

# **2004      Environmentally Acceptable      Endpoints (EAE) of CCME Canada-Wide Standards (CWS) Petroleum Hydrocarbons Fraction F3 for Weathered Petroleum Hydrocarbons in Soil, Phase 1**

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There is an industry-wide issue concerning sites containing petroleum hydrocarbons (PHC), including invert drilling wastes, and crude oil originating from spills, flare pits and other cumulative releases, that have undergone attenuation or remediation (i.e., “aging” or “weathering”) to some degree, but have not met existing guideline levels, particularly for the CCME CWS PHC Fraction F3. It is currently accepted that for most sites requiring remediation, conventional bioremediation technologies will reduce petroleum PHC concentrations below the CCME CWS concentrations, with the exception of the PHC F3

Fraction. The F3 fraction criteria was developed using fresh crude oil, and fails to recognize probable differences in ecotoxicity within the broad range of PHC, as well as fundamental differences between fresh and weathered PHC. This limits oil and gas companies from utilizing the less costly bioremediation technologies and dramatically increases remediation costs to excessive dollar values.

Industry believes that bioremediated soils containing elevated weathered F3 concentrations are non-toxic to plants and invertebrates. To this end, there are currently two ERAC funded projects in progress related to this issue. One study, still dealing only with fresh oil, is attempting to assess the toxicity and suggest acceptable end points for two F3 sub-fractions (F3a and F3b). The second attempts to assay whether existing F3 guideline levels are meaningful to weathered PHC in fine (heavier) textured soils. The project herein proposed is companion to these initiatives. It is proposed that this study assess the affects of weathering to support the subfraction initiative with real world statistical weight of evidence; and, to develop a weathered index based on information and data provided by actual toxicity assessment initiatives supplied by industry, or contained in literature. Appropriate F3 guideline value development for weathered PHC in soil requires a determination of a means to validate and quantify (i.e., characterize) the extent of PHC weathering that has occurred, the bioavailability of the PHC, and

ultimately, the ecotoxicity of the weathered PHC to plants and terrestrial invertebrates.

It is paramount that this work is completed prior to the planned review of the CCME CWS PHC guidelines in 2005, as these regulatory guidelines have been recognized as an on-going process as scientific data increases. There are no current research (e.g., PTAC) projects that specifically address the weathered PHC issue in terms of both characterization of PHC and ecotoxicity, that would otherwise provide the scientific data for the 2005 deadline in support for recognition of development of appropriate F3 guidelines for weathered PHC. The issue of appropriate guidelines for weathered PHCs is potentially worth millions of dollars for the upstream oil and gas industry.

The project goal was to assess whether existing CCME CWS PHC Fraction F3 guideline levels are appropriate for weathered PHC in soil, and if not, conduct the necessary scientifically defensible background work in support of F3 guideline soil (contact) value development for weathered PHC. Specifically, the Phase I component of the project scope will include the following:

1. Characterization of the weathering of various PHC types in samples collected from remediated site soils that do not meet current F3 guideline values (i.e., "weathering index") using SHC/TPH

(GC/FID – US EPA 8015) and CCME CWS for F3 concentrations;

2. Assessment of the bioavailability of the weathered PHC from use of chemical measures (e.g., mild solvent and/or cyclodextrin-based extraction); and,
3. Evaluation of existing toxicological information on the site soils and correlate with the weathering index and bioavailability.

Assuming that the Phase I statistical evaluation supports that a robust weathering index and bioavailability profile can be established and that weathering potentially lowers toxicity, the Phase II component of the project would be conducted (Jan-July, 2005) and consist of the following:

1. Conducting acute and chronic (definitive) plant and invertebrate toxicity testing on samples of soil with measured weathering index and bioavailability, and/or on the extracted weathered F3 in test soils; and,
2. Development of appropriate guideline levels for the F3 soil contact pathway for fine and coarse soil types.

2004 EAE CWS PHC F3 in Soil\_Project Scope

2004 EAE CWS PHC F3 in Soil\_Letter

2004 Axiom\_ Environmentally Acceptable Endpoints for Fraction 3 Report