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Standard Test Method for Determination of Deposition of Aerially Applied Oil Spill Dispersants¹

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1. Scope

1.1 This test method covers the measurement of the deposition of an aerially applied dispersant surrogate, typically dyed water, on the surface of the ground or water. The test method of obtaining these measurements is described, and the analysis of the results, in terms of dispersant use, is considered. There are a number of techniques that have been developed, and this test method outlines their application. These measurements can be used to confirm or verify the specifications of a given equipment set, its proper functioning, and use.

1.2 This test method is applicable to systems used with helicopters or airplanes.

1.3 This test method is one of four related to dispersant application systems. Guide [F1413_F1413](#) covers design, Practice [F1460/F1460M](#) covers calibration, Test Method F1738 covers deposition, and Guide [F1737/F1737M](#) covers the use of the systems. Familiarity with all four standards is recommended.

1.4 There are some exposure and occupational health concerns regarding the methods described. These are not discussed in this test method since they are a function of dispersant formulation. Anyone undertaking such experiments should consult the occupational health experts of the dispersant manufacturer regarding the precautions to be used.

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

1.6 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

¹ This test method is under the jurisdiction of ASTM Committee F20 on Hazardous Substances and Oil Spill Response and is the direct responsibility of Subcommittee F20.13 on Treatment.

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2. Referenced Documents

2.1 ASTM Standards:²

[E642 Practice for Determining Application Rates and Distribution Patterns from Aerial Application Equipment](#)

[E1260 Test Method for Determining Liquid Drop Size Characteristics in a Spray Using Optical Nonimaging Light-Scattering Instruments](#)

[F1413_F1413 Guide for Oil Spill Dispersant Application Equipment: Boom and Nozzle Systems](#)

[F1460/F1460M Practice for Calibrating Oil Spill Dispersant Application Equipment Boom and Nozzle Systems](#)

[F1737/F1737M Guide for Use of Oil Spill Dispersant Application Equipment During Spill Response: Boom and Nozzle Systems](#)

2.2 ASAE/ASABE Standard:³

[ASAE/ASABE S561.1 \(R2013\) Procedure for Measuring Drift Deposits from Ground, Orchard, and Aerial Sprayers - Standard by The American Society of Agricultural and Biological Engineers](#)

3. Significance and Use

3.1 The deposition of an aerially applied dispersant is defined as the amount of an aerially applied dispersant that contacts the surface; whereas, application dosage (frequently referred to as application rate) is the amount of material that is released per unit area by the delivery system. The units of deposition are litres per hectare or U.S. gallons per acre. The deposition may differ from the application dosage (volume of material per unit area) for many reasons, such as, the effects of wind on the spray and the evaporation of the dispersant after it has been released from the aircraft.

3.2 This test method describes the measurement of the ability of a spray system to deposit a dispersant on oil. It is not intended that this test method be used at the time of a spill. These techniques are intended to determine the equipment

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.

³ Available from American Society of Agricultural and Biological Engineers (ASABE), 2950 Niles Road, St. Joseph, MI 49085, <http://www.asabe.org>.

performance during the development of new systems and after the repair or significant modification of a system.

3.3 The data obtained from the use of this test method can be directly related to the deposition of dispersant on an oil slick, and thus can serve to determine both the dispersant deposition and the droplet size.

3.4 Surrogate deposition and droplet size data can be used as a technical basis for the optimization of dispersant application equipment and its use.

3.5 The choice of a dispersant surrogate may vary, typically water is chosen along with a marker dye.

4. Apparatus and Materials

4.1 The basic concept is to provide a collection surface on which the aerially applied material is deposited. The amount of material and the deposition pattern and its droplet size can be measured using this surface. Several systems and methods have been developed, and each has its own advantages and disadvantages.

4.2 These measurements require a large, flat open area (such as a field or an airport) which is suitable for low-level flying and maneuvering. The location should be away from human habitation or environmentally sensitive areas in order to minimize problems due to noise and drifting spray.

4.3 These field programs should be conducted under low-wind conditions in order to minimize drift. Near-surface turbulence due to thermal gradients or atmospheric instability can contribute to a variation in the results. These measurements cannot be carried out in the presence of precipitation or in heavy concentrations of dust.

4.4 All tests are to be conducted with the flight path in an upwind direction. The upwind direction is chosen to simplify the interpretation of the data and to conform with typical field practice. It may be necessary to alter the flight path slightly for changes in wind direction during the course of an experimental program.

4.5 It is common practice to use a surrogate, typically water, rather than the dispersant itself. Dye can be added to the water to provide a measurement target. This dye should respond to the analytical method used in Section 5. Special permission would be required to use a dispersant and permissions may also be required to apply a surrogate, and special precautions may be required to protect and clean the area afterwards.

5. Deposition Measurement Methods

5.1 These techniques involve the use of a collecting surface of known area and the measurement of the amount and character of the dispersant deposited on this area. A variety of systems may be used, such as the following:

5.1.1 *Laser Measuring Instrumentation*—The use of laser-based measuring techniques is becoming more common and can provide both droplet size and deposition distribution. This method employs laser scattering devices deployed in an array on a flat surface (Test Method E1260), the number of these devices depends on the specified horizontal range of these devices and the amount of surface coverage desired by the test

group. The data are collected in the memory of the units and analyzed and processed upon completion of the test. With some units, it is possible to conduct multiple tests before recovery of the data as the data are time-stamped.

5.1.2 *Coated Cards*—Standard cards specifically designed for the purpose (for example, Kromekote cards) of known area are placed in a line perpendicular to the flight path, and extending over a distance 25 % greater than the expected swath width. The cards typically have dimensions of 5 by 7 cm. There should be about twenty cards placed across the flight path in order to have an adequate number of sampling points. In a typical experimental setup, the distance between sampling cards should be greater than one metre and less than three metres. This criteria may require more or less than twenty cards depending on the spray system being tested. Each card should be identified by a unique label, indicating its place on the sampling line and the number of the spray pass. The marking should be made in such a fashion that it will not be removed by the dispersant surrogate, as well as Garrco Vision Pink dye mixed at a ratio of 1:400 to provide color to the Kromekote cards. The cards are kept covered until just before the spray run to reduce the possibility of contamination. The cards are placed in holders if wind can move these cards out of position. The placement, uncovering, and retrieval of these cards is labor intensive. After the spray run, the cards are collected and analyzed by machine (Practice E642, ASAE/ASABE S561.1 (R2013)). The cards may be used to provide both droplet size, spray width and deposition pattern. This method may also be used in combination with other methods to provide data.

5.1.3 *Glass Petri Dishes or Similar Containers*—Flat dishes of known area are placed in a line perpendicular to the flight path, and extending over a distance 25 % greater than the expected swath width. Dishes of a diameter of 120 to 140 mm are typically used. There should be about twenty dishes placed across the flight path in order to have an adequate number of sampling points. In a typical experimental setup, the distance between sampling dishes should be greater than one metre and less than three metres. This criteria may require more or less than twenty dishes depending on the spray system being tested. Each sampling dish should be identified by a unique label, indicating its place on the sampling line and the number of the spray pass. The marking should be made in such a fashion that it will not be removed by the dispersant surrogate, or rough handling. The sampling dishes are kept covered until just before the spray run to reduce the possibility of contamination. The placement, uncovering, and retrieval of these dishes is labor intensive. After the spray run, the dishes are collected and washed with a suitable solvent, such as methanol or hexane, to collect the deposited material. The amount of dye present can be determined by using a colorimeter sensitive to the dye used. The system must be calibrated using a sample of the dyed surrogate and solvent mixture for that experimental pass. For these measurements, care must be taken to ensure that the same dilution factors are used for both the calibration and material from the sampling dishes, since the measurement instruments are only linear over about an order of magnitude of concentration. From these sets of data, the amount of material