



NORM OPERATIONS PROCEDURE

NORM Operations Procedure

January 2023

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 document applies to IPS★ITCS Operations 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 water. Whenever there is a change in the pressure, temperature, or pH, the radium in the produced water 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 ($> 2,000 \mu\text{R/hr}$). There are three types of radiation associated with NORM:

1. Alpha radiation/particles.
2. Beta radiation/particles; and
3. Gamma radiation/rays.

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. Accidental 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 aluminium 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, sand accumulators, 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.

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 surveys 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 survey results shall be maintained in the facility HSE files, and copies should be attached to the work permit. Personnel involved in the work activity with potential for NORM should be notified of the results of the survey.
- D. Line management should ensure that survey and monitoring plans, procedures, and designation of responsibility for completing the survey 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 Advisor

- A. Conduct NORM surveys if trained as a NORM surveyor.
- B. Maintain the NORM survey records in the facility HSE files and verify a copy of the survey record is attached to the work permit when necessary.
- C. Notify IPS★ITCS IH when the NORM survey result is at or above the limit of 50 microroentgen per hour (µR/hr) or 100 counts per minute (cpm) and coordinate the implementation of the control measures at the site.

3.3 Workforce

- A. Workers shall complete the awareness training prior to conducting work activities involving NORM according to Section 4.0, NORM Training.
- B. Workers should be familiar with the sections in this Manual that pertain to their job responsibilities.
- C. Workers 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 IPS★ITCS NORM Procedure, 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 Procedure.
- B. Responsible to review the contents of the NORM Awareness and NORM Survey training periodically.
- 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 (SPR)

- 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 (DEQ).
- D. Complete Hazmat Training.

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 Bureau of Safety and Environmental Enforcement (BSEE) for storing NORM-containing wastes at offshore locations (when needed).

3.7 Radiation Safety Officer (RSO)

Currently, the IPS★TCS RSO is the HSEQT Manager.

- A. Responsible for oversight of the radiation safety program for IPS★ITCS.
- B. Provide technical support on training, work practices, and protective measures when handling radioactive materials.
- C. Act as the point of contact for radiation questions and concerns as well as radiation emergencies.
- D. Maintain records, receipts, exposure monitoring data.

4.0 NORM Training

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

- Workers conducting maintenance activities on and with potential NORM containing equipment and materials (e.g., equipment inspections, equipment removal/demolition and equipment maintenance such as cleaning, etc.) must attend, at a minimum, the IPS★ITCS NORM Awareness Training Class (e.g., NORM Awareness training obtained through Classroom instruction or CBT at the Houston Area Safety Council). 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. This course is provided periodically or upon request.
- IPS★ITCS 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.

- A. Direct skin contact with radioactive scale, solids and liquids shall be avoided to the maximum extent possible.
- B. 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.

- C. Personnel shall thoroughly decontaminate after working with NORM containing equipment, before eating, drinking, or smoking, and at the end of the workday.
 - D. 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.
 - E. Openings on contaminated equipment shall be sealed or wrapped in plastic or other suitable materials.
 - F. NORM containing materials shall be kept wet to limit the possibility of NORM dust becoming airborne.
 - G. Plastic ground covers shall be utilized to the extent possible to contain NORM and to facilitate clean up.
 - H. 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:
 - safety glasses or goggles in high dust areas,
 - disposable or non-porous gloves (two layers of gloves are recommended),
 - rubber or other non-porous protective footwear, hooded disposable coveralls (i.e., Tyvek suits) or non-porous rain suits, and/or
 - respirators with appropriate NIOSH-approved HEPA filters.
- Refer to “Figure 5.6-1: Determine PPE Requirements Based on NORM Survey Results” for more details about the PPE requirements for 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 IPS★ITCS Respiratory Protection Procedure. ***HSE.PRO.Respiratory Protection Procedure.2022***
 - J. PPE, tools, etc. 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 labelled in accordance with Section 6.3, Labelling 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 at an interval of once every three years.

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:
 - 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 a DOT hazardous 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 (FRC, disposable coveralls/Tyvek), nonporous gloves and safety glasses, 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 NORM 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 microroentgens per hour ($\mu\text{R/hr}$); and
2. Laboratory sample analysis results are reported in picocuries per gram (pCi/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 = 2.2×10^9 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. IPS★ITCS 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. IPS★ITCS 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 instrument manufacturer or an approved vendor.

Ludlum Measurements, Inc.
P.O. Box 810 501
Oak Street Sweetwater, TX 79556
Telephone: (800) 622-0828
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.

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:

Place a check source with a known value within $\frac{1}{2}$ 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 $\pm 20\%$ of a known value for the particular meter and source being used.

Note: If the response check value is not $\pm 20\%$ 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. Preoperational checks include a physical integrity, battery, response, and calibration check. Preoperational 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 at a laboratory 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 laboratory 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 and analyzed at a laboratory to determine disposal and shipping requirements.

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 Appendix A 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. Preoperational checks include a physical integrity, battery, response, and calibration check. Preoperational 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 in² (100 cm²) on the item being sampled. To obtain an area of 16 in², 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 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 cm².

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 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 shovelled 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 and/or other items 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. Preoperational checks include a physical integrity, battery, response, and calibration check. Preoperational 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.
- 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". If a NORM survey indicates levels at or above 50 µR/hr including background or removable contamination at or above 1000 dpm/100 cm² or an average fixed contamination at or above 5000 dpm/100 cm² or a single maximum reading of 15000 dpm/100 cm², contact the IPS★ITCS IH Team to ensure proper compliance with the applicable regulatory requirements has been met.

Completed NORM Survey Data Sheets should be maintained in the facility HSE files 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 Labelling of Equipment

If a NORM survey indicates that stated levels defined in Appendix A Table 1 are exceeded in a facility, the associated equipment must be labelled 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 Determining PPE Requirements based on NORM Survey Results

Figure 5.6-1 outlines the procedures for determining the appropriate level of personal protection based on the NORM survey results.

Note: IH should be notified of survey results at or above 50 $\mu\text{R/hr}$ or 100 cpm including background to verify the appropriate PPE to be worn.

Figure 5.6-1

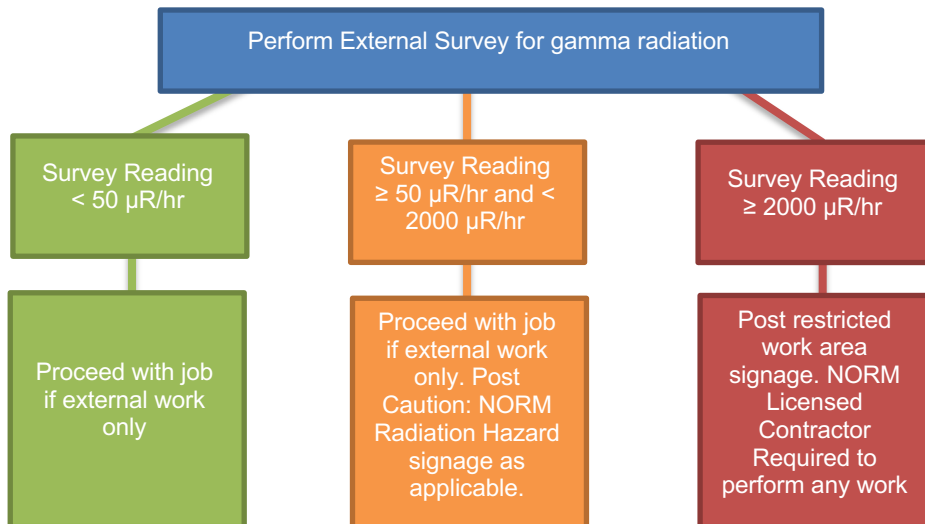
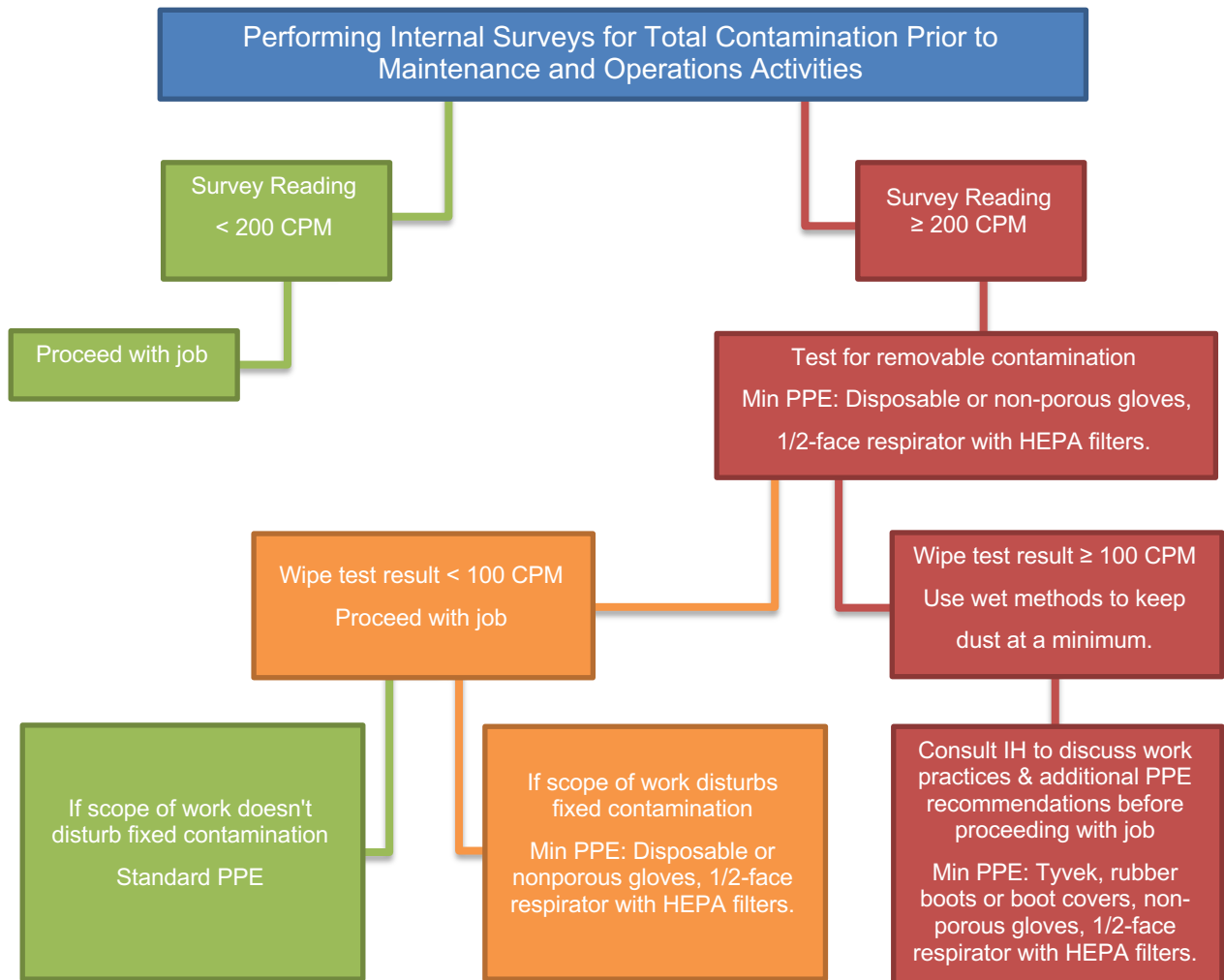


Figure 5.6-1 (Continued)

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. Contact IH or Environmental for laboratory sampling procedure.

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, IPS★ITCS, 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.)

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).

5.7.1 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

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.

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, NORM Chain-of-Custody Blank Form. Key information includes:

- sampler name (printed),
- project location,
- 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 IH and Waste Advisors 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.

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/or 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 IPS★ITCS are permitted to carry NORM samples.
- the maximum allowable radiation level on the external surface of the package cannot exceed 500 $\mu\text{R/hr}$. (If 500 $\mu\text{R/hr}$ 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.
- 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 IPS★ITCS shipping manifest and IPS★ITCS 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 a Safety Data Sheet (SDS) of any hazardous component.

Samples should be sent to:

American Radiation Services (ARS),
2609 North River Road, Port Allen, LA 70767
Telephone: (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 $\mu\text{R/hr}$ or greater, including background radiation levels, or removable radioactive material contamination levels at any accessible point of 1000 dpm/100 cm^2 or an average reading of 5000 dpm/100 cm^2 or a single maximum reading of 15000 dpm/100 cm^2 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. **For any equipment where survey readings indicate that NORM is over 2,000 $\mu\text{R/hr}$, 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 $\mu\text{R/hr}$ 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.
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 IPS★ITCS 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 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 IPS★ITCS 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 shovelled 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 labelled per Section 6.3, Labelling of Containers.
8. Upon completion of maintenance, personnel shall remove their protective clothing in the preestablished decontamination area and immediately perform whole body personnel 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 IPS★ITCS IH Team for assistance in conducting surveys. IPS★ITCS Region Naturally Occurring Radioactive Material
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 rewashed 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 IPS★ITCS 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 ($\geq 2000 \mu\text{R/hr}$), a Controlled Work Area with access restricted to the trained workers wearing the required PPE must be set up.

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).
4. The CWA and CRZ shall have a means to contain 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 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 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 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.
 - 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. NORM greater than twice the local background must be removed from work clothes and 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.

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. 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.

Note: 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, 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 (DEQ) 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, DNV 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 containers with:
 - "IPS★ITCS"
 - Generator location
 - 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 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:
 - i. 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.
 - ii. Do not mix NORM with any other materials.
 - iii. Place NORM sands in "strong, tight containers" that ensures there will be no leakage of radioactive material under conditions normally incidental to transportation.
 - iv. 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:
 - i. “NORM Contaminated Sand”.
 - ii. “IPS★ITCS”; Generator Location; and
 - iii. Start of accumulation date.

6.3 Labelling for Containers

Containers of NORM shall be labelled 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 pCi/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.

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 microroentgens 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. 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 yards 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 Department of Environmental Quality 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 are 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 the 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 IPS★ITCS 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 IPS★ITCS, Lab or, Clients Shipping Manifest This is a "cargo" manifest that is used to identify materials, chemicals, wastes or equipment that are being transported over water to offshore, as well as into the shorebase. This manifest shall be 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 IPS★ITCS, Lab or, Clients 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 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 site. The 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 IPS★ITCS, Lab or, Clients 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, an IPS★ITCS, Lab or, Clients 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 yards or NORM licensed decontamination facility for cleaning. IPS★ITCS 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 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

<https://deg.louisiana.gov/index.cfm?md=resource&tmp=category&catid=radiation-forms-guidesand-information&y=2017&keyword=&pn=4>.

8.1.6 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.

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 ($\mu\text{R/hr}$) 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 Appendix A, Table 1 shall be shipped as “radioactive material” under current DOT regulations.

NORM is regulated as a DOT Hazardous Material if:

- a. Ra-226 or Ra-228 is greater or equal to 270 pCi/g or if Thorium-228 (Th-228) 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/g value multiplied by the approximate weight of waste material). A lab analysis will indicate the radioactive daughter levels in the sample.

Contact IPS★ITCS 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, labelling, 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 $\mu\text{R/hr}$ reading on contact with the equipment or container and the radium-226, radium-228, and thorium-228 pCi/g activity levels.

8.3 General Shipping Requirements/Specifics

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 and/or shipping NORM.

9.0 Contact Information

Since working with NORM containing equipment and materials is complex from a worker protection, sampling, transportation, and manifesting perspective, it is recommended that RSO is consulted and/or assists with the NORM project. The IPS★ITCS RSO is the HSEQT Manager. IPS★ITCS has identified several companies that provide RSOs. Some of these companies 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 an IPS★ITCS vendor.

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 IPS★ITCS Waste Management Procedures.

10.0 Key Documents, References, Appendices

10.1 Key Documents

29 CFR 1910.1096 – Ionizing Radiation
29 CFR 250.300 – BSSE
10 CFR 20 – NRC
49 CFR 171 – 178 – DOT

10.2 Appendices

Appendix A – Regulatory Overview and Limits
Appendix B – Waste Handling – NORM Equipment, Pipe and Diffuse Waste
Appendix C – NORM Survey Data Sheet
Appendix D – NORM Personnel Contamination Monitoring Data Sheet
Appendix E – Preparing Samples for Shipment to a Laboratory
Appendix F – NORM Chain-of-Custody Form (Blank)
Appendix G – Emergency Response Guide for NORM (See ERG)

Revision History

Rev	Rev Date	Rev By	Approved By	Description
1.0	1.3.2022	Shayne Torrans	Shayne Torrans	Initial Procedure Document
1.1	12.5.2022	Shayne Torrans	Shayne Torrans	Format Revision

Approvals:

Procedure Owner

Print Name

Date

Signature

Competency Assessment

No.	Questionnaire	C/NYC
Q1		
A1		
Q2		
A2		
Q3		
A3		
Q4		
A4		
Q5		
A5		

Enclosed Attachments	
Risk Assessment	<input checked="" type="checkbox"/>
Environmental Aspect and Impact	<input checked="" type="checkbox"/>
Training and Competency	<input checked="" type="checkbox"/>
Measure and Evaluation Tools	<input checked="" type="checkbox"/>

Competency Checklist

To be filled out by Trainer and signed by Employee, Assessor and Supervisor before being returned to the HSEQT Manager for recording purposes.

Procedure	Competency	Date	Competent YES / NO	Employee Signature

(Please tick appropriate box)

This employee is competent in performing the job.

This employee has not attained the competency level.

*

* *If the employee has not attained all competency levels, the General Manager must assess the action to be taken, provide an extension of training or alternative action as listed below.*

Alternate action to be taken: _____

Signed By	Employee:	_____	Date:	_____
	Trainer:	_____	Date:	_____
	Assessor:	_____	Date:	_____
	Regional Manager:	_____	Date:	_____

Environmental Aspects and Impacts

Identified Environmental Aspects and Impacts

The following table is a summary of the likely environmental aspects and impacts that may be identified during site inspections. The significance of each impact needs to be assessed using the Risk Assessment Model.

Activity	Aspect	Impact
Purchasing & Administrative Work	Consumption of goods	Conservation of natural resources
	Consumption of energy (eg. Electrical equipment and facilities)	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of waste (eg. Paper)	Consumption of space for waste disposal; Habitat loss
Climate Control	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of noise	Disturbance to community; Habitat loss
Cleaning of – offices / vehicles	Storage, use and release of chemicals	Contamination of air, water or soil; Risk to human health
Transport (Fleet vehicles / staff travel)	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Loss of habitat at all stages of generation; Light pollution
	Consumption of goods (eg. Oil)	Consumption of natural resources; Generation of waste; Habitat loss; Biodiversity impacts
	Generation of waste (eg. Oil)	Consumption of space for waste disposal; Potential contamination of water or soil; Habitat loss
	Exhaust emission	Release of greenhouse gases and atmospheric pollution
	Use of dangerous goods (eg. Batteries)	Potential contamination of air, water or soil; Risk to human health
	Generation of noise	Disturbance to community; Habitat degradation
Operations		

Activity	Aspect	Impact

Risk Assessment

Risk Assessment // insert name here					
Step No: Logical sequence	Sequence of Basic Job Steps documented in the Procedure, Work Instruction and project plans. Break down Job into steps. Each step should be logical and accomplish a major task.	Potential Safety & Environmental Hazards/Impacts at the site of the Job Identify the actual and potential health and safety hazards and the environmental impacts associated with each step of the job.	Risk Rating Refer to the risk matrix or HSEQT.PRO. Risk Mgt	Recommended Corrective Action or Procedure <i>Determine the corrective actions necessary to reduce the risk to as low as reasonably practical (ALARP) refer to HSEQT.PRO. Risk Mgt. The risk must be reduced or controlled to ALARP before work commences.</i> Document who is responsible for implementing the controls to manage each hazard identified.	Risk Rating refer to the risk matrix or HSEQT.PRO. Risk Mgt
1.					
2.					
3.					
4.					
5.					

Audit

Process: insert// Procedure: Insert //			Date:	Audited by:	
			Location of Audit:	Area Mgr/Supervisor:	
Item	Question	Evidence Sited	Comments		Conformance Score 0,3,5
1.					
2.					
3.					
4.					
5.					
6.					
7.					
AUDITOR'S SIGNATURE:		CONFORMANCE SCORE: / 25		0 – Non-Conformance 3 – Continuous Improvement Opportunity 5 – Total Conformance	
SAFETY REP'S SIGNATURE:		CONFORMANCE %:			