Protection of Personnel against NORM Risks

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1. **Introduction**

Naturally Occurring Radioactive Materials (NORM) are deposited on the surface of down-hole and surface equipment during oil and gas production as scales and sludges in tanks and sands in separators. They precipitate from reservoir water/oil and gas on production equipment where changes in temperature, pressure and turbulence occur. The scales, sands and sludges give rise to a radiation hazard.

Potential sites for scale/sludge/sand build up can include: tubing, Xmas Trees, chokes, flow-lines, separators and water disposal equipment, such as pump parts, valves and water lines.

1.1 **Objective**

To explain the hazards associated with NORM scale and the measures to be taken to handle it safely.

1.2 **Scope**

This procedure is applicable to all personnel involved in NORM operations.

1.3 **Responsibilities**

1.3.1 **Work Supervisor**

The work superviser is responsible that the requirements of this procedure are met.

1.3.2 **Employee**

The employee is responsible for wearing the specified PPE and RPE.

2. **Hazards of NORM**

2.1 **External hazards**

It is PDO policy to keep the external radiation dose below 1 mSv/y above background for exposed workers. This is achieved by adopting and following the NORM Management Guidelines and controlling workers’ exposures using specific measures such as: limiting exposure time, restricting access to high radiation areas, adopting a personal protective program for airborne risks.

The main contributor to external dose is gamma radiation, however fortunately NORM from E&P process streams has very little gamma radiation. On occasions such as Zauliyah and Al-Noor, the dose emitted from the NORM inside the tanks and separators can be quite elevated owing to high concentration of NORM (namely Ra-226) contained in the sludge, sand and debris. Like X-rays, Gamma radiation can penetrate through steel and the whole body generating a field which represents an External Hazard. This is generally low around piping, sub surface equipment and Xmas trees, however as mentioned it may be elevated around tanks, vessels and separators. There is a recommended practice to monitor the dose rate of all tanks for NORM prior to entry if the cps exceed 5 cps above background. It is critical to measure them if more than 100 cps are recorded. This should be conducted by a Radiation Protection Technician or someone trained in how to use the Graetz Dose Rate Meter.
2.2 Internal hazards

The principle hazard of exposure to NORM is associated with inhalation and ingestion of radioactive particles into the body or through absorption through cuts in the skin. The reason that this is hazardous is due to the nature of Alpha and Beta particles. These particles are highly charged and release sufficient energy to produce ions. Thus, if they are allowed to come into contact with sensitive cells, the energy from Alpha and Beta particles may damage the lungs.

Simple hygiene controls can prevent the risks from cuts and ingestion which leaves inhalation as the main risk of internal exposure.

3. Handling of NORM

3.1 Principles

As explained, the priority with NORM scale handling is to stop dust being inhaled. This is achieved by adhering to procedures which:

- Stop dust being created by modifying procedures.
- Stop dust entering the body through good personal hygiene
- Contain scale in one area

These procedures are generally based on:

- Minimising work on scaled equipment
- Wearing respiratory protection and other PPE
- Barricade off work areas, restricting access and containing waste

3.2 Training

All personnel involved in NORM operations shall receive the required level of NORM training.

3.3 Detection survey

It is the responsibility of the person in charge of the work (work supervisor) to ensure that monitoring for NORM scale is carried out. This is to be controlled by the Permit to Work system. Where work involves exposure of surfaces that may be contaminated with NORM scale, the Permit shall require regular checks with a Mini 900 meter with EP15 probe. Contamination of clothing should be conducted with the Mini 900/44A probe.
3.4 Protection of personnel

While involved in conducting a NORM job the following points should be considered:

- The number of persons shall be kept to a minimum
- PPE, Respiratory Equipment (RPE) and auxiliaries which may be specified include:
  
  A. Disposable Breathable Coveralls
  B. Rubber gloves (practically, if leather are necessary wear them)
  C. Safety boots
  D. FFP3 Disposable Half-face Respirator (3M 8835 or equivalent)
  E. Safety eye protection (goggles or glasses)
  F. Black/yellow NORM demarcation tape
  G. Radioactive signs (English/Arabic ideally)
  H. Full face mask with FFP3 filter (Bearded workers)
  I. Air supplied breathing apparatus (welding or confined spaces)
  J. Polythene sheet, for covering the floor and wrapping contaminated equipment
  K. Polythene bags, for wrapping contaminated materials/equipment
  L. Adhesive tape
  M. Drip pans, to catch leaking liquids (if practical)
  N. Sealable clean drums with lids, for disposal of radioactive waste (one for solids, one for liquids)

- No smoking, eating, drinking, chewing of gum, sweets or tobacco is permitted.
- Open wounds or skin shall be effectively dressed. In the event of any doubt over the condition, work shall not be permitted.
- Personnel shall be checked for contamination prior to leaving the worksite. If found contaminated, measures as per MSE.09 shall be followed.
Glossary of Abbreviations

Appendix 1

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<tbody>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<td>RPE</td>
<td>Respiratory Protective Equipment</td>
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<td>FFP3</td>
<td>Particulate/Dust Respirator to 99.97% standard</td>
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