



Appendix B: Detailed Engineering
Application Requirements for Gas
Processing Plants
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The following checklists include details of submissions required to assist in the review of gas processing plant applications submitted to the BC Oil and Gas Commission (Commission). As part of an application for a gas processing plant, applicants must submit two paper copies of the following materials, one to the Commission's Kelowna office (Attention: Facilities Engineering), and a second copy to the Commission's Fort St John office (Attention: Technical Advisor, Engineering), in addition to completing an application in the electronic Application Management System.

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. Summaries and Descriptions

- Summary of the Process Hazard Analysis (PHA) including the project hazards identification (HAZID) and risk assessment [the non-process risks associated with the entire facility], and the hazard and operability study (HAZOP) [process and equipment related hazards], if completed to date.
- 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).
- 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 Commission.
- 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 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.
- A summary of the anticipated construction and plant start-up schedule.

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.

Provide a brief summary of the proposed QAQC process for pressure piping and equipment design and construction. Refer to the [Oil and Gas Activity Application Manual](#), Section 4.3 Completing Activity Details: Facility Activity, page 90-92.

Provide a list of all standards and codes to be used in the design, construction, operation and maintenance of the gas processing plant.

- Provide a separate table for the fired appliances with corresponding ASME Boiler Pressure codes, burner control systems and fuel gas piping standards.

Provide a brief summary of how the gas processing plant design addresses seismicity.

Provide a summary of the safety and loss management systems at the gas processing plant including, but not limited to:

1. Gas detection (LEL, propane) systems
2. Fire prevention, detection and response systems
3. Toxic gas (H₂S) detection systems

B. Drawings, Diagrams and Maps

- Plot plan drawing.
- Complete plant piping and instrumentation drawings (P&ID's).
- 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 (i.e. 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 all 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.

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

NOTE: If the gas processing plant piping and/or equipment design has not been finalized (ie.: vendor package drawings are not available), the submission may include preliminary P & IDs with the understanding that the submission of the detailed P & IDs may be submitted during the Commission's engineering review, or a permit condition may be added to require the submission of post-HAZOP IFC P & IDs after the Commission's permit decision, and prior to the commencement of construction.

Other components of the application may have their submission delayed until after the permit has been issued, but prior to the commencement of construction, or operations. This includes the following:

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

C. Plans and Assessments

- 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 Commission 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.
- A Perimeter Groundwater Monitoring Program acceptable to the Commission (see Appendix B1).
- Description of ground permissive systems at truck outs.

D. Flare/incinerator/vent Stack Details

This submission must include:

- Stack height and diameter.
- Predicted normal and maximum emissions of SO₂/hr.
- Rate and calculated volume of potential H₂S 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 H₂S and SO₂, as applicable.
- Description of the design to prevent flashback of flame back into process (e.g.: positive pressure system, flame arrestor).
 - Description of how the design of the flare system will prevent black smoke
 - If there is continuous purge has consideration been given to install purge reducer on the flare tip
 - Description of flare pilot and / or auto ignition
 - 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 Commission. The Facilities Branch of the Commission's Engineering Division can be contacted directly for more information.

Appendix B1: Technical Guidance for Perimeter Groundwater Monitoring Program for Gas Processing Plants

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 of groundwater monitoring programs. The intent of the Perimeter Groundwater Monitoring Program is to provide monitoring well infrastructure at the perimeter of the gas processing plant facility site area that permits groundwater sampling over the long term, providing data to (a) demonstrate compliance with results-based regulations for groundwater protection, and (b) establish baseline groundwater chemistry conditions.

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 Commission's documentation entitled "[Management of Saline Fluids for Hydraulic Fracturing Guideline](#)").

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

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
 - Inferred or known groundwater flow direction
 - Site grading and cut and fill alterations
 - Locations and operational aspects of liquid storage and transfer infrastructure within the site boundaries
 - 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](#), and using standard environmental investigation protocols such as those described in *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples (2003)*.
- 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 formationsthat 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 30m.

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 *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples (2003)*.
- Groundwater sampling and analysis should be carried out at least once annually from all monitoring wells.
- The chemical analyses shall be selected to establish baseline conditions and with consideration of the potential contaminants of concern associated with the inventory of hazardous materials that will be stored.
- 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.
- 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, Hardness)
 - Dissolved Metals
 - Dissolved Gases (e.g., C1-C3)
 - Dissolved Hydrocarbons (e.g., Volatile Hydrocarbons (VHw) (C6 to C10), Benzene, Ethylbenzene, Toluene, Xylenes (BETX), Volatile Petroleum Hydrocarbons (VPHw) (C6 to C10 - BETX), Volatile Organic Compounds, Extractable Petroleum Hydrocarbons C10-C19 (EPHw10-19), Extractable Petroleum Hydrocarbons C19-C32 (EPHw19-32), Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH), Polycyclic Aromatic Hydrocarbons)
 - Amines and Glycols
 - Analyses relevant to all Potential Contaminants of Concern (PCOC's) identified by the QP.

Reporting

Reports and data regarding the Perimeter Groundwater Sampling Program may be required by the Commission. 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 Commission upon request.

Where relevant, submitted documentation should include:

- A description of methodologies used for monitoring well installation and groundwater sampling.
- 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 appropriate comparison criteria and standards.
- Laboratory analytical reports
- Any other information or interpretation as deemed appropriate by the QP or required by the Commission.