BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

BOEM OCS Region: Gulf of Mexico

Planning Area: Gulf wide

Title: Oil/Disbursed Oil-Sediment Interactions in Deepwater Environments and Impacts of Dispersants on the Environmental Fate of Persistent Oil Components (GM-11-13)

Total Cost: $499,979.00 **Period of Performance:** FY 2012-2015

Conducting Organization: Auburn University

BOEM Contact: S.E. O'Reilly, Ph.D.

Description:

Background: The Deepwater Horizon incident revealed several critical knowledge gaps on the effects of dispersants on key physical-chemical processes that control the environmental fate and transport of persistent oil components. This study addresses the BOEM's priority research need to fill in the critical information gaps regarding how dispersed oil components fundamentally interact with sediments and to understand how these fundamentals may change in the deepwater environment. An unprecedented amount of dispersants was applied near the sea floor, yet, knowledge is lacking about how dispersants and marine sediments interact, especially under the deepwater environment, and how such interactions will impact fate and transport of oil components. While studies are underway to investigate the existence and persistence of dispersed oil in the Gulf region, little attention has focused on how the dispersed oil has interacted with sediments. Information is lacking about fundamental properties and behavior of chemically-dispersed oil microdroplets and about the effects of dispersants on the transport and physicochemical transformation of persistent oil compounds. Some key questions remain on: 1) the quantities, kinetics, and mechanisms of how oil and oil components are sorbed to and desorbed from relevant sediments and how the dispersants affect these fundamentals, 2) how dispersant-oil-sediment interactions affect weathering and transport of the oil components, and 3) how these processes are altered in the deepwater environment.

Objectives: The overall goal of this proposed research is to fill in some of the critical knowledge gaps in how oil, dispersants, and sediments interact, how such interactions impact weathering of oil components, and how deepwater conditions alter those interactions. This study will systematically examine how dispersants affect the fundamental physicochemical processes and reactions that govern the interactions between persistent oil components (C10-C30 aliphatic compounds and common polycyclic aromatic hydrocarbons, PAHs) and sediment particles. The specific objectives are:

1. Determine the role and mechanism of the oil dispersants in sorption and desorption of persistent oil components with representative coastal and deep-sea sediments;
2. Test how oil-dispersant-sediment interactions change the settling behavior of suspended particulate matter (SPM), oil and oil components associated thereon;
3. Investigate how oil-dispersant-sediment interactions are altered in a deepwater environment characterized by high pressure, low temperature and high salinity;
4. Evaluate the effects of dispersants and sediment sorption on the natural photodegradation of the persistent oil components in various phases (e.g., seawater-dissolved, sediment-sorbed, and dispersed microdroplet phases); and
5. Determine the contribution of surface-level ozone oxidation to weathering of oil/PAHs in seawater and sediment, and examine how dispersants and sediment sorption affect the reactions.

Methods:

- Identify, acquire, prepare and analyze the necessary media samples, including oil, dispersants, sediments, and seawater.
- Establish and maintain a relevant literature database to keep abreast of latest development in relevant science and studies that could inform this effort.
- Conduct a series of interconnected bench-scale batch and column experiments aimed at resolving the following key research questions: 1) How oil dispersants affect sorption/desorption extents, kinetics, and mechanisms of oil/PAHs with various types of marine sediments; 2) How deepwater environmental conditions alter these interactions; and 3) How dispersants and dispersant facilitated oil-sediment interactions change the degradation and transport of oil/PAHs.

Products: Quarterly reports, technical summary, final report, and digital copies of reports, and peer reviewed journal articles.

Importance to BOEM:

Protecting the environment while ensuring the safe development of the nation's offshore energy and marine mineral resources is a critical part of BOEM's mission. BOEM develops, conducts and oversees world-class scientific research specifically to inform policy decisions regarding development of Outer Continental Shelf energy and mineral resources. Thus, it is important for BOEM's research to help fill in this critical information gap regarding how dispersed oil or its components fundamentally interact with sediments and to begin to understand how these fundamentals may change in a deepwater environment.

Current Status: Awarded July 19, 2012; kickoff meeting pending

Final Report Due: August 2015

Publications: None- newly awarded

Affiliated WWW Sites: None- newly awarded

Revised date: July 31, 2012

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