TECHNICAL BULLETIN

**FQE® NORM-Clear™**

Patented product for the removal of NORM contamination equipment

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| **Bulk density** | 9.98 lb/gallon  
1196 kg/m³ |
| **Solubility** | Complete in Water |
| **Flash point** | > 200°F (93°C) |
| **Approximate storage life** | 1 year |

**Standard Package**
55 US gallons (208 litre) closed head poly drum, tote bin, or bulk.

FQE® NORM-Clear™ is an exclusive water soluble product developed with selective extractants designed to completely remove NORM (Naturally occurring radioactive material) contamination from vessels, tanks or process pipework. It is applied as an additive at the end of decontamination procedures, and addresses highly radiotoxic isotopes that deposit.

Many natural materials contain radioactive elements (radionuclides). The earth's crust is radioactive. While the level of individual exposure is usually trivial, some circumstances arise wherein the concentration of primordial radionuclides reach a level regarding regulation. One of the main industries with an aqueous “Technologically Enhanced Naturally Occurring Radioactive Material” TENORM problem is the petroleum industry.

Highly mineralized formation waters contain highly radiotoxic Radium isotopes RA 226 from Uranium 238 decay and RA 224 and RA 228 from Thorium decay. All three radium isotopes appear in the water produced with oil and gas production. These toxic isotopes, amongst others, deposit on surface equipment (tubulars, vessels, pumps, valves, separators) as scale and sludge at concentrations of up to 15,000 Bq/g. Progeny of the Radium isotopes emit gamma radiation capable of penetrating the walls of these components and high energy photons can contribute to significant dose rate exposure on the outside surfaces when scale accumulates over several months.

FQE NORM-Clear has been developed with selective extractants designed for complexation of Ra2+. FQE NORM-Clear will preferentially form complexes with Ra2+ compared to the alkaline earth cations Na+, K+, Mg2+, Ca2+, Sr2+, and Ba2+, of which a significant excess exists. Of all the alkaline earth elements, Ra2+, is the most challenging.

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Application
As a water-soluble product, FQE NORM-Clear can be applied as an additive at the termination of standard equipment decontamination procedures. It can be dosed into steam vapor allowing the condensate to coat the affected equipment surfaces or applied through an aqueous circulation. Concentrations of 0.5 - 1.0% in steam phase condensation or 1.0 - 2.0% in aqueous circulation is recommended. Expected higher levels of radio-toxic scaling will require additional product to address the descaling process. In circulation processes, application temperatures of 49 - 66°C (120 - 150°F) are recommended.

Dilution
The dilution and rate of application will vary with the severity and nature of the hydrocarbon deposits present, but 1.5 to 5% in water is typical. Circulation rates should be as high as attainable, preferably a minimum of 500 gpm for small volume systems and a minimum of 1,000 gpm for towers and columns. For degassing applications, use 0.25 to 0.50% of steam flow.

Safety
FQE NORM-Clear is generally regarded as safe. It is not teratogenic or carcinogenic and is not mutagenic in animal studies. FQE NORM-Clear is readily biodegradable and should not cause problems in wastewater treatment plants when used as directed.