DETECTION OF PETROLEUM: SEEPS AND SPILLS

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GERG has been a leader in the analyses of petroleum in the environment since it was established in 1981 in the College of Geosciences at Texas A&M University and has acquired and analyzed thousands of core samples in the Gulf of Mexico and globally. Since the early 1980’s, GERG has been at the forefront of scientific discoveries in the Gulf of Mexico including chemosynthetic communities associated with natural petroleum seeps and gas hydrates. GERG has decades of experience on the sources, fate and effects of offshore oil operations through ongoing and past research programs and from its involvement in oil spill response and analytical support. GERG researchers have studied small (e.g., Apex Barge spill) to large scale (Exxon Valdez, Deepwater Horizon) as well as spills in remote areas (Bahía Paraiso off Palmer Station, Antarctica). This presentation will discuss the various techniques available to detect, quantitate and fingerprint petroleum. GERG’s research in response to the Deepwater Horizon spill will be used as an example. A cost effective hierarchical approach will be described. The use of total scanning fluorescence (TSF) established that the field measurements using colored dissolved organic matter (CDOM) fluorescence detected a subsurface plume of oil. Total scanning fluorescence was used to screen water samples for subsequent, more costly analysis. The next analytical level involves using gas chromatography/mass spectrometry (GC/MS) to confirm the presence of polycyclic aromatic hydrocarbons (PAH), the toxic components of petroleum, in the subsurface plume. There was a significant correlation between shipboard CDOM fluorescence, TSF and total PAH concentration. Further analyses of aliphatic hydrocarbons show the effects that weathering of the oil has on the fingerprint of the spilled petroleum at different sites. Background levels of petroleum were detected in the vicinity of the Loop Current based on the fluorescence measurements. GERG is currently using principal component analyses on our extensive set of TSF in water samples from the Gulf of Mexico to establish the water column background signal and to evaluate the effects of weathering on the TSF signature. This will allow GERG to establish natural background conditions prior to future accidental petroleum releases. GERG is experienced in the analysis and interpretation of petroleum biomarkers to establish the thermal history of reservoir petroleum or for environmental forensics (tracking spilled petroleum to its source). Trace metal analysis (such as nickel and vanadium in oil; barium as a tracer for drilling mud) performed by GERG scientists can also be employed help determine the source reservoir or for environmental forensics. GERG has used the metabolites of PAH in the bile of organisms, such as fish, to estimate the impact of oil spills on the biota. GERG is excited to share our expertise with researchers from Brazil.