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Standard Practice for Development and Use of Oil-Spill Trajectory Models[1]

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1. Scope

1.1 This practice describes the features and processes that should be included in an oil-spill trajectory and fate model.

1.2 This practice applies only to oil-spill models and does not consider the broader need for models in other fields. This practice considers only computer-based models, and not physical modeling of oil-spill processes.

1.3 This practice is applicable to all types of oil in oceans, lakes, and rivers under a variety of environmental and geographical conditions.

1.4 This practice applies to two-dimensional models. There are three-dimensional models in the marketplace.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Terminology

2.1 *Definitions:*

2.1.1 *trajectory model*—a computer-based program that predicts the motion and fate of oil on water as a function of time.

2.1.1.1 *Discussion*—Input parameters include oil properties, weather, and oceanographic information. There are four different modes: forecast, hindcast, stochastic, and receptor.

2.1.2 *contingency planning*—planning of several types to prepare for oil spills.

2.1.2.1 *Discussion*—This planning can include modeling such as described in this guide, to predict where oil spills might go and what the fate and properties of that oil would be.

3. Significance and Use

3.1 Trajectory models are used to predict the future movement and fate of oil (forecast mode) in contingency planning, in exercises and during real spill events. This information is used for planning purposes to position equipment and response personnel in order to optimize a spill response. Oil-spill trajectory models are used in the development of scenarios for training and exercises. The use of models allows the scenario designer to develop incidents and situations in a realistic manner.

3.2 Oil-spill trajectory models can be used in a statistical manner (stochastic mode) to identify the areas that may be impacted by oil spills.

3.3 In those cases where the degree of risk at various locations from an unknown source is needed, trajectory models can be used in an inverse mode to identify the sources of the pollution (hindcast mode).

3.4 Models can also be used to examine habitats, shorelines, or areas to predict if they would be hit with oil from a given source (receptor mode).

4. Modelling Methods

4.1 Models simulate the movement of oil on water, calculates the various weathering processes and considers the interaction of the oil with the shoreline. The input data needed by the model includes area maps, oil properties, and spatial and temporal vectors of wind and ocean currents. In some models, there are separate programs for advection and fate. In some cases, the fate models calculate weathering on the total mass of the oil rather than on individual particles. Some models include response strategies (skimming, burning, dispersing, and so forth) and the effect of these on the mass balance.

4.2 The computer model calculates the surface fate of the oil using physical and chemical properties of the oil and weathering algorithms.

4.3 The output of a model is a map showing oil-slick locations as a function of time, and graphs and tables of the weathering of the oil and mass balance.

4.4 The output of the model is subject to uncertainties, primarily caused by uncertainties in the input data from forecast winds and predicted ocean currents. The model should include an estimate of the magnitude of these uncertainties. It should be recognized that models are only a tool and thus outputs should always be confirmed by ground-truthing.

5. Input Modelling Parameters

5.1 In order to generate a georeferenced output, it is necessary to have a suitable base map. This map should have

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[1] This practice is under the jurisdiction of ASTM Committee F20 on Hazardous Substances and Oil Spill Response and is the direct responsibility of Subcommittee F20.16 on Surveillance and Tracking.

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