	<b>Burnt Mountain Services</b> Safety Management System	Initial Issue Date	12/14/2023
		Revision Date:	Initial Version
	<b>NATURALLY OCCURRING RADIOACTIVE MATERIAL (NORM)</b>		Revision No.

## Purpose

The purpose of this program is to prevent exposure to naturally occurring radioactive materials (NORM) when NORM is present. Different types of radionuclides that may be present can include thorium, radium or radon.

## Scope

The operator's program shall take precedence; however, this document covers employees and contractors who enter contaminated vessels or work on contaminated equipment which has been determined to contain levels of technologically enhanced naturally occurring radioactive material (TENORM) and shall be used on owned premises, or when an operator's program doesn't exist or is less stringent.

## Definitions

NORM – Naturally Occurring Radioactive Material – radioactive isotopes that occur naturally in the environment.

TENORM – Technologically Enhanced Naturally Occurring Radioactive Material - naturally occurring radioactive materials that have been concentrated or exposed to the environment through human activity.

## Responsibilities

The NORM program shall be administered by the Safety Manager. The responsibilities of the NORM program administrator shall be:

- To inform the organization of changes in NORM requirements.
- Administer and maintain the written NORM program.
- To ensure the safety of operating personnel by providing guidance and direction.

Supervision shall obtain information regarding the presence of TENORM in the workplace; ensure employees are fully trained in the hazards present, work procedure, safety precautions, and PPE.


Employees shall understand the hazards, work procedure, safety precautions, use of PPE and be able to perform required actions safely.

## Requirement

### General

#### *General Statement regarding the origination of NORM*

Radiation naturally occurs in our environment from mainly two sources: cosmic rays external to the earth and radioactive materials found in the earth's crust. Low level radioactive scale can be produced in the course of some oil and gas operations. Oil and gas production moves NORM to the surface where it accumulates and is classified as technologically enhanced naturally occurring radioactive material (TENORM). NORM deposits may be found in piping, brine and sand filters, saltwater disposal injection wells and equipment, headers, vessels, pumps and to a lesser extent compressor cylinders, bottles, and piping. Produced water can contain radium 226 and 228 that may precipitate as scale in knockouts and scrubbers. In the gas stream, Radon gas decays to Lead-210, then to Bismuth-

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210, Polonium-210, and finally to stable Lead-206. Radon decay elements may occur as a film on the inner surface of inlet lines and compressor components.

Supervision shall receive information from the client regarding TENORM contamination in the facility where work shall commence.

If TENORM is detected and the quantity is sufficient to cause exposure, the work group and the safety department shall develop a specific work-site procedure to control exposure. Work procedures shall contain applicable requirements for time, distance, shielding and decontamination. In addition, the elements and safety precautions listed below shall be contained and followed:

- Where exposures may occur.
- Different types of radionuclides may be present.
- Contaminated equipment that is to be opened will be removed from service, vented, and left idle for a minimum of four hours before work begins.
- Personnel must use time, distance and shielding protection methods.
- Personnel must use proper personal protective equipment (PPE) when entering contaminated vessels or when direct contact with TENORM contamination is possible. If the work creates contaminated dusts, respiratory protection consisting of a half-mask respirator with radioactive particle, or HEPA cartridges, or self-contained breathing apparatus (SCBA).
- Personnel must thoroughly wash their hands and face upon work completion and before eating, drinking chewing gum/tobacco, or smoking. These activities are prohibited within the work area when TENORM work is being performed.
- The number of personnel working in the TENORM areas shall be restricted.
- Contaminated surfaces shall be handled in a wet state.
- Contaminated equipment and personal protection must be disposed of in accordance with approved waste disposal procedures.


### Testing

When the presence of TENORM is suspected and the client has not tested, the safety department shall be contacted to arrange testing through a third-party Industrial Hygienist. Analysis of exposure shall be made through the Safety Department in conjunction with an Occupational Health Physicist. Levels will be compared against known existing rates as provided by the host client or owner of the equipment.

### Training

Each employee who will work in a TENORM area shall be trained before exposure to TENORM contamination and shall receive refresher training at least annually. Training in TENORM shall follow the lesson plan below:

- Section 1: Introduction: Radioactive Matter
- Objective: To provide information about particles of matter and their relationship to radioactive isotopes.
  - Radiation and Radioactivity Hazards
  - Types of Radiation
    - Alpha and beta (origin/hazard/protection from)
    - Gamma and x-ray (origin/hazard/protection from)

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- Section 2: How To Protect Yourself and Others
- Objective: To relate time, distance, and shielding as methods of reducing radiation exposure.
  - Control of Radiation Exposure
    - External exposure - time, distance, and shielding
    - Internal exposure - modes of entry into the body
    - Biological Effects of Exposure to the Human Body
    - Direct effect
    - Indirect effect
    - Factors that determine what a given dose will cause
    - Exposure risks to plant/field personnel
- Section 3: Naturally Occurring Radioactive Material (N.O.R.M.) and Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)
- Objectives:
  - To help the student understand NORM and TENORM
  - To learn Isolation procedures
  - Naturally Occurring Radioactive Material and locations where it can be found
  - The decay scheme of Uranium
  - Discussion on U-238 and its daughter isotopes
  - Technologically Enhanced Naturally Occurring Radioactive Material
    - Where and how TENORM occurs
    - Hazard identification and protection
  - Isolation Procedures
    - Radiation Areas
    - Contaminated Equipment
    - Storage, Transport and Disposal
- Section 4: Safe Worksite Procedures
- Objective: To teach proper safe protocol before, during, and after the job.
  - Pre-job procedures
    - Safety Equipment
    - Pre-job safety meeting
    - Pre-job checklists
  - During Work
    - Safety Procedures (HEPA filters on respirators and limitations)
  - Post-job safety
    - Safety Procedures
    - Personal/Worker Surveys
    - Decontaminating articles - How to properly clean
    - Survey and cleaning of the worksite
  - Normal and Emergency Actions and Situations
    - Safety Procedures
    - Isolation and notification