

STUDY TITLE: IXTOC Oil Spill Damage Assessment Study

REPORT TITLE: IXTOC Oil Spill Assessment, Final Report and Final Report, Appendices (Section Nine)

CONTRACT NUMBERS: BLM: CTO-71; MMS: 14-12-0001-29103

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APPLICABLE PLANNING AREAS: Central Gulf of Mexico; Western Gulf of Mexico

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KEY WORDS: Central Gulf; Western Gulf; fates and effects; benthos; hydrocarbons; oil spill; assessment; sediment; infauna; epifauna; grain size; gas chromatography; spectrometry; abundance; seasonality; commercial fishing

BACKGROUND: The blowout of the IXTOC I oil well in the Bay of Campeche (Mexico) resulted in the release of 0.5 million metric tons of oil into the Gulf of Mexico between June 3, 1979 and March 23, 1980. Of that amount, an estimated 11,000 metric tons impacted south Texas beaches with an unknown quantity of oil dispersing in the waters of the northwest Gulf of Mexico over the biologically productive continental shelf. The BURMAH AGATE oil tanker collided with the freighter MIMOSA in November 1979 5 mi off Galveston, Texas and spilled several million gallons of light crude oil into offshore waters. In the cases of the IXTOC/BURMAH AGATE spills, the circumstances for an accurate damage assessment were favorable because a multidisciplinary baseline study of the South Texas outer Continental Shelf (STOCS) area had been conducted by the Bureau of Land Management (BLM) prior to the spills (1975-1977). The BLM contracted this study to examine and quantify the chemical impact of the IXTOC/BURMAH AGATE spills on the offshore benthic environment and to determine if such impacts resulted in sustained perturbation of the benthic biological community of the STOCS region.

OBJECTIVES: (1) To determine what habitats had been affected by the IXTOC/BURMAH AGATE spills; (2) to determine the nature and extent of the chemical impact; (3) to determine whether biological and ecological perturbations resulted from this impact as compared to both the pre-spill environment (baseline information) and the unaffected environment (reference stations); (4) to determine a causal relationship between any observed biological changes and the chemical impact; (5) to determine potential biological damage to the commercially important shrimp fishery due to the chemical impact; and (6) to determine the pre-spill value of the ecological and/or commercial resource and the extent to which its use and/or value had been diminished.

DESCRIPTION: Baseline data concerning the macroinfauna and concentrations of petroleum in sediment and shrimp samples collected from 12 primary stations from 1974 to 1977 were obtained from the BLM-STOCS Benchmark Study. Sediment, shrimp, and sorbent pad samples were collected from July to December 1979 from the 12 primary stations and at over 90 secondary stations by groups including the regional response team (RRT). Beached oil samples were collected from a variety of stations. A third (post-spill) set of sediment and shrimp samples were collected from the 12 STOCS stations, 26 RRT stations, and 6 BURMAH AGATE stations in December 1980. Benthic samples were collected with a Smith-McIntyre 0.1-m² grab. Biological samples were sieved through a 0.5-mm screen. Six replicate infaunal cores were collected at each of the 12 stations. Twenty-eight additional stations not previously sampled for biological parameters were included in the benthic sampling during 1980. Determinations of sediment grain size were made for all benthic biological samples. Total organic carbon (TOC) was determined for benthic biological and chemical samples.

Statistical analyses of macroinfaunal data included comparisons between sampling periods within stations, and comparison between stations within sampling periods. Correlation analyses were performed on a taxon-by-taxon basis with sediment texture indices and TOC for all sampling periods in which TOC values were available in the STOCS data base. Cluster analyses were used to elucidate groupings of taxa, stations and time periods, and sediment types.

The analytical techniques used in this program were: (1) ultraviolet fluorescence spectroscopy (UV/F); (2) high resolution (fused silica glass) capillary gas chromatography (FSCGC) with flame ionization detection (FID) and sulfur-specific (Hall Electrolytic Conductivity) detection; (3) computer-assisted gas chromatographic mass spectrometry (GC/MS); and (4) stable isotope mass spectrometry.

A hierarchical analytical scheme was developed for examining the molecular and atomic properties of hydrocarbons in the samples. The scheme began by screening large numbers of samples for the possible presence of oil using a "molecular Property" measurement such as UV/F, and building in analytical complexity as needed.

SIGNIFICANT CONCLUSIONS: Petroleum residues attributable to the IXTOC and BURMAH AGATE spills were not identified in the surficial sediments of the study area. Analyses of several water column samples did indicate the presence of IXTOC oil in

suspended sedimentary material. Shrimp tissue analysis results identified the presence of petroleum in chronic low levels, but only one sample was linked to IXTOC residues. No direct links, based on fluctuations in benthic community parameters (abundance and diversity) identified in a comparison of 1976-1977 data with 1980 (post-spill) data, could be made with the IXTOC and/or BURMAH AGATE, spills.

This study established a chemical and biological framework for carrying out spill assessment studies of this nature. It utilized a significant environmental data base for post-impact studies for the first time, and identified several sampling methodology deficiencies which, if corrected, may help to fine-tune such assessments in the future.

STUDY RESULTS: Based on the results from a subset of sediment samples examined by FSCGC, GC/MS, and stable isotope analyses, it was concluded that petroleum residues attributable to the IXTOC and/or the BURMAH AGATE spills were not present in the surface sediment anywhere in the study region. IXTOC oil was, however, detected in suspended sedimentary material at several sites, thus indicating the presence of oil in the water column system during 1979. Significant quantities of polynuclear aromatic hydrocarbon compounds, products of fossil fuel combustion rather than of direct petroleum origin, were widespread in the sedimentary environment and varied with other geochemical parameters (TOC, grain size). Shrimp tissues examined by FSCGC and GC/MS were shown to be imparted by low levels of chronic petroleum pollutants at many sites, only one sample of which could be linked to IXTOC residues.

Through biological analyses, precipitous declines in the numbers of individuals and taxa (abundance and diversity) throughout the STOCs study area were found compared with pre-spill measurements. The mid- and post-spill samples differed significantly in numbers of taxa from the Fall 1976 and Winter 1977 values and differed significantly in numbers of individuals from the Fall 1976, Winter 1977, and Fall 1977 values. Detailed statistical analyses were performed, establishing the grouping of like stations and taxonomic correlations with grain size and TOC parameters.

Because residues of IXTOC oil were not present in any of the sediment samples, the temporal variations in the benthic macroinfaunal community could not be related definitively to either oil-spill-caused perturbation or to any particular human-induced or environmental factor(s), and may fall within the range of natural variability.

STUDY PRODUCTS: ERCO/Energy Resources Co. Inc. 1982. IXTOC Oil Spill Assessment. A final report for the U.S. Department of the Interior, Bureau of Land Management Gulf of Mexico OCS Office, New Orleans, LA. Vol. I - NTIS No. PB82-197781; Vol. II - NTIS No. PB82-197799; Vol. III - NTIS No. PB82-197773; Set - NTIS No. PB82-197765. Contract No. AA851-CTO-71. 447 pp.

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