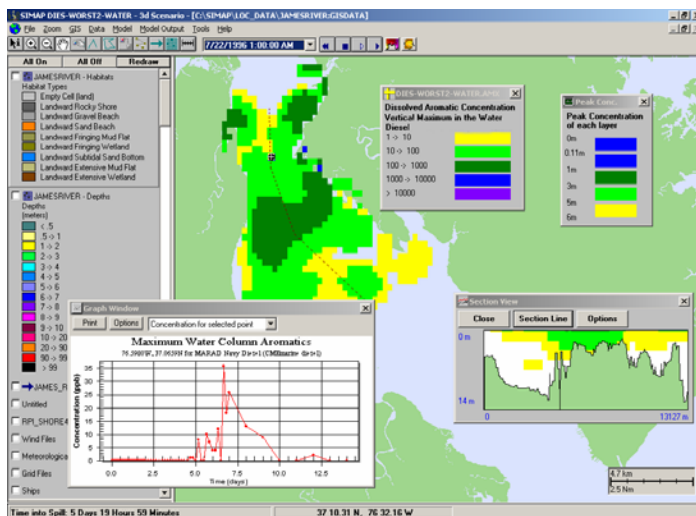
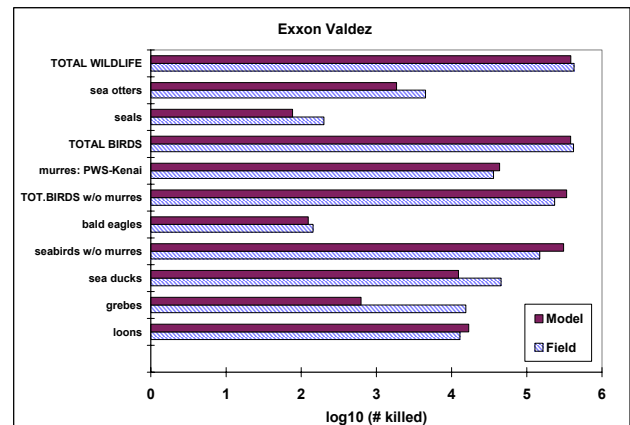


Applied Science Associates develops computer models that evaluate the transport, fate, and biological effects of oil and chemicals in marine and fresh water environments. These models may be applied to spills or long-term discharges. Models hindcast or forecast single scenarios or provide probability distributions of impacts. ASA combines these sophisticated tools with comprehensive field programs and data collection to provide site-specific impact and ecological risk assessments.

SPILL IMPACT ASSESSMENT

A hindcast of a specific oil or chemical spill is modeled to evaluate the likely biological impacts of the event. Site-specific wind, current, and other environmental data are gathered from on-line services, third parties, or field studies. Shoreline and habitat types, as well as bathymetry, are mapped and gridded for use in modeling. The physical, chemical, and toxicological properties of the released substance(s) are determined. Biological abundance data are obtained from existing sources or observations made after the spill in representative habitats. Using this information, and ASA's spill impact models SIMAP (oil) and CHEMMAP (chemicals), the most likely and range of impacts are quantified. These results may be validated with field observations made following the spill.



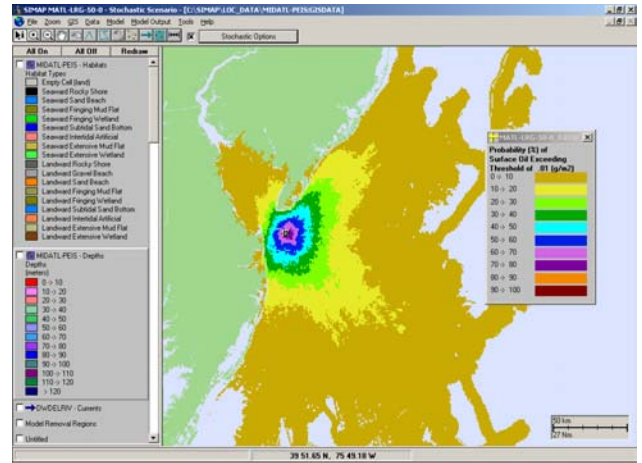
WORST CASE SPILL ANALYSIS

The worst case potential spill may be identified using the probability analysis (3-dimensional stochastic model) described below. Alternatively, the worst case may be those wind and current conditions which would maximize exposure to sensitive resources near the spill site. The worst case scenario is forecast using the 3-dimensional fates and biological effects models in SIMAP and CHEMMAP. This quantifies the worst possible concentrations and biological effects for a spill site. Sensitivity analysis provides measures of uncertainty for these predictions.



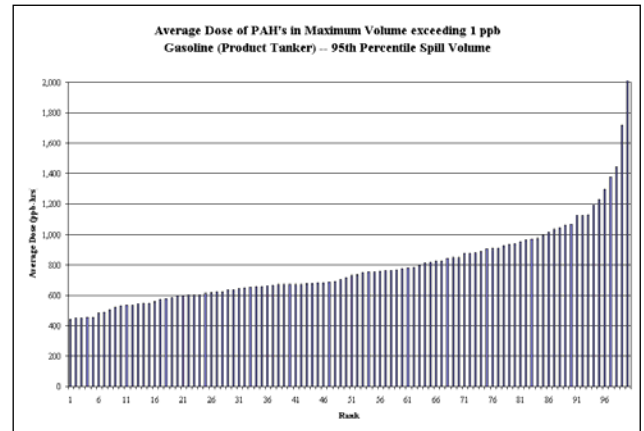
PROBABILITIES OF DISCHARGE IMPACTS

The probability of impact from an oil or chemical discharge is quantified using ASA's three-dimensional stochastic model in SIMAP. To evaluate the distribution of potential impacts resulting from variation in environmental conditions, long-term historical wind and current data are assembled for the area of interest. The model is run many times, randomizing the start date and time within a specified range of months of the year. In addition or alternatively, various other model inputs may be varied within specified ranges, such as the spill volume, spill location, release depth, release duration, and assumed parameters for model algorithms. The multiple model runs provide a frequency distribution of model results, for which statistics are calculated and plotted. An effects endpoint is selected, which provides a threshold above which probabilities are to be reported. Additional statistics are produced for each location (cell) in the model grid, such as maximum exposure, mean and standard deviation.



Model output includes maps and histograms of oil/chemical:

1. mass on the water surface,
2. mass on shorelines,
3. dissolved concentration in the water column,
4. concentration of submerged particles in the water column,
5. mass in the sediments,
6. areas and volumes affected above exposure thresholds, and
7. dose to water column and sediment biota.



ASA integrates computer models with field data to answer interdisciplinary questions related to marine and freshwater environments. Our scope of services is broad, reflecting 20 years of experience solving environmental and engineering issues including: water quality management, biological assessment, and oil and hazardous materials modeling.

ASA'S clients include international governments, universities, research institutes and major oil companies. ASA has a proven track record in providing high quality scientific support services to these clients in support of their global operations.

For more information about ASA's services or applications feel free to contact us or visit our website.



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