Oil and Gas Production Facilities
Chapter 6, Section 2 Permitting Guidance

June 1997
Revised November 1998
Revised January 2000
Revised August 2001
Revised July 28, 2004 (specific guidance for Jonah/Pinedale Anticline Area)
Revised August 2007
Revised March 2010
Revised September 2013 (Added specific guidance for UGRB and revisions to JPAD)

This Guidance applies to surface oil and gas production facilities where hydrocarbon fluids are produced, processed and/or treated prior to custody transfer from the facility.

This Guidance does not apply to natural gas-fired engines unless the engine is used to power a pumping unit. This Guidance also may not be used for sour gas (H_2S) production facilities unless the only emissions of H_2S will be those associated with fugitive losses from valves, fittings, surface piping and pneumatic devices, etc. If there will be H_2S emissions associated with vented gas or tank vapors or if sour gas will be flared the applicant shall contact the Division for permitting guidance prior to construction. This Guidance does not apply to sour (contained H_2S) production facilities.

The Presumptive BACT permitting requirements under this Guidance apply to facilities with associated wells spud on/after August 1, 2010 and to facilities with a modification occurring on/after August 1, 2010, except for facilities located in the **UGRB** and **JPAD/NPL**.

For facilities located in the **UGRB** and **JPAD/NPL**, the Presumptive BACT permitting requirements under this Guidance apply to facilities with associated wells with the first date of production (FDOP) on/after November 1, 2013 and to facilities with a modification occurring on/after November 1, 2013.

Startup or modification of a facility may occur prior to obtaining an Air Quality Permit or Waiver only when the Presumptive BACT permitting requirements under this Guidance are met. Otherwise, an Air Quality Permit or Waiver shall be obtained prior to start up or modification of a facility.

For the purposes of this Guidance **CDA** refers to facilities located in **Concentrated Development Areas**.

UGRB refers to facilities located in the **Upper Green River Basin.**

JPAD/NPL refers to facilities located in the **Jonah and Pinedale Anticline Development Area and Normally Pressured Lance**.

STATEWIDE refers to all facilities not located in the CDA or UGRB.

Table of Contents

Table of Contents (cont.)

Table of Contents (cont.)

Acronyms and Abbreviations

AQD	Air Quality Division
API	American Petroleum Institute
BACT	Best Available Control Technology
BBL	barrel
BPD	barrels per day
BTEX	Benzene/Toluene/ Ethyl-benzene/Xylenes
Btu	British thermal unit
C6 S2	Chapter 6 Section 2 (of the WAQSR)
CAA	Clean Air Act Amendments of 1990
CDA	Concentrated Development Area
CO	Carbon Monoxide
EPA	Environmental Protection Agency
gpm	gallons per minute
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutants
HP	high pressure
Hp	horsepower
JPAD	Jonah & Pinedale Anticline Development Area
lb	pound
LP	low pressure
MMBtu	one million BTUs
MMSCF	one million standard cubic feet ($SCF \times 10^6$) (MMSCFD = 1,000,000 SCF per day)
MSCF	one thousand standard cubic feet (SCF×1000) (MSCFD=1000 SCF per day)
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOI	Notice of Installation
NOV	Notice of Violation
NO_X	Nitrogen Oxides
NSPS	New Source Performance Standards
NSR	New Source Review
pph	pounds per hour
PPMV	parts per million by volume
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
psia	pounds per square inch absolute
SCF	standard cubic foot
SO_2	Sulfur Dioxide
S/W/B	Standing/Working/Breathing losses
TEG	Tri-Ethylene Glycol
TPY	Tons per Year
VOC	Volatile Organic Compounds
WAQD	Wyoming Air Quality Division
WAQSR	Wyoming Air Quality Standards and Regulations
WDEQ	Wyoming Department of Environmental Quality

Introduction

The Chapter 6 Section 2 Oil and Gas Production Facilities Permitting Guidance (C6 S2 Guidance) document serves as a supplement to the **Wyoming Air Quality Standards and Regulations** (**WAQSR**) Chapter 6 Section 2 New Source Review (NSR) permitting program. The C6 S2 Guidance applies solely to the permitting of oil and gas production facilities.

Obtain a copy of the C6 S2 Guidance by contacting the Wyoming Air Quality Division at **(307) 777-7391** or download a PDF version from http://deq.state.wy.us/aqd/

Applicability

If **ANY** air pollutant will be released to the atmosphere from a new or modified facility, the facility is subject to the **WAQSR** and the Wyoming Environmental Quality Act.

Owners/operators of **ALL** regulated air emission sources constructed or modified after May 29, 1974 shall comply with the WAQSR Chapter 6, Section 2 permitting requirements.

Failure to comply with Wyoming air quality regulations may result in an enforcement action in the form of a "Notice of Violation" and penalties of up to $10,000.00 per day.

To obtain a copy of the WAQSR contact the Wyoming Air Quality Division at (307) 777-7391 or download the PDF version from http://deq.state.wy.us/aqd/

Air pollutants associated with O&G production facilities are:

Volatile Organic Compounds (**VOC**): Hydrocarbon compounds excluding methane (C_1) and ethane (C_2). VOCs are also referred to as C_3^+ compounds – propane, butane, pentane, hexane, + etc.

Hazardous Air Pollutants (**HAP**): Section 112(b) of the Clean Air Act lists 188 HAPs. HAPs commonly associated with O&G production are BTEX and n-hexane (benzene, toluene, ethyl-benzene, xylenes and n-C_6).

Nitrogen Oxides (**NO_X**): NO_X emissions are the result of natural gas combustion.

Carbon Monoxide (**CO**): CO emissions are the result of natural gas combustion.

Hydrogen Sulfide (**H_2S**): Sour gas and **Sulfur Dioxide** (**SO_2**) created when sour gas is combusted.

Production Facility Emission Sources

O&G production facilities emission sources:

Storage Tanks: Vapors containing regulated air pollutants are released from solution as oil, condensate and water are transferred from separation equipment to atmospheric storage tanks. These vapors are called **flashing losses**. Vapors evaporated or displaced from tanks are called **working and breathing (also called standing) losses**.

Dehydration Units: Glycol, usually tri-ethylene glycol (TEG), is used in dehydration units to absorb water from wet produced gas. "Lean" TEG contacts the wet gas and absorbs water. The TEG, now considered "rich" is routed through a flash separator and/or reboiler for regeneration. Vapors released from the flash separator and reboiler still vent contain regulated air pollutants.

Pressurized Process Vessels: Vapors vented from gun barrels, separators, treaters, water knockouts, gas boots, flash separators, drip pots, etc. contain regulated air pollutants. The discharge lines and vents from all of these vessels shall be considered when determining emission sources.

Natural Gas-Fired Equipment: Some of the byproducts of natural gas combustion in process heaters, boilers, burners, flares, engines, etc. are regulated air pollutants.

Fugitives: All production facilities contain numerous equipment components such as valves, flanges, threaded connections, tubing connections, open-ended lines, pump seals, etc which are manufactured and installed in ways intended to contain gases or liquids. Over time some of them begin to leak. Unintentional emissions associated with leaks are called fugitive emissions. For purposes of this Guidance, emissions from components that are improperly designed (e.g. enardo valves over pressurizing, failure of thief hatches to reseat after over pressurizing) or equipment not maintained properly (e.g., thief hatch left open) are not considered to be fugitive emissions.

Pneumatic Pumps & Controllers: The discharge vapors from natural gas-operated pneumatic equipment contain regulated air pollutants.

Truck Loading: Vapors displaced from truck tanks during the loading of oil or condensate contains regulated air pollutants.

Venting & Blow down: Natural gas and liquids contain regulated air pollutants.

BACT and Presumptive BACT

Under C6 S2, all new or modified sources or facilities which may generate regulated air emissions shall be permitted prior to start up or modification and **Best Available Control Technology (BACT)** shall be applied to reduce or eliminate emissions, with consideration given for technical feasibility and economical reasonableness. **BACT** is a process, not an emission limit. Regulation does not set a minimum emission threshold below which **BACT** does not need to be considered.

At O&G facilities production rates and associated pollutant emissions are usually unknown prior to start up. The AQD has tailored a permitting program allowing for the start up or modification of O&G facilities prior to permitting provided specific emission control requirements are met.

This is the **Presumptive BACT** permitting process for O&G production facilities.

Presumptive BACT requirements have been established for emissions associated with:

- Flashing & working/breathing losses from atmospheric storage tanks and pressurized vessels
- Dehydration unit process vents
- Natural gas-operated pneumatic equipment
- Natural gas-fired pumping unit engines

If emissions **are** known prior to construction or modification, a permit shall be obtained **PRIOR TO CONSTRUCTION or MODIFICATION** and Presumptive BACT shall be addressed in the application. Examples include:

- Construction of a central tank battery for collecting and processing production from surrounding existing wells with known production rates;
- Consolidation of multiple existing facilities for which production rates have been established;
- Installation of a dehydration unit for an existing well with an established gas production rate;
- Installation of larger capacity equipment to replace undersized equipment;
- Replacement of an emission control system or device with a different system or device.

Presumptive BACT requirements have been established for four (4) areas:

CDA refers to facilities located in **Concentrated Development Areas**.

UGRB refers to facilities located in the **Upper Green River Basin.**

JPAD/NPL refers to facilities located in the **Jonah and Pinedale Anticline Development Area and Normally Pressured Lance**.

STATEWIDE refers to all facilities not located in the **CDA**, **UGRB**, or **JPAD/NPL**

The **CDA** is defined by six (6) counties: Uinta, Lincoln, Carbon, Sweetwater, Fremont, and Natrona

The **UGRB** area is defined as:

Sublette County: (all)

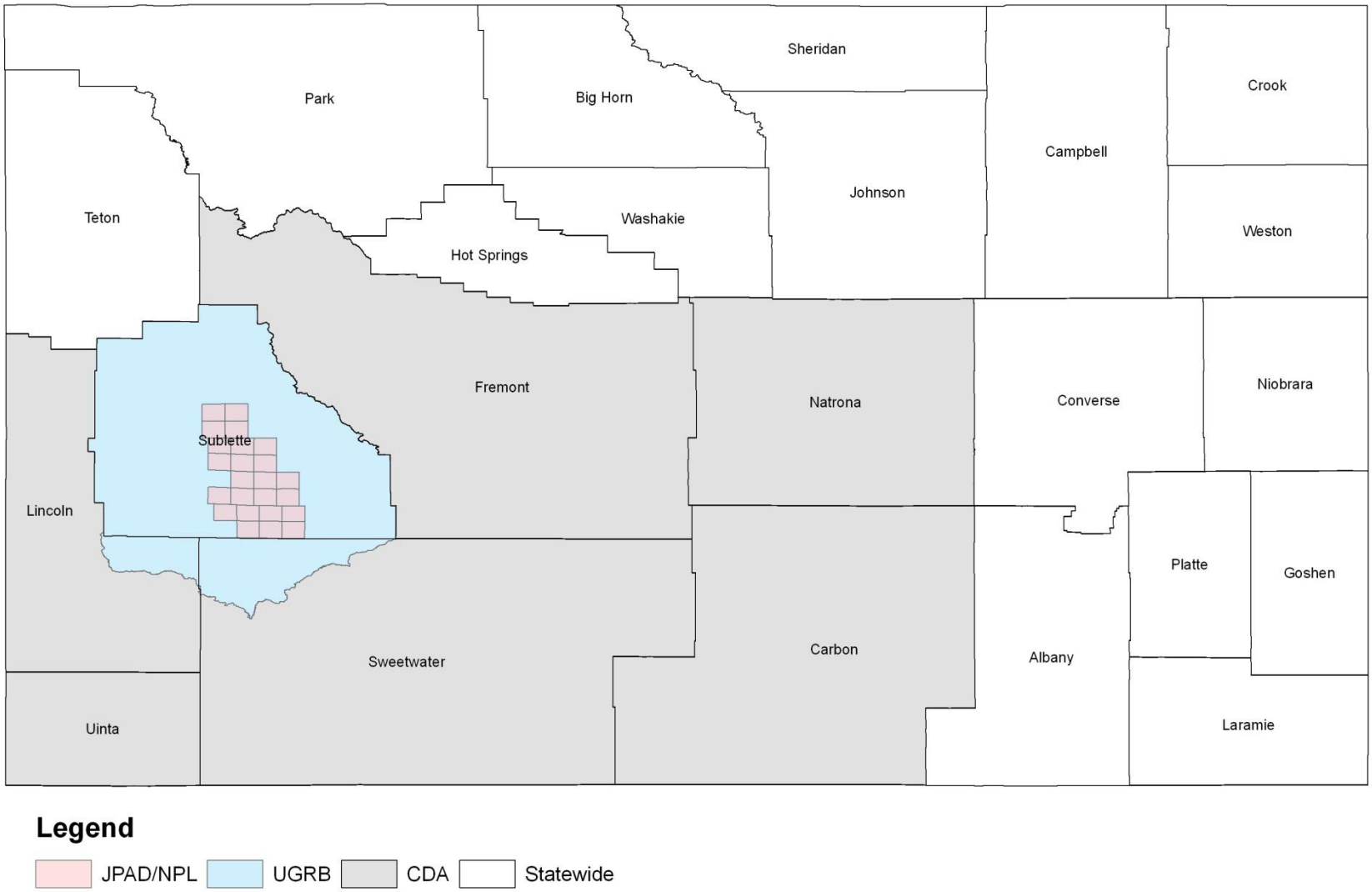
Lincoln County: (part) The area of the county north and east of the boundary defined by a line starting at the point defined by the intersection of the southwest corner Section 30 Range (R) 115 West Township (T) 27N and the northwest corner of Section 31 R 115 West T 27N of Sublette County at Sublette County's border with Lincoln County. From this point the boundary moves to the west 500 feet to the Aspen Creek. The boundary follows the centerline of Aspen Creek downstream to the confluence of Aspen Creek and Fontenelle Creek (in R 116 W T26N, Section 1). From this point the boundary moves generally to the south along the centerline of Fontenelle Creek to the confluence of Fontenelle Creek and Roney Creek (in R115W T24N Section 6). From the confluence, the boundary moves generally to the east along the centerline of Fontenelle Creek and into the Fontenelle Reservoir (in R112W T24N Section 6). The boundary moves east southeast along the centerline of the Fontenelle Reservoir and then toward the south along the centerline of the Green River to where the Green River in R111W T24 N Section 31 crosses into Sweetwater County.

Sweetwater County: (part) The area of the county west and north of the boundary which begins at the midpoint of the Green River, where the Green River enters Sweetwater County from Lincoln County in R111W T24N Section 31. From this point, the boundary follows the center of the channel of the Green River generally to the south and east to the confluence of the Green River and the Big Sandy River (in R109W R22 N Section 28). From this point, the boundary moves generally north and east along the centerline of the Big Sandy River to the confluence of the Big Sandy River with Little Sandy Creek (in R106W T25N Section 33). The boundary continues generally toward the northeast long the centerline of Little Sandy Creek to the confluence of Little Sandy Creek and Pacific Creek (in R106W T25N Section 24). From this point, the boundary moves generally to the east and north along the centerline of Pacific Creek to the confluence of Pacific Creek and Whitehorse Creek (in R103W T26N Section 10). From this point the boundary follows the centerline of Whitehorse Creek generally to the northeast until it reaches the eastern boundary of Section 1 R103W T 26North. From the point where Whitehorse Creek crosses the eastern section line of Section 1 R103W T 26North, the boundary moves straight north along the section line to the southeast corner of Section 36 R103W T27N in Sublette County where the boundary ends.

The **JPAD/NPL** area is defined as:

109W & R110W in T34N,
R109W & R110W in T33N,
R108W, R109W & R110W in T32N,
R108W, R109W & R110W in T31N,
R107W, R108W & R109W in T30N,
R107W, R108W, R109W, & R110W in T29N,
R107W, R108W, R109W, & R110W in T28N,
and R107W, R108W & R109W in T27N

The **STATEWIDE** refers to all other areas.


Park
Sheridan
Big Horn
Crook
Campbell
Johnson
Teton
Washakie
Weston
Hot Springs
Fremont
Natrona
Converse
Niobrara
Sublette
Lincoln
Platte
Goshen
Sweetwater
Carbon
Albany
Uinta
Laramie
Legend
JPAD/NPL
UGRB
CDA
Statewide

Presumptive BACT Requirements for Statewide Facilities

Flashing

For the purpose of determining flashing emissions all vapor streams containing VOC or HAP components from all storage tanks (e.g., oil, condensate, produced water with oil or condensate carryover) and all separation vessels (e.g., gun barrels, production and test separators, production and test treaters, water knockouts, gas boots, flash separators, drip pots, etc.) at a facility which are or may be vented to the atmosphere shall be considered.

New Facilities
Within 60-days of the First Date of Production (FDOP), flashing emissions containing greater than or equal to 10 TPY VOC shall be controlled by at least 98%.

Modified Facilities
Within 60-days of modification, new and existing flashing emissions containing greater than or equal to 10 TPY VOC shall be controlled by at least 98%.

New and Modified Facilities
Condensate and oil tanks that are on site for use during emergency or upset conditions, such as spare tanks at facilities connected to liquids gathering systems, are not subject to the 98% control requirements.

The removal of flashing emissions control devices may be allowed upon approval after one year if VOC flashing emissions have declined to less than, and are reasonably expected to remain below 8 TPY.

Presumptive BACT Requirements for Statewide Facilities (cont.)

Dehydration Units

To meet the P-BACT requirements for dehydration units, operators must follow either Scenario 1 or Scenario 2.

For the purpose of determining emissions from dehydration units, vapor streams containing VOC or HAP components released from the process vents (reboiler still vents & glycol flash separator vents) of all dehydration units at a facility which are or may be vented to the atmosphere shall be considered.

Scenario 1

New Facilities

PAD Facilities

Upon FDOP, all dehydration unit VOC and HAP emissions shall be controlled by at least 98%. After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 6 TPY and
- All units are equipped with still vent condensers.

Single Well Facilities

Upon FDOP, all dehydration units shall be equipped with reboiler still vent condensers. The condensers may not later be removed.

Within 60-days of FDOP, if total **potential uncontrolled**[1] VOC emissions from all units are greater than or equal to 6 TPY, emissions from all units shall be controlled by at least 98%.

After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 6 TPY and
- All units are equipped with still vent condensers.

Modified Facilities

Requirements are the same as those for PADs and single well facilities except use the date of modification in place of FDOP. Control requirements apply to existing and new dehydration units.

[1] See definitions on Page 9

Presumptive BACT Requirements for Statewide Facilities (cont.)

Dehydration Units

Scenario 2

New PAD and Single Well Facilities

Upon FDOP, all dehydration units shall be equipped with glycol flash separators and reboiler still vent condensers. Removal of the flash separators and condensers will not be allowed.

Within 30-days of FDOP, if total **potential uncontrolled**[1] VOC emissions from all dehydration units are greater than or equal to 8 TPY, at least 98% control of emissions shall be installed and operational on all units.

After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 8 TPY and
- All units are equipped with flash separators and still vent condensers.

Modified Facilities

Upon modification, glycol flash separators and reboiler still vent condensers shall be installed and operating on all new and existing dehydration units. Removal of the flash separators and condensers will not be allowed.

Within 30-days of modification, if total **potential uncontrolled**[1] VOC emissions are greater than or equal to 8 TPY, at least 98% control of emissions shall be installed and operational on all new and existing dehydration units.

After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 8 TPY and
- All units are equipped with flash separators and still vent condensers.

All Facilities

When a combustion unit is required at a facility for control of flash or dehydration unit emissions, all non-condensable still vent vapors shall be collected and routed to the combustion unit for at least 98% control of VOC and HAP emissions and all glycol flash separator vapors shall be collected and routed to the combustion unit for at least 98% control of VOC and HAP emissions and/or used as fuel for process equipment burners.

At facilities where a combustion unit is not required for control of flash or dehydration unit emissions, all glycol flash separator vapors shall be collected for use as fuel in process equipment burners. Excess flash vapors that are not used as fuel may be vented to the atmosphere.

[1] See definitions on Page 9

Presumptive BACT Requirements for Statewide Facilities (cont.)

Dehydration Units

Potential Uncontrolled VOC emissions shall be determined using GRI-GLYCalc V3.0 or higher or other method accepted by the Division and shall be based on the projected, year one, average daily dry gas throughput rate, maximum circulation rate for the glycol circulation pump(s) installed, average expected operating parameters for wet gas temperature and pressure, maximum dry gas water content or number of absorber stages and extended hydrocarbon content of the wet gas from a sample of the wet gas taken upstream of the dehydration unit contact tower. Flash separators and still vent condensers, limited operating hours and limited glycol circulation rates shall not be considered when determining potential uncontrolled emissions.

Still vent condensers shall consist of equipment engineered and designed to achieve maximum condensation of the condensable components in the still vent vapors by providing adequate temperature differentials between the condenser outlet and still vent stream. Still vent pipes shall not be considered condensers.

Potential emissions for determining combustion device removal after one year shall be calculated using GRI-GLYCalc V3.0 or higher or other method accepted by the Division based on the most recent 30-days of normal gas production rates, actual average wet gas temperature and pressure, actual water content of the dried gas or number of absorber stages, "worst case" operating parameters of the glycol flash separator and still vent condenser.

"Worst case" flash separator and condenser parameters are:

1) maximum glycol flash separator operating pressure
2) lowest glycol flash separator operating temperature
3) maximum still vent condenser outlet temperature
4) maximum still vent condenser outlet pressure
5) all vapors from flash separator are vented

Actual operating parameters for glycol flash separators and still vent condensers may be used upon approval. Limited operating hours and limited glycol circulation rates shall not be considered when determining potential emissions.

Presumptive BACT Requirements for Statewide Facilities (cont.)

Pneumatic Pumps

New Facilities

PAD Facilities

Upon FDOP, VOC and HAP emissions associated with the discharge streams of all natural gas-operated pneumatic pumps shall be controlled by at least 98% or the pump discharge streams shall be routed into a closed loop system (e.g., sales line, collection line, fuel supply line).

Single Well Facilities

Within 60-days of FDOP,

At sites with combustion units installed for the control of flash or dehydration unit emissions:

VOC and HAP emissions associated with the discharge streams from natural gas-operated pneumatic pumps shall be controlled by at least 98% by routing the pump discharge streams into the combustion unit or the discharge streams shall be routed into a closed loop system.

At sites without combustion units installed for the control of flash or dehydration unit emissions:

Pneumatic pumps (other than those for heat trace/heat medium/hot glycol circulation) shall be solar, electric or air-driven pumps in lieu of natural gas-operated pneumatic pumps. Wherever possible, heat trace/heat medium/hot glycol circulation pumps shall be solar-operated, electric or air-driven.

Modified Facilities

Requirements are the same as above except include all new and existing pneumatic pumps and use the date of modification in place of FDOP.

New and Modified Facilities

At sites where pneumatic pump emissions are controlled by a combustion unit used for the control of flash or dehydration unit emissions, control of the pneumatic pump emissions will be evaluated upon request for removal of the combustion unit. (See Flashing, Page 6)

Presumptive BACT Requirements for Statewide Facilities (cont.)

Pneumatic Controllers

New Facilities

Upon FDOP, natural gas-operated pneumatic controllers shall be low* or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Modified Facilities

Upon modification, new natural gas-operated pneumatic controllers shall be low or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Within 60-days of modification, existing natural gas-operated pneumatic controllers shall be replaced by or converted to low or no-bleed controllers or the discharge streams of the existing natural gas-operated controllers shall be routed into a closed loop system.

* low bleed devices vent less than 6 cfh

Blowdown and Venting

Best Management Practices (BMP) and information gathering requirements will be incorporated into permits for new and modified facilities.

BMP: During manual and automated blow down/venting episodes associated with liquids unloading, wellbore depressurization in preparation for maintenance or repair, hydrate clearing, emergency operations, equipment depressurization, etc., associated VOC and HAP emissions shall be minimized to the extent practicable. During manual blow down/venting, personnel shall remain on site to ensure minimal gas venting occurs.

Information Gathering: Specific recordkeeping and reporting requirements will be established during the permitting process and will include estimates of associated regulated air pollutants, reasons for episodes, durations of episodes, steps taken to minimize emissions and descriptions of emission estimation methods.

Emission Sources without Presumptive BACT requirements

For uncontrolled sources emitting greater than or equal to 8 TPY VOC or greater than or equal to 5 TPY total HAPs that do not have P-BACT requirements, a BACT analysis shall be filed with the permit application for the associated facility.

Presumptive BACT Requirements for CDA Facilities

Flashing

For the purpose of determining flashing emissions all vapor streams containing VOC or HAP components from all storage tanks (e.g., oil, condensate, produced water with oil or condensate carryover) and all separation vessels (e.g., gun barrels, production and test separators, production and test treaters, water knockouts, gas boots, flash separators, drip pots, etc.) at a facility which are or may be vented to the atmosphere shall be considered.

New Facilities

PAD Facilities

Upon FDOP, VOC and HAP flashing emissions shall be controlled by at least 98%.

Single Well Facilities

Within 60-days of FDOP, flashing emissions containing greater than or equal to 8 TPY VOC shall be controlled by at least 98%.

Modified Facilities

PAD Facilities

Upon modification, all new and existing VOC and HAP flash emissions shall be controlled by at least 98%.

Single Well Facilities

Within 60-days of modification, all new and existing flashing emissions containing greater than or equal to 8 TPY VOC shall be controlled by at least 98%.

New and Modified Facilities

Condensate and oil tanks that are on site for use during emergency or upset conditions, such as spare tanks at facilities connected to liquids gathering systems, are not subject to the 98% control requirements.

The removal of flashing emissions control devices may be allowed upon approval after one year if VOC flashing emissions have declined to less than, and are reasonably expected to remain below 8 TPY.

Presumptive BACT Requirements for CDA Facilities (cont.)

Dehydration Units

To meet the P-BACT requirements for dehydration units, operators must follow either Scenario 1 or Scenario 2.

For the purpose of determining emissions from dehydration units, vapor streams containing VOC or HAP components released from the process vents (reboiler still vents & glycol flash separator vents) of all dehydration units at a facility which are or may be vented to the atmosphere shall be considered.

Scenario 1

New Facilities

PAD Facilities

Upon FDOP, all dehydration unit VOC and HAP emissions shall be controlled by at least 98%. After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 6 TPY and
- All units are equipped with still vent condensers.

Single Well Facilities

Upon FDOP, all dehydration units shall be equipped with reboiler still vent condensers. Removal of the condensers will not be allowed.

Within 60-days of FDOP, if total **potential uncontrolled**[1] VOC emissions from all units are greater than or equal to 6 TPY, emissions from all units shall be controlled by at least 98%.

After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 6 TPY and
- All units are equipped with still vent condensers.

Modified Facilities

Requirements are the same as those for PADs and single well facilities except use the date of modification in place of FDOP. Control requirements apply to existing and new dehydration units.

[1] See definitions on Page 9

Presumptive BACT Requirements for CDA Facilities (cont.)

Dehydration Units

Scenario 2

New PAD and Single Well Facilities

Upon FDOP, all dehydration units shall be equipped with glycol flash separators and reboiler still vent condensers. Removal of the flash separators and condensers will not be allowed.

Within 30-days of FDOP, if total **potential uncontrolled**[1] VOC emissions from all dehydration units are greater than or equal to 8 TPY, at least 98% control of emissions shall be installed and operational on all units.

After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 8 TPY and
- All units are equipped with flash separators and still vent condensers.

Modified Facilities

Upon modification, glycol flash separators and reboiler still vent condensers shall be installed and operating on all new and existing dehydration units. Removal of the flash separators and still vent condensers will not be allowed.

Within 30-days of modification, if total **potential uncontrolled**[1] VOC emissions are greater than or equal to 8 TPY, at least 98% control of emissions shall be installed and operational on all new and existing dehydration units.

After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 8 TPY and
- All units are equipped with flash separators and still vent condensers.

All Facilities

When a combustion unit is required at a facility for control of flash or dehydration unit emissions, all non-condensable still vent vapors shall be collected and routed to the combustion unit for at least 98% control of VOC and HAP emissions and all glycol flash separator vapors shall be collected and routed to the combustion unit for at least 98% control of VOC and HAP emissions and/or used as fuel for process equipment burners.

At facilities where a combustion unit is not required for control of flash or dehydration unit emissions, all glycol flash separator vapors shall be collected for use as fuel in process equipment burners. Excess flash vapors that are not used as fuel may be vented to the atmosphere.

[1] See definitions on Page 9

Presumptive BACT Requirements for CDA Facilities (cont.)

Pneumatic Pumps

New Facilities

PAD Facilities

Upon FDOP, VOC and HAP emissions associated with the discharge streams of all natural gas-operated pneumatic pumps shall be controlled by at least 98% or the pump discharge streams shall be routed into a closed loop system (e.g., sales line, collection line, fuel supply line).

Single Well Facilities

Within 60-days of FDOP,

At sites with combustion units installed for the control of flash or dehydration unit emissions:

VOC and HAP emissions associated with the discharge streams from natural gas-operated pneumatic pumps shall be controlled by at least 98% by routing the pump discharge streams into the combustion unit or the discharge streams shall be routed into a closed loop system.

At sites without combustion units installed for the control of flash or dehydration unit emissions:

Pneumatic pumps (other than heat trace/heat medium/hot glycol circulation) shall be solar, electric or air-driven pumps in lieu of natural gas-operated pneumatic pumps. Wherever possible, heat trace/heat medium/hot glycol circulation pumps shall be solar-operated, electric or air-driven.

Modified Facilities

Requirements are the same as above except include all new and existing pneumatic pumps and use the date of modification in place of FDOP.

New and Modified Facilities

At sites where pneumatic pump emissions are controlled by a combustion unit used for the control of flash or dehydration unit emissions, control of the pneumatic pump emissions will be evaluated upon request for removal of the combustion unit. (See Flashing, Page 12)

Presumptive BACT Requirements for CDA Facilities (cont.)

Pneumatic Controllers

New Facilities

Upon FDOP, natural gas-operated pneumatic controllers shall be low* or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Modified Facilities

Upon modification, new natural gas-operated pneumatic controllers shall be low or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Within 60-days of modification, existing natural gas-operated pneumatic controllers shall be replaced by or converted to low or no-bleed controllers or the discharge streams of existing natural gas-operated pneumatic controllers shall be routed into closed loop system.

* low bleed devices vent less than 6 cfh

Well Completions

Operators shall submit applications to perform well completions using Best Management Practices. One permit will be issued to each company that drills and completes wells within the Concentrated Development Areas. The permits will be modeled after those issued to companies completing wells in the Jonah and Pinedale Anticline Development Area. An example of a well completions or "Green Completions" permit is available on the AQD website, http://deq.state.wy.us/aqd or a copy may be obtained by contacting the Wyoming Air Quality Division at **(307) 777-7391.**

Green Completion permit applications shall be filed with the Division by November 1, 2010.

Presumptive BACT Requirements for CDA Facilities (cont.)

Produced Water Tanks

New Facilities

PAD Facilities

Upon FDOP, VOC and HAP emissions from all active produced water tanks shall be controlled by at least 98%.

Single Well Facilities

Within 60-days of FDOP, at sites where flashing emissions must be controlled by at least 98%, VOC and HAP emissions from all active produced water tanks shall be controlled by at least 98%.

Modified Facilities

PAD Facilities

Upon modification, VOC and HAP emissions from all new active produced water tanks shall be controlled by at least 98%.

Within 60-days of modification, existing open-top, active, produced water tanks shall be taken out of service for use as active produced water tanks. All active produced water tanks shall be closed top and shall have VOC and HAP emissions controlled by at least 98%.

New and Modified Facilities

Open-top or blow down tanks shall not be used as active produced water tanks but may be used for blow down or for temporary storage during emergency or upset conditions, such as spare tanks at facilities connected to liquids gathering systems, and do not have to be tied into 98% control systems.

Removal of produced water tank emissions control may be allowed upon approval. (See Flashing, Page 12)

Presumptive BACT Requirements for CDA Facilities (cont.)

Blowdown/Venting

Best Management Practices (BMP) and information gathering requirements will be incorporated into permits for new and modified facilities.

BMP: During manual and automated blowdown/venting episodes associated with liquids unloading, wellbore depressurization in preparation for maintenance or repair, hydrate clearing, emergency operations, equipment depressurization, etc., associated VOC and HAP emissions shall be minimized to the extent practicable. During manual blowdown or venting, personnel shall remain on site to ensure minimal gas venting occurs.

Information Gathering: Specific recordkeeping and reporting requirements will be established during the permitting process and will include estimates of associated regulated air pollutants, reasons for episodes, durations of episodes, steps taken to minimize emissions and descriptions of emission estimation methods.

For companies with existing facilities as of the date of this Guidance, blowdown and venting permit applications shall be filed by November 1, 2010.

Emission Sources without Presumptive BACT requirements

For uncontrolled sources emitting greater than or equal to 8 TPY VOC or greater than or equal to 5 TPY total HAPs that do not have P-BACT requirements, a BACT analysis shall be filed with the permit application for the associated facility.

Presumptive BACT Requirements for UGRB Facilities

Flashing

For the purpose of determining flashing emissions all vapor streams containing VOC or HAP components from all storage tanks (e.g., oil, condensate, produced water with oil or condensate carryover) and all separation vessels (e.g., gun barrels, production and test separators, production and test treaters, water knockouts, gas boots, flash separators, drip pots, etc.) at a facility which are or may be vented to the atmosphere shall be considered.

New Facilities

PAD Facilities

Upon FDOP, VOC and HAP flashing emissions shall be controlled by at least 98%.

Single Well Facilities

Within 60-days of FDOP, for flashing emissions containing greater than or equal to 4 TPY VOC, VOC and HAP flashing emissions shall be controlled by at least 98%.

Modified Facilities

PAD Facilities

Upon modification, all new and existing VOC and HAP flash emissions shall be controlled by at least 98%.

Single Well Facilities

Within 60-days of modification, all new and existing flashing emissions containing greater than or equal to 4 TPY VOC, VOC and HAP flashing emissions shall be controlled by at least 98%.

New and Modified Facilities

Condensate and oil tanks that are on site for use during emergency or upset conditions, such as spare tanks at facilities connected to liquids gathering systems, are not subject to the 98% control requirements.

The removal of flashing emissions control devices may be allowed upon approval after one year if VOC flashing emissions have declined to less than, and are reasonably expected to remain below 4 TPY.

Presumptive BACT Requirements for UGRB Facilities (cont.)

Dehydration Units

For the purpose of determining emissions from dehydration units, vapor streams containing VOC or HAP components released from the process vents (reboiler still vents & glycol flash separator vents) of all dehydration units at a facility which are or may be vented to the atmosphere shall be considered.

New Facilities

PAD Facilities

Upon FDOP, all dehydration unit VOC and HAP emissions shall be controlled by at least 98%. After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 4 TPY and
- All units are equipped with still vent condensers.

Single Well Facilities

Upon FDOP, all dehydration units shall be equipped with reboiler still vent condensers. Removal of the condensers will not be allowed.

Within 60-days of FDOP, if total **potential uncontrolled**[1] VOC emissions from all units are greater than or equal to 4 TPY, VOC and HAP emissions from all units shall be controlled by at least 98%.

After one year, combustion units used to achieve the 98% control may be removed upon approval if

- Total **potential**[1] VOC emissions from all units are less than 4 TPY and
- All units are equipped with still vent condensers.

Modified Facilities

Requirements are the same as those for PADs and single well facilities except use the date of modification in place of FDOP. Control requirements apply to existing and new dehydration units.

All Facilities

When a combustion unit is required at a facility for control of flash or dehydration unit emissions, all non-condensable still vent vapors shall be collected and routed to the combustion unit for at least 98% control of VOC and HAP emissions and all glycol flash separator vapors shall be collected and routed to the combustion unit for at least 98% control of VOC and HAP emissions and/or used as fuel for process equipment burners.

At facilities where a combustion unit is not required for control of flash or dehydration unit emissions, all glycol flash separator vapors shall be collected for use as fuel in process equipment burners. Excess flash vapors that are not used as fuel may be vented to the atmosphere.

[1] See definitions on Page 9

Presumptive BACT Requirements for UGRB Facilities (cont.)

Pneumatic Pumps

New Facilities

Upon FDOP, VOC and HAP emissions associated with the discharge streams of all natural gas-operated pneumatic pumps shall be controlled by at least 98% or the pump discharge streams shall be routed into a closed loop system (e.g., sales line, collection line, fuel supply line).

Modified Facilities

Upon modification, VOC and HAP emissions associated with the discharge streams of all new and existing natural gas-operated pneumatic pumps shall be controlled by at least 98% or the pump discharge streams shall be routed into a closed loop system.

New and Modified Facilities

At sites where pneumatic pump emissions are controlled by a combustion unit used for the control of flash or dehydration unit emissions, control of the pneumatic pump emissions will be evaluated upon request for removal of the combustion unit. (See Flashing, Page 19)

Pneumatic Controllers

New Facilities

Upon FDOP, natural gas-operated pneumatic controllers shall be low* or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Modified Facilities

Upon modification, new natural gas-operated pneumatic controllers shall be low or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Within 60-days of modification, existing natural gas-operated pneumatic controllers shall be replaced by or converted to low or no-bleed controllers or the discharge streams of existing natural gas-operated pneumatic controllers shall be routed into closed loop system.

* low bleed devices vent less than 6 cfh

Presumptive BACT Requirements for UGRB Facilities (cont.)

Fugitives

For new and modified facilities where fugitive emissions are greater than or equal to 4 TPY of VOCs, operators shall submit a Leak Detection and Repair (LDAR) Protocol. The fugitive emission monitoring in the LDAR Protocol shall be no less frequent than quarterly, and may consist of Method 21, infrared camera, audio-visual-olfactory (AVO) inspections, or some combination thereof and must be approved by the Division. A proposed LDAR Protocol consisting of only AVO inspections will not be accepted by the Division.

Well Completions

Operators shall submit applications to perform well completions using Best Management Practices. One permit will be issued to each company that drills and completes wells within the Upper Green River Basin. The permits will be modeled after those issued to companies completing wells in the Jonah and Pinedale Anticline Development Area and Concentrated Development Area. An example of a well completions or "Green Completions" permit is available on the AQD website, http://deq.state.wy.us/aqd or a copy may be obtained by contacting the Wyoming Air Quality Division at **(307) 777-7391.**

Presumptive BACT Requirements for UGRB Facilities (cont.)

Produced Water Tanks

New Facilities

PAD Facilities

Upon FDOP, VOC and HAP emissions from all active produced water tanks shall be controlled by at least 98%.

Single Well Facilities

Within 60-days of FDOP, at sites where flashing emissions must be controlled by at least 98%, VOC and HAP emissions from all active produced water tanks shall be controlled by at least 98%.

Modified Facilities

PAD Facilities

Upon modification, VOC and HAP emissions from all new active produced water tanks shall be controlled by at least 98%.

Within 60-days of modification, existing open-top, active, produced water tanks shall be taken out of service for use as active produced water tanks. All active produced water tanks shall be closed top and shall have VOC and HAP emissions controlled by at least 98%.

New and Modified Facilities

Open-top or blow down tanks shall not be used as active produced water tanks but may be used for blow down or for temporary storage during emergency or upset conditions, such as spare tanks at facilities connected to liquids gathering systems, and do not have to be tied into 98% control systems.

Removal of produced water tank emissions control may be allowed upon approval. (See Flashing, Page 19)

Presumptive BACT Requirements for UGRB Facilities (cont.)

Blowdown/Venting

Best Management Practices (BMP) and information gathering requirements will be incorporated into permits for new and modified facilities.

BMP: During manual and automated blowdown/venting episodes associated with liquids unloading, wellbore depressurization in preparation for maintenance or repair, hydrate clearing, emergency operations, equipment depressurization, etc., associated VOC and HAP emissions shall be minimized to the extent practicable. During manual blowdown or venting, personnel shall remain on site to ensure minimal gas venting occurs.

Information Gathering: Specific recordkeeping and reporting requirements will be established during the permitting process and will include estimates of associated regulated air pollutants, reasons for episodes, durations of episodes, steps taken to minimize emissions and descriptions of emission estimation methods.

Emission Sources without Presumptive BACT requirements

For uncontrolled sources emitting greater than or equal to 4 TPY VOC that do not have P-BACT requirements, a BACT analysis shall be filed with the permit application for the associated facility.

Presumptive BACT Requirements for JPAD/NPL Facilities

Flashing

For the purpose of determining flashing emissions all vapor streams containing VOC or HAP components from all storage tanks (e.g., oil, condensate, produced water with oil or condensate carryover) and all separation vessels (e.g., gun barrels, production and test separators, production and test treaters, water knockouts, gas boots, flash separators, drip pots, etc.) at a facility which are or may be vented to the atmosphere shall be considered.

New Facilities

Upon FDOP, VOC and HAP flashing emissions shall be controlled by at least 98%.

Modified Facilities

Upon modification, all new and existing VOC and HAP flashing emissions shall be controlled by at least 98%.

New and Modified Facilities

Condensate and oil tanks that are on site for use during emergency or upset conditions, such as spare tanks at facilities connected to liquids gathering systems, are not subject to the 98% control requirements.

The removal of flashing emissions control devices may be allowed upon approval after one year if VOC flashing emissions have declined to less than, and are reasonably expected to remain below 4 TPY.

Dehydration Units

New Facilities

Upon FDOP, all VOC and HAP emissions from dehydration unit process vents shall be controlled by at least 98%. No control removal will be allowed.

Modified Facilities

Upon modification, all VOC and HAP emissions from new and existing dehydration unit process vents shall be controlled by at least 98%. No control removal will be allowed.

Presumptive BACT Requirements for JPAD/NPL Facilities (cont.)

Pneumatic Pumps

New Facilities

Upon FDOP, VOC and HAP emissions associated with the discharge streams of all natural gas-operated pneumatic pumps shall be controlled by at least 98% or the pump discharge streams shall be routed into a closed loop system (e.g., sales line, collection line, fuel supply line).

Modified Facilities

Upon modification, VOC and HAP emissions associated with the discharge streams of all new and existing natural gas-operated pneumatic pumps shall be controlled by at least 98% or the pump discharge streams shall be routed into a closed loop system.

New and Modified Facilities

For pneumatic pump emissions controlled by a combustion unit used to control flash emissions which may be removed, the control method for pump emissions will be evaluated upon request for approval to remove the combustion unit. (See Flashing, Page 25)

Pneumatic Controllers

New Facilities

Upon FDOP, natural gas-operated pneumatic controllers shall be low* or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Modified Facilities

Upon modification, new natural gas-operated pneumatic controllers shall be low or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

Within 60-days of modification, existing natural gas-operated pneumatic controllers shall be replaced by or converted to low or no-bleed controllers or the controller discharge streams shall be routed into a closed loop system.

* low bleed devices vent less than 6 cfh

Presumptive BACT Requirements for JPAD/NPL Facilities (cont.)

Produced Water Tanks

New Facilities

Upon FDOP, VOC and HAP emissions from all active produced water tanks shall be controlled by at least 98%.

Modified Facilities

Upon modification, VOC and HAP emissions from all new active produced water tanks shall be controlled by at least 98%.

Within 60-days of modification, existing open-top, active, produced water tanks shall be taken out of service for use as active produced water tanks. All active produced water tanks shall be closed top and shall have VOC and HAP emissions controlled by at least 98%.

New and Modified Facilities

Open-top or blow down tanks shall not be used as active produced water tanks but may be used for blow down or for temporary storage during emergency or upset conditions, such as spare tanks at facilities connected to liquids gathering systems, and do not have to be tied into 98% control systems.

Removal of water tank emissions control may be allowed upon approval. (See Flashing, Page 25)

Fugitives

For new and modified facilities where fugitive emissions are greater than or equal to 4 TPY of VOCs, operators shall submit a Leak Detection and Repair (LDAR) Protocol. The fugitive emission monitoring in the LDAR Protocol shall be no less frequent than quarterly, and may consist of Method 21, infrared camera, audio-visual-olfactory (AVO) inspections, or some combination thereof and must be approved by the Division. A proposed LDAR Protocol consisting of only AVO inspections will not be accepted by the Division.

Well Completions

Operators shall submit applications to perform well completions using Best Management Practices. One permit will be issued to each company that drills and completes wells within the UGRB. The permits will be modeled after those issued to companies completing wells in the Jonah and Pinedale Anticline Development Area. An example of a well completions or "Green Completions" permit is available on the AQD website, http://deq.state.wy.us/aqd or a copy may be obtained by contacting the Wyoming Air Quality Division at **(307) 777-7391.**

Presumptive BACT Requirements for JPAD/NPL Facilities (cont.)

Blowdown/Venting

Best Management Practices (BMP) and information gathering requirements will be incorporated into permits for new and modified facilities.

BMP: During manual and automated blow down/venting episodes associated with liquids unloading, wellbore depressurization in preparation for maintenance or repair, hydrate clearing, emergency operations, equipment depressurization, etc., associated VOC and HAP emissions shall be minimized to the extent practicable. During manual blow down or venting, personnel shall remain on site to ensure minimal gas venting occurs.

Information Gathering: Specific recordkeeping and reporting requirements will be established during the permitting process and will include estimates of associated regulated air pollutants, reasons for episodes, durations of episodes, steps taken to minimize emissions and descriptions of emission estimation methods.

Emission Sources without Presumptive BACT requirements

For uncontrolled sources emitting greater than or equal to 4 TPY VOC that do not have P-BACT requirements, a BACT analysis shall be filed with the permit application for the associated facility.

Determining Presumptive BACT Flashing Emissions

Flashing losses occur when produced liquids (crude oil or condensate) are exposed to temperature increases or pressure drops as they are transferred from production vessels to other vessels or to atmospheric storage tanks. For purposes of this guidance, the term "**flash emissions**" refers to VOC and HAP pollutants associated with entrained natural gas vapors released to the atmosphere from hydrocarbon liquids in surface production equipment. This production equipment may include gun barrels, separators, treaters, produced water tanks, gas drips, freewater knockouts, etc. In addition to flash emissions, vessels containing hydrocarbon liquids also have emissions associated with **working** and **breathing** (also called standing) losses. These are vapors displaced from oil or condensate due to evaporation and agitating.

Use the following steps to determine projected potential flashing and working/breathing losses:

STEP 1: 30-days after the First Date of Production calculate the **average daily condensate or oil production**.
Example: Well produced 600 BBL during the first 30-days after the First Date of Production.
***average daily condensate/oil production** = 600 BBL ÷ 30 days = 20 BPD*

STEP 2: Calculate the **projected first year annualized average daily condensate/oil production** rate by multiplying the average 30-day rate times 0.6. This effectively results in a first year, annualized daily production rate which is 20% of the initial production rate. Additionally, this effectively accounts for an 80% decline in daily production by the end of the first year. (described in more detail on page 40)

Example:
***projected first year, annualized average daily oil/condensate production** = 20 × 0.6 = 12 BPD*

If the expected decline rate is less than 80%, then the expected decline rate should be used. Using an expected decline rate > 80% requires pre-approval from the Division.

STEP 3: Use an approved flash emissions model or direct measurement of tank emissions to determine **projected first year VOC and HAP emissions associated with the projected first year average daily production rate**.

Actual flash emissions are determined the same as projected potential emissions except that the actual average daily condensate or oil production rate is used rather than a projected production rate.

Determining Presumptive BACT Flashing Emissions

Several methods are available to calculate or measure flash emissions with some being more accurate than others. Even through working/breathing/flashing losses are almost always mixed together and exit from a common vent at the same time, some methods only calculate working and breathing losses and some only calculate flashing losses. Some methods will calculate all three types of emissions simultaneously. Each method has specific constraints. For whichever method used, all supporting data used to calculate the emissions, including identification of the calculation method, description of sampling methods and copies of lab sampling analyses shall be provided with the emissions estimate.

	Method	Emissions Calculated	Comments
1	Direct measurement	working, breathing, flash	Sampling and lab analysis required. Results are relatively accurate.
2	Process Simulator	flash only	i.e. PROMAX, HYSIM, HYSIS Software is expensive but results are accurate when based on site-specific sampling and lab analysis.
3	API E&P TANKS Software V 2.0	working, breathing, flash	Requires site specific sampling. Not as accurate as more expensive process simulators and no longer supported by the software producer (American Petroleum Institute).
4	Laboratory measurement of the Gas-Oil-Ratio (GOR) from a pressurized liquid sample	flash only	This is a direct laboratory analysis of the flash vapors emitted from a pressurized oil/condensate sample.
5	EPA TANKS 4.0.9d	working, breathing only	Program distributed by the EPA through their website at http://www.epa.gov/ttn/chief/efpac/efsoftware.html

Extended hydrocarbon liquids analyses used for model input shall be no older than **three** years. Composite analyses may be used as input. These are averaged extended hydrocarbon compositions based on samples from at least five nearby wells producing from the same formation and under similar conditions (± 25° psig) as the well being permitted. Analyses used as the basis for the average shall be no older than **three** years.

Determining Presumptive BACT Dehydration Unit Emissions

Dehydration units use glycol (TEG, DEG or EG) to absorb water from produced gas before it is introduced into gas sales or collection lines. Upon contact with wet gas, "lean" glycol absorbs water and other liquids. It is then considered "rich". To remove impurities, or regenerate, the rich glycol is routed through a glycol flash separator and/or a reboiler. During flash separation and reboiling, water and hydrocarbon vapors containing VOC and HAP pollutants are released from the rich glycol. These are then discharged to the atmosphere from the dehydration unit process vents.

Use the following steps to determine projected potential dehydration unit emissions:

STEP 1: Once a new well has produced for 30-days after the First Date of Production, determine the average daily gas production rate.
Example:
Well produced 100 MMCF during the first 30-days after the First Date of Production
average daily gas production = 100 MMCF ÷ 30 days = 3.3 MMCFD

STEP 2: Calculate the **projected first year, annualized average daily gas production** rate by multiplying the initial average 30-day rate times 0.6. This effectively results in a first year, annualized daily production rate which is 20% of the initial production rate. Additionally, this effectively calculates an 80% decline in daily production by the end of the first year. (described in more detail on page 41.)

Example:
projected first year, annualized average daily gas production *= 3.3 × 0.6 = 2.0 MMCFD*

STEP 3: Use GRI-GLYCalc V3.0 or higher or other method approved by the Division with the projected first year, annualized average daily production rate to determine **potential, annualized uncontrolled VOC and HAP emissions** from the dehydration unit **process vents**. **Process vents** include reboiler still vents, glycol flash separators and still vent condensers.

Model input:
1) An extended hydrocarbon analysis of wet gas sampled upstream of the reboiler contact tower. Or, a composite extended hydrocarbon analysis may be used. A composite analysis is the average composition from at least five nearby wells producing from the same formation as the new well and under the same or very similar separator pressure and temperature conditions. Samples shall be no older than five years.
2) The projected first year average daily gas production rate (MMCFD).
3) Average, actual equipment operational parameters, including wet gas temperature and pressure, dry gas water content, glycol flash separator temperature and pressure, stripping gas source and rate and average operating parameters of emission control equipment.
4) The **maximum lean glycol circulation rate** (gpm) for the glycol circulation pump in use. Maximum circulation rates for the most commonly used Kimray Model pumps are listed in **TABLE 1**.

Determining Presumptive BACT Dehydration Unit Emissions (cont.)

TABLE 1

KIMRAY GLYCOL PUMP RATES				
Model #	Capacity (gpm)		Working Pressure (psi)	
	min	max	min	max
3154 PV	0.05	0.22	100	1500
1715 PV	0.13	0.67	300	1500
4015 PV	0.2	0.67	300	1500
9015 PV	0.45	1.5	300	1500
21015 PV	1.1	3.5	400	1500
45015 PV	2.77	7.5	400	1500
4015 LP	0.13	0.33	100	500
2015 SC	0.13	0.33	100	500
5015 SC	0.2	0.83	100	500
10015 SC	0.37	1.67	100	500
20015 SC	1	3.33	100	500

Data from Kimray O&G Equipment and Controls Catalog

Actual dehydration unit emissions are determined the same as projected potential emissions except that the actual average daily gas production rate is used in the GlyCalc model rather than a projected production rate.

BACT for Flashing Emissions

The following control systems or devices are accepted by the Division as meeting BACT for flash emissions:

1) A vapor recovery device that is designed and operated and may be demonstrated to reduce the mass content of VOC and total HAP emissions in the vapors vented to the device by at least 98% by weight.
2) An enclosed, smokeless combustion device or flare that is designed and operated and may be demonstrated to reduce the mass content of VOC and total HAP emissions in the vapors vented to the device by at least 98% by weight.
3) Any other control device or configuration that can be demonstrated to reduce the mass content of total HAP and VOC in the process gases vented to the device or configuration by at least 98% by weight.
4) Monitoring and recordkeeping which will demonstrate continuous and effective emission control are required upon start up of the control system. For a combustion device this may be a thermocouple and continuous recording device or any other equivalent device to detect and record the presence of the pilot flame, or a combustion chamber temperature recorder/monitor. The monitoring/recording requirements become enforceable permit conditions.
5) Emissions control equipment, systems or devices, all vent lines, connections, fitting, valves, relief valves, thief hatches or any other appurtenance employed to contain and collect vapors and transport them to the emission control system or device, shall be maintained and operated during any time a well is producing such that the emissions are controlled at all times.

CAUTION: Total emissions from any facility or source shall not exceed major source levels prior to emission control installation. Major source levels are 10 TPY of any single HAP, 25 TPY of any combination of HAP or 100 TPY of any regulated pollutant. Flash emissions prior to control installation will be determined using approved emission models or methods based on actual reported production and operating conditions. Reported production includes that sold during well completion activities which are reported to the WOGCC. Flash emissions are directly proportional to production rates, provided operational parameters remain consistent, so it is acceptable to prorate emissions based on production.

BACT for Dehydration Unit Emissions

Other emission control systems or devices than those previously discussed may be used upon approval by the Division to meet BACT requirements for emissions from dehydration unit process vents (reboiler still vents and vents from glycol flash separators or glycol flash tanks). In order to be approved, the operator must provide a demonstration certifying the system or device will reduce the mass content of total HAP and VOC in the process gases vented to the device or configuration by at least 98% by weight.

Emissions control equipment, systems or devices, all vent lines, connections, fitting, valves, relief valves, hatches or any other appurtenance employed to contain and collect vapors and transport them to the emission control system or device, shall be maintained and operated during any time a well is producing such that the emissions are controlled at all times.

Monitoring and recordkeeping which will demonstrate continuous and effective emission control are required upon start up of the control system. For combustion devices this may be a thermocouple and continuous recording device for the pilot flame or any other equivalent device to detect and record the presence of the pilot flame. A temperature recorder/monitor might be used to demonstrate sufficient heat of combustion or a continuous, wind-up chart recorder might be used to demonstrate continual operation by measuring and recording temperature or pressure parameters.

REMINDER: Dehydration units at oil and gas production facilities may be subject to additional NESHAP requirements under 40 CFR part 63, subpart HH. It is the operator's responsibility to comply with all applicable requirements of the NESHAP regulations.

CAUTION: Total emissions from any facility or source shall not exceed major source levels prior to emission control installation. Major source levels are 10 TPY of any single HAP, 25 TPY of any combination of HAP or 100 TPY of any regulated pollutant. Dehydration unit emissions occurring prior to the installation of required controls will be determined using the GRI-GLYCalc model or other method approved by the Division based on the maximum lean glycol circulation rate and the actual reported gas production rate including any gas which was routed through the dehydration unit during well completion operations.

BACT for Sources without P-BACT Requirements

For emission sources without PRESUMPTIVE BACT requirements, BACT shall be addressed when the uncontrolled source emits greater than or equal to 8 TPY VOC or greater than or equal to 5 TPY total HAP emissions.

For these sources **EITHER** the emission source will be controlled using BACT **OR** a BACT cost analysis will be performed and submitted with the application showing either:

control is not technically feasible (i.e., due to physical constraints the emissions cannot be controlled)

OR

control is not economically reasonable (i.e., based on a control cost analysis the "cost to control per ton of pollutant reduced" is uneconomical).

CAUTION: **BACT** may be required at lower levels and for other emissions and emission sources than those stated in this guidance, but as a minimum, **BACT** shall be considered when equal to or above these guidance emission levels. For example, operators installing pumping unit engines according the APP=NOI process might be asked to submit a BACT analysis for the engine.

Multiple pieces of the same type of equipment are considered one emission source for permitting purposes. For example, there are five oily rag burners at a facility. Uncontrolled emissions from the five burners shall be aggregated for permitting purposes. If total uncontrolled VOC emissions from the five burners are less than 8 TPY, BACT requirements are met with no control. If total uncontrolled emissions from the five burners are greater than or equal to 8 TPY VOC or greater than or equal to 5 TPY total HAP, emissions from all five burners shall be reduced to less than 8 TPY total VOC and less than 5 TPY total HAP in order to meet BACT requirements or the applicant shall demonstrate controlling the emissions is not economically reasonable nor technically feasible.

Permit Applications

For **JPAD/NPL** facilities, the application submittal process is different from the process for CDA and Statewide facilities. See Page 45 for **JPAD/NPL** application instructions.

For **UGRB, CDA,** and **Statewide** facilities, unless a permit is issued prior to start up, a C6 S2 Oil & Gas Production Facilities permit application shall be filed within 90-days after the First Date of Production for a new facility or Date of Modification of an existing facility. The application notifies the AQD that the new or modified facility has begun operation. It describes the facility process, equipment and associated emissions/emissions controls and serves as a form of certification by the owner that the Presumptive BACT requirements have been met.

Whether the application is being filed after construction under the Presumptive BACT process or prior to construction, the appropriate application forms depend upon the facility equipment and operating scenario. A complete application includes the following appropriate forms:

- **A cover letter stating the purpose of the application**
- **A written process description and process diagram for the facility including each air emission source and the operational parameters of each source** (examples on pages 32 & 33)
- **The appropriate application forms**

AQD-OG0	Identification of application type (application or NOI = application)
AQD-OG00	Completeness checklist
AQD-OG1	Application Cover Sheet
AQD-OG2	Equipment List
AQD-OG3	Storage Tanks, Pressurized Vessels & Pneumatic Pumps
AQD-OG4	Dehydration Units
AQD-OG5	Pumping Unit Engines
AQD-OG6	Emission Summary
AQD-OG7	Notice of Installation
AQD-OG8	Multiple Facilities
AQD-OG10	BACT cost analysis

- Explanations or demonstrations of all methods used to calculate or estimate emissions for each emission source, including controlled and uncontrolled sources. Emission calculation methods are described later.
- All applicable and required attachments noted on the forms, including
  Input and output for emission models/software/process simulations
  Equipment manufacturer's emissions information
  Laboratory analyses used for emission models/software/process simulations or calculations including a description of sampling procedures and handling, sampling locations, sampling location parameters (i.e., pressure and temperature at sampling port)
- Any additional attachments or information necessary for complete review of the application

Permit Applications (cont.)

Download application forms from the AQD website:

http://deq.state.wy.us/aqd/oilgas.asp

Contact the Wyoming Air Quality Division at **(307) 777-7391**

Make written request to:

Wyoming Department of Environmental Quality
Air Quality Division
Herschler Building, 2-E
122 West 25th Street
Cheyenne, WY 82002
attn: O&G NSR Permitting

or

Wyoming Department of Environmental Quality
Air Quality Division
152 North Durbin Street, Suite 100
Casper, WY 82601
attn: O&G NSR Permitting

For facilities constructed or modified under the **Presumptive BACT** process submit **EITHER** 1 paper copy with original signature and 1 electronic copy **OR** 3 paper copies (one with original signature) of the complete C6 S2 application within **90-days** of the **First Date of Production** to the address below.

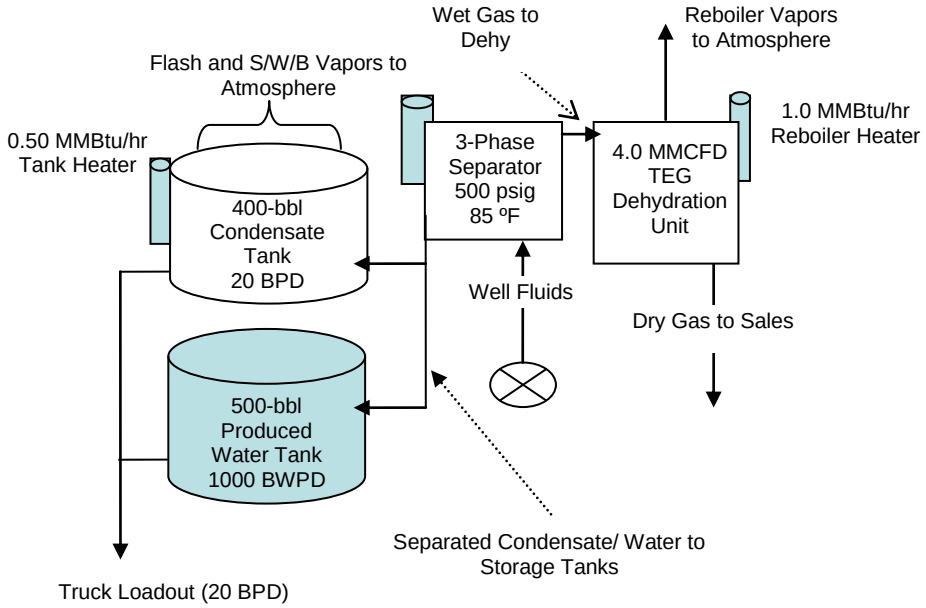
For all facilities where emissions are known prior to construction submit **EITHER** 1 paper copy with original signature and 1 electronic copy **OR** 3 paper copies (one with original signature) of the complete C6 S2 application **prior** to construction to the address below.

NSR Program Manager / attn: O&G Production Facilities
Department of Environmental Quality
Air Quality Division
Herschler Building, 2-E
122 West 25th Street
Cheyenne, WY 82002

The preferred method for filing the application is 1 paper copy with 1 electronic copy.

Permit Applications (cont.)

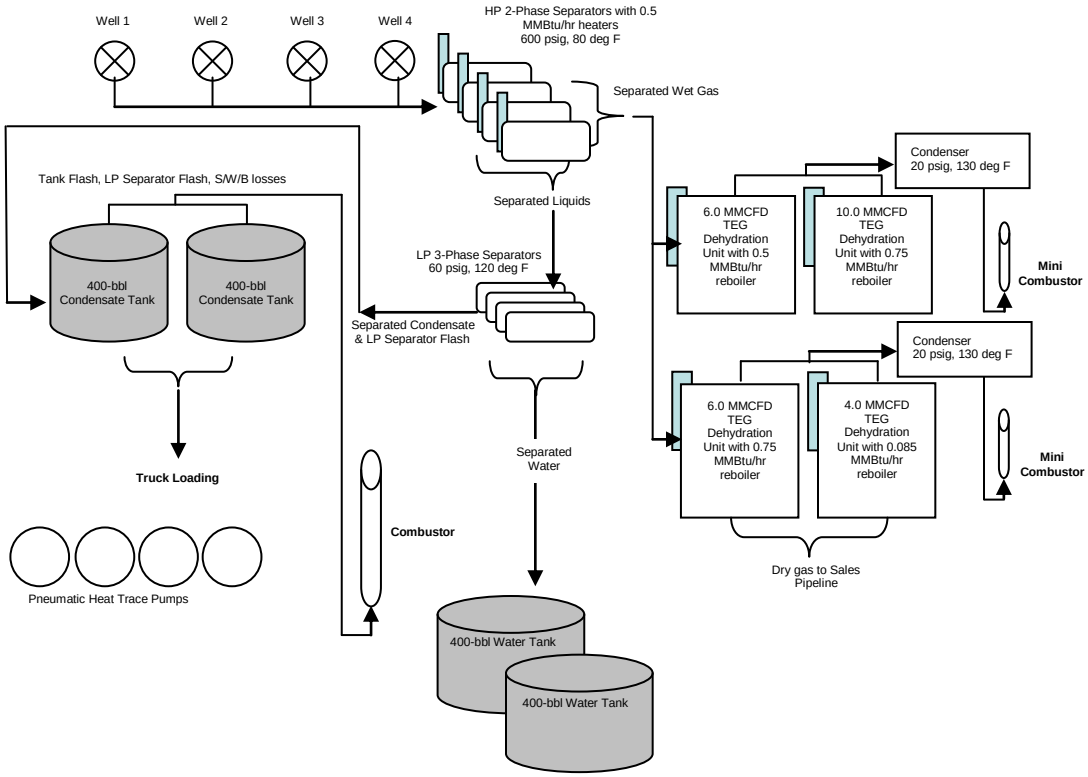
Example Process Diagram & Description



EXAMPLE: Air emission sources in the diagram are the condensate storage tank from which vapors are vented to the atmosphere, the dehydration unit reboiler still vent and the three natural gas-fired process heaters. Produced fluids are directed to the 3-phase separator for separation of condensate/water/gas. Wet gas is directed to the TEG dehydration unit for drying. Separated condensate and water are routed to the appropriate tanks for storage prior to being hauled from location via truck. Produced gas is used as burner fuel. Reboiler vapors and flash emissions are vented to the atmosphere along with S/W/B losses from the condensate tank.

Permit Applications (cont.)

Example Process Diagram & Description



EXAMPLE: Total well fluids from four wells flow to the 2-ph HP separators. Wet gas from the HP separators flows to the four dehydration units. Separated fluids from the 2-ph HP separators flows to the 3-ph LP separators. Separated condensate and water flows from the 3-ph LP separators to the storage tanks. Gas released in the 3-ph separators is routed to the condensate storage tanks. Tank vapors, including tank flash, gas from the 3-ph LP separators and S/W/B vapors are collected and directed to a 30-foot smokeless combustor. The temperature of the combustor is continually monitored and recorded using a SCADA system. Reboiler still vents vapors flow through condensers. Condensed liquids are pumped to the condensate storage tanks. Non-condensable vapors flow to the 20-foot Mini-Combustors. The temperature of the Mini-combustors is continually monitored and recorded using a SCADA system. Pneumatic heat trace pumps operate 6 months per year using produced gas from the HP separators to operate. Vent lines from the pumps are routed into the condensate dump lines from the LP separators.

The process diagram does not need to be computer generated. A simple hand sketch is sufficient as long as the required information is included. The diagram does not need to be drawn to scale and does not need to represent the exact position of production equipment at the facility as long as the process description and operating scenario are clearly defined.

Permit Applications (cont.)

Upon receiving the application, the AQD sends a receipt letter to the applicant. The application is logged into the AQD tracking system and assigned a reviewing engineer. The engineer has up to 30-days to perform a completeness review to ensure adequate and correct information has been filed. If the application is deemed incomplete the engineer will notify the applicant and request further information. Upon completeness the engineer has 60-days to complete a technical review, write an application analysis and make any recommendations. During this process the decision to issue a permit or waiver takes place. If the decision is to issue a permit, the proposed permit, including compliance requirements, is published for a mandatory 30-day public comment period. If no comments are received the permit is issued once the public comment period ends. If comments are received these are addressed by the AQD. It is possible comments will warrant a public hearing. When this is the case, a final permit may be denied or delayed.

An hourly fee will be assessed for the time it takes AQD personnel to process the application. A bill will be sent to the applicant when the process is complete. Billing is handled as follows:

> **Initial billing** is assessed when a proposed permit is sent to public notice. Initial billing shall be paid prior to issuance of the final permit.
>
> **Final billing** is assessed for waivers and permits after these are issued.

Contact the Division for the current hourly rate.

NOTE: The Presumptive BACT permitting process may not be used for sour gas (H_2S) production facilities unless the only emissions of H_2S will be those associated with fugitive losses from valves, fittings, surface piping and pneumatic devices, etc. If there will be H_2S emissions associated with vented gas or tank vapors or if sour gas will be flared the applicant shall contact the Division for permitting guidance prior to construction.

NOTE: NO internal combustion compressor engines or generator engines may be installed under the Presumptive BACT process. No pumping unit engines greater than 50-Hp or with nitrogen oxide (NO_X) emissions greater than 5 TPY may be installed under the Presumptive BACT permitting process.

Such engines shall be permitted prior to installation.

Permit Applications (cont.)

Notice of Installation (NOI)

For some O&G production facilities or equipment, associated air emissions are considered relatively insignificant by the AQD. In these cases the NOI form, **FORM AQD-OG7**, serves as a complete C6 S2 permit application.

The NOI can be used for facilities such as single wellsites, consisting of only a wellhead or perhaps a separation unit, where no produced fluids are stored or dehydrated. Instead, the produced fluids are routed directly from the wellhead or separation vessels into a sales line, collection system or to a separate facility for treatment, storage and sales. The only emissions at this type of facility would be fugitive emissions from equipment leaks and fittings, or NO_X and CO emissions associated with small natural gas fired process heaters.

The NOI may be used as a complete permit application **ONLY** if **ALL** of the following apply to the facility owner:

There are no hydrocarbon liquids storage tanks.
There are no dehydration units.
There are no pressurized vessels from which hydrocarbon vapors are vented to the atmosphere other than during upset or emergency conditions.
There are no internal combustion pumping unit engines $\geq$ 50 HP.
There are no H_2S emissions from the facility other than those associated with fugitive leaks from process components and surface piping.
There are no SO_2 emissions associated with the combustion of sour gas.

REMINDER for Pumping Unit Engines: Pumping unit engines at oil and gas production facilities are subject to additional NESHAP requirements under 40 CFR part 63, subpart ZZZZ. Also, engines at these facilities may be subject to additional NSPS requirements under 40 CFR part 60, subpart JJJJ based on engine manufacture date. It is the operator's responsibility to comply with all applicable requirements of the NSPS and NESHAP regulations.

Using the NOI as notification of equipment replacements and changes

The NOI may be used for notification of equipment change outs or replacements, provided the changes will not significantly increase permitted emissions, if at all. For example, use the NOI as notification of replacement of a TEG dehydration unit with one having a higher design rating but with the same model glycol pump as previously permitted, or higher rated reboiler burner. Increased emissions associated with the larger burner would be considered insignificant and there would be no emissions increase associated with the larger dehy as long as there is no change in the glycol pump model or wet gas throughput.

Permit Applications (cont.)

Another example would be to use the NOI as notification of the installation of additional production tanks at a previously permitted facility provided throughput to the current and additional tanks is the same as or less than the previously permitted throughput and provided the vent lines of the new tanks are tied into emission control devices if such was required for the existing tanks.

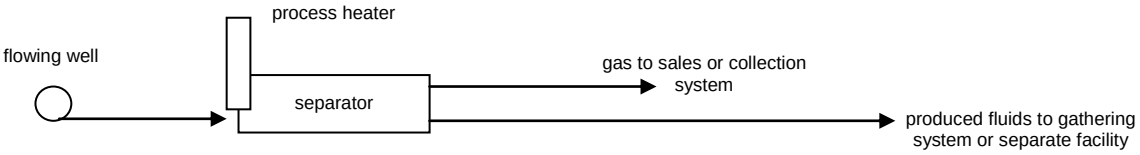
The NOI may be used as notification of the installation of different process heater, such as replacing a 0.5 MMBtu/hr line heater with a 0.75 MMBtu/hr line heater.

Examples are illustrated on the next page.

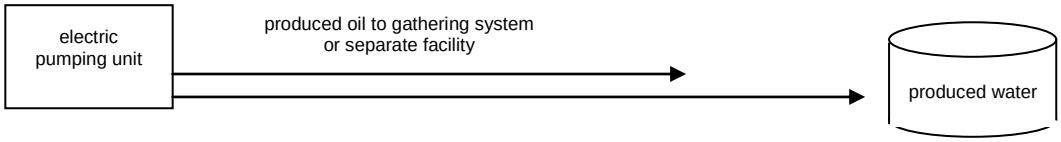
Permit Applications (cont.)

Examples of cases where the NOI may be used as a complete C6 S2 permit application or as notification of equipment changes

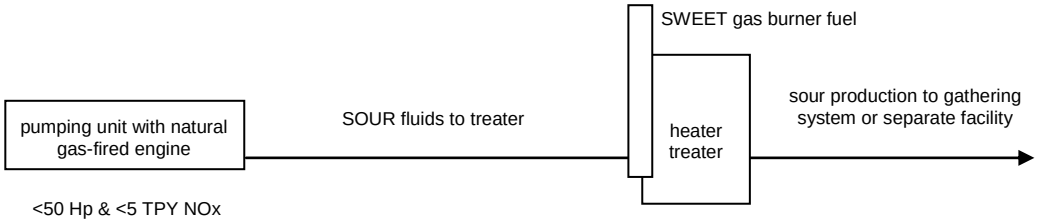
1



2

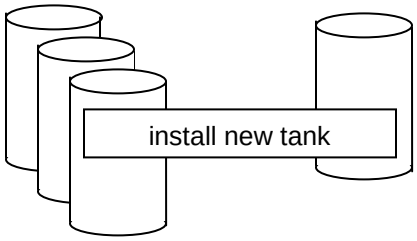


3



<50 Hp & <5 TPY NOx

4



A storage tank is added to an existing facility. Tank throughput at the facility is no greater than previously permitted throughput. If existing tanks are connected to an emission control device, the new tank shall also be connected to the control device.

Permit Applications (cont.)

How to obtain NOI Form AQD-OG7

The link to electronic forms on the AQD website is

http://deq.state.wy.us/aqd/oilgas.asp

Contact the Wyoming Air Quality Division at **(307) 777-7391**

Make written request to: Wyoming Department of Environmental Quality
Air Quality Division
Herschler Building, 2-E
122 West 25th Street
Cheyenne, WY 82002

When/where to file a NOI

Within **60-days** of the **First Date of Production**, equipment change out, equipment replacement or equipment addition submit **EITHER** 1 paper copy with original signature and 1 electronic copy **OR** 3 paper copies (one with original signature) of the NOI form to:

NSR Program Manager / attn: O&G Production Facilities
Department of Environmental Quality
Air Quality Division
Herschler Building, 2-E
122 West 25th Street
Cheyenne, WY 82002

The preferred method for filing the NOI is 1 paper copy with 1 electronic copy.

Specific Requirements for JPAD/NPL Permit Applications

For the **JPAD/NPL**, the Presumptive BACT permitting process varies from that for all other statewide areas.

Unlike the Presumptive BACT permitting process for **UGRB, CDA,** and **STATEWIDE** facilities, the permitting process for **JPAD/NPL** facilities does not require the determination of projected, potential emissions prior to application filing. Instead, emissions meeting the BACT requirements shall be in place upon the First Date of Production at all new and modified facilities. A C6 S2 application is filed to notify the AQD of the start up of a new facility or the modification to an existing facility. The application describes new, modified and future well/equipment installations along with the associated, controlled and uncontrolled emissions and serves as a form of certification by the owner that Presumptive BACT requirements for emission controls and control device monitoring have been and will be met.

A complete C6 S2 application, including all appropriate forms, shall be filed for within sixty-days of the First Date of Production or modification for:

all new single well facilities
all new PAD facilities
modifications to existing single or PAD facilities

If a facility has been previously permitted and the permit contains conditions authorizing additional equipment and wells to be added according to the July 28, 2004 Guidance Addendum, a complete application may be submitted using the **AQD Pinedale-1 Form**.

Any additional attachments or information necessary for complete review of the application

Emissions reported in the application shall be based on projected rates for new wells and current average production rates at the time of application filing for existing wells. Higher production rates may be used if the applicant wants to permit for production/emission increases.

NOTE: At facilities with a permit authorizing the addition of future wells, the authorization becomes invalid if no wells are added to the facility within 24 months after receipt of the permit or if the addition of the planned wells is discontinued for a period of 24 months or more. The permit for the existing wells remains valid.

For facilities requiring a permit prior to start up of operations, emissions reported in the application should be based on expected production rates. Higher production rates may be used if the applicant wants to permit for production/emissions increases.

Specific Requirements for JPAD/NPL Permit Applications

How to obtain C6 S2 application, AQD Pinedale-1 and NOI forms

Download electronic forms from the AQD website at:

http://deq.state.wy.us/aqd/oilgas.asp

Contact the Wyoming Air Quality Division at **(307) 777-7391**

Make written request to:

Wyoming Department of Environmental Quality
Air Quality Division
Herschler Building, 2-E
122 West 25th Street
Cheyenne, WY 82002
attn: O&G NSR Permitting

When/where to file C6 S2 permit applications, AQD Pinedale-1 and NOI forms

For facilities where emissions are known prior to construction submit **EITHER** 1 paper copy with original signature and 1 electronic copy **OR** 3 paper copies (one with original signature) of the complete C6 S2 application **PRIOR** to construction to the address below.

For facilities constructed or modified under the Presumptive BACT process submit **EITHER** 1 paper copy with original signature and 1 electronic copy **OR** 3 paper copies (one with original signature) of the complete C6 S2 application within **60-days** of the First Date of Production to the address below.

For facilities with additions authorized under the July 28, 2004 Guidance Addendum, use the **AQD Pinedale-1 Form.** Submit **EITHER** one electronic and one paper copy with original signature **OR** three paper copies (one with original signature) within **60-days** of the First Date of Production to:

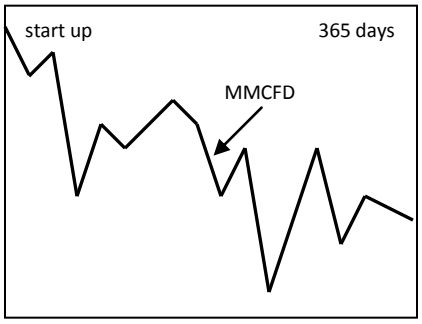
NSR Program Manager / attn: O&G Production Facilities
Department of Environmental Quality
Air Quality Division
Herschler Building, 2-E
122 West 25th Street
Cheyenne, WY 82002

The preferred method for filing the application is 1 paper copy with 1 electronic copy.

The 0.6 decline factor ....

The first year daily production rates are represented by the jagged line **BOX 1**. The area under the line represents the total actual production volume for the first year. It is difficult to calculate the total volume under the jagged line so it is smoothed out **BOX 2** using statistical methods.

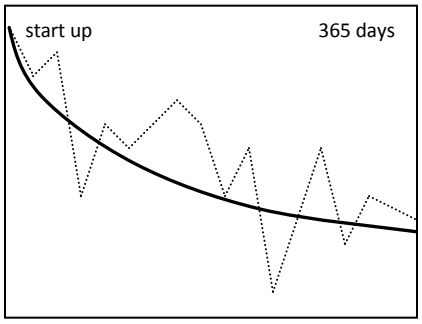
BOX 1



EXAMPLE - actual daily gas production rate vs time

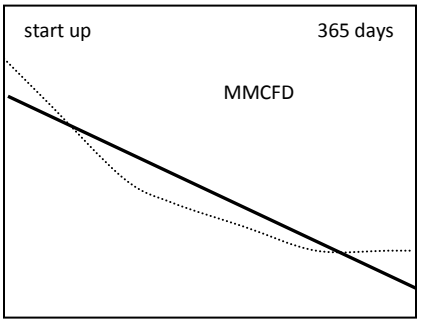
Actual production during the first year is represented by the area under the jagged line which ultimately turns out to be ≈ 730 MMCF.

BOX 2



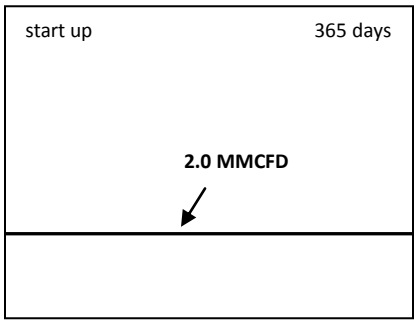
The jagged line representing daily production is "smoothed" out using statistical methods.

BOX 3



The "smoothed" curve in BOX 2 is "straightened" out using mathematical methods.

BOX 4



"leveled" out, projected daily gas production rate vs time

Total projected production for the first year is represented by the area under the straight line
2 MMCFD × 365 days = 730 MMCF

First year projected emissions are based on 730 MMCF of produced gas.

The smoothed curve is "straightened" out in **BOX 3**, then "leveled" out in **BOX 4**. Now the total production for the first year is represented by the area under the line in **BOX 4** which is easily calculated. Production curves from a large sampling of Wyoming wells indicate the average well declines by 80% during the first year. That 80% decline is represented by the level line in **BOX 4** after the first 30-day average production rate is multiplied by 0.6. For the first month the well makes an average 3.333 MMCFD. With 80% decline during the first year, the well will make 0.667 MMCFD at the end of the first year (3.333 - 0.8(3.333) = 0.667). Then the average daily production rate over 365 days is (3.333 + 0.667)/2 = 2.0 MMCFD which is the same as 3.333 × 0.6 = 2.0.

APPENDIX A

FORMS

Form AQD-OG0 Application
Identifies the submittal as a C6 S2 O&G Production Facilities Permit Application

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division
Oil & Gas Production Facilities C6 S2 Permit Application

Company Name: _____

Facility Name: _____

To Be Completed by WDEQ-AQD	
Reviewer	
Copy to	
D.E.	
File:	

Form AQD-OG0
Application September 2013

Form AQD-OG0 NOI
Identifies the submittal as a C6 S2 O&G Production Facilities Notice of Installation = Application

STATE OF WYOMING

Department of Environmental Quality – Air Quality Division
Oil & Gas Production Facilities C6 S2 Notice of Installation

Company Name: _____

Facility Name: _____

To Be Completed by WDEQ-AQD

Reviewer _____
Copy to _____
D.E. _____

File: _____

Form AQD-OG0
NOI September 2013

Form AQD-OG00 Completeness Checklist

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division

Oil & Gas Production Facilities

Checklist for Complete Application

INDUSTRY		DEQ-AQD
	Company Name/Contact Information	
	Well/Facility Name and API #	
	Legal Locations	
	Existing Permit/Waiver #'s	
	List of Equipment Onsite	
	Plot Plan	
	Process Description	
	Current Production Rates	
	Gas/Condensate Analyses	
	All Pertinent Dates (date of first production, control installation date)	
	Emission Models (Input/Output)	
	Other Calculations (heaters, pneumatic equipment, truck loading, etc.)	
	All Applicable Application Forms	
	DEQ Application Cover Sheet	
	Facility Location Specify: STATEWIDE CDA UGRB JPAD/NPL	
SCENARIO 1 SCENARIO 2 NA	Dehydration Unit Presumptive BACT check appropriate box	SCENARIO 1 SCENARIO 2 NA

Form AQD-OG00

Completeness Checklist September 2013

Form AQD-OG1 Application Coversheet

STATE OF WYOMING
Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
Application Cover Sheet

submit (1) one signed original copy AND (1) one electronic copy of the application OR (3) paper copies, one w/ original signature

Company Name _____

Facility Name _____

API Number _____

For more than one well, list additional wells & associated API numbers on page 2 of this form.

OFFICIAL CONTACT PERSON

Name _____ Title _____

Address _____

Telephone _____ Fax _____ E-mail _____

LOCATION

County _____

Legal Description 1/4 1/4 _____ Section _____ T _____ R _____

Latitude _____ Longitude _____

FACILITY INFORMATION

Type of Facility: Single Well _____ PAD _____ Central Tank Battery _____

Type of Application: New Construction _____ Modified Facility _____

First Date of Production _____ Date of Modification _____

Producing Field Name _____

Producing Formation(s) _____

Existing Air Quality Permit / Waiver Numbers _____

Pending Air Quality Permit Application Numbers _____

I, _____
Responsible Official **Title**

state that I have knowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge and belief. I further certify that the emission rates listed on this certification reflect the anticipated emissions due to t

Signature _____ Date _____

Signature Required

FORM AQD-OG1
Application Coversheet September 2013

Form AQD-OG2 Equipment List

STATE OF WYOMING
Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application

Equipment List

Company Name	
Facility Name	

List all production equipment at the site including all pressurized vessels with the potential for flash emissions, all hydrocarbon liquids and produced water storage tanks, all dehydration units, all pneumatic pumps, all natural gas-fired burners and heaters and all emission control equipment and devices. Pressurized vessels with the potential for flash emissions are all vessels that vent vapors to the atmosphere during times other than upset or emergency conditions (water knockouts, 2-phase and 3-phase separators, heater treaters, gun barrels, scrubber pots, etc). Provide design ratings for dehys (MMCFD), process heaters, burners and pilots (MMBtu/hr, SCFH). Provide size of production & water storage tanks (BPD). For dehydration units indicate if the unit includes a glycol flash separator or reboiler still vent condenser. For emission control combustors/flares indicate design rating (MMBtu/hr, SCFD) and combustor/flare height (ft). Provide pneumatic pump motive gas useage (SCFH).

If more space is required, continue on page 2 of this sheet.

PROVIDE INSTALLATION DATES OF ALL EMISSION CONTROL EQUIPMENT & MONITORING DEVICES/SYSTEMS !!!

Example:

1 2-phase high pressure separator (unheated)

1 3-phase low pressure separator w/ 0.5 MMBtu/hr heater

2 0.5 MMBtu/hr line heaters

1 5 MMCFD TEG dehydration unit w/ 0.5 MMBtu/hr reboiler heater, glycol flash separator(0.5 MMBtu/hr heater) and overheads condenser

2 400-bbl condensate tanks

1 400-bbl produced water tank

1 30-ft enclosed combustor (3.0 MMBtu/hr, 5 MCFD) for flashing & reboiler vent/glycol flash separator emissions control installed 1/1/2007

FORM AQD-OG2

Equipment List September 2013

Form AQD-OG2 Equipment List, Page 2

STATE OF WYOMING
Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application

Equipment List - continued

Company Name	
Facility Name	

Form AQD-OG2
Equipment List Page 2 September 2013

Form AQD-OG3 Storage Tanks, Pressurized Vessels & Pneumatic Pumps

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
Storage Tanks, Pressurized Vessels & Pneumatic Pumps

Use as many copies of this form as necessary to include all tanks, vessels and pumps.

Company Name _____

Facility Name _____

STORAGE TANKS

Below, list all atmospheric tanks used to store liquids transferred from an upstream vessel or wellhead. Upstream vessels include separators, treaters, flash tanks, FWKOs, gun barrels, tanks, etc. If more than one tank of the same size is used for the same purpose, receiving fluids from the same upstream vessel, those tanks may be combined on one line.

E X A M P L E S				
2-400	condensate	100	2-phase separator	600
1-1000	produced water, skim oil	1000 water, 5 oil	treater	30
1-300	bad oil tank	5 oil	run tank	atmospheric
size (bbl)	use (condensate / oil / H_2O)	total throughput (bpd)	upstream vessel	upstream vessel pressure (psig)

PRESSURIZED VESSELS List each vessel separately.

Pressurized vessels include FWKO's, heater-treaters, separators (2-phase & 3-phase), gas boots, gun barrels, flash tanks, etc...

E X A M P L E S			
HP 2-phase separator	600	well	1000
LP 3-phase separator	300	HP separator	600
3-phase heater treater	30	well	40
vessel	operating pressure (psig)	upstream vessel	upstream vessel pressure (psig)

What is the API gravity of the SALES oil or condensate at this facility? _____

Does this facility handle sour oil / gas? YES _____ NO _____

EMISSION CONTROL DEVICES & SYSTEMS for FLASH VAPORS & PRESSURE VESSEL PROCESS STREAMS

Identify each emission control system or device and the date(s) of installation for each.

E X A M P L E: 30-foot ACME smokeless combustor for tank vapor emissions control, installed 1/1/2008

Combustion Device Emission Controls (if applicable)

Date of Installation _____

Manufacturer _____

Smokeless Design? Yes _____ No _____

Excess Oxygen (%) _____

VOC Destruction Effeciency (%) _____ HAP Destruction Efficiency (%) _____

Maximum Design Throughput (SCFD) _____ Minimum Design throughput (SCFD) _____

Actual Waste Gas Volume (SCFD) _____ Waste Gas Heat Content (Btu/SCF) _____

Burner Rating (MMBtu/hr) _____

Ignition System: Pilot _____ Electric Spark _____ Other _____

Continuous Pilot? Yes _____ No _____

Pilot Gas Volume (SCFM) _____

Is the Combustion Device Monitored? Yes _____ No _____ How? _____

PNEUMATIC PUMPS

Describe each pneumatic pump using natural gas as the motive gas. Indicate where motive gas is vented (atmosphere or other).

E X A M P L E: 50 SCFH Acme brand heat trace circulation pump operated w/ produced gas, vented to gas collection system.

Form AQD-OG3

Storage Tanks, Pressurized Vessels and Pneumatic Pumps September 2013

Form AQD-OG4 Dehydration Units

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
Dehydration Units

Use multiple copies of this form to provide the required information for each dehydration unit at the facility.

Company Name _____

Facility Name _____

Fill in all information below for each dehydration unit.

P-BACT control scenario (check appropriate box) **SCENARIO 1** ____ **SCENARIO 2** ____

Design Rating (MMSCFD) _____

Type of Glycol: TEG ____ DEG ____ EG ____ other _____

Reboiler Heater Rating (MMBtu/hr) _____

Wet Gas (Upstream of Contact Tower)

Temperature (°F) _____ Pressure (psig) _____

Is the Wet Gas Saturated? YES ____ NO ____

If NO, Wet Gas Water Content (lbs H_2O/MMSCF) _____

Dry Gas (Upstream of Contact Tower)

Flowrate (MMSCFD) _____ Water Content (lbs H_2O/MMSCF) _____

Glycol Circulation Pump

Manfacturer _____

Model _____

Gas Operated Pump? _____ Electric Pump? _____

Maximum LEAN Glycol Circulation Rate (gpm) _____ Actual LEAN Glycol Circulation Rate (gpm) _____

Limited LEAN Glycol Pump Rate (gpm) (if applicable) _____

Source of Motive Gas for Pump _____

Pump Volume Ratio (ACFM/gpm) _____

Glycol Flash Separator (if applicable)

Date of installation _____

Operating Temperature (°F) _____ Operating Pressure (psig) _____

Indirect Heater Rating (MMBtu/hr) _____

Flash Tank Off Gas Stream (scfh) _____

Where are flash vapors routed? _____

Stripping Gas (if applicable)

Source of Stripping Gas Dry Gas ____ Flash Gas ____ Nitrogen ____

Stripping Gas Rate (scfm) _____

Process Vent Emissions Control System / Device

Reboiler Still Vent Condenser (if applicable)

Condenser Temperature (°F) _____ Condenser Pressure (psia) _____

Condenser Vent Vapor Flowrate (scfh) _____

Where are non-condensible vapors routed? _____

Combustion Device (if applicable)

Date of Installation _____

Manufacturer _____

Smokeless Design? Yes ____ No ____

Excess Oxygen (%) _____

VOC Destruction Effeciency (%) _____ HAP Destruction Efficiency (%) _____

Maximum Design Throughput (SCFD) _____ Minimum Design throughput (SCFD) _____

Actual Waste Gas Volume (SCFD) _____ Waste Gas Heat Content (Btu/SCF) _____

Burner Rating (MMBtu/hr) _____

Ignition System: Pilot ____ Electric Spark ____ Other ____

Continuous Pilot? Yes ____ No ____

Pilot Gas Volume (SCFM) _____

Is the Combustion Device Monitored? Yes ____ No ____ How? _____

Describe any process vent emission control devices or systems not described above.

_____

_____

Form AQD-OG4

Dehydration Units September 2013

Form AQD-OG5 Pumping Unit Engines

STATE OF WYOMING
Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
Pumping Unit Engines

This form is to be used for PUMPING UNIT ENGINES ONLY

Company Name _____

Facility Name _____

Engine Manufacturer _____

Model _____

Site Rated Horsepower _____

Number of Cylinders _____

Date of Installation _____

Fuel Type

Natural Gas _____ LP _____

Diesel _____ Gasoline _____

Emissions

Nitrogen Oxides (NO_X) (grams / Hp-hr) _____

Carbon Monoxide (CO) (grams / Hp-hr) _____

Formaldehyde (grams / Hp-hr) _____

Voltile Organic Compounds (VOC) (grams / Hp-hr) _____

Annual Operating Hours (continual - 8760 hr/yr) _____

Emission Control Equipment

Lean Burn Technology _____

Oxidation Catalyst _____

NSCR Catalyst _____

SCR Catalyst _____

Other _____

BEST AVAILABLE CONTROL TECHNOLOGY (B A C T)

Is a BACT analysis attached? YES _____ NO _____

Form AQD-OG5

Pumping Unit Engines September 2013

Form AQD-OG6 Emission Summary

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
EMISSION SUMMARY

Company Name _____

Facility Name _____

This form must be completed for each emission source at the facility. A list of the emission sources which must be considered is found in Appendix B of the C6 S2 O&G Production Facilities Permitting Guidance.

UNCONTROLLED EMISSIONS (Tons Per Year)

These are the total uncontrolled, potential emissions from each source.

EMISSION SOURCE (i.e., tank, natural gas-fired heater, reboiler still vent, glycol flash separator, pneumatic pump, separator gas vent, water knockout vent, etc.)	VOCs	total HAPs	NOX	CO	SO2	H2S

CONTROLLED EMISSIONS (Tons Per Year)

These are the total emissions from each source. Include controlled emissions from each controlled source and uncontrolled emissions from each source which does not require control, such as process equipment burners.

EMISSION SOURCE	VOCs	total HAPs	NOX	CO	SO2	H2S

HAZARDOUS AIR POLLUTANT SUMMARY (Tons Per Year)

Complete this section for each emissions source if TOTAL HAPs from that source are 9 TPY or greater.

SOURCE	Benzene	Toluene	Ethyl-Benzene	Xylenes	Other

Form AQD-OG7 Notice of Installation

STATE OF WYOMING
Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
NOTICE of INSTALLATION

Company Name _____
Facility Name _____

Appropriate use of this form is described on Pages 41 – 44 of the C6 S2 O&G Production Facilities Permitting Guidance.
Submit one (1) signed original copy and one (1) electronic copy of the NOI
OR
three (3) paper copies of the Notice of Installation – one (1) with an original signature.

Contact
Name _____ Title _____
Address _____
Telephone _____ Fax _____ E-Mail _____

Location
County _____
¼ ¼ Section _____ Section _____ Township _____ Range _____
Latitude _____ Longitude _____

Date of Installation _____

Facility Information
API number, if applicable _____
Well field name _____
Producing formation, if applicable _____

Is this NOI being filed for new equipment at a new location? YES ____ NO ____
Is this NOI being filed for new or replacement equipment at an existing location? YES ____ NO ____
If YES, list existing Air Quality Permit or Waiver numbers. _____
List any pending Air Quality Permit application numbers. _____

Below, list the equipment to be installed under this NOI.

E X A M P L E S	
(1) 0.5 MMBut/hr line heater	(1) 25-Hp AJAX pumping unit engine, 2 TPY NO_X emissions
replace 400-bbl condensate tank with like kind	wellhead only @ new sour well facility
(1) 400-bbl cond. tank, vent line routed to existing combustor	(1) unheated 2-phase separator, dumps to collection system

Attach any information demonstrating equipment installed under this NOI complies with the conditions described on Pages 34 – 36 of the C6 S2 O&G Production Facilities Permitting Guidance. For example, provide manufacturer's engine emission factors indicating emissions from a new pumping unit engine will be less than 5 TPY NO_X.

I, _____ _____
Responsible Official Title

state that I have knkowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge and belief. I further certify that the emission rates listed on this certification reflect the anticipated emissions due to the operation of this facility. The facility will operate in compliance with all Wyoming Air Quality Standards and Regulations.

Signature _____ Date _____
Signature Required

Form AQD-OG7
Notice of Installation September 2013

Form AQD-OG8 Multiple Facilities

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
Multiple Facilities

Provide the following information for each site included with a multiple facility application. You may use this form or provide the required information on a spreadsheet or complete as many copies of this form as necessary to include all sites.

Company Name _____

Site Name _____
API Number _____
Production Field Name _____ Producing Formation _____

First Date of Production _____

LOCATION

County _____
Legal Description ¼ ¼ Section _____ Section _____ T _____ R _____
Latitude _____ Longitude _____

CURRENT PRODUCTION RATES

gas (MMCFD) _____ oil / condensate (BPD) _____

EQUIPMENT List tanks, separators, treaters, pneumatic pumps, dehys, flares, burners, etc. Include sizes & design ratings.

_____ _____
_____ _____
_____ _____
_____ _____

Site Name _____
API Number _____
Production Field Name _____ Producing Formation _____

First Date of Production _____

LOCATION

County _____
Legal Description ¼ ¼ Section _____ Section _____ T _____ R _____
Latitude _____ Longitude _____

CURRENT PRODUCTION RATES

gas (MMCFD) _____ oil / condensate (BPD) _____

EQUIPMENT List tanks, separators, treaters, pneumatic pumps, dehys, flares, burners, etc. Include sizes & design ratings.

_____ _____
_____ _____
_____ _____
_____ _____

Form AQD-OG8 Multiple Facilities September 2013

Form AQD-OG9 Change of Ownership

STATE OF WYOMING
Department of Environmental Quality - Air Quality Division

Change of Ownership Form

NEW OWNER

Company Name _____

Mailing Address _____

City _____ State _____ Zip Code _____

Owner or Company Official to contact regarding air pollution matters:

Name _____ Title _____

Address _____

Telephone _____ Fax _____ E-mail _____

PREVIOUS OWNER

Company Name _____

Mailing Address _____ _____

City _____ State _____ Zip Code _____

Telephone _____ Fax _____ E-Mail _____

FACILITY INFORMATION

Facility Name _____ County _____

Date of Ownership Change _____

Legal Description ¼ ¼ Section _____ Section ____ T _____ R _____

Lat/Long Coordinates Latitude _____ Longitude _____

Type of Facility Tank Battery ____ Wellsite Facility ____ Dehydration Unit ____

Compressor Station ____ Gas Plant ____ Other ____

Describe if other _____

_____

FOR MULTIPLE SITES...

On a separate piece of paper continue the list of the facility names, counties, location descriptions and facility types for each site for which ownership has changed.

Form AQD-OG9
Change of Ownership September 2013

Form AQD-OG10 BACT Cost Analysis

Company Name: _____
Facility Name: _____

Wyoming Air Quality Standards and Regulations - Chapter 6, Section 2(c)(v)

Best Available Control Technology Control Cost Analysis Worksheet

(Based on Office of Air Quality Planning and Standards, EPA, OAQPS Control Cost Manual, Fourth Edition, EPA 450/3-90-006, January 1990, Section 2.3.2)

Reference No.	Site Rating (units)	Manufacturer	Model	Control Method	Controlled or Targeted Emission	Typical BACT (units)	Targeted Emission without Control (TPY)	Targeted Emission with Control (TPY)
Example	1500	Waukesha	L7042GSI	Catalitic/AFR	NOx	2 g/hp-hr	144.7	28.9

Reference No.	Interest Rate (i)	Control System Life (n)	Capital Recovery Factor (CRF)	Capital Investment (P)	Annual Maintenance Cost	Capital Recovery Cost (CRC)	Realized Economic Benefit
Example	0.1	10	0.163	$14,000	$4,000	$2,278	$0
0			#DIV/0!			#DIV/0!	
0			#DIV/0!			#DIV/0!	

"n" is the control system economic life, typically thought to be 10-20 years.
"i" is the considered the annual pretax marginal rate of return on private investment (i.e., what it may cost you to borrow the money).
"P" is the capital investment required to install the controls (i.e., equipment purchase cost, installation/retrofit cost, engineering, etc.).
Annual Maintenance Cost is the yearly costs to maintain the control effectiveness (i.e., cleaning, testing, etc).

CRC = CRF * P

CRC = Capital Recovery Cost (Annualized cost of control over the life of the control)
CRF = Capital recovery Factor
P = Capital Investment

CRF = i(1+i)n/(1+i)n-1

i = Annual Interest Rate
n = Economic life of the control

Total Annual Cost (TAC) = Annual Maintenance Cost + Capital Recovery Cost - Realized Economic Benefit

Cost to Control = TAC / (Targeted Emission Volume Without Control - Targeted Emission Volumn with Control)

Reference Number	TAC ($)	Cost to Control ($/Ton)
Example	$6,278	**$54**
0	#DIV/0!	**#DIV/0!**
0	#DIV/0!	**#DIV/0!**

Does the control have "Economic Reasonableness" and "Technical Practicability"? _____

APPENDIX B

EMISSION CALCULATIONS

Emissions from processes and equipment which shall be accounted for and reported by applicants FOR ALL O&G PRODUCTION FACILITIES are:

Emission Unit or Process	Associated Emissions
storage tanks (flashing & S/W/B losses)	VOC HAP H_2S
pressurized vessels (flashing losses)	VOC HAP H_2S
dehydration units (reboiler still vents & glycol flash tanks)	VOC HAP
natural gas fired burners, heaters, flares	NO_X CO SO_2
natural gas operated pneumatic pumps	VOC HAP H_2S
fugitives	VOC HAP H_2S
natural gas fired engines	NO_X CO SO_2
truck load out	VOC HAP H_2S

AP-42 EMISSION FACTORS

Throughout this Guidance reference is made to AP-42 emission factors. The complete AP-42 compilation may be downloaded from http://www.epa.gov/ttn/chief/ap42/index.html

STORAGE TANK EMISSIONS

Flashing and Standing/Working/Breathing (S/W/B) losses are the terms for emissions which occur when hydrocarbon liquids are exposed to temperature and pressure changes (i.e., from separator pressure and temperature to storage tank pressure and temperature) causing hydrocarbon vapors to be released from the liquids. The vapors may contain VOCs, HAPs and H_2S.

Software is available for modeling these emissions. Models accepted by the Air Quality Division are those using Peng-Robinson or S-R-K methods based on widely accepted principals of behavior for hydrocarbon vapors and liquids. Some common software programs for estimating these emissions are PROMAX, HYSIM, HYSYS, K-FLASH, PROSIM and API E&P TANKS v2.0. The models require input detailing chemical properties of the fluids handled and physical operating parameters of the system(s) and production equipment. Output from the models includes volumes, rates and chemical components of the individual process streams from tanks and pressurized vessels.

Emissions from storage tanks may also be physically measured. In order to do so all tank valves, hatches, relief devices, leaks, etc. shall be sealed. Tank vapors shall only be allowed to exit the tank through a metered outlet. Usually this requires a meter capable of measuring low volumes. The measurement period shall last long enough to capture a representative tank vapor volume. An extended hydrocarbon analysis of the vapors shall be obtained along with the vapor volume.

MEASURED TANK FLASH EMISSIONS – EXAMPLE CALCULATION

The tons per year of VOC and HAP emissions associated with tank flashing are calculated as follows:

Given: Condensate tank vapors = 1000 scf/day
VOC weight % = 20
HAP weight % = 5
Condensate vapor molecular weight = 20 lb/lb-mol

TPY total flash emissions = 1000 scf/day × (1 lb-mol/379 scf) × (20 lb/lb-mol) × (ton/2000 lb) × (365 days/year) = 9.6 TPY

TPY total VOC emissions = 9.6 TPY × (20 weight % VOC / 100) = 1.9 TPY VOC
TPY total HAP emissions = 9.6 TPY × (5 weight % HAP / 100) = 0.5 TPY HAP

S/W/B losses

Not all software programs include tools for estimating S/W/B losses. There is free software available from the EPA named EPA TANKS. The most recent available version of EPA TANKS is ver. 4.09D. The software may be downloaded from the EPA website at http://www.epa.gov/ttn/chief/software/tanks/index.html

PRESSURIZED VESSELS

Whenever vapors from a pressurized vessel (separator, treater, FWKO, flash separator, gunbarrel, gas boot, etc) are released to the atmosphere, other than during times of emergency or upset conditions, emissions associated with those vapors shall be accounted for.

The same flash emission models mentioned above, for tank flash emissions, are often used to estimate emissions from pressurized vessels. Again, an extended hydrocarbon analysis of the liquids involved and actual operational conditions of the production equipment are necessary as input for the models.

Even when vapors from a pressurized vessel are collected for use as process burner fuel or fuel for an IC engine, for example, emissions associated with the total vapors shall be accounted for when considering potential emissions from a facility. If the volume and rate of vented vapors are known and an extended hydrocarbon analysis is available, associated emissions may be calculated in the same manner as described on Page 62 (calculation of flash emissions). If these are not available, the volumes shall be measured and analyzed in order to perform the calculations and determine associated emissions.

DEHYDRATION UNIT EMISSIONS

Air pollutants, mostly VOCs and HAPs, are associated vapors released from reboiler still vents and glycol flash separators. To estimate these emissions the GRI-GLYCalc v3.0 or higher model or other approved method is used. This relatively inexpensive software was created by the Gas Research Institute (GRI) for determining optimal operating parameters for dehydration units and is available from the Gas Technology Institute (GTI) with a website address of http://www.gastechnology.org

Input for the model includes an extended hydrocarbon analysis of wet gas sampled upstream of the contact tower, actual operating parameters of all associated equipment (i.e., reboiler still vent temp., flash separator temp., dry gas flow rate, glycol recirculation rate, condenser, etc) and physical properties of the dry and wet gas streams. The model provides an estimate of individual emission components and the rates of vapor and liquid streams exiting each process vent of a dehydration unit. When submitting a GRI-GLYCalc model it is only necessary to submit the INPUT SUMMARY, EMISSIONS SUMMARY, CONDENSER VENT OUTPUT (if applicable) and FLASH TANK OUTPUT (if applicable).

NATURAL GAS FIRED HEATERS (external combustion equipment)

NO_X, CO and VOC emissions from process unit heaters should be calculated using the emission factors (EF) below from EPA AP-42, Tables 1.4-1, 1.4-2 and 1.5-1. The following lists these factors:

Emission Factors for Industrial and Commercial Boilers

Pollutant	Butane Gas[1] (0.3 to 100 MMBtu/hr heat input)	Propane Gas[2] (0.3 to 100 MMBtu/hr heat input)	Natural Gas[3] <100 MMBtu/hr heat input	Natural Gas[3] <100 MMBtu/hr heat input
NO_X[4]	15 lb/1000 gal	13 lb/1000 gal	0.098 lb/MMBtu	100 lb/MMcf
CO[4]	8.4 lb/1000 gal	7.5 lb/1000 gal	0.082 lb/MMBtu	84 lb/MMcf
TOC[4,5]	1.1 lb/1000 gal	1.0 lb/1000 gal	0.010 lb/MMBtu	11 lb/MMcf

1 Based on an average heating value of 102×10^6 Btu/1000 gallons of Butane.

2 Based on an average heating value of 91.5×10^6 Btu/1000 gallons of Propane.

3 Based on an average heating value of 1020 Btu/SCF of natural gas.

4 The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factors by the ratio of the heating value of the actual gas used to the average heating values listed
Converted EF = (EF from table above × (actual heat value/heat value in table)).

5 VOC emissions may be determined by multiplying the calculated TOC (total organic compounds) emission rate by the weight percent of VOC compounds in the actual fuel gas stream.

HEATER EMISSIONS - EXAMPLE CALCULATION

Given: Separator heater rating = 0.5 MMBtu/hr
Gas Heating Value = 1300 Btu/scf
VOC weight % = 20
Annual operating hours = 8760
NO_X EF = 100 lb/MMcf
CO EF = 84 lb/MMcf
TOC EF = 11 lb/MMcf

NO_X emissions = (0.5 MMBtu/hr) × (100 lb/MMcf) × (1300 Btu/1020 Btu) x (1 scf/1020 Btu) × (8760 hr/yr) × (ton/2000 lb) = 0.27 TPY NO_X

For CO emissions, the same calculation is used except the EF is 84 lb/MMcf.

VOC emissions = 0.5 × 11 x (1300/1020) x 1/1020 × 8760/2000 x (20% VOC/100) = 0.006 VOC TPY VOC ← INSIGNIFICANT at less than 0.1 TPY

FLARES

The NO_X and CO emissions for flares should be based on **0.14 lb NO_X/MMBtu and 0.035 lb CO/MMBtu**[1] and the reported fuel usage based heat input. VOC and HAP emissions from flaring should be based upon the guaranteed destruction efficiency of the flare. Reported flared gases shall include pilot gas with heat content and flared gas with average estimated heat content. The rational for using these factors as opposed to AP-42 factors for flares is that the flare factors are believed to be only applicable to chemical plant type flares engaged in burning low BTU gases. The gases typically burned in flares in Wyoming contain more than 900 Btu/scf and emissions are expected to be closer to the AP-42 factors for NO_X and CO from gas fired heaters and boilers greater than 10 MMBtu/hr.

FLARE EMISSIONS - EXAMPLE CALCULATIONS – CONDENSATE TANK FLASH

Given: Total waste gas = 125 scf/hr
Gas heating value = 1350 Btu/scf
H_2S weight % = 5.5
H_2S mole % = 4.4
Tank vapor MW = 28 lb/lbmol
SO_2 MW = 64 lb/lbmol

NO_X emissions = (125 scf/hr) × (1350 Btu/scf) × (0.14 lb NO_X /MMBtu) × (MMBtu/10^6 Btu) × (8760 hr/yr) × (1 ton/2000 lb) = 0.1 TPY NO_X

Unflared H_2S emissions = (125 scf/hr) × (28 lb/lb-mol) × (1 lb-mol/379 scf) × (8760 hr/yr) × (ton/2000 lb) x (5.5/100) = 2.2 TPY H_2S

Flared H_2S emissions = (2.2 TPY) × (100% - 98%/100)= 0.04 TPY H_2S ← INSIGNIFICANT at less than 0.1 TPY

SO_2 emissions from flaring sour gas = (125 scf/hr) × (8760 hr/yr) × (1 lb-mol/379 scf) × (64 lb SO_2/lb/mol) × (ton/2000 lb) × (4.4/100)
= 4.1 TPY SO_2

FLARE PILOT EMISSIONS

Given: Flare pilot gas = 5 scf/min
Gas heating value = 1000 Btu/scf

NO_X emissions = (5 scf/min) × (1000 Btu/scf) × (0.14 lb NO_X/MMBtu) × (MMBtu/10^6 Btu) × (60 min/hr) × (8760 hr/yr) × (1 ton/2000 lb)
= 0.18 TPY NO_X

For CO emissions the same calculations are used except the EF for CO is 0.035 lb/MMBtu.

FLARE EMISSIONS EXAMPLE CALCULATION – DEHYDRATION UNITS

Given: Glycol flash separator vapors = 25 scf/min
Reboiler still vent vapors = 5 scf/min
Total waste gas = 30 scf/min (25 scf/min glycol flash vapors + 5 scf/min reboiler still vent vapors)
Gas Heating Value = 1050 Btu/scf (**assume at least 1000 BTU/SCF if the heat content is unknown**)

NO_X emissions = (30 scf/min) × (1050 Btu/scf) × (0.14 lb NO_X/MMBtu) × (1 MMBtu/10^6 Btu) × (60 min/hr) × (8760 hr/yr) × (1 ton/2000 lb)
= 1.1 TPY NO_X

For CO emissions the same calculations are used except the EF for CO is 0.035 lb/MMBtu.

[1] Emission factors from Section 4 of EPA Document "Preferred and Alternative Methods for Estimating Air Emissions from Oil and Gas Field Production and Processing Operations".

PNEUMATIC PUMPS

If a pneumatic pump uses natural gas as the motive gas, the pump will release VOC and HAP emissions each time it strokes since all motive gas is vented by the pump. To determine emissions from the pump, manufacturer's information regarding gas usage shall be known as well as the hydrocarbon composition of the motive gas.

PNEUMATIC PUMP EMISSIONS - EXAMPLE CALCULATION

A Texsteam Series MX pump is used to circulate hot glycol in heat trace lines. The pump moves 0.15 gallons per 40 strokes and is currently stroking at 20 strokes per minute (spm). The pump requires 24 scf for each gallon of glycol pumped. The pump motive gas weighs 20 lb/lb-mol and contains 50 wt% VOCs and 30 wt% HAPs.

Pump usage/vent rate = (20 strokes/min) × (0.15 gallons/40 strokes) × (24 scf/gallon) = 1.8 scf/min

VOC emissions = (1.8 scf/min) × (20 lb/lb-mol) × (lb-mol/379 scf) × (ton/2000 lb) × (525600 min/yr) × (50 wt% VOC/100) = 12.5 TPY VOC

TRUCK LOADING

VOC emissions from loading oil or condensate into tank trucks should be estimated using the following formula with data from AP-42 tables.

$$L_L - 12.46 \times S \times P \times M/T$$

Where: L_L = loading loss, pound per 1,000 gallons of liquid loaded (lb/1000 gal)
S = a saturation factor (See Table 5.2-1 below)
P = true vapor pressure of liquid loaded (psia)
M = molecular weight of tank vapors (lb/lb-mol)
T = temperature of bulk liquid loaded (°R) (°R = °F + 460)
"S" values are obtained from Table 5.2-1.
"M" and "N" values are obtained from Table 7.1-2.

Table 5.2-1 Saturation (S) Factors for Calculating Petroleum Liquid Loading Losses

Cargo Carrier	Mode of Operation	"S" Factor
tank trucks and rail tank cars	submerged loading of a clean cargo tank	0.50
	submerged loading: dedicated normal service	0.60
	submerged loading: dedicated vapor balance service	1.00
	splash loading of a clean cargo tank	1.45
	splash loading: dedicated normal service	1.45
	splash loading: dedicated vapor balance service	1.00

Table 7.1-2 Properties of Selected Petroleum Liquids
Only crude oil properties are supplied here. The full table of values can be found in AP-42, Table 7.1-2)

petroleum liquid	vapor molecular weight at 60ºF (lb/lb-mol)	condensed vapor density at 60ºF (lb/gal)	liquid density at 60ºF (lb/gal)	true vapor pressure (psi) at various temperatures in ºF						
				40	50	60	70	80	90	100
	"M"			"P"						
Crude Oil RVP 5	50	4.5	7.1	1.8	2.3	2.8	3.4	4.0	4.8	5.7

TRUCK LOADOUT - EXAMPLE CALCULATION

Given: Condensate loaded = 360 bbl crude/month
S = 0.6
P = 2.3 psi
M = 50 lb/lb-mol
T = 50

$$L_L = \frac{(12.46) \times (0.60) \times (2.3 \text{ psi}) \times (50 \text{ lb/lb-mol})}{(50^oF + 460)} = 1.69 \text{ lb/1000 gal}$$

Loading losses (TPY) = (1.69 lb/1000 gal) × (annual sales of 360 bbl/mo) × (12 mo/yr) × (42 gal/bbl) × (ton/2000 lb) = 0.15 TPY

FUGITIVE EMISSIONS

The easiest way to calculate total hydrocarbon fugitive emissions is to multiply the number of components at a site by the EPA Average Emissions Factors shown in the tables below. The first table lists the average emission rates of **total hydrocarbon** (THC) to be assumed for all components in hydrocarbon service installed at a site. The factors are current as of June 15, 1996 and given in pounds per component - day (lb/component-day). The second table lists speciated rates.

The only information needed for this method is a count or estimate of the number of flanges, connectors (other than flanges), open-ended lines, pumps, valves and "other" components at the site grouped by stream (gas, light oil, heavy oil, water/oil). The number of components can be determined by either counting them in the field or by estimating them.

EPA Average Emission Factors for Total Hydrocarbon (THC) Emissions From O&G Production Operations

(lb/component-day)

equipment type	equipment service category			
	gas	heavy oil (< 20ºAPI)	light oil (> 20ºAPI)	water/light oil [1]
connector	.011	.0004	.011	.0058
flange	.021	.000021	.0058	.00015
open ended line	.11	.0074	.074	.013
other [2]	.47	.0017	.4	.74
pump	.13	not available	.69	.0013
valve	.24	.00044	.13	.0052

SOURCE: US EPA Bulletin Board (Leaks_OG.WP5; 8/9/1995)

[1] The water/light oil emission factors apply to water streams in light oil service with water content between 50% and 99%. For streams with water content > 99% the emission rate is considered negligible.

[2] The "other" equipment type includes compressor, pressure relief valves, diaphragms, drains, dump arms, hatches, instruments, meters, polished rods and vents.

NOTE: The emission factors in the table above are not intended to be used to represent emissions from components that are improperly designed (e.g., enardo valves over pressurizing, failure of thief hatches to reseat after over pressurizing) or equipment not maintained properly (e.g., thief hatch left open). For example, emissions from an enardo valve on a condensate tank vent line, operating in the full or partially open position due to excessive tank vapor pressure that exceeds the pressure setting of the enardo valve, are not considered to be fugitive emissions.

Speciated hydrocarbon emission rates can be estimated by multiplying the total hydrocarbon emission rates obtained from the table above by actual measured weight fractions or by using the values listed in the table below.

Speciated Fugitive Emission Factors

(Estimated weight fractions of THC emissions in each category)

	Methane	NMHC	VOC	$C6^+$	Benzene	Toluene	Ethyl-Benzene	Xylenes
light crude	0.613	0.387	0.292	0.02430	0.00027	0.00075	0.00017	0.00036
heavy crude	0.942	0.058	0.030	0.00752	0.00935	0.00344	0.00051	0.00372
gas production	0.92	0.080	0.035	0.00338	0.00023	0.00039	0.00002	0.00010

NOTES: 1. Emission factor = Speciated Emissions/Total Emissions
2. NMHC = Non-methane hydrocarbons
3. VOC = Propane and heavier hydrocarbons

FUGITIVE EMISSIONS - EXAMPLE CALCULATION

Given: 25 valves in light oil service
THC emission factor = 0.13 lb/component-day
VOC weight fraction = 0.292
HAP weight fractions = 0.02430 + 0.00027 + 0.00075 + 0.00017 + 0.00036 = 0.0259

VOC emissions = 25 valves × 0.13 lb THC/valves-day × 1 ton/2000 lb × 365 day/hr × 0.292 = 0.17 TPY VOC

HAP emissions = 25 valves × 0.13 lb THC/valves-day × 1 ton/2000 lb × 365 day/yr × 0.0259 = 0.015 TPY total HAPs

INTERNAL COMBUSTION PUMPING UNIT ENGINE EMISSIONS

The method for calculating engine emissions is to use emission factors provided by the engine manufacturer, the maximum site-rated horsepower and the annual operating hours.

PUMPING UNIT ENGINE EMISSIONS - EXAMPLE CALCULATION

Given: Manufacturer's NO_X emission factor = 2 g/hp-hr
Maximum site-rated horsepower = 250 hp
Annual operating hours = 8760

NO_X emissions = (2.0 g/hp-hr) × (250 hp) × (8760 hr/yr) × (ton/2000 lb) × (1 lb/453.6 g) = 4.8 TPY

For CO and VOC emissions the same calculations are used except the manufacturer's EF for CO and VOC are used.

CONVERTING MOLE PERCENT TO WEIGHT PERCENT

Many emission estimation and calculation methods require weight percents to be used, rather than mole percents. Most lab analyses list gas constituents in mole percents, however you can request the lab provide both mole and weight percents.

You may download the Excel spreadsheet to convert mole percent to weight percent, at http://deq.state.wy.us/aqd/miscforms.asp

APPENDIX C

DEFINITIONS

Air Contaminant - shall mean dust, fumes, mist, smoke, other particulate matter, vapor, gas or any combination of these; but shall not include steam or water vapor.

Air pollutants - Also known as criteria pollutants, Air pollutant emissions which have ambient air standards associated with them. Air pollutants include such emissions as volatile organic compounds (VOC), nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide (SO_2), hazardous air pollutants (HAP) and others.

Average Daily Production - The qualified maximum total production of domestic crude petroleum and petroleum condensates including natural gas liquids produced from a well during a certain period of time (i.e. 1-month, 1-year) divided by the number of calendar days in the certain period during which the well produced. For example, the average 30-daily condensate production rate for well ABC is the qualified maximum total condensate production during the 30-day period x(BBL) ÷ 30(days) = y(BPD). If well ABC only produced 5 days out of the 30-day period, then the average daily condensate production rate for the well is x(BBL) ÷ 5(days) = y(BPD).

Closed System – A vessel (treater, separator), pipeline, sales line, gathering line, collection line, field gas supply or distribution line or any other vessel or line from which no vapors or liquids can exit through open lines, holes, vents or valves unless those lines, holes, vents or valves are connected to another closed system or to a source of continual and complete combustion, unless the vent or valve is a relief device that is designed and intended to open only during emergency situations.

Completion – An oil well shall be considered completed when the first new oil is produced through wellhead equipment into lease tanks from the producing interval after the production string has been run. A gas well shall be considered completed when the well is capable of producing gas through wellhead equipment from the producing zone after the production string has been run.

Condensate - Hydrocarbon liquid separated from natural gas that condenses (becomes liquid) due to changes in temperature, pressure, or both, and remains liquid at standard conditions.

Custody Transfer - The transfer of produced petroleum and/or condensate, after processing and/or treatment in the producing operations, from storage vessels or automatic transfer facilities to pipelines or any other forms of transportation.

Division - The Department of Environmental Quality, Air Quality Division

First Date of Production - The date permanent production equipment is in place and product is consistently flowing to sales lines, gathering lines or storage tanks. Production occurring during well completion activities which is routed to temporary production equipment is considered to occur prior to the First Date of Production. If extended periods of time pass between zone completions but production from initially completed zones is consistently flowing to permanent production equipment, the First Date of Production is the date when production from the initial zones began consistently flowing to the permanent production equipment, even though more zones will be completed later.

Fugitive Emissions (Fugitives) - Air emissions which result from gas vapors escaping through and around seals, packing, gaskets, threads, and other such pressure sealing connections.

Gas – All natural gases and all hydrocarbons not defined as oil.

Gas Well – A well, the principal production of which, at the mouth of the well, is gas, as defined by the Wyoming Conservation Law.

Grand fathered - A facility, installation or site which was built or in service before May 29, 1974 and that has not been physically or operationally changed, causing an increase in any pollutant (to which any state standard applies) or causing the emission of a new pollutant. (Modifications which could eliminate grandfather status are increasing production rate by fracturing, acidizing, recompletion of a zone, change in artificial lift methods, bringing new wells into a central battery or a waterflood response. Also such things as installing an engine, increasing horsepower, change in burner ratings. This list is not all inclusive and judgment should be used to determine appropriate status.)

HAP - Hazardous air pollutant, found in Section 112(b) of the Clean Air Act is a list of 188 contaminants with the classification "hazardous air pollutant". Typical hazardous air pollutants include benzene, toluene, ethyl-benzene, xylene, n-hexane, formaldehyde, methanol and others.

Major Emitting Facility - A facility which either has the potential to emit 250 TPY or more of any one regulated air pollutant or is a named facility and has the potential to emit 100 TPY or more of any one regulated air pollutant.

Major Source - A source which emits either 100 TPY or more of a regulated air pollutant, 10 TPY or more of a hazardous air pollutant, or 25 TPY or more of the total hazardous air pollutants.

Modified Facility - An existing facility becomes modified once production streams or production equipment associated with another well or wells is added to or tied into it. The date modification occurs to an existing facility is the First Date of Production for the added well or the date the production streams associated with an additional well or wells are tied into equipment at the existing facility.

Examples of modified facilities not involving new wells or added production from other wells are:

- An existing well facility is completed in additional production zones resulting in increased production and/or emissions at the facility greater than those previously permitted.
- Existing production equipment is replaced with larger equipment, resulting in increased potential or actual emissions.

Oil – Crude petroleum oil and any other hydrocarbons, regardless of gravities, which are produced at the well in liquid form by ordinary production methods, and which are not the result of condensation of gas before or after it leaves the reservoir.

Oil Well – A well, the principal production of which, at the mouth of the well, is oil, as defined by the Wyoming Conservation Law.

PAD - A PAD facility is a location where more than one well and/or associated production equipment are located, where some or all production equipment is shared by more than one well or where well streams from more than one well are routed through individual production trains located at the same or contiguous and adjacent location. If the production streams or production equipment associated with one or more wells is added to an existing single well facility, that location is then considered to be a PAD facility. A single well becomes a multiple well or PAD facility upon the First Date of Production of an additional well at the location or on the day production streams associated with an additional well or wells from separate locations are routed to the single well facility.

Potential to Emit - The maximum capacity of a stationary source to emit any air pollutant under its physical and operational design. Any physical or operational limitation on the capacity of a source to emit an air pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored or processed, shall be treated as part of its design if the limitation is enforceable by the EPA and the Division.

Recompletion – Any downhole operation in an existing oil or gas well that is conducted to establish production of oil or gas from any geological interval not currently completed or producing in said existing oil or gas well.

Single Well Facility – A single well facility is one where production equipment is associated with only one well. A single well becomes a multiple well or PAD facility upon the First Date of Production of an additional well at the location or on the day production streams associated with an additional well or wells from separate locations are routed to the single well facility.

Spud – The commencement of operations for the first boring of a hole for the drilling of an oil, gas or injection well. This includes setting conductor casing.

Synthetic Minor - "Synthetic Minor" sources are sources that do the following types of things to limit emission rates below 100 TPY: 1) limit operating hours of a source or 2) limit production rates such that source emissions are less than 100 TPY.

VOC - Volatile organic compound means any organic compound which participates in atmospheric photochemical reactions; typically considered C_3^+ or Non-methane/ethane hydrocarbon vapors.

VOC Weight Percent - This is the weight of the volatile organic compounds, expressed as a percent, as compared to the total weight of the compounds in a gas stream. (This should not be confused with the volume or mole percent of a gas stream, which is usually how it is expressed in a lab analysis of a gas.)

Wildcat Well – Any oil or gas well designated as a wildcat well by the Wyoming Oil and Gas Conservation Commission. Wildcat wells are wells outside known fields or new wells which are determined by the Commission to have discovered oil or gas in a pool not previously proven productive.

Workover – Any downhole operation in an existing oil or gas well that is designed to sustain, restore or increase the production rate or ultimate recovery in a geologic interval currently completed or producing in said existing oil or gas well. Workover includes but is not limited to: acidizing, reperforating, fracture treating, sand/paraffin removal, casing repair, squeeze cementing or setting bridge plugs to isolate water productive zones from oil or gas productive zones or any combination thereof. Workover does not mean the routine maintenance, repair or replacement of downhole equipment such as rods, pumps, tubing, packers or other mechanical devices.

Worst case - A situation allowed in air permitting in the State of Wyoming where a facility, site or source (which is representative of all the facilities, sites or sources within a designated field area) may be used to represent the worst air emissions for the field area sources.

Wyoming Environmental Quality Act - Wyoming Statute, Title 35 "Public Health and Safety", Chapter 11 "Environmental Quality" which provides the authority for the rules and regulations of the Air Quality Division.