MEMORANDUM

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To: **David J. McWalter – McWalter Consulting Limited** **Date:** **August 30, 2022**

From: **Clement Ng** **Solaris Project #: HE22-04269**

Subject: Description of hydrogen production facility and site plan to support rezoning application

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Description of Proposed Hydrogen Production Facility:

The intend of the facility is to produce, compress, store and dispense hydrogen on site. The facility will also include diesel storage and dispensing.

To accomplish this, the facility will be divided into two sections:

1. Hydrogen Production and Storage – This section is where all the electrical equipment, electrolysers, hydrogen compressors, and hydrogen storage will be located. See Site Plan below.

   The electrical equipment will be located near the northern lease boundary. BC Hydro lines are near the area, making it an ideal spot to locate the BC Hydro metering building and electrical substation that will feed the facility's electrical equipment, including electrolysers, compressors, refueling stations, etc. Directly south of the electrical equipment will be the electrolyser units, which are used to produce hydrogen by means of water electrolysis. The electrolyser and some balance of plant equipment will be installed in 40 ft containerized enclosures. Southeast of the electrolyser will be the hydrogen compressors, which take suction from the electrolyser and discharge into the hydrogen storage system. Directly east of the hydrogen compressors will be the hydrogen storage units, which will store the hydrogen and supply it to the hydrogen dispensing area as required. Hydrogen storage cylinders/containers will be installed outdoors. The proposed layout and minimum separation distances for process equipment is based on requirements from the Canadian Hydrogen Installation Code (CAN/BNQ 1784-000/2022) and Hydrogen Technologies Code (NFPA 2)
   There will be two points of access for the Hydrogen Production and Storage area; one on the western end and one on the eastern end. The western access provides an entry point should there be any maintenance and/or replacement on the electrolysers and the hydrogen compressors. The eastern access provides an entry point should there be any maintenance and/or replacement on the hydrogen storage units and gas control panels. Both entry points can be used for maintenance and/or replacement on the electrical equipment, and for emergency access.

2. Hydrogen and Diesel Dispensing – This section is where hydrogen dispensers, diesel storage tank and dispensers, Diesel Exhaust Fluid (DEF) tank and dispensers, and the amenities/control building will be located. See Site Plan below.

   The amenities/control building will be located on the northwestern corner of the Hydrogen and Diesel Dispensing area. The hydrogen chillers are located as close to the dispensers as possible while not being too far away from the hydrogen storage units as well. The hydrogen and diesel dispensers are situated at

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the middle in consideration of the wide turning radii of the trucks. Like the Hydrogen Production and Storage area, the Hydrogen and Diesel Dispensing area will also have two points of access.

Site Plan - (Double click on image below to open file):

PG H2 Production Facility Plot Plan.pdf

Rendering of Proposed Facility:

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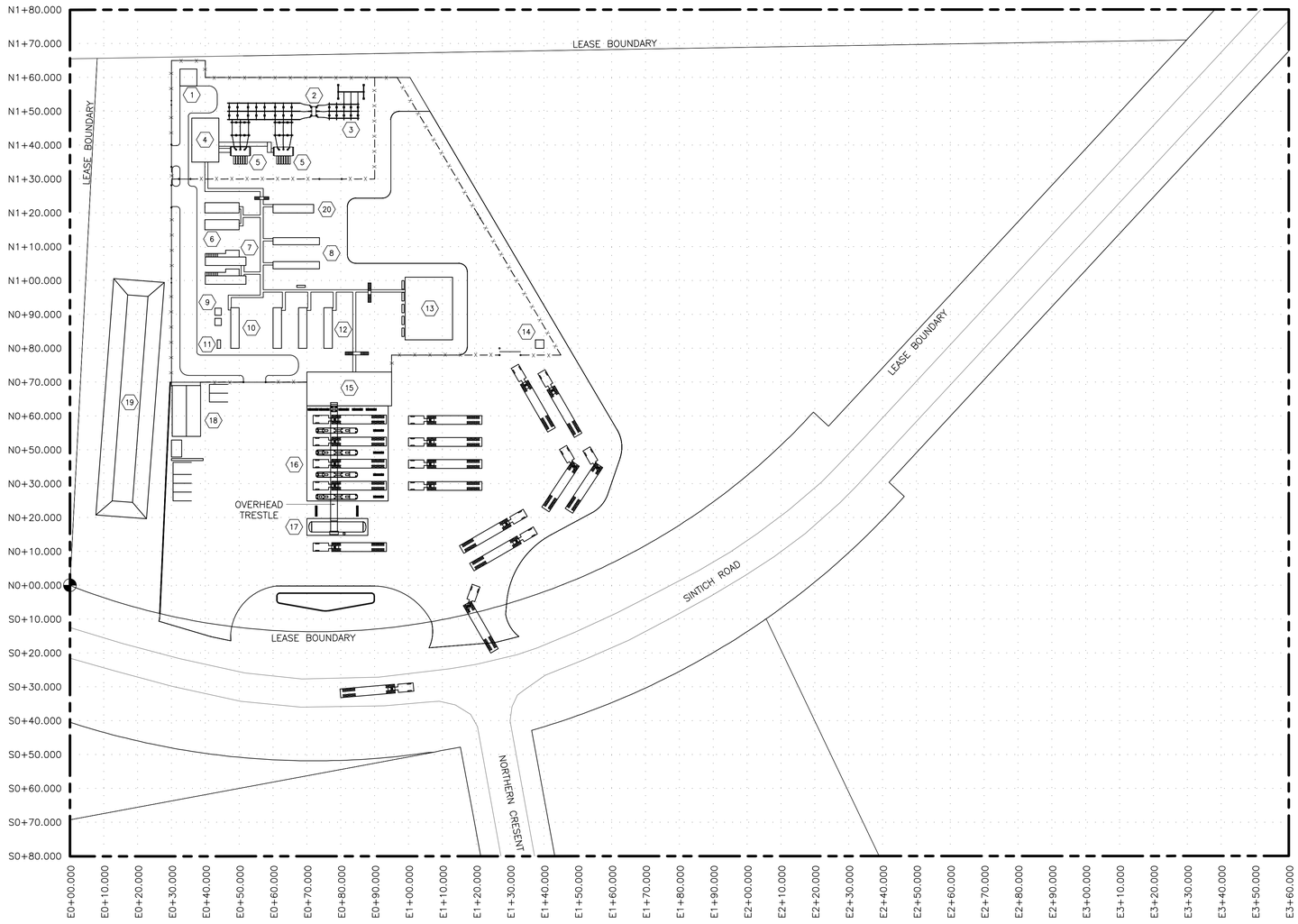
SITE NORTH



EQUIPMENT TAGS

REF. NO.	EQUIP. NO.	DESCRIPTION
1	–	BC HYDRO METERING BUILIDNG
2	–	HIGH VOLTAGE CIRCUIT BREAKER
3	–	69kV DEADEND STRUCTURE
4	–	25kV OUTDOOR SWITCHGEAR
5	–	16 MVA 69kV TRANSFORMER
6	–	ELECTRICAL EQUIPMENT
7	–	ELECTROLYZERS
8	–	ELECTROLYZER COOLERS
9	–	600V TRANSFORMER
10	–	ELECTRICAL BUILDING/INSTRUMENT AIR COMPRESSOR
11	–	BACKUP GENERATOR
12	–	HYDROGEN COMPRESSORS
13	–	HYDROGEN STORAGE
14	–	SECURITY KIOSK
15	–	HYDROGEN CHILLERS
16	–	HYDROGEN/DIESEL DISPENSERS
17	–	DIESEL STORAGE
18	–	AMENITIES BUILDING
19	–	DETENTION POND
20	–	COLD STORAGE
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NOTES:

1.

DWG. NUMBER	REFERENCE DRAWINGS	REV.	DATE	REVISION DESCRIPTION	DRAWN	CHECK	APPR.
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PROFESSIONAL & PERMIT STAMPS

PRELIMINARY

PERMIT STAMP AND PROFESSIONAL STAMP AFFIXED ABOVE SHALL APPLY ONLY TO REV(s) A

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	DRAWN	DESIGNED	CHECKED	APPROVED
BY	WHM	CHB	JAS	CNG
DATE	22/04/22	YY/MM/DD	YY/MM/DD	YY/MM/DD

hydra

CLIENT: HYDRA ENERGY
PROJECT: PG H2 PRODUCTION FACILITY
LOCATION: PRINCE GEORGE, BRITISH COLUMBIA

TITLE:
PLOT PLAN
HYDROGEN FACILITY

SCALE: 1:750
JOB NO.: HE22-04269
PROJECT ID: 4269
DRAWING NUMBER: -
REV.: A

LAST SAVED: 7/12/2022 6:11:41 PM BY: MINH.NGUYEN
PLOTTED: 7/13/2022 10:08:02 AM, BY: MINH NGUYEN

FILENAME: J:\HYDRA ENERGY\HE22-04269 PRINCE GEORGE HYDROGEN PRODUCTION FACILITY PRE-FEEDFID PACKAGE\DRAWINGS\34-PIPING ENGINEERING\2D DRAWINGS\PLOT PLANS\PLOT PLAN.DWG

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To: **David J. McWalter – McWalter Consulting Limited** **Date:** **December 8, 2022**

From: **Clement Ng** **Solaris Project #: HE22-04269**

Subject: Air and Noise Pollution Impact

The government of BC on its path to transition away from fossil fuels to low carbon energy systems has proposed the establishment of the British Columbia Energy Regulator, formerly known as BC Oil and Gas Commission (BCOGC). This regulatory body will expand its regulatory responsibilities to include hydrogen, ammonia, and methanol.

Currently, there is no specific guidelines developed for hydrogen production. BC OGC is going to develop specific guidelines in the next couple of years as part of the "BC Hydrogen Strategy" proposed by the BC government. In the meantime, in order to ensure no adverse environmental impacts with the proposed Hydrogen Production facilities, Hydrogen projects will follow the following best practices for noise and emissions for facilities in the oil and gas industry:

- BC Environmental Protection and Sustainability
  - Waste Discharge Authorization.
  - Air Quality Objectives and Standards which are non-statutory limits on the acceptable presence of contaminants in the atmosphere
  - Air dispersion modelling that provides a case and effect link between the emissions into the air and the resulting air pollution concentrations.
- BC Noise Control Best Practices Guidelines which outline the recommended best practices for noise control operations resulting from operations at a well or facility.
- Occupational Health and Safety (OHS) regulations.

In terms of Greenhouse Gas (GHG) emissions, the federal Hydrogen Strategy from the Government of Canada and the European Commission recommend a carbon intensity threshold of 36.4 g CO2e/MJ (See Figure below). BC will use this target as a starting point.

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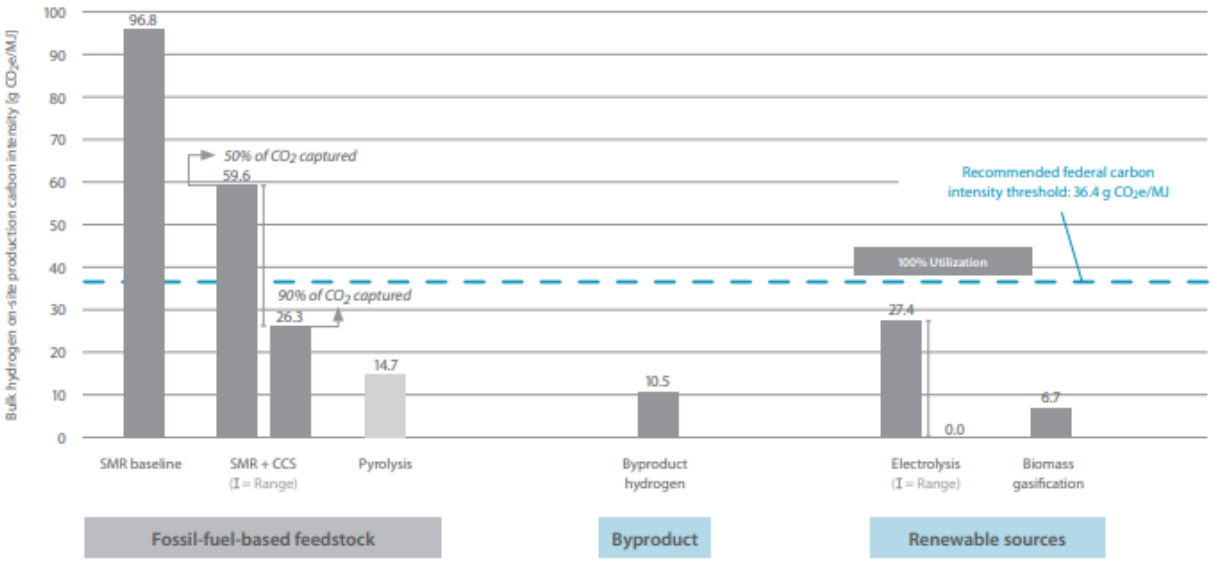
GHG emissions intensity of different hydrogen production methods



The carbon intensity of the production pathways shown above are modelled estimates and use a "cradle-to-gate" life-cycle analysis that includes emissions associated with feedstock production, transportation, losses, flaring, land use changes, hydrogen production and carbon capture and storage (if applicable). Data are from the B.C. low carbon fuel standard and *BC Hydrogen Study – Final Report* (2019). The actual carbon intensity of a specific hydrogen production project will depend on a number of factors.

As shown on the figure, a facility which produces hydrogen through electrolysis will have a GHG emission intensity of 27.54 g CO_2e/MJ, significantly below the recommended threshold. Since there are no direct carbon emission during the hydrogen production process, CO_2 emissions are determined by the carbon intensity of the carbon source. Because electricity is supplied by BC Hydro, which generates 98% of the electricity from clean/renewable resources, the carbon intensity of the production process is very low.

The facility will be designed to conform to Noise attenuation requirements laid out in the OHS regulations. In addition, noise pollution impacts will continually by assessed to determine if there are any significant changes to sound emanating from the facility and improving notification measures to neighbors of a planned noisy event.

Addressed to the City of Prince George regarding potential noise and air pollution of the hydrogen production and refueling facility planned for 9048 Sintich Road:

Hydra Energy has selected electrolysis as the production method by which we will generate hydrogen for refueling class 8 trucking fleets. Water electrolysis is a hydrogen production method that uses electric power to split water into molecular hydrogen and oxygen. Thus, there are no direct carbon emissions during the production process with oxygen being the only vented by-product. The production process generates minimal noise and the balance of the equipment necessary for the compression, chilling, storage and processing of the hydrogen is all spec'd to be containerized which will limit noise pollution. Beyond that, the project was consciously designed to meet the strictest regulatory standards related to the production and handling of hydrogen.

Below is the regulatory matrix that was compiled by Solaris MCI, the engineering firm contracted to design the facility:

11.0 CODES AND STANDARDS

The facility will be designed, constructed, and tested in accordance with the most stringent requirements in the latest version of applicable industry standards and codes. Overarching codes and standards include, but not limited to:

A list of codes and standards developed specifically for the design and installation of hydrogen systems include, but not limited to:

- ANSI/CSA HGV 4.1 Standards for Hydrogen Dispensing System
- ANSI/CSA HGV 4.2 Standard for Hoses for Compressed Hydrogen Fuel Stations, Dispensers, and
Vehicle Fuel Systems
- ANSI/CSA HGV 4.4 Standards for Breakaway Devices for Compressed Hydrogen Dispensing Hoses and
Systems
- ANSI/CSA HGV 4.5 Standard for Priority and Sequencing Equipment for Hydrogen Vehicle Fueling
- ANSI/CSA HGV 4.6 Manual Operated Valves for Use in Gaseous Hydrogen Vehicle Fueling Stations
- ANSI/CSA HGV 4.7 Automatic Valves for Use in Gaseous Hydrogen Vehicle Fueling Stations
- ANSI/CSA HGV 4.8 Hydrogen Gas Vehicle Fueling Station Compressor Guidelines
- ANSI/CSA HGV 4.10 Standard for Fittings for Compressed Hydrogen Gas and Hydrogen-Rich Gas Mixtures

- ASME B31.12 Hydrogen Piping and Pipelines
- CAN/BNQ 1784-000 Canadian Hydrogen Installation Code – recognized as a best practice document by TSBC
- CAN/CSA C22.2 No. 60079 Electrical Equipment for Explosive Atmospheres (IEC 60079)
- CAN/ULC S653 Aboveground Steel Contained Tank Assemblies for Flammable and Combustible Liquids
- CCME PN13226 Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products – Canadian Council of Ministers of Environment
- CGA H-5 Standard for Bulk Hydrogen Supply Systems
- CGA G-5 Hydrogen
- CGA G-5.3 Commodity Specification for Hydrogen
- CGA G-5.4 Standard for Hydrogen Piping Systems at User Locations
- CGA G-5.5 Hydrogen Vent Systems
- CGA G-5.8 Standards for High-Pressure Hydrogen Piping Systems at Consumer Locations
- CGA S-1.1 Pressure Relief Device Standards – Part 1 – Cylinders for Compressed Gases
- CGA S-1.3 Pressure Relief Device Standards – Part 3 – Stationary Storage Containers for Compressed Gases
- CGA V-1 Compressed Gas Cylinder Outlet and Inlet
- CGA V-9 Standard for Compressed Gas Cylinder Valves
- CGA V-10 High Pressure Gas Trailer Connection
- ISO 19880-1 Gaseous Hydrogen - Fueling Stations - Part 1 General Requirements
- ISO 19880-2 Gaseous Hydrogen - Fueling Stations - Part 2 Dispenser
- ISO 19880-3 Gaseous Hydrogen - Fueling Stations - Part 3 Valves
- ISO 19880-4 Gaseous Hydrogen - Fueling Stations - Part 4 Compressors
- ISO 19880-5 Gaseous Hydrogen - Fueling Stations - Part 5 Hoses
- ISO 19880-6 Gaseous Hydrogen - Fueling Stations - Part 6 Fittings
- ISO 19880-8 Gaseous Hydrogen - Fueling Stations - Part 8 Hydrogen Quality Control
- ISO 22734 Hydrogen generators using water electrolysis — Industrial, commercial, and residential applications
- ISO TR15916 Basic Considerations for the safety of hydrogen systems
- NFPA 2 Hydrogen Technologies Code
- SAE J2600 Compressed Hydrogen Surface Vehicle Fueling Connection Devices
- SAE J2601 Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles
- SAE J2601-2 Fueling Protocol for Gaseous Hydrogen Powered Heavy Duty Vehicles
- SAE J2799 Hydrogen Surface Vehicle to Station Communications Hardware and Software
- ANSI/AIAA G-095A-2017 Guide to Safety of Hydrogen and Hydrogen Systems

A list of codes and standards that are relevant to the design and installation of hydrogen systems include, but not limited to:

- CSA Z662 Oil and Gas Pipeline Systems Code
- CAN/CSA Z767 Process Safety Management
- Directive: Natural Gas and Hydrogen Refuelling Stations - Gas Safety Regulation Requirements
- Quarantine Approvals -Canadian Border Services Agency, Quarantine Act.
- Petroleum Storage and distribution facilities Stormwater Regulation – BC Ministry of Environment, Environmental Management Act.
- Venting of Trucks Guideline – Work Safe BC, OHS Regulation 23.80
- Guidelines 20.3-2 Qualified coordinators – Work Safe BC, Worker Compensation Act and the OHS Regulation Section 20.3
- ASME BPVC Boiler and Pressure Vessel Code Section VIII, Div. 1 and 2 – Rules for Construction of Pressure Vessels
- CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code
- ISO 4126-1 Safety Devices for Protection Against Excessive Pressure. Part 1: Safety Valves
- ISO 8573-1 Compressed air - Part 1: Contaminants and Purity Classes
- IEEE 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems
- IEEE 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
- ASME B31.3 Process Piping
- CSA C22.1-18/21 Canadian Electrical Code, Part I, Safety Standard for Electrical Installations (Latest Version Adopted by the Jurisdiction Having Authority)
- CSA C22.1-18/21 Canadian Electrical Code, Part II, General Requirements (Latest version adopted by the jurisdiction having authority)
- CSA C22.2 0-10 General Requirements - Canadian Electrical Code, Part II
- CSA C22.2 0.4-17 Bonding of Electrical Equipment
- IEC 60079-10-1 Explosive Atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres
- IEC 80079-20-1 Electrical apparatus for explosive gas atmospheres Part 20: Data for flammable gasses and vapours, relating to the use of electrical apparatus
- API RP 505 Edition 2 2018 Recommended Practice for the Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Zone 0, Zone 1, and Zone
- NFPA 2 Hydrogen Technologies Code
- NFPA 55 Compressed Gas and Cryogenic Fluids Code
- NFPA 56 Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems
- NFPA 67 Guide on Explosion Protection for Gaseous Mixtures in Pipe System
- NFPA 68 Standard on Explosion Protection by Deflagration Venting
- NFPA 69 Explosion Prevention Systems
- API Std 520 Sizing, Selection, and Installation of Pressure-relieving Devices
- API Std 521 Pressure-Relieving and De-pressuring Systems
- API Std 614 Lubrication, Shaft-Sealing and Oil-control Systems and Auxiliaries

The facility must also be designed to conform to the Health & Safety, and Noise Attenuation requirements laid out in the Occupational Health and Safety (OHS) Regulations of Canada.

Please advise if additional information is required.

Ilya Radetski

Service Delivery Lead

Hydra Energy Corp