

Analysis of Environmental Risk of Chemical Products Used in Deepwater Oil and Gas Operations



CLIENT:

Mineral Management Service (MMS), U.S. Department of the Interior

PROJECT ELEMENTS:

- Chemical Discharge Risk Assessment
- Chemical Spill Modeling using CHEMMAP
- Identify natural/biological resources of concern
- Spill/discharge worst-case scenarios

PROBLEM. PURPOSE.

Led by A.D. Little, a team including ASA, was assembled to analyze environmental risks associated with chemical products used in deepwater oil and gas operations in the Gulf of Mexico. ASA utilized its Chemical Spill Model System (CHEMMAP) to perform chemical spill modeling. The model results are used to evaluate risks of impacts from spills.

[Literature Review, Environmental Risks of Chemical Products Used in Gulf of Mexico Deepwater Oil & Gas Operations, Minerals Management Service, Gulf of Mexico OCS Region, OCS Study MMS 2001-011]

SCIENCE. SERVICES. SOLUTIONS.

The steps in the risk analysis were:

- Identify potential natural resource receptors (map biological resources of concern, such as highly sensitive coral reefs)
- Develop spill/discharge worst case scenarios (chemicals, volumes, etc.)
- Conduct spill modeling using the stochastic model in CHEMMAP
- Assess potential environmental impacts

The probability of impact from an oil or chemical discharge is quantified using ASA's three-dimensional stochastic model in CHEMMAP. In the stochastic model, many runs are made for each release scenario and location. Using a historical wind and current record for a location, the model randomizes spill date, and thus the wind and current conditions. The spill volume may also be randomized. An effects endpoint is selected based on toxicity data, which provides a threshold above which probabilities and expected concentrations are reported. Model output includes maps of chemical:

- Mass or volume on the water surface
- Mass or volume on shorelines
- Particulate concentration in the water
- Dissolved concentration in the water
- Concentration adsorbed to suspended sediments on the water
- Mass concentration in the sediments

PRODUCTS. RESULTS.

Statistics were produced for each location (cell) in the model grid. These were displayed in contour maps, which may be overlaid on maps of receptors of concern. Statistics on all model runs may be viewed in total (as probabilities) or individually. The outputs were: probability of (any) amount exceeding the threshold passing that location, time when amount first exceeds the threshold at the location, mean expected maximum mass or concentration at the location (i.e., mean of all runs), worst case (maximum possible) amount that could hit a location (i.e., maximum of all runs), and start date and time for run producing the worst case at the location. Seventeen scenarios were run for hypothetical spills in the offshore Gulf of Mexico. An assessment of potential ecological risks was based on these modeling results.

