NORM Implementation Plan 210-IP

July 2009

Overview

Purpose

This document provides a sample NORM (Naturally Occurring Radioactive Material) Implementation Plan (IP) that Devon Divisions and Business Units may use to comply with Devon's NORM Standard.

Scope

This document provides practices and procedures to identify and manage facilities and equipment known or suspected to contain NORM that meet the *NORM Standard.* Operating Divisions and Corporate Departments are responsible for complying with the minimum requirements specified in the *NORM Standard* by

- using this Implementation Plan as-is and implementing as their Program
- modifying this Implementation Plan and implementing as their Program, or
- writing and implementing a new Program that meets their specific needs.

Important: If the Operating Division or Corporate Department Program deviates from the Implementation Plan, the reason for change must be justified and approved by the Vice President or his or her designee.

Reference: For additional information on implementing EHS Standards, see the *Corporate Standard to Division Procedures Process* available on Access Devon.

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Overview, Continued

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Identification of NORM Radiation Safety Officer(s) (RSO)

Identification of NORM RSO

The Devon Person-in-Charge (PIC) is responsible for identifying the NORM RSO or equivalent. Contact Environmental, Health and Safety (EHS) Department for guidance.

NORM RSO Requirements

NORM RSO requirements include

- NORM RSO certification and experience, or
- adequate training and experience.

Reference: For NORM RSO training requirements refer to the Devon Training Catalog.

Responsibilities

Devon PIC Responsibilities

The Devon PIC has the overall authority and responsibility for implementing the NORM Implementation Plan and is responsible for the following items:

Responsibilities	See Page
Identifying the NORM RSO or the equivalent	3
Notifying the NORM RSO in the event that NORM contaminated material must be stored at a Devon location	14-17, 28-32
Ensuring that Devon employees follow the *NORM Standard*, the written NORM Program, and applicable Federal/State regulations	5
Ensuring Devon employees that could be exposed to NORM are trained in NORM identification, handling, and personal protection procedures before they begin assigned tasks and Pre-Job Safety Meetings are conducted	6-7, 20-26
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Verifying the proper NORM warning signage and/or labeling is posted	19, 22-23
Verifying that NORM surveying, sampling, and shipment of NORM samples for laboratory analysis are conducted by trained/qualified personnel	40
Communicating NORM hazards to employees/contractors	27
Selecting contractors that are specifically licensed (or similarly qualified if no regulatory licensing is required) for the shipment, decontamination, treatment, storage, and/or disposal of NORM contaminated material and property	37
Documenting and retaining NORM records	41

Reference: The *PIC Flowchart for NORM Requirements* is available on Access Devon.

NORM RSO Responsibilities

The RSO is responsible for

- developing the written NORM Program, Worker Protection procedures, and NORM Surveying and Sampling procedures
- reviewing the annual written NORM Program content and implementation
- ensuring that the requirements of the general license as well as applicable State/Federal regulations are properly met and implemented
- ensuring proper criteria are met before any NORM contaminated material or property is released for unrestricted use
- providing a list of specifically licensed contractors (or similarly qualified if no regulatory licensing is required) for the shipment, decontamination, treatment, storage, and/or disposal of NORM contaminated material and property to the PIC
- overseeing the storage, decontamination, transfer to another facility, and/or transfer for treatment/disposal of NORM contaminated material or property

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Responsibilities, Continued

NORM RSO Responsibilities (continued)

- ensuring that the requirements for protection of employees, contractors, and the environment are followed, and
- managing training requirements for employees appropriate for the job tasks they perform.

EHS Department Responsibilities

The EHS Department is responsible for

- assisting Operations in implementation of the *NORM Standard* and the written NORM Program, and
- assessing the effectiveness of the *NORM Standard* and the written NORM Program.

Employees Responsibilities

Employees are responsible for

- understanding the requirements of the *NORM Standard* and the written NORM Program and performing work in accordance with those requirements
- notifying the PIC before conducting operations where NORM warning signs/labels are present
- making the Devon PIC aware of any problems encountered
- stopping any NORM activity which may be dangerous to safety, health, equipment and/or the environment, and
- following the instructions of the NORM RSO.

Contractor Responsibilities

Contractors are responsible for

- observing NORM warning signs and labels
- notifying the PIC before conducting operations where NORM warning signs/labels are present
- training their employees in the hazards and required personal protection relating to NORM exposure, and
- reporting any NORM related incidents or issues in accordance with Devon's *Incident Reporting and Investigation Standard*.

Specifically Licensed Contractor Responsibilities

Specifically Licensed Contractors are responsible for

- conducting work in compliance with the applicable agency NORM regulations and following standards/procedures that are at least as stringent as Devon's standards and procedures, and
- reporting any NORM-related incidents or issues in accordance with Devon's *Incident Reporting and Investigation Standard*.

Definition, Location and Production of NORM

Definition and Locations of NORM in Nature

NORM is any nuclide that is radioactive in its natural physical state (i.e., not man-made). NORM is common in the environment and occurs in

- soils
- water
- food, and
- air.

NORM Types of Concern in the Oil and Gas Industry

There are many different types of radioactive materials found in nature. The oil and gas industry is concerned with the following 4 particular types of NORM, which are the daughter products of Uranium-238 and Thorium-232:

- Radium-226
- Radium-228
- Thorium-228, and
- Radon-222.

Hydrocarbon bearing sandstone and limestone formations can contain the naturally occurring radioactive isotopes of uranium and thorium such as Uranium-238 and Thorium-232.

Uranium-238 and Thorium-232 each have their own unique decay schemes, passing through a number of radioactive transformations, which include

- radium
- radon, and
- thorium, until a stable or non-radioactive element is formed.

Production of NORM

NORM is

- not produced in significant amounts during drilling, and
- more a phenomenon associated with production and processing activities.

Generally, the longer the production, the greater the water production, and the greater the accumulation of NORM.

Prime candidates for high levels of NORM contamination are old oil and gas producing fields with

- higher water cuts
- mineralized saline water, and
- scaling problems.

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Definition, Location and Production of NORM, Continued

NORM Deposition

NORM may be deposited during oil and gas operations as barium sulfate/calcium scale, sediment, sludge, or other solid residue that collects on the internal surfaces of

- tubing
- casing
- pipes
- filters
- valves
- heater treaters
- generators
- reserve pits
- tank bottoms
- other production and processing equipment, and
- scale-contaminated soil around production wells and pipe-cleaning yards.

NORM Accumulation: Oil and Gas Production

During production of hydrocarbons the associated waters carry the radioactive isotopes to the surface where they can precipitate out of solution and build up in barium sulfate/calcium scale or sludge inside casing, pipes, tanks, processing equipment, and other equipment.

Radium is very soluble in the chloride rich brine fluids associated with most oil and gas production. If Uranium-238 and Thorium-232 are present in the formation, their daughter products, Radium-226 and Radium-228, will

- dissolve into the chloride rich brine waters
- follow the waters up the tubulars leading out of the formation, and
- follow the waters through the well head and into the production equipment.

NORM Accumulation: Gas Processing Activities

In gas processing activities, NORM generally occurs as radon gas (Radon-222) in the natural gas stream. Radon-222 decays to Lead-210, then to Bismuth-210, Polonium-210, and finally to stable Lead-206.

Radon decay elements occur as a film on the inner surface of inlet lines, treating units, pumps, tanks, valves, and other equipment associated with propylene, ethane, and propane processing streams.

Identification of NORM Hazards by Surveying and/or Sampling

Initial Surveying or Sampling

Initial surveying and/or sampling will be conducted at each Devon facility or location in a manner that provides a thorough assessment of where NORM hazards exist from material and property, including but not limited to

- equipment and/or soils at pipe/equipment storage areas
- vessels
- tubulars
- tanks, and
- any other equipment that has been in contact with produced gas or fluids.

Additional (Repeat) Surveying and Sampling

Conduct additional (repeat) surveying and, if necessary, sampling of material and property for all of the following events (where NORM is known to exist):

- prior to any transfer of equipment/tubulars to another operator, the general public, or a salvage firm
- prior to the movement or removal of equipment/tubulars from any facility or facility reclamation
- on equipment associated with production from a new geological formation
- prior to the cleaning or opening of equipment
- at facilities where pipe has been cleaned, and
- at facilities where NORM contaminated materials are known to have been spread, spilled or stockpiled.

Follow-up Surveying and Sampling

Conduct follow-up surveying and, if necessary, sampling 2 years after the initial survey on material and property that have NORM levels above 30 microR/hr, but below regulatory limits.

If the results of the follow-up survey indicate that NORM levels:

- have not increased from the initial survey, then the next follow-up survey will be conducted in 5 years.
- have increased, then the follow-up surveying frequency will be kept at 2 years.

Who Conducts Initial, Additional (Repeat), and Follow-up Surveying and Sampling

Equipment/tubular surveys for NORM shall be conducted by employees who have completed either the NORM Surveyor I training course or the NORM Surveying, Sampling, and Sample Shipping (NORM Surveyor II) training course.

Soil/waste surveys for NORM and NORM sampling shall be conducted by employees who have completed the NORM Surveying, Sampling, and Sample Shipping (NORM Surveyor II) training course.
Reference: For more information on the NORM Surveyor I and NORM Surveyor II training courses, refer to the Devon Training Catalog.

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Identification of NORM Hazards by Surveying and/or Sampling, Continued

State Specific Requirements

There are additional Louisiana State and Mississippi Oil and Gas Board requirements for NORM hazards identification.

Reference: For additional requirements on

- Louisiana, see Identification of NORM Hazards by Surveying and/or Sampling - Louisiana Requirements topic, or
- Mississippi, see Identification of NORM Hazards by Surveying and/or Sampling - Mississippi Requirements topic.

Identification of NORM Hazards by Surveying and/or Sampling - Louisiana Requirements

Confirmatory Initial Survey

Perform an initial confirmatory survey for each potentially contaminated site.

The confirmatory survey is a survey of potentially contaminated equipment, land, or sites in order to establish, with reasonable certainty, the absence or magnitude of NORM contamination.

Submitting Results of Confirmatory Surveys

Submit the results of all confirmatory surveys to your designated NORM RSO.

If the confirmatory survey shows the presence of NORM in excess of the levels specified in the NORM Exemption Limits topic, the NORM RSO shall file the following information with the Louisiana Department of Environmental Quality, Emergency and Radiological Services Division:

- *NORM Site Notification Form (Form RPD-36*), and
- the results of the confirmatory survey(s).

Reference: For more information, see
- the NORM Exemption Limits topic, and
- the *NORM Site Notification Form (Form RPD-36*) available on Access Devon.

Follow-up Confirmatory Surveys

Perform follow-up confirmatory surveys whenever activities at the site could result in a possible change in the regulatory status of the site, i.e. in the event of non-routine circumstances including, but not limited to

- equipment repairs
- equipment maintenance
- site maintenance, or
- accidents and spills that result in a release of production scales or sludges onto the surface.

Identification of NORM Hazards by Surveying and/or Sampling - Mississippi Requirements

Initial Surveys

Perform the initial surveys

- prior to the start of exploration/production operations, and
- again 2 years after the start of exploration/production operations.

Routine Surveys

After the initial survey of location sites, perform routine surveys as follows:

- every 5 years during exploration/production activities if the maximum exposure rate recorded in the last survey exceeds 50 microR/hr above background, or
- every 10 years if the maximum exposure rate is lower.

Additional Surveys

Perform surveys as necessary to evaluate radiological conditions in the event of non-routine circumstances including, but not limited to

- equipment repairs
- equipment maintenance
- site maintenance, and
- accidents and spills that result in release of production scales or sludges onto the surface.

Ground Surface Surveys

Report the maximum reading for each 1 m^2 (3 feet by 3 feet) ground surface survey location within a grid covering

- the well head
- tank battery site
- heater treater site, and
- all surface pipe areas and other areas of the location site where contamination is likely to occur.

Note: Elsewhere on the location site, report the maximum readings for each 10 m^2 (3 feet by 30 feet) grid area.

Survey Documentation

Document all surveys on *Mississippi Oil and Gas Board Form No. 21*, or on a form that contains equivalent information.

Reference: The *Mississippi Oil and Gas Board Form No. 21* is available on Access Devon.

Procedures for NORM Surveying and Sampling

Procedures for Surveying and Sampling

Procedures for NORM Surveying and Sampling are posted on Access Devon.

Topics Covered

Procedures for NORM Surveying and Sampling include the following topics:

- Survey instruments
- Pre- and post-operational testing of survey instruments
- General procedures for NORM Radiation Surveys
- Loose surface contamination surveys
- Equipment/tubular survey procedures
- Soil survey procedures
- Sampling of sludges, scales, and liquids, and
- Sampling of soils.

Instructions for Shipping NORM Samples and Interpreting Laboratory Results

Instructions for Shipping NORM Samples and Interpreting Laboratory Results

Instructions for Shipping NORM Samples and Interpreting Laboratory Results are posted on Access Devon.

Topics Covered

Instructions for Shipping NORM Samples and Interpreting Laboratory Results include the following topics:

- Shipping NORM Samples for Analysis
- Determining through laboratory results if NORM-contaminated material is exempt from NORM regulations, and
- Determining if Department of Transportation (DOT) will regulate NORM shipment as radioactive.

NORM Exemption Limits

Exempt Materials

The following products/materials are exempt from the requirements of the NORM regulations:

- natural gas and natural gas products
- crude oil and crude oil products, and
- produced water from oil and gas production if it is re-injected in a well approved by the agency having jurisdiction to regulate such discharge.

NORM Exemption Limits for All Devon Areas Except Louisiana and Mississippi

NORM contaminated materials, facilities, equipment, and/or soil might be exempted from the requirements of the NORM regulations based on the exemption limits specified in the table below.

Exemption Category	Radiation Exposure Rate/Activity Level
NORM Contaminated Equipment and Tubulars including: • all tubulars • wellheads • separators • tanks • condensers • heater-treaters • pumps • filters, or • any other related apparatus that have been in contact with produced gas or fluids associated with the oil and gas industry	50 microR/hr or less including background at any accessible point on the equipment **Notes**: • A piece of equipment or tubular at a site may exhibit an exposure rate below 50 microR/hr and be exempt. • Material removed from the equipment during cleaning operations (i.e. sludges and scales) may become non-exempt – see NORM Waste category below.
NORM Contaminated Waste including: • tank sludges • production sands • pipe scale • slurries, or • other wastes	• 30 picocuries/gram (pCi/g) or less of Radium-226 or Radium-228, or • 150 pCi/g or less of any other NORM radionuclide, provided that these concentrations are not exceeded at any time.
NORM Contaminated Soils including: • oilfield and gas properties • real estate, or • pits, etc.	• 30 pCi/g or less of Radium-226 or Radium-228, or • 150 pCi/g or less of any other NORM radionuclide Measurements are • Taken in layers of soil up to 15 cm deep, and • averaged over 100 m^2.

NORM Exemption Limits - Louisiana

NORM Exemption Limits for Louisiana

NORM contaminated materials, facilities, equipment, and/or soil might be exempted from the requirements of the Louisiana NORM regulations based on the exemption limits specified in the table below.

<table>
<tr><th>Exemption Category</th><th>Radiation Exposure Rate/Activity Level</th></tr>
<tr><td>NORM Contaminated Equipment and Tubulars including:

• all tubulars
• wellheads
• separators
• tanks
• condensers
• heater-treaters
• pumps
• filters, or
• any other related apparatus that have been in contact with produced gas or fluids associated with the oil and gas industry</td><td>50 microR/hr or less at any accessible point on the equipment.

Notes:
• A piece of equipment or tubular at a site may exhibit an exposure rate below 50 microR/hr and be exempt.
• Material removed from the equipment during cleaning operations (i.e. sludges and scales) may become non-exempt – see NORM Waste category below.</td></tr>
<tr><td>NORM Contaminated Waste including:

• tank sludges
• production sands
• pipe scale
• slurries, or
• other wastes</td><td>• 5 pCi/g or less of Radium-226 or Radium-228 above background, or
• 150 pCi/g or less of any other NORM radionuclide, provided that these concentrations are not exceeded at any time.</td></tr>
<tr><td>NORM Contaminated Soils including:

• oilfield and gas properties
• real estate, or
• pits, etc.</td><td>• No single noncomposited sample to exceed 60 pCi/g of Radium-226 or Radium-228, and
• activity levels averaged over any 100 m^2.

Activity level must meet 1 of the 2 measurement requirements below:
<table><tr><th>No.</th><th>Requirements</th></tr><tr><td>1</td><td>• 5 pCi/g or less of Radium-26 or Radium-228, above background, averaged over the first 15 cm depth, and
• 15 pCi/g above background, averaged over each subsequent 15 cm thick layer of soil.</td></tr><tr><td>2</td><td>• 30 pCi/g or less of Radium-226 or Radium-228, averaged over 15 cm deep layers, and
• no member of the public (continually present) could receive a total effective dose equivalent (TEDE) exceeding 100 millirem a year.</td></tr></table></td></tr>
</table>

NORM Exemption Limits - Mississippi

NORM Exemption Limits for Mississippi

NORM contaminated materials, facilities, equipment, and/or soil might be exempted from the requirements of the Mississippi NORM regulations based on the exemption levels specified in the table below.

<table>
<tr><th>Exemption Category</th><th>Radiation Exposure Rate/Activity Level</th></tr>
<tr><td>NORM Contaminated Equipment and Tubulars including:

• all tubulars
• wellheads
• separators
• tanks
• condensers
• heater-treaters
• pumps
• filters, or
• any other related apparatus that have been in contact with produced gas or fluids associated with the oil and gas industry</td><td>25 microR/hr or less above background at any accessible point on the equipment.

Notes:
• A piece of equipment or tubular at a site may exhibit an exposure rate below 25 microR/hr and be exempt.
• Material removed from the equipment during cleaning operations (i.e. sludges and scales) may become non-exempt – see NORM Waste category below.</td></tr>
<tr><td>NORM Contaminated Waste including:

• tank sludges
• production sands
• pipe scale
• slurries, or
• other wastes</td><td>Activity level must meet 1 of the 3 measurement requirements below:

<table><tr><th>No.</th><th>Requirements</th></tr><tr><td>1</td><td>• 30 pCi/g or less of Radium-226 or Radium-228, and
• the radon emanation rate is less than 20 pCi/m^2/sec or</td></tr><tr><td>2</td><td>• 5 pCi/g or less of Radium-226 or Radium-228, and
• the radon emanation rate is greater than 20 pCi/m^2/sec or</td></tr><tr><td>3</td><td>• 150 pCi/g or less of any other NORM radionuclide, and
• provided that these concentrations are not exceeded at any time.</td></tr></table></td></tr>
</table>

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NORM Exemption Limits - Mississippi, Continued

<table>
<tr><th>Exemption Category</th><th>Radiation Exposure Rate/Activity Level</th></tr>
<tr><td>NORM Contaminated Soils including:

• oilfield and gas properties
• real estate, or
• pits, etc.</td><td>Activity levels averaged over any 100 m^2 must meet 1 of the 2 measurement requirements below:

<table>
<tr><th>No.</th><th>Requirements</th></tr>
<tr><td>1</td><td>• 30 pCi/g or less of Radium-226 or Radium-228, averaged over the first 15-cm of soil below the surface, and
• the radon emanation rate is less than 20 $pCi/m^2/sec$.</td></tr>
<tr><td>2</td><td>• 5 pCi/g or less of Radium-226 or Radium-228 averaged over the first 15 cm depth, and
• 15 pCi/g, averaged over each subsequent 15 cm thick layer of soil, and
• the radon emanation rate is greater than 20 $pCi/m^2/sec$.</td></tr>
</table>

Additional Mississippi Oil and Gas Board requirements:
• There should be no exposure rate readings greater than 50 microR/hr above background on the surface of the land.
• If 5 boreholes per acre (minimum of 3 per site) are drilled at least 1 m deep, the exposure rate readings in the boreholes should be less than 200 microR/hr.</td></tr>
</table>

General License Requirements

General License Requirements

In the United States, coverage under a general license is required by some states to mine, extract, receive, possess, own, use, process, and transfer NORM not exempt in the NORM Exemption Limits topic without regard to quantity.

Important: A general license does not authorize the manufacturing or distribution of products containing NORM that are not exempt in the NORM Exemption Limits topic.

Devon Operation States with General License Requirements

Currently, there are 4 states in which Devon operates that have general license requirements. They are

- Louisiana
- Texas
- New Mexico, and
- Misssissippi.

Louisiana General License Requirements

Louisiana general license requirements include

- Once a site contaminated with NORM in excess of the levels specified in the topic titled NORM Exemption Limits – Louisiana is identified, the operator shall file the *NORM Site Notification Form (Form RPD-36*) and the results of the confirmatory survey with the Louisiana Department of Environmental Quality, Emergency and Radiological Services Division.
- The operator is assigned a NORM general license number. NORM contaminated sites can be registered individually or by field in the case of well sites. Each NORM site is assigned a unique ID number. The general license will remain in effect for the operator until all registered NORM sites have been either released for unrestricted use or transferred to another operator. An application fee and an annual maintenance fee are required according to the fee payment schedule provided in LAC 33: XV.2599 (Appendix A).
- Compliance with the requirements of the general license is established by following this Implementation Plan.

Reference: For more information, see

- the Identification of NORM Hazards by Surveying and/or Sampling – Louisiana Requirements topic, and
- the *NORM Site Notification Form (Form RPD-36*) available on Access Devon.

Texas, New Mexico, and Mississippi General License Requirements

In Texas, New Mexico, and Mississippi, the general license is issued by rule, and coverage under a general license is automatic once the operator has identified the presence of NORM in excess of the levels specified in the topics titled NORM Exemption Limits (TX & NM) and NORM Exemption Limits – Mississippi (MS). Compliance with the requirements of the general license is established by following this Implementation Plan.

Warning Signage and Labeling Requirements

General Requirements

Equipment/tubulars and facilities contaminated with NORM in excess of the levels specified in the topic titled NORM Exemption Limits shall be identified

- with a clearly visible waterproof sign as follows:
  - yellow and black stating "Caution NORM (Naturally Occurring Radioactive Material) Is Present", or
  - orange and black stating "Warning Contains NORM (Naturally Occurring Radioactive Material)" or
- by marking the letters "NORM" legibly with a waterproof paint or ink.

For an interconnected equipment system such as wellhead, flow line, or facility piping system, identify the system as a whole with a sign described above.

Labeling for Groups of Equipment

Groups of equipment/tubulars, some of which are NORM contaminated, that are kept in a common container, stack, or are wrapped, bound or tied securely together should be tagged or marked with a sign described above.

Rational: Provides notice that any piece of equipment in the group may be NORM-contaminated.

Protection of Employees, Contractors, and the Environment

NORM Exposure in Oil and Gas Operations

In oil and gas operations, most of the NORM that workers or the general public can be exposed to resides inside of closed steel vessels and piping. This metal shielding greatly reduces the exposure hazard.

The quantity of materials affected by NORM at any given work location is generally small and the external radiation levels are low. Many facilities will have no detectable NORM accumulation.

When NORM Exposure Is Greater

Radiation exposure to workers and the public is greater when production/processing equipment, lines, manifolds and tubing are disassembled for repairs or for the removal of scale and/or sludge.

Impacts to land surfaces can occur at pipe cleaning yards, storage yards, or in pits where scale and sludges have been disposed.

External Exposure to NORM

External exposure to NORM occurs when gamma radiation from surrounding equipment strikes the body. The amount of gamma radiation able to penetrate processing equipment is generally not large enough to present a health risk to employees on existing Devon sites.

Internal Exposure to NORM

Internal exposure to NORM occurs when contaminated dusts caused by grinding, polishing, and cutting operations, or sludge are inhaled or ingested.

The table below describes how internal NORM exposure can occur.

Internal Exposure to NORM	Description
Inhalation	Breathing in through the nose and mouth resulting in NORM particulates being taken into the lungs.
Ingestion	Taken in through the mouth resulting in NORM particulates being taken into the digestive tract.
Open cuts or wounds	Allows NORM particulates to enter the bloodstream.

Inhalation and ingestion are the primary means of employee exposure to NORM in oil and gas operations.

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Protection of Employees, Contractors, and the Environment,
Continued

Methods to Reduce NORM Exposure

In order to reduce exposure to NORM, use a combination of some or all of the following methods:

- the As Low As Reasonably Achievable (ALARA) concept
- personal protective equipment
- written NORM worker protection procedures, and
- personnel training.

The ALARA Concept

Devon employees and contractors will practice the concept of reducing exposure to a level As Low As Reasonably Achievable (ALARA) when working around NORM contaminated equipment and facilities. This is accomplished by

- limiting the amount of time spent in an area of known NORM contamination
- working at the maximum possible distance from NORM
- using shielding to contain NORM materials, and
- wearing personal protective equipment when handling NORM contaminated equipment/tubulars and/or NORM waste.

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Protection of Employees, Contractors, and the Environment,
Continued

Caution Sign Posting Requirements

The table below describes the caution sign posting requirements for designated areas.

Caution Sign	Posting Requirements for Designated Areas
Restricted Area	Accessible areas with exposure rates • greater than 2000 microR/hr, or • areas where a member of the public could receive a total effective dose (TEDE) greater than 0.1 rem/year, exclusive of background and medically administered radiation or radioisotopes.
Radiation Area	Areas with greater than 5000 microR/hr 30 cm (1 foot) from the source of radiation.
High Radiation Area	Areas with greater than 100000 microR/hr 30 cm (1 foot) from the source of radiation.
Radioactive Material Area	Areas where greater than 1 microcuri (mCi) of Ra-226 is stored. **Reference**: For more information, see Calculations for Radioactive Material Area below.
Airborne Radioactivity Area	Areas where 1 Derived Air Concentration (DAC) value is exceeded. **Reference**: For more information, see Regulatory DAC Values below.

Calculations for Radioactive Material Area

A total of 1 mCi of Radium-226 can be exceeded by having 440 pounds of material contaminated at 5 pCi/g, or by having 73 pounds of material contaminated at 30 pCi/g.

The calculations used to estimate the volume values are given below. It is a responsibility of the NORM RSO to make a determination of whether an area meets a "radioactive material area" posting requirement.

$$\frac{1\ \text{mCi}}{5\text{pCi/g} * 454\ \text{g/lb} * 0.000001\ \text{mCi/pCi}} = 440\ \text{pounds}$$

$$\frac{1\ \text{mCi}}{30\text{pCi/g} * 454\ \text{g/lb} * 0.000001\ \text{mCi/pCi}} = 73\ \text{pounds}$$

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Protection of Employees, Contractors, and the Environment,
Continued

Regulatory Derived Air Concentration (DAC) Values

The regulatory DAC value for

- Radium-226 is $3*10^{-10}$ mCi/mL, and
- Radium-228 in air is $5*10^{-10}$ mCi/mL.

Determine whether 1 DAC value is exceeded by

- taking an air sample in the area, and
- performing a laboratory analysis of that air sample.

Additional Caution Sign Posting Requirements for Mississippi

Additional requirements from the Mississippi Oil and Gas Board for access to exploration/production sites in accessible locations are summarized in the table below.

If exposure rate above background exceeds …	Then …
250 microR/hr	post Caution Signs at the perimeter of the property visible from all accessible locations.
700 microR/hr	• fence the immediate area with a 5 feet high field fence or chain link fence located to restrict maximum exposure rates to 250 microR/hr above background, and • post Caution Signs on the fence.
5,000 microR/hr	• fence the immediate area with a 5 feet high field fence or chain link fence, and • post Caution Signs • on the fence, and • at the location(s) where the 5,000 microR/hr is exceeded.

Mississippi Caution Sign Wording

According to the Mississippi Oil and Gas Board, caution signs shall have the words

- **"**Caution – N.O.R.M. – Potential Health Risk**"** on the upper panel in 3 inch upper-case yellow letters on a black background, and
- **"**No Trespassing – Authorized Personnel Only**"** on the lower panel in 2 inch upper-case black letters on a yellow background.

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Protection of Employees, Contractors, and the Environment,
Continued

General Surveys

General surveys are conducted to evaluate incidents that can result in worker exposure.

A NORM RSO will perform general surveys as necessary to evaluate
- radiation levels
- concentrations or quantities of radioactive material, and
- the potential radiological hazards that could be present.

Minimum Personal Protective Equipment (PPE) Requirements

The table below describes minimum personal protective equipment requirements.

Item	Requirement
1	Wear gloves, in addition to mandatory PPE (i.e. hard hat, safety glasses with side shields, and steel toed boots) when performing NORM survey, sampling or routine maintenance work.
2	If through the course of your task you are expected to get some NORM contamination on your clothing or boots, wear disposable Tyvek® clothing coveralls and boot covers.
3	Contact the designated NORM RSO if questions about PPE arise.
4	Use the minimum PPE requirements provided above to fill out a *PPE Hazard Assessment Form.*

Selecting PPE

When selecting PPE before entering an area, consider the following aspects of the clothing and the job:

Feature	Consideration
Fit	Protective clothing should be comfortable and provide sufficient mobility.
Condition	Inspect each article for holes, torn seams, broken zippers, etc. If defects are found, discard the article and select another.
Nature of work	When selecting gloves, be sure the style is suitable for the type of work being performed. **Example**: If heavy, rough work is to be done, place work gloves over the latex gloves.

Minimizing NORM Environmental Impacts

To prevent contamination of the soil or other equipment
- seal out-of-service and/or stored NORM contaminated equipment in plastic, or close all fittings to prevent NORM dust or scale from collecting on soil, and
- place plastic covers on the ground or use containers when opening NORM contaminated equipment to contain any material which may be deposited on the ground.

Written NORM Worker Protection Procedures

Who Performs Routine Maintenance Work

Routine maintenance work includes tasks where the risk of significant NORM exposure is low and/or the creation of airborne NORM is avoidable.

Any Devon employee performing routine maintenance work on equipment/tubulars and facilities contaminated with NORM above the exemption limits must be trained on and follow the written NORM Worker Protection Procedures.

Any contractor performing routine maintenance work on equipment/tubulars and facilities contaminated with NORM above the exemption limits must be trained on the NORM Worker Protection Procedures appropriate for the tasks they are performing.

Reference: For more information, see the written NORM Worker Protection Procedures sub-section below.

Louisiana On-site Maintenance Requirements

In Louisiana, general licensees are authorized to perform on-site maintenance work if the maximum radiation level does not exceed 2000 microR/hr at any accessible point in the work area.

If this radiation level is exceeded, a specifically licensed contractor recognized by the appropriate certifying State authorities and approved by a NORM RSO shall conduct the work.

Written NORM Worker Protection Procedures

Follow written NORM Worker Protection Procedures whenever performing routine maintenance work on equipment/tubulars and facilities contaminated with NORM above the exemption limits.

NORM Worker Protection Procedures should be developed as a separate stand-alone document so that it can be made available upon request by employees or representatives of the state regulatory agency. These procedures should apply to the work that is being performed.

In Louisiana and Mississippi States, submit written NORM Worker Protection Procedures for approval to the appropriate state regulatory agencies.

References: For more information, see

- sample NORM Worker Protection Procedures posted on Access Devon, and **Note:** It is recommended that these be modified for specific facilities or maintenance tasks.
- the Training Requirements topic for information on the NORM Worker Protection Procedures training course.

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Written NORM Worker Protection Procedures, Continued

Who Performs Non-Routine Work

Non-routine work includes tasks where the risk of significant NORM exposure is high and/or the creation of airborne NORM is unavoidable.

Only use specifically licensed contractors for non-routine work on equipment/tubulars contaminated with NORM above the exemption limits.

Examples of this type of work on equipment/tubulars contaminated with NORM above the exemption limits include but are not limited to

- vessel or tank entry
- sludge and scale handling or removal
- equipment decontamination, or
- any work activity where NORM inhalation is unavoidable.

Questions on Who Should Perform Work

Contact your designated NORM RSO if you have any questions about whether work should be performed by a specifically licensed contractor.

Communication of NORM Hazards to Employees and Contractors

Employee Notification

In Devon Operation states that have requirements for obtaining a general license (LA, MS, NM, and TX), current copies of the following materials must be posted in the local field office where NORM exists:

- Notice to Employees**,** a state-specific form.
  Reference: State-specific "Notice to Employees" forms are available on Access Devon.
  Examples:
  - *Louisiana Form DRC-3*
  - *Texas BRC Form 203-1*
- A notice that states where the following documents may be examined
  - all applicable federal and state regulations
  - the license, conditions or documents incorporated into the license by reference and amendments thereto, and
  - the operating procedures applicable to work under the license.
- Any notice of violation involving
  - radiological working conditions
  - proposed imposition of penalty or order issued, and
  - any response from the licensee.

Posting Notices

Notices and/or forms specified above should be

- posted in sufficient number of places to permit employees to observe them on the way to or from any particular work location to which the document applies
- conspicuous, and
- replaced if defaced or altered.

Contractor Notification

The Devon PIC will provide a notification of the potential NORM hazards to any contractor working at a facility with equipment/tubulars contaminated with NORM above the exemption limits using one of the following:

- Pre-Job Safety Meeting
- contractor orientation
- work permit, or
- equivalent.

Locations of NORM hazards are identified through labeling and caution signage.

Reference: For more information, see the Warning Signage and Labeling Requirements topic.

Storage Requirements for Non-Exempt NORM and NORM Waste

NORM Waste Storage Requirements

NORM waste storage requirements include

- Only storing NORM and NORM waste in designated areas.
  - Stack containers of NORM waste in such a fashion that each container identification label can be read from the access aisle or area.
    Note: Requirements for labeling NORM containers are given below.
  - Storage of NORM waste in piles is prohibited.
- Keeping NORM and NORM waste in a container that is in good condition.
- NORM waste containers
  - should be made of, or lined with, materials that will not react with, or be incompatible with the NORM waste
  - stored so that the ability of the container to contain the waste is not impaired or compromised
    Example: Corrosive NORM waste should be stored in plastic containers rather than metal containers.
  - shall always be closed and sealed during storage, except when it is necessary to add or remove waste, and
  - should not be opened, handled, or stored in a manner that may rupture the container or cause it to leak.

NORM Waste Container Inspection

At least quarterly, inspect the areas where containers of NORM waste are stored.

Develop a schedule and procedure for assessing the condition of each tank containing NORM waste. The schedule and procedure must be adequate to detect cracks, leaks, corrosion, and erosion that may lead to cracks, leaks, or wall thinning.

Record these inspections and keep the records on file.

Container Labeling Requirements

All containers with non-exempt NORM waste should have a durable, clearly visible label bearing the radiation symbol and the words

- CAUTION, RADIOACTIVE MATERIAL, or
- DANGER, RADIOACTIVE MATERIAL.

The label should also provide the following information:

- the radionuclides present if known
  Examples: Radium-226, Radium-228, etc.
- an estimate of the quantity of radioactivity in picocuries/gram
- the date of estimated activity
- radiation levels in microR/hr, and
- types of material stored.
  Examples: Sludge, scale, liquid, soil, etc.

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Storage Requirements for Non-Exempt NORM and NORM Waste, Continued

Removal of Radioactive Material Label

Prior to removal or disposal of empty uncontaminated containers to unrestricted areas, the radioactive material label should be

- removed or defaced, or
- otherwise clearly indicated that the container no longer contains radioactive materials.

Exemptions to Labeling Requirements

The following containers are NOT required to be labeled as described above:

- containers holding very small quantities of NORM waste, and
  Example: Sample containers
- containers holding NORM waste when they are in transport and packaged and labeled in accordance with the regulations of the U.S. Department of Transportation (DOT).

Storage Limits

Non-exempt NORM should not be stored on Devon locations for longer than 1 year. Transfer all containers holding non-exempt NORM to an authorized facility as soon as possible for

- treatment
- storage, or
- disposal.

References: For more information, see the following topics:

- Transfer of Non-Exempt NORM Waste for Treatment/Disposal
- Storage Requirements for Non-Exempt NORM and NORM Waste - Additional Louisiana Storage Limit Requirements, and
- Storage Requirements for Non-Exempt NORM and NORM Waste - Additional New Mexico Storage Limit Requirements.

Storage Requirements for Non-Exempt NORM and NORM Waste - Additional Louisiana Storage Limit Requirements

90 Day Storage Limit

A general licensee is authorized to store non-exempt NORM waste in a container for 90 days from the date of generation. After such time, the NORM waste must be transferred to an authorized facility for purposes of treatment, storage, or disposal.

For more information, see the following topics:
- General License Requirement, and
- Transfer of Non-Exempt NORM Waste for Treatment/Disposal.

Post Financial Security for Storage Over 90 Days

If storing non-exempt NORM or NORM waste for greater than 90 days, post financial security with the Louisiana Department of Environmental Quality to ensure the protection of the public health and safety and the environment in the event of

- abandonment
- default, or
- other inability or unwillingness of the licensee to meet the requirements.

Financial Security

Financial security shall name the Louisiana Department of Environmental Quality as beneficiary with

- a bond issued by a fidelity or surety company authorized to do business in Louisiana
- a personal bond secured by such collateral as the department deems satisfactory
- a cash bond
- a liability endorsement, or
- a letter of credit.

The value of the financial security instrument

- shall be equal to or greater than the amount of the security required
- must be available in Louisiana and be continuous for the term of the license, and
- be an amount based upon a department-approved cost estimates plan for decontamination, decommissioning, restoration, and reclamation of buildings, equipment, and the site to levels that would allow unrestricted use.

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Storage Requirements for Non-Exempt NORM and NORM Waste - Additional Louisiana Storage Limit Requirements, Continued

Storing NORM Waste Up to 365 Days

To store NORM waste in a container for up to 365 days from generation, a general licensee must

- submit a written NORM waste management plan to the Office of Environmental Compliance, Emergency and Radiological Services Division, and
- receive authorization from the Louisiana Department of Environmental Quality.

The general licensee may store NORM waste in containers up to 365 days from generation under the written NORM waste management plan while waiting for department determination.

Surface Equipment Decontamination

Surface equipment that has been removed from service and is not employed for its designated function, excluding wellheads, shall be decontaminated within 1 year from the date the equipment was removed from service.

This requirement does not apply to equipment that remains subsurface, such as pipelines, and is associated with production wells or injection wells classified as having future utility.

Storage Requirements for Non-Exempt NORM and NORM Waste - Additional New Mexico Storage Limit Requirements

Storage Over 1 Year

Storage of non-exempt NORM for longer than 1 year must be under a specific license unless the New Mexico Environmental Department grants an extension of a general license.

Reference: For more information, see the General License Requirements topic.

Extension of a General License

An extension of a general license

- must be requested by the general licensee on an annual basis, and
- may be granted by the New Mexico Environmental Department on an annual basis, not to exceed 10 years of storage under a general license.

In granting the extension of a general license for storage of non-exempt NORM, the Department must certify that the licensee has valid reasons why the non-exempt NORM under his or her ownership will not be disposed within the next year.

Factors the Department will consider in determining whether the licensee has valid reasons of receiving an extension include, but are not limited to

- the volume and radioactivity of non-exempt NORM, and/or
- location of the storage facility and its proximity to populated areas or sensitive environments.

Transfer of Non-Exempt NORM from Devon to Another Oil and Gas Operator

Requirements

The transfer of non-exempt NORM from Devon to another oil and gas operator is allowed provided that

- the NORM-contaminated equipment and facilities are to be used by the recipient for the same purpose or at the same site.

The Devon PIC is responsible for

- contacting Material Control within the Procurement Department to conduct a sale transaction
- assessing the extent of NORM contamination or material present
- evaluating the NORM hazards
- informing the owner receiving the NORM of these assessments and evaluations
- maintaining records required prior to and up to the time of documented transfers, and
- ensuring legal review of any bill of sale or other agreement documenting a sale transaction.

Transfer of Non-Exempt NORM Waste for Treatment/Disposal

General Requirements

Non-exempt NORM waste will be managed and disposed in accordance with applicable state and federal regulatory requirements by transfer of the wastes for disposal to a land disposal facility licensed by

- the state regulatory department/agency
- the U.S. Nuclear Regulatory Commission
- an agreement state
- a licensing state, or
- alternative methods authorized by the state regulatory department/agency

Who Can Receive Non-exempt NORM

Transfers of waste containing NORM for treatment/disposal shall be made only to persons **specifically licensed to receive waste containing NORM.**

It is the responsibility of the transferor to ensure that the recipient possesses specific authorization prior to transfer.

Records of Transfers

Maintain records of transfers for treatment/decontamination/disposal for state regulatory agency inspection. Records of transfers include but are not limited to manifests, acceptance confirmation letters, and material transfer reports.

Louisiana Requirements:

- A written confirmation of the acceptability of the NORM or NORM waste shall be obtained from the operation of the specifically licensed commercial treatment/decontamination/disposal facility before initiating a shipment.
- Each shipment of non-exempt NORM to a facility specifically licensed for treatment/decontamination/disposal shall be accompanied by a manifest.
- The *Louisiana NORM Waste Manifest (RPD-37)* form is available on Access Devon. Provide each transporter, the operator of the designated treatment/decontamination/disposal facility with one copy of the manifest each for their records and retain one copy of the manifest for Devon records.
- Shipments to a non-hazardous oilfield waste (NOW) commercial facility shall be accompanied by a nonhazardous oilfield waste shipping control ticket (manifest) that can be obtained from the Louisiana Department of Environmental Quality.

Mississippi Requirements:

- A Radioactive Waste Transport Permit shall be purchased from the Mississippi Emergency Management Agency (MEMA) before shipping NORM into, within, or through the state. An application for a permit together with the necessary fee shall be submitted to MEMA at least 30 days before the shipment.
- MEMA should be notified in writing at least 7 days before the transport of a shipment within or through the state of Mississippi.

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Transfer of Non-Exempt NORM Waste for Treatment/Disposal,
Continued

Additional Disposal Options in Louisiana

The table below describes disposal options for **non-hazardous oilfield waste** in Louisiana.

If NORM concentrations ...	**Then non-hazardous oilfield waste can be transferred for ...**
do not exceed 30 pCi/g of Radium-226 or Radium-228	disposal to a non-hazardous oilfield waste (NOW) commercial facility regulated by the Department of Natural Resources for treatment if the following conditions are met: • dilution in the end product after treatment does not exceed 5 pCi/g above background of Radium-226 or Radium-228 • the non-hazardous oilfield waste commercial facility has a program for screening incoming shipments to ensure that the 30 pCi/g limit of Radium-226 or Radium-228 is not exceeded, and • the Department of Natural Resources approves.
exceed 5 pCi/g of Radium-226 or Radium-228 above background, but does not exceed 200 pCi/g of Radium-226 or Radium-228 and daughter product	treatment at non-hazardous oilfield waste (NOW) commercial facilities specifically licensed by Louisiana Department of Environmental Quality for such purposes.

Decontamination of NORM Contaminated Material and Property

Purpose of Decontamination	In order to meet the criteria for release for unrestricted use, the decontamination should be performed to reduce the radiation levels below the exemption limits specified in the NORM Exemption Limits topic.
Who Performs Decontamination	The decontamination of NORM contaminated facilities, sites, or equipment/tubulars shall only be performed by persons **specifically licensed** by • the U.S. Nuclear Regulatory Commission • the state where the decontamination work is being performed • another agreement state • another licensing state, or • otherwise authorized by the appropriate regulatory department/agency.
Additional Louisiana State Requirements	Unless otherwise directed in writing by the Louisiana Department of Environmental Quality, in order to release property for unrestricted use, a licensee shall submit **a plan for the decontamination** to the Office of Environmental Compliance, Emergency and Radiological Services Division, for approval. Upon approval, the licensee shall implement the plan in accordance with such approval. Should decontamination activities involve construction that may impact the ground to a depth greater than 3 feet, prior approval by the Office of Environmental Compliance, Emergency and Radiological Services Division must be obtained.
Records of Transfers for Decontamination	Maintain records of transfers for decontamination for state regulatory agency inspection. **Reference:** For additional Louisiana and Mississippi requirements on records of transfers, see the Transfer of Non-Exempt Waste for Treatment/Disposal topic.

Selection of Specifically Licensed NORM Contractors

NORM RSO Responsibility	The NORM RSO is responsible for providing a list of specifically licensed contractors (or similarly qualified if no regulatory licensing required) for the shipment, decontamination, treatment, storage, and/or disposal of NORM contaminated material and property to the PIC.
PIC Responsibility	The PIC is responsible for selecting contractors that are specifically licensed (or similarly qualified if no regulatory licensing required) for the shipment, decontamination, treatment, storage, and/or disposal of NORM contaminated material and property from the list provided by the NORM RSO.

Criteria for Release of NORM Contaminated Material and Property

Criteria for Equipment/ Tubulars

Before releasing any equipment or tubulars to the public, the following actions must be taken:

- conduct an equipment/tubular radiation survey to ensure that radiation exposure rates at a distance of ½ inch from the equipment/tubular surface are less than those specified in the NORM Exemption Limits topic
- conduct a loose surface contamination survey to ensure that the loose surface contamination level on accessible surfaces of equipment or tubular does not exceed 1000 dpm/100cm^2, and
- document the survey results using one of the following forms available on Access Devon:
  - *Equipment NORM Survey Form*
  - *Casing/Tubing NORM Survey Form*

Reference: For more information, see Procedures for NORM Surveying and Sampling on Access Devon.

Criteria for Land

Land/soil can be released to the public if it contains NORM at activity levels less than the limits specified for NORM Soils in the NORM Exemption Limits topic.

Criteria for Rinse and Wash Water

NORM contaminated rinse and wash water **cannot** be released to the environment with Radium-226 or Radium-228 activity levels exceeding 60 pCi/l.

Important: NORM regulations do **not** apply to produced waters.

Training Requirements

NORM Training Program

A NORM training program will be implemented for Devon employees who are affected by the *NORM Standard*. There are 5 courses available depending on the employee's involvement with NORM.

The 5 NORM training courses include

- NORM Awareness
  - Required for any Devon employee that works at a Devon site and/or facility where NORM is present.
- NORM Worker Protection Procedures
  - Required for any Devon employee who will be performing routine maintenance work on NORM labeled (i.e. contaminated with NORM above the exemption limits) equipment/tubulars and facilities.
- NORM Surveyor I,
  - Required for any Devon employee who will conduct equipment/tubular surveys for NORM contamination at a Devon site and/or facility. This training does NOT include surveying for loose surface contamination, surveying soils, NORM sampling, or shipping of NORM samples for laboratory analysis.
- NORM Surveying, Sampling, and Sample Shipping, and
  Note: Also referred to as NORM Surveyor II.
  - Required for any Devon employee who will survey for NORM contamination at a Devon site and/or facility, perform NORM sampling, and/or conduct shipping of NORM samples for laboratory analysis.
- NORM Radiation Safety Officer.
  - Required for any Devon employee who will be performing the duties of NORM Radiation Safety Officer.

The training program will be implemented in accordance with the curriculum for the NORM training courses provided in the Devon Training Catalog.

Training Requirement

Depending on the job tasks employees perform, they should successfully complete 1 or more of the NORM training courses listed above.

Recordkeeping

Location of Records

The local field office keeps NORM records.

Record Retention Schedule

Use the table below for the record retention schedule.

Type of Record	Retention Period	Record Class Code
Provisions of the NORM Implementation Plan	EVT + 6 years (EVT = termination or cancellation of a general license)	EH60
Audits and other reviews of the NORM Implementation Plan content and implementation	CY + 5 years (CY = current year)	EH20
NORM surveys	EVT + 30 years (EVT = superseded or discontinued)	EH47
Survey instruments calibration	EVT + 30 years (EVT = superseded or discontinued)	EH47
Survey results to determine the dose from external sources of radiation in the assessment of individual dose equivalent	EVT + 30 years (EVT = termination of employment)	EH49
Measurement results and calculations • used to determine individual intakes of radioactive material, and • used in the assessment of internal dose	EVT + 30 years (EVT = termination of employment)	EH49
Air sampling and bioassays	EVT + 30 years (EVT = termination of employment)	EH49
Measurement results and calculations used to evaluate the release of radioactive effluents to the environment	EVT + 30 years (EVT = termination of employment)	EH49
Training records	EVT + 5 years (EVT (for training programs) = training program is superseded or is no longer in effect) (EVT (for training attendance and certification) = termination of employment)	EH90 & HR80
Records of transfers for treatment/decontamination/disposal	EVT + 30 years (EVT = substance no longer present at site)	EH40

Terms and Definitions

Accessible Point	An external location on a piece of equipment or place in a facility where NORM may be present.
Activity Level	A level in picocuries/gram determined by collecting a sample and sending it to a radiological laboratory for analysis.
Agreement State	A state that has entered into an agreement with the U.S. Nuclear Regulatory Commission under subsection 274b of the Atomic Energy Act of 1954, as amended (68 Stat. 919), to assume responsibility for regulating within its borders byproduct, source, or special nuclear material in quantities not sufficient to form a critical mass.
Confirmatory Survey	A survey of potentially contaminated land, equipment, or sites in order to establish, with reasonable certainty, the absence or magnitude of NORM contamination.
Contamination Survey	A use of swipes or direct instrument surveys to identify and quantify radioactive material on equipment or on personnel.
Counts per minute (Cpm)	A number of radioactive decays per minute detected by an instrument.
Date of Generation	A date of the first addition of waste into the container.
Decontamination	A cleaning process of removing NORM contaminants from equipment/tubulars or facilities to reduce levels of radiation.
Disintegration per minute (Dpm)	A number of radioactive decays per minute taking place within the material.

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Terms and Definitions, Continued

General License	A license issued to mine, extract, receive, possess, own, use, process, and transfer NORM not exempt in the NORM Exemption Limits topic without regard to quantity.
Microroentgen / hour (MicroR/hr)	A unit of gamma exposure rate used when measuring gamma radiation exposure rate associated with NORM contaminated equipment with a scintillation instrument.
Millirem (mR)	A unit of radiation dose.
Non-Routine Work	A task where the risk of significant NORM exposure is high and/or the creation of airborne NORM is unavoidable.
Naturally Occurring Radioactive Material (NORM)	A nuclide that is radioactive in its natural physical state (i.e., not man-made), but not including source, byproduct, or special nuclear material.
Picocuries/ gram (pCi/g)	A unit of activity level of material determined by taking a material sample and sending it for analysis to a radiological laboratory.
Pile	A non-containerized accumulation of solid, non-flowing NORM waste.
Radiation Exposure Rate	A measurement in microR/hr determined by using a scintillation instrument such as the Ludlum Model 2241 digital survey meter with a Ludlum 44-2 scintillation probe.
Radiation Survey	A measurement with a scintillation instrument to evaluate and assess the presence of radioactive materials or other sources of radiation.

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Terms and Definitions, Continued

Release Criterion	A level of activity, exposure rate, or surface count rate, below which equipment/tubular, materials, or land areas can be released for unrestricted use.
Routine Maintenance Work	A task where the risk of significant NORM exposure is low and/or the creation of airborne NORM is avoidable.
Total Effective Dose Equivalent (TEDE)	A sum of the deep dose equivalent for external exposures plus the committed effective dose equivalent for internal exposures, generally expressed in units of millirem.
Unrestricted Use	A use that does not have controls in place to protect an individual member of the public from exposure to radiation or radioactive material.