

Gulf of Mexico



Operations: HSE

Health and Industrial Hygiene

GoM Region Benzene Safe Work Practice

AMENDMENT RECORD

Amendment Date	Revision Number	Amender Initials	Amendment
10/1/15	4	D. Liu / V. Murray/ A. Syverson/ L. East/ D. Haines	<ul style="list-style-type: none"> • Updated Authority and Custodian. • Added additional information on key elements of the program, role & responsibilities, areas of potential exposures, exposure limits, exposure monitoring, PPE, medical surveillance. • Added Appendix for benzene health effects, first aid, and medical surveillance sampling. • Added reference to GoM Access to Employee Exposure and Medical Records SWP and Respiratory Protection SWP. • Transferred the whole document to the new GoM document template.
10/1/12	3	Authority: Director Health and Safety Custodian: Health and Industrial Hygiene Team Leader	Updated Authority and Custodian. Updated Purpose/scope and General Requirements. 4.3- Added key responsibilities of the Health and IH Team Leader. 5.1-Added reference to GoM Respiratory Protection program and specific respiratory requirements as well as minimizing exposures. 5.6 Revised section to clarify container labelling. 5.8 Added training requirements
06/16/11	2	Authority: GoM VP HSSE & Engineering Custodian: GoM Health and Safety Manager	Formatted headers and footers to reflect new document layout. Updated hyperlink for 1910.1028 document in Sec. 6.0.
01/31/06	1	Authority: S. Garner/ S. Tink/ C. Jackson Custodian: Jack Kogut	No content changes. Revised 3 authorities and 1 custodian. Changed CD # from 10005 to UPS-US- SW-GOM-HSE-DOC-00094-2. Removed reference to the Industrial Hygiene Manual in 3.0 Requirements Section.
01/16/02	0	Authority: S. Garner/ B. Herbert/ R. White/ S. Flynn/ Custodian: Ray Britt	Initial issue as controlled document. Prior revision history located in hard-copy consolidated manual.

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1 Introduction

This Safe Work Practice (SWP) addresses the recognition, evaluation, and control of occupational exposures to benzene.

This Practice conforms to Occupational Health and Safety Administration (OSHA) 1910.1028 Benzene Standard and BP's Operating Management System (OMS) framework. Although 29 CFR 1910.1028(a)(2)(vi) specifically exempts oil and gas drilling, production and serving operations from the benzene regulations, BP GoM meets the requirements of the benzene regulations in this SWP.

2 Scope

This SWP applies to the GoM Region workforce (employees and contractors) and facilities, where crude oil, natural gas, and other hydrocarbons are processed or handled.

3 Key Responsibilities

3.1 Offshore Installation Manager (OIM), Person In Charge (PIC) or Designate

- A. Verify that risk assessments are conducted to identify potential activities that may be associated to benzene exposure.

3.2 Issuing Authority (IA)

- A. Ensure that the team understands the assessment process and that the aim is to recognize and reduce risks associated with benzene for the task to be completed safely or, if risks cannot be adequately controlled, to prevent the task from taking place.
- B. Ensure that members of the risk assessment team have a full opportunity to contribute and that the details of the assessment are agreed by team members.

3.3 Performing Authority (PA)

- A. Inspect the worksite, either alone or preferably with the IA to identify the hazards associated with benzene and planned controls prior to completion of the risk assessment for the task being planned.
- B. Document the task hazards associated with benzene, risks and controls on the WCC-Permit with input from the IA.
- C. Conduct a pre-job toolbox talk with the work crew to communicate the WCC- permit content and requirements and verify their understanding before the Work Crew sign the work party declaration section of the WCC-permit.

34 Health and Safety (H&S) Site Lead

- A. Assist in identifying and predicting benzene hazards and take prompt corrective actions or measures to eliminate/reduce potential exposures.
- B. Assist management, supervisors, and workforce with requests regarding training and personal protective equipment (PPE) use/supply when working with benzene.
- C. Consult with Health and Industrial Hygiene Team on training, work practices, and protective measures for activities with benzene exposure potential.
- D. Review third-party contract risk/hazard assessments for activities with potential for benzene exposure.
- E. Verify signs posted and storage tanks labeled in areas where benzene has been detected at or above 0.1% by volume (1,000 ppm).

35 Industrial Hygiene Advisor

- A. Review and update this SWP and training materials per the document management control system review process and cycle.
- B. Provide technical support on benzene work practices and protective measures.
- C. Conduct and/or support personal and area benzene sampling, as requested and to comply with OSHA regulations.
- D. Determine which workers and/or job categories should be included in the medical surveillance program based on exposure monitoring results. And provide list of workers and/or job categories requiring inclusion in the medical surveillance program to the facility and the Occupational Health Advisor.

36 Occupational Health Advisor

- A. Maintain the Occupational Health Database (e.g., Medgate) listing workers included in the respiratory protection and medical surveillance program as necessary.
- B. Coordinate medical surveillance testing when exposure results indicate it is necessary.

37 Medics

- A. Work with Occupational Health Advisor on benzene medical surveillance to collect biological samples and send the samples to the lab.

38 Workforce

- A. Understand the hazards associated with benzene and follow the appropriate controls defined in this SWP, work procedures, and benzene training.

4 General Requirements

4.1 Benzene Overview

Benzene is an aromatic hydrocarbon and its vapors are released from liquid hydrocarbon mixtures. It evaporates into air very quickly and is highly flammable. In its pure form, benzene has a sweet and pleasant odor. But, in the oil and gas industry, produced fluids such as: condensate, oil, produced water, and natural gas liquids (NGLs) are complex mixtures of hydrocarbons. Therefore, personnel in oil and gas operations do not handle pure benzene nor will they smell a sweet and pleasant odor. Thus, odor does not provide an adequate warning of its hazard. The amount of benzene is usually the greatest in the lighter crude oils and condensates. It can also be found as an additive in cleaning fluids.

4.2 Health Effects

The potential health effects from benzene exposure include:

- A. Acute exposure (short-term) - Central nervous system depression, headache, nausea, dizziness, drowsiness, weariness, excitation, respiratory, eye and skin irritation, unconsciousness or death.
- B. Chronic exposure (long-term) - Reduction in circulating blood count, platelets, red and white blood cells, bone marrow and blood disorders, anemia, acute Myelogenous leukemia, cancer of the bone marrow and blood.

Refer to Section 8.1 Benzene Health Effects for more details.

4.3 Areas/Tasks with Potential Benzene Exposure

Benzene is commonly found in oil and gas operations such as: condensate, NGLs, produced water, and crude oil products. Drilling mud and well intervention fluids returned from oil- and condensate-bearing formations may carry benzene into mud and fluid handling equipment. Exposures above the action level are possible when process equipment is opened for service/maintenance or when process fluids leak or spill. Consumer products containing benzene include, but are not limited to, tobacco, gasoline, solvents, adhesives, and varnishes.

Within GoM Production and Wells operations, benzene can be present in many process streams associated with the following (but not limited to) operations or tasks below:

- A. Process sampling,
- B. Tank and vessel entry and cleaning,
- C. Filter change out (i.e., glycol sock filter change out),
- D. Turbine meter change out
- E. Changing or inspecting orifice plates,
- F. Site blow-down,
- G. Pigging, and

H. Well flow back tanks, shakers, and mud tanks.

4.4 Elements for Managing Benzene Risks

Engineering controls and good work practices must eliminate or control potential exposures as much as feasible. Personnel shall use the recommended PPE per written job procedures or per guidance from GoM Industrial Hygiene.

The main elements to manage health risks from working with benzene are:

- A. Evaluating benzene exposure
- B. Controlling personnel exposures (with engineering controls and/or good work practices)
- C. Personal protective equipment
- D. Establishing regulated areas as needed
- E. Hazard communication with warning signs and labels
- F. Medical surveillance as needed
- G. Employee training

5 Process

5.1 Evaluating Benzene Exposure

5.1.1 Exposure Limits

The BP GoM Region has adopted the ACGIH TLVs for benzene exposure protection. Where personal sampling is not feasible, control recommendations will be based on direct reading instrument sampling. When direct reading sampling results are greater than 0.5 ppm, personal industrial hygiene monitoring should be conducted to determine the exposure level for comparison to the limits in **Table 1 - Benzene Exposure Limits**. When current or prior industrial hygiene monitoring indicates benzene at or above the limits in Table 1, a minimum of an air-purifying respirator (APR) with organic vapor cartridges is required (See Section 5.3 for more details on respiratory protection). As a primary means of control, engineering controls should be evaluated to reduce exposures.

Table 1: Benzene Exposure Limits

Regulatory or Recommending Body	Average Exposure Time	Exposure Limit (ppm)	Possible Actions
BP GoM Action Level (AL)	Any duration	0.5	Personal exposure monitoring; PPE
ACGIH TLV - TWA	8-hours	0.5	Exposure controls; respiratory protection
ACGIH TLV - STEL	15-minutes	2.5	
OSHA Action Level	8-hours	0.5	Exposure controls; respiratory protection; medical surveillance
OSHA PEL - TWA	8-hours	1	Regulated area; exposure

OSHA STEL - TWA	15-minutes	5	controls; respiratory protection; medical surveillance
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5.1.2 Exposure Monitoring

In the absence of controls (i.e., ventilation, respirators) and previous monitoring data, benzene air concentrations should be evaluated using direct reading instruments and/or exposure monitoring. Specifically, monitoring should take place where benzene concentrations have the potential to exceed the action level for a task or activity.

5.1.2.1 Direct Reading Measurement

Direct reading instruments can be used as a field screening tool to check benzene concentrations in workers' breathing zones. Whenever process equipment is opened, benzene vapors may present potential exposure hazards. Direct reading instruments recommended for evaluation of benzene exposures include detector tubes, the Draeger CMS, the UltraRAE and the Ion Science Tiger Select. Use the monitoring results from the direct reading instrument to determine appropriate controls. If direct-reading measurements are greater than the action limit and no prior personal monitoring data is available, provide PPE and conduct personal exposure monitoring with laboratory analysis.

5.1.2.2 Personal Benzene Exposure Monitoring

Personal benzene exposure monitoring will be conducted as part of the GoM Region exposure assessment program or when exposure concerns are raised or when process changes affect benzene exposure potential. Personnel may wear passive monitoring badges for full-shift samples or personal air sampling pumps with charcoal tubes for short-term samples mounted in the breathing zone.

The Industrial Hygiene Advisor will report monitoring data to the workers involved in the monitored task within 15 working days from the receipt of results.

A. If personal exposure monitoring reveals worker exposure at or above the OSHA action level, but at or below the 8-hour PEL-TWA, the facility shall implement appropriate controls and repeat personal monitoring at least every year.

B. If sample results reveal exposures above the OSHA 8-hour PEL-TWA, appropriate controls shall be implemented and monitoring for the workers shall be repeated at least every six months.

C. Monitoring for the STEL shall be repeated as necessary to evaluate exposures of workers subject to short-term exposures.

D. When exposure monitoring indicates benzene levels greater than the OSHA PEL, a written plan (i.e., Site Health/IH Plan) to reduce the exposures to below the PEL using engineering, work practice and respiratory protection controls is required. The Site Health/IH Plan should include a schedule for the development and implementation of the controls.

5.1.2.3 Area or personal monitoring may be performed during an event such as a spill, equipment rupture or leak to evaluate personnel exposures and to verify adequacy of PPE use.

5.1.2.4 Area or personal monitoring may be performed after the cleanup of spills, equipment ruptures or leaks to ensure that benzene air concentrations have returned to pre-event levels. Contact the GoM Industrial Hygiene Advisor for advice on sampling protocols and strategy.

5.2 Controlling Benzene Exposure

Minimizing the risk of exposure from inhalation of hydrocarbon vapors and skin contact can be accomplished by actions such as:

- A. Designing and installing of engineering controls when feasible (e.g., proper equipment sealing, monitoring, containment, etc.);
- B. Using process controls to isolate hydrocarbons and eliminate or control benzene vapors;
- C. Draining, flushing and/or purging equipment and vessels prior to being opened;
- D. Venting hydrocarbon vapors when opening vessels (i.e. floatation cells/water treatment skids) and when changing process filters; and
- E. The use of PPE for skin as well as respiratory protection when needed.

5.3 Personal Protective Equipment

5.3.1 Respiratory Protection

Wear respiratory protection when implementing engineering controls or if engineering controls are not feasible or are not able to reduce the exposure to below the exposure limits, based on the concentration ranges outlined in **Table 2 - Respiratory Protection Requirements by Concentration Range** below.

Table 2: Respiratory Protection Requirements by Concentration Range

Half-face air-purifying respirator w/ organic vapor cartridges	0.5 - 5
Full-face air-purifying respirator w/ organic vapor cartridges	6 - 25
Supplied air (air line or SCBA)	Above 25

The Industrial Hygiene Advisor can assist with the determination of the appropriate level of respiratory protection. No personnel shall utilize respiratory protection unless trained, medically evaluated and fit tested for the specific type and size of respirator utilized.

5.3.2 Skin and Eye Protection

Goggles, face shield, chemical resistant gloves (e.g., nitrile), and aprons or splash suits may be required per the job risk assessment and/or PPE Hazard Assessment.

5.4 Regulated Areas

Regulated areas, as defined by OSHA 1910.1028, shall be established wherever the airborne concentration of benzene exceeds, or can reasonably be expected to exceed, either the 8-hour time weighted averages (TWA) of 1 ppm or the STEL of 5 ppm.

The regulated work area is demarcated from the rest of the work site by physical means or signs that limit access to only authorized, properly equipped personnel in order to minimize benzene exposure. Signs with the following legend are posted at all entrances to the regulated work area.

<p>DANGER BENZENE MAY CAUSE CANCER HIGHLY FLAMMABLE LIQUID AND VAPOR DO NOT SMOKE WEAR RESPIRATORY PROTECTION IN THIS AREA AUTHORIZED PERSONNEL ONLY</p>

5.5 Container Labeling

Container labeling, as outlined in BP GoM Hazard Communication SWP, is required for containers which contain greater than 0.1% benzene.

5.6 Medical Surveillance

5.6.1 Emergency Examinations

When there is a potential emergency or unanticipated exposure to benzene, a urine sample shall be collected from the exposed workers at the end of their work shift. The Medics and H&S Site Lead should work with the Occupational Health Advisor to facilitate sample collection. Refer to Section 8.3 Benzene Medical Surveillance Sampling for more information.

Once the sample is collected, a urinary phenol and/or a S-Phenylmercapturic acid in urine test shall be performed on the sample within 72 hours. Based on the results of the testing, a complete blood count test and/or other medical examination may be required.

5.6.2 General, Initial, and Periodic Examinations

- A. A medical surveillance program will be available to BP employees for the duration of their employment who are or may be exposed to benzene at or above the action level 30 or more days per year, or at or above the PEL-TWA or STEL 10 or more days per year.
- B. If a facility has a job classification where employees may be exposed or who are known to have been exposed at this level, the Supervisor or H&S Site Lead should notify the Health & Industrial Hygiene Team that the employee should be included in the medical surveillance program upon initial assignment or identification of the historical exposure.
- C. The Occupational Health Advisor will provide direction to the employee and Supervisor regarding the initial and annual periodic examinations.
- D. Examinations will include a:
 1. Detailed occupational history review,
 2. Physical exam,
 3. Complete blood count, and/or
 4. Pulmonary function test.
- E. Based on the results of the testing (i.e., alterations in the components of the blood or signs and symptoms associated with benzene exposure), additional medical exams may be required.

- F. Additional tests will be determined by a physician or hematologist (treats blood disorders).

5.7 Training

BP personnel who travel offshore are required to complete an initial BP GoM Benzene Awareness Computer Based Training (CBT) in VTA/My Learning.

BP personnel with potential/measured exposures exceeding the OSHA AL or PEL are required to complete the Benzene Awareness CBT annually.

BP will inform contractors of the locations and job tasks with the potential for elevated benzene levels as part of the Control of Work (COW) hazard assessment.

5.8 Record Keeping

The BP GoM Health & Industrial Hygiene Team establishes and maintains exposure and medical records of all measurements according to the OSHA benzene standard.

6 Definitions/Acronyms

Terms	Description
ACGIH	American Conference of Governmental Industrial Hygienists
Breathing Zone	A ten-inch radius around the worker's nose and mouth.
Carcinogen	A substance or agent that is capable of causing cancer. Years of study show that chronic (long-term) inhalation exposure to benzene can cause leukemia (cancer of the blood-forming organs in the body).
Container	Any barrel, bottle, bag, can, cylinder, drum, tote tank, or the like, but does not include piping systems.
Permissible Exposure Limit (PEL)	OSHA regulatory limits on the amount or concentration of a substance in the air. OSHA PELs are based on an 8-hour time weighted average (TWA) exposure or a 15-min short-term exposure limit (STEL).
Regulated Area	An area where airborne concentrations of benzene exceed or can reasonably be expected to exceed the permissible exposure limits.
TLV	Threshold Limit Value

7 Key Documents/Tools/References

- A. [OSHA 29 CFR 1910.1028, Benzene](#)
- B. [Access to Employee Exposure and Medical Records](#)
- C. [Respiratory Protection](#)

8 Appendix

8.1 Benzene Health Effects

Benzene may cause adverse health effects from exposure via inhalation, ingestion, and dermal or eye contact. Benzene is a known human carcinogen.

Benzene is an organic solvent and can cause acute (short-term) symptoms typical of volatile organic solvents. Acute symptoms include central nervous system depression, headache, nausea, dizziness, drowsiness, lack of energy, excitation, and respiratory irritation. These effects usually occur at exposure levels of 25 parts per million (ppm) to 100 ppm. Since these effects are acute, they are usually reversed by removal of the exposed person to a safe breathing area. Benzene remains in the body less than six to nine hours and is excreted from the body naturally. However, death may occur after brief exposures at concentrations around 20,000 ppm and higher. High exposures lead rapidly to deep anesthesia of the central nervous system. If untreated at this stage, respiratory arrest rapidly ensues, leading to respiratory failure.

Long-term exposure to low level of benzene may affect the blood making tissues of the body, reducing the circulating blood count, platelets, red/white blood cells and damaging to the bone marrow, causing anemia and/or internal bleeding. Long-term overexposure has caused leukemia, specifically acute myelogenous leukemia, and subsequent death in some workers exposed to benzene for periods of less than five and up to thirty years at varying concentrations, in some instances as low as 10 ppm benzene. There is limited data regarding developmental and reproductive effects from benzene exposure.

Although inhalation of benzene is generally the primary pathway of exposure, absorption through the skin may also contribute to the total dose. Skin contact with benzene can lead to skin irritation, de-fatting, dryness, discoloration, muscle weakness, and cracking. Eye contact can result in mild irritation, blurred vision, tearing, pain, and redness.

8.2 First Aid

- A. **Eye and Face Exposure:** If produced fluids are splashed in your eyes, wash the eyes immediately with large amounts of water. If irritation persists or vision changes are noted, seek immediate medical attention.
- B. **Skin Exposure:** If produced fluids are spilled on your clothing or skin, remove the contaminated clothing and wash the exposed skin with large amounts of water and soap immediately. Wash contaminated clothing before you wear it again.
- C. **Inhalation (breathing in):** If you or any other person breathes in produced fluid vapors, get the exposed person to fresh air at once. Initiate cardiopulmonary resuscitation, if needed. Seek immediate medical attention.

D. **Ingestion (swallowing)**: If produced fluids have been swallowed and the exposed person is conscious, do not induce vomiting. Seek immediate medical attention.

8.3 Benzene Medical Surveillance Sampling

A. LabCorp Benzene Test Manual



LabCorp_Test
Menu.pdf

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Document Authorization Form

Navigate through the form with the Tab key to fill in data. Just click on the boxes you wish to check



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