

	<b>NORM MANAGEMENT</b> ALL-A0A-00-000-HST-0029	<b>Retention Code:</b> <i>CG01 - CA</i>
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## Document History

Date	Approved by	Change Summary
June 2020	David Reaich	Usability Mapped – Issued for Use

## About the Procedure

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### Purpose

The purpose of this procedure is to minimize exposure to radiation from Naturally Occurring Radioactive Materials (NORM) and to assist ConocoPhillips operations and facilities in complying with applicable legislation.

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# 1. About NORM

## Where can NORM be present

NORM can be present in various process streams and locations, including:

Process Streams	Other Locations
<ul style="list-style-type: none"> <li>Produced water, crude oil/emulsion, and natural gas</li> <li>Gas and oil transmission lines</li> <li>Gathering and processing facilities</li> <li>Ethane systems</li> </ul>	<ul style="list-style-type: none"> <li>Well bore perforations</li> <li>Well tubulars</li> <li>Wellheads</li> <li>Downhole pumps</li> <li>Propane pumps and bullets</li> <li>Barium and/or strontium scales or sludges</li> </ul>

Process changes can affect NORM deposition rates. Any conditions causing entrained materials to precipitate out can cause NORM deposition such as:

- Changes in flow direction
- Changes in pressure constrictions
- Well casing leakage allowing contamination from formation water
- Where fractionation of natural gas occurs. NORM can concentrate in the propane-rich and ethane-rich streams.

NORM deposits may vary from well to well and from week to week. The following may lead to an increase in Norm deposition:

- Enhanced oil recovery techniques
- The addition of new production wells
- Accepting third party production
- Changing chemical additives.

## NORM Radiation Types

There are three types of NORM radiation:

- Alpha
- Beta
- Gamma.



**CAUTION:** All three types of radiation can cause human tissue damage and present an increased risk of cancer.

NORM radiation risk concerns

Dangerous human exposure is not expected when NORM is inside closed process systems. When equipment is opened for cleaning or maintenance, however, exposure to NORM may occur if it presents as a dust, sludge or friable scale.



**CAUTION:** Ingesting NORM presents the greatest risk of exposure.

## 2. NORM Measurement

### Types of NORM monitoring

Types of NORM monitoring include:

- Alpha/beta measurement inside equipment
- Personal dosimetry
- Airborne NORM dust exposure monitoring

### NORM measurement procedures

Follow the below procedure to measure NORM:

Step	Action
1.	Determine the background reading for the location. This can vary and may affect measurements.
2.	Use gamma readings on the outside of equipment to determine possible presence of NORM. It is an approximate measurement designed only to locate NORM.
3.	Readings of twice background or more indicate NORM. Further measurements and possibly sampling for laboratory analysis may be required to better determine the risk level and need for additional precautions.
4.	If NORM has been detected at the site, complete internal pancake probe measurements when the equipment is next opened (e.g., at turnaround). If possible, also collect scale or sludge samples and submit them to an approved laboratory for gamma spectroscopy analysis
5.	Provide measurement results to your HS Coordinator.

For entry into confined spaces when NORM is suspected:

- Comply with Confined Space Entry Code of Practice
- Take gamma radiation measurements inside the confined space when safe to do so
- Minimize time inside the confined space
- Consider specialized contractor for entry/cleaning when NORM has been identified
- Contact HS Coordinator for historical NORM sampling results

### 3. NORM Classification

**External Gamma Measurements**

Where external gamma measurement readings measure twice the background count and above, proceed to complete further analysis (i.e. internal measurement) when the equipment is next opened (e.g. outages)

**Internal Measurements**

Internal measurements classifications as follows:

Measurement (Counts per Minute)	Classification
Less than twice the background	Non-restricted, no requirements
Less than 200 CPM	No action required to protect workers
200 – 1500 CPM	NORM is present, use protection
Above 1500 CPM	Probably radioactive, requires further assessment and is subject to TDG Regulations

## 4. Minimizing Exposure to NORM

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### General precautions

General precautions for minimizing exposure to NORM include:

- Minimize time spent in area.
- Keep as far away from the NORM-contaminated material/equipment as possible.
- Keep NORM material at arm's length from the body, wherever possible.
- Minimize dust generation; don't grind, chip or sand scale.
- Minimize contamination of clothing.
- Cover all cuts and abrasions on skin.
- Do not eat, drink or smoke in a potentially contaminated work area.
- Label all vessels/equipment that contains NORM.

### Personal Protective Equipment (PPE)

Use the following PPE for handling NORM, where the risk of inhalation of NORM dust/mist is minimal (i.e., materials are wet or otherwise dust generation is insignificant):

- Impervious gloves (e.g., Viton, nitrile, neoprene)
- Wear fire-retardant disposable coveralls if possible
- Rubber or neoprene boots (or disposable boot covers if area is dry)
- Safety glasses/goggles to prevent dust from entering eyes.

When handling dry NORM-contaminated sludges or dust, dusty scale or other operations where dust inhalation can occur, also wear a half facepiece P100 (HEPA) cartridge respirator.

### Decontamination Guidelines

Decontamination guidelines are as follow:

- Remove contaminated clothing and PPE.
- Wash hands, forearms and face thoroughly at the end of work and before eating, drinking or smoking.
- Check contamination of workers' hands and clothing using a radiation meter equipped with a pancake probe. If counts are greater than twice the background level, repeat washing to get down to less than twice the background.
- Wash or discard contaminated PPE as NORM-contaminated waste.



## 5. NORM Storage, Labeling, Cleaning, and Disposal

### Storage

The objective of storage is to prevent NORM from becoming airborne or being washed onto the ground by rain.

Store NORM in a secure location away from normal operations until transportation can be arranged.



**NOTE:** Prevent leakage of NORM until it is cleaned or disposed of (e.g. use bull plugs, blind flanges, and wrapping/taping in polyethylene sheeting or tarp).

### Labeling

Label all NORM-contaminated equipment, packages and containers with the wording “Warning – Naturally Occurring Radioactive Materials (NORM) – Wear Respirator to Avoid Breathing Dust”.

Include the date the container was filled and surface gamma radiation measurements made.

### Cleaning

NORM-contaminated equipment can be cleaned and returned to service.

Contact H&S Operations regarding which NORM may be cleaned by ConocoPhillips personnel and which requires outside service.



**NOTE:** Contractors who may be exposed to NORM must have their own NORM management procedures.

### Disposal

If the transportation of NORM waste or NORM contaminated equipment is required, please contact H&S Operations for further instructions.

ConocoPhillips does not dispose, sell, recycle, give or donate used oilfield equipment to the public or other companies unless it has passed the following criteria:

- Equipment/piping has been properly cleaned of internal/external oilfield products (e.g., sludge/oil/scale/other residue).
- Has been scanned for NORM contamination and managed as required based upon remaining contaminate levels.

## 6. NORM Management Plans

### Develop NORM Management Plans

Develop specific NORM Management Plans with procedures wherever NORM may be present. Examples include:

- Opening surface equipment
- Vessel entry
- Service rig operations
- Bottom hole pump servicing

Contact H&S Operations when NORM has been identified as a hazard in work scope.



**NOTE:** To avoid surprises and unnecessary delays, consider external gamma surveys of gathering and producing facilities before turnarounds. This will ensure temporary NORM storage is arranged if needed.