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Standard Guide for Taking Property and Behavior Measurements on Weathered Fractions of Oil¹

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1. Scope

1.1 This guide summarizes methods to fractionate oil by evaporative weathering and then measure the properties and behavior of the weathered oil. The results of this guide can provide oil behavior data for input into oil spill models and response method selection.

1.2 This guide covers general procedures for oil weathering and behavior and does not cover all possible procedures which may be applicable to this topic.

1.3 The results obtained using this guide are intended to provide baseline data for the behavior of oil and petroleum products when spilled and input to oil spill models.

1.4 The results obtained using this guide can be used directly to predict certain facets of oil spill behavior or as input to oil spill models.

1.5 The accuracy of the guide depends very much on the representative nature of the oil sample used. Certain oils can have different properties depending on their chemical contents at the moment a sample is taken.

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

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

¹ This guide 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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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- D97 Test Method for Pour Point of Petroleum Products
- D971 Test Method for Interfacial Tension of Insulating Liquids Against Water by the Ring Method
- D1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
- D1824 Test Method for Apparent Viscosity of Plastisols and Organosols at Low Shear Rates
- D4294 Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry
- D4377 Test Method for Water in Crude Oils by Potentiometric Karl Fischer Titration (Withdrawn 2020)³
- D5002 Test Method for Density, Relative Density, and API Gravity of Crude Oils by Digital Density Analyzer
- D5853 Test Method for Pour Point of Crude Oils
- D5949 Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)
- D6352 Test Method for Boiling Range Distribution of Petroleum Distillates in Boiling Range from 174 °C to 700 °C by Gas Chromatography
- D6450 Test Method for Flash Point by Continuously Closed Cup (CCCFP) Tester
- D6560 Test Method for Determination of Asphaltenes (Heptane Insolubles) in Crude Petroleum and Petroleum Products
- D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- D7094 Test Method for Flash Point by Modified Continuously Closed Cup (MCCCFP) Tester
- D7169 Test Method for Boiling Point Distribution of Samples with Residues Such as Crude Oils and Atmospheric and Vacuum Residues by High Temperature Gas Chromatography
- F2059 Test Method for Laboratory Oil Spill Dispersant Effectiveness Using the Swirling Flask
- F3045 Test Method for Evaluation of the Type and Viscoelastic Stability of Water-in-oil Mixtures Formed from Crude Oil and Petroleum Products Mixed with Water
- F3251 Test Method for Laboratory Oil Spill Dispersant Effectiveness Using the Baffled Flask
- F3633 Guide for Measuring the Adhesion of Crude Oils and Fuel Oils
- F3634 Guide for Preparing Weathered Samples of Oil Using a Rotary Evaporator

3. Terminology

- 3.1 *adhesion*—the tendency of dissimilar particles or surfaces to cling to one another. In this case oil to surfaces such as oleophilic skimmer surfaces.
- 3.2 *emulsion*—a type of colloid, specifically, a dispersion of small droplets of one liquid in another.
- 3.3 *interfacial tension*—the elastic tendency of a fluid surface which makes it acquire the least surface area possible.
- 3.4 *simulated distillation (SIM DIS)*—measurement of the boiling temperatures of fractions of oil using chromatography alone.
- 3.5 *stability index*—an index describing the stability of an emulsion. In this guide, it is calculated using data derived from rheological measurements.
- 3.6 *water-in-oil emulsion*—an emulsion consisting of a continuous phase of oil containing a dispersed phase of water.

4. Summary of Guide

- 4.1 Oil is evaporatively weathered to at least three (3) stages, with the first stage being fresh oil and the second being intermediate and with the final stage being extensive. Extensive weathering is reasonably maximum weathering for example, ten (10) days equivalent or with little change in properties occurring in the final sub-stages of weathering.
- 4.2 Sub-samples of the oil are taken at each weathering stage and desired properties and behaviors (such as density, viscosity, emulsion formation, etc.) are measured.

5. Significance and Use

- 5.1 A standard procedure is necessary to establish property changes for spilled oils or petroleum products at different oil weathering stages.

³ The last approved version of this historical standard is referenced on www.astm.org.