

**STUDY TITLE:** Adaptation of the Minerals Management Service's Oil Weathering Model

**REPORT TITLE:** Adaptation of the Minerals Management Service's Oil Weathering Model for Use in the Gulf of Mexico Region

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**PROJECT MANAGER:** B.E. Kirstein

**AFFILIATION:** Chemical & Process Engineering Associates

**ADDRESS:** 3129 Hataca Road, Carlsbad, CA 92009

**PRINCIPAL INVESTIGATOR:** B.E. Kirstein

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**BACKGROUND:** The Gulf of Mexico is a region that produces a considerable quantity of oil that is consumed in the United States. The entire range of refined petroleum products is also transported through this region. The U.S. Department of the Interior, Minerals Management Service, conducts various studies of the fate of spilled oil and products for the purpose of assessing the environmental impact of these petroleum-related activities in this region. This report provides a computational tool which predicts the fate of spilled oil and petroleum products so that a more accurate and realistic environmental assessment for various scenarios can be made.

**OBJECTIVES:** The objectives of this study are: (1) To provide a readily usable open-ocean oil-weathering model which can be run on a personal computer; (2) to provide a means for utilizing wind-speed scenarios and surface temperatures pertinent to the Gulf of Mexico; (3) to provide in readily available form for use as input data to physical properties of ten (10) crude oils and refined petroleum products pertinent to the Gulf of Mexico region; (4) to provide physical-property conversion calculations within the oil-

weathering code so that more available data are directly usable; and (5) to provide a description of the oil-weathering model and directions for its use.

**DESCRIPTION:** The intended use of the MMS open-ocean oil-weathering model is to predict the material balance of spilled oil remaining on the ocean surface. The technical approach used to write the model is the utilization of petroleum-industry crude oil and refined product inspections and physical properties along with known oil-weathering processes. The material balance algorithms use these available inspections and physical properties along with environmentally determined parameters to predict that rate at which mass leaves the slick. Since it is generally known that the mass-loss rate processes which determine the fate of spilled oil are wind dependent, variable-wind speed as a function of time is justified as model input. Wind-speed information was obtained from buoy data in justified as model input. Wind-speed information was obtained from buoy data in the Gulf of Mexico and used to generate hourly wind-speed tables for use as input to the oil-weathering model. Sea-surface temperatures from annual compilations are used as input to set the weathering temperature. The software codes developed to implement variable-wind speed for oil-weathering predictions are written such that the user can run these codes on any personal computer immediately.

**SIGNIFICANT CONCLUSIONS:** The range of environmental parameters in the form of wind-speed variation and sea-surface temperature vary significantly in the Gulf of Mexico region with respect to the short-term fate of the weathering of oil and petroleum products. The range of physical properties of petroleum and petroleum products produced in the shipped through the region is significant. By providing the user with access to the pertinent physical properties through examples and sources of information, future use of the model as a prediction tool will provide more accurate and realistic assessments.

**STUDY RESULTS:** The MMS open-ocean oil-weathering code has been extensively modified and adapted for use on a personal computer. The modifications include the use of variable-wind speed as a function of time as an environmental parameter. The assumptions, governing equations and algorithms are discussed to illustrate which oil-weathering processes are wind-speed dependent. Wind-speed information and sea-surface temperatures for regions in the Gulf of Mexico are provided so that the modified model can be used immediately. A selection of crude oils and petroleum products produced in and shipped through the region are provided as examples of information required for model use. A discussion of crude oil and petroleum product information sources is also presented. Detailed user's instructions on the use of the model, examples demonstrating the use of the model and program listings are provided.

**STUDY PRODUCT:** Kirstein, B.E. 1992. Adaptation of the Minerals Management Service's Oil-Weathering Model for Use in the Gulf of Mexico Region. OCS Study 92-0023. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA. 64 pp.