Noble Denton marine services

WIND-TO-HYDROGEN

Identification of Training / Credential Requirements

econext

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1 EXECUTIVE SUMMARY

This report summarizes the findings found by DNV in support of econext's research to identify jobs and skills relating to Newfoundland and Labrador's emerging clean energy industry. This project focused primarily on wind-to-hydrogen projects. Newfoundland and Labrador is expected to have multiple wind-to-hydrogen projects commencing in the near future. In preparation for these projects, econext has requested DNV to complete a study on the training and qualification requirements for workers for the construction and operation of the various phases of wind-to-hydrogen projects.

The workforce for the following phases of wind-to-hydrogen has been assessed:

- Onshore Wind Farms
- Electrolysis
- Ammonification
- Ammonia Storage
- Hydrogen Storage
- Marine Transportation of Hydrogen/Ammonia

The required positions for both construction and operation of each of the above phases was identified, then the qualification and training requirements for each position was listed. Availability of each of the required trainings and qualifications in Newfoundland and Labrador was determined. If trainings/qualifications were not available in Newfoundland and Labrador, it was then determined if there was availability in Canada or Europe. The applicable standards for each phase of wind-to-hydrogen projects were also identified in this study.

The report also provides an overview of the recognized training centres in Newfoundland and Labrador, highlighting the specialized green energy training programs offered in the province.

Various gaps in the province's preparedness for Wind-to-Hydrogen projects have been identified through the completion of this project. Each of the gaps identified is described within the report. DNV provides their recommendations for items which may aid in bridging the identified gaps.

2 INTRODUCTION

The objective of this project is to support econext's research to identify jobs and skill requirements relating to the province's emerging clean energy industry, specifically in wind-to-hydrogen projects.

DNV has supported this research by identifying the training requirements related to the monitoring, inspection, safety, first-response, and regulations associated with the wind energy and the production, storage, transportation, and handling of hydrogen and ammonia. The required qualifications of workers in each aspect of a wind-to-hydrogen project are also identified within this report.

2.1 List of Abbreviations

The following abbreviations are used in this report:

Table 1- Acronyms

Abbreviation	Description
ATR	Autothermal Reforming
AWP	Arielwork Platform
CCS	Carbon Capture and Storage
CHCSR	Canadian Hydrogen Codes and Standards Roadmap
CSWG	Codes and Standards Working Group
CNA	College of the North Atlantic
CSA	Canadian Standards Association
EVREC	Exploits Valley Renewable Energy Corporation
GWO	Global Wind Organisation
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
LOHC	Liquid Organic Hydrogen Carrier
MEWP	Mobile Elevating Work Platform
NARL	North Atlantic Refining Corp
NLCSA	Newfoundland & Labrador Construction Safety Association
NRC	Natural Resources Canada
NDms	Noble Denton marine services
NL Hydro	Newfoundland and Labrador Hydro
OHS	Occupational Health and Safety
PEM	Polymer Electrolyte Membrane
PPE	Personal Protective Equipment
SDO	Standards Development Organizations
SMR	Steam Methane Reforming
WHMIS	Workplace Hazardous Materials Information System
WHS	Workplace Health and Safety

3 PREDICTED WORKFORCE REQUIREMENTS

3.1 Green Energy Projects

Newfoundland and Labrador's provincial economic forecasts are increasing electricity demand. NL Hydro is investigating new generation opportunities to meet the projected increased demand. Newfoundland and Labrador have great potential for renewable energy, the province specifically is well equipped to handle wind-to-hydrogen projects.

Below is a list of the proposed green energy projects in Newfoundland and Labrador:

- EverWind NL Company – Wind Farm
- Exploits Valley Renewable Energy Corporation (EVREC) – Production Facility to Export Green Ammonia
- Toqlukuti'k Wind and Hydrogen Ltd. (ABO Energy) – Wind Farm and Hydrogen Facility
- World Energy GH2 Inc – Wind Farms and a Hydrogen and Ammonia Production Facility
- Pattern Energy (Port of Argentia Project) – Wind Energy to Green Fuels Production Project
- North Atlantic Refining Corp (NARL) – Wind Energy Development for LOHC's

Newfoundland and Labrador's workforce requirements rise along with the development of these projects. In total, these six projects are predicted to create upwards of 14,250 jobs. This report will focus on the workforce requirements for the construction phase as well as the operation phase. Both phases have differentiating workforce needs. For the construction phase, many skilled tradespersons are needed such as metal fabricators, heavy machinery operators, pipefitters and carpenters. The operational phase requires more technical roles such as engineers, technicians and operators. With the increasing workforce requirements, the need for applicable training programs also increases. With these projects being some of the first of their kind in the province, Newfoundland and Labrador's current workforce requires an assessment to determine the preparedness for Green Energy work.

3.2 Natural Resources Canada's Roadmap

The Natural Resources Canada's (NRC) Codes and Standards Working Group (CSWG) has recently released a Canadian Hydrogen Codes and Standards Roadmap (CHCSR) document which identified possible harmonization of hydrogen codes and standards and addressing gaps to enable low-carbon hydrogen adoption and deployment. It included specific recommendations for action directed at governments, industry, and Standards Development Organizations (SDOs). The gaps in these codes and standards could hinder the widespread production, delivery, storage, and use of clean hydrogen. Addressing these challenges early on is crucial to establishing a robust foundation for the deployment of clean hydrogen across Canada. The CHCSR only addresses the possible need and priority of the code review and does not go into detail about the workforce requirements, training, certification, and upskilling for Newfoundland's and Labrador's hydrogen industry.

The CHCSR presents effective and targeted actions that are proposed to be initiated for the prioritized elements. The figure below illustrates a potential timeline for addressing gaps identified as short-term and medium-term priorities. The elements are listed in order of their overall rating, while adhering to the specified short-term and medium-term timelines. The actual timelines for this work will depend on SDOs forming technical committees to develop or update standards for each specific element.

16. **Natural Resources Canada**. (2025). *Canadian Hydrogen Codes and Standards Roadmap*. Received from econext and can be found at https://natural-resources.canada.ca/energy-sources/clean-fuels/hydrogen-strategy/canadian-hydrogen-codes-standards-roadmap

3.2.1 Gap Analysis

The CHCSR provided simplified results of the gap analysis, the extent of the gaps was defined as:

- No gap – A relevant and applicable standard is published and may be used as-is.
- Partial gap – There is a relevant, but not necessarily completely applicable, published standard or standards that can be leveraged and modified or adopted.
- Full gap – There is no published Canadian, United States, regional, or international standard available. If there is a relevant standard under development but not yet published, a full gap was still assigned.

3.2.2 Prioritizing Gaps

A Decision-Based Priority Matrix rating system was established to evaluate multiple variables, assessing the significance of the gaps and their impact on removing barriers to safe hydrogen deployment. Various stakeholder groups, including members of the CSWG task forces and external representatives from provincial governments and jurisdiction authorities, were invited to participate in the rating exercise. The ratings were based on criteria that reflect current hydrogen deployment or facilitate successful future deployment. These criteria primarily focus on addressing codes and standards gaps and do not necessarily indicate the economic priority of the elements. The criteria included:

- Number of Canadian Companies
- Activity in the Sector
- Impact
- Technology Readiness Level
- Urgency

3.2.3 Timelines for Actions

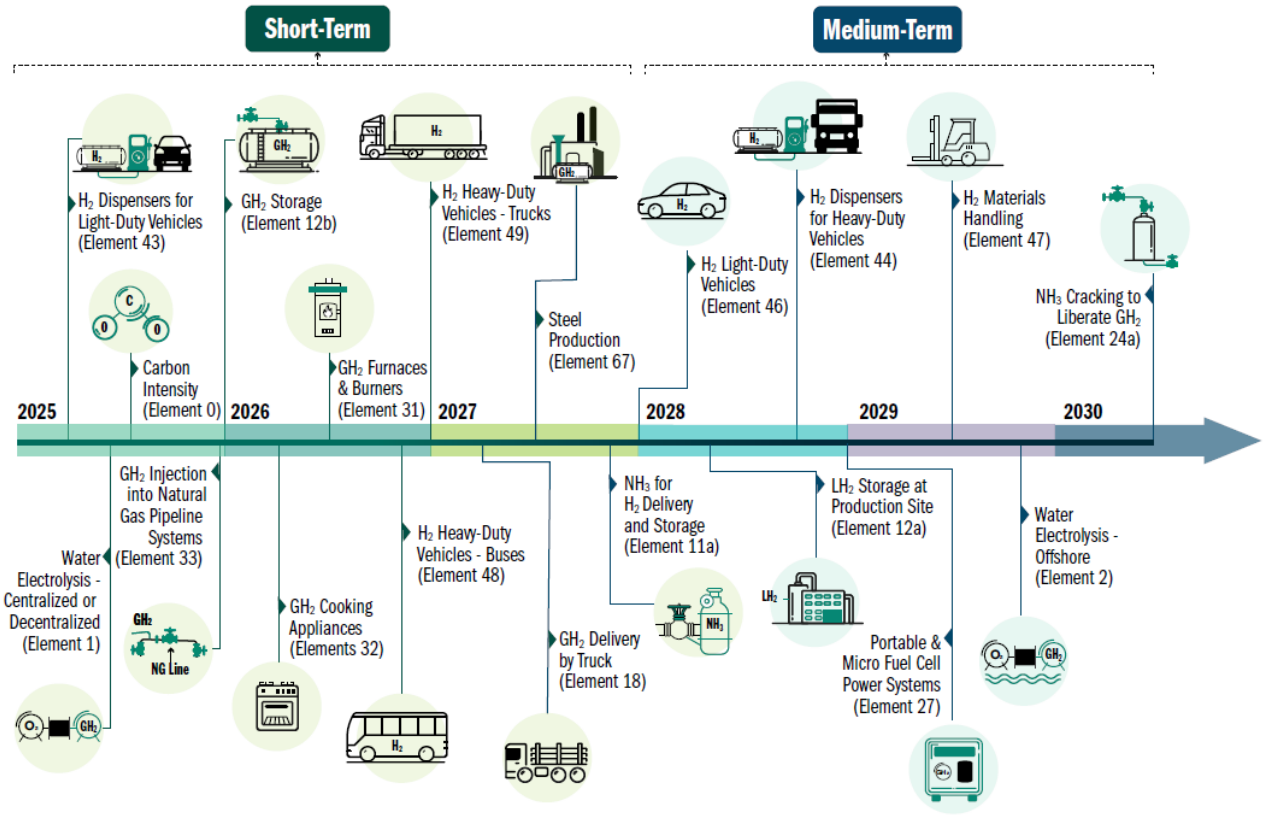
Timelines were recommended to apply the standards-based options to address identified gaps:

- Short-term - Gaps associated with these elements are the highest priority and necessary to address. This Roadmap recommends relevant codes and standards to be published within three years of this report's publication (i.e., before 2028). This aligns with typical Canadian standard development timelines of 18 to 36 months.
- Medium-term - Gaps are critical to fill, but do not need to be addressed immediately. This Roadmap recommends codes and standards to be published in the next three to six years (i.e., 2028–2030).
- Long-term - No gap exists, or gaps are non-critical but potentially beneficial to address eventually. Codes and standards can be published in six years or more (i.e., 2031 and beyond).

The results of these actions are to provide clearer defined requirements for workforce requirements, training, certification, and upskilling.

16. **Natural Resources Canada**. (2025). *Canadian Hydrogen Codes and Standards Roadmap*. Received from econext and can be found at https://natural-resources.canada.ca/energy-sources/clean-fuels/hydrogen-strategy/canadian-hydrogen-codes-standards-roadmap

Figure 1 - Canadian Hydrogen Codes and Standards Roadmap



4 WIND-TO-HYDROGEN PROJECTS

The following subsections provide an overview of the workforce requirements and associated upskilling requirements, for both construction and operations. Each section will also state the applicable standards to which construction and operations are to be in accordance with. Each phase of wind-to-hydrogen projects has been assessed, including Onshore Wind Farm, Electrolysis, Ammonification, Ammonia Storage, Hydrogen Storage and Marine Transportation of Hydrogen/Ammonia. These phases cover the development, storage, and transport required for hydrogen.

4.1 Onshore Wind Farm

Energy development is the first phase of wind-to-hydrogen projects. Wind farms are a clean way to generate electricity which can be used to create hydrogen through electrolysis. Onshore wind farms use turbines to harness wind energy to generate electricity. Onshore wind farms consist of various turbines, export cables and a substation. The main features of wind turbines are the foundation, tower, hub & nacelle and rotor blades. The nacelle contains the main shaft, gear box, high speed shaft and generator. When the blades rotate, this energy passes through the gear box to rotate magnets inside a coil of wire which produces electricity.

4.1.1 Workforce Requirements

The following subsections provide a breakdown of the key positions that have been identified that would be needed for the construction and operation of an onshore wind farm.

4.1.1.1 Construction

Below are the key positions identified to be required for the construction phase of onshore wind farms:

- Industrial Electrician
- Carpenter
- Heavy Equipment Operator
- Industrial Mechanic (Millwright)
- Ironworker
- Metal Fabricator (Fitter)
- Sheet Metal Worker
- Crane Operator
- Welder
- Project Manager
- Surveyor
- Wind Turbine Technician
- Blade Technician (Turbine Blade Machinist)
- Laborer
- Transport Truck Driver

4.1.1.2 Operations

Below are the key positions identified to be required for the operational phase of onshore wind farms:

- Wind Turbine Technician
- Blade Technician (Turbine Blade Machinist)
- Mechanic
- Electrician
- Heavy Equipment Operator

4.1.2 Upskilling

The following items have been identified as additional training/certificates workers in the above roles may require:

Construction:

- Lockout/Tag out
- First Aid

2. **Orsted.** How does onshore wind power work? *Orsted.* [Online] [Cited: 15 January 2025.] https://orsted.com/en/what-we-do/renewable-energy-solutions/onshore-wind-energy/technology.

- Confined Space Entry
- Fall Protection
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- Regulatory Awareness
- Power Line Hazards
- Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)
- Supervisor Health and Safety Training (WorkplaceNL)
- Emergency Preparedness for Workers
- OHS Committee, WHS Representative and Designate Training
- Wind Turbine High Angle Rescue
- Blade Repair
- Transportation of Dangerous Goods
- Air Brake Endorsement

Operations:

- Wind Turbine High Angle Rescue
- First Aid
- Confined Space Entry
- Fall Protection
- Workplace Hazardous Materials Information System (WHMIS)
- Regulatory Awareness
- Blade Repair
- Lockout/Tag out
- Power Line Hazards
- Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)

Appendix A presents the results of the upskilling availability in Newfoundland and Labrador. If the training is not available in Newfoundland and Labrador, it is then indicated if it is available in Canada or Europe. Appendix B includes a list of the available training/education that has been identified for the roles. Please note that the lists are not exhaustive, there may be additional offerings available that have not been listed.

4.1.3 Applicable Standards/Regulations

The standards and regulations applicable to onshore wind farms are listed in Appendix A. The standards cover the following aspects:

- Acoustic Noise
- Electrical Connections (off grid)
- Electrical Connections (Grid Connected)
- Foundations
- Towers
- Markings for Aviators
- Environmental Design
- Load Cases
- Lightening Protection
- Blades/Rotor
- Mechanical Systems
- Performance Measurement
- Power Quality
- Worker Safety

The Canadian Standards Association (CSA) guide to Canadian wind turbine codes and standards provides an excellent overview of the standards pertaining to wind turbines in Canada.

3. **Canadian Standards Association.** CSA Guide to Canadian wind turbine codes and standards. *Canadian Standards Association.* [Online] 2008. https://www.csagroup.org/documents/codes-and-standards/standards/energy/CSAGuidetoCanadianWindTurbineCodes.pdf.
4. **US Department of Energy.** Hydrogen Production: Electrolysis. *US Department of Energy.* [Online] [Cited: 15 January 2025.] https://www.energy.gov/eere/fuelcells/hydrogen-production-electrolysis.

4.2 Electrolysis

Electrolysis is a process in which electricity is used to split water into hydrogen and oxygen, the reaction takes place in an electrolyzer. If the electricity used in this process is obtained through a clean method, the hydrogen produced would be considered green hydrogen. There are a variety of electrolyzers that can be used in this process, each functioning in different ways. One of the most common types of electrolyzers are Polymer Electrolyte Membrane (PEM) Electrolyzers. An electrolyzer consists of an anode and a cathode separated by an electrode, PEM electrolyzers use a solid specialty plastic material for the electrolyte.

4.2.1 Workforce Requirements

The following subsections provide a breakdown of the key positions that have been identified that would be needed for the construction and operation of an electrolysis facility.

4.2.1.1 Construction

Below are the key positions identified to be required for the construction phase of an electrolysis facility:

- Industrial Electrician
- Plumber
- Ironworker
- Boilermaker
- Carpenter
- Concrete Finisher
- Gasfitter
- Heavy Equipment Operator
- Industrial Mechanic (Millwright)
- Instrumentation and Control Technician
- Insulator
- Lather (Interior Systems Mechanic)
- Metal Fabricator (Fitter)
- Sheet Metal Worker
- Crane Operator
- Refrigeration and Air Conditioning Mechanic
- Sprinkler Fitter
- Steamfitter/Pipefitter
- Welder
- Surveyor
- Scaffolder
- Transport Truck Driver
- Project Manager

4.2.1.2 Operations

Below are the key positions identified to be required for the operational phase of an electrolysis facility:

- Automation & Controls Specialist
- Chemical/Process Engineer
- Mechanical Engineer
- Electrical Engineer
- Instrumentation Engineer
- Facility Engineer
- Measurement Specialist
- Process Control Engineer
- Process Safety Engineer
- Production Engineer
- Renewable Power Interconnection Specialist
- Control Room Operator
- Lab Technician
- Maintenance Planner
- Maintenance Trade: Electrical Technician
- Maintenance Trade: Instrumentation Technician
- Maintenance Trade: Mechanical Technician

- Plant Manager
- Plant Operator
- Heavy Duty Equipment Technician

4.2.2 Upskilling

The following items have been identified as additional training/certificates workers in the above roles may require:

Construction:

- Lockout/Tag out
- First Aid
- Confined Space Entry
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- H2S Alive Training
- Regulatory Awareness
- Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)
- Power Line Hazards
- Transportation of Dangerous Goods
- Air Brake Endorsement
- Supervisor Health and Safety Training (WorkplaceNL)
- Emergency Preparedness for Workers
- OHS Committee, WHS Representative and Designate Training

Operation:

- General Hydrogen Training (Properties, Behaviour and Potential Hazards)
- Hydrogen Safety Training
- H2S Alive Training
- First Aid
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- Automated Process Systems & Control Systems Training (Electrolyzers)
- Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers
- Training on the Selection, Design, and Maintenance of Electrolyzers, Vessels, Piping systems and Fitting Valves & Seals (Withstand Hydrogen Properties)
- Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen Properties)
- Training on Hydrogen Production Processes using PEM Electrolyzers
- High Power Electrical Equipment Training (Electrolyzer)
- Training on Instrumentation and Electrical Equipment and Systems (Electrolyzer)
- Hydrogen Gas Value Chain Training
- Training on electrolyzer hydrogen production plant control systems and advanced control systems for process optimization
- Hydrogen Control Skills Training (Hazard Risk Analysis and Reviews, Mechanical Integrity & Instrumented System Analysis and Operation Readiness Inspection)
- Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (Electrolyzer Production Plant)
- Training on Selection and Maintenance of Instrumentation Equipment and Systems (Electrolyzer Production Plant)

Appendix A presents the results of the upskilling availability in Newfoundland and Labrador. If the training is not available in Newfoundland and Labrador, it is then indicated if it is available in Canada or Europe. Items marked with an asterisk (*) indicate that training is available for the general type of system (ex: high power electrical equipment) but not for the specific application (ex: electrolyzer). However, the general training in combination with the addition training on the specific application/item should be sufficient.

Appendix B includes a list of the available training/education that has been identified for the roles. Please note that the lists are not exhaustive, there may be additional offerings available that have not been listed.

4.2.3 Applicable Standards/Regulations

The standards and regulations applicable to electrolysis are listed in Appendix A. The standards cover the following aspects:

- Electrolyzers
- Enclosure design
- Hydrogen vent system
- Piping system
- Oxygen
- Hydrogen Quality
- Gas Processing Units
- Facilities and Plant Design
- Fire Protection & Explosive Atmospheres
- Safety and Control Architecture

The National Renewable Energy Laboratory developed a presentation for the Electrolyzer Installation Workshop which provides and overview of the relevant codes and standards for electrolysis.

The CHCSR has stated that water electrolysis in general has a partial gap, low overall rating with a short-to-mid-term priority for production. Here are some of the identified aspects for water electrolysis:

Onshore Water Electrolysis:

- Partial gap
- Low overall rating
- Short-term action recommended
    - A Canadian standard already exists for similar equipment

Offshore Water Electrolysis:

- Partial gap
- Low overall rating
- Mid-term action recommended
    - A Canadian standard already exists for similar equipment

4.3 Ammonification

Ammonification is the process in which ammonia is formed by combining nitrogen with hydrogen. Ammonia is an effective means of storage for hydrogen due to its various beneficial characteristics. For ammonia production to be green, nitrogen is separated from the air and the hydrogen used is produced from water electrolysis. Typically, hydrogen is produced at ammonia plants using steam methane reforming (SMR) and autothermal reforming (ATR) of natural gas and would need to be combined with carbon capture and storage (CCS) to be considered low carbon.

Ammonia is gaining attention as a promising carrier for hydrogen delivery and storage, with its production processes being both technologically advanced and commercially established. The interest in using ammonia as a hydrogen carrier arises from its versatility, as it can be directly utilized in various applications or converted back into hydrogen at the point of use.

5. **Hartmann, Kevin.** Electrolyzer Codes and Standards. *National Renewable Energy Laboratory.* [Online] 27 September 2023. https://www.energy.gov/sites/default/files/2023-11/2-04-codes-standards-hartmann.pdf.
6. **Accelerator, The Transition.** Hydrogen Workforce Assessment Tool. *Workforce Requirements for Advancing a Hydrogen Economy.* [Online] July 2022. https://transitionaccelerator.ca/wp-content/uploads/2023/05/TA_H2-Workforce-Requirements-Assessment-Tool_FINAL-1.pdf.

4.3.1 Workforce Requirements

The following subsections provide a breakdown of the key positions that have been identified that would be needed for the construction and operation of an ammonification facility.

4.3.1.1 Construction

Below are the key positions identified to be required for the construction phase of an ammonification facility:

- Industrial Electrician
- Plumber
- Ironworker
- Boilermaker
- Carpenter
- Concrete Finisher
- Gasfitter
- Heavy Equipment Operator
- Industrial Mechanic (Millwright)
- Instrumentation and Control Technician
- Insulator
- Lather (Interior Systems Mechanic)
- Metal Fabricator (Fitter)
- Sheet Metal Worker
- Crane Operator
- Refrigeration and Air Conditioning Mechanic
- Sprinkler Fitter
- Steamfitter/Pipefitter
- Welder
- Surveyor
- Scaffolder
- Transport Truck Driver
- Project Manager

4.3.1.2 Operations

Below are the key positions identified to be required for the operational phase of an ammonification facility:

- Automation and Control Specialist
- Electrical & Instrumentation Engineer
- Facility Engineer
- Measurement Specialist
- Mechanical Engineer: Equipment & Piping / Reliability
- Process Control Engineer
- Process Engineer
- Process Safety Engineer
- Production Engineer
- Control Room Operator
- Lab Technician
- Maintenance Planner
- Maintenance Trade: Electrical Technician
- Maintenance Trade: Instrumentation Technician
- Maintenance Trade: Mechanical Technician
- Plant Manager
- Plant Operator
- Heavy Duty Equipment Technician

4.3.2 Upskilling

The following items have been identified as additional training/certificates workers in the above roles may require:

Construction:

5. **Hartmann, Kevin.** Electrolyzer Codes and Standards. *National Renewable Energy Laboratory.* [Online] 27 September 2023. https://www.energy.gov/sites/default/files/2023-11/2-04-codes-standards-hartmann.pdf.
6. **Accelerator, The Transition.** Hydrogen Workforce Assessment Tool. *Workforce Requirements for Advancing a Hydrogen Economy.* [Online] July 2022. https://transitionaccelerator.ca/wp-content/uploads/2023/05/TA_H2-Workforce-Requirements-Assessment-Tool_FINAL-1.pdf.

- Lockout/Tag out
- First Aid
- Confined Space Entry
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- H2S Alive Training
- Regulatory Awareness
- Power Line Hazards
- Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)
- Transportation of Dangerous Goods
- Air Brake Endorsement
- Supervisor Health and Safety Training (WorkplaceNL)
- Emergency Preparedness for Workers
- OHS Committee, WHS Representative and Designate Training

Operation:

- General Hydrogen Training (Properties, Behaviour and Potential Hazards)
- Hydrogen Safety Training
- Hydrogen Production Process Training (SMR/ATR)
- Automated Process Systems and Control Systems Training (SMR/ATR)
- General Ammonia Training (Properties, Behaviour and Potential Hazards)
- H2S Alive Training
- First Aid
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- Ammonia Safety Training
- Training on Instrumentation and Electrical Equipment and Systems (SMR/ATR Production Plants)
- Hydrogen Gas Value Chain Training
- Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen/Ammonia Properties)
- Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen/Ammonia Properties)
- Hydrogen Control Skills Training (Hazard Risk Analysis and Reviews, Mechanical Integrity & Instrumented System Analysis and Operation Readiness Inspection)
- Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (SMR/ATR Hydrogen Production Plant)
- Training on Maintenance of Equipment and Systems (SMR/ATR Hydrogen Production Plant)

Appendix A presents the results of the upskilling availability in Newfoundland and Labrador. If the training is not available in Newfoundland and Labrador, it is then indicated if it is available in Canada or Europe. Items marked with an asterisk (*) indicate that training is available for the general type of system (ex: Instrumentation and Electrical Equipment and Systems) but not for the specific application (ex: SMR/ATR Production Plants). However, the general training in combination with the additional training on the specific application/item should be sufficient.

Appendix B includes a list of the available training/education that has been identified for the roles. Please note that the lists are not exhaustive, there may be additional offerings available that have not been listed.

4.3.3 Applicable Standards/Regulations

The standards and regulations applicable to ammonification are listed in Appendix A. The standards cover the following aspects:

- Enclosures Design
- Hydrogen Vent System
- Piping System
- Oxygen
- Hydrogen Quality
- Gas Processing Units
- Facilities and Plant Design
- Fire Protection and Explosive Atmospheres
- Safety and Control Architecture

The CHCSR has stated that ammonification has a variable rating and priority based on the ammonia conversion aspect. Here are some of the identified aspects for ammonification:

Ammonia from Hydrogen General

- Partial gap
- Low overall rating
- Short-term action recommended
    - No standard exists and should be developed

Ammonia Cracking to Liberate Hydrogen

- Full gap
- Medium overall rating
- Mid-term action recommended
    - Recommended to wait until the technology has matured or commercialized

4.4 Ammonia Storage

As stated, ammonia is a very effective means for hydrogen storage. Ammonia has a high auto ignition temperature, low storage pressure and offers stability for long term storage. These characteristics make ammonia a safe means for hydrogen storage and transportation. Under atmospheric conditions ammonia is a gas, however it is often stored as a liquid at an increased density. There are two methods for storing ammonia as a liquid, either the pressure is increased while maintaining the temperature or the temperature is increase while maintaining the pressure. Ammonia can be stored in light tanks; however, an understanding of the chemical is required when working with or around it.

4.4.1 Workforce Requirements

The following subsections provide a breakdown of the key positions that have been identified that would be needed for the construction and operation of an ammonia storage facility.

4.4.1.1 Construction

Below are the key positions identified to be required for the construction phase of an ammonia storage facility:

- Industrial Electrician
- Plumber
- Ironworker
- Boilermaker
- Carpenter
- Concrete Finisher
- Gasfitter
- Heavy Equipment Operator
- Industrial Mechanic (Millwright)
- Instrumentation and Control Technician
- Insulator
- Lather (Interior Systems Mechanic)
- Metal Fabricator (Fitter)
- Sheet Metal Worker
- Crane Operator
- Refrigeration and Air Conditioning Mechanic

7. *Ammonia as Effective Hydrogen Storage: A Review on Production, Storage and Utilization.* **Aziz, Muhammed.** s.l.: Advances in Hydrogen Energy, 2020.

- Sprinkler Fitter
- Steamfitter/Pipefitter
- Welder
- Surveyor
- Scaffolder
- Transport Truck Driver
- Project Manager

4.4.1.2 Operations

Below are the key positions identified to be required for the operational phase of an ammonia storage facility:

- Automation and Control Specialist
- Electrical & Instrumentation Engineer
- Facility Engineer
- Measurement Specialist
- Mechanical Engineer: Equipment & Piping / Reliability
- Control Room Operator
- Lab Technician
- Maintenance Planner
- Maintenance Trade: Electrical Technician
- Maintenance Trade: Instrumentation Technician
- Maintenance Trade: Mechanical
- Plant Manager
- Plant Operator

4.4.2 Upskilling

The following items have been identified as additional training/certificates workers in the above roles may require:

Construction:

- Lockout/Tag out
- First Aid
- Confined Space Entry
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- H2S Alive Training
- Regulatory Awareness
- Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)
- Power Line Hazards
- Transportation of Dangerous Goods
- Air Brake Endorsement
- Supervisor Health and Safety Training (WorkplaceNL)
- Emergency Preparedness for Workers
- OHS Committee, WHS Representative and Designate Training

Operation:

- General Ammonia Training (Properties, Behaviour and Potential Hazards)
- H2S Alive Training
- First Aid
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- Ammonia Safety Training
- Automated Process Systems and Control Systems Training (Ammonia Storage)
- Training on Instrumentation and Electrical Equipment and Systems (Ammonia Storage)

- Ammonia Gas Value Chain Training
- Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Ammonia Properties)
- Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Ammonia Properties)
- Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (Ammonia Storage)
- Training on Maintenance of Equipment and Systems (Ammonia Storage)

Appendix A presents the results of the upskilling availability in Newfoundland and Labrador. If the training is not available in Newfoundland and Labrador, it is then indicated if it is available in Canada or Europe. Items marked with an asterisk (*) indicate that training is available for the general type of system (ex: Instrumentation and Electrical Equipment and Systems) but not for the specific application (ex: Ammonia Storage). However, the general training in combination with the addition training on the specific application/item should be sufficient.

Appendix B includes a list of the available training/education that has been identified for the roles. Please note that the lists are not exhaustive, there may be additional offerings available that have not been listed.

4.4.3 Applicable Standards/Regulations

The standards and regulations applicable to ammonia storage are listed in Appendix A. The standards cover the following aspects:

- Enclosures Design
- Vent System
- Piping System
- Oxygen
- Hydrogen Quality
- Gas Processing Units
- Facilities and Plant Design
- Fire Protection and Explosive Atmospheres
- Safety and Control Architecture

The CHCSR has stated that ammonia storage has a low rating and variable action based on the delivery or storage aspect. Here are some of the identified aspects for ammonia storage and delivery:

<u>Ammonia General Storage:</u>

- Partial gap
- Low overall rating
- Short-term action recommended
    - No standard exists and should be developed

<u>Storage/Delivery on Ship:</u>

- No gap
- Low overall rating
- Long-term action recommended
    - Recommend a periodic review of standards

4.5 Hydrogen Storage

Pure hydrogen storage needs to be considered for the cases in which hydrogen is not converted to ammonia for storage. Hydrogen can be stored as a compressed gas or a liquid. High pressure tanks are required to store hydrogen as a gas and cryogenic temperatures are required to store hydrogen as a liquid due to the extremely low boiling point at atmospheric

conditions. It is very important for people working with and around hydrogen to understand its properties and the hazards involved.

4.5.1 Workforce Requirements

The following subsections provide a breakdown of the key positions that have been identified that would be needed for the construction and operation of a hydrogen storage facility.

4.5.1.1 Construction

Below are the key positions identified to be required for the construction phase of a hydrogen storage facility:

- Industrial Electrician
- Plumber
- Ironworker
- Boilermaker
- Carpenter
- Concrete Finisher
- Gasfitter
- Heavy Equipment Operator
- Industrial Mechanic (Millwright)
- Instrumentation and Control Technician
- Insulator
- Lather (Interior Systems Mechanic)
- Metal Fabricator (Fitter)
- Sheet Metal Worker
- Crane Operator
- Refrigeration and Air Conditioning Mechanic
- Sprinkler Fitter
- Steamfitter/Pipefitter
- Welder
- Surveyor
- Transport Truck Driver
- Scaffolder
- Project Manager

4.5.1.2 Operations

Below are the key positions identified to be required for the operational phase of a hydrogen storage facility:

- Hydrogen Technician
- Automation and Control Specialist
- Electrical & Instrumentation Engineer
- Facility Engineer
- Measurement Specialist
- Mechanical Engineer: Equipment & Piping / Reliability
- Control Room Operator
- Lab Technician
- Maintenance Planner
- Maintenance Trade: Electrical Technician
- Maintenance Trade: Instrumentation Technician
- Maintenance Trade: Mechanical
- Plant Manager
- Plant Operator

4.5.2 Upskilling Availability

The following items have been identified as additional training/certificates workers in the above roles may require:

Construction:

- Lockout/Tag out
- First Aid

8. **US Department of Energy.** Hydrogen Storage. *US Department of Energy.* [Online] [Cited: 15 January 2025.] https://www.energy.gov/eere/fuelcells/hydrogen-storage.

- Confined Space Entry
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- H2S Alive Training
- Regulatory Awareness
- Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)
- Power Line Hazards
- Transportation of Dangerous Goods
- Air Brake Endorsement
- Supervisor Health and Safety Training (WorkplaceNL)
- Emergency Preparedness for Workers
- OHS Committee, WHS Representative and Designate Training

Operation:

- Regulatory Awareness
- 4th Class Power Engineering
- Confined Space Entry
- Fall Protection
- H2S Alive Training
- First Aid
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- General Hydrogen Training (Properties, Behaviour and Potential Hazards)
- Hydrogen Safety Training
- Hydrogen Production Process Training
- Automated Process Systems and Control Systems Training (Hydrogen Storage)
- Training on Instrumentation and Electrical Equipment and Systems (Hydrogen Storage)
- Hydrogen Gas Value Chain Training
- Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen Properties)
- Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen Properties)
- Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (Hydrogen Storage)
- Hydrogen Production Process Training (SMR/ ATR)
- Training on Maintenance of Equipment and Systems (Hydrogen Storage)

Appendix A presents the results of the upskilling availability in Newfoundland and Labrador. If the training is not available in Newfoundland and Labrador, it is then indicated if it is available in Canada or Europe. Items marked with an asterisk (*) indicate that training is available for the general type of system (ex: Instrumentation and Electrical Equipment and Systems) but not for the specific application (ex: Hydrogen Storage). However, the general training in combination with the additional training on the specific application/item should be sufficient.

Appendix B includes a list of the available training/education that has been identified for the roles. Please note that the lists are not exhaustive, there may be additional offerings available that have not been listed.

4.5.3 Applicable Standards/Regulations

The standards and regulations applicable to hydrogen storage are listed in Appendix A. The standards cover the following aspects:

- Hydrogen Storage/Enclosure Design
- Piping/Fittings
- Materials
- Venting

- Transport
- Hydrogen Generators
- Testing

The CHCSR has stated that hydrogen storage has a variable rating and action based on the delivery or storage aspect. Here are some of the identified aspects for hydrogen storage and delivery:

Hydrogen Liquefaction Plant:

- Full gap
- High overall rating
- Mid-term action recommended
    - No standard exists and should be developed

Liquid Organic Hydrogen Carriers (LOHC) for Hydrogen Storage:

- Partial gap
- Medium overall rating
- Mid-term action recommended
    - Recommended to wait until the technology has matured or commercialized

LOHC Dehydrogenation to Liberate Hydrogen:

- Partial gap
- Medium overall rating
- Mid-term action recommended
    - A Canadian standard already exists for similar equipment

Liquid Hydrogen Storage at End-Use Site:

- No gap
- High overall rating
- Long-term action recommended
    - Recommend a periodic review of standards

Liquid Hydrogen Vaporization at Distribution Site:

- Partial gap
- High overall rating
- Mid-term action recommended
    - A Canadian standard already exists for similar equipment

4.6 Marine Transportation of Hydrogen / Ammonia

As Newfoundland and Labrador is an island, the most logistic and feasible method of transportation of hydrogen and/or ammonia would be marine transportation using tanker vessels. It is important for all persons involved in the transportation to be aware of the hazards of both hydrogen and ammonia as well as prepared to detect and respond to emergencies.

4.6.1 Workforce Requirements

The following subsections provide a breakdown of the key positions that have been identified that would be needed for the construction and operation of an ammonia/hydrogen marine load out facility.

4.6.1.1 Construction

Below are the key positions identified to be required for the construction phase of an ammonia/hydrogen marine load out facility:

- Industrial Electrician
- Ironworker
- Carpenter
- Concrete Finisher
- Gasfitter
- Heavy Equipment Operator
- Industrial Mechanic (Millwright)
- Insulator
- Metal Fabricator (Fitter)
- Sheet Metal Worker
- Crane Operator
- Sprinkler Fitter
- Steamfitter/Pipefitter
- Welder
- Surveyor
- Scaffolder
- Project Manager

4.6.1.2 Operations

Below are the key positions identified to be required for the operational phase of an ammonia/hydrogen marine load out facility:

- Shore Side Workers
- Seafarers on Marine Vessels

Please note that further breakdown of seafarers on marine vessels is possible, however it is presumed that these workers will not be local as there are no local cargo tankers for ammonia/hydrogen. The tankers will most likely come from other locations in the world, and the crew training requirements will fall under the vessel's flag state regulations. There may be a requirement for local seafarers on assist tugs, their qualification requirements are stipulated by Transport Canada and have not been specified in this project.

4.6.2 Upskilling

The following items have been identified as additional training/certificates workers in the above roles may require:

Construction:

- Lockout/Tag out
- First Aid
- Confined Space Entry
- Workplace Hazardous Materials Information System (WHMIS)
- Respiratory Protection Training
- H2S Alive Training
- Regulatory Awareness
- Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)
- Power Line Hazards
- Supervisor Health and Safety Training (WorkplaceNL)
- Emergency Preparedness for Workers
- OHS Committee, WHS Representative and Designate Training

Operation:

- Training in handling hazardous materials (Hydrogen & Ammonia)
- Training in monitoring and controlling the transfer of hydrogen and ammonia
- First Aid
- Workplace Hazardous Materials Information System (WHMIS)
- Regulatory Awareness

- H2S Alive Training
- Respiratory Protection Training
- Cryogenic Systems Training
- Training on the operation of specialized equipment for the storage and transfer of hydrogen and ammonia
- Firefighting and Emergency Response Training
- Transfer Procedures Training
- Leak Detection and Response Training
- Environmental Impact Mitigation Training
- STCW Basic Safety

Appendix A presents the results of the upskilling availability in Newfoundland and Labrador. If the training is not available in Newfoundland and Labrador, it is then indicated if it is available in Canada or Europe.

Appendix B includes a list of the available training/education that has been identified for the roles. Please note that the lists are not exhaustive, there may be additional offerings available that have not been listed. Additionally, the qualification requirements for seafarers have not been specified as there is a variety of factors to determine the required qualifications, for local seafarers Transport Canada's requirements shall be met.

4.6.3 Applicable Standards/Regulations

The standards and regulations applicable to the marine transportation of hydrogen and ammonia are listed in Appendix A.

The CHCSR has stated that ammonia storage has a variable rating and action based on the delivery or storage aspect. Here are some of the identified aspects for ammonia storage and delivery:

Ammonia Delivery by Ship:

- No gap
- Low overall rating
- Long-term action recommended
    - Recommend a periodic review of standards

LOHC Delivery by Ship:

- Partial gap
- Medium overall rating
- Mid-term action recommended
    - A Canadian standard already exists for similar equipment

Green Hydrogen Delivery by Ship:

- Full gap
- High overall rating
- Mid-term action recommended
    - Recommended to wait until the technology has matured or commercialized

Hydrogen Dispensers for Ships (includes: permanently installed dispensers, portable dispensers, high-pressure and low-pressure dispensers):

- Partial gap
- Medium overall rating
- Mid-term action recommended
    - A Canadian standard already exists for similar equipment

9. **WorkplaceNL.** Certification Training Standards. *WorkplaceNL.* [Online]
10. **Government of Canada.** Recognized Institutions and Approved Training Courses – TP 10655E. *Government of Canada.* [Online]

Hydrogen Powered Ships (includes: liquid hydrogen marine, green hydrogen marine, ships, tugboats, boats, submarines, unmanned marine vehicles):

- Partial gap
- High overall rating
- Mid-term action recommended
    - No Canadian standard exists but recommended to reference or adopt existing international standards.

Regarding the above bullet point on hydrogen powered ships, the international standards are already in place and have been utilized globally. There are relatively few hydrogen-powered ships in operation, but the number has been and is growing. Currently, there are about 83 hydrogen-powered ships either in operation or on order. This includes various types of vessels such as ferries, crew transfer vessels, and service operation vessels for offshore wind farms. The maritime industry, with DNV's support, is actively exploring hydrogen as a sustainable fuel option, and several projects and initiatives are underway to increase the number of hydrogen-powered ships in the coming years. DNV has published the "Handbook for Hydrogen-Fuelled Vessels, (https://www.dnv.com/maritime/publications/handbook-for-hydrogen-fuelled-vessels-download/)" which provides a comprehensive roadmap for safe hydrogen operations using fuel cells. This handbook addresses the technical, safety, and regulatory challenges associated with hydrogen as a ship fuel, offering valuable guidance to shipowners and operators. Within this, DNV led the MarHySafe project, a consortium of 26 leading companies and associations, to explore the most pressing issues surrounding hydrogen as a ship fuel. The project resulted in a handbook that sheds light on key lessons and best practices for the maritime industry.

17. **DNV**. (2021). *Handbook for Hydrogen-Fuelled Vessels*. Retrieved from https://www.dnv.com/maritime/publications/handbook-for-hydrogen-fuelled-vessels-download/.

5 RECOGNIZED TRAINING CENTERS IN NEWFOUNDLAND

WorkplaceNL has the responsibility to administer, regulate and monitor certification training for various high-risk activities. The certifications presently regulated by WorkplaceNL are:

- Confined Space Entry
- Fall Protection
- Traffic Control Persons
- Power Line Hazards
- Mines Rescue
- OHS Committees/WHS Representatives/Designates
- Occupational Diving (Surface Attendant)
- First Aid
- Supervisor Health and Safety
- Musculoskeletal Injury Prevention

WorkplaceNL approves training providers to deliver the above certification training. To be approved, WorkplaceNL will confirm that the provider is using an approved curriculum and has approved trainers as per the WorkplaceNL certification training standard. The below training providers have been approved to provide certification training for one or more of the above certifications:

- A1 Safety Training and Consulting Ltd
- College of the North Atlantic
- Dallas Mercer Consulting/Innu Dmc
- Dexter Institute Inc
- Eastern Safety Services
- EASY Safety Training & Service
- First Aid Vitals
- HSE Integrated Ltd
- Janes Safety Services
- Newfoundland & Labrador Construction Safety Association (NLCSA)
- NL First Aid & Safety
- Pretty Safe Enterprises
- Puglisevich Crews & Services Limited
- Rogers Enterprises Limited
- Safety NL

The following is a list of the recognized institutions in Newfoundland and Labrador that have been approved by Transport Canada to provide specialized marine training nationally:

- Canadian Corps of Commissionaires Newfound land and Labrador Division
- College of the North Atlantic
- Fisheries and Marine Institute of Memorial University
- Professional Fish Harvesters Certification Board of Newfoundland and Labrador
- RelyOn Nutec
- Virtual Marine

The Provincial Apprenticeship and Certification Board in Newfoundland and Labrador provide the accreditation of apprenticeship programs for the province. Below is a list of the accredited training providers:

- Academy Canada
- Boilermakers Industrial Training Centre
- Bricklayer & Allied Craftworkers
- Carpenters Millwrights College
- College of the North Atlantic
- DieTrac Technical Institute
- Ironworkers Education and Training Co.
- Keyin College
- NL Heat and Frost Insulator Training Centre
- Operating Engineers

- U.A. Training Centre

Memorial University of Newfoundland is the provinces university which offers various degree programs and master's programs.

5.1 Newfoundland and Labrador – Specialized Green Energy Trades

College of the North Atlantic (CNA) is now offering two new programs in the green energy field. Both programs are described in detail in the following subsections.

5.1.1 Hydrogen Technician

The Hydrogen Technician program offered by CNA provides training on hydrogen safety and production technologies. The program provides practical training to reinforce theoretical concepts. Upon completion of the program, graduates are qualified for industrial plant operations. The program provides foundational training to upskill effectively for specific hydrogen processes.

Along with various foundational courses, the following hydrogen/ammonia specific courses are included in the program:

- Hydrogen Safety
    - This course focuses on the identification of hazards relating to hydrogen safety. Some items that are covered in the course are: safety zones, personal protective equipment (PPE), emergency response procedures and evacuations for hydrogen related incidents.
- Green Hydrogen Industry
    - This course evaluates the occupations and production facilities involved in producing green hydrogen.
- Ammonia Safety
    - This course focuses on the identification of hazards relating to ammonia. Some items that are covered in the course are: safety zones, personal protective equipment (PPE), emergency response procedures and evacuations for ammonia related incidents.
- Hydrogen Production
    - This course introduces hydrogen and the fundamentals of hydrogen production. It teaches the uses and application of hydrogen in process plants, including the operation of hydrogen units.
- Ammonia Production
    - This course introduces ammonia and the fundamentals of ammonia production. It teaches the uses and application of ammonia in process plants, including the operation of ammonia units.
- Hydrogen Fuel Cells
    - This course introduces hydrogen fuel cells. It examines the structure and underlying electrochemical principles and it teaches procedures pertaining to production, operation and maintenance of hydrogen fuel cells.

10. **Government of Canada.** Recognized Institutions and Approved Training Courses – TP 10655E. *Government of Canada.* [Online]
11. **Newfoundland and Labrador.** Apprenticeship and Trades Certification Division. *Newfoundland and Labrador.* [Online] https://www.gov.nl.ca/atcd/training-institutions/accreditation/list-of-accredited-programs/.
12. **College of the North Atlantic.** Hydrogen Technician Program Information. *College of the North Atlantic.* [Online] https://www.cna.nl.ca/program/hydrogen-technician#.

5.1.2 Wind Turbine Technician

The Wind Turbine Technician program offered by CNA provides training on the mechanical and electrical systems of turbine and hydraulic systems. The program allows participants to apply classroom theory in a wind turbine training facility. Upon completion of this program, graduates will be qualified to work on the installation, operation, maintenance and repair of wind turbines.

Along with various foundational courses, the following wind energy specific courses are included in the program:

- Wind Energy Electrical Basics
    - This course covers the electrical basic principles of wind energy. It introduces alternating current and direct current circuits and analyses the relationship between voltage, impedance and current.
- Wind Energy Mechanical Systems (I & II)
    - The combination of these two courses teaches the basic mechanical theory and standard work practices with mechanical systems. The use of hand tools, tool inspection, fastener selection and application, and lubrication techniques are covered. Participants will learn to assemble drive train systems and learn about bearing systems. Levelling and aligning machines is a focus area of the course.
- Intro into Wind Turbine Systems
    - This course covers the basics of wind energy including the history of wind power, different types of turbine designs, turbine system components, turbine aerodynamics and site selection. The course also covers the differences between small scale wind market and utility and large wind projects.
- Wind Turbine Work Practices (I & II)
    - The combination of these courses introduces the industry's best practices in safety and planning for field work. Risk assessment tools, workforce planning concepts, job safety analysis and incident investigation techniques are covered. The course also touches on the Occupational Health and Safety (OHS) legislation.
- Wind Energy Electrical Equipment
    - This course introduces the electrical equipment used in wind generators and shows how they are connected to the distribution grid. The general concepts as well as testing and maintenance of electrical generation and distribution equipment and AC/DC machines are covered.
- Wind Turbine Hydraulics
    - This course introduces fluid power technology relating to hydraulic systems, focusing on the fundamentals of hydraulic system components. The course covers the theory of hydraulics, types of fluids, conductors and seals, reservoirs, hydraulic actuators, and control valves and pumps.
- Wind Turbine Controls
    - This course focuses on the basic theory and operation of industrial control systems used in wind turbines. The control systems studied includes networking principles, protocols and common hardware types. The course also covers common troubleshooting and diagnostic techniques.

13. **Wind Turbine Technician Program Information**. *College of the North Atlantic.* [Online] https://www.cna.nl.ca/program/wind-turbine-technician#.

6 GREEN ENERGY TRAINING STANDARDS

6.1 Global Wind Organization

The Global Wind Organization (GWO) has developed training standards for various aspects of wind farm projects. Their standards are created by GWO members then reviewed and updated by GWO's committees. The training standards are created to reflect the risks and hazards technicians in wind farms face at work.

Below is a list of the standards developed by GWO:

- Advanced Rescue Training Standard (and Refresher)
- Basic Safety Training Standard (and Refresher)
- Basic Technical Training Standard
- Blade Repair Training Standard
- Control of Hazardous Energies Standard (and Refresher)
- Crane and Hoist Standard
- Enhanced First Aid Standard (and Refresher)
- Entry Level Wind Technician Framework
- Instructor Qualification Standard
- Service Lift Training Standard
- Slinger Signaller Standard
- Wind Limited Access Standard

6.2 The Nautical Institute

The Nautical Institute offers a training standard for handling alternative fuels in the maritime sector. The standard was developed to ensure that seafarers who handle alternative fuels are properly trained and capable of handling them. The goal of the voluntary standard was to be a resource for employers and training centres to offer guidance on training for seafarers and others involved in the handling of alternative fuels. The topics and learning objectives covered in the training standard are as follows:

- Introduction to ships alternative fuels
    - The learning objective of this topic is to be able to recognise and describe the physical and chemical properties of ammonia, methanol, and hydrogen as ships fuels.
- Equipment and systems
    - The learning objective of this topic is to be able to understand the design and specifications of fuel systems including ventilation and gas detection systems.
- Personal, ship, and environment safety
    - The learning objective of this topic is to understand the protocols for loading and unloading of bunkers, transfer procedures, precautions, monitoring and control measures. Additionally, the topic also covers health hazards, PPE and first aid.
- Emergency response
    - The learning objective of this topic is to understand emergency response and shutdown procedures.
- Laws and codes
    - The learning objective of this topic is to provide awareness of flag state law and international codes and protocols.

14. **Global Wind Organization.** GWO Training Standards. *Global Wind Organization.* [Online] https://www.globalwindsafety.org/trainingstandards/browse.
15. **The Nautical Institute.** Training Standard for Handling Alternative Fuels in the Maritime Sector. *The Nautical Institute.* [Online] November 2024. https://safety4sea.com/wp-content/uploads/2024/11/TheNauticalInstitute-Green-Curriculum-2024_11.pdf.

7 IDENTIFIED GAPS

Throughout the course of this project, various gaps have been identified relating to Newfoundland and Labrador's workforce training requirements and availability for wind-to-hydrogen projects.

The first gap was identified while compiling information on the training requirements for each phase of wind-to-hydrogen projects. Newfoundland and Labrador, and Canada in general, does not have a clear outline of the training requirements for these roles. Through research, training and certifications have been identified which would be beneficial for persons working in these roles however there is no overruling regulations available which state what training and certification is required for these workers. Employers may be able to offer training to prepare workers for their roles by requiring certain training and certification, but with no overruling requirements from the regulators there will be discrepancies in the trainings throughout each project. Expanding on this gap, many of the trainings that have been identified are not specific training courses/certificates that are required, many of the identified green energy related trainings are a description of the understanding/training that workers should have, not a designated training course. This again can cause discrepancies in training as there is no hard specific requirement.

In alignment with the above gap, there is additionally no training standards available in Canada to evaluate the effectiveness of green energy related training courses and certificates. For many of the identified trainings, there are courses offered through a variety of sources however, with no stipulation on what is required from the regulators, it is difficult to rate the effectiveness of a course. Without clear guidelines on what is required for each type of training/certification there again will be many discrepancies in the trainings and there will be no guarantee that all workers are adequately trained, even if they have completed all identified trainings.

Finally, the results of this project highlights that many of the green energy related upskilling trainings are not available in Newfoundland and Labrador. Although much of the trainings are available online, there are no in person certifications available in the province for many of these identified requirements. Newfoundland and Labrador have many recognized training facilities, however none of which offer upskilling programs specifically for green energy.

8 CONCLUSIONS/RECOMMENDATIONS

There are various recommendations offered to help bridge the gap in Newfoundland and Labradors preparedness for wind-to-hydrogen projects, specifically in relation to training requirements and availability.

It is recommended that regulations are developed on the required trainings for green energy roles by the Government of Newfoundland and Labrador and/or Canada. If regulations are created and enforced by regulators, this will ensure alignment between all parties and provide clarity, removing any discrepancies due to the interpretation of what is required. The CHCSR was produced in 2025 and concludes with actionable steps for developing regulations and training standards for green energy roles, promoting innovation and capacity building, and ensuring alignment between all parties to remove discrepancies in requirements. The steps include a prioritized list of codes and standards to review with an assessment on addressing gaps is essential to enable low-carbon hydrogen adoption and deployment.

Another recommendation is that training standards are developed for the training/certification requirements for green energy projects. Similarly to WorkplaceNL's legislation to administer training for high-risk hazards outlined in the Newfoundland and Labrador Occupational Health and Safety Act, there should be a body approving/regulating the green energy training/certification offered in Newfoundland and Labrador. A body such as WorkplaceNL should work with the provinces recognized training programs to help them offer acceptable green energy training and certification.

Finally, it is recommended that the province leverages off the new training programs offered by the College of the North Atlantic. The availability of these courses is a great first step for the province in the field of green energy, however further benefits could be developed from these programs. There are a variety of courses offered within these programs that have been highlighted in this report, if these courses could be offered independently, it would be a great resource for upskilling.

To conclude it has been determined that Newfoundland and Labrador is well suited and prepared for the construction phase of wind-to-hydrogen projects, however the province is lacking in the availability of specialized upskilling for green energy operations and maintenance. Additionally, it should be noted that there may be additional training and qualification requirements for the designers of the systems and facilities used in wind-to-hydrogen projects, however the design is outside of the scope of this project therefore the requirements have not been assessed.

9 REFERENCES

1. **Hatch.** *Identifying Workforce Capacity Gaps in Newfoundland and Labradors Clean Energy Industry.* St. Johns : s.n., 2024.
2. **Orsted.** How does onshore wind poer work? *Orsted.* [Online] [Cited: 15 January 2025.] https://orsted.com/en/what-we-do/renewable-energy-solutions/onshore-wind-energy/technology.
3. **US Department of Energy.** Hydrogen Production: Electrolysis. *US Department of Energy.* [Online] [Cited: 15 January 2025.] https://www.energy.gov/eere/fuelcells/hydrogen-production-electrolysis.
4. **Accelerator, The Transition.** Hydrogen Workforce Assessment Tool. *Workforce Requirements for Advancing a Hydrogen Economy.* [Online] July 2022. https://transitionaccelerator.ca/wp-content/uploads/2023/05/TA_H2-Workforce-Requirements-Assessment-Tool_FINAL-1.pdf.
5. *Ammonia as Effective Hydrogen Storage: A Review on Production, Storage and Utilization.* **Aziz, Muhammed.** s.l. : Advances in Hydrogen Energy, 2020.
6. **US Department of Energy.** Hydrogen Storage. *US Department of Energy.* [Online] [Cited: 15 January 2025.] https://www.energy.gov/eere/fuelcells/hydrogen-storage.
7. **WorkplaceNL.** Certification Training Standards. *WorkplaceNL.* [Online]
8. **Government of Canada.** Recognized Institutions and Approved Training Courses – TP 10655E. *Government of Canada.* [Online]
9. **Newfoundland and Labrador.** Apprenticeship and Trades Certification Division. *Newfoundland and Labrador.* [Online] https://www.gov.nl.ca/atcd/training-institutions/accreditation/list-of-accredited-programs/.
10. **College of the North Atlantic.** Hydrogen Technician Program Information. *College of the North Atlantic.* [Online] https://www.cna.nl.ca/program/hydrogen-technician#.
11. —. Wind Turbine Technician Program Information. *College of the North Atlantic.* [Online] https://www.cna.nl.ca/program/wind-turbine-technician#.
12. **Global Wind Organization.** GWO Training Standards. *Global Wind Organization.* [Online] https://www.globalwindsafety.org/trainingstandards/browse.
13. **The Nautical Institute.** Training Standard for Handling Alternatice Fuels in the Maritime Sector. *The Nautical Institute.* [Online] November 2024. https://safety4sea.com/wp-content/uploads/2024/11/TheNauticalInstitute-Green-Curriculum-2024_11.pdf.
14. **Hartmann, Kevin.** Electrolyzer Codes and Standards. *National Renewable Energy Laboratory.* [Online] 27 September 2023. https://www.energy.gov/sites/default/files/2023-11/2-04-codes-standards-hartmann.pdf.
15. **Canadian Standards Association.** CSA Guide to Canadian wind turbine codes and standards. *Canadian Standards Association.* [Online] 2008. https://www.csagroup.org/documents/codes-and-standards/standards/energy/CSAGuidetoCanadianWindTurbineCodes.pdf.
16. **Natural Resources Canada**. (2025). *Canadian Hydrogen Codes and Standards Roadmap*. Received from econext and can be found at https://natural-resources.canada.ca/energy-sources/clean-fuels/hydrogen-strategy/canadian-hydrogen-codes-standards-roadmap.
17. **DNV**. (2021). *Handbook for Hydrogen-Fuelled Vessels*. Retrieved from https://www.dnv.com/maritime/publications/handbook-for-hydrogen-fuelled-vessels-download/.

APPENDIX A
Summary of Results

Wind-to-Hydrogen: Available Standards and Worker Qualifications

Onshore Wind Farm

Construction:

Applicable Standards	Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
			Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Newfoundland and Labrador Occupational Health and Safety Regulations	Industrial Electrician	Lockout/Tag out	Yes	-	-	Certificate of Qualification - Industrial Electrician (72201)	Yes	-	-
CSA Guide to Canadian wind turbine codes and standards:		First Aid	Yes	-	-				
CAN/CSA-F416-87, Wind Energy Conversion Systems (WECS) — Safety, Design, and Operation Criteria		Confined Space Entry	Yes	-	-				
CAN/CSA-F417-M91, Wind Energy Conversion Systems (WECS) — Performance		Fall Protection	Yes	-	-				
CAN/CSA-F429-M90, Recommended Practice for the Installation of Wind Energy Conversion Systems		WHMIS	Yes	-	-				
CAN/CSA-F418-M91, Wind Energy Conversion Systems (WECS) — Interconnection to the Electric Utility		Respiratory Protection Training	Yes	-	-				
CAN/CSA-C61400-11, Wind turbine generator systems — Part 11: Acoustic noise measurement techniques		Regulatory Awareness	Yes	-	-				
CAN/CSA-C61400-12-1, Wind turbines — Part 12-1: Power performance measurements of electricity producing wind turbines	Carpenter	First Aid	Yes	-	-	Certificate of Qualification - Carpenter (72310)	Yes	-	-
CAN/CSA-C61400-24, Wind turbine generator systems — Part 24: Lightning protection		Confined Space Entry	Yes	-	-				
CAN/CSA-C61400-1, Wind turbines — Part 1: Design requirements (Expected publication May 2008)		Fall Protection	Yes	-	-				
CAN/CSA-C61400-2, Wind turbines — Part 2: Design requirements for small wind turbine		WHMIS	Yes	-	-				
CSA C22.2 No. 272 - Wind Turbine Electrical Systems		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
Acoustic Noise:	Heavy Equipment Operator	First Aid	Yes	-	-	Provincial Trade - Heavy Equipment Operator	Yes	-	-
CSA Z107.10-06, Guide for the use of acoustical Standards in Canada		Power Line Hazards	Yes	-	-				
CAN/CSA-ISO 1996-1:05, Acoustics — Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures		Confined Space Entry	Yes	-	-				
CAN/CSA-ISO 1996-2, Acoustics — Description and measurement of environmental noise		Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Yes	-	-				
“National Guidelines for Environmental Noise Control” by the Federal-Provincial Advisory Council on Environmental and Occupational Health, Health Canada		WHMIS	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Industrial Mechanic (Millwright)	First Aid	Yes	-	-	Certificate of Qualification - Industrial Mechanic (Millwright) (72400)	Yes	-	-
Electrical Connections (Off Grid):		Confined Space Entry	Yes	-	-				
CSA Canadian Electrical Code (CEC), Part I		Fall Protection	Yes	-	-				
Components certified to applicable CSA CEC, Part II Standards (e.g., CSA C22.2 No. 100, CSA C22.2 No. 14, etc.)		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Electrical Connections (Grid Connected):		Regulatory Awareness	Yes	-	-				
CSA Canadian Electrical Code (CEC), Part I	Ironworker	First Aid	Yes	-	-	Certificate of Qualification - Ironworker (72105)	Yes	-	-
CAN/CSA-C22.2 No. 257, Interconnecting inverter-based micro-distributed resources to distribution systems		Confined Space Entry	Yes	-	-				
CSA C22.3 No. 9, Interconnection of distributed resources and electricity supply systems (for installations up to 10 MW connected to distribution systems up to 50 kV)		Fall Protection	Yes	-	-				
		WHMIS	Yes	-	-				
Foundations:		Respiratory Protection Training	Yes	-	-				

Structural design requirements of: CAN/CSA-F416		Regulatory Awareness	Yes	-	-				
Structural design requirements of: CSA S37, Antennas, Towers, and Antenna Supporting Structures	Metal Fabricator (Fitter)	First Aid	Yes	-	-	Certificate of Qualification - Metal Fabricator (Fitter) (72104)	Yes	-	-
IEC 61400 series Standards and references		Confined Space Entry	Yes	-	-				
CAN/CSA-F416. Clause 6.2.6		Fall Protection	Yes	-	-				
		WHMIS	Yes	-	-				
Towers:		Respiratory Protection Training	Yes	-	-				
CAN/CSA-F416 Clause 6.2.2		Regulatory Awareness	Yes	-	-				
National (Canadian) structural codes and standards for materials	Sheet Metal Worker	First Aid	Yes	-	-	Certificate of Qualification - Sheet Metal Worker (72102)	Yes	-	-
National Building Code of Canada		Confined Space Entry	Yes	-	-				
		Fall Protection	Yes	-	-				
		WHMIS	Yes	-	-				
Markings for aviators:		Respiratory Protection Training	Yes	-	-				
CARS 621.19.12, Marking and Lighting of Wind Turbines and Windfarms		Regulatory Awareness	Yes	-	-				
	Crane Operator	Power Line Hazards	Yes	-	-	Certificate of Qualification - Mobile Crane Operator (72500)	Yes	-	-
Environmental Design:		First Aid	Yes	-	-				
IEC 61400-1 and IEC 61400-2		Fall Protection	Yes	-	-				
CAN/CSA-F416		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Load Cases:		Regulatory Awareness	Yes	-	-				
Clause 7 of IEC 61400-1	Welder	First Aid	Yes	-	-	Certificate of Qualification - Welder (72106)	Yes	-	-
Clause 7 of IEC 61400-2		Confined Space Entry	Yes	-	-				
Clause 7.6.1.3 of IEC 61400-1		Fall Protection	Yes	-	-				
CAN/CSA-F416 Clause 5.1 and 5.2		WHMIS	Yes	-	-				
Clause 4.2.1 of the National Building Code (1985)		Respiratory Protection Training	Yes	-	-				
CSA S37 (1986)		Regulatory Awareness	Yes	-	-				
CAN/CSA-C61400-1	Project Manager	Supervisor Health and Safety Training (WorkplaceNL)	Yes	-	-	PMP Certification	Yes	-	-
CAN/CSA-C61400-2		First Aid	Yes	-	-	Prerequisite: Secondary Degree (High School Diploma, Associates Degree, Global Equivalent)	Yes	-	-
		Confined Space Entry	Yes	-	-	or Prerequisite: Four Year Degree (Bachelors Degree or Global Equivalent)	Yes	-	-
Lightening Protection:		Fall Protection	Yes	-	-				
IEC 61024		WHMIS	Yes	-	-				
IEC/TR 61400-24		Regulatory Awareness	Yes	-	-				
CAN/CSA-F416		Emergency Preparedness for Workers	No	Yes	-				
CSA CEC, Part I		OHS Committee, WHS Representative and Designate Training	Yes	-	-				
CAN/CSA-B72, Installation Code for Lightning Protection Systems	Surveyor	First Aid	Yes	-	-	Bachelors Degree in Geomatics Engineering or Survey Engineering	No**	Yes	-
		Confined Space Entry	Yes	-	-	Or College Diploma in Survey Science or Geomatics Technology	Yes	-	-
Blades/Rotors:		Fall Protection	Yes	-	-	Completion of Professional Land Surveyor Examinations	Yes	-	-
IEC 61400-23		WHMIS	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
Mechanical Systems:	Wind Turbine Technician	Wind Turbine High Angle Rescue	No	Yes	-	Industrial Mechanic (Millwright)	Yes	-	-
IEC 61400-1		First Aid	Yes	-	-	or Wind Turbine Technician Certificate	Yes	-	-
IEC/TS 61400-13		Confined Space Entry	Yes	-	-				
		Fall Protection	Yes	-	-				
Performance Measurement:		WHMIS	Yes	-	-				
IEC TC 88		Regulatory Awareness	Yes	-	-				

IEC 61400-12-1, Power performance measurements of electricity producing wind turbines / CAN/CSA-C61400-12-1

Power Quality:

IEC 61400-21

Worker Safety:

CSA Z259

CAN/CSA-Z431, Basic and safety principles for man-machine interface, marking and identification — Coding principles for indication devices and actuators

CSA Z432, Safeguarding of machinery

CAN/CSA-Z460, Control of hazardous energy — Lockout and other methods

BS EN 50308, Wind Turbines — Protective Measures — Requirements for Design, Operation and Maintenance

Blade Technician (Turbine Blade Machinist)	Blade Repair	No	No	Yes	Certificate of Qualification - Machinist	Yes	-	-
	First Aid	Yes	-	-				
	Confined Space Entry	Yes	-	-				
	Fall Protection	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Laborer	First Aid	Yes	-	-	Secondary School	Yes	-	-
	Confined Space Entry	Yes	-	-				
	Fall Protection	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Transport Truck Driver	Transportation of Dangerous Goods	Yes	-	-	Secondary School	Yes	-	-
	Air Brake Endorsement	Yes	-	-	Driver Training Course	Yes	-	-
					Class 1 or D License and/or Class 1 or A License	Yes	-	-
					Air Brake Endorsement	Yes	-	-

Operations:

Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
		Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Wind Turbine Technician	Wind Turbine High Angle Rescue	No	Yes	-	Industrial Mechanic (Millwright)	Yes	-	-
	First Aid	Yes	-	-	or Wind Turbine Technician Certificate	Yes	-	-
	Confined Space Entry	Yes	-	-				
	Fall Protection	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Blade Technician (Turbine Blade Machinist)	Blade Repair	No	Yes	-	Certificate of Qualification - Machinist	Yes	-	-
	First Aid	Yes	-	-				
	Confined Space Entry	Yes	-	-				
	Fall Protection	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Mechanic	First Aid	Yes	-	-	Certificate of Qualification - Industrial Mechanic (Millwright) (72400)	Yes	-	-
	Confined Space Entry	Yes	-	-				
	Fall Protection	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Electrician	Lockout/Tag out	Yes	-	-	Certificate of Qualification - Industrial Electrician (72201)	Yes	-	-
	First Aid	Yes	-	-				
	Confined Space Entry	Yes	-	-				
	Fall Protection	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
	First Aid	Yes	-	-	Provincial Trade - Heavy Equipment Operator	Yes	-	-
	Power Line Hazards	Yes	-	-				
	Confined Space Entry	Yes	-	-				

	Heavy Equipment Operator	Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Yes	-	-				
		WHMIS	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
Electrolysis									
Applicable Standards	**Construction:**								
	Required Positions:	**Training Requirements:**	**Training/Upskilling Availability**			**Qualification Requirements:**	**Education/Training Availability**		
			Newfoundland	**Canada**	**Europe**		**Newfoundland**	**Canada**	**Europe**
Electrolyzer Specific Codes and Standards:	Industrial Electrician	Lockout/Tag out	Yes	-	-	Certificate of Qualification - Industrial Electrician (72201)	Yes	-	-
NFPA 2 Hydrogen Technologies Code - Chapter 12 Hydrogen Generation Systems		First Aid	Yes	-	-				
CSA/ANSI B22734 Hydrogen Generators using Water Electrolysis (adoptions with Canadian and US deviation of ISO 22734)		Confined Space Entry	Yes	-	-				
DNV ST J301: Electrolyzer systems.		WHMIS	Yes	-	-				
ASME BPVC Section VIII Division I: Rules for Construction of Pressure Vessels.		Respiratory Protection Training	Yes	-	-				
		H2S Alive Training	Yes	-	-				
Enclosures Design:		Regulatory Awareness	Yes	-	-				
NFPA 2 Hydrogen Technologies Code	Plumber	First Aid	Yes	-	-	Certificate of Qualification - Plumber (72300)			
NFPA 69 Standard on Explosion Prevention Systems		Confined Space Entry	Yes	-	-				
NFPA 70 National Electric Code (NEC)		Respiratory Protection Training	Yes	-	-				
NFPA 496 Standard for Purged and Pressurized Enclosures		H2S Alive Training	Yes	-	-				
FPA 497 Recommended Practice of the Classification of Flammable Liquids, Gases, or Vapors		Regulatory Awareness	Yes	-	-				
IEC 60079-10-1 Explosive Atmospheres – Part 10-1: Classification of Areas- Explosive Gas Atmosphere	Ironworker	First Aid	Yes	-	-	Certificate of Qualification - Ironworker (72105)	Yes	-	-
IEEE Standard 463-2013: Electrical Safety Practices in Electrolytic Cell Line Working Zones.		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Hydrogen Vent system:		H2S Alive Training	Yes	-	-				
NFPA 2 Hydrogen Technologies Code		Regulatory Awareness	Yes	-	-				
CGA G-5.5 Hydrogen Vent Systems	Boilermaker	First Aid	Yes	-	-	Certificate of Qualification - Boilermaker (72103)	Yes	-	-
CGA S.1 Pressure Relief Device Standards		Confined Space Entry	Yes	-	-				
S 1.1 Part 1 - Cylinders for Compressed Gases		H2S Alive Training	Yes	-	-				
S 1.2 Part 2 - Portable Containers for Compressed Gases		Respiratory Protection Training	Yes	-	-				
S 1.3 Part 3 – Stationary Storage Containers for Compressed Gases		Regulatory Awareness	Yes	-	-				
	Carpenter	First Aid	Yes	-	-	Certificate of Qualification - Carpenter (72310)	Yes	-	-
		Confined Space Entry	Yes	-	-				
Piping System:		WHMIS	Yes	-	-				
NFPA 2 Hydrogen Technologies Code		H2S Alive Training	Yes	-	-				
ASME B31.3 Process Piping		Respiratory Protection Training	Yes	-	-				
ASME B31.12 Hydrogen Piping and Pipelines		Regulatory Awareness	Yes	-	-				
ASME Boiler and Pressure Vessel Code	Concrete Finisher	First Aid	Yes	-	-	Certificate of Qualification - Concrete Finisher (73100)	Yes	-	-
HGV 4.10-2012 Standard for Fittings for Compressed Hydrogen Gas and Hydrogen Rich Gas Mixtures		Confined Space Entry	Yes	-	-				
CGA G-5.4-2012 Standard for Hydrogen Piping Systems at User Locations		WHMIS	Yes	-	-				
ASME Section IX: Qualification standard for welding, brazing, and fusing procedures.		Respiratory Protection Training	Yes	-	-				
ASME/ANSI B16: Flanges & Fittings, Valves.		Regulatory Awareness	Yes	-	-				

API Standard 520: Sizing, Selection, and Installation of Pressure-relieving Devices.	Gasfitter	First Aid	Yes	-	-	Certificate of Qualification - Gasfitter (Class A / Class B) (72302)	No	Yes	-
API Standard 526: Flanged Steel Pressure-relief Valves.		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
Oxygen:		Respiratory Protection Training	Yes	-	-				
CGA G-4 Oxygen		Regulatory Awareness	Yes	-	-				
CGA G-4.1 Clean Equipment for Oxygen Service	Heavy Equipment Operator	First Aid	Yes	-	-	Provincial Trade - Heavy Equipment Operator	Yes	-	-
CGA P-8.7 Safe Location of Oxygen and Inert Gas Vents		Confined Space Entry	Yes	-	-				
NFPA 53 Systems in Oxygen-Enriched Atmospheres		WHMIS	Yes	-	-				
ASTM A967 Passivation of Stainless Steels		Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Yes	-	-				
ASTM G65 Standards Guide for Evaluating Nonmetallic Materials for Oxygen Service		Respiratory Protection Training	Yes	-	-				
ASTM G93 Standard Guide for Cleanliness Levels and Cleaning Methods for Materials and Equipment ASTM G94 Standard Guide for Evaluating Metals in Oxygen Service		Regulatory Awareness	Yes	-	-				
ASTM G88 Designing Systems for Oxygen Service	Industrial Mechanic (Millwright)	First Aid	Yes	-	-	Certificate of Qualification - Industrial Mechanic (Millwright) (72400)	Yes	-	-
ASTM G127 Guide for the Selection of Cleaning Agents for Oxygen Service		Confined Space Entry	Yes	-	-				
ASTM G131 Standard Practice for Cleaning of Materials and Components by Ultrasonic Techniques		WHMIS	Yes	-	-				
OSHA 1910.104 Oxygen		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Hydrogen Quality Standards:		Regulatory Awareness	Yes	-	-				
SAE J2719 Hydrogen Fuel Quality for Fuel Cell Vehicles	Instrumentation and Control Technician	First Aid	Yes	-	-	Certificate of Qualification - Instrumentation and Control Technician (22312)	Yes	-	-
ISO 14687 Hydrogen Fuel Quality - Product Specification		Confined Space Entry	Yes	-	-				
CGA 5.3 Commodity Specification for Hydrogen		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
Gas Processing Units:		Respiratory Protection Training	Yes	-	-				
API Standard 618: Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services.		Regulatory Awareness	Yes	-	-				
TEMA Standards: Shell & Tube Heat Exchanger Design.	Insulator	First Aid	Yes	-	-	Certificate of Qualification - Insulator (Heat and Frost) (72321)	Yes	-	-
API Standard 662/ISO 15547-1: Plate Heat Exchangers for General Refinery Services.		Confined Space Entry	Yes	-	-				
ASME B73: Horizontal End Suction Centrifugal Pumps.		WHMIS	Yes	-	-				
API Standard 2000: Venting Atmospheric and Low-pressure Storage Tanks.		H2S Alive Training	Yes	-	-				
ASME RTP-1–2021: Reinforced Thermoset Plastic Corrosion-Resistant Equipment.		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
Facilities & Plant Design:	Lather (Interior Systems Mechanic)	First Aid	Yes	-	-	Certificate of Qualification - Lather (73102)	Yes	-	-
ISO/TR 15916:2015 Report: Basic considerations for the safety of hydrogen systems.		Confined Space Entry	Yes	-	-				
OSHA Regulations: Hazardous Materials.		WHMIS	Yes	-	-				
40 CFR Part 68: Chemical Accident Prevention Provisions.		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Fire Protection & Explosive Atmospheres:		Regulatory Awareness	Yes	-	-				
IEC 600791-10-1: Explosive atmospheres.	Metal Fabricator (Fitter)	First Aid	Yes	-	-	Certificate of Qualification - Metal Fabricator (Fitter) (72104)	Yes	-	-
NFPA 497: Classification of Flammable Liquids, Gases, or Vapors.		Confined Space Entry	Yes	-	-				
ISO 15848-2: Industrial valves — Measurement, test and qualification procedures for fugitive emissions.		WHMIS	Yes	-	-				
NFPA 55: Compressed gases and Cryogenic Fluid.		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Safety & Control Architecture:		Regulatory Awareness	Yes	-	-				

IEC 61511: Functional safety instrumented systems for the process industry sector. IEC 61508: Functional safety of electrical/electronic programmable electronic safety-related systems. ISO 12100: Safety of machinery — General principles for design — Risk assessment and risk reduction Newfoundland and Labrador Occupational Health and Safety Regulations	Sheet Metal Worker	First Aid	Yes	-	-	Certificate of Qualification - Sheet Metal Worker (72102)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Crane Operator	Power Line Hazards	Yes	-	-	Certificate of Qualification - Mobile Crane Operator (72500)	Yes	-	-
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Refrigeration and Air Conditioning Mechanic	First Aid	Yes	-	-	Certificate of Qualification - Refrigeration and Air Conditioning Mechanic (72402)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Sprinkler Fitter	First Aid	Yes	-	-	Certificate of Qualification - Sprinkler Fitter (72301)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Steamfitter/Pipefitter	First Aid	Yes	-	-	Certificate of Qualification - Steamfitter/Pipefitter (72301)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Welder	First Aid	Yes	-	-	Certificate of Qualification - Welder (72106)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Surveyor	First Aid	Yes	-	-	Bachelors Degree in Geomatics Engineering or Survey Engineering	No**	Yes	-
		Confined Space Entry	Yes	-	-	Or College Diploma in Survey Science or Geomatics Technology	Yes	-	-
		WHMIS	Yes	-	-	Completion of Professional Land Surveyor Examinations	Yes	-	-
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Scaffolder	First Aid	Yes	-	-	Scaffolding Course	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				

	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Transport Truck Driver	Transportation of Dangerous Goods	Yes	-	-	Secondary School	Yes	-	-
	Air Brake Endorsement	Yes	-	-	Driver Training Course	Yes	-	-
					Class 1 or D License and/or Class 1 or A License	Yes	-	-
					Air Brake Endorsement	Yes	-	-
Project Manager	Supervisor Health and Safety Training (WorkplaceNL)	Yes	-	-	PMP Certification	Yes	-	-
	First Aid	Yes	-	-	Prerequisite: Secondary Degree (High School Diploma, Associates Degree, Global Equivalent)	Yes	-	-
	Confined Space Entry	Yes	-	-	or Prerequisite: Four Year Degree (Bachelors Degree or Global Equivalent)	Yes	-	-
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
	Emergency Preparedness for Workers	No	Yes	-				
	OHS Committee, WHS Representative and Designate Training	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				

Operations:

Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
		Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Automation & Controls Specialist	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Automation, Instrumentation & Controls or Electrical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Instrumentation or Automation Engineering)	Yes	-	-
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on Hydrogen Production Process using PEM Electrolyzers	No	No	Yes				
	Automated Process Systems & Control Systems Training (Electrolyzers)	No	Yes* (online)	-				
Chemical/Process Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Process Engineering or Electrochemistry)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
Mechanical Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree - Mechanical Engineering	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	Training on the Selection, Design, and Maintenance of Electrolyzers, Vessels, Piping systems and Fitting Valves & Seals (Withstand Hydrogen Properties)	No	Yes* (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				

		Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen Properties)	No	Yes* (online)	No				
	Electrical Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree - Electrical Engineering	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		High Power Electrical Equipment Training (Electrolyzer)	No	Yes* (online)	-				
	Instrumentation Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Electrical and Instrumentation Engineering	No	Yes	-
		Hydrogen Safety Training	No	USA (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Instrumentation and Electrical Equipment and Systems (Electrolyzer)	No	Yes* (online)	-				
	Facility Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Process Engineering or Mechanical Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Hydrogen Gas Value Chain Training	No	Yes (online)	-				
	Measurement Specialist	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
		Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Hydrogen Gas Value Chain Training	No	Yes (online)	-				
	Process Control Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering or Electrical & Instrumentation Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Production Plant Control Systems & Advanced Control Systems for Process Optimization (Electrolyzer)	No	Yes* (online)	-				

Process Safety Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering or Process Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Hydrogen Control Skills Training (Hazard Risk Analysis and Reviews, Mechanical Integrity & Instrumented System Analysis and Operation Readiness Inspection)	No	Yes (online)	-				
Production Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering or Mechanical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
Renewable Power Interconnection Specialist	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree - Electrical Engineering	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	High Power Electrical Equipment Training (Electrolyzer)	No	Yes* (online)	-				
Control Room Operator	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Petrochemistry, Chemical Processes, Control Room Operator or Power Engineering Technology)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
Lab Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Chemical Technology, Process Technology, Petroleum Technology or Laboratory Technician)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
Maintenance Planner	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Electrician, Industrial Mechanic/Millwright or Instrumentation Technician)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-	Or Bachelors Degree (Electrical Engineering or Mechanical Engineering)	Yes	-	-
	Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen Properties)	No	Yes* (online)	No				
	H2S Alive Training	Yes	-	-				

		First Aid	Yes	-	-			
		WHMIS	Yes	-	-			
		Respiratory Protection Training	Yes	-	-			
		Training on the Selection, Design, and Maintenance of Electrolyzers, Vessels, Piping systems and Fitting Valves & Seals (Withstand Hydrogen Properties)	No	Yes* (online)	-			
	Maintenance Trade: Electrical Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Industrial Electrician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (Electrolyzer Production Plant)	No	Yes* (online)	-				
	Maintenance Trade: Instrumentation Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Instrumentation Technician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Selection and Maintenance of Instrumentation Equipment and Systems (Electrolyzer Production Plant)	No	Yes* (online)	-				
	Maintenance Trade: Mechanical Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Mechanic/Millwright)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Hydrogen Technician	Yes	-	-
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on the Selection, Design, and Maintenance of Electrolyzers, Vessels, Piping systems and Fitting Valves & Seals (Withstand Hydrogen Properties)	No	Yes* (online)	-				
	Plant Manager	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
		Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
	Plant Operator	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Technology Diploma (Petrochemistry, Chemical Process Engineering or Power Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Certificate of Qualification - Refrigeration Operator	No	Yes	-
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				

		Respiratory Protection Training	Yes	-	-				
		Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				
	Heavy Duty Equipment Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Heavy Duty Equipment Technician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Electrochemical Reactions, Processes and Hydrogen Production using PEM Electrolyzers	No	No	Yes				

Ammonification

Construction:

Applicable Standards	Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
			Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Newfoundland and Labrador Occupational Health and Safety Regulations	Industrial Electrician	Lockout/Tag out	Yes	-	-	Certificate of Qualification - Industrial Electrician (72201)	Yes	-	-
American National Standard Safety Requirement for the Storage and Handling of Anhydrous Ammonia - ANSI K61/ CGA 2.1 - 2014\		First Aid	Yes	-	-				
		Confined Space Entry	Yes	-	-				
Enclosures Design:		WHMIS	Yes	-	-				
NFPA 69 Standard on Explosion Prevention Systems		Respiratory Protection Training	Yes	-	-				
NFPA 70 National Electric Code (NEC)		H2S Alive Training	Yes	-	-				
NFPA 496 Standard for Purged and Pressurized Enclosures		Regulatory Awareness	Yes	-	-				
FPA 497 Recommended Practice of the Classification of Flammable Liquids, Gases, or Vapors	Plumber	First Aid	Yes	-	-	Certificate of Qualification - Plumber (72300)			
IEC 60079-10-1 Explosive Atmospheres – Part 10-1: Classification of Areas- Explosive Gas Atmosphere		Confined Space Entry	Yes	-	-				
IEEE Standard 463-2013: Electrical Safety Practices in Electrolytic Cell Line Working Zones.		Respiratory Protection Training	Yes	-	-				
		H2S Alive Training	Yes	-	-				
Hydrogen Vent system:		Regulatory Awareness	Yes	-	-				
NFPA 2 Hydrogen Technologies Code	Ironworker	First Aid	Yes	-	-	Certificate of Qualification - Ironworker (72105)	Yes	-	-
CGA G-5.5 Hydrogen Vent Systems		Confined Space Entry	Yes	-	-				
CGA S.1 Pressure Relief Device Standards		WHMIS	Yes	-	-				
S 1.1 Part 1 - Cylinders for Compressed Gases		Respiratory Protection Training	Yes	-	-				
S 1.2 Part 2 - Portable Containers for Compressed Gases		H2S Alive Training	Yes	-	-				
S 1.3 Part 3 – Stationary Storage Containers for Compressed Gases		Regulatory Awareness	Yes	-	-				
	Boilermaker	First Aid	Yes	-	-	Certificate of Qualification - Boilermaker (72103)	Yes	-	-
Piping System:		Confined Space Entry	Yes	-	-				
NFPA 2 Hydrogen Technologies Code		H2S Alive Training	Yes	-	-				
ASME B31.3 Process Piping		Respiratory Protection Training	Yes	-	-				
ASME B31.12 Hydrogen Piping and Pipelines		Regulatory Awareness	Yes	-	-				
ASME Boiler and Pressure Vessel Code	Carpenter	First Aid	Yes	-	-	Certificate of Qualification - Carpenter (72310)	Yes	-	-
HGV 4.10-2012 Standard for Fittings for Compressed Hydrogen Gas and Hydrogen Rich Gas Mixtures		Confined Space Entry	Yes	-	-				
CGA G-5.4-2012 Standard for Hydrogen Piping Systems at User Locations		WHMIS	Yes	-	-				
ASME Section IX: Qualification standard for welding, brazing, and fusing procedures.		H2S Alive Training	Yes	-	-				
ASME/ANSI B16: Flanges & Fittings, Valves.		Respiratory Protection Training	Yes	-	-				
API Standard 520: Sizing, Selection, and Installation of Pressure-relieving Devices.		Regulatory Awareness	Yes	-	-				

API Standard 526: Flanged Steel Pressure-relief Valves.	Concrete Finisher	First Aid	Yes	-	-	Certificate of Qualification - Concrete Finisher (73100)	Yes	-	-
		Confined Space Entry	Yes	-	-				
Oxygen:		WHMIS	Yes	-	-				
CGA G-4 Oxygen		Respiratory Protection Training	Yes	-	-				
CGA G-4.1 Clean Equipment for Oxygen Service		Regulatory Awareness	Yes	-	-				
CGA P-8.7 Safe Location of Oxygen and Inert Gas Vents	Gasfitter	First Aid	Yes	-	-	Certificate of Qualification - Gasfitter (Class A / Class B) (72302)	No	Yes	-
NFPA 53 Systems in Oxygen-Enriched Atmospheres		Confined Space Entry	Yes	-	-				
ASTM A967 Passivation of Stainless Steels		WHMIS	Yes	-	-				
ASTM G65 Standards Guide for Evaluating Nonmetallic Materials for Oxygen Service		H2S Alive Training	Yes	-	-				
ASTM G93 Standard Guide for Cleanliness Levels and Cleaning Methods for Materials and Equipment ASTM G94 Standard Guide for Evaluating Metals in Oxygen Service		Respiratory Protection Training	Yes	-	-				
ASTM G88 Designing Systems for Oxygen Service		Regulatory Awareness	Yes	-	-				
ASTM G127 Guide for the Selection of Cleaning Agents for Oxygen Service	Heavy Equipment Operator	First Aid	Yes	-	-	Provincial Trade - Heavy Equipment Operator	Yes	-	-
ASTM G131 Standard Practice for Cleaning of Materials and Components by Ultrasonic Techniques		Confined Space Entry	Yes	-	-				
OSHA 1910.104 Oxygen		WHMIS	Yes	-	-				
		Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Yes	-	-				
Hydrogen Quality Standards:		Respiratory Protection Training	Yes	-	-				
SAE J2719 Hydrogen Fuel Quality for Fuel Cell Vehicles		Regulatory Awareness	Yes	-	-				
ISO 14687 Hydrogen Fuel Quality - Product Specification	Industrial Mechanic (Millwright)	First Aid	Yes	-	-	Certificate of Qualification - Industrial Mechanic (Millwright) (72400)	Yes	-	-
CGA 5.3 Commodity Specification for Hydrogen		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
Gas Processing Units:		H2S Alive Training	Yes	-	-				
API Standard 618: Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services.		Respiratory Protection Training	Yes	-	-				
TEMA Standards: Shell & Tube Heat Exchanger Design.		Regulatory Awareness	Yes	-	-				
API Standard 662/ISO 15547-1: Plate Heat Exchangers for General Refinery Services.	Instrumentation and Control Technician	First Aid	Yes	-	-	Certificate of Qualification - Instrumentation and Control Technician (22312)	Yes	-	-
ASME B73: Horizontal End Suction Centrifugal Pumps.		Confined Space Entry	Yes	-	-				
API Standard 2000: Venting Atmospheric and Low-pressure Storage Tanks.		WHMIS	Yes	-	-				
ASME RTP-1–2021: Reinforced Thermoset Plastic Corrosion-Resistant Equipment.		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Facilities & Plant Design:		Regulatory Awareness	Yes	-	-				
ISO/TR 15916:2015 Report: Basic considerations for the safety of hydrogen systems.	Insulator	First Aid	Yes	-	-	Certificate of Qualification - Insulator (Heat and Frost) (72321)	Yes	-	-
OSHA Regulations: Hazardous Materials.		Confined Space Entry	Yes	-	-				
40 CFR Part 68: Chemical Accident Prevention Provisions.		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
Fire Protection & Explosive Atmospheres:		Respiratory Protection Training	Yes	-	-				
IEC 600791-10-1: Explosive atmospheres.		Regulatory Awareness	Yes	-	-				
NFPA 497: Classification of Flammable Liquids, Gases, or Vapors.	Lather (Interior Systems Mechanic)	First Aid	Yes	-	-	Certificate of Qualification - Lather (73102)	Yes	-	-
ISO 15848-2: Industrial valves — Measurement, test and qualification procedures for fugitive emissions.		Confined Space Entry	Yes	-	-				
NFPA 55: Compressed gases and Cryogenic Fluid.		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
Safety & Control Architecture:		Respiratory Protection Training	Yes	-	-				
IEC 61511: Functional safety instrumented systems for the process industry sector.		Regulatory Awareness	Yes	-	-				
IEC 61508: Functional safety of electrical/electronic programmable electronic safety-related systems.		First Aid	Yes	-	-	Certificate of Qualification - Metal Fabricator (Fitter) (72104)	Yes	-	-

ISO 12100: Safety of machinery — General principles for design — Risk assessment and risk reduction	Metal Fabricator (Fitter)	Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Sheet Metal Worker	First Aid	Yes	-	-	Certificate of Qualification - Sheet Metal Worker (72102)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Crane Operator	Power Line Hazards	Yes	-	-	Certificate of Qualification - Mobile Crane Operator (72500)	Yes	-	-
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Refrigeration and Air Conditioning Mechanic	First Aid	Yes	-	-	Certificate of Qualification - Refrigeration and Air Conditioning Mechanic (72402)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Sprinkler Fitter	First Aid	Yes	-	-	Certificate of Qualification - Sprinkler Fitter (72301)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Steamfitter/Pipefitter	First Aid	Yes	-	-	Certificate of Qualification - Steamfitter/Pipefitter (72301)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Welder	First Aid	Yes	-	-	Certificate of Qualification - Welder (72106)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Surveyor	First Aid	Yes	-	-	Bachelors Degree in Geomatics Engineering or Survey Engineering	No**	Yes	-
		Confined Space Entry	Yes	-	-	Or College Diploma in Survey Science or Geomatics Technology	Yes	-	-
		WHMIS	Yes	-	-	Completion of Professional Land Surveyor Examinations	Yes	-	-
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				

	Regulatory Awareness	Yes	-	-				
Scaffolder	First Aid	Yes	-	-	Scaffolding Course	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Transport Truck Driver	Transportation of Dangerous Goods	Yes	-	-	Secondary School	Yes	-	-
	Air Brake Endorsement	Yes	-	-	Driver Training Course	Yes	-	-
					Class 1 or D License and/or Class 1 or A License	Yes	-	-
					Air Brake Endorsement	Yes	-	-
Project Manager	Supervisor Health and Safety Training (WorkplaceNL)	Yes	-	-	PMP Certification	Yes	-	-
	First Aid	Yes	-	-	Prerequisite: Secondary Degree (High School Diploma, Associates Degree, Global Equivalent)	Yes	-	-
	Confined Space Entry	Yes	-	-	or Prerequisite: Four Year Degree (Bachelors Degree or Global Equivalent)	Yes	-	-
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
	Emergency Preparedness for Workers	No	Yes	-				
	OHS Committee, WHS Representative and Designate Training	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				

Operations:

Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
		Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Automation and Control Specialist	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Automation, Instrumentation & Controls or Electrical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Instrumentation or Automation Engineering)	Yes	-	-
	Hydrogen Production Process Training (SMR/ ATR)	No	USA (online)	-				
	Automated Process Systems and Control Systems Training (SMR/ATR)	No	Yes* (online)	-				
	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				
Electrical & Instrumentation Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Electrical and Instrumentation Engineering	No	Yes	-
	Hydrogen Safety Training	No	USA (online)	-				
	Training on Instrumentation and Electrical Equipment and Systems (SMR/ATR Production Plants)	No	Yes* (online)	-				
	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				

Facility Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Process Engineering or Mechanical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				
Measurement Specialist	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
	Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
	Hydrogen Gas Value Chain Training	No	Yes (online)	-				
	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				
Mechanical Engineer: Equipment & Piping / Reliability	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree - Mechanical Engineering	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen/Ammonia Properties)	No	Yes* (online)	-				
	Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen/Ammonia Properties)	No	Yes* (online)	No				
	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				
Process Control Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering or Electrical & Instrumentation Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				
	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering or Process Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				

	Process Engineer	Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Process Safety Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering or Process Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Hydrogen Control Skills Training (Hazard Risk Analysis and Reviews, Mechanical Integrity & Instrumented System Analysis and Operation Readiness Inspection)	No	Yes (online)	-				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Production Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering or Mechanical Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Control Room Operator	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Petrochemistry, Chemical Processes, Control Room Operator or Power Engineering Technology)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Lab Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Chemical Technology, Process Technology, Petroleum Technology or Laboratory Technician)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				

		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Maintenance Planner	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Electrician, Industrial Mechanic/Millwright or Instrumentation Technician)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Bachelors Degree (Electrical Engineering or Mechanical Engineering)	Yes	-	-
		Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen/Ammonia Properties)	No	Yes* (online)	-				
		Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen/Ammonia Properties)	No	Yes* (online)	No				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Maintenance Trade: Electrical Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Industrial Electrician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (SMR/ATR Hydrogen Production Plant)	No	Yes* (online)	-				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Maintenance Trade: Instrumentation Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Instrumentation Technician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Training on Instrumentation and Electrical Equipment and Systems (SMR/ATR Production Plants)	No	Yes* (online)	-				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Maintenance Trade: Mechanical Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Mechanic/Millwright)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Hydrogen Technician	Yes	-	-
		Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen/Ammonia Properties)	No	Yes* (online)	-				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				

		Ammonia Safety Training	No	Yes (online)	-				
	Plant Manager	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
		Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		Training on Maintenance of Equipment and Systems (SMR/ATR Hydrogen Production Plant)	No	Yes (online - USA)	-				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Plant Operator	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Technology Diploma (Petrochemistry, Chemical Process Engineering or Power Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Certificate of Qualification - Refrigeration Operator	No	Yes	-
		Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Heavy Duty Equipment Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Heavy Duty Equipment Technician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				

Ammonia Storage

Construction:

Applicable Standards	Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
			Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Newfoundland and Labrador Occupational Health and Safety Regulations	Industrial Electrician	Lockout/Tag out	Yes	-	-	Certificate of Qualification - Industrial Electrician (72201)	Yes	-	-
Canadian Hydrogen Installation Code - CAN/BNQ 1784-000/2022		First Aid	Yes	-	-				
American National Standard Safety Requirement for the Storage and Handling of Anhydrous Ammonia - ANSI K61/ CGA 2.1 - 2014		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
Enclosures Design:		Respiratory Protection Training	Yes	-	-				
NFPA 69 Standard on Explosion Prevention Systems		H2S Alive Training	Yes	-	-				

NFPA 70 National Electric Code (NEC)		Regulatory Awareness	Yes	-	-				
NFPA 496 Standard for Purged and Pressurized Enclosures	Plumber	First Aid	Yes	-	-	Certificate of Qualification - Plumber (72300)			
FPA 497 Recommended Practice of the Classification of Flammable Liquids, Gases, or Vapors		Confined Space Entry	Yes	-	-				
IEC 60079-10-1 Explosive Atmospheres – Part 10-1: Classification of Areas- Explosive Gas Atmosphere		Respiratory Protection Training	Yes	-	-				
IEEE Standard 463-2013: Electrical Safety Practices in Electrolytic Cell Line Working Zones.		H2S Alive Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
Vent system:	Ironworker	First Aid	Yes	-	-	Certificate of Qualification - Ironworker (72105)	Yes	-	-
NFPA 2 Hydrogen Technologies Code		Confined Space Entry	Yes	-	-				
CGA G-5.5 Hydrogen Vent Systems		WHMIS	Yes	-	-				
CGA S.1 Pressure Relief Device Standards		Respiratory Protection Training	Yes	-	-				
S 1.1 Part 1 - Cylinders for Compressed Gases		H2S Alive Training	Yes	-	-				
S 1.2 Part 2 - Portable Containers for Compressed Gases		Regulatory Awareness	Yes	-	-				
S 1.3 Part 3 – Stationary Storage Containers for Compressed Gases	Boilermaker	First Aid	Yes	-	-	Certificate of Qualification - Boilermaker (72103)	Yes	-	-
		Confined Space Entry	Yes	-	-				
Piping System:		H2S Alive Training	Yes	-	-				
NFPA 2 Hydrogen Technologies Code		Respiratory Protection Training	Yes	-	-				
ASME B31.3 Process Piping		Regulatory Awareness	Yes	-	-				
ASME B31.12 Hydrogen Piping and Pipelines	Carpenter	First Aid	Yes	-	-	Certificate of Qualification - Carpenter (72310)	Yes	-	-
ASME Boiler and Pressure Vessel Code		Confined Space Entry	Yes	-	-				
HGV 4.10-2012 Standard for Fittings for Compressed Hydrogen Gas and Hydrogen Rich Gas Mixtures		WHMIS	Yes	-	-				
CGA G-5.4-2012 Standard for Hydrogen Piping Systems at User Locations		H2S Alive Training	Yes	-	-				
ASME Section IX: Qualification standard for welding, brazing, and fusing procedures.		Respiratory Protection Training	Yes	-	-				
ASME/ANSI B16: Flanges & Fittings, Valves.		Regulatory Awareness	Yes	-	-				
API Standard 520: Sizing, Selection, and Installation of Pressure-relieving Devices.	Concrete Finisher	First Aid	Yes	-	-	Certificate of Qualification - Concrete Finisher (73100)	Yes	-	-
API Standard 526: Flanged Steel Pressure-relief Valves.		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
Oxygen:		Respiratory Protection Training	Yes	-	-				
CGA G-4 Oxygen		Regulatory Awareness	Yes	-	-				
CGA G-4.1 Clean Equipment for Oxygen Service	Gasfitter	First Aid	Yes	-	-	Certificate of Qualification - Gasfitter (Class A / Class B) (72302)	No	Yes	-
CGA P-8.7 Safe Location of Oxygen and Inert Gas Vents		Confined Space Entry	Yes	-	-				
NFPA 53 Systems in Oxygen-Enriched Atmospheres		WHMIS	Yes	-	-				
ASTM A967 Passivation of Stainless Steels		H2S Alive Training	Yes	-	-				
ASTM G65 Standards Guide for Evaluating Nonmetallic Materials for Oxygen Service		Respiratory Protection Training	Yes	-	-				
ASTM G93 Standard Guide for Cleanliness Levels and Cleaning Methods for Materials and Equipment ASTM G94 Standard Guide for Evaluating Metals in Oxygen Service		Regulatory Awareness	Yes	-	-				
ASTM G88 Designing Systems for Oxygen Service	Heavy Equipment Operator	First Aid	Yes	-	-	Provincial Trade - Heavy Equipment Operator	Yes	-	-
ASTM G127 Guide for the Selection of Cleaning Agents for Oxygen Service		Confined Space Entry	Yes	-	-				
ASTM G131 Standard Practice for Cleaning of Materials and Components by Ultrasonic Techniques		WHMIS	Yes	-	-				
OSHA 1910.104 Oxygen		Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Hydrogen Quality Standards:		Regulatory Awareness	Yes	-	-				
SAE J2719 Hydrogen Fuel Quality for Fuel Cell Vehicles	Industrial Mechanic (Millwright)	First Aid	Yes	-	-	Certificate of Qualification - Industrial Mechanic (Millwright) (72400)	Yes	-	-
ISO 14687 Hydrogen Fuel Quality - Product Specification		Confined Space Entry	Yes	-	-				
CGA 5.3 Commodity Specification for Hydrogen		WHMIS	Yes	-	-				

Gas Processing Units: API Standard 618: Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services. TEMA Standards: Shell & Tube Heat Exchanger Design. API Standard 662/ISO 15547-1: Plate Heat Exchangers for General Refinery Services. ASME B73: Horizontal End Suction Centrifugal Pumps. API Standard 2000: Venting Atmospheric and Low-pressure Storage Tanks. ASME RTP-1–2021: Reinforced Thermoset Plastic Corrosion-Resistant Equipment. Facilities & Plant Design: ISO/TR 15916:2015 Report: Basic considerations for the safety of hydrogen systems. OSHA Regulations: Hazardous Materials. 40 CFR Part 68: Chemical Accident Prevention Provisions. Fire Protection & Explosive Atmospheres: IEC 600791-10-1: Explosive atmospheres. NFPA 497: Classification of Flammable Liquids, Gases, or Vapors. ISO 15848-2: Industrial valves — Measurement, test and qualification procedures for fugitive emissions. NFPA 55: Compressed gases and Cryogenic Fluid. Safety & Control Architecture: IEC 61511: Functional safety instrumented systems for the process industry sector. IEC 61508: Functional safety of electrical/electronic programmable electronic safety-related systems. ISO 12100: Safety of machinery — General principles for design — Risk assessment and risk reduction	Industrial Mechanic (Millwright)	H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Instrumentation and Control Technician	First Aid	Yes	-	-	Certificate of Qualification - Instrumentation and Control Technician (22312)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Insulator	First Aid	Yes	-	-	Certificate of Qualification - Insulator (Heat and Frost) (72321)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Lather (Interior Systems Mechanic)	First Aid	Yes	-	-	Certificate of Qualification - Lather (73102)	**Yes**	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Metal Fabricator (Fitter)	First Aid	Yes	-	-	Certificate of Qualification - Metal Fabricator (Fitter) (72104)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Sheet Metal Worker	First Aid	Yes	-	-	Certificate of Qualification - Sheet Metal Worker (72102)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Crane Operator	Power Line Hazards	Yes	-	-	Certificate of Qualification - Mobile Crane Operator (72500)	Yes	-	-
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Refrigeration and Air Conditioning Mechanic	First Aid	Yes	-	-	Certificate of Qualification - Refrigeration and Air Conditioning Mechanic (72402)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				

Sprinkler Fitter	First Aid	Yes	-	-	Certificate of Qualification - Sprinkler Fitter (72301)	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Steamfitter/Pipefitter	First Aid	Yes	-	-	Certificate of Qualification - Steamfitter/Pipefitter (72301)	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Welder	First Aid	Yes	-	-	Certificate of Qualification - Welder (72106)	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Surveyor	First Aid	Yes	-	-	Bachelors Degree in Geomatics Engineering or Survey Engineering	No**	Yes	-
	Confined Space Entry	Yes	-	-	Or College Diploma in Survey Science or Geomatics Technology	Yes	-	-
	WHMIS	Yes	-	-	Completion of Professional Land Surveyor Examinations	Yes	-	-
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Scaffolder	First Aid	Yes	-	-	Scaffolding Course	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Transport Truck Driver	Transportation of Dangerous Goods	Yes	-	-	Secondary School	Yes	-	-
	Air Brake Endorsement	Yes	-	-	Driver Training Course	Yes	-	-
					Class 1 or D License and/or Class 1 or A License	Yes	-	-
					Air Brake Endorsement	Yes	-	-
Project Manager	Supervisor Health and Safety Training (WorkplaceNL)	Yes	-	-	PMP Certification	Yes	-	-
	First Aid	Yes	-	-	Prerequisite: Secondary Degree (High School Diploma, Associates Degree, Global Equivalent)	Yes	-	-
	Confined Space Entry	Yes	-	-	or Prerequisite: Four Year Degree (Bachelors Degree or Global Equivalent)	Yes	-	-
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
	Emergency Preparedness for Workers	No	Yes	-				
	OHS Committee, WHS Representative and Designate Training	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
Operations:								

Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
		Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Automation and Control Specialist	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Automation, Instrumentation & Controls or Electrical Engineering)	Yes	-	-
	H2S Alive Training	Yes	-	-	Or Technology Diploma (Instrumentation or Automation Engineering)	Yes	-	-
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				
	Automated Process Systems and Control Systems Training (Ammonia Storage)	No	Yes* (online)	-				
Electrical & Instrumentation Engineer	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Electrical and Instrumentation Engineering	No	Yes	-
	Ammonia Safety Training	No	Yes (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on Instrumentation and Electrical Equipment and Systems (Ammonia Storage)	No	Yes* (online)	-				
Facility Engineer	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Process Engineering or Mechanical Engineering)	Yes	-	-
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Safety Training	No	Yes (online)	-				
Measurement Specialist	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
	Ammonia Safety Training	No	Yes (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Ammonia Gas Value Chain Training	No	No	Yes (Virtual)				
Mechanical Engineer: Equipment & Piping / Reliability	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree - Mechanical Engineering	Yes	-	-
	Ammonia Safety Training	No	Yes (online)	-				
	Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Ammonia Properties)	No	Yes* (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Ammonia Properties)	No	Yes* (online)	No				
	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Petrochemistry, Chemical Processes, Control Room Operator or Power Engineering Technology)	Yes	-	-

	Control Room Operator	H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Lab Technician	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Chemical Technology, Process Technology, Petroleum Technology or Laboratory Technician)	Yes	-	-
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				
	Maintenance Planner	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Electrician, Industrial Mechanic/Millwright or Instrumentation Technician)	Yes	-	-
		Ammonia Safety Training	No	Yes (online)	-	Or Bachelors Degree (Electrical Engineering or Mechanical Engineering)	Yes	-	-
		Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Ammonia Properties)	No	Yes* (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Ammonia Properties)	No	Yes* (online)	-				
	Maintenance Trade: Electrical Technician	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Industrial Electrician	Yes	-	-
		Ammonia Safety Training	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (Ammonia Storage)	No	Yes* (online)	-				
	Maintenance Trade: Instrumentation Technician	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Instrumentation Technician	Yes	-	-
		Ammonia Safety Training	No	Yes (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Instrumentation and Electrical Equipment and Systems (Ammonia Storage)	No	Yes* (online)	-				
	Maintenance Trade: Mechanical	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Mechanic/Millwright)	Yes	-	-
		Ammonia Safety Training	No	Yes (online)	-	Or Hydrogen Technician	Yes	-	-
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				

		Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Ammonia Properties)	No	Yes* (online)	-				
	Plant Manager	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
		Ammonia Safety Training	No	Yes (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Maintenance of Equipment and Systems (Ammonia Storage)	No	Yes (online - USA)	-				
	Plant Operator	General Ammonia Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Technology Diploma (Petrochemistry, Chemical Process Engineering or Power Engineering)	Yes	-	-
		H2S Alive Training	Yes	-	-	Or Certificate of Qualification - Refrigeration Operator	No	Yes	-
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Ammonia Safety Training	No	Yes (online)	-				

Pure Hydrogen Storage

Construction:

Applicable Standards	Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
			Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Newfoundland and Labrador Occupational Health and Safety Regulations	Industrial Electrician	Lockout/Tag out	Yes	-	-	Certificate of Qualification - Industrial Electrician (72201)	Yes	-	-
Canadian Hydrogen Installation Code - CAN/BNQ 1784-000/2022		First Aid	Yes	-	-				
Clean Electricity Regulations (CER)		Confined Space Entry	Yes	-	-				
CSA B107 Enclosed Hydrogen Equipment - Safety		WHMIS	Yes	-	-				
Safe Handling Of Cryogenic Liquid - CGA P-12-2022		Respiratory Protection Training	Yes	-	-				
OHSA Process safety management and EPA risk management plan guidance document for bulk liquid hydrogen supply systems - CGA P-28-2023		H2S Alive Training	Yes	-	-				
Standard for Bulk Hydrogen Supply Systems (an American National Standard) - CGA H-5-2020		Regulatory Awareness	Yes	-	-				
Hydrogen Technologies Code - NFPA 2	Plumber	First Aid	Yes	-	-	Certificate of Qualification - Plumber (72300)			
Hydrogen Storage and Transport Beyond Pipelines: Regulations and Standardization (CSA Group Research Report)		Confined Space Entry	Yes	-	-				
CSA/ANSI FC 5 - Hydrogen Generators Using Fuel Processing Technologies - Part 1: Safety		Respiratory Protection Training	Yes	-	-				
CSA Z741 - Geological Storage of Carbon Dioxide		WHMIS	Yes	-	-				
CSA TS-226 - Geological Storage of Carbon Dioxide - Measurement, Monitoring and Verification Plans		H2S Alive Training	Yes	-	-				
CSA/ANSI R124/BNQ 1789-200 - A Harmonized Methodology for Reporting the Production Pathway and Carbon Intensity of Hydrogen (in progress)		Regulatory Awareness	Yes	-	-				
Advanced Classification of Hydrogen: Life Cycle Assessment and Beyond (CSA Group Research Report)	Ironworker	First Aid	Yes	-	-	Certificate of Qualification - Ironworker (72105)	Yes	-	-
Carbon Capture and Geological Storage Technologies in Hydrogen Production (CSA Group Research Report)		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				

Storage systems/enclosure design:		H2S Alive Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
Cryogenic Hydrogen Storage - CGA H-3-2019	Boilermaker	First Aid	Yes	-	-	Certificate of Qualification - Boilermaker (72103)	Yes	-	-
Locating bulk liquid storage systems in courts - CGA P-41-2023		Confined Space Entry	Yes	-	-				
Highway tanks and TC portable tanks for the transportation of dangerous goods - CSA B620:20		H2S Alive Training	Yes	-	-				
Selection and use of highway tanks and TC portable tanks for the transportation of dangerous goods, Class 2 - CSA B622:20		Respiratory Protection Training	Yes	-	-				
Portable tanks for the transport of dangerous goods - CSA B625:20		Regulatory Awareness	Yes	-	-				
Safety in Storage, Handling and Distribution of Liquid Hydrogen (Revision of Doc 6/02) - EIGA Doc 6/19	Carpenter	First Aid	Yes	-	-	Certificate of Qualification - Carpenter (72310)	Yes	-	-
Standard for Design Requirements for Tube Trailers and Tube Modules (Formerly TB-25) - CGA C-29:2019		Confined Space Entry	Yes	-	-				
Propane storage and handling code - CSA B149.2:20		WHMIS	Yes	-	-				
Storage, handling, and dispensing of aviation fuels at aerodromes - CSA B836:22		H2S Alive Training	Yes	-	-				
Collapsible fabric storage tanks (bladders) - CSA B837:14 (R2019)		Respiratory Protection Training	Yes	-	-				
Compressed Hydrogen Powered Industrial Trucks On-Board Fuel Storage and Handling Components - CSA HPIT 1:15 (R2020		Regulatory Awareness	Yes	-	-				
Quantitative Risk Assessment of Underground Storage of Hydrogen - CSA W228	Concrete Finisher	First Aid	Yes	-	-	Certificate of Qualification - Concrete Finisher (73100)	Yes	-	-
Storage of Hydrocarbon in Underground Formations - CSA Z341 SERIES:22		Confined Space Entry	Yes	-	-				
Compressed Hydrogen Gas Vehicle Fuel Containers - CSA/ANSI HGV 2:23		WHMIS	Yes	-	-				
Thermal Activated Pressure Relief Devices for Compressed Hydrogen Vehicle Fuel Containers - CSA/ANSI HPRD 1:21		Respiratory Protection Training	Yes	-	-				
ISO 11114-1 Gas Cylinders - Compatibility of cylinder and valve materials with gas contents Part 1: Metallic materials		Regulatory Awareness	Yes	-	-				
ISO 11114-2 Gas Cylinders - Compatibility of cylinder and valve materials with gas contents Part 2: Non-Metallic materials	Gasfitter	First Aid	Yes	-	-	Certificate of Qualification - Gasfitter (Class A / Class B) (72302)	No	Yes	-
ISO 11114-4 Gas Cylinders - Compatibility of cylinder and valve materials with gas contents Part 4: Test methods for selecting metallic materials resistant to hydrogen embrittlement		Confined Space Entry	Yes	-	-				
Standard for Cylinder Connections on Portable Cryogenic Liquid Cylinders - CGA V-23-2020		WHMIS	Yes	-	-				
Cylinders, spheres, and tubes for the transportation of dangerous goods - CSA B339-18 (R2023)		H2S Alive Training	Yes	-	-				
Selection and use of cylinders, spheres, tubes, and other containers for the transportation of dangerous goods, Class 2 - CSA B340-18 (R2023)		Respiratory Protection Training	Yes	-	-				
Boiler, pressure vessel and pressure piping code - CSA B51:19		Regulatory Awareness	Yes	-	-				
ASME BPVC Section VIII, Division 1 Rules for Construction of Pressure Vessels Division 1	Heavy Equipment Operator	First Aid	Yes	-	-	Provincial Trade - Heavy Equipment Operator	Yes	-	-
ASME BPVC Section VIII, Division 2 Rules for Construction of Pressure Vessels Division 2, Alternate Rules		Confined Space Entry	Yes	-	-				
ASME BPVC Section VIII, Division 3 Rules for Construction of Pressure Vessels Division 3, Alternate Rules High Pressure Vessels Article KD-10 Special Requirements for Vessels in		WHMIS	Yes	-	-				
ASME Code Case 2390 Composite Reinforced Pressure Vessels		Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Yes	-	-				
ASME BPVC-Section X Fiber-Reinforced Plastic Pressure Vessels		Respiratory Protection Training	Yes	-	-				
CGA S-1.3 Pressure Relief Device Standards-Part 3- Stationary Storage Containers for Compressed Gases		Regulatory Awareness	Yes	-	-				
CGA PS-46 Position Statement - Roofs Over Hydrogen Storage Systems	Industrial Mechanic (Millwright)	First Aid	Yes	-	-	Certificate of Qualification - Industrial Mechanic (Millwright) (72400)	Yes	-	-
		Confined Space Entry	Yes	-	-				
Piping/Fittings:		WHMIS	Yes	-	-				
Standard for fittings for compressed hydrogen gas and hydrogen rich gas mixtures - CSA/ANSI HGV 4.10-2021		H2S Alive Training	Yes	-	-				
Hydrogen Piping and Pipelines - ASME B31.12 - 2023		Respiratory Protection Training	Yes	-	-				
Process Piping - ASME B31.3-2022		Regulatory Awareness	Yes	-	-				
Gas Transmission and Distribution Piping Systems - ASME B31.8-2022		First Aid	Yes	-	-	Certificate of Qualification - Instrumentation and Control Technician (22312)	Yes	-	-

Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections - CGA V-1-2023	Instrumentation and Control Technician	Confined Space Entry	Yes	-	-				
Compressed Gas Association Standard For Compressed gas Cylinder Valves - CGA V-9-2024		WHMIS	Yes	-	-				
ASME STP-PT-006 Design Guidelines for Hydrogen Piping and Pipelines		H2S Alive Training	Yes	-	-				
Oil and gas pipeline systems - CSA Z662:23		Respiratory Protection Training	Yes	-	-				
CGA G-5.4 Standard for Hydrogen Piping Systems at User Locations		Regulatory Awareness	Yes	-	-				
CGA G-5.6 Hydrogen Pipeline Systems	Insulator	First Aid	Yes	-	-	Certificate of Qualification - Insulator (Heat and Frost) (72321)	Yes	-	-
ASME B31.8S Managing System Integrity of Gas Pipelines		Confined Space Entry	Yes	-	-				
NFPA 855 Standard for the Installation of Stationary Energy Storage Systems		WHMIS	Yes	-	-				
ASME B31.1 Power Piping		H2S Alive Training	Yes	-	-				
ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids		Respiratory Protection Training	Yes	-	-				
ASME B31.8 Gas Transmission and Distribution Piping Systems		Regulatory Awareness	Yes	-	-				
	Lather (Interior Systems Mechanic)	First Aid	Yes	-	-	Certificate of Qualification - Lather (73102)	Yes	-	-
Materials:		Confined Space Entry	Yes	-	-				
Test methods for evaluating material compatibility in compressed hydrogen applications - Metals - ANSI/CSA CHMC 1-2014 (R2023)		WHMIS	Yes	-	-				
Test methods for evaluating material compatibility in compressed hydrogen applications - Polymers - CSA/ANSI CHMC 2:19		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Venting:		Regulatory Awareness	Yes	-	-				
CGA G-5.5 Standard for Hydrogen Vent Systems	Metal Fabricator (Fitter)	First Aid	Yes	-	-	Certificate of Qualification - Metal Fabricator (Fitter) (72104)	Yes	-	-
CGA H-12 Mechanical Integrity of Syngas Outlet Systems		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
Transport:		H2S Alive Training	Yes	-	-				
Pressure receptacles and multiple-element gas containers for the transport of dangerous goods - CSA B341-18 (R2023)		Respiratory Protection Training	Yes	-	-				
Dispensing systems and components for fueling hydrogen powered industrial trucks - CSA HPIT 2:17 (R2021)		Regulatory Awareness	Yes	-	-				
Best practices for defueling, decommissioning, and disposal of compressed hydrogen gas vehicle fuel containers. - CSA SPE-2.1.3:20	Sheet Metal Worker	First Aid	Yes	-	-	Certificate of Qualification - Sheet Metal Worker (72102)	Yes	-	-
HGV Series for H2 fueling stations and vehicle components - CSA/+G81:G767ANSI HGV 4.1 to 4.10		Confined Space Entry	Yes	-	-				
Fuel system Components for Compressed Hydrogen Gas Powered Vehicles - CSA/ANSI HGV 3.1:22		WHMIS	Yes	-	-				
Compact Hydrogen Fueling Systems - CSA/ANSI HGV 5.2 Hydraulic machines – Francis turbine pressure fluctuation transposition -		H2S Alive Training	Yes	-	-				
IEC TS 62882:2020		Respiratory Protection Training	Yes	-	-				
ASME BPVC-Section XII Transportation Tanks		Regulatory Awareness	Yes	-	-				
ISO 16111 Transportable Gas Storage Devices - Hydrogen Absorbed in Reversible Metal Hydrides	Crane Operator	Power Line Hazards	Yes	-	-	Certificate of Qualification - Mobile Crane Operator (72500)	Yes	-	-
		First Aid	Yes	-	-				
Testing:		WHMIS	Yes	-	-				
ASTM F326-23 Standard Test Method for Electronic Measurement For Hydrogen Embrittlement from Cadmium - Electroplating Processes		Regulatory Awareness	Yes	-	-				
ASTM F519-23 Standard Test Method for Mechanical Hydrogen Embrittlement Evaluation of Plating/Coating Processes and Service Environments	Refrigeration and Air Conditioning Mechanic	First Aid	Yes	-	-	Certificate of Qualification - Refrigeration and Air Conditioning Mechanic (72402)	Yes	-	-
ASTM F1113-87 (2017) Standard Test Method for Electrochemical Measurement of Diffusible Hydrogen in Steel		Confined Space Entry	Yes	-	-				
ASTM F1459-06 (2017) Standard Test Method for Determination of the Susceptibility of Metallic Materials to Hydrogen Gas Embrittlement		WHMIS	Yes	-	-				
ASTM F1624-12 (2018) Standard Test Method for Measurement of Hydrogen Embrittlement Threshold in Steel by the Incremental Step Loading Technique		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
Hydrogen Generators:		Regulatory Awareness	Yes	-	-				
UL Subject 2264 B Hydrogen Generators Using Water Reaction	Sprinkler Fitter	First Aid	Yes	-	-	Certificate of Qualification - Sprinkler Fitter (72301)	Yes	-	-
UL Subject 2264 D Portable Water Electrolysis Type Hydrogen Generators		Confined Space Entry	Yes	-	-				
UL Subject 2264 Water Electrolysis Type Hydrogen Generators		WHMIS	Yes	-	-				
ISO 16110-1 Hydrogen Generators Using Fuel Processing Technologies - Safety		H2S Alive Training	Yes	-	-				

ISO 16110-2 Hydrogen Generators Using Fuel Processing Technologies - Test Method for Performance
CSA/ANSI B22734:23 Hydrogen generators using water electrolysis — Industrial, commercial, and residential applications
CSA FC5 Hydrogen Generators Using Fuel Processing Technologies – Part 1: Safety
CSA FC4 / CSA C22.2 No. 22734 Hydrogen Generators using Water Electrolysis - Industrial, Commercial and Residential Applications
Code for the field approval of fuel-burning appliances and equipment - CSA B149.3:20
Portable engine fueling system for marine use - CSA B306:23
Well design for petroleum and natural gas industry systems - CSA Z625:16 (R2021)
NFPA 55 - Compressed Gases and Cryogenic Fluids Code
CGA H-13 Hydrogen Pressure Swing Adsorber (PSA) Mechanical Integrity Requirements
CGA H-17 Guideline for Small Scale Hydrogen Production
CGA G-5.3 Commodity Specification for Hydrogen
CGA P-96 Reciprocating Cryogenic Pumps and Pump Installations for Hydrogen and Liquefied Natural Gas
CGA P-37 Good Environmental Management Practices for the Compressed Gas Industry
ANSI/ISA-60078-29-1 (12.13.01) - 2003 Explosive Atmospheres Part 29-1: Gas detectors - Performance requirements of detectors for flammable Gases
ASTM F2078-22 Standard Terminology Relating to Hydrogen Embrittlement Testing
CGA PS-48 CGA Position Statement On Clarification Of Existing Hydrogen Setback Distances And Development Of New Hydrogen Setback Distances In NFPA 55
ISO/TS 19883 Pressure swing adsorption system for hydrogen separation and purification
IGF International Code of Safety for Ships Using Gases or Other Low-flashpoint Fuels: Part E

	Respiratory Protection Training	Yes	-	-					
	Regulatory Awareness	Yes	-	-					
Steamfitter/Pipefitter	First Aid	Yes	-	-	Certificate of Qualification - Steamfitter/Pipefitter (72301)	Yes	-	-
	Confined Space Entry	Yes	-	-					
	WHMIS	Yes	-	-					
	H2S Alive Training	Yes	-	-					
	Respiratory Protection Training	Yes	-	-					
	Regulatory Awareness	Yes	-	-					
Welder	First Aid	Yes	-	-	Certificate of Qualification - Welder (72106)	Yes	-	-
	Confined Space Entry	Yes	-	-					
	WHMIS	Yes	-	-					
	H2S Alive Training	Yes	-	-					
	Respiratory Protection Training	Yes	-	-					
	Regulatory Awareness	Yes	-	-					
Surveyor	First Aid	Yes	-	-	Bachelors Degree in Geomatics Engineering or Survey Engineering	No**	Yes	-
	Confined Space Entry	Yes	-	-	Or College Diploma in Survey Science or Geomatics Technology	Yes	-	-
	WHMIS	Yes	-	-	Completion of Professional Land Surveyor Examinations	Yes	-	-
	H2S Alive Training	Yes	-	-					
	Respiratory Protection Training	Yes	-	-					
	Regulatory Awareness	Yes	-	-					
Transport Truck Driver	Transportation of Dangerous Goods	Yes	-	-	Secondary School	Yes	-	-
	Air Brake Endorsement	Yes	-	-	Driver Training Course	Yes	-	-
					Class 1 or D License and/or Class 1 or A License	Yes	-	-
					Air Brake Endorsement	Yes	-	-
Scaffolder	First Aid	Yes	-	-	Scaffolding Course	Yes	-	-
	Confined Space Entry	Yes	-	-					
	WHMIS	Yes	-	-					
	H2S Alive Training	Yes	-	-					
	Respiratory Protection Training	Yes	-	-					
	Regulatory Awareness	Yes	-	-					
Project Manager	Supervisor Health and Safety Training (WorkplaceNL)	Yes	-	-	PMP Qualification	Yes	-	-
	First Aid	Yes	-	-	Prerequisite: Secondary Degree (High School Diploma, Associates Degree, Global Equivalent)	Yes	-	-
	Confined Space Entry	Yes	-	-	or Prerequisite: Four Year Degree (Bachelors Degree or Global Equivalent)	Yes	-	-
	WHMIS	Yes	-	-					
	Regulatory Awareness	Yes	-	-					
	Emergency Preparedness for Workers	No	Yes	-					
	OHS Committee, WHS Representative and Designate Training	Yes	-	-					
	H2S Alive Training	Yes	-	-					
	Respiratory Protection Training	Yes	-	-					

Operations:

Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
		Newfoundland	Canada	Europe		Newfoundland	Canada	Europe

Hydrogen Technician	Regulatory Awareness	Yes	-	-	Certificate of Qualification - Hydrogen Technician	Yes	-	-
	4th Class Power Engineering	Yes	-	-				
	Confined Space Entry	Yes	-	-				
	Fall Protection	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
Automation and Control Specialist	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Automation, Instrumentation & Controls or Electrical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Instrumentation or Automation Engineering)	Yes	-	-
	Hydrogen Production Process Training	No	No	Yes (online)				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Automated Process Systems and Control Systems Training (Hydrogen Storage)	No	Yes* (online)	-				
Electrical & Instrumentation Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Electrical and Instrumentation Engineering	No	Yes	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Training on Instrumentation and Electrical Equipment and Systems (Hydrogen Storage)	No	Yes* (online)	-				
Facility Engineer	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Process Engineering or Mechanical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Hydrogen Production Process Training	No	No	Yes (online)				
Measurement Specialist	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Hydrogen Gas Value Chain Training	No	Yes (online)	-				
Mechanical Engineer: Equipment & Piping / Reliability	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree - Mechanical Engineering	Yes	-	-
	Hydrogen Safety Training	No	USA (online)	-				
	Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen Properties)	No	Yes* (online)	-				
	H2S Alive Training	Yes	-	-				
	First Aid	Yes	-	-				

		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen Properties)	No	Yes* (online)	No				
	Control Room Operator	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Petrochemistry, Chemical Processes, Control Room Operator or Power Engineering Technology)	Yes	-	-
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Hydrogen Safety Training	No	USA (online)	-				
	Lab Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Diploma (Chemical Technology, Process Technology, Petroleum Technology or Laboratory Technician)	Yes	-	-
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Hydrogen Safety Training	No	USA (online)	-				
	Maintenance Planner	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Electrician, Industrial Mechanic/Millwright or Instrumentation Technician)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Bachelors Degree (Electrical Engineering or Mechanical Engineering)	Yes	-	-
		Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen Properties)	No	Yes* (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen Properties)	No	Yes* (online)	No				
	Maintenance Trade: Electrical Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Industrial Electrician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (Hydrogen Storage)	No	Yes* (online)	-				
	Maintenance Trade: Instrumentation Technician	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification - Instrumentation Technician	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Instrumentation and Electrical Equipment and Systems (Hydrogen Storage)	No	Yes* (online)	-				
		General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Certificate of Qualification (Industrial Mechanic/Millwright)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Hydrogen Technician	Yes	-	-

	Maintenance Trade: Mechanical	H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Selection, Design and Maintenance of Air Separation Units, Vessels, Piping Systems and Fitting Valves & Seals (Withstand Hydrogen Properties)	No	Yes* (online)	-				
	Plant Manager	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Bachelors Degree (Chemical Engineering, Electrical & Instrumentation Engineering or Mechanical Engineering)	Yes	-	-
		Hydrogen Safety Training	No	USA (online)	-	Or Technology Diploma (Chemical Engineering, Electrical Engineering, Instrumentation or Mechanical Engineering)	Yes	-	-
		Hydrogen Production Process Training (SMR/ ATR)	No	No	Yes (online)				
		H2S Alive Training	Yes	-	-				
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Training on Maintenance of Equipment and Systems (Hydrogen Storage)	No	Yes (online - USA)	-				
	Plant Operator	General Hydrogen Training (Properties, Behaviour and Potential Hazards)	No	Yes (online)	-	Technology Diploma (Petrochemistry, Chemical Process Engineering or Power Engineering)	Yes	-	-
		H2S Alive Training	Yes	-	-	Or Certificate of Qualification - Refrigeration Operator	No	Yes	-
		First Aid	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Hydrogen Safety Training	No	USA (online)	-				

Marine Transportation Ammonia / Hydrogen

Construction:

Applicable Standards:	Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
			Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Newfoundland and Labrador Occupational Health and Safety Regulations	Industrial Electrician	Lockout/Tag out	Yes	-	-	Certificate of Qualification - Industrial Electrician (72201)	Yes	-	-
Transportation of Dangerous Goods Regulations - SOR/2001-286		First Aid	Yes	-	-				
Cylinders, spheres, and tubes for the transportation of dangerous goods - CSA B339-18 (R2023)		Confined Space Entry	Yes	-	-				
Selection and use of cylinders, spheres, tubes, and other containers for the transportation of dangerous goods, Class 2 - CSA B340-18 (R2023)		WHMIS	Yes	-	-				
Hydrogen Storage and Transport Beyond Pipelines: Regulations and Standardization (CSA Group, December 2023)		Respiratory Protection Training	Yes	-	-				
International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code		H2S Alive Training	Yes	-	-				
Canada Shipping Act, 2001 - Marine Personnel Regulations		Regulatory Awareness	Yes	-	-				
Suite of CSA Standards for Transportation of Dangerous Goods	Ironworker	First Aid	Yes	-	-	Certificate of Qualification - Ironworker (72105)	Yes	-	-
Hydrogen Storage and Transportation Beyond Pipeline: Regulations and Standardization (CSA Group Research)		Confined Space Entry	Yes	-	-				
Hydrogen and Compressed Natural Gas (CNG) Standards - Comparison of Pressure Terminology and Validation Pressure Test Levels (CSA Group Research Report)		WHMIS	Yes	-	-				
ANSI/CSA CHMC 1 - Test Methods for Evaluation Material Compatibility in Compressed Hydrogen Applications - Metals		Respiratory Protection Training	Yes	-	-				
ANSI/CSA CHMC 2 - Test Methods for Evaluation Material Compatibility in Compressed Hydrogen Applications - Polymers		H2S Alive Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
		First Aid	Yes	-	-	Certificate of Qualification - Carpenter (72310)	Yes	-	-
		Confined Space Entry	Yes	-	-				

	Carpenter	WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Concrete Finisher	First Aid	Yes	-	-	Certificate of Qualification - Concrete Finisher (73100)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Gasfitter	First Aid	Yes	-	-	Certificate of Qualification - Gasfitter (Class A / Class B) (72302)	No	Yes	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Heavy Equipment Operator	First Aid	Yes	-	-	Provincial Trade - Heavy Equipment Operator	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Industrial Mechanic (Millwright)	First Aid	Yes	-	-	Certificate of Qualification - Industrial Mechanic (Millwright) (72400)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Insulator	First Aid	Yes	-	-	Certificate of Qualification - Insulator (Heat and Frost) (72321)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Metal Fabricator (Fitter)	First Aid	Yes	-	-	Certificate of Qualification - Metal Fabricator (Fitter) (72104)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				
	Sheet Metal Worker	First Aid	Yes	-	-	Certificate of Qualification - Sheet Metal Worker (72102)	Yes	-	-
		Confined Space Entry	Yes	-	-				
		WHMIS	Yes	-	-				
		H2S Alive Training	Yes	-	-				
		Respiratory Protection Training	Yes	-	-				
		Regulatory Awareness	Yes	-	-				

Crane Operator	Power Line Hazards	Yes	-	-	Certificate of Qualification - Mobile Crane Operator (72500)	Yes	-	-
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Sprinkler Fitter	First Aid	Yes	-	-	Certificate of Qualification - Sprinkler Fitter (72301)	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Steamfitter/Pipefitter	First Aid	Yes	-	-	Certificate of Qualification - Steamfitter/Pipefitter (72301)	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Welder	First Aid	Yes	-	-	Certificate of Qualification - Welder (72106)	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Surveyor	First Aid	Yes	-	-	Bachelors Degree in Geomatics Engineering or Survey Engineering	No**	Yes	-
	Confined Space Entry	Yes	-	-	Or College Diploma in Survey Science or Geomatics Technology	Yes	-	-
	WHMIS	Yes	-	-	Completion of Professional Land Surveyor Examinations	Yes	-	-
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Scaffolder	First Aid	Yes	-	-	Scaffolding Course	Yes	-	-
	Confined Space Entry	Yes	-	-				
	WHMIS	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
Project Manager	Supervisor Health and Safety Training (WorkplaceNL)	Yes	-	-	PMP Certification	Yes	-	-
	First Aid	Yes	-	-	Prerequisite: Secondary Degree (High School Diploma, Associates Degree, Global Equivalent)	Yes	-	-
	Confined Space Entry	Yes	-	-	or Prerequisite: Four Year Degree (Bachelors Degree or Global Equivalent)	Yes	-	-
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
	Emergency Preparedness for Workers	No	Yes	-				
	OHS Committee, WHS Representative and Designate Training	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
Operations:								

Required Positions:	Training Requirements:	Training/Upskilling Availability			Qualification Requirements:	Education/Training Availability		
		Newfoundland	Canada	Europe		Newfoundland	Canada	Europe
Shore Side Workers	Training in handling hazardous materials (Hydrogen & Ammonia)	No	Yes (Online)	-	Secondary School	Yes	-	-
	Training in monitoring and controlling the transfer of hydrogen and ammonia	No	No	Yes (Online)				
	First Aid	Yes	-	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	Cryogenic Systems Training	No	Yes (Online)	-				
Seafarers on Marine Vessels	Training in handling hazardous materials (Hydrogen & Ammonia)	No	Yes (Online)	-	Training Appropriate for each Marine Crew Role (Likely non-Canadian vessel & existing crew)	-	-	-
	Training on the operation of specialized equipment for the storage and transfer of hydrogen and ammonia	No	Yes (Online)	-				
	Firefighting and Emergency Response Training	Yes	-	-				
	Cryogenic Systems Training	No	Yes (Online)	-				
	Transfer Procedures Training	No	Yes	-				
	Leak Detection and Response Training	No	USA (Online)	-				
	Environmental Impact Mitigation Training	No	Yes (Online)	-				
	WHMIS	Yes	-	-				
	Regulatory Awareness	Yes	-	-				
	H2S Alive Training	Yes	-	-				
	Respiratory Protection Training	Yes	-	-				
	First Aid	Yes	-	-				
	STCW Basic Safety	Yes	-	-				

APPENDIX B
Upskilling/Training Availability

Training:	Training Centre:	Location:
4th Class Power Engineering	College of the North Atlantic	Newfoundland and Labrador
Ammonia Gas Value Chain Training	DNV - Training course Role of ammonia in a hydrogen economy	Norway (Online)
Ammonia Safety Training	SafetyCanada - Ammonia Awareness	Canada (Online)
	CDN Safety Training - Ammonia Awareness	Canada (Online)
Automated Process Systems & Control Systems Training (Electrolyzers / SMR/ATR / Ammonia Storage / Hydrogen Storage)	EPIC Training - Industrial Automation: Instrumentation and Control Systems	Canada (Virtual)
Blade Repair Training	Global Wind Organization	China / North America
	Relay	Canada
	Blade Care Academy (Berlin)	Germany
	Advanced Blade Repair Services (UK)	United Kingdom
Confined Space Entry	SafetyNL	Newfoundland and Labrador
Emergency Preparedness for Workers	Canadian Centre for Occupational Health and Safety	Canada - Online
Environmental Impact Mitigation Training	EPIC - Environmental Impact Assessment	Canada (Online)
Fall Protection	Safety NL	Newfoundland and Labrador
Firefighting and Emergency Response Training	Marine Institute - Safety and Emergency Response Training Fire Prevention and Fire Fighting - STCW - RelyOn Nutec	Newfoundland and Labrador
First Aid	Puglisevich	Newfoundland and Labrador
General Ammonia Training (Properties, Behaviour and Potential Hazards)	BakerRisk - Ammonia Production and Storage Safety Training	Texas (Virtual)
	OSG - Anhydrous Ammonia Awareness Training	Canada (Online)
H2S Alive Training	Puglisevich	Newfoundland and Labrador
High Power Electrical Equipment Training (Electrolyzer)	Canada Training Group - Advanced Electrical System Testing and Maintenance - includes Medium Voltage	Canada
	Canada Training Group - CSA Z463 Maintenance of Electrical Systems	Canada
Hydrogen Control Skills Training (Hazard Risk Analysis and Reviews, Mechanical Integrity & Instrumented System Analysis and Operation Readiness Inspection)	WHA International Inc - H2 Analyze - Hydrogen Safety Training: Expert Application	United States (Online)
Hydrogen Gas Value Chain Training	GeoLogica - Hydrogen Technology: Value Chain and Projects (E572)	North America / United Kingdom (Online)
	IFP Training - Hydrogen Chain Outlook	United Kingdom
Hydrogen Production Process Training (SMR/ ATR)	World Hydrogen Leaders - Blue Hydrogen, Ammonia and Methanol	United Kingdom (Online)
	PetroSkills - Hydrogen Production	United States (Online)
Hydrogen Stafety Training	BakerRisk - Hydrogen Safety Training	United States (Virtual)
Leak Detection and Response Training	PetroSkills - Leak Detection and Repair	United States (Online)
Lockout/Tag out	Puglisevich	Newfoundland and Labrador
Mobile Elevating Work Platform (MEWP) / Arielwork Platform (AWP)	Safety NL	Newfoundland and Labrador
OHS Committee, WHS Representative and Designate Training	Safety NL	Newfoundland and Labrador
Operational Training - Cryogenic Systems	University of Waterloo - Cryogenic and Compressed Gas Safety (SO1030)	Canada (Online)
Operational Training - Transfer Procedures	Transport Canada - Supervision of a Chemical Transfer Operation Course	Canada
Power Line Hazards	Puglisevich	Newfoundland and Labrador
Regulatory Awareness	Puglisevich	Newfoundland and Labrador
Respiratory Protection Training	Safety NL	Newfoundland and Labrador
STCW Basic Safety	RelyOn Nutec	Newfoundland and Labrador
Supervisor Health and Safety Training (WorkplaceNL)	Puglisevich	Newfoundland and Labrador
Training in handling hazardous materials (Hydrogen & Ammonia)	EPIC - Storage and Handling of Hazardous Materials	Canada (Online)
Training in monitoring and controlling the transfer of hydrogen and ammonia to ensure safety and efficiency	IChemE - Advanced Process Safety Considerations for Hydrogen Projects	United Kingdom (Online)
Training on cryogenic systems and the ability to manage and maintain storage facilities and pipelines.	University of Waterloo - Cryogenic and Compressed Gas Safety (SO1030)	Canada (Online)
Training on electrochemical reactions, processes and hydrogen production using PEM electrolyzers	Hydrogen Training Solutions - Principles of PEM Electrolyzer Operation Training Course	United Kingdom
Training on electrolyzer hydrogen production plant control systems and advanced control systems for process optimization	VectorSolutions - Industrial Controls Training - Instrumentation & Controls Training	North America (Online)
Training on Hydrogen Production Process	IChemE - Hydrogen Workshop	United Kingdom (Online)
Training on hydrogen production process using PEM electrolyzers	Hydrogen Training Solutions - Principles of PEM Electrolyzer Operation Training Course	United Kingdom
Training on Instrumentation and Electrical Equipment and Systems (Electrolyzer / SMR/ATR Production Plants)	VectorSolutions - Instrumentation & Controls Training	North America (Online)
Training on Maintenance of Equipment and Systems (Hydrogen Storage)	AIChE Institute for Learning & Innovation - Hydrogen System Maintenance and Inspection	United States (Online)
Training on Selection and Maintenance of Instrumentation Equipment and Systems (Electrolyzer Production Plant / SMR/ATR Production Plant / Ammonia Storage / Hydrogen Storage)	VectorSolutions - Instrumentation & Controls Training	North America (Online)
	Siemens Energy - (OIT101.2) Instrumentation and Measurement Principles	United States (Online)

Training on the Hydrogen properties, behaviour and potential hazards	Steel University - Properties and Hazards of Hydrogen	Germany (Online)
	QuickTrain Canada - Hydrogen Awareness	Canada (Online)
Training on the operation of specialized equipment for the storage and transfer of hydrogen and ammonia	NAIT - CLNF210 - Hydrogen Production and Storage Anhydrous Ammonia - Bulk Carrier Training Program	Canada (Online)
Training on the Selection and Maintenance of Electrical and Electronic Equipment and Systems (Electrolyzer Production Plant / SMR/ATR Production Plant / Ammonia Storage / Hydrogen Storage)	EPIC - Electrical Power Equipment - Selection, Commissioning and Maintenance	Canada (Online)
	BCIT - Renewable Energy Electrical Systems Installation and Maintenance	Canada
	ATS - Industrial Maintenance Training	United States (Online)
Training on the Selection, Design and Maintenance of Combustion, Compression, Pumping and Turbine Systems & Equipment (Withstand Hydrogen/Ammonia Properties)	KOENIG - Pumps, Compressors & Turbines Course	Canada (Online)
Training on the Selection, Design, and Maintenance of Electrolyzers, Air Separation Units, Vessels, Piping systems and Fitting Valves & Seals (Withstand Hydrogen/Ammonia Properties)	EPIC Training - Industrial Piping: Design, Operation and Maintenance	Canada (Online)
	ASME | Material Selection for Piping Systems and PVs	Spain (Online)
Transportation of Dangerous Goods	St. Johns Ambulance	Newfoundland and Labrador
Wind Turbine High Angle Rescue	Infrastructure Health & Safety Association	Canada
WHMIS	Safety NL	Newfoundland and Labrador

Qualifications	School / Training Centre	Location	Notes:
Industrial Electrician (72201)	College of the North Atlantic	Newfoundland and Labrador	
Air Brake Endorsement	Motor Registration	Newfoundland and Labrador	
Bachelors Degree - Chemical Engineering	College of the North Atlantic	Newfoundland and Labrador	
Bachelors Degree - Electrical Engineering	College of the North Atlantic	Newfoundland and Labrador	
Bachelors Degree - Geomatics Engineering or Survey Engineering	Memorial University	Newfoundland and Labrador	Geotechnical and Structural Engineering - Graduate Program (Diploma)
	University of Calgary	Alberta	Bachelor of Science in Geomatics Engineering
Bachelors Degree - Mechanical Engineering	College of the North Atlantic	Newfoundland and Labrador	
Boilermaker (72103)	Boilermakers Industrial Training Centre	Newfoundland and Labrador	
Carpenter (72310)	College of the North Atlantic	Newfoundland and Labrador	
Certificate of Qualification - Heavy Duty Equipment Technician	College of the North Atlantic	Newfoundland and Labrador	
Certificate of Qualification - Hydrogen Technician	College of the North Atlantic	Newfoundland and Labrador	
Certificate of Qualification - Refrigeration Plant Operator	British Columbia Institute of Technology	British Columbia	
Chemical Process Engineering Technology	College of the North Atlantic	Newfoundland and Labrador	
College Diploma in Survey Science or Geomatics Technology	College of the North Atlantic	Newfoundland and Labrador	Geomatics/Surveying Engineering Technology
Concrete Finisher (73100)	Bricklayer & Allied Craftworkers	Newfoundland and Labrador	
Drivers Licensing	Motor Registration	Newfoundland and Labrador	
Driving Training	A & P	Newfoundland and Labrador	
Electrical and Instrumentation Engineering	Northern Alberta Institute of Technology	Alberta	
Federal or Provincial Land Surveyor's License	Association of Newfoundland Land Surveyors	Newfoundland and Labrador	
Gasfitter (Class A / Class B) (72302)	Northern Alberta Institute of Technology	Alberta	
Heavy Equipment Operator	College of the North Atlantic	Newfoundland and Labrador	
Industrial Mechanic (Millwright) (72400)	College of the North Atlantic	Newfoundland and Labrador	
Instrumentation and Control Technician (22312)	College of the North Atlantic	Newfoundland and Labrador	
Instrumentation and Controls Technician	College of the North Atlantic	Newfoundland and Labrador	
Insulator (Heat and Frost) (72321)	NL Heat and Frost Insulator Training Centre	Newfoundland and Labrador	
Ironworker (72105)	Ironworkers Education and Training Co.	Newfoundland and Labrador	
Lather (73102)	Carpenter Millwright Collage	Newfoundland and Labrador	
Metal Fabricator (Fitter) (72104)	College of the North Atlantic	Newfoundland and Labrador	
Mobile Crane Operator (72500)	College of the North Atlantic	Newfoundland and Labrador	
Plumber (72300)	College of the North Atlantic	Newfoundland and Labrador	
PMP Certification	Project Management Institute (certification)	Newfoundland and Labrador	Training can be completed at Memorial University
Professional Land Surveyor Examinations	Association of Newfoundland Land Surveyors	Newfoundland and Labrador	Canadian Board of Examinators for Professional Surveyor
Red Seal Trade - Machinist	College of the North Atlantic	Newfoundland and Labrador	

Refrigeration and Air Conditioning Mechanic (72402)	College of the North Atlantic	Newfoundland and Labrador	
Scaffolding Course	Carpenter Millwright Collage	Newfoundland and Labrador	
Sheet Metal Worker (72102)	College of the North Atlantic	Newfoundland and Labrador	
Steamfitter/Pipefitter (72301)	College of the North Atlantic	Newfoundland and Labrador	
Technology Diploma - Mechanical Engineering	College of the North Atlantic	Newfoundland and Labrador	
Welder (72106)	College of the North Atlantic	Newfoundland and Labrador	
Wind Turbine Technician Certificate	College of the North Atlantic	Newfoundland and Labrador	

About DNV

DNV is the independent expert in risk management and assurance, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions.

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