3.5 NATURAL GAS FACILITIES AND CRUDE OIL FACILITIES

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Process Description

Natural gas production facilities engage in the production of natural gas, which is obtained from natural gas wells. Natural gas pumped from a well is first fed to an inlet separator that removes liquid water, heavy hydrocarbons, brine, and particulate matter from the incoming natural gas. The liquid and contaminants are stored in condensate storage tank(s). Organic emissions from the hydrocarbons are associated with the condensate tanks. Condensate is later removed via tank truck. The natural gas may then be sent to a compressor system to compress the gas to the required pressure to be sent to the natural gas pipeline.

Crude oil production facilities engage in the production of crude oil, which is obtained from crude oil wells. Crude oil pumped from a well is first fed to an inlet separator that removes contaminated water (containing hydrocarbons) and natural gas from the incoming crude oil. The contaminated water is stored in storage tank(s) and/or is pumped for disposal into a water injection well. The natural gas is sent to a compressor system for disposal into a gas injection well, or the gas may also be used as fuel in engines to provide power at the facility. The crude oil may then be pumped to the crude oil pipeline and/or stored in a sales tank.

The potential sources of air pollution at these facilities include production and injection wells, compressor engines, fugitive emissions from leaking process equipment, storage and separator vessels for hydrocarbon condensate and/or crude oil, and if present, glycol dehydrators. Glycol dehydrators are used at natural gas facilities to further remove water from natural gas streams to prevent the formation of hydrates and corrosion in the pipelines. Triethylene glycol (TEG) is used in 95% of natural gas dehydrators, while the remaining 5% use ethylene glycol (EG) or diethylene glycol (DEG).

In the dehydrator, the “lean” (low water content) glycol contacts the “wet” (high water content) natural gas stream and absorbs water from the gas. The glycol exiting the bottom of the absorber is now “rich” and has higher water content. The gas exiting the top of the absorber has lower water content and is referred to as dry gas. The rich glycol is sent to the regenerator (reboiler and stripping column) where it is heated to drive off the absorbed water and is recycled to the absorber. The reboiler supplies heat to regenerate the rich glycol in the still by simple distillation. The separation is relatively easy because of the wide difference in boiling points of water and glycol. A still or stripping column is used in conjunction with the reboiler to regenerate the glycol. On many dehydrators, the still is placed vertically on top of the reboiler so that vapors from the reboiler directly enter the bottom of the distillation column. To prevent excessive glycol losses due to vaporization at the top of the column, a condenser usually controls reflux. A phase separator (flash tank) between the absorber and the still may exist to remove the lighter dissolved gases from the warm rich glycol, which thereby reduces VOC emissions from the still. The glycol-circulating pump moves the glycol through the system. Hydrocarbons in the natural gas are removed with the water and the rich glycol stream can contain as much as 1%-dissolved hydrocarbons. These hydrocarbons are driven off in the regenerator and are emitted into the atmosphere along with the water, unless the exhaust from the regenerator is abated using a

reboiler and/or condenser. The VOCs from the regenerator vent contain benzene, toluene, ethylbenzene, and xylene isomers (collectively known as BTEX).

Production and injection wells require a permit per Regulation 2-1-128.15. Production wells may be grouped as a single source if the wells are located in the same general area. Injection wells may be grouped as a single source if the wells are located in the same general area. The source description for each group of wells should include the total number of wells and identification numbers.

Any internal combustion engine over 50 HP requires a permit per Regulation 2-1-114.2.1. Most natural gas and crude oil production facilities use natural gas engines to run their compressors; and such engines are generally greater than 250 HP. Hence, most compressor engines require air permits.

The natural gas heaters used in mechanical separators typically have firing rates less than 1 MMBTU/hr. Hence, such heaters are exempt from permitting requirements per Regulation 2-1-114.1.2.

Fugitive emissions from leaking process equipment and control systems include pumps, valves, compressors, and flanges. The emissions from these components should be identified and accounted for with the application for the natural gas or crude oil production facility.

Storage vessels and separator vessels, which contain hydrocarbon condensate, require a permit if the vessel is greater than 260 gallons in capacity, per Regulation 2-1-123.1 and contain an organic layer which is greater than 1 weight percent VOC per Regulation 2-1-123.6. The permitting of these storage tanks is covered in the permit handbook for Organic Liquid Storage Tanks.

Completeness Determination

The following District forms should be completed and fees provided for the natural gas facilities. Use the Completeness Determination Checklist to verify completeness. Use the Data Form Guidance to ensure that the forms are completed correctly. Use the Fee Calculation Guidance to ensure that the fees are calculated accurately.

1. Form 101-B (one for facility).
2. Form C (one per compressor engine)
3. Form G (one per dehydrator, one per group of production wells, and one per group of injection wells)
4. Form T (one per tank).
5. Natural Gas Analysis of "wet" gas.
6. Dehydrator Specifications, if present.
7. Identification of the total number of components (pumps, valves, compressors, and flanges of natural gas or crude oil production facility).
8. Identification of the total number of high-bleed and low-bleed pneumatic devices
8. Water analysis of the condensate.
9. If compressor engine, dehydrator, or condensate tank exhausts into add-on abatement device, Form A (one per device).
10. If Health Risk Screening is triggered, Form HRSA (one per source).
11. Fees, calculated per Regulation 3 (Schedule B) for compressor engines, (Schedule C) for condensate tanks; and (Schedule F) for dehydrators.

Emission Calculations

WELL EMISSIONS
Emissions associated with production and injection wells are from fugitive components. Fugitive emissions from component leaks occurring at wells shall be included under the fugitive emissions calculations.

COMPRESSOR EMISSIONS
Emissions from the compressor engines are estimated using the emission factors associated with that engine. Refer to the permit handbook chapter 2.3.2.

DEHYDRATOR EMISSIONS
Emissions from the dehydrator are from the reboiler stack and the flash drum. The flash drum gases are typically used to fuel the reboiler. A VOC control efficiency of 98% is expected for the reboiler. A condenser usually abates the vent from the reboiler stack. The resulting emissions from the reboiler burner exhaust (from the flash gas) and the reboiler stack and condenser should be estimated using the Gas Research Institute's GRI-GLYCalc Program as recommended by EPA. To use this program, the applicant must provide the following information:

1) Dehydrator specifications
2) Wet gas analysis

The permit should contain a limit on hourly mass emission rates for VOC and benzene to ensure that the stated destruction efficiencies are achieved. In addition, an initial source test and additional annual source tests in the summer months should also be required in the permit conditions. The permit engineer should summarize and include a copy of the results in the evaluation report.

FUGITIVE EMISSIONS
Additional sources of emissions are from the fugitive emissions from valves, flanges, connectors, compressors, and pumps. For each source in a permit application, the applicant must provide the number of fugitive components in each of the different service lines (i.e., wet gas, dry gas, rich glycol, lean glycol). These fittings are exempt from the Natural Gas and Crude Oil Production rule as per Regulation 8-37-111, since this is not a distribution, storage, or transportation facility. The fittings are also exempt from the Valves and Flanges at Chemical Plants rule as per Regulation 8-22-113, since only natural gas or crude oil is being handled. Therefore, the emission factors proposed for this installation are the "uncontrolled" emission factors from the "California Implementation Guidelines for Estimating Mass Emissions of Fugitive Hydrocarbon Leaks at Petroleum Facilities" prepared by the California Air Pollution Control Officers Association Engineering Managers Committee (CAPCOA) and the California Air Resources Board (ARB). The applicant will be limited to 10,000 ppmv TCH at the fugitive components so that the "<10,000 ppm" emission factors of Table IV-2C "CAPCOA Oil and Gas Production Screening Value Range Emission Factors" may be used. The annual fugitive emission estimates for a given facility shall include emissions from a single pegged (>10,000 ppm) component leak occurring for 90 days, as allowed under Regulations 8-37-301 and 8-37-305. The ">10,000 ppm" emission factors may be used for this single pegged leaking component. For a

conservative emission estimate, the highest ">10,000 ppm" emission factor may be used for the single pegged leaking component. Other District-approved methodologies for estimating emissions may be acceptable provided that the calculated emissions are enforceable through permit conditions.

Component Type	Service Type	< 10,000 ppmv THC Emission Factor (kg/hr/source)[b]	≥ 10,000 ppmv THC Emission Factor (kg/hr/source)[b]
Valves	Gas/Light Liquid	3.5E-05	1.386E-01
	Light Crude Oil	1.90E-05	7.07E-02
	Heavy Crude Oil	1.40E-05	N/A
Pump seals	Gas/Light Liquid	9.96E-04	8.9E-02
	Light Crude Oil	2.65E-04	8.9E-02
	Heavy Crude Oil	N/A	N/A
Others[c]	Gas/Light Liquid	1.47E-04	1.376E-01
	Light Crude Oil	1.31E-04	7.1E-03
	Heavy Crude Oil	5.7E-05	N/A
Connectors	Gas/Light Liquid	1.20E-05	2.59E-02
	Light Crude Oil	1.0E-05	2.34E-02
	Heavy Crude Oil	8.0E-06	N/A
Flanges	Gas/Light Liquid	2.80E-05	6.1E-02
	Light Crude Oil	2.4E-05	2.6E-01
	Heavy Crude Oil	2.3E-05	N/A
Open-ended lines	Gas/Light Liquid	2.4E-05	5.49E-02
	Light Crude Oil	1.8E-05	2.22E-02
	Heavy Crude Oil	1.5E-05	7.11E-02

[a]Source: Fax Transmittal from STAR Environmental, dated December 17, 1997, entitled *Comparison of Screening Value Range Factors for Oil and Gas Production Operations*. These factors were developed using the separated oil and gas production default zero factors and pegged factors. Correlation equations for the petroleum industry (revised to reflect the technical corrections and adjustments discussed in Section III of the implementation guidelines) were used for components with screening values between background and 9,999 ppmv.
[b]These factors are for total organic compound emission rates (including non-VOC's such as methane and ethane) and apply to light crude, heavy crude, gas plant, gas production, and off shore facilities.
[c]The "Others" component type was derived from compressors, diaphragms, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods stuffing boxes, relief valves, and vents. This "Others" component type should be applied for any component type other than connectors, flanges, open-ended lines, pumps, or valves.

To determine the VOC or NMHC emissions and toxic air contaminant emissions from the fugitives associated with the dehydrator, the composition of each stream from the GRI-GLYCalc program is used. Combustion emissions from the reboiler are determined using AP-42 Emission

Factors from Table 1.4-1 for Natural Gas Combustion for Boilers less than 100 MMBtu/hr. Refer to the permit handbook chapter 2.1.

To determine the VOC or NMHC emissions and toxic air contaminant emissions from the fugitives associated with other sources (i.e. engines, tanks, etc.), use the composition of each stream associated with the given source.

PNEUMATIC DEVICE EMISSIONS

Natural gas powered pneumatic devices operate valves automatically and control pressure, flow, temperature, and liquid levels. As part of normal operation, these devices release natural gas to the atmosphere. Pneumatic devices are categorized as continuous bleed, actuating/intermittent bleed, and self-contained devices. A continuous bleed device is used to modulate flow, liquid level, or pressure and will generally vent gas at a steady rate. An actuating or intermittent bleed device performs snap-acting control and release gas only when it strokes a valve open or closed or as it throttles gas flow. A self-contained device releases gas into the downstream pipeline, not to the atmosphere. According to an EPA guidance document "Options for Reducing Methane Emissions from Pneumatic Devices in the Natural Gas Industry," any pneumatic device that bleeds in excess of 6 scf/hr is categorized as a high-bleed device. As described in the EPA document and based on industry trends, most existing high-bleed devices can be replaced with low-bleed devices or retrofitted or configured for low-bleed operation.

For each source in a permit application, the applicant must provide the total number of high-bleed and low-bleed pneumatic devices. Emissions for a given pneumatic device may be determined by applying the wet gas analysis data to the the gas bleed rate for the device. For facilities that do not use high-bleed devices, the default bleed rate of 6 scf/hr may be assumed in the emission calculations in lieu of device-specific bleed rates. Facilities that use high-bleed devices must provide device-specific bleed rates and supporting documentation for each high-bleed device, and such facilities may be subject to additional fugitive monitoring and/or control requirements. The aforementioned EPA document contains a list of bleed rates for various pneumatic devices.

STORAGE AND SEPARATOR TANKS

The storage or separator tank emissions are estimated using the EPA Tanks 4.0 Program. The tank contains condensate with a layer of volatile hydrocarbons. The hydrocarbons float to the top of the tank and emissions should be calculated assuming that the tank contents are 100%. Based on analysis of the condensate from natural gas production wells within the District, it has been determined that the hydrocarbon is similar to gasoline with a RVP of 9. This is a very conservative estimate. Refer to permit handbook chapter 4.

Toxic Risk Screening:

Emissions of hexanes, benzene, toluene, ethyl benzene, and xylene may be emitted from the dehydrator, fugitive, combustion, and condensate tanks. The permit engineer should ensure that the emission calculations include the hourly and annual emission estimates for these TACs to determine whether an acute or chronic risk screening trigger level listed in Table 2-5-1 of Regulation 2-5 is exceeded.

Applicable Requirements

District Rules and Regulations

Natural gas compressor engines at natural gas or crude oil production facilities are generally subject to the nitrogen oxides and carbon monoxide emission limits of Regulation 9-8-301 because they are generally greater than 250 HP per Regulation 9-8-110.1.

Glycol Natural Gas Dehydrators are generally not subject to the standards of Regulation 8-2 because it is a natural gas operation per Regulation 8-2-110. In addition, it is also not subject to the fugitive provision of Regulation 8-37, because the rule does not apply to natural gas distribution, transportation and storage facilities per Regulation 8-37-111. However, the facility must apply for this exemption per Regulation 8-37-403 by submitting a written petition for exemption to the APCO.

In addition, the other fugitive components associated with the natural gas or crude oil production facility are not subject to the fugitive provisions of Regulation 8-37 for any facility, which processes natural gas streams that contain more than 90% methane by volume per Regulation 8-37-112. Similarly, the facility must also apply for this exemption by submitting a written petition for exemption to the APCO. The facility must submit this petition annually. The facility must show by gas analysis, on an annual basis, that the percentage of methane in the natural gas stream is more than or equal to 90% by volume. The fittings are also exempt from the Valves and Flanges at Chemical Plants rule as per Regulation 8-22-113, since only natural gas is being handled.

The storage and separator tanks are generally subject to the provisions of Regulation 8-5 because the condensate usually always contains a layer of hydrocarbon, which has a vapor pressure greater than 0.5 psia. As a result, as long as the storage tank is greater than 260 gallons (per Regulation 8-5-110.1), it is subject to the standards of Regulation 8-5. The glycol natural gas dehydrators and tanks are not expected to be significant sources of particulates or sulfur dioxide. As a result, the natural gas production facilities are expected to comply with Regulation 6-1 and Regulation 9-1.

Best Available Control Technology (BACT)

BACT for Natural Gas Production Facilities are not yet specified in the BACT/TBACT Workbook. However, San Joaquin Valley Unified Air Pollution Control has deemed a still bottom combustor (thermal oxidizer) operating at 95% destruction efficiency to be BACT for a dehydrator in their BACT guidelines (section 1.8.3).

The following are applicable BACT requirements for:

Internal Combustion Engines
- I. C. Engine - Spark Ignition, Natural Gas Fired Rich Burn Engine
- I. C. Engine - Spark Ignition, Natural Gas Fired Lean Burn Engine

Organic Liquid Storage Tanks
- Storage Tanks - Fixed Roof, Organic Liquids, <20,000 gal
- Storage Tanks - Fixed Roof, Organic Liquids, >=20,000 gal

Inform the BACT Coordinator of updates to the BACT/TBACT Workbook.

NSPS

The glycol natural gas dehydrators may be subject to the NSPS, Subpart KKK: Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants, if it is located at a an onshore natural gas processing plant as defined in the NSPS. The permit engineer should review the proposed application to ensure that any proposed dehydrator is either exempt from the NSPS or complies with the NSPS.

Furthermore, if the facility does contain a sweetening unit or sulfur recovery unit, the facility is subject to NSPS, Subpart LLL: Standards of Performance for Onshore Natural Gas Processing: SO2 Emissions.

A facility that commences construction, reconstruction, or modification after August 23, 2011 may be subject to NSPS Subpart OOOO: Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution. The permit engineer should review the proposed application to ensure that any affected sources are either exempt from the NSPS or complies with the NSPS.

NESHAPS

If the facility is a major source of HAPs, the glycol natural gas dehydrators, storage vessels, and ancillary equipment at natural gas production facilities may be subject to NESHAPS 40 CFR 63 Subpart HH: National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities; while the dehydrators at natural gas transmission and storage facilities may be subject to the NESHAPS 40 CFR 63 Subpart HHH: National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities. The permit engineer should review the proposed application to ensure that any proposed dehydrator and/or storage vessels are either exempt from the NESHAPS or complies with the NESHAPS, if the facility is a major source of HAPs.

California Environmental Quality Act (CEQA)

Permit applications which are reviewed following the specific procedures, fixed standards and objective measurements set forth in this chapter (3.5) are classified as ministerial and will accordingly be exempt from CEQA review per Regulation 2-1-311.

In addition to the above-mentioned source-specific applicable requirements, other requirements may also be applicable depending on the facility, its application emissions, and its source location:

- Offsets
- Prevention of Significant Deterioration
- School Notification
- Risk Screening Analysis

Permit Conditions

Standardized conditions for natural gas facilities are available from the Permit Condition Guidance. Refer to the Evaluation Report Template Guidance to obtain the Microsoft Word formatted permit conditions for this source category.