



Designation: D7294 – 13 (Reapproved 2021)

Standard Guide for Collecting Treatment Process Design Data at a Contaminated Site—A Site Contaminated with Chemicals of Interest¹

This standard is issued under the fixed designation D7294; 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 guide lists the physical and chemical treatment processes design data needed to evaluate, select, and design treatment processes for remediation of contaminated sites. This data is listed in **Tables 1 and 2**. Much of these data can be obtained and analyzed at the site with instruments and test kits.

1.2 It is recommended that this guide be used in conducting environmental site assessments and Remedial Investigations/Feasibility Studies (RI/FS) and selections of remedy in U.S. Code of Federal Regulations 40 CFR 300.430.

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

D422 Test Method for Particle-Size Analysis of Soils (Withdrawn 2016)³

D1067 Test Methods for Acidity or Alkalinity of Water

D1293 Test Methods for pH of Water

D1498 Test Method for Oxidation-Reduction Potential of Water

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2434 Test Method for Permeability of Granular Soils (Constant Head)

D3590 Test Methods for Total Kjeldahl Nitrogen in Water

D3921 Test Method For Oil and Grease and Petroleum Hydrocarbons in Water (Withdrawn 2013)³

D4327 Test Method for Anions in Water by Suppressed Ion Chromatography

D4564 Test Method for Density and Unit Weight of Soil in Place by the Sleeve Method (Withdrawn 2013)³

D4611 Test Method for Specific Heat of Rock and Soil

D4943 Test Method for Shrinkage Factors of Cohesive Soils by the Water Submersion Method

D4972 Test Methods for pH of Soils

D5084 Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

D5334 Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure

D5463 Guide for Use of Test Kits to Measure Inorganic Constituents in Water

D5730 Guide for Site Characterization for Environmental Purposes With Emphasis on Soil, Rock, the Vadose Zone and Groundwater (Withdrawn 2013)³

D6836 Test Methods for Determination of the Soil Water Characteristic Curve for Desorption Using Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, or Centrifuge

E953/E953M Practice for Fusibility of Refuse-Derived Fuel (RDF) Ash

2.2 Other Documents:

Remediation Technologies Screening Matrix and Reference Guide⁴

U.S. Code of Federal Regulations 40 CFR 300.430⁵

¹ This guide 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 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 The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available at <http://www.frtr.gov>.

⁵ Available at <http://www.gpoaccess.gov/cfr/index.html>.

TABLE 1 Water Parameters^A

NOTE 1—"X" parameters are recommended during early site investigations before any treatment is being considered or has been selected.

NOTE 2—"O" parameters are recommended in addition to "X" if the technology is being considered or has been selected.

Technology ^B	DO (field)	Temperature (field)	Total Suspended Solids (TSS)	Turbidity ^C	CO ₂	H ₂ S	Dissolved H ₂	Methane, Ethane and Ethene	pH (field)	ORP (field)	Chloride (Cl ⁻)	Fluoride (F ⁻)	Ca ²⁺ , Mg ²⁺ , Mn ²⁺ , Na ⁺ , K ⁺ ^D	TOC	COD	DOC	Total Dissolved Solids (TDS)	Alkalinity HCO ₃ ⁻ , CO ₃ ²⁻	Conductivity (field) ^E	Volatile Fatty Acids	Biological Oxygen Demand (5-day BOD)	Oil/Grease	Ammonia (NH ₃)	Phosphorous (total)	Ferrous Iron Fe ^{+2F}	Total Iron Fe ⁺² + Fe ^{+3D}	Sulfate/sulfite (SO ₄ ⁼ /SO ₃ ⁼)	Nitrate/nitrite (NO ₃ ⁻ /NO ₂ ⁻)	Kjeldahl Nitrogen	Sieve Analysis ^G	
	IN-SITU TREATMENT																EX-SITU TREATMENT														
	See Soil, Sediment & Sludge Parameters—thermally enhanced SVE																Same parameters as air sparging														
Phytoremediation ^H Permeable Reactive Barriers Monitored Natural Attenuation Enhanced Bioremediation Air Sparging Hot Water or Steam Flush/Strip Slurry Walls Bioslurping ^I Dual (multiphase) Phase Extraction ^J Chemical Oxidation In-Well Air Stripping Free Product Recovery	See Soil, Sediment & Sludge Parameters																See Dual (multiphase) Phase Extraction														
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

^A This table was developed jointly by the U.S. Army Corps of Engineers, Hazardous, Toxic, and Radioactive Waste Center of Expertise and the U.S. Environmental Project—Engineering Forum.^B See Treatment Technology Profiles in www.frttr.gov for a description of the technology.^C Quality of sampling indicators.^D If these cations are to be analyzed in an offsite laboratory, evaluate analyzing all metal as the cost may be the same.^E Conductivity is a good indicator of Total Dissolved Solids (TDS).^F Analyze for Fe²⁺ in the field or total iron in the laboratory and estimate Fe²⁺ from turbidity, etc.^G Estimate of soil hydraulic properties in the aquifer where the samples were taken. This information may already be available.^H See soil parameters for vadose zone.^I Easily converted to conventional bio venting system or SVE after free product is removed to complete the remediation. Include bio/SVE parameters.^J Dual (multiphase) extraction is generally combined with technologies such as bioremediation, air sparging, bioventing, and soil vapor extraction. Include parameters for these technologies if they are being considered.

TABLE 2 Soil, Sediment, and Slurry Parameters^A

NOTE 1—"X" parameters are recommended during early site investigations before any treatment is being considered or has been selected.

NOTE 2—"O" parameters are recommended in addition to "X" if the technology is being considered or has been selected.

Technology ^B	IN-SITU TREATMENT																												EX-SITU TREATMENT											
	Temperature	Soil pH	Low Volatile Metals (Sb, AS)	Semi Volatile Metals (Hg, Br, Cr, Na, K)	TOC	Kjeldahl nitrogen	Nitrate, Nitrite	Available P (soil), Total P (water)	Plasticity (Atterberg limits)	Sieve Analysis/(Particle Size Analysis)	Specific Heat BTU/lb	Soil Fusion Temperature	Sodium	Moisture Content	Field Capacity	Bulk Density	Potassium	Soil Permeability	Oil and Grease ^C	Cation Exchange Capacity	Alkalinity (HCO ₃ ⁻ , CO ₃ ⁻²) (water)	Fe+3, Mn+4 (water)	Oxygen (soil gas)	CO ₂ (Soil gas)	Calcium, Magnesium	Soluble Solids (electrical conductivity)	Conductivity (thermal)	Capillary pressure-saturation curve	Stratigraphy ^C	Humic Content	Fluoride, Chloride	Sulfate	Sulfur (total)							
Bioventing ^F	X	X			X	O	O	O	X	X				X	O	O	O	O			O		O		X					X	O									
Soil Flushing ^F	X	X			X	X	X	O	X	X				X	O	O	O	O			O		O		X					X	O									
Soil Vapor Extraction ^F	X	X			X	O	O	O	X	X	O		X	X	O	O	O	O			O		O							X	X									
Thermally Enhanced SVE ^E	X	X			X	O	O	O	X	X	O		X	X	O	O	O	O			O		O						X	X										
Monitored Natural Attenuation																																								
(See water parameters table)																																								
Solidification/Stabilization ^F					X				O	X			O	X				O																						
Hot Water/Steam Flushing/ Strip-ping		X																																						
See thermally enhanced SVE																																								
Phytoremediation ^{G,H}	X	X			O	O	O	O		X			O	O	O	O	O	O			O		O																	
Chemical Reduction/Oxidation																																								
(See water parameters table)																																								
Slurry Wall & Sheet Piling	X	X			O					X			O	O				O			O		O																	
Composting		O			O	O	O	O		X								O																						
Landfarming ^H	X	O			O	O	O	O		X								O																						
Slurry Phase Biological Treatment		X			X	X	X	O		X								O																						
Chemical Reduction/Oxidation		X			X	X	X	O		X				O																										
Soil Washing		X			X	X	X			X																														
Soil Vapor Extraction	X	X								X								O																						
Solidification/Stabilization																																								
(Same as in situ)																																								
Thermal Desorption ^I		O	X	X	O	O	O	O	O	X		O	O	X																										
Incineration																																								
(See thermal desorption)																																								
Sediment Technologies applicable to saturated soils will generally also be applicable to sediments.																																								
Biopiles	X				X	O	O	O	O	X				O	O																									

This table was developed jointly by the U.S. Army Corps of Engineers, Hazardous, Toxic, and Radioactive Waste Center of Expertise and the U.S. Environmental Protection Agency Technical Support Project—Engineering Forum.

See Treatment Technology Profiles in www.ftrr.gov for a description of the technologies.

Only if visible evidence.

Usually available from geological investigation data.

Radon zone.

Radon or saturated zone.

See water parameters table for saturated zone.

Additional data on soil conditioning may be needed to determine the suitability of the soil to support vegetation suitable for phytoremediation.

Includes cement kilns.