safety assessment
- ✓ Physics
- ✓ Fuel and fuel channels
- ✓ Thermal hydraulics
- ✓ Fuel normal operating conditions

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.

Chemistry, Materials and Components – CM&C

The overarching goals of the CM&C Program are the continued safe operation of CANDU nuclear facilities and reliable electricity production.

CM&C work includes

- Chemistry
- Fields and dose reduction
- Non-destructive equipment tools for steam generators (SG) and heat exchangers (HX)
- Containment boundary degradation
- Improved components, materials, maintenance and processes
- Reactor vessel and piping degradation
- SG & HX integrity and cleaning

Get Involved

As a Member

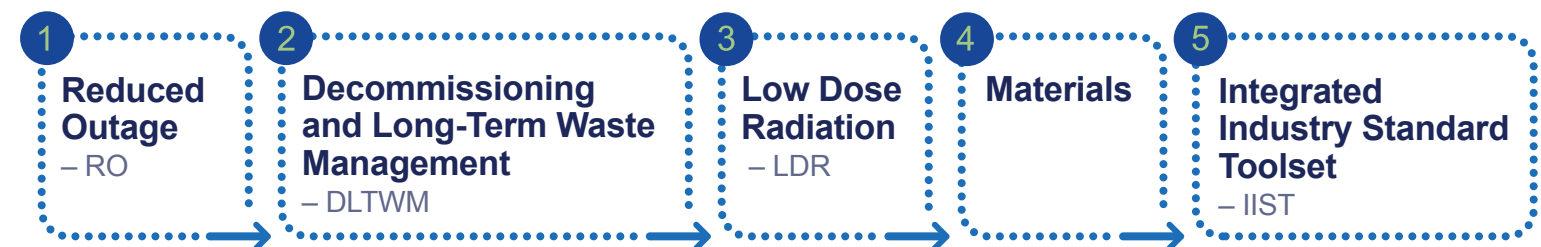
- Participate in the R&D technical programs and projects.
- Attend technical committee meetings, workshops and conferences.
- Participate in the R&D planning meetings and receive project proposals.
- Receive indexes, abstracts of R&D reports and reports contributed by members.
- Access the COG website (COGonline.org) for OPEX, R&D products, technical bulletins and more.

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

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.

5 Strategic R&D Focus Areas



Health Safety and Environment – HS&E

The HS&E Program addresses issues related to:

- 1:** Radiation monitoring, radiation protection and dosimetry, including the establishment of the risks of radiation exposure to workers, the public and the environment.
- 2:** Emissions management, techniques for monitoring emissions, and environmental impact assessment, including techniques for monitoring impacts on the environment for both radiological and conventional contaminants.
- 3:** Issues related to waste management, minimizing volumes and costs and storing waste safely.

Compliance with the requirements of Canadian Nuclear Safety Commission (CNSC) Regulatory Documents (REGDoc), Provincial and Federal requirements and Canadian Standards Association (CSA) standards related to the environment are important drivers for the program.

Industry Standard Toolset – IST



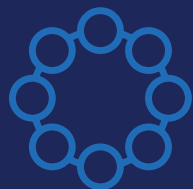
The IST Program increases regulatory confidence, reduces costs and improves quality by consolidating the qualification, development and maintenance activities on computer codes used for design, safety analysis and operational support of CANDU reactors.

The program administers 18 codes in four categories:

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

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 project opportunities.



Joint Projects and Services

The COG JP&S Program uses a collaboration framework where members create solutions to common issues and together, innovate new approaches to design, operation, maintenance and refurbishment. As well, JP&S tackles supply chain-related issues such as acquisition of spare parts, bulk procurement and obsolescence management. JP&S also provides essential services through our shared quality assurance, auditing, and inspection qualification programs.

Services

CANDU Procurement and Audit Committee (CANPAC)

Joint quality assurance audits of direct suppliers to COG's utility members

CANDU Industry Assessment Committee

Joint quality assurance audits of sub-suppliers to Tier 1 suppliers

CANDU Inspection Qualification Bureau (CIQB)

Review and certification of inspection procedures by qualified subject matter experts for COG's utility members

Program Areas

Fuel Channels

Fuel Channel Life Management (FCLM), Spacer Life Management (SLM) and Surveillance Projects (pressure tubes/spacers)

Technical

Safety and licensing, decommissioning, operational and plant improvements, engineering, equipment reliability, etc.

Supply Chain, Obsolescence and Procurement Program (SCOP)

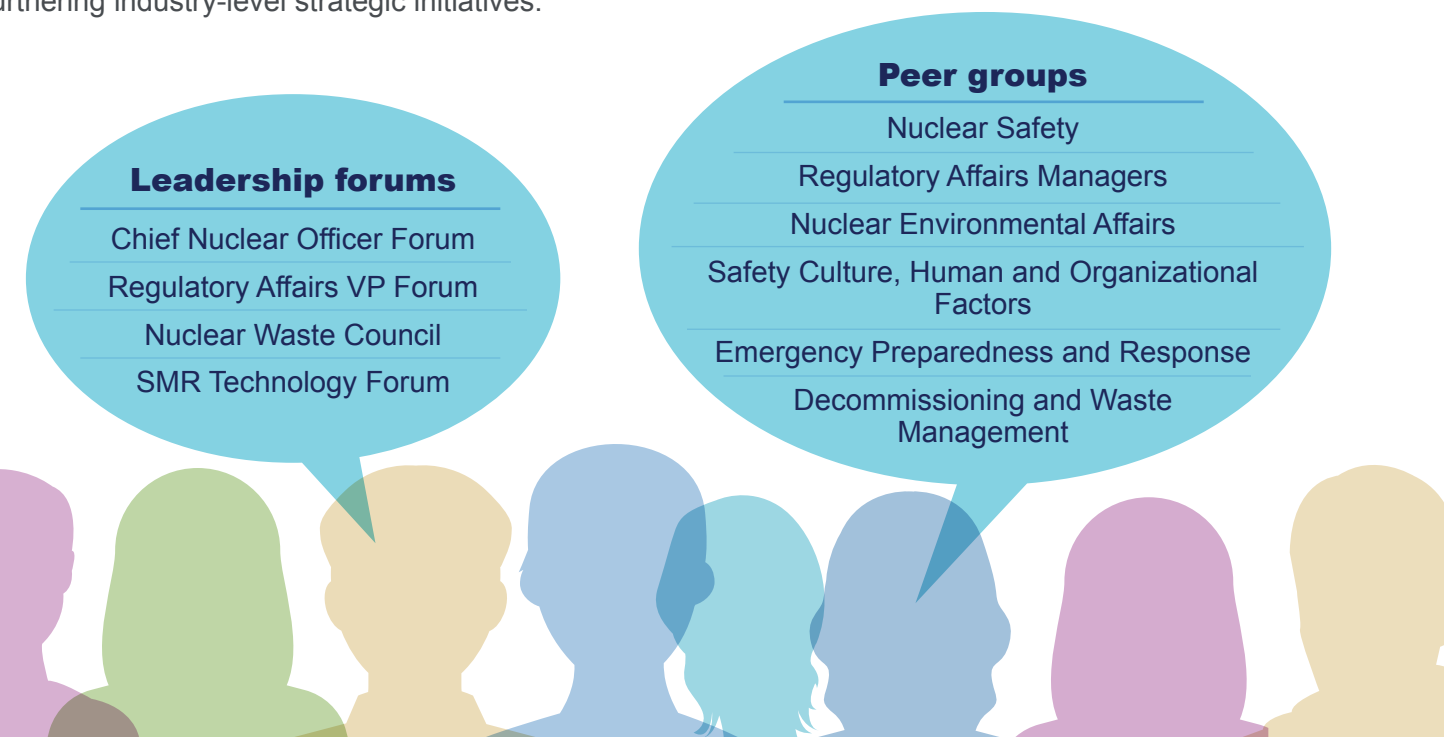
Oversight and collaboration among CANDU utilities to mitigate and resolve common high-risk procurement and obsolescence issues and reduce procurement costs.



Nuclear Safety and Environmental Affairs

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.



Enhanced quality, consistency and reduction of costs

Consolidates all applicable technical and commercial requirements

Provides a **fleet approach** for CANDU-6 operators

Provides **project management services** and contract administration

Identifies and develops solutions to problems shared by two or more members

Develops IP and maintains custody on members' behalf

Innovates new approaches for longer, more robust plant life

Procures services and equipment on behalf of members

Provides auditing services to **ensure quality and reliability** of CANDU systems and components



NSEA at COG

NSEA works on behalf of COG members to achieve common industry approaches and best practices to CANDU operations and regulation, worldwide.

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 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.



Information Exchange

Information Exchange connects members for sharing of timely information, knowledge management and collaboration for operational, maintenance and refurbishment innovation. Information Exchange leverages experience and best practices across the industry and among CANDU utilities so that each member and supplier participant can make the most of shared operating experience and best practices.

Program Areas and Tools

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.

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

COG hosts more than 150 workshops, peer team meetings, conferences and other events for its members and industry partners, annually. Biennially in alternating years, COG hosts COG Collaboration Week, an event that combines workshops with networking and collaboration for industry leaders and colleagues from CANDU plants worldwide across a spectrum of plant groups, and the Technical Committee Meeting, a unique opportunity to meet with international colleagues and exchange operating experience and technical information. These events provide rich opportunities for shared learning and building connections.

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.

JIT Briefings, RapidOPEX and Work Group Handbooks

These 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.

Information Exchange connects members for sharing of timely information, knowledge management and collaboration for operational, maintenance and refurbishment innovation.



Learning and Development

A collaborative learning environment

COG's Learning and Development is part of COG's Information Exchange program. It 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.

800 REVIEWED EVENTS

COG holds weekly OPEX screening meetings where members agree on significance and discuss follow-up actions. Approximately 800 events are reviewed annually.

45,000+ DATABASE ENTRIES

COG's OPEX database of about 45,000 entries provides members searchable information to help solve problems today based on past experience from COG members.

150+ HOSTED FORUMS

COG hosts about 150 forums/peer groups/technical committee meetings and workshops each year for members and supplier participants.

Program offerings include

Nuclear Professional Development Seminar

NPDS is a three-week leadership program examining leadership, management practices and performance at the plant. NPDS is not technology-specific. It is 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.

Other courses offered through Learning and Development

- ✓ Instructional techniques
- ✓ Leadership training – customized programs
- ✓ Nuclear safety culture – customized programs
- ✓ Personality profiles – using Myers-Briggs concepts
- ✓ Regulatory affairs training
- ✓ Specialized technical programs
- ✓ Strategic Thinking for Maintenance Managers
- ✓ Supplier Participant First-Line Supervisor Program
- ✓ Team leader, chair and facilitator workshops

Take advantage of all COG Information Exchange products and services.

Visit www.COGonline.org and go to the Information Exchange page.

COGonline.org

A virtual resource