Appendices

List of Appendices

Appendix A: Technical and Engineering Pipeline Assessment Requirement Clauses per CSA Z662

Technical and engineering pipeline details are required for all known design specifications for the pipeline, and the start and end points of the pipeline. The start and end points are not just from lease to lease, but the exact start and end point of the pipeline. Requirements listed here reference Clauses, Tables and Figures in CSA Z662 available at the Canadian Standards Association website.

- Engineering assessment required by CSA Z662.
- Table 4.2: to support the use of a higher value being used for location factor on a gas pipeline.
- Clause 4.3.12.2 for pressure test design of components not listed in Z662-11.
- Clause 4.4.3 to determine spacing for isolating valves, unless spaced according to Table 4.7.
- Clause 5.1.3 for use of materials other than as specified in the standards.
- Clause 5.2.4/5.2.5.1 for use of materials other than Table 5.3.
- Clause 5.6.1 for reuse of materials in a different system than they were removed from.
- Clause 9.1.3 for exclusion of certain corrosion control practices.
- Clause 10.3.1.1 to confirm which sections are suitable for use where conditions which can lead to failure are discovered.
- Clause 10.3.1.2 to determine which portions may be susceptible to failure prior to operating at a higher pressure than the established operating pressure. This may include changes which are below MOP.
- Clause 10.3.7.1 prior to a change in service fluid. This is any change in service fluid.
- Clause 10.3.8 prior to upgrading to a higher MOP.
- Clause 10.3.9.1 prior to pressure testing existing piping to make sure the line will not be adversely affected and that the line can sustain the proposed pressure.
- Clause 10.7.1 where a change in class location occurs to allow for meeting anything other than the higher class location requirements.
- Clause 10.8.1 where an existing pipeline is crossed by a road or railway where not updating the design to accommodate.
- Clause 10.8.3 to confirm that a pipeline can sustain the anticipated surface load for any crossings other than road or rail.
- Clause 10.9.2.4 to return an above ground tank to service following a repair without a hydrostatic test.

- Clause 10.10.1.4 to determine suitable operating pressure where defects may make the pipeline unsuitable for normal operating pressure.
- Clause 10.10.2.1 to use a different maximum length and depth of corrosion limit than specified in Figure 10.1.
- Clause 10.10.2.7 to determine that a corroded area is acceptable which does not meet the criteria of other clauses in 10.10.2.
- Clause 10.10.4.2 to determine dents other than those listed are acceptable.
- Clause 10.10.5 to determine surface cracks to be acceptable.
- Clause 10.10.7 to determine weld defects to be acceptable.
- Clause 10.11.4.3 to support design and installation of repair sleeves.
- Clause 10.12.1.1 to support a temporary repair method (welding or non-welding).
- Clause 10.15.2.1 prior to reactivating a pipe.
- Clause 12.4.1.4 to support designs in gas distribution systems which use a weak link in the event of excessive pullout force.
- Clause 12.4.2.4 to determine the chemical factor for liquid hydrocarbons between 0.5 and 1 for polyethylene piping design pressure calculations.
- Clause 13.1.2.16 to demonstrate adequate corrosion resistance of some types of risers or couplings on composite lines for the life of the pipeline where cathodic protection will not be provided.
- Clause 13.2.2.12 to thermoplastically line previously in service pipes (unless a leak test is run).
- Clause 13.2.8.3 to support continued use of the pipeline following a liner breach on thermoplastically lined pipe.
- Clause 13.3.3.6 to demonstrate adequate corrosion resistance of some types of risers or couplings on Polyethylene lines for the life of the pipeline where cathodic protection will not be provided.
- Clause 16.8.7 for any sour lines where there is a possibility of a change in service fluid composition or operating conditions to determining whether the pipeline is suitable for the new conditions.
- Clause 16.10.3.2 for any gas pipelines being returned to service after an extended period of non-use prior to admission of sour fluids.
- Clause 17.4.7 for above ground installations on composite reinforced steel pipelines to ensure suitability.
- Clause 17.10.3 to determine that a corroded area is acceptable which does not meet the criteria of 10.10.2.

- Clause N.13.1 where inspection, testing, patrol or monitoring indicates conditions or imperfections which might lead to failure or damage incidents with significant consequences. To be performed to N.13.2.2.

Appendix B: Detailed Engineering Application Requirements for Gas Plants

The following checklists include details of submissions required to assist in the review of processing facility permit applications submitted to the BC Energy Regulator (Regulator) under the Oil and Gas Processing Facility Regulation (OGPFR). The applicant must submit an application in the electronic Application Management System for a facility permit.

Section 4.3 of the Oil and Gas Activity Application Manual provides details on the permit application preparation and submission details for all facility permit applications including gas processing plants.

A pre-application submission meeting with the Regulator is recommended for all new processing facility permits and significant amendments to assist in the timely and effective processing of the application.

Qualified Professional (QP) (as defined in the OGPFR) means a person who is authorized under the Engineers and Geoscientists Regulation to use the reserved title professional engineer or professional geoscientist."

A. Summaries and Descriptions

- Detailed project description of the plant (i.e. DBM) and the proposed processes, including total processing capacity and design flow rates (inlet, recovered products, fuel gas, emissions).
- Summary of codes and standards for engineering design, siting, construction, and operation in addition to those adopted under Section 2 of the OGPFR and prepared by a QP.
- Construction schedule.
- Design basis for flaring, venting and relief systems prepared by a QP.
- Design basis for the collection, storage, treatment and disposal systems for handling surface runoff and industrial waste-water prepared by a QP.
- Preliminary engineering design information, plot plans and process flow diagrams prepared by a QP.
- Description and construction plan for modular units constructed outside of BC.
- Reports that include findings and recommendations from the following studies and assessments that are prepared by a QP. Refer to Section 4 of the OGPFR.
    - Design and safety studies on the siting of the proposed processing facility and the equipment.
    - Hazard identification studies.
    - Assessments of environmental effects.
    - Preliminary consequence assessments.
    - Social and cultural effects assessment.

- Report prepared by third party or QP that verifies the quality assurance program for the processing facility, being the processes and procedures to ensure that the facility will be constructed to conform to all

applicable requirements of Section 6 and 7 of the OGPFR. Refer to the Oil and Gas Activity Application Manual, Section 4.3 Completing Activity Details: Facility Activity.

Pre-engagement with local Indigenous nations report. Refer to Section 5 of the OGPFR.

- A plant material balance at design conditions.
- A gas processing plant proliferation review that includes the rationale for constructing the newly proposed plant after consideration of existing active plants and pipeline infrastructure feeding into active plants within a 50 km radius.
- If acid gas is to be discharged to a subsurface formation, a brief description of the proposal must be supplied along with a copy of the reservoir approval issued by the Regulator.
- Summary of site surface run-off water management, including the design and sizing criteria of any containment ponds.
- Summary of inlet separator/slug catcher capacity considerations.
- Summary of prime mover starter systems and associated pump drives, and if natural gas is utilized, confirm that the vented gas is connected to the flare/incineration system, or conserved.
- Summary of why pressure relief devices (i.e. PSV's) are not connected to the plant flare system, if applicable.
- Description of the provisions for facility security.
- List of hazardous materials that will be stored and a description of the storage method.
- Total kilowatt rating of all compressor prime movers, and the estimated compressor seal vent rate and confirmation if this is venting, tied to flare or conserved.
- Dehydrator Engineering & Operations Sheet (DEOS), if applicable.
- Total amount of H2S and CO2 emissions from all sources at the facility in tonnes per day.
- Description of how the plant has been designed to process gas from in-line testing of wells with potential liquid slugs and CO2 spikes.
- Summary of plant supervision model including operator response time if not manned 24 hours per day.
- Plant shutdown and blowdown philosophy and how consideration has been made to ensure that high pressure gas is not trapped in the facility during an emergency event. Include a summary of fuel gas system blowdowns in an emergency event.

If the proposal includes a sulphur processing facility, include a written submission that:

- Describes the proposed control measures to limit the release of sulphur dust and entrained gases.
- Describes the proposed method to degasify produced liquid sulphur and to dispose of sulphur compounds and other vapours associated with such processes.
- Describes how sulphur volumes will be measured and reported.

If the proposal includes the following systems below, a brief summary of how the gas processing plant design addresses seismicity and, a summary of the safety and loss management systems at the gas processing plant including, but not limited to are required:

- Gas detection (LEL, propane) systems
- Fire prevention, detection and response systems
- Toxic gas (H2S) detection systems

B. Drawings, Diagrams and Maps

Applicable drawings, diagrams and maps should include the following:

- Plot plan drawing
- If available, plant piping and instrumentation drawings (P&IDs)
- Process flow diagram (PFD) of the plant and set of plant PFDs
- Map(s) showing:

1. Facility being applied for
2. All other existing plants and sulphur handling facilities at the site or in the area (within 50 km)
3. All occupied dwellings and surface improvements in the area (within 10 km)
4. All lakes, streams, and other surface bodies of water in the area (within 10 km)
5. All municipal boundaries, and settlements in the area (within 20 km)
6. General land use (forested, farming, other) in the area (within 10 km)

- Metering block diagram (i.e. metering schematic) detailing:

1. All meters in the plant (production accounting and non-production accounting).
2. Meter types (e.g. orifice, turbine, ultrasonic, coriolis).
3. All production accounting meters in the plan on a list or table on the metering schematic. This will typically be a subset of the plant meters. This list should be cross referenced to the meters shown on the metering schematic by meter number and/or meter description. Also, types of measuring devices used to determine levels and/or volumes in tanks or production vessels for production accounting purposes should be included, (e.g. level gauge, level transmitter, pressure transmitter inlet piping header to plant inlet separators).
4. All stream (plant and inlet header) block valves and normal operational state (normally open or normally closed), that can cause a change in fluid flow that will impact the production accounting model.
5. Fuel gas lines (plant and/or field).
6. Pilot gas and dilution gas streams to plant flare stacks. Include tie in points in the plant.
7. All plant piping that can impact the production accounting model.
8. Fluid injection streams. e.g. water, acid gas.
9. Flare stacks and incinerator stacks.

- Gathering block diagram (i.e.: gathering system schematic) detailing:

1. Type of primary well production (oil or gas).
2. Wellsite locations, indicated by the legal surface location.

3. Wellsite configuration (three phase separation, two phase separation, wet meter). This may be typical if all wellsites are the same.
4. All field meters and types. e.g. orifice meter, turbine, etc.
5. All field process equipment. e.g. compressors, separators, tanks, etc.
6. Gathering system offload streams that permit volumes to deliver to processing that is different from the plant applied for.
7. Gathering system onload streams that permit volumes to be received from other reporting facilities, gas plants or gathering systems.
8. Return fuel gas streams from a plant, facility or other processing equipment.

For larger facilities, an optional gas gathering schematic may be used to show battery/facility delineation.

C. Plans and Assessments (to be submitted with the permit application, if available)

• Noise Impact Assessment (NIA). Refer to the BC Noise Control Best Practices Guideline. Attach NIA report to application.

• Light Assessment - summary of how light pollution has been identified, considered and mitigated. The International Regulator on Illumination (CIE) 150 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations can be used.

• Fracture sand management plan for the plant. Include the strategies incorporated to capture and monitor for fracture sand returns and associated erosion at the plant.

• Fugitive Emissions Management Plan for the proposed plant.

• Air monitoring plan, if applicable. This may include passive or real time plant/perimeter detection for H2S and/or SO2, wind speed and direction monitoring.

• Storage tank secondary containment plans (production and non-production storage). Include location of truck loading lines and truck loading boxes. If hauling of fluids is proposed by truck, an estimate of how many trucks are expected per day at the facility.

- A summary for the following with regards to pressurized hydrocarbon storage bullets (if applicable):
    - How the bullets have been appropriately spaced to meet the intent of API 2510 when storing LPG and therefore not within the NFPA 30 Code.
    - When remote impoundment is being utilized as the means for secondary containment describe the flow direction of spilled product and the containment capacity.
    - Description of ground permissive systems at truck outs.

- A Perimeter Groundwater Monitoring Program acceptable to the Regulator as outlined in Appendix B1.

The following components of the permit application may be submitted after the initial application if not available, but at minimum a preliminary version is required prior to completion of the engineering review. In special cases the submission of final reports could be extended until the commencement of construction, or operations. The components include:

- Plant isolation and blowdown philosophy
- Noise impact assessment
- Light assessment
- Flare stack / incinerator dispersion model
- Fugitive emissions management plan

D. Flare/Incinerator/Vent Stack Details

This submission must include:

- Stack height and diameter.
- Predicted normal and maximum emissions of SO_2 /hr.
- Rate and calculated volume of potential H_2S releases.
- Results of gas/vapour dispersion modeling for lit and unlit conditions.
- Maximum expected rates for continuous flaring, and volumes/compositions of flared streams.
- Maximum stream velocity in metres per second at the flare metering point.
- Description of the flare metering configuration for the following scenario's taking into consideration the upper and lower limits of the manufacturers specifications, and the required published regulatory meter uncertainties: (1) purge gas volume determination during routine operations and, (2) during shutdown and depressurization events.
- Description of how plant processing will conserve gas volumes by avoiding tie-in to the flare and/or incinerator stack of recoverable streams (vapor recovery considerations).
- Description of how plant ESD procedures will limit emissions.
- Description of the flame-out detection system configuration for the flare stack/incinerator equipment, and if it is set up to alarm and/or shutdown process.
- Appropriate isopleths for the various levels of H_2S and SO_2, as applicable.
- Description of the design to prevent flashback of flame back into process (e.g.: positive pressure system, flame arrestor), including:

  - Description of how the design of the flare system will prevent black smoke and reduce flame size.
  - Description of flare pilot and / or auto ignition systems.
  - Description of how the facility complies to API Standard 521 and API 537, as applicable.

E. Other Requirements

The permitting requirements for design changes proposed while the plant permit application is in review, or after the plant permit is issued will be determined on a case-by-case basis by the Regulator. The Facilities Branch of the Regulator's Engineering Division can be contacted directly for more information.

Before construction of a processing facility begins the permit holder must develop a management system to anticipate and manage potential hazards throughout the life cycle of a processing facility. The management system does not need to be developed or submitted for the processing facility permit application. Once construction of a processing facility begins, the Regulator may request a copy of the management system to verify compliance at any time during the life of the facility.

Appendix B1: Technical Guidance for Perimeter Groundwater Monitoring Program for Processing Facilities

The Perimeter Groundwater Monitoring Program shall be prepared by a Qualified Professional (QP), registered with Engineers and Geoscientists of BC (EGBC). The QP shall have appropriate experience and expertise in the design and implementation of groundwater monitoring programs. The intent of the Perimeter Groundwater Monitoring Program is to provide monitoring well infrastructure at the perimeter of the processing facility and around significant fluid storage areas within the facility boundaries that permits groundwater sampling over the long term, providing data to (a) establish baseline groundwater level and chemistry conditions, and (b) demonstrate compliance with results-based regulations for groundwater protection during the life of the facility.

The implementation of a Perimeter Groundwater Monitoring Program does not preclude any future requirements for investigative groundwater monitoring should an incident occur, and is separate from any other on-site groundwater monitoring requirements associated with specific activities (e.g., for saline water containment ponds as described in the Regulator's Management of Saline Fluids for Hydraulic Fracturing Guideline.

The following provides technical guidance regarding the Regulator's expectations with respect to the Perimeter Groundwater Monitoring Program.

Timing of Monitoring Well Construction

To allow for an assessment of baseline groundwater conditions, where baseline groundwater conditions are established by groundwater level and groundwater quality data representing more than one sampling occasion, perimeter groundwater monitoring wells shall be constructed prior to facility operations.

A perimeter groundwater monitoring program may be required by the Regulator for processing facility amendments.

Considerations for Monitoring Well Locations

- Potential considerations for determining the number and locations of perimeter groundwater monitoring wells include but may not be limited to:
    - Coverage of all perimeter boundaries.
    - Locations and operational aspects of liquid storage and transfer infrastructure within the site boundaries.
    - Inferred or known groundwater flow direction.
    - Site grading and cut and fill alterations.
    - Surrounding receptor locations (e.g., water wells, surface water bodies, residential areas, environmentally sensitive areas).
    - Any other factors as determined by the QP.

Considerations for Monitoring Well Design

- Monitoring wells shall be designed and installed in accordance with the BC Groundwater Protection Regulation (gov.bc.ca), and using standard environmental investigation protocols such as those described in the B.C. Field Sampling Manual - Province of British Columbia (gov.bc.ca).
- Monitoring wells shall be installed and screened to permit the collection of representative groundwater samples from the shallowest "aquifer", where "aquifer" is defined in the Water Sustainability Act (WSA) as:
    a. a geological formation,
    b. a group of geological formations, or
    c. a part of one or more geological formations that is groundwater bearing and capable of storing, transmitting and yielding groundwater.
- The need for monitoring well installation within deeper aquifers may be considered based on site-specific circumstances.
- Unless deemed warranted by the QP, the maximum recommended depth for perimeter monitoring wells is 10 metres.
- If groundwater is not encountered during drilling, groundwater monitoring wells shall be installed for future groundwater monitoring purposes and/or for use as a vapour probe.

Considerations for Groundwater Sampling and Analysis

- Groundwater sampling shall be conducted using standard environmental sampling and quality assurance/quality control protocols such as those described in the B.C. Field Sampling Manual - Province of British Columbia (gov.bc.ca).
- The chemical analyses shall be selected by the QP to establish baseline conditions and with consideration of the Potential Contaminants of Concern (PCOCs) associated with the inventory of hazardous materials that will be stored and/or used at the site.
- Once baseline conditions are established by data representing more than one sampling occasion, sampling programs may consider the use of representative indicator parameters for ongoing monitoring, as determined by the QP.
- On-going groundwater sampling and analysis should be carried out at least once annually from all monitoring wells.
- Sample analysis must be conducted by an accredited laboratory.
- Consideration of the following analytical parameters is recommended:
    - Routine water quality parameters (e.g., Major Cations and Anions, Total Dissolved Solids (TDS), Alkalinity, pH, Electrical Conductivity, Dissolved Oxygen, Oxidation-Reduction Potential, Hardness).
    - Dissolved Metals.
    - Dissolved Gases (e.g., C1-C3).
    - Dissolved Hydrocarbons (e.g., Volatile Hydrocarbons (VHw6-10), Benzene, Ethylbenzene, Toluene, Xylenes (BETX), Volatile Petroleum Hydrocarbons (VPHw), Volatile Organic Compounds, Extractable Petroleum Hydrocarbons (EPHw10-19 and EPHw19-32), Light and Heavy Extractable Petroleum Hydrocarbons (LEPHw/HEPHw), Polycyclic Aromatic Hydrocarbons).
    - Amines, Glycols and Methanol.

- Analyses relevant to all other PCOCs identified by the QP.

Reporting

Reports and data regarding the Perimeter Groundwater Sampling Program may be required by the Regulator at any time during the life of the facility or as specified in the permit conditions. If not required to be submitted, all information and data relevant to the Perimeter Groundwater Monitoring Program shall be retained by the permit holder to be submitted to the Regulator upon request.

Where relevant, submitted documentation should include:

- A description of methodologies used for monitoring well installation, water level measurements and groundwater sampling, including quality assurance and quality control protocols.
- Graphical well logs with stratigraphic observations and monitoring well construction details.
- A site plan showing locations of monitoring wells relative to site boundaries, on-site infrastructure, and relevant surrounding features.
- Water level measurements in monitoring wells.
- Analytical results in tabular form with comparison to appropriate criteria and standards.
- Laboratory analytical reports.
- Data analysis (statistics, trends) and interpretation, as applicable.
- Any other information or interpretation as deemed appropriate by the QP or required by the Regulator.

Monitoring Well Decommissioning

- Upon site closure, the monitoring wells shall be properly decommissioned in accordance with the BC Groundwater Protection Regulation (gov.bc.ca).

Appendix C: Facility Changes Requiring an Amendment

The following lists equipment and examples of facility changes requiring the submission of a facility permit amendment for the addition of temporary or permanent equipment on Crown or private land.

- Amine sweetening package - process gas
- Amine sweetening package - fuel gas
- Bullet - condensate storage
- Bullet - LPG storage
- Capacity - gas/liquids throughput permit increase
- Compressor
- Condensate stabilization unit
- Cooler/heat exchanger
- Debutanizer unit
- Deethanizer unit
- Depropanizer unit
- Dehydrator - glycol (process & fuel gas)
- Dehydrator - molecular sieve
- Flare stack
- Generator - (gas/diesel)
- Permitted H_2S increase
- Incinerator
- Meter equipment related to production accounting
- Pump (used to transport hydrocarbon liquid (oil, LPV or HPV) in a pipeline, or pump fresh water
- Pump jack (gas and electric)
- Process refrigeration unit
- Facility storage (pit or tank)
- Treater – Oil

Appendix D: Facility Changes Where No Amendment or NOI is Needed

The following list includes examples of facility changes that do not require a Notice of Intent or amendment. These changes can be made under the authority of the existing facility permit (if not requiring new land).

- Analyzer
- Blow case (without compressor)
- Chemical tank
- Coalescer
- Dehydrator - instrument air
- De-sand tank
- Field header
- Filter
- Filter pot
- Fresh water tank
- Gas boot
- Generator - solar/fuel cell
- Generator – thermo electric
- Heater
- Instrument air compressor unit
- Line heater
- Meter - non accounting
- Odourization pot
- Piping changes at the facility not impacting measurement or air emissions
- Plunger lift
- Propane tank
- Pump (except those referenced in Appendix C)

- Regulator
- Regulator vault
- Sand filter
- Scada
- Scrubber
- Separator
- Valve
- Valve vault

Appendix E: Aggregate Operation Application Process