COG PRODUCTS HIGHLIGHTS

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.

CANDU OWNERS GROUP

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 (NBIP)
- Canadian Nuclear Laboratories (CNL)

International Members:
- Koma Hydro and Nuclear Power (KOMP)
- Nucleoeléctrica Argentina (NA-SA)
- Societate Nationala Nuclearelectrica, Romania (SNRN)
- CNNP Nuclear Power Operations Management, China - CNNO
- Nuclear Power Corporation of India (NPCIL)
- Pakistan Atomic Energy Commission (PAEC)
- Hydro/Quebec as an Information Exchange program participant
- Nuclear Waste Management Organization (NWMO)

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:
- Acrem
- AECON
- Alitea
- ATC Automation
- BWXT Canada
- Cameco
- CNPPO
- Curtis-Wright
- E.S. Fox
- Hatch
- KEPIC
- L&T
- MDS Nuclear
- Nasona Canada
- PCL Construction
- Promodem
- RCM Technologies
- Rohs Royce
- SNC-Lavalin
- Stern Laboratories
- Westinghouse
- Worley Parsons
- Xcell

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 regulatory standards.

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

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)
- 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)

International Members:
- Canadian Nuclear Laboratories (CNL)
- CNPO
- CCNuclear
- Cameco
- BWXT Canada
- ATS Automation
- E.S. Fox
- Hatch
- MDS Nuclear
- Koma Hydro and Nuclear Power (KOMP)
- Alitea
- ATC Automation
- BWXT Canada
- Cameco
- CNPPO
- Curtis-Wright
- E.S. Fox
- Hatch
- KEPIC
- L&T
- MDS Nuclear
- Nasona Canada
- PCL Construction
- Promodem
- RCM Technologies
- Rohs Royce
- SNC-Lavalin
- Stern Laboratories
- Westinghouse
- Worley Parsons
- Xcell

World Association of Nuclear Operators (WANO)

World Association of Nuclear Operators (WANO)
JOINT PROJECTS & SERVICES

Joint Projects and Services
- Provides a fleet approach for CANDU-6 operators
- Identifies and develops solutions to problems shared by two or more members
- Innovates new approaches for longer, more robust plant life
- Provides auditing services to ensure quality and reliability of CANDU systems and components
- Procures services and equipment on behalf of members
- Develops IP and maintains custody on members’ behalf
- Provides project management services and contract administration
- Consolidates all applicable technical and commercial requirements

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.

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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 complex, part-end equipment requirements. It’s one more tool in obsolescence management.

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.

Are we there yet?
Send us your feedback on project completion so we can improve our services.
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Photo courtesy of Bruce Power
Information Exchange connects members for sharing of timely information, knowledge management and collaboration for operational, maintenance and refurbishment innovation.

Information Exchange Program Areas & 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.

COG’s public website: www.candu.org provides information on COG, members and the industry for non-COG members. Both sites feature COGznant, 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 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.

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. This book 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

Chapters cover:

- Introduction to Nuclear Reactors
- Genealogy of CANDU Reactors
- Nuclear Processes & Neutron Physics
- Reactor Statics
- Reactor Dynamics
- Thermalhydraulic Design
- Thermalhydraulic Analysis
- Plant Systems
- Plant Operations
- Instrumentation and Control
- Electrical Systems
- Radiation Protection & Environmental Safety
- Reactor Safety / Safety Analysis
- Nuclear Reactor Materials
- Nuclear Process Systems
- Chemistry & Corrosion
- Regulatory Requirements and Licensing
- Fuel
- Fuel Cycles
- Storage and Disposal of Irradiated Fuel
- Fuel Handling and Storage
- Incore Fuel Management

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.

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

COG hosts about 150 forums / peer groups / technical committee meetings and workshops each year for members and supplier participants. New in 2017: SMR technology and radioactive waste management forums.

44,000

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.

800

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

150+

COG hosts about 150 forums / peer groups / technical committee meetings and workshops each year for members and supplier participants. New in 2017: SMR technology and radioactive waste management forums.
NUCLEAR SAFETY & 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.

This is accomplished through leadership forums:
- Chief Nuclear Officer Forum
- Regulatory Affairs VP Forum
- Radioactive Waste Leadership Forum
- SMR Technology Forum

And peer groups:
- Nuclear Safety Peer Group
- Regulatory Affairs Managers Peer Group
- Nuclear Environmental Affairs Peer Group
- Safety Culture, Human and Organizational Factors Peer Group
- Emergency Preparedness and Response Peer Group
- 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 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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COG IT Services

INFORMATION MANAGEMENT & TECHNOLOGY

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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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.

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

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.

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
- Fuel and fuel channels

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

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.

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. Eight focus areas include:
- Outage reduction
- Enhance computer codes for improved safety margins
- Improved materials for extended reactor life
- Technology & infrastructure for decommissioning and waste
- Climate change impact assessment on CANDU
- Technology to reduce environmental impacts
- Advance knowledge and public acceptance on low-level radiation
- Human performance and organization aspects of nuclear generation

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

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

Get involved...
Excellence through collaboration

Innovation
Breakthroughs

Continuous Improvement
Incremental

Knowledge Management

= PERFORMANCE EXCELLENCE and INDUSTRY SUSTAINABILITY
Safe, reliable, cost-effective and environmentally-sound operation

CANDU Owners Group Inc.
CNL CANADA
OPG CANADA
Bruce Power CANADA
NB Power CANADA

NA-3A INDIA

NPCIL INDIA

PAEC PAKISTAN

SNN SLOVAKIA

CNNO CHINA

KHI HEPKorea

RESEARCH INSTITUTIONS

ACADEMIA

SUPPLY CHAIN

INDUSTRY PARTNERS

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