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Standard Practice for Assessment of Attaining Clean Up Level for Site Closure[1]

This standard is issued under the fixed designation D 6597; 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 covers the steps necessary to determine if a site is ready for closure with emphasis on general sampling techniques and how to determine if the agreed upon level of remediation has been achieved.

1.2 A minimum of statistical procedures is used in this practice.

1.3 The standard practice does not address radioactive waste sites nor does it cover every situation that can occur in the field. It does cover the following general sampling techniques: soil sampling, swipe sampling of buildings and equipment, surface impoundments, waste piles, and layered tanks. It does not cover drum sampling, general water sampling and monitoring wells and their construction.

1.4 *This standard does not purport to address all 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 to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1452 Practice for Soil Investigation and Sampling by Auger Borings[2]

D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils[2]

D 1587 Practice for Thin-Walled Tube Geotechnical Sampling of Soils[2]

D 3550 Practice for Ring-Lined Barrel Sampling of Soils[2]

D 4547 Guide for Sampling Waste and Soils for Volatile Organic Compounds[3]

D 4687 Guide for General Planning of Waste Sampling[3]

D 5088 Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites[2]

D 5283 Practice for Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation[3]

D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock[2]

D 5451 Practice for Sampling Using a Trier Sampler[3]

D 5730 Guide for Site Characterization for Environmental Purposes With Emphasis on Soil, Rock, the Vadose Zone and Ground Water[2]

D 5792 Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives[3]

D 5956 Guide for Sampling Strategies for Heterogeneous Wastes[3]

D 6009 Guide for Sampling Waste Piles[3]

D 6051 Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities[3]

D 6232 Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities[3]

D 6250 Practice for Derivation of Decision Point and Confidence Limit for Statistical Testing of Mean Concentration in Waste Management Decisions[3]

D 6311 Guide for Generation of Environmental Data Related to Waste Management Activities: Selection and Optimization of Sampling Design[3]

E 1728 Practice for Field Collection of Settled Dust Samples Using Wipe Sampling Methods for Lead Determination by Atomic Spectrometry Techniques[4]

2.2 *API Standard:*

API Standard 2015 Cleaning Petroleum Storage Tanks[5]

2.3 *Federal Standards:*

Title 40, Code of Federal Regulation (CFR), Part 245, [6]

Title 40, Code of Federal Regulation (CFR), Part 265, Guidance on Demonstrating Equivalence [6]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *clean up level, n*—a concentration of a compound or element, in a defined volume of material, that is allowed to remain on a site.

3.1.1.1 *Discussion*—The numerical level usually is determined during the DQO process using a mean, median, or percentage value based upon health risk, fate and transport consideration, site location and intended use.

[1] This practice is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.01 on Planning for Sampling.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 11.04.

[4] *Annual Book of ASTM Standards*, Vol 04.11.

[5] Available from American Petroleum Institute, 1801 K Street NW, Washington, DC 20226.

[6] Available from Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

3.1.2 *closure*, *n*—all waste and manufactured residue are remediated to an acceptable clean up level.

4. Summary of Practice

4.1 The site is determined to be remediated and ready to be closed when site contaminant concentrations meet the agreed upon cleanup level for the site for each media of concern and sampling and analysis procedures meet data quality objectives (DQOs).

4.2 Optimization of sampling design is discussed in brief or by reference.

4.3 The site closure document assumes that the site has been characterized, the characterization was found to be adequate, and DQOs were met.

4.4 A copy of the table of contents of a closure plan submitted to a government agency is included to give an overall view of some items that should be considered. This example should be used only for guidance (see Appendix X1.2).

4.5 This site closure practice contains lists of equipment and sampling methods used in sampling of soils and buildings to confirm the cleanup level(s) has/have been reached.

5. Significance and Use

5.1 This practice contains a mechanism to determine that the hazardous constituents have been remediated to an acceptable level.

5.2 This practice assists both the regulator and the owner/operator in establishing cost-effective steps and procedures necessary to determine if the site has achieved its objective for site closure.

5.3 This practice can be applied to hazardous and nonhazardous spills or leaks, surface impoundments, waste piles, buildings, and tanks. The general nature of this practice allows its use in a large variety of situations.

6. Planning Using the DQO Process

6.1 The Practice D 5792 is a companion to this practice. A thorough study of this practice will prevent many costly mistakes later in the remediation program. The Code of Federal Regulations document 40 CFR 245 covers the DQo process).

6.2 The DQO process should be completed and agreed to by the stakeholders.

6.2.1 The DQO process must specify some numerical value or values that the stakeholders agree beforehand that the decision for site closure shall depend on (see Note 1). For example, the decision rule may state that if the lower 95 % confidence limit is less than the regulatory limit, then the site is safe to close (see Practice D 6250). In that case, no additional sampling is needed and the site may be closed. The conditions for site closure must be stated clearly.

NOTE 1—At some sites, the cleanup goal may be to eliminate an exposure pathway, as is done for installation of slurry walls or caps around or on a site. In these cases no numerical cleanup level is specified.

6.3 After the site has been remediated, the question becomes whether the effort has met the clean up level. The verification process is established during the DQO process. The process may require additional sampling or simply a visual confirmation.

6.3.1 The number of samples and where they will be taken will depend upon the values and acceptable risk established during the DQO process.

NOTE 2—The number of samples may change if the sampling results indicate additional remediation is required.

7. General Sampling Considerations

7.1 A written sampling plan should be prepared before the sampling begins. There are several ASTM documents the stakeholders may want to review during the planning process, and they include: Guides D 4687, D 5434, and D 6051 and Practice D 5283.

7.2 Complete records of all sampling activities must be maintained.

7.3 Before the final sampling commences, the project manager or other responsible party should confirm that the site is ready for the final sampling in preparation for closure. Any differences between planned and actual remediation activities should be documented.

8. Sample Design

8.1 The sampling design is established and optimized during the DQO process.

8.1.1 The sampling design may change if the data from the samples do not confirm clean closure has been achieved. The sampling design should be reevaluated because the site conditions have changed due to the remediation effort. Fewer samples may be required for the second confirmation try.

8.1.2 After further remediation has occurred, the site again is sampled for confirmation that the site meets the clean closure requirements and the DQOs. If the cleanup level(s) has/have been reached and the DQOs have been met, the site is ready for closure.

9. Determination of Attainment of Clean Closure

9.1 The decision rule for closure attainment typically is specified in Step 5 of a DQO process (see Practice D 5792).

9.2 Clean closure value or values usually are developed and agreed to by the stakeholders during the DQO process. The values often are mandated by regulations.

9.3 Examples of closure attainment in the decision rule can include the following:

9.3.1 When the upper 95 % confidence limit of the mean is less than the regulatory limit,

9.3.2 When the lower 95 % confidence limit of the mean is less than the regulatory limit,

9.3.3 When the sample mean is less than the regulatory limit, and

9.3.4 When there is a 90 % confidence that no more than 5 % of the samples are expected to exceed the regulatory limit (in statistical terms, when the upper 95 % tolerance limit is less than the regulatory limit with 90 % confidence).

9.4 The first three examples (9.3.1, 9.3.2 and 9.3.3) have to do with closure decisions based on the mean concentration of a site. Details of how these decision rules can be formulated statistically are given in Practice D 6250.

9.5 At other times, the decision rule can be a qualitative one. For example, a decision-maker can conclude that closure standard has been achieved when all the sample values are

below detection limit.

9.6 A review of the US Government guidance document to help the user demonstrating clean colsure equivalence will be helpful. It is found in Code of Federal Regulation, 40 CFR 265.

9.7 Other documents that contain more detailed statistical methods are "Statistical Methods for Evaluating the Attainment of Cleanup Standards"[7] and USEPA document "Methods for Evaluating the Attainment of Cleanup Standards.[8]

10. Sampling Soils

10.1 Selecting appropriate sampling equipment for a site investigation or closure can be a challenging task. Sampling equipment should be selected to accommodate all of the known physical characteristics of concern or chosen, such that the effect of any sampling bias is minimized. In general, the same types of equipment used during the investigation phase of sampling can be used during the confirmation phase.

10.1.1 The sampling equipment should not discriminate against certain physical characteristics, for example, phase or particle size.

10.1.2 Other considerations in selecting the sampling equipment is the ability to access and extract the sample from the relevant location in the target population, ability to collect a sufficient mass of sample so that the target population is represented, ease of operation, cost of the equipment, and the ability to properly decontaminate the sampling apparatus. Guide D 6232 provides criteria for selecting sampling equipment. Also consider Guide D 5730.

10.2 A list of samplers that are in use to sample soils are found in Appendix X1.

11. Sampling Waste Piles and Surface Impoundments

11.1 It is assumed that the waste pile or surface impoundment has been remediated. The question is whether the site has been remediated to the condition specified in the DQOs. In most cases, automated soil boring is most appropriate for taking samples from the sides and bottom of the remediated site. Hand equipment can be used when sampling locations are based on knowledge gained during the site assessment stage, such as locations where the highest concentration of the compounds of interest was located.

NOTE 3—Guides D 6009 and D 6311 will help the user in the determination of how to sample waste piles and set up a sampling plan.

11.2 If the clean-up level(s) has/have been reached and the DQOs have been met, then site closure can proceed. If it is determined that the clean up level has not been reached, further excavation and additional sampling may be required. If unexpected exceedances are detected, the conceptual model may have to be revisited to determine if the model is still valid.

12. Sampling Tanks

12.1 The tank should be inspected visually before any sampling is done to ensure that the contents have been removed and the tank is clean.

12.2 After the visual check has been completed from the top access panel and the oxygen content is adequate for entry, the tank may be opened and a swipe sample or other appropriate samples taken to determine if level of remaining material is at a level below the clean up level (see API Standard 2015). The number of samples is dependent upon the level of confidence required (see Guide D 6311).

13. Buildings and Equipment

13.1 A site may contain buildings and equipment used in conjunction with hazardous materials resulting in the need for decontamination before being removed from the site. Procedures such as washing with detergents and water or solvents can be used to clean up the building or equipment (see Practice D 5088). After the cleaning procedure has been completed, the results may require verification before the building or equipment is removed or dismantled.

13.2 Wet-wipe sampling (see Practice E 1728) or cyclone vacuuming procedures are used frequently and the results compared with a fixed standard. Generally, authoritative sampling is used; however, systematic random sampling can be used if a more accurate estimate of the mean concentration is required.

14. Keywords

14.1 clean; closure; decontaminate; impoundment; site; soils; tank; waste

[7] Gilbert, R. O. and Simpson, J. C., "Statistical Methods for Evaluating the Attainment of Cleanup Standards", Vol 3, "Reference-Based Standards for Soils and Solid Media", Prepared for the USEPA by Pacific Northwest Laboratory, Richland, WA, PNL-7409 Vol 3, Rev. 1, 1992.

[8] USEPA, "Methods for Evaluating the Attainment of Cleanup Standards", Vol 1: Soils and Solid Media," Statistical Policy Branch (PM-223), 1989b.

APPENDIX

(Nonmandatory Information)

X1. SOIL SAMPLING DEVICES

X1.1 Augers (see Practice D 1452) and trier samplers (see Practice D 5451) are used primarily for disturbed or grab samples used in chemical analyses. Hand augers will reach surface soils to depths of 3 to 15 ft (1 to 5 m).

X1.2 Split barrel samplers (see Test Method D 1586) provide samples that allow description of lithology and other subsurface features and laboratory measurements of soil parameters unaffected by sample disturbance.

X1.3 Thin-wall tube (see Practice D 1587) and ring-lined barrel samplers (see Practice D 3550) collect undisturbed samples of unconsolidated material that are suitable for laboratory testing.

X1.4 Surface sampling techniques such as scoop, spoon, trawl, hand-corers, and shovel can be used to verify whether a site has met the site objectives. The hand corer is the best to minimize bias.

X1.5 Special handling is required for sampling for volatile organics to minimize the lost of contaminants (see Guide D 4547).