



## Operations: HSE

### Health and Industrial Hygiene

#### Radiation Protection Policy - Radioactive Materials and Sources, including General and Specific Licenses

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### AMENDMENT RECORD

Amendment Date	Revision Number	Amender Initials	Amendment
09/12/2019	5	DLiu; VDMurray	Changed the title of the document to Radiation Protection Policy – Radioactive Materials and Sources, including General and Specific Licenses. Updated HSE Site Lead to HSE Site Advisor. Changed the General Radiation Awareness training to Radiation - Sealed Sources Awareness training to align with the course title in My Talent & Learning. Added new section for non-ionizing radiation safety in Appendix B.
06/14/2018	4	DLiu; VDMurray; CMetzler	Incorporated the GoM Region SWP - Specifically Licensed Devices into the Appendix of this document. Updated the leak testing requirements in Table 1 according to 10 CFR 39.35. Changed the document title to include the specifically licensed devices and replaced “safe work practice” with “policy”.
08/11/2016	3	VDMurray	Document reviewed with no changes.
08/05/2015	2	VDMurray	Updated document template and custodian/authority. Minor non-technical updates. Added definitions for radioactive material, radioactive tracer, and general license. Updated review frequency to annual to align with regulatory requirement in US NRC 10 CFR 20.
05/30/2012	1	Authority: HS Director Custodian: Health & IH Team Leader	Changed document title to reflect content of the document. Added references to active general license, NORM and Specifically Licensed Device policies. Updated definition of REM to include the SI unit (Sv) conversion. Added the definition of the SI unit (Sv). Amended the definition of radiation area to match the NRC’s definition. Defined radiation symbol as “Radiation Trefoil”, and provided a pictogram. Added the BP general requirements for working with or around radiation. Added the term radiation to General Radiation Awareness Training. Added Appendix 1: GoM – NRC Licensed Devices.
08/01/2008	0	Authority: HSSE Director Custodian: HSSE Programs Manager	Date of initial issue as a controlled document.

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## 1 Introduction

This Policy covers the occupational use of radioactive materials and devices permitted under a Nuclear Regulatory Commission (NRC) general license and specific license that may produce personnel exposures to ionizing radiation. This Policy also addresses the hazards and controls of potential exposures to the non-ionizing radiation sources (e.g., antennas) in Appendix B. The procedures, control methods, work practices, and monitoring described in this Policy aim to reduce the exposure from occupational sources of ionizing radiation to as low as reasonably achievable (ALARA) and maintain compliance with regulatory requirements.

**Currently, there is no specific license in effect between BP and the NRC. The requirements for the specifically licensed devices are in Appendix A, if one were to be put into effect.**

## 2 Scope

This Policy applies to BP GoM Region operations, wells, and projects.

## 3 Key Responsibilities

### 3.1 Offshore Installation Manager (OIM)/Facility Manager/ or Designate

- A. Responsible for the implementation of this Policy by ensuring that the proper resources and equipment are allocated with regard to radiation safety.
- B. Verify that risk assessments are conducted to identify activities involving radioactive materials and devices that may be associated with potential radiation 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 the use of radioactive materials and devices for the task to be completed safely or, if risks cannot be controlled, to prevent the task from taking place.
- B. Ensure that the assessment team includes personnel with the necessary knowledge and competence for the task involved.
- C. Verify that this Policy has been communicated to third party/contract personnel and that they have procedures, resources, equipment, and training to complete the work activity.

### 3.3 Performing Authority (PA)

- A. Inspect the worksite, either alone or preferably with the Issuing Authority to identify the hazards associated with radioactive materials and devices and planned controls prior to completion of the risk assessment for the task being planned.
- B. Document the task hazards associated with radioactive materials and devices, risks and controls, jobsite and process safety hazards on the work permit with input from the Issuing Authority.

### 3.4 Third Parties/Contractors

Provide work procedures, exposure monitoring methods and records, and exposure control measures to the Issuing Authority and Radiation Safety Officer that will be utilized when handling radioactive materials and devices when performing work activities at BP GoM facilities.

### 3.5 Health, Safety and Environmental (HSE) Site Advisor

- A. Assist management, supervisors, and workforce with requests regarding work practices and protective measures when working with radioactive materials and devices.
- B. Consult with Health & Industrial Hygiene Team on training, work practices, and protective measures for activities with potential for radiation exposure.
- C. Review third-party contract risk/hazard assessments when there is potential for radiation exposure, consult with Health & Industrial Hygiene Team as needed.

### 3.6 Health & Industrial Hygiene Team

- A. Review and update this Policy and training materials per the document management control system review process and cycle.
- B. Provide technical support on training, work practices, and protective measures when handling radioactive materials and devices.
- C. Conduct and/or support surveys/sampling, as requested. Assess the results of assessments and audits to identify trends, emerging risks, and opportunities to improve risk reduction measures.
- D. Provide guidance and technical support regarding medical surveillance and biological monitoring requirements for potential radiation exposures, as appropriate.

### 3.7 Environmental Advisor

- A. Provide technical support on radioactive material and device waste characterization and disposal, as appropriate.

- B. Conduct and/or support surveys/sampling, as requested.

### 3.8 Authorized Users

Personnel who conduct radiation work in accordance with BP's general license and / or specific license and under the direction of the Radiation Safety Officer.

### 3.9 Radiation Safety Officer (RSO)

Currently, the GoM RSO is the Health Manager.

- A. Responsible for oversight of the radiation safety program for the GoM Region.
- B. Provide technical support on training, work practices, and protective measures when handling radioactive materials and devices.
- C. Act as the point of contact for radiation questions and concerns as well as radiation emergencies.
- D. Maintain records, receipts, exposure monitoring data, and radiation source inventories.
- E. Shall be notified prior to the purchase and installation of radiation sources or devices to assist with the appropriate licensing requirements.

## 4 General Requirements

- A. Work involving the use of ionizing radioactive materials at BP facilities is generally conducted by third party/contract personnel. The responsibility for the radioactive material; implementing testing and exposure control measures; disposal; and decontamination of any associated equipment or the site is the responsibility of third party/contract personnel and shall be managed in accordance with the regulatory requirements.
- B. The following health and safety regulatory standards apply for controlling and managing potential ionizing radiation exposures that may occur at BP GoM Region facilities:
  - 1. 10 CFR 20 US NRC Standards for Protection Against Radiation
  - 2. OSHA 29 CFR 1910.1096 Ionizing Radiation
- C. Due to potential health effects resulting from exposure to radiation, exposure levels should be kept ALARA.
- D. The standard personal protective equipment requirements apply when handling radioactive materials, this includes a hardhat, safety glasses, gloves, hearing protection, and fire-retardant clothing. Survey meters and personal dosimeters / film badges may also be required when handling radioactive materials depending on source activity level and potential for personnel exposure.

- E. The license requires annual calibration of survey meters and leak tests and function tests of safety devices every six months unless a longer interval has been approved by the NRC.
- F. Sources shall be shielded to minimize exposure and prevent release of radioactive materials.
- G. Radioactive materials and devices shall be secured while in use and/or in storage.

## 5 Process

### 5.1 Uses of radioactive materials and devices

- A. Natural, man-made, and enhanced radioisotopes are used by the oil and gas industry to:
  - 1. Explore for oil and natural gas;
  - 2. Determine density and level of products in pipelines or vessels;
  - 3. Test pipes and welds, including structural cracks and stresses in equipment;
  - 4. Test the thickness of metal products such as steel; and
  - 5. Trace or monitor the movement of materials and equipment (e.g., radioactive tracers).

### 5.2 Health Effects

- A. Stochastic Health Effects
  - 1. Stochastic effects are associated with long-term, low-level (chronic) exposure to radiation. "Stochastic" refers to the likelihood that something will happen.
  - 2. Increased levels of exposure make these health effects more likely to occur, but they do not influence the type or severity of the effect.
  - 3. Cancer is considered to be the primary health effect from radiation exposure. Radiation can also cause mutation changes in DNA that are teratogenic or genetic. Teratogenic mutations are caused by exposure of the fetus in the uterus and affect only the individual who was exposed. Genetic mutations are passed on to offspring.
- B. Non-Stochastic Health Effects
  - 1. Non-stochastic effects appear in cases of exposure to high levels of radiation, and they become more severe as the exposure increases. Short-term, high-level exposure is referred to as acute exposure.
  - 2. Many non-cancerous health effects of radiation are non-stochastic. Unlike cancer, health effects from acute exposure to radiation usually appear quickly.

3. Acute health effects include burns and radiation sickness. Radiation sickness is also called radiation poisoning. It can cause premature aging or even death. If the dose is fatal, death usually occurs within two months. The symptoms of radiation sickness include nausea, weakness, hair loss, skin burns or diminished organ function.

### 5.3 Occupational Exposure Limits

Operations, Wells, and Projects shall limit doses of ionizing radiation from occupational sources of ionizing radiation to ALARA and shall not exceed the following limits:

- A. **5 rem/year** for workers (total dose equivalent)
- B. **100 mrem/year** for non-workers (members of the public)

### 5.4 Risk Management

#### A. Detecting and Measuring Ionizing Radiation in the Workplace

1. Facilities or operations utilizing ionizing radioactive sources or equipment continuously shall conduct and document surveys at least annually to verify that dose limits for ionizing radiation from occupational sources are not exceeded. Survey equipment shall be appropriately calibrated and capable of measuring the types of ionizing radiation present. Third party/contract personnel utilizing ionizing radioactive sources or equipment shall provide documentation that such surveys are conducted.
2. Personnel utilizing equipment or allowed access to areas with dose rates greater than or equal to 2 mrem in any hour or who have the potential to receive 500 mrem (0.5 rem) per year shall be issued a personal dosimeter that is capable of measuring the types of radiation to which they are exposed.
3. An investigation and action plan to reduce further doses are required whenever a worker's dose equals or exceeds the exposure limits.

#### B. Testing of Sources

Licensed third party/contract personnel may utilize radioactive sources for well logging sources, Table 1 defines leak testing requirements for these and other radioactive sources.

**Table 1. Sources and Leak Testing Frequency Requirements**

Type of Source	Routine Period
Well Logging Source	6 months
Energy Stabilization Sources for Well Logging Detectors	36 months

Sources contained within Surface Meters (level indicators, density gauges, flow meters)	6 months Unless otherwise specified
Alpha Emitters	3 Months
Minitrons (Neutron Generators)	Exempt
<ol style="list-style-type: none"> <li>1. Sources containing activities less than or equal to 3.7 MBq are exempt.</li> <li>2. Any sealed source test result greater than or equal to 185 Bq shall be temporarily removed from service and tested again. If a second test result is greater than or equal to 185 Bq, the source shall be permanently removed from service.</li> <li>3. Radiation producing machines purchased directly from manufacturers shall be tested per the schedule set out by the manufacturer or at least annually to determine the radiation levels produced by the machines in areas accessible to personnel.</li> </ol>	

## 5.5 Controlling Ionizing Radiation Exposures

### A. Radioactive Sources

1. Control measures appropriate to the ionizing radiation equipment used and potential exposure levels present shall be in place and implemented.
2. Prior to obtaining any radioactive materials, the RSO shall be notified.
3. Radioactive materials shall be obtained from approved suppliers and shall be legally authorized as materials.
4. Sealed sources and radiation producing machines, other than those used as a component of designed equipment, shall be purchased directly from approved, legally authorized manufacturers. Accelerators, cabinet and flash X-ray units, X-ray fluorescence devices and scanning electron microscopes are examples of radiation producing machines.

### B. Inventory and Storage of Material

1. Sources and devices shall meet applicable regulatory standards and licensing requirements.
2. Radioactive materials shall be physically inventoried and documented at least annually unless otherwise specified by a device registry or license, except for special form materials with activities less than 50 kBq.

3. Licensed third party/contract personnel may utilize and store radioactive sources to prevent unauthorized removal while onsite, Table 2 defines requirements with regards to defining controlled and restricted areas for barricading.

**Table 2. Source Type and Storage Requirements**

<b>Type of Source</b>	<b>Activity</b>	<b>Stored Within</b>
Special form sources not contained within surface meters of logging tools	Any	Restricted Area
Natural Thorium	Any	Restricted Area
Minitrons not installed within equipment	Any	Restricted Area
Minitrons installed within equipment	Any	Controlled Area
Special form sources contained within logging tools	$\leq 3.7$ MBq	Controlled Area
Special form sources contained within surface meters	$< 10$ GBq	Restricted Area or Permanently Mounted to Operating Equipment
All other authorized materials	Any	Restricted Area

C. Safe Handling of Ionizing Radioactive Materials/Sources

1. Personnel handling ionizing radiation material/sources shall be aware of the type of material/source and be trained on the hazards and proper control procedures.
2. Exposure to ionizing radiation shall be minimized to ALARA.
3. No eating, drinking or smoking may take place in any area in which there are ionizing radioactive sources.
4. Wear gloves and/or other protective clothing when there is a possibility of contamination of the hands or body.
5. Personnel shall wear the appropriate radiation dose monitoring equipment, if applicable, when working with or around materials/sources.
6. Radioactive materials/sources shall be clearly labeled, using the standard radiation symbol.
7. Commercially prepared materials/sources shall not be tampered with or physically modified.
8. Discarded ionizing radioactive waste shall be properly disposed of and documented according to approved methods and never deposited into trash cans.

9. Check the hands and body for accidental contamination after the use of sources with the potential for contamination.

D. Incident and Emergency Reporting

1. The following incidents shall be immediately reported to the BP Person in Charge and the RSO:
  - a. Leaking or ruptured source;
  - b. Spill of radioactive material;
  - c. Lost, missing or stolen radioactive material;
  - d. Vehicle accident when the cargo includes radioactive material;
  - e. Any dose of ionizing radiation exceeding the limits defined in this document; and
  - f. A shutter on a surface meter is stuck in the open position.
2. Whenever a source is stuck in a well, it shall be immediately reported to the BP Person in Charge and the RSO for any of the following:
  - a. The first attempt to recover the source has failed;
  - b. The abandonment of the source is imminent; or
  - c. When fishing operations could damage or rupture the source.
3. Any accident, injury, or loss of control of a radiation source that could cause an excessive or uncontrolled radiation exposure to any individual shall be considered a radiation emergency.
  - a. The first action to take in any such emergency is to provide first aid to injured persons and/or prevent further injury.
  - b. Persons should immediately leave the affected area until the extent of the radiological hazard can be determined, but they should remain in the vicinity until they have been personally scanned for contamination.
  - c. The RSO shall be immediately notified for guidance before additional actions are taken.

E. Disposal

1. Disposal transportation and final disposal, if applicable, shall be in accordance with the NRC, Department of Transportation (DOT) and Environmental Protection Agency (EPA) regulations.
2. Contact the RSO and/or Environmental Team.
3. Most special form materials should be returned to the manufacturer/origin for disposal.

## 5.6 Training

- A. Workers whose tasks involve working with or around sealed radiation sources shall receive Radiation - Sealed Sources Awareness training, which is available in My Talent & Learning (MT&L).
- B. Those who may be exposed to levels above 100 mrem per year, operate ionizing radiation devices, handle ionizing radiation sources, or work within restricted areas shall receive both the Radiation - Sealed Sources Awareness training and additional task and exposure control training. These individuals will also be identified as Authorized Users.

## 5.7 Recordkeeping

- A. Audits of the radiation safety program shall be maintained for three years unless defined by a license.
- B. Current up-to-date licenses shall be maintained until the NRC or agreement state authorizes disposal.
- C. Disposal records shall be maintained until the NRC or agreement state authorizes disposal and a transfer letter is received.
- D. Annual Inventory records shall be maintained for three years unless defined by a license.
- E. Survey and calibration records shall be maintained for a minimum of three years.
- F. Personal monitoring records should be maintained for a minimum of 30 years plus facility lifetime.
- G. Source leak tests are required by the NRC and Agreement states to be maintained for three years.
- H. Gauge receipt records shall be maintained for three years following disposal.
- I. Shutter safety mechanism test records shall be maintained for three years.
- J. Training records shall be maintained for three years.
- K. Transfer records shall be maintained for three years following transfer.

## 6 Definitions/Acronyms

Terms	Description
Controlled Area	An area, outside a restricted area but inside the site boundary, to which access can be limited by the licensee for any reason.
Dosimeter	Small air-filled ionization chamber that measures radiation dose by responding to ionization in the air.

General License	Allows certain persons to receive and use a device containing byproduct material if the device has been manufactured and distributed in accordance with a specific license issued by the NRC or by an Agreement State.
Ionizing Radiation	Charged particles (alphas, betas, positrons and protons), neutrons, gamma rays and x-rays capable of creating damage to human cells through the ionization of chemicals within the cell.
Leak test	Check for the escape of radioactive material from a source housing.
Nuclear Regulatory Commission (NRC)	The federal regulating body with jurisdiction over radiation activities for the Gulf of Mexico Deep Water.
Occupational Sources of Ionizing Radiation	Includes radiation-producing machines and radioactive source materials either present or used at BP locations or for BP operations (background sources of radiation are not occupational sources of ionizing radiation).
Radiation Area	An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates or 100 mrem in any 5 consecutive days.
Radiation Emergency	An emergency in which there is, or is perceived to be, a hazard due to radiation exposure from a source. Examples include a leaking source, spill of radioactive material, or an exposure that exceeds the occupational exposure limits.
Radiation Producing Machine	Any device with the specific purpose of creating ionizing radiation (e.g., X-ray units, X-ray fluorescence devices, radiation flow detection device, level detection devices, etc.). Note: Electronic devices creating ionizing radiation as an indirect consequence of their operations are not classified as radiation producing machines.
Radiation Safety Officer (RSO)	The individual accountable for the radiation safety program.
Radioactive Materials	Materials and substances that spontaneously emit energy in the form of alpha, beta, gamma radiation or x-rays.

Radioactive Tracers	Examples include use of tracers to determine the injection profile and locate fractures created by hydraulic fracturing or investigate and trace the movement of materials and equipment by utilizing radiation detection equipment.
Radiation Symbol	The standardized radiation presence symbol. Also known as the Trefoil. 
rem	A measure of the dose to the human body tissues in terms of its estimated biological effect (1 millirem (mrem) = 0.001 rem and 1 mrem = 0.01 mSv).
Restricted Area	An area, access to which is limited by the licensee or registrant for the purpose of protecting individuals against undue risks from exposure to sources of radiation.
Sealed Source	Radioactive material sealed in a capsule designed to prevent leakage or escape of the material.
Special Form Radioactive Material	Radioactive material that is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule and the piece or capsule has at least one dimension not less than 5 mm (0.2 in)

## 7 Key Documents/Tools/References

- A. [US NRC 10 CFR Part 19, 20, 31, 32, 39, and 40](#)
- B. [OSHA 29 CFR 1910.1096, Ionizing Radiation](#)
- C. [OSHA 29 CFR 1910.1200, Hazard Communication Standard](#)
- D. [OSHA 29 CFR 1910.1020, Access to Employee Exposure and Medical Records](#)
- E. [GoM Region Naturally Occurring Radioactive Material \(NORM\) Manual](#)
- F. NRC General License Numbers: GL 725890, GL 725958, GL 725957

## 8 Appendix A - Specific Licenses

**Currently, there is no specific license in effect between BP and the NRC. This document covers the requirements if one were to be put into effect.**

### 8.1 Purpose/Scope

The purpose of this document is to define the requirements set forth by the U.S. Nuclear Regulatory Commission (NRC) and the terms of any active specific license agreement between BP and the NRC. The intent of this program to reduce the exposure from occupational sources of ionizing radiation to As Low As Reasonably Achievable (ALARA) to employees and the public.

Radioactive materials, as sealed sources in devices, may be used in the Gulf of Mexico (GoM) to monitor and measure density and analyze water and oil interfaces.

### 8.2 Definitions

**Dose-Pocket dosimeter** – small air-filled ionization chamber that measures radiation dose by responding to ionization in the air.

**Leak test** – check for the escape of radioactive material from a source housing.

**Millirem (mrem)** – a measure of the dose to the human body tissues in terms of its estimated biological effect. (1 mrem = 0.01 mSv)

**Millisievert (mSv)** – the SI measure of the dose to the human body tissues in terms of its estimated biological effect. (1 mSv = 100 mrem)

**Radiation Area** – an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates or 100 millirem in any 5 consecutive days.

**Radiation Safety Officer (RSO)** – person who is responsible for overseeing Radiation Safety and the Radiation Safety Program.

**Radiation Symbol** –  The standardized radiation presence symbol. Also known as the “Trefoil”.

**Restricted Area** – area with access controlled for the purpose of radiation protection.

**Sealed Source** – radioactive material sealed in a capsule designed to prevent leakage or escape of the material.

**Special Form Radioactive Material** – radioactive material that is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule and the piece or capsule has at least one dimension not less than 5 mm (0.2 in).

### 8.3 General Requirements

**Health:** Due to potential health effects resulting from exposure to radiation, exposure levels should be kept As Low As Reasonably Achievable (ALARA).

**Safety – Special PPE & Hazards:** Minimum Personal Protective Equipment (PPE) required includes hardhat, safety glasses, gloves, hearing protection, and Fire-Retardant Clothing. Survey Meters and personal dosimeters / film badges are usually not required.

**Quality:** The BP license requires annual calibration of survey meters, and leak tests and function tests of safety devices every six months unless a longer interval has been approved by the NRC. The Radiation Safety Officer (RSO) and authorized users shall be certified through appropriate training.

**Environment:** Sources are shielded and special form radioactive material to minimize exposure and prevent release of radioactive materials.

**Security:** Facility employees shall establish and maintain a high level of alertness as described in the Facility Security Plan. Devices shall be secured in use and in storage.

### 8.4 Key Responsibilities

#### A. Offshore Installation Manager (OIM)/Person in Charge (PIC)

The Offshore Installation Manager (OIM)/Person in Charge (PIC) is responsible for the implementation of this Policy by ensuring that the proper resources and equipment are allocated with regard to radiation safety.

#### B. Radiation Safety Officer (RSO)

Individual responsible for technical support to the BP GoM Radiation Safety Program. Responsibilities include maintaining the appropriate license with the US NRC, auditing the program, maintaining records, notifying the NRC of any radiation emergencies, and directing any radiation work in accordance with the license. It also involves communicating with contract company RSO's when applicable. Currently, the GoM RSO is the Health Manager.

Provide verification that requirements associated with licenses are being effectively implemented to prevent non-compliance or over exposure of personnel to radiation. Assess at defined intervals the results of self-assessments and audits to identify trends, emerging risks and opportunities to improve risk reduction measures for preventing non-compliance and over exposure to radiation.

#### C. Authorized Users

BP or Contractors who conduct radiation work (e.g., safety checks) in accordance with BP's specific license and through the direction of the RSO.

## 8.5 Procedures

### 8.5.1 General Operating Procedures

The radioactive material used in the level indicator is contained in a special form sealed source double stainless-steel sealed capsule, which is loaded into a shielded source housing. The source housing is plumbed directly into the vessel. Radiation passes through the product and vessel wall to a detector strip, which transmits an electronic signal to the Control Room. A specific radioactive material license must be issued by the Nuclear Regulatory Commission for these sources.

All radioactive devices shall be maintained in accordance with the requirements of BP's license issued by the Nuclear Regulatory Commission and as outlined in this procedure.

Employees shall be trained on the location of radioactive devices when they are located on the facility. Employees shall not perform any work that will require "accessing" the radioactive source or device (i.e. removal of the device, service of the device, etc.).

Source housings shall be identified by the conventional trefoil radiation symbol. The blades will be magenta on a yellow background. The sign will read: "Caution-Radioactive Materials".

Each gauge shall be operated within the manufacturer's specified temperature and applicable environmental limits such that the shielding and insertion rod/cable mechanism of the source housing is not compromised.

Any incident, Notice of Violation (NOV), leak test failure / noticeable radiation increase, or any other occurrence involving the radioactive device shall be reported immediately to the RSO, HSSE, and Facility Leadership. Any NOV shall be submitted to the Regulatory and Legal Teams.

Any incident, Notice of Violation (NOV), leak test failure / noticeable radiation increase, or any other occurrence involving the radioactive device shall be investigated.

Specific license registration fees shall be paid according to Federal and State licensing requirements.

### 8.5.2 Leak Tests, Operation Checks, and Inventory

The RSO will inventory and perform operational inspections and leak tests of nuclear sources every six months, unless a longer term has been agreed upon by the NRC, and will complete and maintain appropriate documentation.

An inventory of devices stating the manufacture name, isotope, activity, location, serial number and model number shall be maintained by the RSO.

Devices shall be tested for proper operation of the on-off mechanism and indicator, at intervals not to exceed 6 months or at other intervals specified by the device registration.

Leak tests shall be performed by an organization approved by the NRC or an Agreement State to provide leak-testing services or with a leak test kit supplied by an organization authorized by the NRC or an Agreement State to provide leak test kits. The leak test kit manufacturer's instructions must be followed for safety.

Sources held in storage and in use do not need to be tested. When the source is removed from storage for use or transfer to a company licensed to receive sources for disposal, it shall be tested before use or shipping.

### **8.5.3 Labeling and Signage**

The source housing shall have a label that states the type and quantity of radioactive material, the date of manufacture, and the manufacturer's name. The label shall bear the conventional trefoil radiation symbol. The label shall be maintained in a readable condition. A radiation warning sign shall be posted near the source when the dose rate is equal to or greater than 5 mrem/hr at a distance of 12 inches from the surface of the gauge.

### **8.5.4 Emergency Procedures**

In the event of a radiation emergency such as: Fire, Stuck Shutter, Loss or Theft, Fall or Collision or Radiation Exposure:

- Handle the immediate emergency first, and inform fire-fighting personnel that radioactive sources are in the area. As soon as the immediate emergency is taken care of:
  - Isolate the areas around the source in all directions.
  - Note the names of personnel who may have been in the area
  - Notify the RSO Immediately. The RSO will guide any further actions.
  - Emergency Phone Numbers: a list of emergency numbers shall be kept by the RSO and shall include at a minimum the Nuclear Regulatory Commission and the device manufacturer.

In the event of a facility evacuation, any devices containing radioactive material shall be retracted into the source housing and locked in the off position. Follow regional energy isolation procedures.

Furthermore, the source housing shall be secured to the facility with a cable and lock during evacuation and shall also be documented on the energy isolation documentation.

#### **8.5.5 Radiation Emergency Kit**

An emergency radiation kit shall be available in the event a radiation emergency should occur. The kit shall be equipped with the following:

- Radiation warning signs
- 200 ft. of barricade rope
- 200 ft. of radiation hazard flagging
- Wipe test kits
- Rubber gloves
- Survey meter (spare batteries)
- Plastic bags
- Rolled plastic sheeting
- Emergency procedures

#### **8.5.6 Receipt, Installation, Removal, Storage, and Disposal**

Prior to purchasing radioactive devices, employees shall contact the GoM RSO. The device shall be included in the list of NRC licenses.

When receiving radioactive materials onsite, a visual inspection shall occur to check for damage to the source housing, to ensure the ON/OFF mechanism is closed and locked, and to verify the shipment is complete.

After receiving radioactive materials onsite and prior to installation, radioactive material shall be kept in a secured storage location. Personnel shall be notified that radioactive material is onsite. A copy of the shipping manifest and receipt shall be kept on file by the RSO and Environmental Team.

Installation of devices shall only be performed by the manufacturer, distributor, or other personnel specifically licensed to install devices.

Devices in storage do not require leak tests or operation checks but shall remain on the facility inventory which is updated semi-annually.

Removal, transfer, and disposal of devices shall only be performed by the manufacturer, distributor, or other personnel specifically licensed to move, transport, relocate, or dispose of devices. A review by the GoM RSO of the third-party license to ensure that it applies to offshore

facilities under NRC jurisdiction shall be done prior to the start of any work. Agreement State licensees must have applied for reciprocity with the U.S. NRC.

A copy of records of receipt, transfer, and disposal must be kept on file by the RSO.

Sources deemed to be inoperable shall be repaired or disposed of properly to prevent accumulation and possibility of a radiation incident. Contact the RSO for assistance with inoperable sources.

NOTE: BP IS NOT AUTHORIZED TO PERFORM NON-ROUTINE ACTIVITIES AS DEFINED BY THE LICENSE AGREEMENT WITH THE NRC.

### **8.5.7 Confined Space Entry**

When confined space entry is required on vessels equipped with devices containing radioactive material, the source(s) shall be retracted into the source housing and locked in the off position. Confirmation of radiation levels with a survey instrument shall be done prior to entry into the vessel. The isolation of the source shall follow energy isolation procedures.

### **8.5.8 Radiographic Inspection**

Radiographic inspections performed by third party contractors shall be conducted under the radiography organization's license and radiation safety program. The RSO shall review the radiography contractor's license to ensure that it applies to offshore facilities under NRC jurisdiction. Agreement State licensees must have applied for reciprocity with the NRC.

### **8.5.9 Monitoring**

In the event of an emergency, a radiation survey meter and pocket dosimeter shall be used by the RSO when evaluating the situation.

Because personnel monitoring is required only for individuals who could receive in excess of 500 mrem in a year, BP employees are unlikely to require dosimetry. When sources are loaded in vessels, the radiation area will be below 5 mrem/hour 12" from the vessel wall.

Exposure monitoring records are available to monitored employees upon request to the RSO.

Workers must obey radiation signs and barricaded areas established by the RSO or radiography contractors during radiography procedures.

### **8.5.10 Notices**

The following items shall be posted in a conspicuous location available to workers:

- Copies of Nuclear Regulatory Commission (NRC) Form 3
- A notice of where BP's Specific License and 10 CFR Parts 19 and 20 may be inspected
- Any Notice of Violation or citation issued by the NRC

### **8.5.11 Security**

The following actions shall be implemented, where applicable, to mitigate potential threats:

- Control personnel access through security screenings at heliport.
- Establish heightened sensitivity to the presence of any suspicious packages transported by personnel or observed in the vicinity of the facility.
- Limit the potential for theft or sabotage of licensed materials by securing devices during evacuation.
- Promptly report relevant suspicious or unusual activities involving radioactive materials to the BP Offshore Installation Manager (OIM) and the RSO.

### **8.5.12 Training**

- Personnel arriving at a BP facility will be given a brief notification regarding the presence and location of nuclear (radioactive sources) at the facility as part of the HSSE orientation.
- Additional radiation safety awareness training may be given upon arrival to those individuals working in areas, which possess devices containing radioactive material. Content will follow the procedures set forth in this Policy.
- More detailed training will be given upon assignment to authorized users of the devices in accordance with 10 CFR 30.33(a) (3).
- RSOs are required to receive additional training in accordance with 10 CFR 30.33(a) (3).

### **8.5.13 Auditing**

Audits shall be conducted at intervals not to exceed 12 months (10 CFR 20.1101) and records for previous audits shall be maintained for three years by the RSO. The audits shall identify any deficiencies and ensure corrective actions are taken for said deficiencies.

Items to be audited include but are not limited to:

- Organization and Scope of Program
- Training and Instructions to Workers
- Radiation Survey Instruments
- Gauge Inventory

- Personnel Radiation Protection
- Public Dose
- Operating and Emergency Procedures
- Leak Tests
- Maintenance of Gauges
- Transportation
- Auditor's Independent Survey Measurements (If Made)
- Notification and Reports
- Posting and Labeling
- Record Keeping
- Bulletins and Information Notices
- Special License Conditions or Issues

#### **8.5.14 Record Keeping**

The following records shall be retained by the RSO:

- Initial radiation survey (for reference)
- Leak tests
- Operation checks (shutter tests)
- Receipt of gauge (shipping papers)
- User training
- Transfer or disposal of material
- Maintenance records
- Monitoring records
- Survey records
- Audit records

#### **8.6 Key Documents and References**

- Nuclear Regulatory Commission 10CFR Part 19
- Nuclear Regulatory Commission 10CFR Part 20
- Nuclear Regulatory Commission 10CFR Part 33
- Nuclear Regulatory Commission 10CFR Part 35
- BP GoM Naturally Occurring Radioactive Material (NORM) Manual

### **9 Appendix B – Non-Ionizing Radiation (i.e., Antennas)**

#### **9.1 General Information**

Non-ionizing radiation includes the spectrum of ultraviolet (UV), visible light, infrared (IR), microwave (MW), radio frequency (RF), and extremely low frequency (ELF). Unlike the ionizing

radiation, non-ionizing radiation does not have enough energy to remove electrons from atoms and molecules.

RF and MW refer to the electromagnetic radiation in the frequency range of 3 kilohertz (kHz) - 300 gigahertz (GHz). This is the frequency band that is used for communications transmission and broadcasting. The radio antennas and 4G LTE antennas installed in the BP GoM offshore facilities emit the radiation in the range of RF / MW.

## 9.2 RF Health Effects

Exposure to high levels of RF radiation may be harmful due to the ability of RF energy to rapidly heat biological tissue. Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with or dissipate the excessive heat that could be generated. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because of the relative lack of available blood flow to dissipate the excessive heat load. The thermal effects may have the symptoms such as blindness, cataracts, sterility, perspiring, labored breathing, burns, headache, numbness, paresthesia, diarrhea, skin erythema, etc.

Exposure to RF radiation may also cause potential non-thermal effects to the immune system, body's circulation rhythms, and endocrine.

International Agency for the Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as Group 2B "possibly carcinogenic to humans based on an increased risk for glioma, a malignant type of brain cancer associated with wireless phone use."

Pacemakers and other medical devices could be susceptible to electromagnetic signals that could cause them to malfunction.

Existing equipment installed offshore emitting RF has restricted access in order to minimize exposure potential.

## 9.3 RF Exposure Limits

Various organizations have developed exposure standards for RF energy. These standards recommend safe levels of exposure for both the general public and for workers. As GoM personnel are not trained to work in the occupational / controlled RF radiation environment, GoM adopts the exposure limits applied to the general public.

The Federal Communications Commission (FCC) guidelines for human exposure to RF field has adopted the recommended exposure limits published by National Council on Radiation Protection and Measurements (NCRP) and the Institute of Electrical and Electronics Engineers (IEEE). Table 9.3-1 below lists the FCC limits for general population exposure, which GoM has adopted.

Table 9.3-1: Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electrical Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Average Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3 – 1.34	614	1.63	(100)*	30
1.34 – 30	824/f	2.19/f	(180/f <sup>2</sup> )*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	--	--	f/1500	30
1500 – 100,000	--	--	1.0	30

\*Plane-wave equivalent power density

#### 9.4 RF Exposure Control

In GoM, the potential exposure to the RF / MW radiation emitted from the antennas is controlled by keeping personnel outside the exclusion distance from the antenna installation. The antenna will be shut down through the control of work (CoW) process, if any work will be carried out inside the exclusion zone. The exclusion distance is calculated using the equation below:

$$R = (0.64 \times \text{EIRP} / \pi \times S)^{1/2}$$

Where:

R = Exclusion distance in meters

EIRP = Equivalent isotropically radiated power in watts

S = Exposure limit in W/m<sup>2</sup>

Set up barriers according to the calculated exclusion distance and post RF warning signs. Examples of common RF warning signs are shown in the pictures below. Specific work instruction can be added into the signs as necessary.



## 9.5 References

[Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields](#)

[ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields \(up to 300 GHz\)](#)

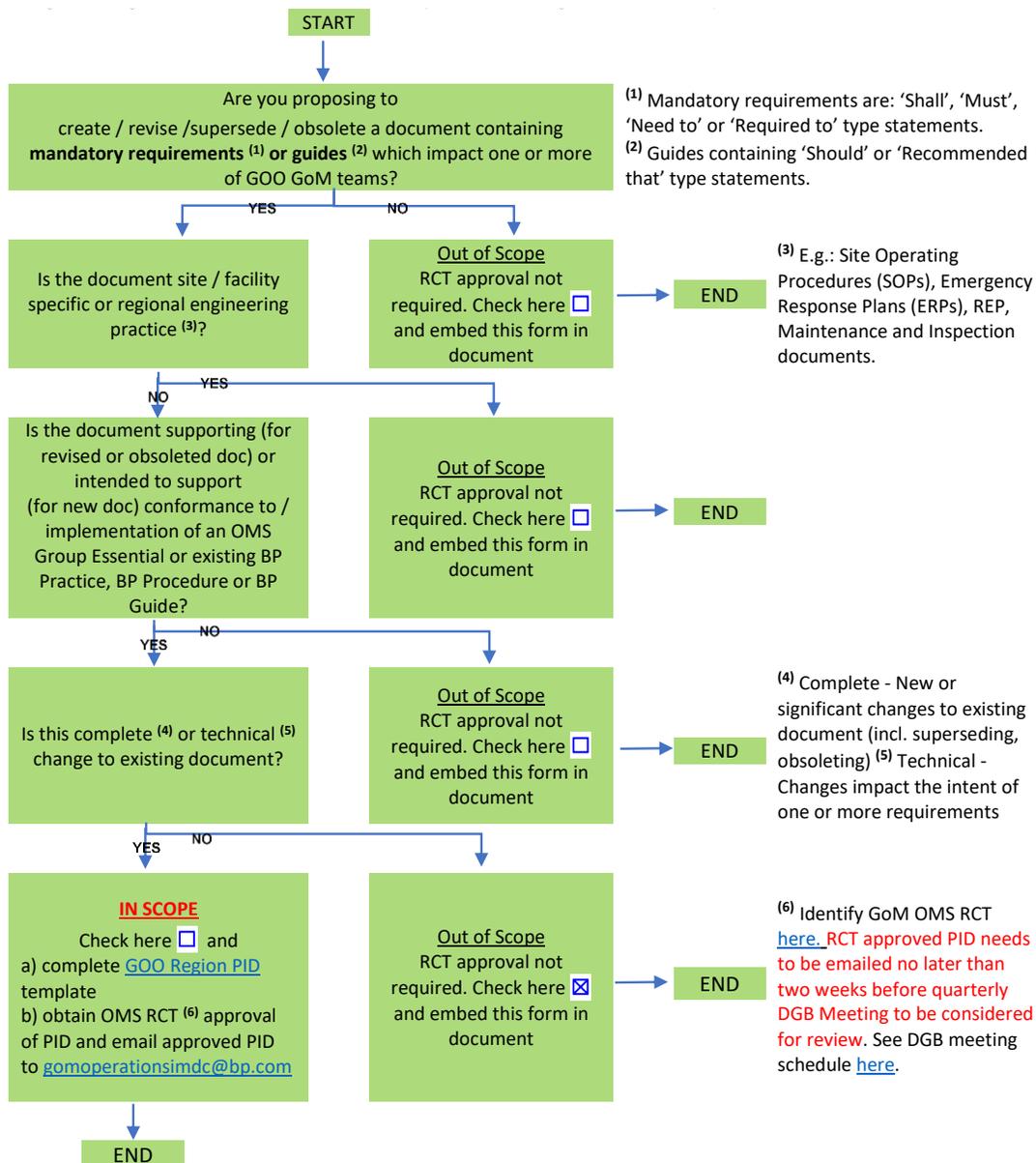
ANSI C95.2 Radio Frequency Radiation Hazard Warning Symbol

[OSHA 1910.97 Non-ionizing Radiation](#)

# Gulf of Mexico

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