

**Gulf**of**Mexico**



**Operations: HSE**

**Health and Industrial Hygiene**

**GoM Region Naturally Occurring Radioactive  
Material (NORM) Manual**

## Amendment Record

Revision Date	Authority	Custodian	Revision Details
07/06/2018	Health Manager	Industrial Hygienist & Environmental Advisor	<ul style="list-style-type: none"> <li>Minor editing changes</li> </ul>
03/29/2017	Health Manager	Industrial Hygienist & Environmental Advisor	<ul style="list-style-type: none"> <li>Reformatted the document with the new GoM document template.</li> <li>Re-edited the whole document to improve the content flow, structure, and logic. Removed the redundant information.</li> <li>Verified the accuracy of the information and regulatory requirements and updated accordingly.</li> <li>New Figure 5.6-1 for NORM survey procedure for PPE assessment.</li> <li>Combined and incorporated the vessel washout procedure to the specific work procedure.</li> <li>Added responsibilities for Environmental Advisor, Waste Advisor and HS SL.</li> <li>Incorporated environmental NORM procedures for waste handling, storage, transportation and disposal into the Manual.</li> <li>Re-edited the NORM waste disposal and shipment sections to clarify the requirement. Removed the "exclusive use" from the shipment.</li> <li>Added links to the associated regulations.</li> <li>Updated the appendices according to the latest process and forms.</li> </ul>
02/11/2014	Director, Health and Safety	Health and Industrial Hygiene Team Lead	<p>Formatted document to GoM Safe Work Practice format</p> <p>Incorporated Appendices A-I into the main body of the Manual. Obsoleted managed Documents:</p> <p>Appendix A - UPS-US-SW-GOM-HSE-DOC-00629-2</p> <p>Appendix B - UPS-US-SW-GOM-HSE-DOC-00630-2</p> <p>Appendix C - UPS-US-SW-GOM-HSE-DOC-00631-2</p> <p>Appendix D - UPS-US-SW-GOM-HSE-DOC-00632-2</p> <p>Appendix E - UPS-US-SW-GOM-HSE-DOC-00633-2</p> <p>Appendix F - UPS-US-SW-GOM-HSE-DOC-00634-2</p> <p>Appendix G - UPS-US-SW-GOM-HSE-DOC-00635-2</p> <p>Appendix H - UPS-US-SW-GOM-HSE-DOC-00636-2</p> <p>Appendix I - UPS-US-SW-GOM-HSE-DOC-00637-2</p>

			(All were individual appendices) Changed reference to the GoM Safe Practices Manual to GoM Safe Work Practices Updated Waste Management Manual links to Waste Management Procedures
04/20/2012	Director, Health and Safety	Health and Industrial Hygiene Team Leader	Amended NORM waste handling trigger levels to reflect regulatory changes. Changed MMS to BSEE. Changed governing BSEE NTL to 2009-G35. Amended state and federal regulatory activity levels for exemption status to reflect current regulations. Added intrinsically safe meter usage. Changed document authority and custodian titles. Revised all Appendices to reflect document owners. Changed meter calibration vendor from ARS to Almac. Added specification that probes must remain with their correspondingly calibrated meter.
10/01/09	GoM HSSE Director	GoM HSSE Programs Manager	Removed reference to BP NAG in the manual. Added Sections 5.13, 5.14, and 5.15. Added Mississippi regulation limits. Changed titles to Senior Industrial Hygienist. Revised Appendix B.
11/01/06	Stan Garner, Steve Tink, Curtis Jackson and Duane Kortsha	Jack Kogut	Converted from a GoM Document to a Regional NAG/GoM document. Changed the GoM Industrial Hygiene Coordinator title of custodian to Regional Industrial Hygiene Coordinator.
06/10/05	Stan Garner, Curtis W. Jackson, Ralph DeLeonardis, Bernie Herbert	Jack Kogut	Initial Issue as controlled document.

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## 1.0 Introduction

### 1.1 Purpose

This document outlines the processes to be used when naturally occurring radioactive material (NORM) is present in equipment being maintained or removed from service or when NORM containing material is being disposed of as waste. The processes are designed to protect workers and the environment from exposure to NORM and to comply with regulatory requirements relating to NORM.

### 1.2 Scope

This manual applies to Gulf of Mexico Region Operations, Wells and Projects that involve equipment and materials potentially containing NORM.

## 2.0 NORM Overview

### 2.1 Background on NORM

There are two primary types of NORM in which the oil and gas industry are concerned: radium-226 and radium-228 and their radioactive decay products (“daughters”), in particular radon-222, lead-210, and polonium-210.

Radium can be brought to the earth’s surface during oil and gas production. Radium is very soluble in produced waters. Whenever there is a change in the pressure, temperature, or pH, the radium in the produced waters may precipitate out of solution. Oil and gas production can concentrate radium in scales, sands and sludge in equipment during normal operations.

Radon is an inert, colorless and odorless gas. Radon does not present a health hazard because it is not easily absorbed into the body and is quickly cleared when it is absorbed. Radon’s radioactive breakdown products or daughters (e.g., polonium-210 and lead-210) may be inhaled, ingested or absorbed when attached to scale or dust generated during equipment inspection and repair.

NORM generally poses an internal hazard. The regulatory standards are designed to minimize internal radiation exposure of personnel by preventing or minimizing the ingestion, inhalation or absorption. Unprotected overexposure to radium and radium daughter containing dusts has been associated with an increased risk of lung cancer and leukemia. Most NORM material taken into the body is deposited in the bones, where it can reside for a long time. Radium has a biological half-life of 44 years and therefore remains in the body for a considerable length of time. For this reason, exposure must be minimized and kept at or below recognized exposure standards. NORM does not present a considerable external radiation hazard, (i.e., via the skin), although there is some potential for external hazards in areas where the NORM levels are very high (> 2,000 µR/hr).

There are three types of radiation associated with NORM:

1. Alpha radiation/particles;

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2. Beta radiation/particles; and
3. Gamma radiation/ray.

### 2.1.1 Alpha Radiation (Found in Natural Gas NORM)

Alpha radiation is the most damaging type of radiation to human health associated with NORM. One alpha particle is considered to be twenty times more damaging than one gamma ray. Alpha radiation only travels about two inches in air and cannot penetrate our clothing or the dead layer of skin on our bodies. Therefore, alpha radiation is not an external hazard to the human body. However, alpha radiation is considered an internal hazard. Inhalation is the major route of exposure. Incidental ingestion is possible.

For a piece of equipment or other material, alpha radiation can be detected by using a field survey meter with an end window or 'pancake' probe and a known efficiency for detecting alpha radiation.

### 2.1.2 Beta Radiation

Beta radiation is an energized electron particle that requires shielding, such as aluminum foil, heavy leather working gloves, or polycarbonate plastic to protect the body from absorbing the radiation. Beta radiation health hazards occur when it enters the body by ingestion, absorption or inhalation.

For a piece of equipment or other material, beta radiation can be detected by using a field survey meter with an end window or 'pancake' probe and a known efficiency for detecting beta radiation.

### 2.1.3 Gamma Radiation

Gamma radiation requires the shielding of lead, steel, concrete, earth or a similar dense or thick material to protect the body. The health hazards of gamma radiation occur when large amounts of it travel through the body.

For a piece of equipment or tubular, gamma radiation can be detected by using a survey meter with a gamma scintillation probe.

## 2.2 Types of NORM Containing Waste, Materials, and Equipment

The production of oil and gas generates waste and materials that may contain NORM. The types of waste most likely to contain NORM are filters from process streams, storage tank scale or sludge, produced sands, water separation tank sludge, well bore scale, and sludge from pigging operations. The types of equipment most likely to contain NORM are pipelines, filters, pumps, lines, and wellhead equipment (tubulars), heater-treaters, water knockouts, liquid product tanks, separators, water transfer pumps, and produced water-handling equipment.

NORM containing equipment and material shall be cleaned, stored and disposed of according to strict guidelines. The procedures for handling, surveying, storing and shipping NORM containing equipment and materials are outlined in this manual.

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### 3.0 Roles and Responsibilities

#### 3.1 Management

- A. Line management is responsible for ensuring that personnel receive proper NORM training appropriate to their job responsibilities and according to Section 4.0, NORM Training.
- B. Line management shall ensure that NORM measurements are taken on stationary and recovered equipment (e.g., tubulars, valves, vessels, etc.) that may contain NORM. The measurements shall be completed by trained personnel, before any equipment is moved off location and be conducted according to Section 5.3, NORM Measurements.
- C. Line management shall ensure that monitoring of any vessel or confined space containing or potentially containing NORM is conducted before personnel enter the vessel or space and that the appropriate permit(s) are obtained according to Section 5.3, NORM Measurements. Documentation of the monitoring results shall be maintained in the facility HSE files / recordkeeping database and copies should be attached to the work permit. Personnel involved in the operation should be notified of the results of the monitoring.
- D. Line management should ensure that monitoring plans, procedures and designation of responsibility for completing the monitoring are included in NORM-related written plans and activities (e.g., vessel entries, re-completions, vessel cleanouts, risk assessment, etc.).
- E. Line management shall ensure that well solids transported to shore are tested for NORM, according to the NORM measurement and sampling procedures stated in this Manual.
- F. Line management shall ensure that equipment and appropriate PPE for handling NORM are available for use on the offshore facility, and facility personnel working in an area / on equipment containing NORM are wearing appropriate PPE according to the work procedure, work permit, risk assessment and this Manual.
- G. Line management shall ensure that NORM containers are appropriately labelled.

#### 3.2 Health, Safety & Environmental (HSE) Site Lead

- A. Conduct NORM survey if trained as a NORM surveyor.
- B. Maintain the NORM survey record in the facility HSE file and verify a copy of the survey record is attached to the work permit when necessary.
- C. Notify GoM IH when the NORM survey result shows above the limit level (50  $\mu$ R/hr or 100 cpm) and coordinate the implementation of the control measures at the site.

#### 3.3 Employee

- D. Employees shall complete the proper training prior to conducting work involving NORM according to Section 4.0, NORM Training.

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- E. Employees who conduct work involving NORM should be familiar with the sections in this Manual that pertain to their job responsibilities.
- F. Employees who conduct work involving NORM shall follow the procedures outlined in this Manual to ensure proper protection against NORM exposure.

### 3.4 Industrial Hygienist (IH)

- A. Maintain the GoM NORM Manual, including updating the health/IH related content in the document and roll out the updates according to the document review schedule. Act as the point of contact for health/IH questions or concerns regarding the NORM Manual.
- B. Responsible for the contents of the NORM Awareness and NORM Survey training.
- C. Responsible for conducting and documenting periodic NORM surveys for each facility at least every three years and for providing field survey/sampling support as requested.
- D. Maintain a register/database of locations and equipment where NORM has been identified on each facility, based on NORM Surveys and any ad-hoc detection of NORM on the facility.

### 3.5 Waste Single Point of Responsibility

- A. Ensure that well solids transported to shore for disposal are tested for NORM, according to the NORM measurement and sampling procedures stated in this Manual.
- B. Conduct quarterly inspections of areas where NORM wastes are stored.
- C. Ensure that written records of the inspections are made and maintained for five years for possible review by the Louisiana Department of Environmental Quality.

### 3.6 Environmental Advisor (Waste)

- A. Maintain and update the environmental related content in the NORM Manual.
- B. Act as the point of contact for environmental questions or concerns regarding the NORM Manual.
- C. Verify that quarterly inspections have been completed for areas where containers of NORM waste are stored.
- D. Coordinate among relevant teams (e.g. Health & Industrial Hygiene, Operations, Regulatory Permitting & Compliance Management) applications to BSEE for storing NORM-containing wastes at offshore locations when needed.

## 4.0 NORM Training

Employees who may work with NORM containing equipment and materials must attend the appropriate level of NORM training, as outlined below:

- Employees conducting maintenance activities on and with potentially NORM containing equipment and materials (e.g., equipment inspections, equipment removal/demolition and

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equipment maintenance such as cleaning, etc.) must attend, at a minimum, the BP internal NORM Awareness Training Class (e.g., NORM Awareness training obtained through CBT). No refresher training is required.

- For employees responsible for gathering samples and/or conducting surveys with detection equipment, a NORM Surveyor course shall also be completed before surveying or sampling without the direct supervision of an Industrial Hygienist. This course is provided periodically or upon request. The course should be repeated every 5 years.
- BP employees will not perform any work activity that requires a radiation/Norm license.

## 5.0 NORM Procedures

### 5.1 General NORM Handling Precautions

The following radiological precautions shall be followed when working with or around NORM containing pipe, equipment, soil, or wastes.

- Direct skin contact with radioactive scale, solids and liquids shall be avoided to the maximum extent possible.
- Eating, drinking, smoking and chewing shall not be allowed in the work area where work is being performed on NORM containing equipment or where NORM containing material is being handled.
- Personnel shall thoroughly decontaminate after working with NORM containing equipment, before eating, drinking, or smoking, and at the end of the workday.
- Work activities involving NORM shall be conducted in areas to which access has been restricted. The number of personnel in the work area shall be kept to a minimum.
- Openings on contaminated equipment shall be sealed or wrapped in plastic or other suitable materials.
- NORM containing materials shall be kept wet to limit the possibility of NORM dust becoming airborne.
- Plastic ground covers shall be utilized to the extent possible to contain NORM and to facilitate cleanup.
- Workers who may be exposed to NORM must be provided with and wear proper Personal Protective Equipment (PPE) to reduce the risk of exposure. The most effective PPE for working around NORM includes:
  - protective eyewear, specifically goggles in high dust areas,
  - disposable or non-porous gloves (two layers of gloves are recommended),
  - hooded disposable coveralls (i.e., Tyvek suits) or non-porous rain suits,
  - rubber or other non-porous protective footwear, and

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- respirators with appropriate NIOSH-approved HEPA filters.

Refer to “Figure 5.6-1: Overview of NORM Survey Procedures for PPE Assessment” for more details about the PPE requirements under the different NORM levels.

- I. When respiratory protection is required, the selection, use, and care of any respiratory protective equipment must be in compliance with the GoM Respiratory Protection Safe Work Practice (SWP).
- J. Gloves, respirators, coveralls, plastic, and rags that have come in contact with NORM shall be either decontaminated or placed in containers, drums, sealed and held for disposal. Contaminated PPE shall not be removed from the restricted work area until it has been decontaminated or placed in approved waste receptacles.
- K. NORM containing material shall be sealed in DOT 17-H steel drums or other suitable containers. Drums and other containers shall be labeled in accordance with Section 6.3, Labeling of Containers.

**5.2 NORM Surveys and Sampling**

A NORM survey is defined as the monitoring of equipment, containers, or materials using handheld instruments that provide radiation readings. Sampling is defined as the taking of a portion of a suspect material (either from the inside of equipment/tubulars, or a material waste, such as sludge or suspected surface contamination) and sending it to a laboratory for analysis.

**5.2.1 Baseline Surveys**

An initial NORM baseline survey shall be performed on facilities in order to determine if the facility contains NORM, and to record the location of NORM on the facility. Follow-up surveys shall be performed thereafter at an interval of once every three years. The GOM IH Team can assist in coordinating and completing the surveys.

**5.2.2 Routine Survey**

Routine NORM surveys shall be performed, prior to commencement of any work, on equipment (e.g., vessels, tubulars, containers, etc.), piping and material that have been exposed to produced fluids (oil, gas, or water) and that are to be worked on or removed from location. These surveys are required in order to assure that proper precautions and procedures will be in place prior to initiating maintenance activities and also to determine if further sampling is required for shipping classification. This includes:

- produced sand and sludge material (e.g., solids and tank bottoms) that have the potential to contain NORM,
- tubing and casing removed from a well,
- pipeline pigging operations and filter changing operations,
- vessels, tanks, piping runs or other equipment that may have had contact with produced fluids prior to:

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- on-site repair, maintenance or inspection,
- decommissioning or removal activities,
- transfer or sale to a third-party (third parties must be notified of the presence of any NORM above release limits), or
- release to a third party for repair, maintenance, inspection, or unrestricted use (items that could contain NORM above trigger limits shall only be released to licensed NORM contractors or facilities).

NORM surveys shall also be performed prior to entry into any vessel, tank or confined space where NORM is suspected to be present in excess of background. These surveys shall be repeated prior to any re-entry and at intervals during clean out of the vessel, as readings have the potential to change.

**5.2.3 Sampling**

Vessels, tubulars, piping, valves, equipment, containers (e.g., cutting boxes, 55-gallon drums, roll-off boxes, etc.), and materials shall be sampled prior to shipment when they exhibit readings equal to or greater than twice background levels. If sampling is not possible, then the waste shall be properly contained and shipped as DOT HAZMAT material. Appendix B, Waste Handling – NORM Equipment, Pipe and Diffuse Waste outlines the directives for evaluating and disposing of NORM containing equipment.

**5.2.4 PPE Requirements for Conducting NORM Survey and Sampling**

Suitable protective clothing, including at least long sleeves (preferably disposable or non-porous coveralls), non-porous gloves and eye protection, should be worn to prevent skin and personal clothing contact with NORM.

When personnel enter a work area where there is potential to breathe NORM containing dust, a NIOSH approved air-purifying respirator equipped with P-100 HEPA filters should be worn.

**5.3 NORM Measurements**

**5.3.1 Types of Measurements**

In order to determine if equipment/materials contain NORM, measurements shall be made by a trained surveyor. It is important to remember that the different types of radiation (alpha, beta, and gamma) are measured differently and controlled differently. There are essentially two types of measurements: field measurements and laboratory analyses.

1. Field measurements for Alpha and Beta are measured in counts per minute (cpm) and then converted to disintegrations per minute (dpm) and gamma radiation is measured in micro-roentgens per hour (µR/hr); and

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2. Laboratory sample analysis results are reported in picocuries per gram ( $\rho\text{Ci/g}$ ) of each radioisotope detected. Total activity of each sample analyzed is also required for determination when DOT shipping requirements are applicable.

Note: One curie =  $2.2 \times 10^9$  dpm; 1 cpm  $\approx$  10 dpm

### 5.3.2 NORM Survey Equipment

Instruments that measure gamma radiation and read in units of  $\mu\text{R/hr}$  are used to determine if equipment, vessels, piping runs, tubulars or containers contain NORM. BP typically uses a Ludlum Model 3 survey meter with a Ludlum Model 44-2 sodium iodide detector to conduct surveys for gamma radiation.

Instruments that measure alpha/beta radiation and read in units of cpm are used to perform surveys of potentially contaminated surfaces and within gas systems to determine if equipment, vessels, piping runs, tubulars or containers contain regulated gas NORM. These instruments are also used to determine if loose surface NORM is present and to determine if NORM is present on clothing and personnel. BP typically uses a Ludlum Model 3 survey meter with a Ludlum Model 44-9 "pancake" type probe to measure for alpha/beta radiation.

**Safety note:** NORM survey instruments are not intrinsically safe unless specifically noted on the instrument or instrument manual and have some potential for sparking when detector cables are connected / disconnected and when switches are turned on or off. Where explosive atmospheres may be encountered, hot work permits must be initiated. An intrinsically safe meter and probe, such as a Ludlum Model 3-IS with corresponding intrinsically safe probe, may also be used in lieu of a hot work permit.

### 5.3.3 Instrument Calibration

Survey instruments are required to be calibrated every twelve months, after probe replacement, and after instrument repair. Replacing instrument batteries or a coaxial cable of the same length as the original is not considered instrument repair. The calibration must be performed by the manufacturer or an approved vendor. A company that can calibrate survey instruments is:

Ludlum Measurements, Inc.  
P.O. Box 810  
501 Oak Street  
Sweetwater, TX 79556  
Telephone: (800) 622-0828  
[www.ludlums.com](http://www.ludlums.com)

Note that each meter is calibrated to a specific probe. A model 3 meter can only be used with the probe it was calibrated to. Meters and probes cannot be mixed and matched.

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### 5.3.4 Meter Use

Pre-operational check of survey meters shall be performed prior to every use. Pre-operational check consists of a physical integrity, battery, response and calibration check. Pre-operational check shall be performed as follows:

**Physical Check:** Inspect the instrument, items to verify include:

- frayed, torn cables,
- corroded or stuck connectors,
- cracked meter faces,
- bent or loose deflection needles,
- loose or misaligned selector switch,
- cracked casing, and
- torn Mylar on detector face, if applicable.

**Calibration Check:** Verify that the meter is within calibration time limit by checking the calibration sticker attached to the instrument's housing. Instruments are required to be calibrated every twelve months.

**Battery Check:** Turn the scale selector switch on the instrument to the **BAT** position for a minimum of five seconds and verify on the meter face that the battery is functional. The meter needle must measure within the **BAT TEST** region. Batteries shall be replaced if the indicating needle does not reach the **BAT TEST** region on the meter face.

**Response Check:** Perform a response check prior to use as follows:

Ludlum Model 3 with 44-2 probe or equivalent:

Place a check source with a known value against the end face of the probe. Turn the scale selector switch to an appropriate scale so that the indicating needle does not peg high or low, and so that a comprehensive instrument reading can be obtained. Note the meter reading in  $\mu\text{R/hr}$ . Values for the response check must be  $\pm 20\%$  of a known value for the particular meter and source being used.

Ludlum Model 3 with 44-9 "pancake" probe or equivalent:

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Place a check source with a known value within ½ inch of the Mylar window of the probe. Turn the scale selector switch to an appropriate scale so that the indicating needle does not peg high or low, and so that a comprehensive instrument reading can be obtained. Note the meter reading in CPM. Values for the response check shall be ± 20% of a known value for the particular meter and source being used.

If the response check value is not ± 20% of the known value, the meter will need to be sent for calibration.

### 5.3.5 Procedure for Performing NORM Surveys of Structures, Equipment, Tubulars, and Containers

A Ludlum Model 3 survey meter with a Ludlum Model 44-2 probe, or equivalent instrumentation, shall be used to measure dose rate.

- A. Ensure the instrument's pre-operational checks have been satisfactorily completed. Pre-operational checks include a physical integrity, battery, response, and calibration check. Pre-operational checks are described in Section 5.3.4, Meter Use of this Manual.
- B. Set the **AUD** (audio) switch to the **ON** position. The audio response is immediate.
- C. Set the response mode switch to **F** for fast. The meter's indicating needle movement achieves 90% of full range in four seconds in the fast response mode and 22 seconds in the slow response mode.
- D. Switch the meter to the x1 scale.
- E. Obtain a background reading by measuring radiation exposure levels at waist height, or approximately 3 feet from the ground, a sufficient distance from the tubulars, equipment, vessels, etc., so that they do not contribute to the measured radiation levels.
- F. Obtain tubular/equipment exposure rates by holding the probe within ½ inch of the item or area being surveyed. The probe shall be moved along the equipment at a rate of two to three inches per second.
- G. Upon detecting the presence of radioactive material, switch the instrument to S mode for slow response.
- H. Allow the meter needle to stabilize. If the needle goes off scale on the x1 scale, then switch the meter to the x10 scale. Use higher scales as necessary.

A reading on vessels or tubulars of twice background or greater is an indication that the items may contain regulated NORM. A sample of the potential NORM material (i.e., scale, sand, sludge) must be taken and analyzed for radium-226, radium-228 and total activity before these items can be shipped. The analytical results will determine the shipping requirements. Therefore, shipment of the waste cannot occur until the lab results have been obtained.

A reading on containers (e.g., cutting boxes, 55-gallon drums) of twice background or greater is an indication that the container may contain regulated NORM materials. The contents of containers exhibiting indications of NORM shall be sampled to determine disposal and shipping requirements.

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Equipment and tubulars with readings of 50 µR/hr or greater , including background, shall not be released for unrestricted use. Equipment and tubulars exceeding these readings can only be shipped to a licensed NORM facility.

**5.3.6 Procedure for Performing Fixed and Loose Surface NORM Surveys**

Equipment, tools, and containers shall be surveyed for fixed and loose surface NORM prior to leaving an area suspected or known to contain fixed or loose surface NORM.

No items shall be allowed to leave the area with accessible surface NORM at or above state levels found in Table 1. Areas of surface NORM should be wrapped or covered prior to exit from the work area so that contact of the surface NORM with an unprotected worker is prevented.

Monitoring for fixed or loose surface NORM can be accomplished using a Ludlum Model 3 survey meter with a Ludlum Model 44-9 Geiger Mueller "pancake" type probe. Other equivalent types of instruments may be used.

- A. Ensure the instrument’s pre-operational checks have been satisfactorily completed. Pre-operational checks include a physical integrity, battery, response, and calibration check. Pre-operational checks are described in Section 5.3.4, Meter Use of this manual.
- B. Set the AUD (audio) switch to the ON position. The audio response is immediate.
- C. Set the response mode switch to F for fast. The meter’s indicating needle movement achieves 90% of full range in four seconds in the fast response mode and 22 seconds in the slow response mode.
- D. Turn the meter on and obtain a background count rate.
- E. To monitor for fixed contamination, hold the probe within 1/2 inch of the counting surface of the instruments probe. If an increase in count rate is noted, switch the instrument to S mode for slow response and hold the probe in place until the meter reading stabilizes. Sustained readings greater than or equal to regulated levels may be an indication of regulated fixed surface NORM. This is the total CPM measured.
- F. To monitor for loose surface contamination, using moderate pressure, a wipe shall be smeared over an area of 16 in<sup>2</sup> (100 cm<sup>2</sup>) on the item being sampled. To obtain an area of 16 in<sup>2</sup>, the wipe may be smeared over an area four inches x four inches or an area one inch wide by sixteen inches long. Paper or cloth material such as Whatman filter paper, Chem-Wipes™, or similar absorbent material may be used for wipes. The size of the paper must be trimmed to be less than the active surface area of the probe being used (the mica window portion of the probe).
- G. Hold the wipe within ½ inch of the counting surface of the instruments probe for a minimum of 22 seconds under the slow response mode. If an increase in count rate is noted, the wipe must be held under the probe until the meter reading stabilizes. Wipes with a sustained reading greater than or equal to regulated levels may be an indication of regulated loose removable surface NORM.
- H. CAUTION: Avoid allowing the probe face to contact the surface being surveyed or the wipe surface to avoid contamination. Suspected contamination of the probe face can be

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checked by moving the meter back to the area where the original background reading was taken. Increased levels could be a result of detector contamination. The detector should be gently cleaned until reaching initial background.

- I. Instrument readings in cpm can be converted to dpm using the following equation, when necessary. The manufacturer's efficiency for the Ludlum Model 3 with a 44-9 Geiger Mueller "pancake" type probe is 30% for alpha particles, 10% for beta particles and 0.1% for gamma rays. The active probe area of a Ludlum Model 44-9 probe is 20 cm<sup>2</sup>.

<b>DPM =</b>	<b>CPM</b>	<b>X</b>	<b>100 cm<sup>2</sup></b>
	<b>% Detector Efficiency</b>		<b>Probe active area</b>

**5.3.7 NORM Surveying of pigs, pig traps, valves, pump elements, pipeline filters**

- A. Minimum PPE for NORM survey work is required (refer to Section 5.2.4)
- B. Check for the LEL using a calibrated 4-gas meter and obtain a Hot Work Permit for the NORM Survey meters if appropriate. If available, use an intrinsically safe NORM meter.
- C. NORM dose rate and surface contamination need to be checked separately. Refer to Section 5.3.5 and Section 5.3.6 for specific information on how to conduct the surveys.
- D. Complete an external dose rate NORM survey of the pig-receiving trap, associated valves, pipe work and the site surface around and below the pig trap door prior to the arrival of the pipeline pig. Associated operating pumps, valves and pipe work should also be surveyed. Readings should be recorded as the base line condition of the equipment and facility.
- E. Prior to the arrival of the pig, a plastic containment liner shall be placed on the ground below the pig trap door and a plastic bucket placed under the door on top of the plastic. A 17H 55-gallon drum shall be placed close by on the edge of the ground plastic to receive any liquids/solids removed from the pig trap. Non-operational personnel around the pig trap shall relocate to the upwind side of the pig trap prior to the blow down of the pig trap.
- F. On arrival of the pig and before the trap is depressurized, the trap shall again be surveyed from the outside and the dose rates recorded. This will determine if the radium-226 from oil or the short-lived gamma radioisotope daughter products of radon-222 are present, giving preliminary indication of the presence of NORM.
- G. During the blow down of the pressure from the pig trap, there is a high probability of organic vapor and particulate being blown into the air from the blow down activity. This material

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discharged into the atmosphere may include fine NORM particulate and should be avoided by personnel. The particulate will fall out of the vapor under gravity and represent a potential inhalation and or ingestion hazard.

- H. Once the pig trap has been blown down it may be opened, and following a 4-gas meter check, a NORM survey may be carried out on the inside of the trap and the end of the pig. Sludge may have been pushed in front of the pig and should be shoveled into the prepared open topped 55-gallon drum and the top bolted into place.
- I. The pig should be removed in the normal manner onto the pig tray and the outside of the pig completely surveyed for the presence of NORM, first by using a sodium iodide detector, then by using a pancake detector to look for lead-210, bismuth-210 and polonium-210. These are primarily alpha emitters and require the use of a pancake detector for their detection and measurement.
- J. A NORM contaminated pig or other item shall be wrapped in plastic and a NORM Specific Licensed Company contacted to perform the pig decontamination.

**5.3.8 Procedure for Performing Personnel Monitoring**

Personnel monitoring can be accomplished using a Ludlum Model 3 meter with a Ludlum Model 44-9 Geiger Mueller "pancake" type probe. Other equivalent types of instruments may be used.

Personnel shall monitor for NORM as follows:

- A. Ensure the instrument’s pre-operational checks have been satisfactorily completed. Pre-operational checks include a physical integrity, battery, response and calibration check. Pre-operational checks are described in Section 5.3.4, Meter Use of this NORM Manual.
- B. Set the AUD (audio) toggle switch to ON. The audio response is immediate with the Ludlum Model 3 survey meter. Meter response, as shown by the indicating needle, is delayed and slower.
- C. Set the response mode switch to S for Slow.
- D. Turn the meter on and obtain a background reading. Personnel monitoring shall be performed in an area where background radiation levels are distinguishable, not in the contaminated area. Move the instrument to an area of lower background if necessary.
- E. The probe shall be held within ½ inch of the body and moved at a rate not to exceed two to three inches per second. The surveyor shall pay close attention to the instrument’s response when surveying in the slow response mode, and must slow the rate of movement of the probe as necessary to ensure identification of NORM. Probe contact with the body shall be avoided to the maximum extent possible. Monitoring shall start with the hands and feet. Special attention shall be given to the hair, face, hands, feet, knees and chest.

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- F. When monitoring, special attention shall be paid to the audible response. An increase in audible clicks indicates an increase in activity and the probe movement rate must be slowed down. Personnel will be considered contaminated when radiation levels are detected with a sustained reading greater than or equal to 100 cpm. If the sustained reading occurs over clothing, the clothing affected should be removed, the person re-surveyed and/or decontaminated, and the clothing decontaminated according to Section 5.8 and 5.9.

#### 5.4 Survey Documentation

NORM surveys of vessels, equipment, tubulars and containers shall be documented, whether NORM is detected or not, on a "NORM Survey Data Sheet" (Appendix C). If a NORM survey indicates levels at or above 50  $\mu\text{R/hr}$  including background or removable contamination at or above 1000 dpm/100  $\text{cm}^2$  or an average fixed contamination at or above 5000 dpm/100  $\text{cm}^2$  or a single maximum reading of 15000 dpm/100  $\text{cm}^2$ , contact the GoM IH Team to ensure proper compliance with the applicable regulatory requirements has been met. IH should maintain a facility-specific NORM register to record the NORM being detected above the limit levels.

Completed NORM Survey Data Sheet should be maintained in the facility HSE files / recordkeeping database and copies should be attached to the work permit when necessary.

NORM personnel monitoring surveys shall be documented whether NORM is detected or not, on a "NORM Personnel Contamination Monitoring Data Sheet" (Appendix D). Records of personnel monitoring surveys shall be maintained as exposure records for a period of at least 30 years beyond employment by sending records to the IH Team for inclusion in the IH database.

#### 5.5 Labeling of Equipment

If a NORM survey indicates that stated levels defined in Table 1 are exceeded in a facility, the associated equipment must be labeled according to state requirements. Each piece of equipment shall be identified with either the letters "NORM" or "Caution: NORM Radiation Hazard", as applicable, securely attached by a clearly visible waterproof tag or marking with legible waterproof paint or ink. If employees are present who speak languages other than English, a translation of the warning should be added to the tag or marking as long as the original warning is still present.

For interconnected equipment systems such as a wellhead, flow line, or facility piping system, the system should be identified as a whole with tags or markings that provide notice to workers that the entire system may contain NORM.

#### 5.6 NORM Survey for PPE Assessment

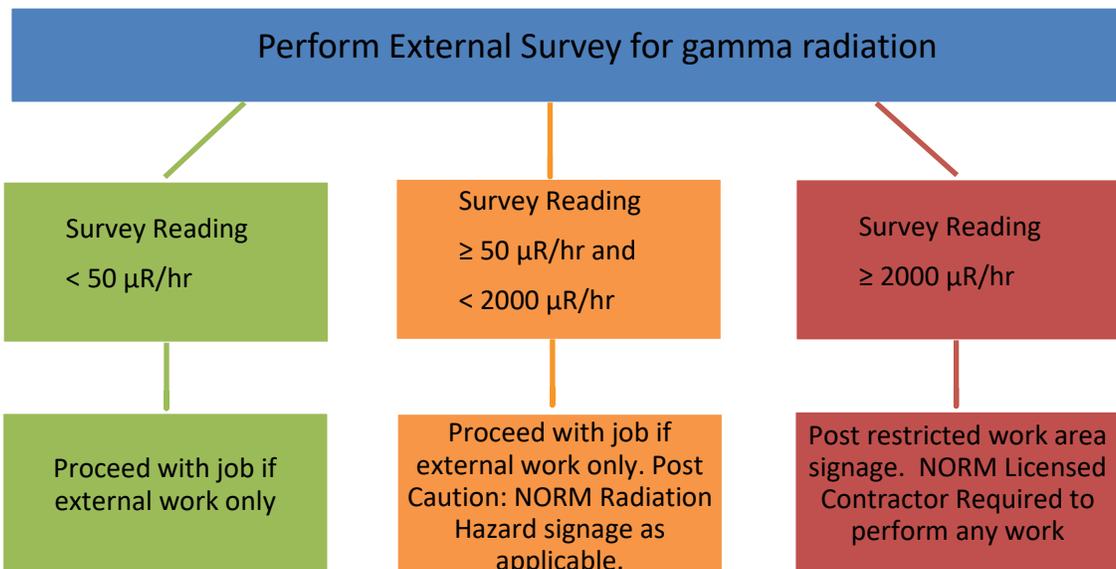
Workers who may be exposed to NORM as a result of their regular duties must be provided with and wear proper PPE to reduce the risk of exposure. Since the alpha, beta, gamma radiation have varying characteristics and exposure risks, protective measures will also differ. For example, alpha and beta inhalation and/or ingestion exposure can be reduced through the use of respirators, but gamma exposure can only be controlled by restrictions on time, distance and shielding. Figure 5.6-

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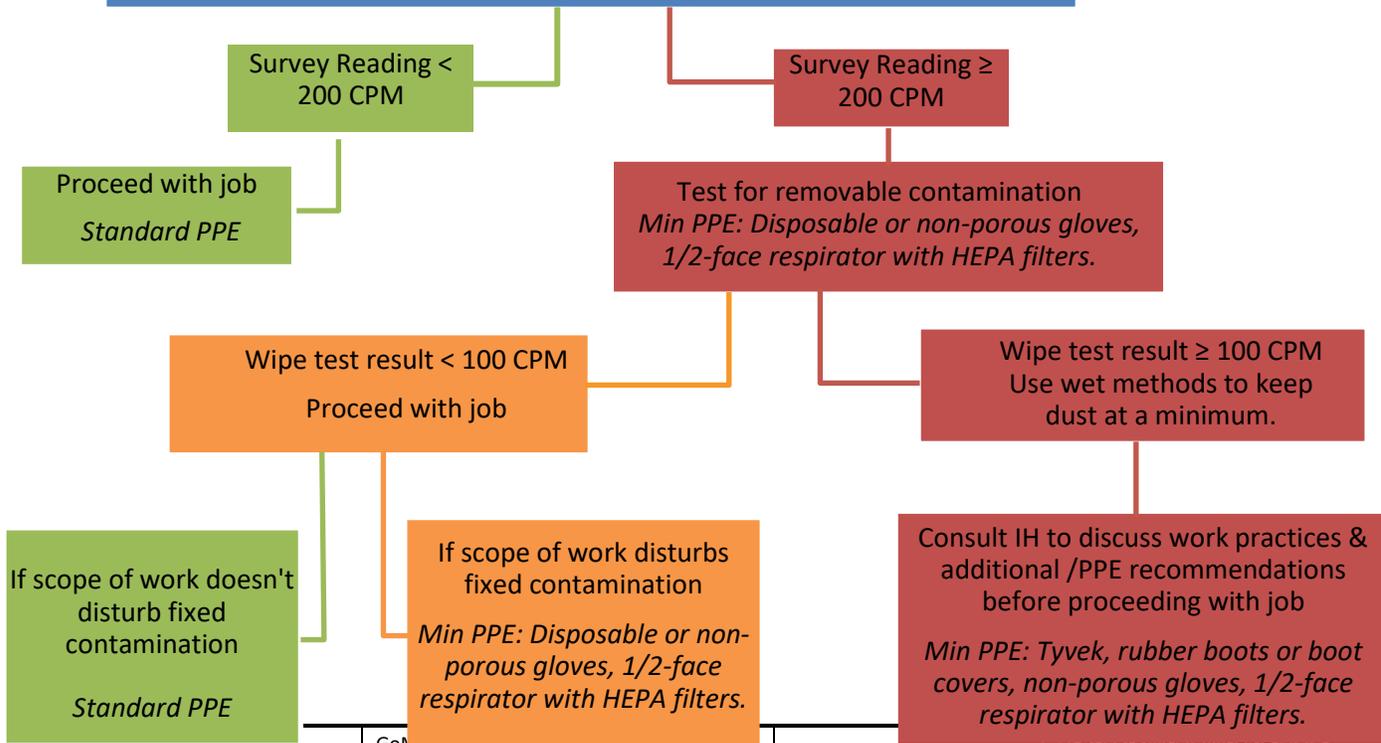
1 outlines the procedures for determining the appropriate level of personal protection based on the NORM survey results. **Note:** The IH should be notified if a survey result at or above 50 µR/hr or 100 cpm including background to verify the appropriate PPE to be worn.

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Figure 5.6-1: Overview of NORM Survey Procedures for PPE Assessment



Performing Internal Surveys for Total Contamination Prior to Maintenance and Operations Activities



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## 5.7 Procedure for Collecting and Shipping Scale, Sand, Sludge, Slurry, and Liquid Samples

Sampling is needed to determine if equipment or materials with radioactive readings at levels making it DOT regulated and to determine proper waste disposal location.

Samples may be collected using a shovel, auger, trowel, coring device or other similar instrument. Samples shall be collected in a manner that best represents the average of the material. For example, if a drum or container has stratified layers, the sample must be collected to ensure material from each layer is included in the sample container. Sampling devices shall be cleaned between samples to prevent sample cross contamination. Gloves shall be worn when collecting scale, sand, slurry, sludge, or liquid samples. Keep material damp or wet to minimize particles in the air.

Solid material shall be collected when containers hold materials that have separated under the influence of gravity (e.g., paraffin, sludge, water and sand). NORM particulates tend to attach themselves to the solid particles.

Place some type of plastic under the sampling equipment to contain any leaks while collecting the sample.

A sample I.D. number, BP, the project/location where the sample was taken from, the date and time the sample was taken, and the initials or printed name of the person taking the sample shall be indicated on each sample container.

Tightly seal the jars or other sample containers to prevent breakage/leakage during transportation. Jars can be placed in large zip lock bags, or wrapped in bubble wrap, to minimize spillage if a jar breaks during transit.

If there are multiple waste containers to sample, be prepared to collect a composite sample rather than a grab sample from each container. A composite should only be taken if all the waste was generated in the same manner and process (e.g., same pipe surfaces, same produced sand, etc.)

### 5.7.1 Liquid Samples

Samples of materials with a liquid consistency shall be placed into non-breakable plastic or metal containers and sealed tightly. A minimum of one gallon of liquid sample material is required by laboratories to perform a proper radioactive material concentration analysis.

### 5.7.2 Sludge Type Samples

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Samples with a more viscous consistency (slurries, sludge, etc.) shall be placed into a plastic zip-lock bag inside a non-breakable plastic or metal container and sealed tightly. A minimum of one quart of this sample material type is required by a laboratory to perform a proper radioactive material concentration analysis.

### 5.7.3 Scale Samples

A minimum of 50 grams (0.11 pounds) of scale is required by a laboratory to perform a proper radioactive material concentration analysis. The containers used for scale samples shall be durable enough to withstand normal handling and transport conditions without a loss of integrity. Examples of suitable containers often used for scale samples are plastic bottles or zip-lock bags. If a zip-lock bag is used as the container, it should be double bagged to add protection.

The easiest method of obtaining a sample from pipe or other tubular goods is to gather the sample when a string of pipe is being pulled from the ground. An exposure rate survey of the pipe as it is being pulled shall be performed. If a section of pipe indicates NORM activity, while the pipe is still hanging vertical in the air, place a bucket under the end of the pipe and strike the pipe several times with a sledgehammer. Normally, there is enough loose scale in the pipe to gather a sample from what falls into the bucket.

Other methods of gathering a sample from NORM containing pipe include the use of chisels, honing devices, and other similar mechanical means.

The sample should be representative of the material to be disposed. A composite sample may be warranted if there are several containers of the same material and a composite from different levels in the container may be warranted if the material is not homogeneous.

Appropriate PPE shall be worn (see Section 5.2.4) when any of the above sampling methods are utilized.

Samples shall be analyzed for radium-226, radium-228, and total activity. The analytical results will determine shipping and disposal requirements.

Additional sampling may be required to determine if the shipment is also regulated under other DOT hazardous material transportation requirement (e.g., hazardous constituents).

### 5.7.4 The Chain of Custody (COC)

A chain of custody (COC) document must be properly completed to document sampling details. It is a tool to communicate the billing and sample information as well as analysis requested. See Appendix G for a blank COC. Key information includes:

- sampler name (printed),
- project location,

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- sample type (liquid, solid, etc.) If the container has a layer of liquid of solids, make sure to collect the solid phase which will have the radioactive material,
- ID number of sample that correlated to sample container ID,
- analysis requested "Radium 226" (Ra226), "Radium 228"(Ra228) and "Thorium 228"(Th228),
- time and date sample was collected,
- custody transfer of sample through all handlers from the facility to the lab.

Include the Waste Advisor contact information on the chain of custody so that the results can be interpreted for waste classification and the necessary profiling, guidance and arrangements can be made for proper disposal.

A chain of custody (COC) form (Appendix G, NORM Chain-of-Custody Blank Form) must accompany all samples sent to a laboratory.

All personnel along the transportation route must sign off that they have received and relinquished the samples. From an offshore facility, the initial sampler, boat captain, shore base personnel and truck driver must all sign this form at the appropriate places listing dates and times of transfer.

The facility sending the sample should keep a copy in their records in the event that the COC is lost or misplaced.

**5.7.5 Shipping NORM Samples**

NORM samples should be shipped as a "Limited Quantity" shipment if the following conditions are met:

- a private carrier is used (UPS, Federal Express). It is against the law to mail radioactive material using the US Postal System. Vessels and aircraft contracted to BP are permitted to carry NORM samples;
- the maximum allowable radiation level on the external surface of the package cannot exceed 500 µR/hr. (If 500 µR/hr on the outside of the package is exceeded, a larger package must be used or the number of samples inside the package must be limited);
- the outside of the inner packaging or, if there is no inner packaging, the outside of the packaging itself must bear the word "Radioactive". This requirement is usually met by writing the word "Radioactive" on the actual sample containers themselves;

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- The UN Identification Number “UN 2910” must be marked on the outside of the package;

Shipping shall be in accordance with all DOT regulations for shipping this type of material including DOT shipper’s requirements and training.

Additional paperwork is required such as the BP shipping manifest (boat cargo manifest) and BP Hazardous material manifest (if it is known that the sample exhibits hazards that must be communicated per DOT). If the sample hazards are unknown or may not be present due to dilution of the mixture, then DOT paperwork is not required. If applicable, send an SDS of any hazardous component.

Samples should be sent to: American Radiation Services (ARS), 2609 North River Road, Port Allen, LA 70767 tel: (225) 381-2991. Refer to Appendix F Preparing Samples for Shipment to a Laboratory for guidance.

**5.8 Specific NORM Work Procedures**

Any work on equipment, tubulars, vessels or machinery with reading of 50 µR/hr or greater, including background radiation levels, or removable radioactive material contamination levels at any accessible point of 1000 dpm/100 cm<sup>2</sup> or an average reading of 5000 dpm/100 cm<sup>2</sup> or a single maximum reading of 15000 dpm/100 cm<sup>2</sup> shall be conducted according to the procedures outlined in this section.

Such readings are subject to the additional requirements of establishing additional PPE, boundaries and decontamination facilities.

Due to the higher potential for personnel exposure and/or potential respiratory exposure requiring the possible use of respiratory protection, facilities may choose to use a third-party licensed NORM contractor, especially if BP employees have not been tested to wear respirators. For any equipment where survey readings indicate that NORM is over 2,000 µR/hr, a licensed NORM contractor must perform any work with the equipment or materials. When working on equipment where survey readings indicate that NORM is over 2,000 µR/hr workers must wear a Thermoluminescent dosimetry (TLD), Optically Stimulated Luminescence (OSL) or similar radiation badge.

The process to be used is:

1. Establish a boundary around the work area. The boundary must be as small as possible, but large enough to allow for personnel and equipment access and egress from the work area and to allow for all work to be accomplished in a safe manner. Label the boundary: “Caution: Restricted Area / NORM”. Containers shall be provided for discarded protective clothing and trash at the exit from the work area.

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2. Prior to maintenance on NORM containing equipment or opening vessels, inspection hatches, sludge traps or pig receivers, sufficient ground cover must be placed below the item or work area. The ground cover must be made of a plastic, waterproof type material capable of withstanding the work activities involved without tearing or ripping. Alternatively, a suitable drip tray or catch pan may be used. The ground cover shall be sized to provide for the containment of leakage and waste, and to allow ample room for peripheral related work.
3. Establish a personnel monitoring and decontamination area for personnel (see Section 5.3.8, Procedure for Performing Personnel Monitoring). Contact the GoM IH Team for assistance in conducting monitoring. Standard waterless gels, such as Go-Jo®, or damp towels may be used for personnel decontamination. The personnel decontamination and personnel monitoring area shall be located as close as possible to the work location and must contain a receptacle for solid waste, such as paper towels and rags. If water will be used to decontaminate personnel, actions shall be taken to collect the rinse and wash water.
4. Hold a safety meeting and Level I/II Risk Assessment for all personnel performing work. Radiological items which shall be addressed during the meeting include, but are not limited to, protective clothing and respiratory protection requirements, radiation levels, maintenance activities which may cause radioactive materials to become airborne, location of personnel monitoring and decontamination stations, personnel monitoring requirements, requirements for generated waste, heat stress, and actions to be taken in the event of emergencies (injured man, fire, explosions, spills, etc.).
5. A minimum of coveralls, rubber boots or shoe covers, eye protection and gloves shall be worn during maintenance activities such as pulling tubing, cleaning vessels and wrapping pipe/equipment. Hoods and water resistant type suits may also be required based on the type of maintenance activities being performed. The need for respirators shall be evaluated based on the type of maintenance activity and the status of the NORM (i.e., is the NORM wet or dry? Will grinding, welding, hydrolancing, torching or hydroblasting be taking place? Will these or other maintenance activities cause NORM to become airborne?). Contact the GoM IH Team for assistance in determining the potential for NORM dust exposure.
6. Commence maintenance activities. Any dry material that contains NORM shall be kept in a damp state to prevent the generation of airborne radioactive materials. Dry material shall be dampened periodically throughout the maintenance activity.
7. When finished with the cleaning/washing, the material shall be shoveled from the containment pan or ground cover and into drums for storage/disposal. Foreign material (welding rods, gaskets, etc.) shall be separated from the sand and scale if possible. NORM containing waste generated during maintenance shall be placed in drums or containers and marked or labeled per Section 6.3, Labeling of Containers.
8. Upon completion of maintenance, personnel shall remove their protective clothing in the pre-established decontamination area and immediately perform whole body personnel

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monitoring. Procedures for monitoring personnel for NORM are contained in Section 5.3.8, Procedure for Performing Personnel Monitoring (results shall be recorded on a NORM Personnel Monitoring sheet – Appendix D, NORM Personnel Monitoring Sheet Data). Contact the GoM IH Team for assistance in conducting surveys.

9. Personnel who exceed monitoring levels on their skin shall be decontaminated by washing the affected area using soap and tepid (room temperature) water. A gentle washing action, with vigorous rinsing and high lather soap shall be used. Waterless washing gels and damp cloths, i.e., baby wipes, may also be used. Upon completion of the washing process, the affected area shall be resurveyed. Areas found to exceed monitoring levels after the initial wash shall be re-washed and surveyed until free of NORM. Care shall be taken not to irritate or abrade the skin. Only injured personnel requiring immediate medical attention shall be allowed to leave the area before they meet the monitoring criteria.
10. All material, equipment and tools not placed in containers or drums must be surveyed for both loose NORM and exposure rate levels upon exit from the work area. Contact the GoM IH Team for any required assistance in conducting loose NORM surveys. The external surfaces of containers or drums shall be surveyed for loose NORM prior to exiting the work area. Procedures for the surveying of loose NORM can be found in Section 5.3.6, Procedure for Performing Loose Surface NORM Surveys. If loose NORM is found, the equipment and/or tools shall be decontaminated again or contained/wrapped until readings show that decontamination is complete.
11. Upon job completion, the accessible areas of work area shall be surveyed for loose NORM. Any loose surface NORM found shall be promptly cleaned up and properly disposed of.
12. Once the work area has been verified to be free of loose surface NORM, the boundary and postings may be taken down.

**5.9 NORM Controlled Work Area (CWA)**

When trained NORM workers are required to work on regulated NORM, a Controlled Work Area with access restricted to the trained workers wearing the required PPE must be set up. The basic structure of the CWA is shown in Figure 5.9-1.

1. The CWA will be marked out with black and yellow or Purple and Yellow tape with the words **“CAUTION RADIATION HAZARD”** securely placed around the CWA.
2. Warning Signs that state, **“CAUTION Radioactive Materials”**, shall be placed along all sides of the physical barrier around the CWA.
3. Access to and Exit from the CWA is via a Contamination Reduction Zone (CRZ).

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4. The CWA and CRZ shall have a means to contain all NORM and fluids used to clean the NORM from the contaminated equipment, PPE and instrumentation. The containment may be of a number of forms such as one or more of the following:
- Heavy-duty environmental plastic liner with a raised edge to collect NORM and or fluids.
  - A plastic or metal container placed on top of a plastic sheet on which the work will be carried out.
  - On an offshore platform, the floor of the module in which the NORM contaminated equipment is being removed and wrapped in heavy plastic for shipment to a specific NORM Licensed company for cleaning, may form the primary containment. This is provided that all drains and openings are sealed, as required, to prevent NORM or cleaning fluids from draining into the drain system and depositing NORM particles from the equipment removal process.
  - For open site remediation, the work area is the site. Large areas can be deemed "controlled", when the access to the site is clearly marked with Caution Tape and the CRZ is set up using plastic in addition to all of the CRZ supplies being placed into the CRZ area.
5. The CRZ and clean area will be set up with the following instruments and PPE:
- A contamination survey meter that can detect alpha, beta and gamma radiation. (Ludlum model 3 with a 44-9 pancake probe for alpha and beta, and a 44-2 scintillator tube for gamma).
  - Personnel and equipment contamination survey record sheet.
  - Clean PPE for all trained persons authorized to enter the CWA.
  - Either wet wipes or a bucket of soapy water and foot brush to clean off steel toe waterproof footwear.
  - Wet face and hand wipes for washing off personal skin contamination.
  - Dry paper towels for wiping clean face, hands, instruments, equipment and any item measuring > twice the local background that was cleaned of NORM.

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- Dirty end of CRZ will have Bags for contaminated PPE > twice the local background.
6. Each person leaving the CRZ or removing an item from the CRZ must survey either themselves or the item being removed from the CRZ using a contamination meter and pancake probe.
  7. All NORM greater than twice the local background must be removed from work clothes and all items before they are removed from the CRZ.
  8. The result of each survey shall be recorded on the CRZ exit log with sufficient detail to identify both surveyor and item surveyed, time, date, site/platform/location/lease, company etc.

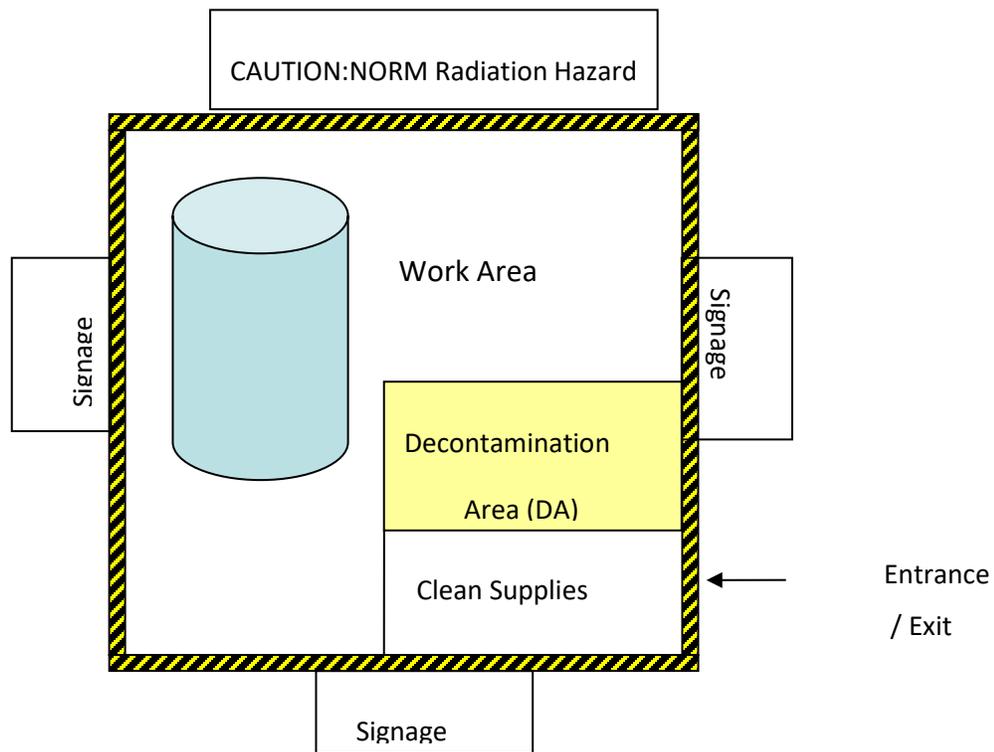


Figure 5.9-1 Structure of a CWA

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## 6.0 NORM Storage

Although NORM waste is not routinely stored offshore, it should be noted that the BSEE requires companies obtain BSEE approval for the offshore storage of E&P wastes containing NORM above background levels. Normally, BSEE will grant a permit allowing for the storage of NORM for a maximum of one year. This approval shall be obtained *before* proceeding with storage operations. (See NTL No. 2009-G35). The Environmental Advisor (Waste) shall be responsible for coordinating (with the RC&E Permitting and Compliance Management Team) preparation and submission of an application to BSEE for storing NORM-containing waste.

Containers of NORM waste and NORM containing equipment shall be stored in an area posted: "Caution: Restricted Area / NORM."

Containers of NORM waste shall be stacked in such a fashion that each container's identification label is easily visible and can be read from the access aisle or adjacent area. All containers of NORM waste shall, at a minimum, bear the conventional radiation tri-foil symbol and the words "Caution: Radioactive Materials." Additional information required on container labels can be found in Section 6.3, Labeling for Containers of this plan.

Louisiana allows storage of NORM waste by a general licensee with a State approved NORM waste management plan for a period of 365 days from the date of generation. The NORM waste shall be transferred to a licensed NORM disposal facility before this 365-day period has been exceeded. In Louisiana State and its state waters, a quarterly inspection shall be made of areas where containers of NORM waste are stored (e.g. Fourchon Shore Base (FSB), Production Management Facility (PMF)), to identify any leaks or deterioration of containers and the containment system. Records of the inspections shall be made and maintained for inspection by the Louisiana Department of Environmental Quality for five years.

### 6.1 Equipment and Pipe

- If equipment or piping is NORM contaminated, plug openings with newspaper, wrap with plastic and duct tape or use insulating sealant foam to seal the ends and prevent leakage.
- Place equipment or pipe in "strong, tight containers" such as 55 gallon drums, cuttings box, ONV cargo baskets, roll-off box or frac tank that ensures there will be no leakage of radioactive material under conditions normally incident to transportation.
- Mark all containers with :
  - "BP"
  - Generator location (e.g., MC474)

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- Start of accumulation date.
- Record Ludlum readings from exterior of equipment in uR/hr.

The markings must be displayed on a background of sharply contrasting color and must be printed in English, durable, and legible.

- Separate NORM and NORM-free scrap metals before shipment. For equipment and pipe not NORM contaminated, handle as “Scrap Metal”.
- For pipe and equipment that is DOT regulated [See Table 1 & 8.2-1] mark as:
  - “NORM Contaminated Equipment”

**6.2 Produced Sand/Tank Bottoms**

A. For produced sand that is not DOT regulated:

- Non-bulk packaging: 1A2 drum or DOT salvage drum
- Bulk packaging: Marine Portable Transfer Tank or Cuttings Box.

B. For produced sand that is DOT regulated:

- Non-bulk packaging: 7A Type A package (similar to removable head drum 1A2)
- Bulk packaging: 15 bbl or 25 bbl cutting box or marine portable tank
- Additional notes:
  - Allow sand to stand for several minutes settle solids from liquids (if any). Pump off water to production system, leaving solids and sludges in drum.
  - Do not mix NORM with any other materials.
  - Place NORM sands in "strong, tight containers" that ensures there will be no leakage of radioactive material under conditions normally incidental to transportation.
  - NORM containers must be inspected prior to adding waste to ensure that lids, gaskets and seals are in good condition and will prevent leakage of waste during transportation.
- Mark as:

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- “NORM Contaminated Sand”;
- “BP”; Generator Location (e.g., MC474);
- and start of accumulation date.

### 6.3 Labeling for Containers

Containers of NORM shall be labeled with a durable, clearly visible label bearing the radiation symbol and the words, “Caution, Radioactive Material” or “Danger, Radioactive Material”. The label shall also provide applicable information such as the radionuclides present, radiation levels, the quantity of radioactivity (in  $\rho\text{Ci/g}$ ) if identified, the date for which the activity is estimated, and the type of material. This will assist individuals handling containers or working near the containers to take precautions to avoid or minimize exposures.

Prior to the removal or disposal of empty containers to unrestricted areas, workers shall first check to ensure that no NORM is present, then remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive materials.

Two shipping labels are required on each package on opposite sides of the container. Proper labels are determined by radiation level reading at 1 meter (3.3 feet) from the package as indicated in Table 6.3-1.

**Table 6.3-1 DOT Shipping Label Requirements**

Transport Index (T.I.) Notes 1,2,3	Radiation Level at Package Surface (RL)	Shipping Label Type
0	$RL \leq 500 \mu\text{R/hr}$	White – I 
$>0 \leq 1.0$	$500 \mu\text{R/hr} < RL \leq 50,000 \mu\text{R/hr}$	Yellow – II 
$>1.0 \leq 10$	$50,000 \mu\text{R/hr} < RL \leq 200,000 \mu\text{R/hr}$	Yellow – III 

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**Note 1: Transport Index (T.I.)** – A dimensionless number (rounded up to the first decimal place) placed on the label of a package to designate the degree of control exercised by the carrier during transportation. The transport index is determined as follows:

“The number expressing the maximum radiation level in microrentgens per hour ( $\mu\text{R/hr}$ ) at one meter (3.3 feet) from the external surface of a package”. (49 CFR 173.403). To convert  $\mu\text{R/hr}$  to millirem, divide  $\mu\text{R/hr}$  by 1,000. Example:  $50 \mu\text{R/hr} \div 1,000 = 0.05 \text{ mrem/hr}$ .

The transport index of a package is determined by measuring the radiation level one meter away from the package. If the radiation dose one meter away from a package were measured to be 1.87 millirem per hour, then the T.I. value would be 1.9. If the radiation dose one meter away from a package were measured to be 0.07 millirem per hour, then the T.I. value would be 1.

**Note 2:** If the measured T.I. is not greater than 0.05, the value may be considered to be zero. (49 CFR 172.403 Table, Note 2)

**Note 3:** The label applied must be the highest category required for any two determining conditions for the package. (49 CFR 172.403(b)).

DOT shipping labels shall be attached to the external surfaces of all containers contained in a shipment. Two shipping labels are required on each container. The labels shall be placed on opposite sides of the container. The type of label required depends upon the magnitude of the radiation level on the package surface and the Transport Index (T.I.) value associated with the package. The TI value of a package containing radioactive material is defined in Note 1 above.

## 7.0 Disposal Options

NORM waste falls into the category of E&P Exempt Waste (formerly known as Non-hazardous Oilfield Waste, or “NOW”). NORM waste shall be surveyed and sampled for the radiation level, which will determine the proper disposal method, receiving facility, shipping method, and manifests to be used. See Appendix B, Waste Handling – NORM Equipment, Pipe and Diffuse Waste with regard to sampling/handling for waste disposal.

The BSEE requires that companies obtain BSEE approval of the disposal methods for drill cuttings, sand, and other well solids containing NORM above background levels. This approval shall be obtained *before* proceeding with disposal operations. (See NTL No. 2009-G35)

### 7.1 Disposal of Equipment and Pipe Contaminated with NORM

#### 7.1.1 Scrap Yard

Scrap yard generally will not accept any equipment or tubular goods with gamma exposure rate readings equal to or greater than background levels (i.e.,  $8 \mu\text{R/hr}$ ). This is not a regulatory limit, rather a self-imposed scrap yard limit.

#### 7.1.2 Decontamination Facility

In Louisiana, equipment and pipe contaminated at levels equal or greater than  $8 \mu\text{R/hr}$  must be sent to a facility that is licensed for NORM services by the Louisiana Dept. of Environmental Quality

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Radiation Protection Division to separate the NORM scale from the equipment or pipe. (These sites are listed in Section 9.1 NORM Cleaning Services)

Once decontaminated, the equipment or pipe can be sent to a scrap metal recycling facility.

NORM wastes from decontamination activities is considered “E&P Exempt waste” and can either go to E&P Exempt transfer facilities if < 30 pCi/gm or to NORM licensed disposal facilities (e.g., Ecoserv's Big Hill, TX facility) if ≥ 30 pCi/gm.

**7.2 Disposal of Diffuse Waste**

Diffuse waste (e.g., sands, sludge, scales, paraffins, etc.) may contain NORM at levels that require special disposal. Contact your Area Environmental Advisor (Waste) for disposal instructions and assistance.

**7.2.1 Produced Sand/Scale < 30 pCi/g**

For analysis that registers Ra-226 or Ra-228 < 30 pCi/g, the produced sand or scale can be taken to any Louisiana or Texas Transfer facility for the E&P Exempt waste disposal companies approved by BP to accept this waste (e.g., EcoServ Environmental).

**7.2.2 Produced Sand/Scale ≥ 30 pCi/g**

If the analysis for either Ra-226 or Ra-228 is ≥ 30 pCi/g, then there is only one facility approved to accept this waste. That facility is Ecoserv’s Big Hill facility located in Winnie, Texas. The produced sand or scale shall be manifested directly to this facility and cannot be received at a transfer facility. The Big Hill facility shall be notified prior to sending NORM waste there so that a gate time can be assigned for the waste to be accepted.

**7.3 Waste Reduction Opportunities**

- Use scale inhibitors where NORM scale could potentially accumulate.
- Clean NORM contaminated sand and scale from pipe and equipment to minimize volume of NORM waste requiring disposal and to allow for the recycling of the pipe and equipment.
- Design perforations in completion to minimize sand production.
- Improve gravel pack design.
- Optimize production rate to minimize sand production.

**8.0 Shipping NORM**

**8.1 Manifesting**

Several manifests are required for sending NORM for disposal.

**8.1.1 BP Shipping Manifest**

This is a “cargo” manifest that is used to identify all materials, chemicals, wastes or equipment that are being transported over water to offshore, as well as into the shorebase. This manifest shall be

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used to document the shipment of NORM produced sand, equipment or tubulars going in for cleaning and/or disposal. If the NORM is also a hazardous material, it shall be indicated on the manifest in the appropriate hazmat column.

**8.1.2 BP Hazardous Material Manifest / DOT Hazardous Material Manifest**

This is also a “cargo” manifest to be used in conjunction with the shipping manifest above. This manifest shall identify DOT Hazardous Materials and shall be used if the waste is regulated as a Hazardous Material. The proper DOT description shall be listed on this manifest, and shall be signed by an individual who has received the proper DOT training.

**8.1.3 Louisiana Exploration & Production (E&P) Waste Shipping Control Ticket or UIC-28 Manifest**

The UIC-28 manifest is a manifest issued by the Louisiana Department of Natural Resources (LDNR). This manifest is required for all E&P Exempt waste that will be disposed of in Louisiana or will be transported through Louisiana for disposal in the other state (e.g., Texas). If NORM-produced sand is ready for shipment to either an E&P Exempt waste transfer facility, or directly to EcoServ’s Big Hill NORM facility, then this manifest shall be completed at the rig or platform.

UIC-28 form can be ordered from the LDNR approved printing companies. Appendix E contains a list of the approved UIC-28 form printing companies.

**8.1.4 BP Non-Hazardous Waste Manifest**

If NORM is not to be shipped to or through Louisiana, the Louisiana UIC-28 manifest cannot be used. If the State does not have a NORM waste manifest form or other manifest requirement, a BP Non-Hazardous waste manifest shall be used.

**8.1.5 Louisiana NORM Waste Manifest (RPD-37)**

This is another manifest that may be required for sending NORM waste for disposal in Louisiana. This manifest is issued by the State of Louisiana through the Department of Environmental Quality. This manifest shall be used when shipping NORM with contamination levels of 30 pCi/g or greater or when sending NORM containing equipment or pipe to shorebases or NORM licensed decontamination facility for cleaning. **BP has been issued a General License for NORM (LA0188NO1).** This code shall be used on the NORM manifest.

The manifest form can be obtained from the division (The Louisiana Department of Environmental Quality) and shall contain at a minimum, the number of copies that it will provide to the licensee, each transporter, and the operator of the designated facility. One copy will be provided to each for their records, with the remaining copies to be returned to the licensee and the other appropriate parties.

Louisiana NORM Waste Manifest forms can be downloaded via the internet from <http://www.deq.louisiana.gov/portal/Portals/0/permits/Radiation/PDF%20RPD-37%20NORM%20Manifest%2006.pdf> .

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**8.1.6** The table listed below provides the correct manifests, which shall be completed at the point of generation (rig or platform) in order for the waste to be sent into shore. There are several different manifests, dependent upon whether the waste will be disposed of in Louisiana, go through Louisiana for disposal in Texas, or be disposed of in Texas directly from offshore.

Waste Category	BP Shipping Manifest	BP Hazmat Manifest (DOT)	UIC-28 Manifest	RPD-37 NORM Manifest	BP Non-Hazmat Waste Manifest
NORM to or through LA	X	X <sup>1</sup>	X	X <sup>2</sup>	
NORM to TX Directly	X	X <sup>1</sup>			X

Notes:

<sup>1</sup> Manifest required if NORM is regulated as a DOT Hazardous Material

<sup>2</sup> Manifest required if NORM is equal to or greater than 30 pCi/g

## 8.2 Federal Shipping Requirements Overview

The Federal Department of Transportation (DOT) regulates shipments of radioactive material exceeding both an “Activity Concentration for Exempt Material” value and an “Activity Limit for an Exempt Consignment” value. The “Activity Concentration for Exempt Material” value and the “Activity Limit for an Exempt Consignment” value shall be calculated according to the instructions in 49 CFR 173.433.

*Note: 49 CFR 173.433 contains instructions for deriving (calculating) Exempt Activity Concentration limits and Exempt Consignment Activity limits for mixtures of radionuclides, i.e., radium-226, radium-228 and thorium-228.*

A laboratory analysis is necessary to determine the activity concentration for exempt material and the activity limit for an exempt consignment. These values cannot be determined using a handheld survey instrument and there may be little correlation between the survey numbers (μR/hr) and the analytical data results (pCi/g).

Samples of scale, sludge, sands, etc., must be collected from equipment, tubulars and containers exhibiting survey readings of twice background levels or greater prior to shipment to determine if the Federal DOT radioactive material shipping regulations apply. Containers, equipment and tubulars containing material over the reading listed in the Table 1 shall be shipped as “radioactive material” under current DOT regulations.

NORM is regulated as a DOT Hazardous Material if:

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- a. Ra 226 or Ra 228 is greater or equal to 270 pCi/g or if Thorium 228 (Th228) is greater or equal to 27 pCi/g, and
- b. the shipment of Ra 226 or Thorium 228 is greater or equal to 270,000 pCi, or Ra 228 is greater or equal to 2,700,000 pCi. (The latter value is determined by multiplying the pCi/gm value x approximate weight of waste material). A lab analysis will indicate the radioactive daughter levels in the sample. Contact GoM Environmental Advisor (Waste) for determination of DOT Hazardous Material jurisdiction for shipment.

If radioactive tracers (man-made sources) have been used at your facility, contact the Waste Advisor to assist in determining if readings are from NORM or tracers.

Shipments of NORM can generally be classified into three different shipping categories. Each of the shipping categories has specific marking, labeling, placarding and communication requirements. The shipping categories that most NORM shipments will be made under are: Limited Quantity shipments, Low Specific Activity (LSA) shipments and Surface Contaminated Object (SCO) shipments. The type of shipment made depends upon the µR/hr reading on contact with the equipment or container and the radium-226, radium-228, and thorium-228 pCi/g activity levels.

**Table 8.2-1 Shipping Categories**

Shipping Category	Pertains To:	Limits
Limited Quantity	Waste, Equipment and Tubulars	Maximum reading on external surface of container, tubular or equipment cannot exceed 500 µR/hr  AND  the activity contained in any single package cannot exceed 10 <sup>-3</sup> of an A <sub>2</sub> value.(Refer to 49 CFR 173.425)
Low Specific Activity –I (LSA-I)	Diffuse Materials Only (sands, sludge, scales, etc.)	Maximum activity concentration cannot exceed 30 times the “Activity Concentration for Exempt Material” limit.
Surface Contaminated Object - I (SCO-I)	Equipment and Tubulars	Removable (non-fixed) contamination on accessible surfaces averaged over 300cm <sup>2</sup> cannot exceed 220 dpm/cm <sup>2</sup> for beta and gamma and low toxicity alpha emitters, and 22 dpm/cm <sup>2</sup> for all other alpha emitters, <i>and the</i>

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Shipping Category	Pertains To:	Limits
		fixed contamination on accessible surfaces averaged over 300cm <sup>2</sup> cannot exceed 2,200,000 dpm/cm <sup>2</sup> for beta and gamma and low toxicity alpha emitters, and 220,000 dpm/cm <sup>2</sup> for all other alpha emitters, <i>and the</i>  fixed plus removable contamination on inaccessible surfaces averaged over 300cm <sup>2</sup> cannot exceed 2,200,000 dpm/cm <sup>2</sup> for beta and gamma and low toxicity alpha emitters and 220,000 dpm/cm <sup>2</sup> for all other alpha emitters.

**8.3 General Shipping Requirements/Specifics**

Table 8.3-1, General Shipping Requirements/Specifics provides the specific shipping details for each category of NORM shipments. All shipments shall be accompanied by shipping papers that contain the following information:

1. name of the shipper
2. emergency response telephone number
3. the proper shipping name: "Radioactive Material, excepted package – limited quantity of material"
4. the hazard class of the material: "Class 7, UN 2910" for Limited Quantity shipments, "UN 2912" for LSA shipments, or "UN 2913" for SCO shipments.
5. items three and four above must be shown in sequence with no additional information interspersed. For example: "Radioactive Material, excepted package – limited quantity of material, 7, UN2910"
6. the total quantity, inclusive of NORM and waste equipment, by net or gross mass, capacity, or as otherwise appropriate
7. the names of the radionuclides contained in the shipment, example radium-226, radium-228, thorium-228. Abbreviations, such as Ra-226, Ra-228, and Th-228 are authorized
8. a description of the physical and chemical form of the material, and
9. the activity contained in the shipment in terms of Disintegrations per Second (dps).

An "X" must be placed before the proper shipping name on the shipping paper (Manifest) in the column captioned "HM". The "X" may be replaced by "RQ" if appropriate.

HAZMAT transportation training is required for personnel responsible for packaging / shipping NORM.

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**Table 8.3-1 General Shipping Requirements/Specifics**

LIMITED QUANTITY SHIPMENTS								
Pertaining To:	Limits	Container Requirements	DOT Shipping Label Requirements	Container Markings	Placard Requirements	Max Radiation Levels	Max Contamination Levels	Special Communications
Waste, Equipment and Tubulars	<p>Max Reading on external surface NTE 500 µR/hr</p> <p><b>AND</b> the activity contained in any single package NTE 10<sup>-3</sup> of an A<sub>2</sub> value.</p> <p>- maximum external readings do not exceed 500 uR/hr with activity contents in any single package not to exceed 81,000,000 pCi for Ra 226, 540,000,000 pCi for Ra 228 and 27,000,000 pCi for Th 228</p> <p>49 CFR 173.421&amp;425</p>	<p>Materials must be in strong, tight container such as 55 gal. drum, cuttings box, DNV cargo baskets, roll-off box or frac tank.</p> <p>Tubulars must be bundled appropriately with like reading tubulars</p> <p>Open ends should be sealed</p> <p>Vessels are considered a strong container</p> <p>49 CFR 173.410</p>	<p>None Required</p> <p>Exempt as per 49 CFR 173.421(a)</p>	<p>Outside of inner package or container itself must read "RADIOACTIVE" UN2910</p> <p>49 CFR 173.421(d)</p> <p>The outside of each package must be marked with "UN2910"</p> <p>49 CFR 173.422(a)</p> <p>The markings must be displayed on a background of sharply contrasting color and must be printed in English, durable, and legible.</p>	<p>Not Required</p> <p>49 CFR 172.500(b)(3)</p>	NTE 500 µR/hr	<p>NTE loose surface contamination of:</p> <p>alpha 24 dpm/cm<sup>2</sup></p> <p><b>beta/gamma</b> 240 dpm/cm<sup>2</sup></p>	<p>Emergency Response Guide (Appendix H) must accompany shipment</p> <p>Call or fax dock/base to schedule shipment and a gate time for ECOSERV (Newpark) to accept the waste greater than 30 pCi/gm</p>

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<p><b>INDEX</b> NTE = Not To Exceed</p> <p>Paperwork; (Maintain a copy of all manifests while shipments are active; send manifests with shipment. Complete the:</p> <ul style="list-style-type: none"> <li>• BP Shipping Manifest with "DOT regulated NORM Equipment or piping" or "DOT regulated NORM Produced Sand"</li> <li>• BP Hazardous Material Manifest with the following description "Radioactive Material, excepted package - limited quantity of material (Oilfield NORM), 7, UN 2910"</li> <li>• LA NORM RPD 37 form with following description "Radioactive Material, excepted package - limited quantity of material (Oilfield NORM), 7, UN 2910". Must include names of radionuclides (e.g., Ra 226 and Ra 228). The General license number for BP, as required on the RPD-37 manifest, is LA0188N01.- IF going to/through Louisiana</li> <li>• BP Non Hazardous Waste Manifest with "NORM produced sand" or "NORM Contaminated Equipment/Pipe".</li> <li>• LA UIC 28 "E&amp;P Exempt Waste Manifest" for produced sands/solids.</li> <li>• If appropriate: ECOSEV (Bil Hill) Texas Manifest (from shore base transfer only) with "NORM produced sand".</li> </ul>
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LOW SPECIFIC ACTIVITY SHIPMENTS "NON-EXCLUSIVE USE"*2								
Pertaining To:	Limits	Container Requirements	DOT Shipping Label Requirements	Container Markings	Placard Requirements	Max Radiation Levels	Max Contamination Levels	Special Communications
Diffuse Materials Only (e.g. sands, sludge, scales, etc.)	Maximum activity concentration NTE 30 times the "Activity Concentration for Exempt Material" limit.  Ra 226 and Ra 228 activity levels of material not exceeding 8,100 pCi/gm and Th 228 activity levels not exceeding 810 pCi/gm	Containers certified as "Industrial Packages", type IP-I, IP-II or IP-III certified containers  DOT Spec 7A Type A packages may be used for domestic shipments only  49 CFR 173.427	See Section 6.3 Table 6.3-1  49 CFR 172.403	Exterior of each container must be marked "RADIOACTIVE – LSA"- (I,II, or III) UN#: LSA-I UN2912 LSA-II UN3321 LSA-III UN3322  Non-bulk packages must be marked with the shipper's and receiver's names and addresses  Non-bulk packages do not have to be marked "RQ", instead, packages	Requirements for Yellow III label only  49 CFR 172.504	NTE: 200,000 µR/hr  TI NTE 10	NTE loose surface contamination of:  alpha 24 dpm/cm <sup>2</sup>  beta/gamma 240 dpm/cm <sup>2</sup>	1. Shipper must supply carrier w/ 24 hour notification telephone number for in event of accident, fire, breakage, spillage, release or spread of LSA material  2. Statement 2*1 must appear on shipping papers  3. Emergency Response Guide (Appendix H) must accompany shipment  Call or fax dock/base to schedule shipment and a gate time for the approved disposal facility to accept the waste greater than 30 pCi/gm

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				<p>containing a hazardous substance must now be marked "RQ". NORM will become a hazardous substance when the radium-226 curie content in a single package exceeds 0.54 Ci's. 49 CFR 173.427(a)</p> <p>Each container &gt; 110 pounds must have its weight plainly marked on the outside of each container</p> <p>IP-1, IP-2, or IP-3, as appropriate, must be marked on the outside of the package. 49 CFR 172.310(b).</p>				
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**INDEX**  
 NTE = Not To Exceed  
 TI = Transport Index, maximum radiation level in millirem per hour at 1 m.  
 \*1. Statement 2: "This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation."  
 \*2. "Non-Exclusive Use" is defined as a shipment in which BP does not have the sole use of the transport vehicle or vessel and in which BP does not dictate the loading or unloading actions.

Paperwork; Complete the following:

- BP Shipping Manifest as "DOT regulated NORM equipment or piping" or "DOT regulated NORM produced sand" and that the mode of transportation is intended to be "Non-Exclusive Use Shipment".
- BP Hazardous Material Manifest with the following description "Radioactive Material, low specific activity (LSA-I) - non fissile, 7, UN 2912"
- LA NORM RPD 37 form with following description " Radioactive Material, low specific activity (LSA-I) - non fissile, 7, UN 2912". Must include names of radionuclides (e.g., Ra 226 and Ra 228)
- LA UIC 28 "E&P Exempt Waste Manifest" for produced sands/solids.

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SURFACE CONTAMINATED OBJECTS SHIPMENTS "NON-EXCLUSIVE USE"*2								
Pertaining To:	Limits	Container Requirements	DOT Shipping Label Requirements	Container Markings	Placard Requirements	Max Radiation Levels	Max Contamination Levels	Special Communications
Equipment and Tubulars	There is no "Curie package limit" for SCO shipments. Instead the non-fixed contamination on accessible surfaces cannot exceed 2,200 dpm/100cm <sup>2</sup> alpha and 22,000 dpm/100cm <sup>2</sup> gamma/beta, and the fixed contamination on accessible surfaces cannot exceed 22,000,000 dpm/100cm <sup>2</sup> alpha and 220,000,000 dpm/100cm <sup>2</sup> gamma/beta, and the non-fixed plus the fixed contamination on inaccessible surfaces cannot exceed 22,000,000 dpm/100cm <sup>2</sup> alpha and 220,000,000 dpm/100cm <sup>2</sup> gamma/beta.	Containers certified as "Industrial Packages", type IP-I, IP-II or IP-III certified containers  DOT Spec 7A Type A packages may be used for domestic shipments only  49 CFR 173.427	See Section 6.3; Table 6.3-1  49 CFR 172.403	Exterior of each container must be marked "RADIOACTIVE – SCO" UN2913  Non-bulk packages do not have to be marked "RQ", instead, packages containing a hazardous substance must now be marked "RQ". NORM will become a hazardous substance when the radium-226 curie content in a single package exceeds 0.54 Ci's.  Non-bulk packages must be marked with the shipper's and receiver's name and address  Each container > 110 pounds must have its weight plainly marked on the outside of each container  49 CFR 173.427(a)	49 CFR 172.504	NTE: 200,000 µR/hr  TI NTE 10	NTE loose surface contamination of:  <b>alpha</b> 24 dpm/cm <sup>2</sup>  <b>beta/gamma</b> 240 dpm/cm <sup>2</sup>	1. Shipper must supply carrier w/ 24 hour notification telephone number for in event of accident, fire, breakage, spillage, release or spread of LSA material  2. Statement 2*1 must appear on shipping papers  3. Emergency Response Guide (Appendix H) must accompany

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				IP-1, IP-2, or IP-3, as appropriate, must be marked on the outside of the package. 49 CFR 172.310(b).				
<p>INDEX</p> <p>NTE = Not To Exceed                  TI = Transport Index, maximum radiation level in millirem per hour at 1 m.</p> <p>*1. Statement 2: "This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation."</p> <p>*2. "Non-Exclusive Use" is defined as a shipment in which BP does not have the sole use of the transport vehicle or vessel and in which BP does not dictate the loading or unloading actions.</p>								

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## 9.0 Contact Information

Since working with NORM containing equipment and materials can be complicated from a worker protection, sampling, transportation, and manifesting perspective, it is recommended that RSO professionals be consulted and, if possible, come to your facility to assist with every phase of the NORM project. BP has identified five companies that provide RSO professionals. Some of these companies also have onshore yards that are licensed for cleaning of NORM equipment. This information is intended to provide assistance with determining what type of service is available and to help in selecting a BP vendor.

### 9.1 NORM Cleaning Services

Company Name	Yard Location	Contact Person	Phone number
Trussco	Abbeville, LA	John Tweedel	337-893-5392 (o)
Major Equipment & Remediation - MER	Amelia, LA	Ray Autrey	985-385-3132 (o) 800-942-3132 (o)
PSC – previously was Philip Services Corp	Amelia, LA *Only facility that will accept equipment for decon at their yard	Patrick Kennedy	985-631-3973 (o) 985-518-3368 (m)
Production Management - PMI	no yard for storage or cleaning	Ronald Courville	985-631-3837 (o) 888-269-5989 (p)
Grand Isle Shipyard – GIS	no yard for storage or cleaning	Scott Abercrombie	985-702-8133 (o) 504-812-6144 (m)

The following lab is approved for conducting NORM Specific Activity analysis.

Lab analysis for Specific Activity ( $\rho\text{Ci/g}$ ) required for proper transportation and disposal of NORM wastes.

Company Name	Lab Location	Contact Persons	Phone numbers
American Radiation Services – ARS	2609 N. River Road Port Allen, LA 70767	Danny Coleman Keith Lemoine	800-401-4277

As mentioned in Section 7.2 Disposal of Diffuse Waste, NORM waste shall be disposed of at E&P Exempt disposal facilities. E&P exempt facility information is listed in the BP GoM Waste Management Procedures.

### 9.2 Disposal of NORM Equal to or Over 30 $\rho\text{Ci/g}$

Company Name	Disposal Site Location	Contact Persons	Phone numbers
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EcoServ.	Big Hill Facility 26462 Wilber Road Winnie, TX 77665	Terry Vidrine Alissa Robinson	409-794-3450 409-794-3455
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### 9.3 Instrument Purchase, Recalibration & Repair

Company Name	Shop Location	Contact Person	Phone number
Ludlum Measurements, Inc.	501 Oak Street Sweetwater, TX 79556	Sales or Service Dept.	915-235-5494

## 10.0 Key Documents, References, Appendices

### 10.1 Key Documents

[GoM Waste Management Procedure](#)

[29 CFR 1910.1096, OSHA \(Occupational Safety and Health Administration\), Ionizing Radiation](#)

[30 CFR 250.300, BSEE \(Bureau of Safety and Environmental Enforcement\), Pollution Prevention](#)

[10 CFR 20, NRC \(Nuclear Regulatory Commission\), Standards for Protection against Radiation](#)

[49 CFR 171 -178, DOT \(Department of Transportation\), Hazardous Materials Regulations](#)

[Notice to Lessee \(NTL\) No. 2009-G35 \(BSEE Guidance for disposal and storage of solid wastes\)](#)

### 10.2 Appendices

<b>Title of Document:</b>	GoM Region Naturally Occurring Radioactive Material (NORM) Manual	<b>Document Number:</b>	UPS-US-SW-GOM-HSE-DOC-00628-2
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## Appendix A, Regulatory Overview and Limits

The Bureau of Ocean Energy Management (BOEM), the Bureau of Safety and Environmental Enforcement (BSEE) and the federal government do not regulate NORM. However, the federal government does have basic radiation protection regulations pertaining to worker and environmental protection and the shipping, disposal and storage of radioactive materials. The minimum requirements are included in state plans, where state plans exist (e.g., Texas and Louisiana Continental Shelf areas). Although the Louisiana and Texas NORM rules and regulations only apply to state waters and state land, BP applies these regulatory limits to offshore federal water operations in the absence of similar federal regulations.

Potentially applicable federal radiation regulations can be found in:

- 29 CFR 1910.1096, OSHA (Occupational Safety and Health Administration), Ionizing Radiation
- 30 CFR 250.300, BSEE (Bureau of Safety and Environmental Enforcement), Pollution Prevention
- 10 CFR 20, NRC (Nuclear Regulatory Commission), Standards for Protection against Radiation
- 49 CFR 171 -178, DOT (Department of Transportation), Hazardous Materials Regulations
- Notice to Lessee (NTL) No. 2009-G35 (BSEE Guidance for disposal and storage of solid wastes).

NORM regulations typically address the following topics:

- Control of the occupational exposure (dose) to all employees,
- Surveys and monitoring in accordance with federal and/or state requirements,
- Respiratory protection and control measures to restrict internal exposure,
- Posting of signs and labels,
- Documentation of program requirements, survey and monitoring results, and
- Compliance with state reporting and disposal criteria.

The following regulatory aspects shall be addressed and adhered to during all work involving NORM.

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**Table 1: Regulatory NORM Limits for NORM Handling and Waste Disposal**

Authority	Trigger Limit	Impact
<b>Handling NORM Containing Materials and Equipment</b>		
<b>BP GOM</b>	50 $\mu$ R/hr or greater 200 cpm for fixed surface contamination 100 cpm for loose surface contamination	Refer to Figure 5.6-1 for handling and protection
<b>Texas:</b> <b>Louisiana:</b>	50 $\mu$ R/hr or greater including background	Considered non-exempt equipment/tubulars. Equipment released to a recipient for cleaning or maintenance / overhaul must be released to a NORM Licensed Contractor.
<b>Louisiana:</b>	5 $\rho$ Ci/g or greater Radium-226 or Radium-228 or 150 $\rho$ Ci/g or greater of any other NORM radionuclide	Considered non-exempt material-diffuse materials (e.g., sands, sludge, scales, waste).
<b>Texas:</b>	30 $\rho$ Ci/g or greater Radium-226 and/or Radium-228 or 150 $\rho$ Ci/g or greater of any other NORM radionuclide	Considered non-exempt material-diffuse materials (e.g., sands, sludge, scales, waste).
<b>Texas:</b>	>1,000 dpm/100 cm <sup>2</sup> removable >5,000 dpm/100 cm <sup>2</sup> average > 15000 dpm/100 cm <sup>2</sup> maximum surface NORM for tubulars and all equipment.	Surface contamination - Indicates potential for respiratory exposure and additional health and safety requirements must be met, in particular, containment for shipping.
<b>BP GOM</b> <b>Texas:</b> <b>Louisiana:</b>	2,000 $\mu$ R/hr or greater	Licensed NORM Contractors are required. Wear radiation badges when performing work. Note: For reading above 50 $\mu$ R/hr consult with the GOM Industrial Hygiene Team.
<b>Handling NORM Containing Waste</b>		

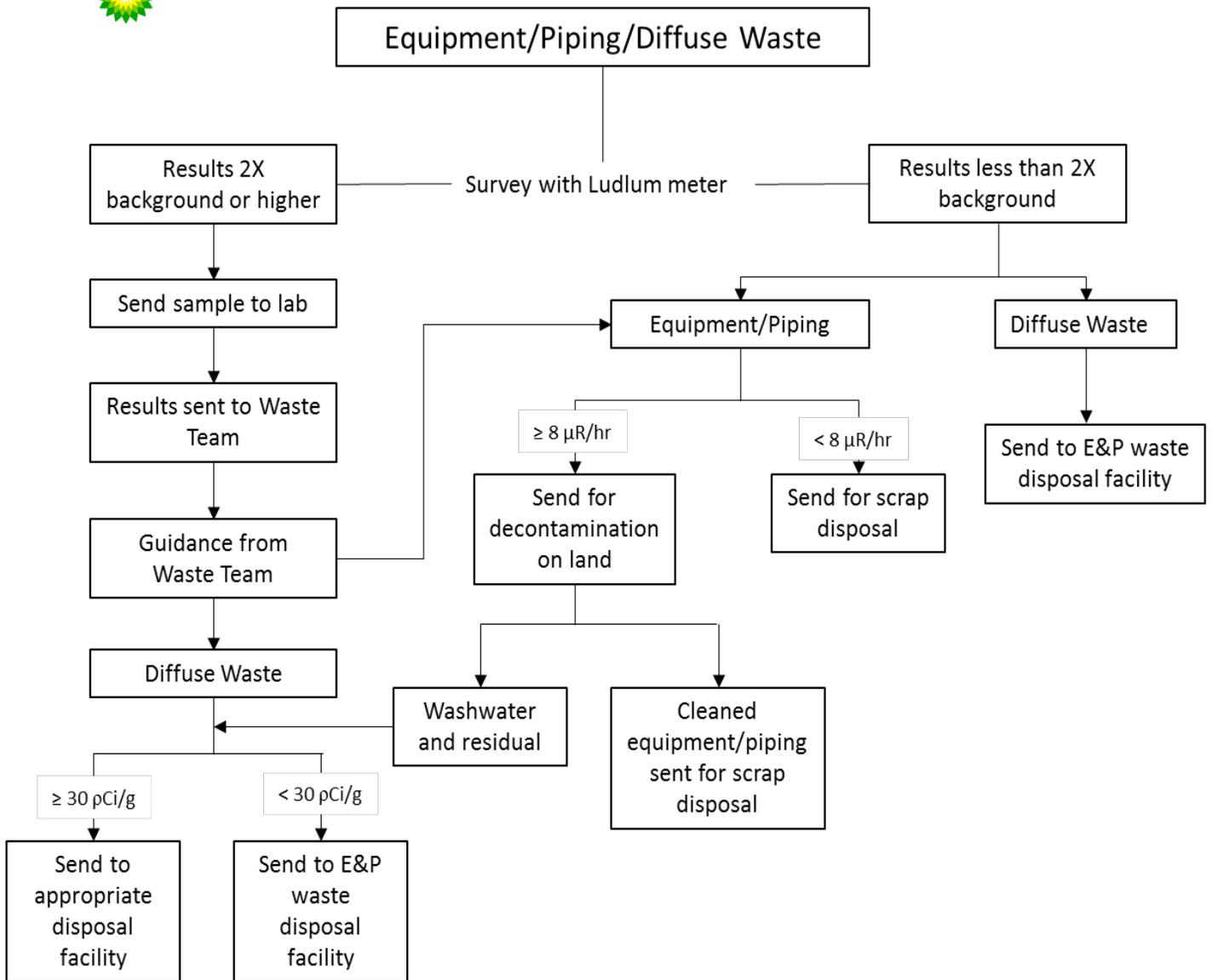
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Authority	Trigger Limit	Impact
<b>Bureau of Safety and Environmental Enforcement:</b>	Above background	BSEE approval required for disposal method and storage of NORM.
<b>Dept. Of Transportation:</b>	Twice background ( $\mu\text{R/hr}$ ) or greater on equipment/tubulars	Sample required to be taken of contents for lab analysis to determine DOT shipping requirements and disposal/treatment methods
<b>Dept. Of Transportation:</b>	<ol style="list-style-type: none"> <li>1. Ra-226 activity &gt; 270 <math>\rho\text{Ci/g}</math> and total Ra-226 activity in a consignment &gt; 270,000 <math>\rho\text{Ci}'\text{s}</math> <u>or</u></li> <li>2. Ra-228 activity &gt; 270 <math>\rho\text{Ci/g}</math> and total Ra-228 activity in a consignment &gt; 2,700,000 <math>\rho\text{Ci}'\text{s}</math> <u>or</u></li> <li>3. Th-228 activity &gt; 27 <math>\rho\text{Ci/g}</math> and total Th-228 activity in a consignment &gt; 270,000 <math>\rho\text{Ci}'\text{s}</math>.</li> </ol>	Manifesting, shipping (Section 8)
<b>Texas:</b>	<p>30 <math>\rho\text{Ci/g}</math> Radium-226 or Radium-228 or greater for sludge, scales, paraffins and sands</p> <p>or</p> <p>150 <math>\rho\text{Ci/g}</math> of any other NORM radionuclide</p>	<p>Below 30 <math>\rho\text{Ci/g}</math> Radium-226 or Radium-228 waste can go to E&amp;P Exempt facility</p> <p>Above 30 <math>\rho\text{Ci/g}</math> Radium-226 or Radium-228 waste must go to a NORM waste facility</p> <p>Disposal site/manifesting (Section 7&amp;8)</p>
<b>Louisiana:</b>	<p>5 <math>\rho\text{Ci/g}</math> Radium-226 or Radium-228 for sludge, scales, paraffins and sands</p> <p>or</p> <p>&gt;150 <math>\rho\text{Ci/g}</math> or greater of any other NORM radionuclide</p>	<p>Non-exempted NORM waste. If below 30 <math>\rho\text{Ci/g}</math> Radium-226 or Radium-228, waste can go to E&amp;P Exempt facility</p> <p>Above 30 <math>\rho\text{Ci/g}</math> Radium-226 or Radium-228 waste must go to a NORM waste facility and require RPD-37 NORM manifest</p> <p>Disposal site/manifesting (Section 7&amp;8)</p>
<b>Scrap Dealers</b> (*rule of thumb)	8 $\mu\text{R/hr}$	Requires decontamination if $\geq 8 \mu\text{R/hr}$

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## Appendix B, Waste Handling NORM Equipment, Pipe and Diffuse Waste



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### Appendix C, NORM Survey Data Sheet



Norm Survey Data Sheet.docx

### Appendix D, NORM Personnel Contamination Monitoring Data Sheet



NORM Personnel Contamination Monitc

### Appendix E, Louisiana UIC-28 Manifest Form Order List



UIC 28 Approved Printing Companies.

### Appendix F, Preparing Samples for Shipment to a Laboratory



ShippingSamplesforAnalysis.pdf

### Appendix G, NORM Chain-of-Custody Form (Blank)



Blank ARS CoC.PDF

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## Appendix H, Emergency Response Guide for NORM

(To be provided to the Carrier)

Check the appropriate shipping name listed below:

- \_\_\_\_\_ Radioactive Material, excepted package-limited quantity of material UN2910  
 \_\_\_\_\_ Radioactive Material, low specific activity (LSA-I) non fissile UN2912  
 \_\_\_\_\_ Radioactive Material, surface contaminated objects (SCO-I) non fissile UN2913

### POTENTIAL HAZARDS

#### HEALTH HAZARDS

- Radioactive material: degree of hazard will vary from little to moderate, depending on type and quantity of radioactive material.
- Many of these materials may not have radioactive material labels.
- Some radioactive materials cannot be detected by commonly available instruments.
- Spilled radioactive materials usually will be visible if packaging fails.
- Runoff from fire control or dilution may cause pollution.

#### FIRE OR EXPLOSION

- Some of these materials may burn, but none of them ignites readily.
- Radioactivity does not change flammability or other properties of the materials

### EMERGENCY ACTIONS

- Keep unnecessary people at least 150 feet upwind of spill: greater distances may be necessary for people downwind, or if advised by Radiation Authority.
- Isolate the area and deny entry.
- Response actions may be performed prior to any radiation measurements.
- Positive pressure self-contained breathing apparatus (SCBA) and structural fire fighter's protective clothing will provide limited protection.
- Notify Radiation Authority of accident conditions.
- Detain uninjured persons, isolate equipment with suspected contamination, and delay cleanup until instruction from Radiation Authority.

#### FIRE

- Do not move damaged containers: move undamaged containers out of the fire zone.
- **Small Fires:** Dry chemical, CO<sub>2</sub>, water spray, or regular foam.

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- **Large Fires:** Water spray, for or regular foam.

**SPILL OR LEAK**

- **Do not touch damaged containers or spilled material.**
- Dike far ahead of spill to collect runoff water.
- Cover powder spill with plastic sheet or tarp to minimize spreading.

**FIRST AID**

- Use fire aid treatment according to the nature of the injury.
- If not affecting injury, remove and isolate suspected contaminated clothing and shoes; wrap victim in a sheet or blanket before transporting.
- If there is no injury, remove and isolate suspected contaminated clothing and shoes; assist person to shower with soap and water and notify Radiation Authority of action.
- Advise medical personnel that the victim may be contaminated with low level radioactive material.

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## Appendix I, Flowchart – DOT Label Requirements

### DOT Shipping Requirements

	Limited Quantity	LSA Exclusive Use	LSA Non Exclusive Use
Proper Shipping Name	Radioactive Material, excepted package – limited quantity of material.	Radioactive Material, LAS, n.o.s.	Radioactive Material, LSA, n.o.s.
UN Identification Number	UN2910	UN2912	UN2912
Hazard Class	7	7	7
Markings	Radioactive	Radioactive – LSA. The letters RQ must also appear on non-bulk packages	Radioactive Material, LSA, n.o.s. UN2912. The exterior of each non-bulk package must also be marked with the shippers and receivers name and address
Labeling	None	None	White-I labels if rad. Levels are < 500 uR/hr Yellow-II labels for rad levels > 500 uR/hr but < 50,000 uR/hr Yellow – III labels for rad. Levels > 50,000 uR/hr but < 200,000 uR/hr.
Placarding	None	Class 7 Radioactive Placards Required	None
Written “Exclusive Use Vehicle Control Instructions” Required ?	No	Yes	No
Special Written Communication Requirements	49CFR 173.422(1) statement must be forwarded with the shipment.  A 24-hour Emergency Response telephone number must appear on the shipping paper work.  The activity contained in the shipment in units of Bq (Becquerel’s) must be included on the shipping manifest or paperwork	A signed, 49CFR 172.204(a)(1) certification statement must be forwarded with the shipment.  A 24-hour Emergency Response telephone number must appear on the shipping paper work.  The activity contained in the shipment in units of Bq (Becquerel’s) must be included on the shipping manifest or paperwork	A signed, 49CFR 172.204(a)(1) certification statement must be forwarded with the shipment.  A 24-hour Emergency Response telephone number must appear on the shipping paper work.  The activity contained in the shipment in units of Bq (Becquerel’s) must be included on the shipping manifest or paperwork
Required BP Manifests	BP Shipping Manifest BP Hazardous Material Manifest RPD 37 Manifest ARS lab report ( if sampled) Acceptance Letter NORM survey log	BP Shipping Manifest BP Hazardous Material Manifest RPD 37 Manifest ARS lab report ( if sampled) Acceptance Letter NORM survey log	BP Shipping Manifest BP Hazardous Material Manifest RPD 37 Manifest ARS lab report ( if sampled) Acceptance Letter NORM survey log

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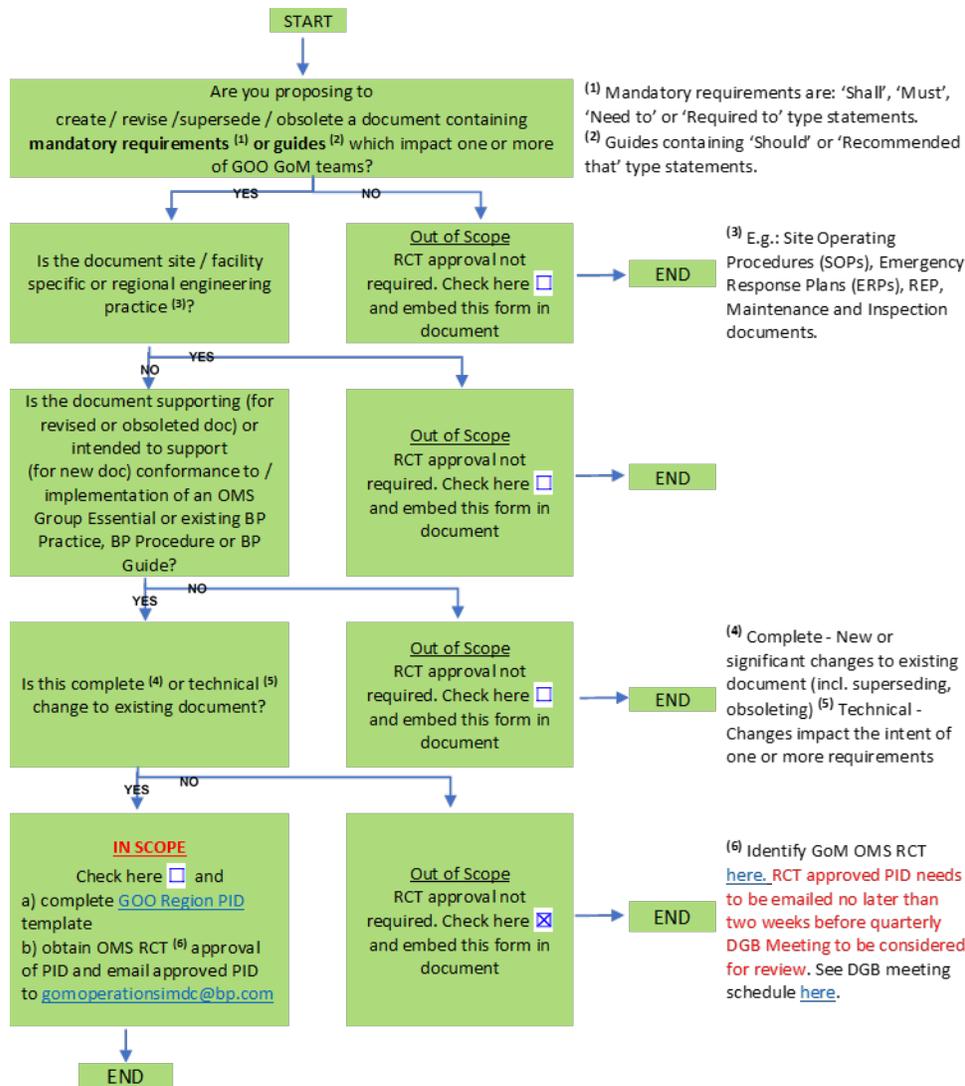
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	Holly Reidenbach	<i>Holly Reidenbach</i>	07/06/2018
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<b>Communication Completed</b> <small>(If not applicable, put N/A in front of Name &amp; Title, then sign and date)</small>	N/A, Diane Liu, Industrial Hygienist	<i>Diane Liu</i>	07/06/2018
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<b>Authority - Name &amp; Title, then sign and date)</b>	Valerie Murray, Health Manager	<i>Valerie Murray</i>	07/09/2018
<b>Document Posted - Name &amp; Title, then sign and date)</b>	Debe Edwards, GOC & IMDC Document Controller	<i>Debra Edwards</i>	23-07-18
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