

PURPOSE/APPLICATION

To provide guidance to all persons working around naturally occurring radioactive materials (NORM).

PPE

- CPES minimum requirements
- Respiratory protective equipment
- Disposable coveralls

TRAINING

- NORM Awareness Training

HAZARDS SOURCES & CONCERNS

- Personal health risk
- H₂S
- Fires/Explosions
- Radiation
- Chemical Exposure



NORM

NORM's are radioactive elements present in the earth's crust and within the tissues of all living beings. Although the concentration of NORM in most natural substances is low, higher concentrations may arise as the result of human activities. They are particularly common in sealed underground facilities where residue and scale can build up. For example, calcium scale precipitated from oil recovery brine may contain radium at much greater concentrations than the water source itself. Special precautions are needed for handling, storing, transporting, and disposal of this material, by-products, end-products or process equipment. The handling and disposal of NORM within Canada is regulated by the provincial and territorial governments.

NORM Radiation can be found in many forms depending on location and types. NORM's can change the Radiation changes the molecules it collides with irradiating pipe or other buried facilities. Some elements such as uranium decay and release radiation.

Note: Before beginning any demolition, maintenance work or turnaround work engage with client to determine if NORM contaminated material is present or the potential exists within the work scope.

Common Location of NORM's:

NORM's are often found in rocks or sand, oil and gas production residue such as mineral scale in pipes, sludge and contaminated equipment, coal ash and on filter media such as the desiccant and gas filters. NORM's can also be present in consumer products, including common building products such as brick and cement blocks, granite counter tops, glazed tiles, phosphate fertilizers and tobacco products. High hazard locations include:



Scale containing NORM on service line

Liquid petroleum gases (LPG's)

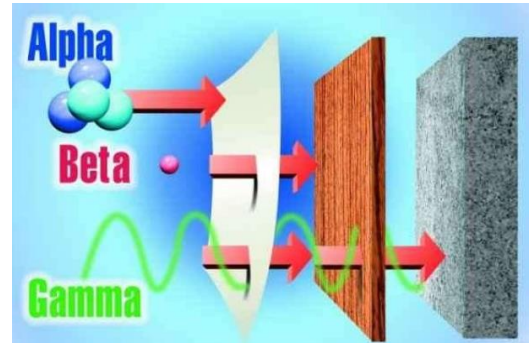
- Radon and lead-210 is concentrated within refrigeration equipment and bullets, propane filters

Sludge

- Common where liquids and solids are mixed such as, separators, tanks, filter pots, produced water, glycol, amine etc.

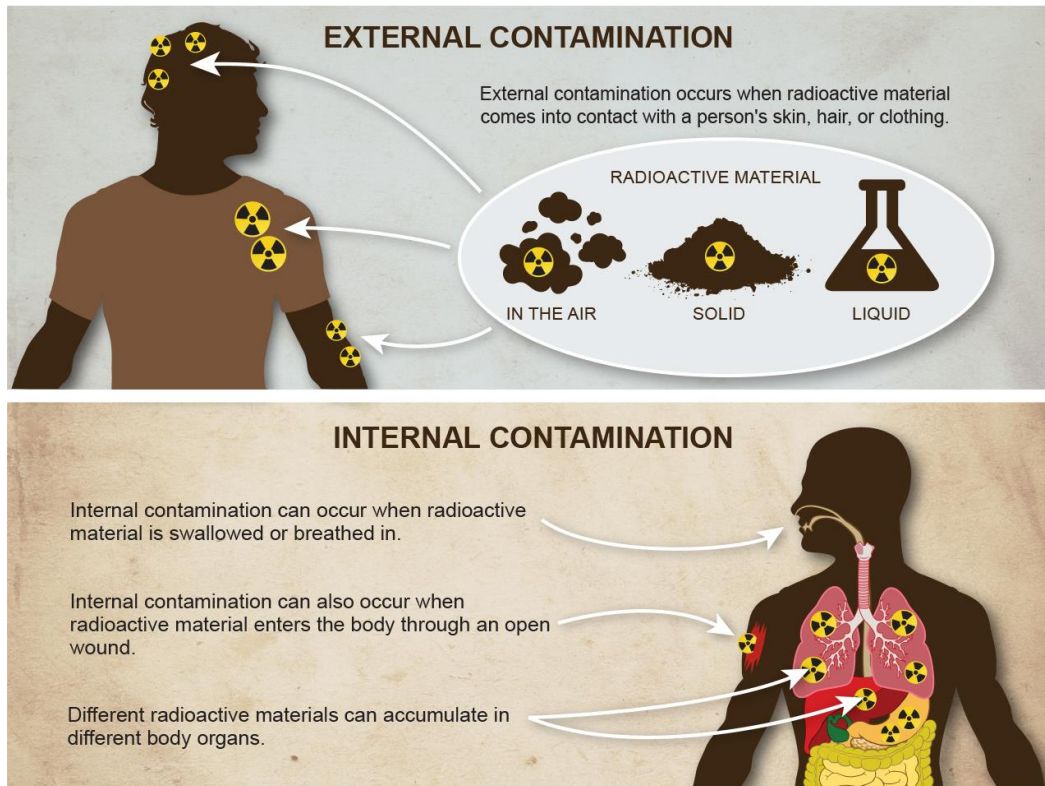
Scale

- Typically encountered where there is turbulence such as in valves, meters etc.



Key NORM Radiation Types and routes of entry:

- Gamma radiation is capable of penetrating body tissues. It is not usually a concern, because of lower activity, low quantities and low exposure time
- Radon (gaseous form) are not usually an inhalation concern if confined spaces are adequately ventilated
- Beta and Alpha (Particles) can represent an inhalation/ingestion concern



During the decay process three different forms of energy are emitted from the disintegrating elements:

Alpha radiation is made up of positively charged alpha particles that travel a very short distance and have little penetrating power. Even a piece of paper or the dead outer layers of human skin is sufficient to stop alpha particles. However, ingestion or inhalation of these particles can cause internal tissue damage.

Beta radiation is made up of beta particles that are high energy, negatively charged sub-particles. They have a higher penetrating ability than alpha particles, but when passing through clothing or equipment or living tissue, the particles lose most of their original energy. Beta particles pose a smaller internal hazard to humans than alpha particles, but due to an increase in speed and travelling distance, these particles remain hazardous to internal organs.

Gamma rays are high-energy electromagnetic radiation, emitted from unstable nuclei purging itself of excess energy. This form of radiation can penetrate tough barriers such as steel plate and can travel over hundreds of meters. For this reason, gamma rays can penetrate the body very easily and pose a much greater external hazard (i.e.: burning) than alpha or beta particles but are not as hazardous to internal organs (i.e.: they are so small that they will not hit any atoms in the body and will just go through it).

There is another type of radiation, **neutron radiation** that the general public associates with radioactive sources. Neutron radiation is energy released from an atom in the form of neutral particles called neutrons and can be highly damaging. However, this type of radiation only occurs inside a nuclear reactor and never naturally and is not associated with NORM.

Safe Handling of NORM's:

Best practices for individuals encountering NORM's include:

THE DO's

- **DO** Wear appropriate PPE when handling NORM contaminated materials (Tyvek or disposable clothing, disposable gloves, respiratory protective equipment)
- **DO** Discard contaminated clothing and PPE appropriately
- **DO** Wash potentially exposed areas (face, hands, etc.) before breaks (Eating, smoking, drinking, end of shift) to reduce the risk of ingesting radioactive material
- **DO** Store NORM and any contaminated materials (including clothing) and waste in a designated area
- **DO** Minimizing operations that may generate dust containing NORM (e.g., cutting, grinding or polishing)
- **DO** Minimize the time spent in NORM-contaminated work areas and storage areas
- **DO** Maximize the distance from the source when handling or storing NORM
- **DO** Use appropriate shielding to minimize dose rates from the material if required

THE DON'Ts

- **DON'T** eat, drink or smoke in areas where the presence of NORM is a possibility
- **DON'T** take materials or personal clothing that could be contaminated home

Other (or more involved) measures should only be considered under the direction of personnel trained in radiation safety, specialized in the handling and disposal of NORM. Precautions can include:

- Decontaminating equipment that has been exposed to NORM prior to disposal
- Using personal protective equipment, including non-porous coveralls, boots and gloves, and protective eyewear and respirators, depending on the situation
- Ensuring that pipes are sealed, and ground covers are used, to prevent environmental contamination
- Preventing dust inhalation, by keeping NORM materials damp with water
- Ensuring that all workers are checked for any contamination with NORM before leaving the work area
- Evaluating and decontaminating areas of potential NORM
- Decontamination by using high pressure washing or high- efficiency particulate air (HEPA) filter vacuuming



How to Detect NORM's:

Radiation readings above typical background radiation levels may indicate the presence of NORM. Determining the type of material present is essential to assess what, if any, precautions need to be taken with the material. This process is called characterization. Radiation surveys used for characterization should be conducted by personnel trained in radiation safety (i.e. Radiation Safety Officer) or by external consultants.

How Do I Dispose of NORM?

CPES should not assume the risk of transporting and/or disposing of potentially NORM contaminated materials. Disposal of NORM contaminated waste should be overseen by owner/clients authorized representative. NORM-contaminated waste cannot go to a regular landfill if it exceeds release limits published in the Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials. It should be disposed of at a facility authorized to accept contaminated materials.

Transportation of NORM Contaminated Materials

The transportation of NORM across Canada is regulated by the TDG regulations if the activity of the material exceeds 70 Bq/g. These TDG regulations are consistent across all provinces.

Materials with NORM activity less than 70 Bq/g are exempt from the regulations if other hazardous properties such as flashpoint or PCB concentration do not make the materials dangerous.

If the substance or piece of equipment is contaminated with NORM greater than 70 Bq/g, then it has to be transported as an Excepted Package under TDG. Materials transported under this shipping name will not need to comply with certain requirements of the TDG regulations as long as the shipment meets all the requirements of Excepted Package.

REFERENCES

- Directive 58 (part of the Oil and Gas Conservation regulations)
- Guidelines for the handling of Naturally Occurring Radioactive materials (NORM) in Western Canada, Western Canadian NORM Committee, August 1995.
- Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM). October 2000.
- CAPP Guide – Naturally Occurring Radioactive Material (NORM) June 2005.

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