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STUDY TITLE: Long-Term Effects of Contaminants from OCS Produced Water Discharges

REPORT TITLE: Long-term Effects of Contaminants from OCS Produced-water Discharges at Pelican Island Facility, Louisiana

CONTRACT NUMBER(S): 14-35-0001-30660-19937

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREA(S): Central Gulf of Mexico

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COSTS): $42,180 federal funds, $42,884 matching funds

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KEY WORDS: produced waters, brine, discharges, effluents, hydrocarbons, metals, benthos, TTAH, *FFPI, fate and effects, Louisiana, OCS

BACKGROUND: There were over 1,200 produced water discharges in the coastal habitats of Louisiana and Texas by the late 1980s. Fifteen of these discharges contained produced waters generated from the Outer Continental Shelf (OCS). In order to meet requirements of Federal and State regulations to end produced water discharges by January 1999, many of the produced water treatment facilities have been dismantled, or the waste product is being reinjected or transported offshore for disposal. Several studies have documented the fate and effects of produced water discharges on sediment contamination, benthic communities and bioaccumulation potential. The effects depend on the volume of the discharge, the chemical characterization of the discharge, and the physiography and hydrography of the receiving environment. Produced water derived contamination signals and/or effects on benthic organisms may be minimal near the discharge, but they may also be substantial and extend great distances from the discharge. Produced water derived contaminants may accumulate in the sediments adjacent to and downstream from the discharge point resulting in high concentrations of hydrocarbons to depths of 25 to 30 cm in vertical sediment cores. Hydrocarbon contamination resulting from these discharges may also persist through

time both in surficial sediments and vertically into subsurface sediments. The receiving environment for a produced water discharge abandoned for two years at Pelican Island was examined in 1989, and produced water contaminants and effects on macroinfauna were documented.

OBJECTIVES: (1) determine the temporal differences in the fate of the produced water contaminant accumulation, persistence and effects on the macroinfauna, (2) characterize the sediments and macroinfaunal communities in a canal adjacent to a discontinued produced water discharge nine years after cessation of the effluent, (3) compare the two-year post-discharge conditions with the nine-year post-discharge conditions.

DESCRIPTION: Sampling was conducted in November of both years along an expected gradient of contamination away from the point of the discontinued effluent. Sediments from the surface and vertical cores were analyzed by gas chromatography/mass spectrometry (GC/MS) for hydrocarbon contamination and by inductively coupled argon plasma emission spectroscopy (ICP) for metals. The macroinfauna retrieved on a 0.5-mm sieve was used to characterize the benthic community.

SIGNIFICANT CONCLUSIONS: The surficial sediment contamination and effects seen at two-years post discharge were not apparent at nine-years post-discharge. There were still contaminants, including weathered petroleum source hydrocarbons and creosote, accumulated in higher concentrations vertically in the sediments (up to 10 cm).

STUDY RESULTS: Improvements in hydrocarbon analytical methods between 1989 and 1996 reduced detection limits and expanded the ability to characterize the source compounds. Some of the higher concentrations of selected AH were due, in part, to a wider range of target analytes. The signature of relatively fresh low-sulfur petroleum at depth in the EW3 core from 1996 was compositionally dissimilar to the 1989 data. The source of petroleum detected at EW3 was characteristically similar to produced water discharges characterized in the 1989 study. The overall petroleum-source pollution was reduced at the station closest to the abandoned discharge (EW4) and represented a weathering of the contaminants. A high level of creosote with depth in the core for EW4 in 1996, however, represented an additional AH content that was not present in 1989. Heavily degraded petroleum characterized sections of vertical cores from station EW4 in 1989. This same signature was present in 1996 but with lower concentrations. These similarities/changes are consistent with weathering of the contaminant and not new inputs. The higher AH concentrations in the vertical cores for station EW3, however, indicated a buried fresh oil signature that was not as degraded as the petroleum contamination at EW4. The benthic communities were significantly different among stations within the canal adjacent to the Pelican Island facility after nine years of the effluent. The abundance and species richness of the most affected stations sampled at two-years post-discharge were significantly greater in the nine-year post-discharge samples.

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STUDY PRODUCT(S): Rabalais, N. N., L. E. Smith, C. B. Henry, Jr., P. O. Roberts, and E. B. Overton. 1998. Long-Term Effects of Contaminants from OCS-Produced Water Discharges at Pelican Island Facility, Louisiana. OCS Study MMS 98-0039. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana, 91 pp.

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