**KUWAIT OIL COMPANY (KOC)’S OPERATIONS**

- Kuwait Oil Company (KOC) is one of the major oil and gas exploration companies in Kuwait / GCC.
- KOC’s operational areas spread all over Kuwait and the region.
- 3 producing major assets in North Kuwait, South & East Kuwait and West Kuwait.
- Operations includes drilling, oil & gas production, export and marine.
- 25 Gathering Centers, 7 Booster Stations, 6 Water Centers, 25 Storage Tanks, and 3 Water Injection Plants.
- About 9000+ KOC employees & 80,000 Contractor employees.
- Diversified multinational workforce & Severe Weather Conditions.

**2040 STRATEGY**

- Exploration
- Drilling
- Production
- Gas Operations
- Export & Marine
- Gathering Centers
- Booster Stations
- Oil Wells
- Flow Lines
- Export Terminals
- Water Injection and Treatment Plants
- Tank Forms

**Major facilities are:**

**Classification of the Area**

### Type of measurement

- **Purpose**
- **In-situ External Radiation Dose Measurement**
- **Personnel Exposure monitoring**
- **Measurements accumulated dose using radiation measurements.**
- **Yavance NORM Monitor (OSL) & Optical Stimulated Luminance Doseimeter (OSLD)**

**Methodology and Instrumentation**

- **Total number of measurement over the entire samples**
- **33,190 Measurements**
- **250 Personal samples**

**Results-Summary of NORM Contaminated Equipment (Based on External Radiation Measurement)**

- Potentially NORM contaminated equipment in different facilities.

**Conclusions**

- Workplace exposure monitoring for NORM indicated the following:
  - No areas are exceeding 10 µSv/hr in the entire operational facilities of the company.
  - Accidental dose of the radiation workers were well below the permitted annual radiation dose.
  - Flow and downhole pipes are potentially contaminated more than the other equipment in the operational facilities.

**Recommendations**

- Removal and safe transportation of contaminated equipment/sail in compliance with the radiation safety program and local regulations in the State of Kuwait.
- NORM contaminated materials including vessels, separators, tubulars and others must be decontaminated.
- On-site decontamination must be carried out when equipment such as production separator vessel which cannot be reasonably removed.
- Removal of NORM scale inside these equipment shall be carried out by internationally recognized method (i.e. high pressure water jetting).
- Routine NORM monitoring that includes baseline surveys, pre-shutdown surveys and operational assessments.
- Specific monitoring during shutdown of vessels / tanks to insure that appropriate preparation for handling NORM is made for maintenance and workovers.
- Site workers (permanent employees and contractors) working around the NORM contaminated areas shall be monitored for personal radiation exposure using personal electronic radiation dosimeter or equivalent.
- Display radiation hazard signage at access point.
- Equipment (dose-rate and contamination meter) are available on-site for monitoring of workplace and workers.
- Implementation and follow-up on the required PPE in the operational facilities in the company.
- Routine awareness and specific NORM training to the workforce in the company.

**Qualitative Risk Assessment (QRA)**

- Occupational Health risk is determined based on Severity (S) and Likelihood (L) of Occupational Health Hazards and will be ranked as ‘low’, ‘medium’ or ‘high’.

<table>
<thead>
<tr>
<th>Severity of Health Risk</th>
<th>Criteria</th>
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<tr>
<td><strong>Negligible</strong> Exposure to occupational health hazards resulting in negligible illness or health effects to employees. On-Site Medical Treatment (NORM) (NORM)</td>
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<tr>
<td><strong>Minor</strong> Exposure to occupational health hazards resulting in minor illness or health effects to employees. No additional Medical Treatment (NORM)</td>
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<tr>
<td><strong>Moderate</strong> Exposure to occupational health hazards resulting in moderate illness or health effects to employees. May need Emergency Medical Treatment (NORM)</td>
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<tr>
<td><strong>Severe</strong> Exposure to occupational health hazards resulting in severe illness or health effects to employees. May need Hospitalization (NORM)</td>
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- **Likelihood** Criteria:
  - Very Likely: Not occurred in the company or occurred once in more than 10 years
  - Likely: Occurred once in more than 5 years but within 10 years
  - Possibly: Occurred in the company but within 5 years
  - Slightly: Occurred at least once in a year
  - Frequently: Occurred many times in a year

**Occupational Health Risk Evaluation Matrix**

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Risk Control Regime</th>
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<tr>
<td><strong>High</strong> The activity shall not be carried out as the risk is high. Adequate control measures shall be established to bring the risk level to at least “Medium”. However, if the company has the activity and determines that tolerating the risk, the activity shall not be carried out unless the risk is demonstrated to be low as a reasonable practical (ALARP) with all the possible control measures within the influence of the Company Approval from line management shall be obtained and all control measures must be in place and implemented before the activity can commence. The risk is Medium. However, the activity shall be further assessed to determine if any additional control measures are required or possible to demonstrate the risk is reduced to “Low” or as low as reasonably practicable (ALARP). If required, such additional control measures shall be established before the activity can be performed. The risk is Low. No additional control measures will be required. However, the existing control measures shall be continued to be enforced to ensure the risk is maintained at “Low”</td>
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<td><strong>Medium</strong> The activity shall be carried out as the risk is medium. Control measures shall be established to bring the risk level to at least “Low”. However, if the company has the activity and determines that tolerating the risk, the activity shall not be carried out unless the risk is demonstrated to be low as a reasonable practical (ALARP) with all the possible control measures within the influence of the Company Approval from line management shall be obtained and all control measures must be in place and implemented before the activity can commence. The risk is Medium. However, the activity shall be further assessed to determine if any additional control measures are required or possible to demonstrate the risk is reduced to “Low” or as low as reasonably practicable (ALARP). If required, such additional control measures shall be established before the activity can be performed. The risk is Low. No additional control measures will be required. However, the existing control measures shall be continued to be enforced to ensure the risk is maintained at “Low”</td>
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<tr>
<td><strong>Low</strong> The activity shall be carried out as the risk is low. No additional control measures shall be required. However, the existing control measures shall be continued to be enforced to ensure the risk is maintained at “Low”</td>
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