

# Oil Spill Modeling Workshop

## Oil Spill Modeling: Biological Effects Model

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### Mission

The Biological Effect Model Subgroup will evaluate modeling approaches, available information, potential algorithms, and data needs for developing the next-generation oil spill biological effects model. The assumed inputs to the biological effects model include (1) wind data as time- and (optionally) spatially-varying velocities; (2) current data as time- and spatially-varying velocities; (3) environmental conditions such as temperature and salinity; and (4) physical fates model outputs that quantify spatial distributions, physical-chemical characteristics, and concentrations over time of floating oil, entrained oil droplets, dissolved hydrocarbons, oil in sediments, and oil on shorelines. Processes to be considered in the biological effects modeling review and model algorithm development include:

- Exposure evaluation
  - to floating oil, entrained droplets, dissolved hydrocarbons, oil in sediments, oil on shoreline
  - for habitats, wildlife, fish and invertebrates
  - including consideration of behavior, i.e., normal, avoidance and attraction.
- Uptake of hydrocarbons into biota (pathways and rates of uptake)
- Lethal and sublethal effects levels and algorithms for individual effects
  - Mechanical/smothering/thermal/toxicological effects of (whole) oil on wildlife and aquatic biota
  - Toxicity of hydrocarbons on aquatic biota
    - Acute effects of short-term exposures (considering duration of exposure from <12 hrs to weeks)
    - Long-term effects of short-term exposures on development, growth, reproduction, etc.
  - Phototoxicity of PAHs on aquatic biota
- Population level effects and recovery rate [identification of issue; review of modeling approaches; but not a review of specifics for individual species]
- Ecosystem level effects and recovery rate [identification of issue; review of modeling approaches; but not a review of specifics for individual ecosystems]
  - Trophic transfer
  - Change in competitive/synergistic relationships
- Scaling restoration with modeling [review of modeling approaches; but not a review of specifics for individual habitats or species]
  - Habitat Equivalency Analysis
  - Resource Equivalency Analysis

### Areas of overlap of missions between subgroups

The biological effects model depends on the physical fates model to quantify spatial distributions, physical-chemical characteristics, and concentrations over time of floating oil, entrained oil droplets, dissolved hydrocarbons, oil in sediments, and oil on shorelines. Thus, these two models need to be coordinated in the methods and units used to describe the oil components in each environmental compartment. Most importantly, the chemical characterization of the oil is typically broken out into “pseudocomponents”, or groups of hydrocarbons of similar physical-chemical and toxicological behavior. That characterization needs to be consistent and appropriate for tracking both the fate of the oil and the potential effects.

#### **Coastal Response Research Center**

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Physical transport processes applying to oil and dissolved components also apply to planktonic organisms. Thus there is overlap between the biological effects, physical fates and transport model groups in resolving this issue. Spatial and time scales of the biological effects and physical fates models need to be coordinated such that appropriate processes and scales of contamination are resolved in both models.

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