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STUDY TITLE: Fate and Effects of Nearshore Discharges of OCS Produced Waters

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SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREA: Central Gulf of Mexico

COMPLETION DATE OF REPORT: June 1991

COSTS: FY 1988: $500,000; FY 1989: $107,575

CUMULATIVE PROJECT COST: $607,575

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KEY WORDS: produced waters, brine, discharges, hydrocarbons, trace metals, radionuclides, benthos, hydrography, bioaccumulation, fate and effects, Louisiana

BACKGROUND: During the production of oil or gas, water that is trapped within permeable sedimentary rock may also be brought to the surface. This produced water may have salinity in excess of that of ambient sea water. In addition, produced waters contain elevated levels of various inorganic and organic substances. Large volumes of produced water generated in the Federal OCS are piped ashore with the petroleum product streams and treated at shore-based or nearshore facilities located in Louisiana waters. While few in number, these OCS-generated produced waters account for large volumes, individually and collectively, of the total produced waters discharged into Louisiana coastal environments. Preliminary investigations indicated that a more detailed analysis of the fate and effects of these produced water discharges were desirable.

OBJECTIVES: (1) characterize the chemical composition of produced waters discharged for coastal OCS facilities in order to understand the variability (2) better define the spatial and possible temporal scale of impacts at the three areas previously studied, (3) characterize the effects of produced water discharges from other OCS

separation facilities located in different environments, (4) characterized the dispersion of contaminants in produced waters by field measurements of tracers of dissolved substances (e.g., salinity and radium), and (5) characterize the bioavailabiltiy of contaminants to marine organisms in the field.

DESCRIPTION: Of the 15 facilities which have been identified as discharging OCS-generated produced water into coastal environments of Louisiana (volumes reported as of 02/90, 10 facilities in seven areas were studied. The discharge volumes of the study sites range from 3,000 to 106,000 $bbl \cdot d^{-1}$. The receiving environments for these effluents are varied, but include the shallow, nearshore continental shelf; high energy, freshwater distributaries of the Mississippi River delta; and brackish and saline coastal environments with moderately to poorly flushed waters.

At each site, an assessment of the fate and effects of produced water discharges was made along with a detailed analysis of the effluent. The receiving environment was characterized with respect to hydrographic regime and the sedimentary characteristics. Hydrographic profiles, interstitial salinity of surface sediments and near-bottom water contaminants were examined to determine the extent of the brine effluent and its chemical constituents. Likewise, surficial sediments were examined to assess the extent and composition of chemical contamination. Vertical sediment cores provided information on the long-term accumulation of chemicals. Biological assessments included benthic community analyses and the bioaccumulation of produced-water-origin contaminants by filter-feeding bivalves.

SIGNIFICANT CONCLUSIONS: A total of 253,994 $bbl \cdot d^{-1}$ produced waters originating on the Federal OCS are piped ashore for treatment and discharge in Louisiana State waters. This volume represents 13% of all produced waters discharged into Louisiana's waters. Elevated levels of dissolved solids (salinity), volatile hydrocarbons, sulfides and total radium activities identified contaminants of the brine effluent in waters directly overlying the sediments. Sediments up to 1300 m from the produced water outfalls exhibited evidence of contamination by petrogenic hydrocarbons from the effluents. Effects on the benthic macroinfauna were demonstrated at most of the study area. Oysters in close proximity to the discharge points and to 1 km distances from the discharges accumulated produced water origin contaminants.

STUDY RESULTS: Several factors determine the fate and effects of produced waters in coastal environments and organisms.

*P.I.'s affiliation may be different than that listed for Project Managers.