

THE CANADIAN HYDROGEN SAFETY CENTRE

ENABLING CANADA'S HYDROGEN FUTURE

CENTRE DETAILS

Mission

Deliver tangible hydrogen safety solutions across multiple industrial sectors and regions

Objectives



Forecast industry needs and prioritize activities to align with sector growth



Coordinate Canada's hydrogen safety expertise and capabilities



Support the development and implementation of codes, standards, and regulations



Enable access to infrastructure, facilities, and expertise to develop, test, validate, qualify, and certify safety equipment and systems



Serve in an advisory capacity to governments, regulators, policy makers, and industry on safety issues, events, and solutions



CENTRE FORMATION

The Centre was proposed following a series of engagements with relevant hydrogen-industry stakeholders.



April 2022

Hydrogen Safety Market Review

November 2022

Hydrogen Safety Workshop
(60 Stakeholders)

February - April 2023

Individual Hydrogen Industry Engagements (20 Stakeholders)

Workshop Feedback

These engagements validated the need for a hydrogen safety centre with outputs such as project delivery to solve industry challenges. These engagements also highlighted the need for more details on the structure of the proposed centre (membership, fees, and roles) as well as details on project delivery (type, outputs, and conflicts).

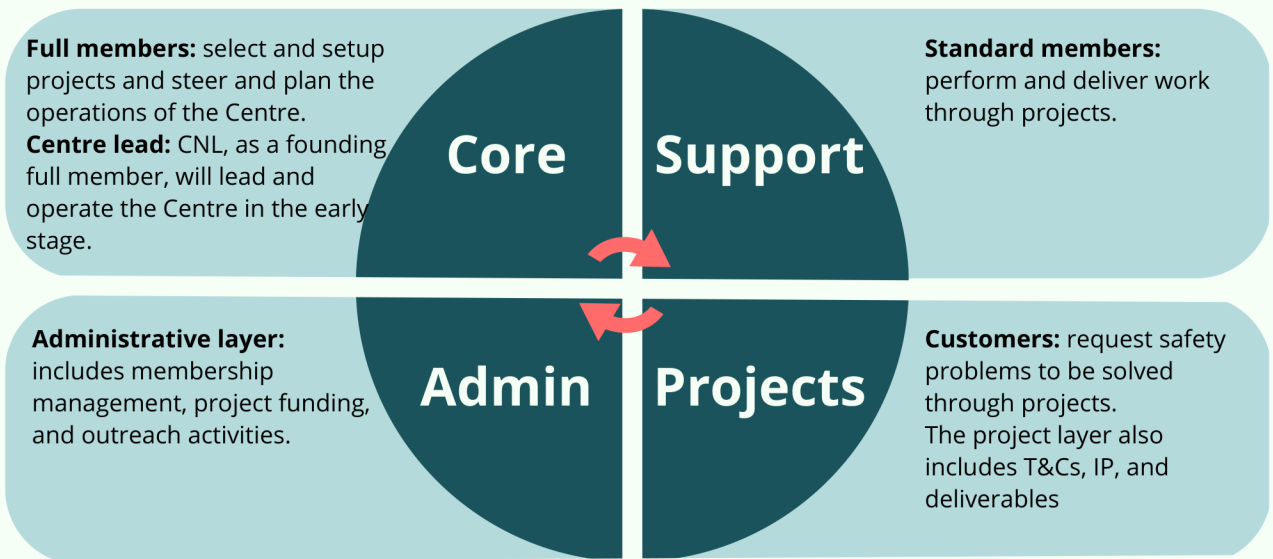
CENTRE DIFFERENTIATORS

The Centre will be nationally focused with joint coordination, be industry and technology agnostic, include local and regional stakeholders, provide education and training opportunities for municipalities, first responders and regulators, and consolidate safety capabilities and expertise to meet the requirements of the growing hydrogen industry. Key differentiators of the Centre include:

- Facilities access, development, and expansion
- Project-based delivery of tangible solutions (development, testing, and commissioning)
- Short turnaround time to set up projects and deliver solutions



CENTRE STRUCTURE & ACTIVITIES



The Centre will enable the adoption of infrastructure and technologies for multi-sectoral hydrogen applications.

- 1 Coordinate Canada's hydrogen safety capabilities by working with members, groups, and networks
- 2 Enable access to infrastructure, facilities, and expertise as part of projects
- 3 Support development and adherence to safety regulations, codes, and standards (RCS)
- 4 Undertake safety testing and experimentation
- 5 Provide independent reviews of design and installations
- 6 Provide investigation and forensic function for safety incidents and events
- 7 Deliver training, education, and outreach programs to municipalities, regulators, industry, and the public
- 8 Provide a networking platform with hydrogen and safety subject matter experts (SMEs)



PROJECT TYPES & EXECUTION

Project Workflow Example:



Potential Project Types Include:

- Program of work to get to the solution through a sequence of projects
- Safety issue common to a sector or industry requires addressing as directed by regulator
- Safety issue at a particular site for one of the full members of the Centre
- Strategic projects that require targets for future expansion in the hydrogen industry
- Safety devices and mitigation measures for enabling and enhancing standards

INTELLECTUAL PROPERTY

Intellectual Property will reside within projects:

- Project solutions will generate IP outputs
- Project setup will define ownership, rights, and exploitation
- Constraints to be captured as part of Project Terms and Conditions (T&C)
- Licensing beyond project duration on a case-by-case basis
- Shared IP for joint projects require agreement amongst parties involved
- Centre will not own any IP, but will coordinate

Scenario*	Full Ownership	Part Ownership
Centre role	License IP back from members for coordination	
Full member role	Owner	Partial Owner
Long-term exploits with	Owner	Full group
Project type	Single full member	Multiple members and customers

*IP scenarios have been provided, however, more detailed discussions will occur on a case-by-case basis.



FULL MEMBERSHIP

As a full member, you will bring your hydrogen safety problem to get it solved. An industry-wide safety problem allows you to engage with industry counterparts for a resolution. A full member is also a steering committee (core) member of the Centre, with early adopters having the potential to obtain founding member recognition.

Member	Industry	EPC	Investor	National Lab
Member Fee	\$300k	\$200-300k	\$0.2-1M	\$200-300k
Problem Provider	✓	✓	X	X
Solution Developer	X	✓	✓	✓
Project Leadership	✓	✓	X	✓
Centre Governance	✓	✓	*	✓

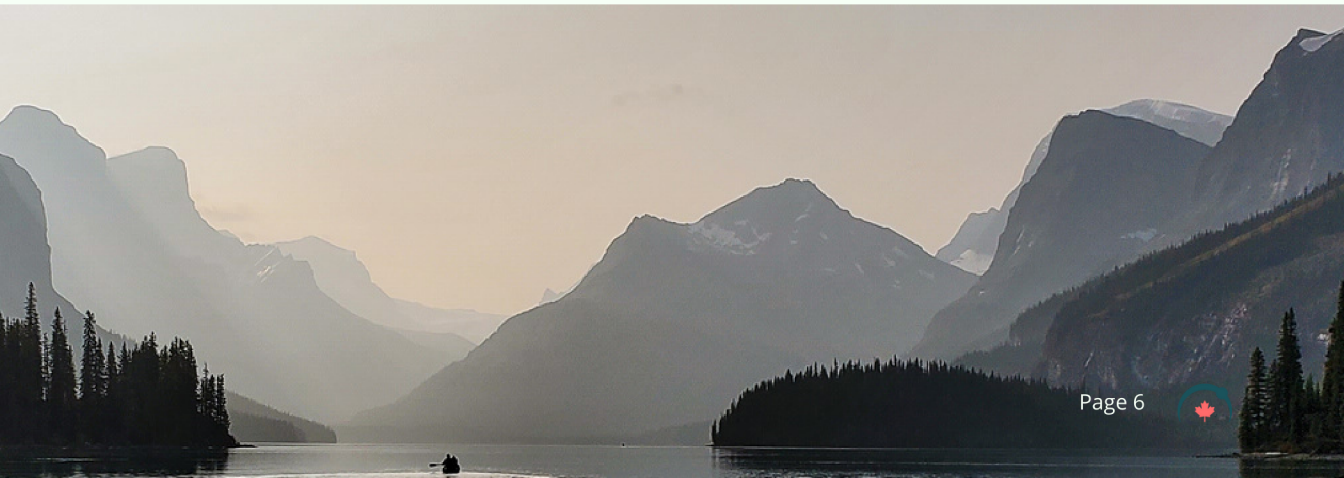
*On a case-by-case basis



STANDARD MEMBERSHIP

As a standard member, you will bring your hydrogen safety experts and capabilities. You will have the opportunity to grow and develop your offerings with each project and have the opportunity to generate revenue through the use of your facilities and infrastructure, along with networking opportunities for additional work.

Member	Government	Service Companies	Regional Institutes	Universities/ Colleges
Member Fee	\$20-50k	\$10-50k	\$10-20k	\$5-10k
Staff Access	✓	✓	X	✓
Facilities Access	✓	X	✓	✓
Project Support	X	✓	X	X
Capability Development	✓	✓	✓	✓



SUBJECT MATTER EXPERTS

Introducing the SMEs of the founding member of the Centre – Canadian Nuclear Laboratories (CNL).



Zhe (Rita) Liang, Principal Combustion Scientist

Dr. Zhe (Rita) Liang has a doctorate in Mechanical Engineering. She has 16 years' experience leading CNL's hydrogen safety program. Rita has been actively involved in various international collaboration projects addressing hydrogen safety issues for nuclear power plants, including chairing members from 15 OECD countries and publishing an OECD/NEA report on hydrogen management and related computer codes.



Helmut Fritzsche, Principal Scientist

Dr. Helmut Fritzsche has a doctorate in physics and is a senior research scientist with over 20 years' experience with interaction of hydrogen and deuterium with materials. Helmut has co-authored over 130 peer-reviewed papers in areas such as metal hydrides, polymers, thin films, and surface science. He is a scientific reviewer of a wide range of journals and has 20+ years' experience as principal investigator in various research projects.



Lee Gardner, Research Scientist, Catalysts and Safety

Mr. Lee Gardner has a degree in Chemical Engineering. He has 15 years of experience leading interdisciplinary projects that relate to hydrogen safety. Lee has been involved hydrogen safety through small and large-scale experiments; hydrogen safety test facility development and management; catalyst development, production and testing; and hydrogen behaviour simulation models. He is a licensed professional engineer in the province of Ontario.



Kanchan Dutta, Hydrogen Research Scientist

Dr. Kanchan Dutta has a doctorate in Chemical Engineering. He joined CNL as a research scientist in 2021. He has more than 17 years of experience in design engineering and research and development. His expertise encompasses hydrogen technologies, such as hydroprocessing, selective hydrogenation, renewable fuels by catalytic hydrogenation, hydrogen safety, natural gas catalytic conversion, and medical devices.



Marco Zanoni, Research Scientist

Dr. Marco Zanoni has a doctorate in Environmental Engineering and joined CNL in 2022. He has 13 years of experience in developing and optimizing new technologies in hydrogen safety/production, combustion processes, and waste management. His expertise involves heat and mass transfer in porous media, phase-change processes, combustion, and waste-to-energy processes, combining theory, laboratory- and field-scale experiments, and numerical modeling. He is currently involved in CFD modelling of hydrogen dispersion, combustion and recombination and risk assessment for hydrogen applications.



Julien Lang, Research Scientist, Materials

Dr. Julien Lang has a doctorate in Physics. Julien has been involved in studying the interaction of hydrogen, deuterium, and tritium with materials for over 15 years. He has been working on the development of new materials, such as high entropy alloys, for hydrogen safety and storage. He has co-authored over 20 peer-reviewed hydrogen-related papers and is a scientific reviewer for various international journals.



Michael Gharghouri, Research Scientist, Materials

Dr. Michael Gharghouri has a doctorate in Materials Engineering. Michael worked at the NRC's Canadian Neutron Beam Centre for 11 years, planning and executing neutron scattering experimental campaigns in the area of materials science. Michael has over 30 years of experience in mechanical testing, strain measurement, materials characterization and data analysis, and has co-authored 80+ peer-reviewed journal papers on a wide range of topics.



Nirmal Gnanapragasam, Principal Scientist, Process and Modeling

Dr. Nirmal Gnanapragasam has a doctorate in Mechanical Engineering. He has 16 years of hydrogen and energy systems research experience. Nirmal is leading the formation of the Canadian Hydrogen Safety Centre. He has led CNL teams on transport sector fleet and safety assessments for GO Trains and the Canadian Coast Guard. He is a licensed professional engineer in the province of Ontario. He is part of the task force to update CSA Z341 standard on underground gas storage to include hydrogen.



Donald Ryland, Branch Manager

Dr. Donald Ryland has a doctorate in Chemical Engineering. Over his 25 years at CNL, he has led research and development projects in hydrogen production, storage methods, hydrogen safety systems suitable for both nuclear and non-nuclear applications, and the production of novel catalysts used in these systems. He is currently a member of the ASME Committee for Nuclear Air and Gas Treatment, where he was a key member of the team that wrote a code section for Hydrogen Recombiners.



Sam Suppiah, Technical Director

Dr. Sam Suppiah has a doctorate in Chemical Engineering and is currently the Technical Director of the Hydrogen and Tritium Technologies Directorate at CNL. He has more than 35 years of expertise in the areas of Heavy Water and Tritium, Catalysis, Electrolysis Technologies, Fuel Cell Technologies, Nuclear and non-Nuclear Battery Technologies, Hydrogen Production from High and Medium Temperature Thermochemical Processes, Steam Electrolysis, Energy Storage and Hydrogen Safety.



Alistair Miller, Researcher Emeritus

Dr. Alistair Miller has a doctorate in Chemical Engineering and has been a Researcher Emeritus with CNL since retirement from a 40-year career with Atomic Energy of Canada Limited in 2005. Throughout his career, he has been a designer of heavy water processes, closely involved with the design of Canadian heavy water plants and as an ongoing expert advisor on their operations.

LOOKING AHEAD

The Centre's establishment phase is underway with ongoing structural developments such as preparation of membership agreements, operating principles, formulation of administration structure, initiation and growth strategies, and the management of membership and projects.

Some of these activities are ongoing processes which will require input from full members.

Connect with us to find out how you can participate and contribute to the growth and development of the Centre.

Additionally, the Centre lead team is continuing engagement with potential members in order to:



Develop problem statements and prioritize needs for projects



Narrow the needs of members to help them get to the solution



Accept and onboard new full and standard members



Execute and grow the Centre and its outputs

FREQUENTLY ASKED QUESTIONS

Why is a Canadian Hydrogen Safety Centre required?

- Hydrogen is an energy carrier essential to decarbonizing various economic sectors in Canada. It is included in the long-term plans of federal and provincial governments, with national infrastructure rapidly expanding beyond its established applications.
- Safety practices, solutions, and regulations are critical for the successful deployment of these technologies in society. Safety risks require a deeper understanding to ensure they are given the attention and resources required, especially when interfacing with multiple standards across diverse industrial sectors.
- The emerging paradigm of distributed hydrogen production and utilization requires new thinking when compared with the current centralized operating models.

Who can join the Centre?

The Centre is open to any Canadian and international stakeholders with activities relating to hydrogen safety. This includes organizations with hydrogen safety challenges looking for solutions and supporting organizations with hydrogen safety capabilities that can provide safety solutions. These include industries across the economy: hydrogen technology developers, hydrogen producers and distributors, hydrogen handling, hydrogen end-users, universities, national laboratories, EPCs, and government.

Who is leading the Centre?

CNL will lead and operate the Centre through the establishment phase. Once the Centre obtains additional full members, the governance of the Centre will be managed by the steering committee. This includes strategy development, financial management, and operational functions.

What jurisdictions does the Centre operate in?

The Centre is focused on solving the challenges that exist within the Canadian hydrogen ecosystem. Various hydrogen activities relevant to Canada also intersect with the United States and will be supported as part of this Centre.

How does the Centre grow?

The Centre's growth pathway involves building the group of members which have hydrogen safety challenges (full members) and also building the network of hydrogen safety solution providers (standard members). The Centre then will embark on delivering projects that are required by its members and expanding on the offerings available to its members.



**To find out more or learn how to get involved,
visit**

www.ch2cs.ca

or email us at

hydrogen@cnl.ca

We look forward to hearing from you

