Designation: D5831 – 23

Standard Practice for Screening Fuels in Soils[1]

This standard is issued under the fixed designation D5831; 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 is a screening procedure for assessing the presence of fuels containing aromatic compounds in soils. If a sample of the contaminant fuel is available, the concentration of the fuel in the soil can be determined. If the contaminant fuel type is known but a sample of the contaminant fuel is not available, an estimate of the concentration of the fuel in the soil can be made using average response factors based on composition of the fuel in the soil. If the kind of contaminant fuel is unknown, this screening method can be used to identify the presence of contamination.

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

1.3 *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.*

1.4 *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]

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water
D5681 Terminology for Waste and Waste Management
E131 Terminology Relating to Molecular Spectroscopy
E169 Practices for General Techniques of Ultraviolet-Visible Quantitative Analysis
E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
E275 Practice for Describing and Measuring Performance of Ultraviolet and Visible Spectrophotometers
E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
E925 Practice for Monitoring the Calibration of Ultraviolet-Visible Spectrophotometers whose Spectral Bandwidth does not Exceed 2 nm

3. Terminology

3.1 *Definitions*—For definitions of terms used in this screening practice, refer to Terminologies D5681 and E131.

4. Summary of Practice

4.1 A sample of soil is extracted with isopropyl alcohol, and the extract is filtered. The ultraviolet absorbance of the extract is measured at 254 nm. If a sample of the contaminant fuel is available, the approximate concentration of contamination can be calculated. If the contaminant fuel type is known but a sample of the contaminant fuel is not available, an estimate of the contaminant concentration is determined using average response factors based on composition of the fuel in the soil. If the composition of the contaminant fuel is not known, the absorbance value is used to indicate the presence or absence of fuel contamination. Calcium oxide is added to the soil as a conditioning agent to minimize interferences from humic materials and moisture present in the soil. Particulate interferences are removed by passing the extract through a filter.

5. Significance and Use

5.1 This practice is a screening procedure for determining the presence of fuels containing aromatic compounds in soils. If a sample of the contaminant fuel is available for use in calibration, the approximate concentration of the fuel in the soil can be calculated. If the fuel type is known but a sample of the contaminant fuel is not available for calibration, an estimate of the contaminant fuel concentration can be calculated using average response factors based on composition of the fuel in the soil. If the composition of the contaminant fuel is unknown, a contaminant concentration cannot be calculated, and this practice can only be used only to indicate the presence or absence of fuel contamination.

[1] This practice is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.05 on Screening Methods.

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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.

TABLE 1 Approximate Quantitation Limits for Various Fuel Types in Soils Based on 0.036 AU

Material	Limit of Quantitation (LOQ), mg/kg
Coal Oil	21
Crude Oil	61
Diesel Fuel	75
Weathered Diesel Fuel	21
Used Motor Oil	162
Weathered Gasoline	170
Unleaded Gasoline	316
Jet Fuel JP-2	378
Motor Oil	533
Aviation Gasoline	1066
Synthetic Motor Oil	1382

TABLE 2 Reciprocal Absorptivities at 254 nm for a 1 cm Path Length Cell

Material	1/Absorptivity, mg/L/AU
Coal Oil	59
Crude Oil	169
Diesel Fuel	209
Weathered Diesel Fuel	58
Used Motor Oil	450
Weathered Gasoline	473
Unleaded Gasoline	877
Jet Fuel JP-2	1050
Motor Oil	1480
Aviation Gasoline	2960
Synthetic Motor Oil	3840

5.2 Fuels containing aromatic compounds, such as diesel fuel and gasoline, as well as other aromatic-containing hydrocarbon materials, such as crude oil, coal oil, and motor oil, can be determined by this practice. The quantitation limit for diesel fuel is about 75 mg/kg. Approximate quantitation limits for other aromatic-containing hydrocarbon materials that can be determined by this screening practice are given in Table 1. Quantitation limits for highly aliphatic materials, such as aviation gasoline and synthetic motor oil, are much higher than those for more aromatic materials, such as coal oil and diesel fuel.

NOTE 1—The quantitation limits listed in Table 1 are estimated values because in this practice, the quantitation limit can be influenced by the particular fuel type and soil background. For information on how the values given in Table 1 were determined, see Appendix X1. Data generated during the development of this screening practice and other information pertaining to this practice can be found in the referenced research reports (**1, 2**).[3]

5.3 When applying this practice to sites contaminated by diesel fuel, care should be taken in selecting the appropriate response factor from the list given in Table 2, with consideration given to whether or not the fuel contamination is fresh or has undergone weathering or biodegradation processes. See Appendix X2.

5.4 A consideration in using this practice is whether the contamination is a mixture of one or more fuel types. If this is the case, and a site-specific response factor (see X2.3) cannot be determined, the response factors for the individual fuel types in the mixture should be used to estimate contaminant concentrations.

5.5 Certain materials, such as asphalts and asphalt residuals and oils and pitch from trees and other vegetation, which respond as fuel when tested by the practice, give high blank absorbance values which may interfere with use of this practice. See 8.1.2.1 and Note 3 for information on determining if this practice can be applied to a specific soil containing one or more of these types of materials.

5.6 Extractable material, which scatters or absorbs light at 254 nm, is a potential interference for this screening practice.

[3] The boldface numbers in parentheses refer to a list of references at the end of this standard.

6. Apparatus

6.1 *Glass Bottles,* wide-mouth, 125 mL with polytetrafluoroethylene-lined lids.

6.2 *Portable Scale,* (for field testing) or laboratory balance, capable of weighing to 0.1 g.

6.3 *Portable Stirring Device,* (for field testing) or magnetic stir bar and stirrer, which result in motion of the solids during stirring.

6.4 *Syringes,* disposable, polyethylene or polypropylene, 10 mL capacity.

6.5 *Syringe Filters,* disposable, polytetrafluoroethylene, 0.45 µm pore size, 25 mm diameter.

6.6 *Spectrometer,* set at 254 nm with a 1 cm path length, quartz cell (cuvette).

6.7 *Volumetric Flasks and Pipets,* for preparing standard solutions.

6.8 *Laboratory Balance,* capable of weighing to 0.0001 g.

7. Reagents and Materials

7.1 *Purity of Reagents*—Reagent-grade chemicals shall be used in all screening tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[4] Other grades may be used, provided that the reagent is demonstrated to be of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Calcium Oxide Powder, Reagent Grade*—Use calcium oxide powder, reagent grade, dried at 900 °C for 12 h and stored in a desiccator or tightly sealed glass container prior to use. This is a conditioning agent for removal of interferences caused by the presence of humic material or moisture, or both, in the sample.

[4] Reagent Chemicals, American Chemical Society Specifications, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.