Designation: F2067 – 07

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

This standard is issued under the fixed designation F2067; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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 does not address issues of computer operation. It is assumed that the user of this practice is familiar with the use of a computer and its operating systems.

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. Input parameters include oil properties, weather, and oceanographic information. There are four different modes: forecast, hind cast, stochastic, and receptor.

3. Significance and Use

3.1 During an oil-spill response, trajectory models are used to predict the future movement and fate of oil (forecast mode). This information is used for planning purposes to position equipment and response personnel in order to optimize a spill response.

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 possible sources of the pollution (receptor mode).

3.4 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.

4. Modelling Methods

4.1 A typical model simulates the motion 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.

4.2 The computer model calculates the 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.

4.4 Trajectory models operate in a number of modes; predictive, stochastic and receptor.

4.5 The output of the model is subject to errors, primarily caused by errors in the input data from forecast winds and predicted ocean currents. The model should include an estimate of the magnitude of these errors.

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 a resolution in the order of 100 metres near shore and 1 km in the open ocean. The base-map data should be in a common mapping format, for example MID/MIF, ARC, and DIF. The map should be vector-based in order that the output can be scaled to be consistent with the extent of the trajectory. The data on the map should be organized in layers, with ocean current, wind fields, and trajectory information available as separate layers.

5.2 The physical and chemical properties of the oil are needed in order to calculate the weathering of the oil. This data should be derived from readily available distillation data

[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.

Current edition approved April 1, 2007. Published April 2007. Originally approved in 2000. Previously approved in 2006 as F2067 – 00 (2006). DOI: 10.1520/F2067-07.