	NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM) PROGRAM	Document No.:	HSE-OP-035
		Department:	Operations
		Revision Date:	07 APR 2010
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Purpose

The NORM safety program at Trinity Medical Management ("Trinity") fully supports the concept that all radiation doses should be "as low as reasonably achievable" (ALARA). This implies that no dose should be acceptable if it can be avoided or is without benefit. Our NORM program depends on the cooperation of all workers exposed to radionuclides. The program includes the use of proper equipment and procedures to lower radiation exposure and protect our employees.

Oil and gas production and processing operations sometimes cause naturally occurring radioactive materials (NORM) to accumulate at elevated concentrations in by-product waste streams. This presents a potential health risk to our employees. Trinity is committed to providing our employees with the information, training and personal protective equipment necessary to protect themselves from dangerous exposure to various radionuclides found in NORM. Naturally occurring radioactive materials (NORM) generally contain radionuclides found in nature, such as radium, thorium, uranium, etc. Once this NORM becomes concentrated through human activity, such as mineral extraction or oil production, it can become a radioactive contamination hazard or a radioactive waste. Radium-226 (Ra-226) and radium-228 (Ra-228) are of primary concern as these radionuclides have been known to accumulate in oil/gas production equipment and waste.

Administrative Duties


The Training and Compliance Manager (TCM) has overall responsibility for coordinating safety and health programs in this company. He/she is the person having overall responsibility for the NORM Program. The TCM will review and update the program, as necessary and at least annually. Copies of the written program may be obtained in the Operations office.

Additional responsibilities include:

- Consulting with workers on all matters relating to the use of radionuclides.
- Developing and implementing procedures for periodic radiological surveys of work areas, monitoring of personnel, and handling and disposal of radioactive wastes.
- Maintaining records of personnel monitoring, accidents and incidents, and other documents required by the program.
- Responding to all emergencies involving radioactive materials, providing expert advice and assistance as required to resolve problems.
- Providing liaison between the Company and Medical Professionals in matters relating to employee exposure to radiation, monitoring results, etc.

Definitions

Radiation includes alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light.

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Radioactive material means any material which emits, by spontaneous nuclear disintegration, corpuscular or electromagnetic emanations.

Restricted area means any area to which access is controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

Unrestricted area means any area access to which is not controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

Dose means the quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body. When the provisions in this section specify a dose during a period of time, the dose is the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use.

Rad means a measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit of mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue (1 millirad (mrad)=0.001 rad).

Rem means a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of 1 roentgen (r) of X-rays (1 millirem (mrem)=0.001 rem). The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions for irradiation. Each of the following is considered to be equivalent to a dose of 1 rem:

- A dose of 1 roentgen due to X- or gamma radiation;
- A dose of 1 rad due to X-, gamma, or beta radiation;
- A dose of 0.1 rad due to neutrons or high energy protons;
- A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye;


Work-Site Specific Information

Trinity's employees are at highest risk for exposure to Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM). The Training and Compliance Manager is responsible for evaluating each individual worksite for the following:

- Potential exposure locations.
- Potentially contaminated materials &/or equipment.
- Radionuclides potentially present.
- Required protective measures & equipment to limit employee exposure.

Types of NORM

There are two types of NORM material: Discrete and Diffuse.

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The first, **discrete NORM**, has a relatively high radioactivity concentration in a very small volume, such as a radium source used in medical procedures or level gauges. Because of its relatively high concentration of radioactivity, this type of NORM poses a direct radiation exposure hazard.

The second type, **diffuse NORM**, has a much lower concentration of radioactivity, but is spread out over a large volume of material, such as contaminated soil. Diffuse NORM poses a different type of problem because of its high volume and low concentration of radioactive material. The following are six sources of diffuse NORM which may create exposure hazards to our employees:

- Metal Mining & Processing Waste
- Coal Ash
- Phosphate Waste
- Uranium Mining Overburden
- Oil and Gas Production Wastes
- Water Treatment Residues

Diffuse NORM may pose a health hazard because of its many uses. For example, though most metal-mining waste is stored near where it is generated, small amounts have been used as construction backfill and road building materials. It is also used in concrete and wallboard.

Coal ash is primarily used as an additive in concrete and as backfill. Phosphate waste (slag) from the processing of elemental phosphorous has been used in construction and in paving. Uranium mining waste is the soil and rock that is removed during surface or underground uranium mining. This waste is sometimes used to backfill mined-out areas and to construct roads around the mining site.


Oil and gas production may produce radioactive pipe scale (a residue left in pipes from producing oil wells) and sludge that leave sites and equipment contaminated. In the past, some contaminated piping and other scrap metal have been used inadvertently by schools and other organizations for playground equipment, welding material, fencing, etc. because this contaminated metal was recycled before it was found to be contaminated.

Radiation-contaminated water treatment residue accumulates when radioactive material is filtered out of drinking water during the purifying process. This waste may be disposed of in landfills or lagoons. It may also be used in agriculture as a soil conditioner.

The improper use or disposal of such naturally-occurring radioactive materials can result in significant contamination of the environment and elevated radiation exposure. This can adversely affect the health of those occupationally exposed, as well as the general public.

NORM Safe Practices

The following precautions should be taken to minimize exposure to NORM-contaminated materials:


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- Employees and contractors should be advised of the presence of this contamination and of procedures to minimize exposure.
- Direct skin contact with radioactive scale and solids should be avoided to the extent reasonably possible.
- Eating, drinking, smoking and chewing should not be allowed in the work area where work is being performed on contaminated equipment or where contaminated soil is being handled.
- Personnel should thoroughly wash their hands and face after working with contaminated equipment, and before eating, drinking, or smoking, and at the end of the day.
- The number of personnel in the work area should be kept to a minimum.
- If possible, openings on contaminated equipment should be sealed or wrapped in plastic. Work on contaminated equipment, such as cutting, grinding, sand-blasting, welding, drilling, or polishing should be kept to a minimum.
- If work requires any action that might produce dust or if loose contamination is suspected, the following additional precautions should be taken:
 - A respirator appropriate for radioactive particulates should be worn. Suitable coveralls and gloves should be worn.
 - Activities should be conducted in well-ventilated areas to which access has been restricted.
 - Plastic ground covers should be utilized to the extent possible to contain contaminants and facilitate cleanup.
 - Gloves, respirators, coveralls, and rags should be decontaminated or placed in double bags, sealed and held for proper disposal.
 - The need for Personnel Monitoring and Bioassay should be evaluated and provided if necessary. In addition to the general guidance given above for pipe scale, there may be other industrial operations, such as vessel entry, dismantling of equipment, refurbishing of equipment or transportation, which may also require precautionary procedures.

Employee Protection

Protecting our employees from overexposure to NORM is of the highest priority of Trinity. Methods of protection offered and used by our employees include:

- Time: limit duration of exposure.
- Distance: when possible, maintain a safe distance from NORM contaminated materials and/or equipment.
- Shielding: when possible, used NORM-resistant materials to isolate the employee from exposure.
- PPE: provide and train employees in the proper selection, use and care.
- Personal Hygiene: provide employees with adequate facilities and training to remove and/or decontaminate clothing, tools, equipment, or other items so that exposure is not spread out of immediate work area.

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Training

All employees who may have the potential for radiation exposure shall be trained in the hazards, locations, and methods to identify the hazards and methods used to protect themselves (HEPA filters on respirators & limitations). Training will be conducted prior to exposure and at least annually thereafter. Training will include both normal and emergency situations.

Monitoring & Records

If employee personal monitoring is conducted, Trinity will maintain records of the radiation exposure of those employees and advise each employee of his/her individual exposure on at least an annual basis. Each monitoring result will be compared to the last most recent monitoring and the original baseline. The Training and Compliance Manager is responsible for conducting all employee personal and area monitoring.

Disclosure to Former Employee of Individual Employee's Record

At the request of a former employee an employer shall furnish to the employee a report of the employee's exposure to radiation as shown in records maintained by the employer. This report will be provided within 30 days from the time the request is made, and will cover each calendar quarter of the individual's employment involving exposure to radiation or such lesser period as may be requested by the employee. The report shall also include the results of any calculations and analysis of radioactive material deposited in the body of the employee. The report shall be in writing and contain the following statement: "You should preserve this report for future reference."