

Guideline to Reduce Benzene Emissions from Glycol Dehydrators

Guideline S-18

November 2015

Revision 2.0

Record of Change

Revision	Date	Author	Description
1.0	April 1, 2010	PNG	Original
2.0	November 1, 2015	PNG	Update to facilitate IRIS implementation in November 2015

This guideline sets out the requirements for the reduction of benzene emissions from glycol dehydrators

With the issuance of this guideline, the Ministry of the Economy (ECON) have established mandatory requirements to ensure continued reductions of benzene emissions to reduce potential impact on the public.

Licensees must comply with the following new requirements effective July 1, 2010:

- 1) When evaluating dehydration requirements in order to achieve the lowest possible benzene emission levels, licensees should use the Decision Tree Process in Appendix A of the Canadian Association of Petroleum Producers (CAPP) document [Best Management Practices for Control of Benzene Emissions from Glycol Dehydrators](#), June 2006 (*Benzene Control BMP*) and retain appropriate analysis documentation for review by regulatory agencies. Licensees must follow the public consultation process outlined in the Benzene Control BMP.
- 2) Licensees must ensure that all their dehydrators meet the following benzene emission limits.

Date Dehydrator Installed or Existing Dehydrator Relocated	Benzene Emission Limits
Prior to January 1, 1999 <ul style="list-style-type: none"> • Greater than 750 m to permanent resident or public facility • Less than 750 m to permanent resident or public facility 	5 tonnes/yr 3 tonnes/yr
January 1, 1999, to January 1, 2007	3 tonnes/yr
After January 1, 2007	1 tonne/yr

- i) If more than one dehydrator is located at a facility or lease site, the cumulative benzene emissions for all dehydrators must not exceed the limit of the oldest dehydrator on site. Modifications may be required to existing unit(s) to meet the site limit.
 - ii) Any new or relocated dehydrators added to an existing site with dehydrator(s) must operate at a maximum benzene emission limit of 1 tonne/yr or less. The cumulative benzene emissions must not exceed the limit of the oldest dehydrator on site.
 - iii) For dehydrators that are only in operation for a portion of the year, the daily emission rate must not exceed the above annual benzene emission limits divided by 365. (For example, for a dehydrator with an annual benzene emission limit of 3 tonnes that only operates for six months of the year, the maximum annual emission limit would be 1.5 tonnes or a maximum daily emission rate of 8.2 kg/day.) See Section 2.3 of the Benzene Control BMP for details on calculating and reporting of emissions from dehydrators that only operate a portion of the year.
- 3) Licensees must complete a Dehydrator Engineering and Operations Sheet (DEOS) (see Attachment 1) to determine the benzene emissions from each dehydrator. This sheet summarizes optimum operating conditions to minimize benzene emissions and must be posted at the dehydrator for use by the operations staff and inspection by ER. The DEOS must be revised every 12 months, upon relocation, or upon a change in status (resume operation, shut-in, bypassed) of the dehydrator.

- 4) Licensees must complete and submit an annual Dehydrator Benzene Inventory List (see typical inventory list in Attachment 2), listing all the licensees' dehydrators, as set out in the June 2006 CAPP Benzene Control BMP by July 1 each year. Copies of the annual Dehydrator Benzene Inventory List form are available from CAPP at www.capp.ca. This information must be submitted to ECON through the Petroleum Development Branch by e-mail to benzene@gov.sk.ca.

Compliance and Enforcement

These requirements will be subject to compliance review by ECON. Regulatory requirements are those rules that industry has an obligation to meet and against which ECON may take enforcement action in cases of noncompliance.

Background

Benzene is classified as a toxic substance under the Canadian Environmental Protection Act and as a Group 1 carcinogen by the International Agency for Research on Cancer. As a non-threshold carcinogen, there is considered to be some health risk at any level of exposure. As a result, benzene emissions must be managed to achieve the lowest levels practicable to minimize human exposure. A Benzene Workplace Health and Safety Sheet (Attachment 3) was prepared to promote awareness of benzene hazards and methods to minimize exposure for operations staff.

Contact

Any comments or questions with respect to this guideline should be directed to ECON's Petroleum Development Branch by e-mail at benzene@gov.sk.ca.

(This sheet must be revised annually, or upon dehydrator relocation or change in status, and posted at the dehy.)

Technical Contact: Print Name/Phone #/email: _____

Revision Date (dd-mm-yyyy): _____ Facility or Site Name: _____

Licensee Name: _____ Operator Name: _____

Gov't Licence No: _____ Location, DLS: _____ - _____ - _____ W

Installation Type: Well Compressor Battery Plant Cavern Other DEHY Type: TEG DEG EG

Date Dehy installed/relocated? (dd-mm-yyyy): _____ Current Dehy Status: Producing Shut-In
 Bypassed Other: _____ Date Dehy Status Changed? (dd-mm-yyyy): _____

Typical number of operating days per year: _____ Number of dehy's on site: _____

Distance to Closest Resident (if < 750 metres): _____ Normal Gas Flow Rate to Dehy: (e³ m³/d): _____

Benzene Content in Gas to Dehy (mole %): _____ (If zero, Dehy operations sheet must still be posted)

Feed gas benzene determination method: Analysis Date of analysis (dd-mm-yyyy): _____

Other (describe): _____

Glycol Pump Make/Model# _____ Normal Pump Speed: _____ RPM or SPM

Plunger diameter/stroke length: _____ inches, or _____ mm

Normal Glycol Circulation: _____ USgpm Normal Absorber Temp: _____ °C Normal Absorber Press: _____ kPag

Emission Calculation Method: GRI GLYCalc™ Version #:__ HYSYS™ ProSim™ Total Capture

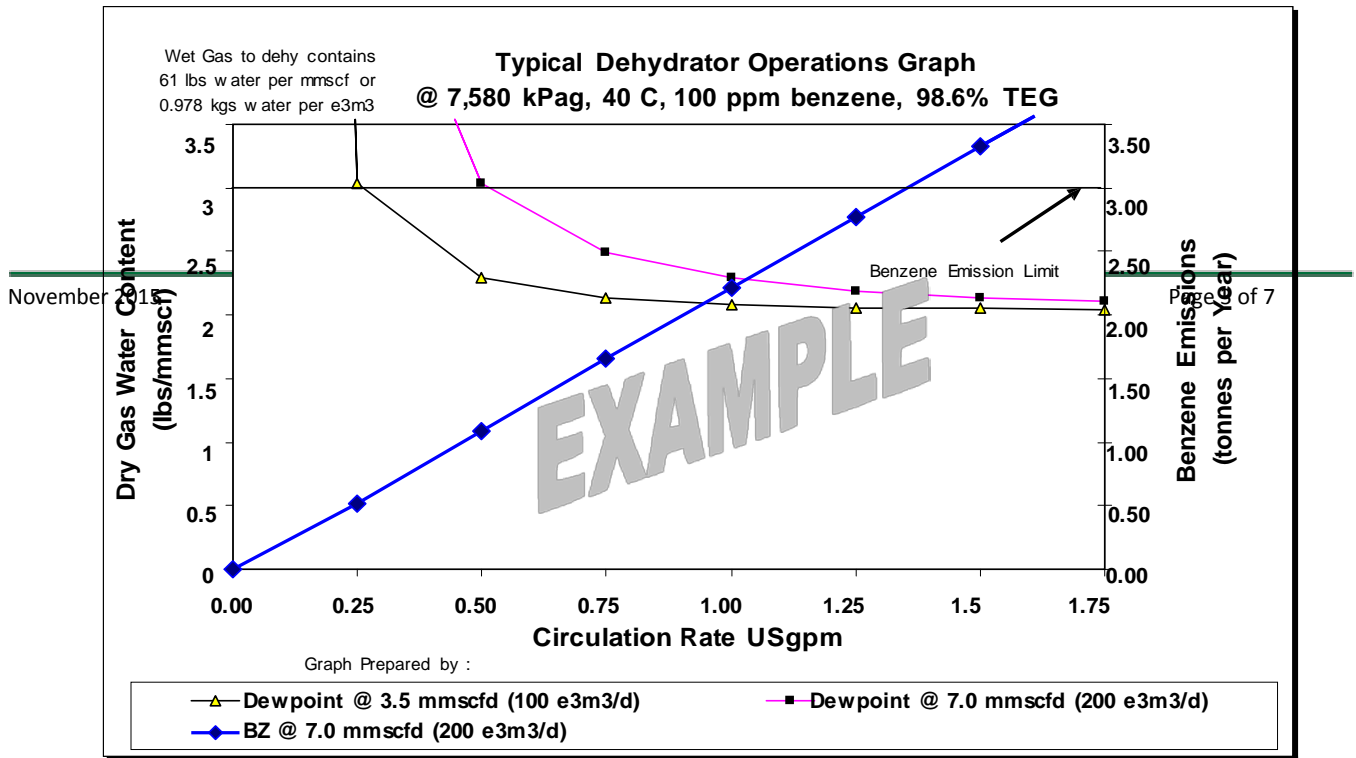
Rich/Lean Glycol Other—Describe: _____

Benzene Emission Controls: No Yes Describe (condenser, tank, incinerator, flare, other): _____

Dehy decision tree analysis (DTA) completed?: No Yes (mandatory for all new or relocated dehy's)

When operating, average benzene emissions (in tonnes/yr)* Before Controls: _____ After Controls: _____

***Note:** In accordance with Guideline to Reduce Emissions from Glycol Dehydrators, this dehydrator must be operated below _____ tonnes/yr benzene emissions. If multiple dehy's exist on this site, the aggregate benzene emissions must be less than _____ tonnes/yr, which is the maximum per year allowed for the oldest dehy on site.



Attachment 2 Canadian Oil and Gas Industry - Annual Dehydrator Benzene Inventory List For:

2006 (yyyy)

Company Net Gas Production:

10³ m³ /day

Instructions: This form must be completed and submitted annually by July 1st for the previous year of operations. Upon completion, submit this form to ER Petroleum Development Branch by email to benzene@gov.sk.ca Attention: Manager of Saskatchewan Operations, CAPP

DEOS Completed	Multiple Dehys on Site?	Company Data Revision Date: July 1, 2007		Date Submitted to CAPP/ER: July 1, 2007							Dehydrator Use (Installation Type)			Production Status	Benzene Concentration (Gas to Dehy)	Number of Operating Days per year	Benzene Emissions Rate While Operating	Annual Benzene Emissions for dehydrator	
		Licensee	Field Name	BC Centzone	Complete LSD 01-01-020-25W4	LSD	Sect	Twn	Rge	Mer	Installation Type	Glycol Type	Operating Status	Normal gas flowrate to dehy 10 ³ m ³ /day or shut-in or by-passed, or	Mole % for each dehy	days	kilograms/day	Emissions Prior to Control	Emissions After Control
Yes / No	Yes / No	Operating Company Name	Field Name	BC Centzone	Complete LSD 01-01-020-25W4	LSD	Sect	Twn	Rge	Mer	Installation Type	Glycol Type	Operating Status	Normal gas flowrate to dehy 10 ³ m ³ /day or shut-in or by-passed, or	Mole % for each dehy	days	kilograms/day	Emissions Prior to Control	Emissions After Control
- Separator Ops			Field Name	BC Centzone	Complete LSD	LSD	Sect	Twn	Rge	Mer	Installation Type	Glycol Type	Operating Status	Normal gas flowrate to dehy 10 ³ m ³ /day or shut-in or by-passed, or	Mole % for each dehy	days	kilograms/day	Emissions Prior to Control	Emissions After Control
- Sold			Field Name	BC Centzone	Complete LSD	LSD	Sect	Twn	Rge	Mer	Installation Type	Glycol Type	Operating Status	Normal gas flowrate to dehy 10 ³ m ³ /day or shut-in or by-passed, or	Mole % for each dehy	days	kilograms/day	Emissions Prior to Control	Emissions After Control
Example Data:			Field Name	BC Centzone	Complete LSD	LSD	Sect	Twn	Rge	Mer	Installation Type	Glycol Type	Operating Status	Normal gas flowrate to dehy 10 ³ m ³ /day or shut-in or by-passed, or	Mole % for each dehy	days	kilograms/day	Emissions Prior to Control	Emissions After Control
Yes	Yes	ABC Resources Inc.	Sample Location Field	BC Centzone	01-01-020-25W2	1	1	20	25	2	Compressor	TEG	Operating	200	0.015%	300	2.00	3.50	0.60
Yes	Yes	ABC Resources Inc.	Sample Location Field	BC Centzone	01-01-020-25W2	1	1	20	25	2	Compressor	TEG	Operating	200	0.018%	200	9.50	6.00	1.90

Sample

*Note: Copies of the Annual Dehydrator Benzene Inventory List Forms are available from CAPP at www.capp.ca

Attachment 3 Benzene—Workplace Health and Safety

What is benzene?

Benzene, a colourless, flammable liquid with a sweet odour, is classified as a toxic substance under the Canadian Environmental Protection Act. As a non-threshold carcinogen, it is considered to be of some health risk at any level of exposure. It is also classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC). It is to be managed by reducing human exposure to the extent possible and practicable.

Where is benzene found in the workplace?

Crude oil and natural gas condensate contain benzene. The concentration varies depending on the geology and location of the well site. Benzene and other hydrocarbons may be released from stacks, flares, glycol dehydrators, hydrocarbon storage facilities, and other operations that involve crude oil or condensate. Occupational exposure to benzene in the upstream oil and gas industry occurs mainly through the use of glycol dehydrators as benzene is removed from the gas stream during dehydration.

How can workers become exposed to benzene?

Workers may become exposed by inhalation or by direct contact with the skin. This may occur when changing filters and pumps and when handling rich glycol at dehydrators. Although readily absorbed after inhalation, benzene is not easily absorbed through skin contact. The absorption of benzene vapour through the skin is unlikely to be significant at concentrations below 25 ppm.

What are the health risks of benzene exposure?

Short-Term Acute Exposure

Acute exposures (greater than 3200 µg/m³ or 1000 ppb over an 8-hour period) are unlikely during routine operations and worker activities. Limited studies suggest that acute exposure to benzene may depress the central nervous system. Common symptoms at 50 to 150 ppm are drowsiness, dizziness, headache, nausea, vomiting, sleepiness, fatigue, nose and throat irritation, slurred speech, loss of balance, and disorientation. Exposure above 20 000 ppm for 5 to 10 minutes can cause death.

Long-Term Chronic Exposure

Chronic exposure may result in a range of health effects, depending on the dose and frequency of exposure. Health effects of prolonged exposure relate mainly to the skin and blood. Prolonged and repeated contact with benzene can cause redness, drying, and cracking of the skin. Prolonged exposure above workplace limits may suppress the production of red blood cells, white blood cells, and clotting cells by damaging bone marrow. Benzene may also increase the incidence of a specific type of leukemia (acute myelogenous leukemia) and other forms of leukemia and lymphomas.

Exposure to benzene along with other substances may enhance health effects. Exposure to benzene and ethanol can increase the effects on the blood system. Exposure to toluene and benzene can reduce the body's ability to remove benzene, as toluene slows the rate of clearance of benzene by competing for metabolic pathways.

How can you avoid exposure to benzene?

Engineering Controls

- Optimize glycol circulation.
- Implement alternatives for hydrate control and dehydration, such as using a flash tank separator, a line heater, or solid desiccant or molecular sieve plants.
- Ensure that equipment and barriers for preventing exposure are working and maintained according to specifications.

Administrative controls

- Verify that safe work practices are formalized, reviewed, and updated.
- Ensure that employees are properly trained in safe work practices.
- Monitor air to ensure that the benzene concentration does not exceed the occupational exposure limit.

Personal protective equipment

- Use close-fitting goggles or a National Institute for Occupational Safety and Health (NIOSH)- approved supplied-air respirator (SAR) with a full face mask that includes an end-of-use indicator.
- Wear, wash, and maintain chemical-resistant clothing (gloves, coveralls, boots) appropriate for conditions of use.