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Standard Guide for Selection of Minimum Set of Data Elements Required to Identify Locations Chosen for Field Collection of Information to Describe Soil, Rock, and Their Contained Fluids[1]

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1. Scope

1.1 This guide[2] covers factors to consider for the selection of the minimum set of data elements required for the accurate location and cataloging of information collected for geological science (geoscience) investigations, which includes geoecology.

1.1.1 Geoscience investigations include soil surveys, foundation investigations, geologic studies, hydrologic evaluations, environmental appraisals, contamination inquiries, archaeological surveys, and other studies that involve the soil, rock, and contained fluids from the lands surface to any explored depth underground.

1.2 A unique geoscience data location, on or below the earth's surface, can be described by X, Y, and Z coordinates and by that method establish the dimensional relationship to data of a similar nature. Additional location information needed depends upon the type of geoscience data collection locality.

1.2.1 The basic type is a single position described by finite X, Y, and Z coordinates. The X, Y, and Z coordinates uniquely position the location on or below the earth's surface.

NOTE 1—An example is the latitude and longitude in horizontal coordinates and the altitude (or elevation) in vertical distance of a ground-water location or site. Data collected at the site, for example, water levels, are measured by the vertical interval as referenced to the altitude.

1.2.2 Another type of location is described by finite X and Y coordinates that has multiple vertically positioned Z coordinates. This is equivalent to the location type described in 1.2.1, except that multiple vertical dimensions are stated as Z coordinates, rather than vertical intervals.

NOTE 2—An example is latitude, longitude, and multiple altitudes of a soil sampling location or site. Each altitude represents a different sampling position that has the same latitude and longitude coordinate. The upper and lower limit of a sampling interval can be expressed by altitudes.

1.2.3 Another type is a location described by finite X and Y coordinates with multiple Z coordinates that are not vertically oriented from X and Y coordinates.

NOTE 3—An example is a slanted borehole where the top is at a different latitude and longitude coordinate than the sampling positions in the hole. Methods of describing these sampling points are: treat each position as a separate location with finite latitude, longitude, and altitude values; describe the horizontal deviation of the sampling point from the finite latitude and longitude coordinates at the top of the borehole.

1.2.4 Another type is a location with considerable horizontal dimension that cannot be described by a finite X and Y coordinate, however, a single Z coordinate may be acceptable.

NOTE 4—Examples are sinkholes, waste disposal pits, septic systems, underground injection facilities, mines, archaeological sites, and some ponds or lakes. These locations can be described by including additional information that gives the horizontal components of the location along with the latitude, longitude, and altitude coordinates or by multiple sets of X and Y coordinates that encompass the location.

1.3 Additional key data elements are needed to simplify the identification and cataloging of the geoscience data.

1.3.1 These elements describe political entities, data sources, and individual characteristics of the location.

NOTE 5—The data assist in file organization by placing the information into logical categories and to further identify the geoscience location by use of familiar terminology. A carefully designed minimum set of data elements contributes to the recoverability and the future value of the entire data file.

1.4 *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.*

1.5 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This guide cannot replace education or experience and should be used in conjunction with professional*

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[2] As defined by ASTM—a guide is a series of options or instructions that do not recommend a specific course of action. The purpose of a guide is to offer guidance, based on a consensus of view-points, but not to establish a fixed procedure.

judgment. Not all aspects of this guide may be applicable in all circumstances. This guide is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this guide be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

2. Referenced Documents

2.1 *ASTM Standards:* [3]

D 420 Guide to Site Characterization for Engineering, Design, and Construction Purposes

D 653 Terminology Relating to Soil, Rock, and Contained Fluids

D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)

D 2607 Classification of Peats, Mosses, Humus, and Related Products[4]

D 3282 Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D 4083 Practice for Description of Frozen Soils (Visual-Manual Procedure)

D 4220 Practices for Preserving and Transporting Soil Samples

D 4427 Classification of Peat Samples by Laboratory Testing

D 4448 Guide for Sampling Ground-Water Monitoring Wells

D 4700 Guide for Soil Sampling from the Vadose Zone

D 4879 Guide for Geotechnical Mapping of Large Underground Openings in Rock

D 5092 Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers

D 5254 Practice for Minimum Set of Data Elements to Identify a Ground-Water Site

D 5299 Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities

D 5408 Guide for Set of Data Elements to Describe a Ground-Water Site; Part One—Additional Identification Descriptors

D 5409 Guide for Set of Data Elements to Describe a Ground-Water Site; Part Two—Physical Descriptors

D 5410 Guide for Set of Data Elements to Describe a Ground-Water Site; Part Three—Usage Descriptors

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

D 5474 Guide for Selection of Data Elements for Ground-Water Investigations

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

D 5911 Practice for Minimum Set of Data Elements to Identify a Soil Sampling Site

3. Terminology

3.1 *Definitions:* Except as listed or noted below, all definitions are in accordance with Terminology D 653. Additional definitions are in References **(1-17)**.[5] See Guide D 420, Classification D 2487, Practice D 2488, Classifications D 2607 and D 3282, Practices D 3740, D 4083, and D 4220, Classification D 4427, Guides D 4448, D 4700, and D 4879, Practice D 5092, and Guides D 5299 and D 5434.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *altitude*—the vertical distance, in feet (or metres), of a level, a point, or an object considered as a point, above or below a reference datum surface, usually mean sea level. The Z coordinate for geoscience locations. The term elevation has been used synonymously with altitude in some segments of the geoscience discipline.

3.2.2 *geological science*—any of the subdisciplinary specialties that are part of the science of geology; for example, geophysics, geochemistry, paleontology, petrology, etc. The term is commonly used in the plural **(1)**.

3.2.3 *geoscience*—a short form, sometimes used in the plural, denoting the collective disciplines of the geological sciences **(1)**.

3.2.4 *geoscience location*—a geographic area or single point where geoscience data are collected and can be uniquely positioned by X, Y, and Z coordinates at the location or some point within the location.

3.2.5 *key data elements*—as used in this guide, information that is essential for the accurate location and cataloging of information collected for geoscience investigations.

3.2.6 *latitude*—the coordinate representation that indicates locations on the surface of the earth using the earth's equator as the respective latitudinal origin. The X coordinate for geoscience locations.

3.2.7 *longitude*—the coordinate representation that indicates locations on the surface of the earth using the prime meridian (Greenwich, England) as the longitudinal origin. The Y coordinate for geoscience locations.

4. Significance and Use

4.1 Adequately documented geoscience data are beneficial to studies utilizing traditional and computer technology for conducting resource surveys and in analyzing environmental concerns.

4.1.1 Geoscience data that include the standard coordinates pinpoint the location of the information on or below the earth's surface and by that establish the dimensional relationship to data of a similar nature (see 5.2).

[3] 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.

[4] Withdrawn.

[5] The boldface numbers given in parentheses refer to a list of references at the end of the text.

NOTE 6—Some investigations destroy the sample in the process. As such, the information cannot be duplicated by resampling. The data and the original location of the tested sample may be the only remaining result.

4.1.2 Geoscience data that include "key" information has an enhanced capability for acceptable verification, as each additional data item strengthens the uniqueness for singular identification.

4.1.2.1 Key data categories included for unique identification of the geoscience information consist of political regimes, source of data, and location characteristics (see 5.3).

4.2 Use of a standardized minimum set of data elements by project investigators increase the usefulness of the geoscience information, in that the material can more easily be interchanged.

4.2.1 Data verification, essential in quality control, can be more routine when geoscience locations are accurately identified.

4.2.2 Key items allow for ease of selection by placing the geoscience data into logical categories, such as counties, resource extraction locations, and source agencies.

4.2.3 Data files organized by use of key data elements, whether stored in cabinets or a computer file, are less complicated to find.

4.2.4 Geoscience data are usually collected for an ongoing project, however, the value is greatly increased when these data are available for future studies.

5. Documentation

5.1 *Introduction*—The list of "minimum set of data elements" varies depending upon the type of geoscience information. The differences are in the sections "coordinates and related data" and "individual location characteristics" (see Fig. 1) **(18-21)**.

5.2 *Coordinates and Related Data*—This category allows the geoscience location to be positioned on the earth's surface and subsurface by universally recognized coordinates and numerical dimensions. Each coordinate system should be identified and accompanied by a precision or accuracy value. The U.S. Environmental Protection Agency (EPA) has guidance documents concerning their policy for locating data points or sites. Publication "Representation of Geographic Point Locations for Information Interchange," FIPS PUB 70-1 contains additional guidance **(22-25)** (See Practices D 5254 and D 5911).

5.2.1 *X-Coordinate*—Universally latitude, however, most coordinate systems are convertible to latitude (See Practices D 5254 and D 5911).

5.2.2 *Y-Coordinate*—Universally longitude, however, most coordinate systems are convertible to longitude (See Practices D 5254 and D 5911).

5.2.3 *Z-Coordinate*—Altitude (elevation) or other system that can be related to mean sea level (See Practices D 5254 and D 5911).

5.2.4 *Horizontal Dimensions*—Information required for a geoscience location that cannot be completely described by the X and Y coordinate position.

5.2.4.1 *Size Measurements*—Distance, in feet or metres, from the X and Y coordinate position for length and width of the geoscience location.

5.2.4.2 *Offset Angles*—Angle and bearing from the X and Y coordinate position for slanted holes, outcrop slopes, mine excavations, etc.

5.3 *Political Entities:*

NOTE 7—Political entities or regimes are established by a governmental agency (national or local) for the purpose of regulating a land area.

5.3.1 *Introduction*—A description of the governmental divisions helps in the identification and organization of data for geoscience locations. The divisions for the United States (below Federal) are state, county, and local. **(18-21, 26-28)** (See Practices D 5254 and D 5911).

NOTE 8—For countries other than the United States, present the divisions needed for detailed identification.

5.3.2 *State or Equivalent:*

5.3.2.1 *State*—This is the first political subdivision below the federal. These can be named provinces, districts, possessions, territories, or even counties.

NOTE 9—The country name may be required when the file of geoscience data are located in more than one nation.

5.3.3 *County or Equivalent:*

5.3.3.1 *County or Parish*—In the United States, this is the subdivision below the state level. In Alaska, this subdivision is borough or census area. Some states (Maryland, Missouri, Nevada, and Virginia) have independent cities.

NOTE 10—A local subdivision may be needed to adequately describe the geoscience location, such as city, town, village, municipality, township, or borough.

5.4 *Source Identifiers:*

NOTE 11—Source identifiers are information about a location or site that assists in describing the origin or ownership of the data.

5.4.1 *Introduction*—Each data element contributes to the unique identity of the geoscience location, and also helps in the retrieval of the information. **(18-21)** (See Practices D 5254 and D 5911).

5.4.2 *Project Identification*—This information is useful when these data are gathered for a specific project.

5.4.3 *Owners' Name*—Each geoscience location has a property owner that is an important part of the identification.

5.4.4 *Source Agency or Company and Address*—Much of the geoscience data are gathered by agencies or companies that are not the property owners but that are probably the repository for the data files.

5.4.5 *Unique Identification*—This is an identification assigned by the original collector of the data or by the agency or company that is the repository of the primary file.

NOTE 12—Commonly, the identification is a combination of letters and numbers that symbolizes the project or county with code letters and the order of data collection by a sequence number. Another example is a number formed from the combination of township, range, section, and section subdivisions that is an approximate geoscience data location, but not an exact coordinate **(29)**.

5.4.6 *Date of First Record*—The date establishes the time frame for the proper identification of the geoscience information.

5.5 *Individual Location Characteristics:*

DATA ELEMENT \ LOCATION DESCRIPTION		DATA REFERENCED TO A FINITE LOCATION	DATA LOCATED BY MULTIPLE Z LEVELS AND SINGLE X AND Y COORDINATES	SLANTED OR NON-VERTICAL SAMPLE LOCATION	HORIZONTAL DIMENSIONS PARTLY IDENTIFY SAMPLE LOCATION
COORDINATES & RELATED DATA	X-COORDINATE	SINGLE	SINGLE	SINGLE OR MULTIPLE	SINGLE OR MULTIPLE
	Y-COORDINATE	SINGLE	SINGLE	SINGLE OR MULTIPLE	SINGLE OR MULTIPLE
	Z-COORDINATE	SINGLE	MULTIPLE	MULTIPLE	SINGLE
	HORIZONTAL SIZE, ANGLE, & BEARING	NO	NO	POSSIBLE	POSSIBLE
POLITICAL ENTITIES	STATE OR EQUIVALENT	YES	YES	YES	YES
	COUNTY OR EQUIVALENT	YES	YES	YES	YES
SOURCE IDENTIFIERS	PROJECT IDENTIFICATION	YES	YES	YES	YES
	OWNERS' NAME	YES	YES	YES	YES
	SOURCE AGENCY OR COMPANY AND ADDRESS	YES	YES	YES	YES
	UNIQUE IDENTIFICATION	YES	YES	YES	YES
	DATE OF FIRST RECORD	YES	YES	YES	YES
INDIVIDUAL LOCATION CHARACTERISTICS	SETTING	YES	YES	YES	YES
	TYPE OF LOCATION	YES	YES	YES	YES
	USE OF LOCATION	YES	YES	YES	YES
	REASON FOR DATA COLLECTION	YES	YES	YES	YES
	DEPENDENT ON DATA CATEGORY	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE

FIG. 1 Guide for Selection of Minimum Set of Data Elements Required to Identify Locations Chosen for the Field Collection of Information to Describe Soil, Rock, and Their Contained Fluids

5.5.1 *Introduction*—The location characteristics give specific information about the geoscience data collection location and contribute to the organization and cataloging of the files. **(18-21, 30-35)** (See Practices D 5254 and D 5911).

5.5.2 *Setting*—This refers to the topographic or geomorphic features near the geoscience location.

5.5.3 *Type of Location*—The type of location is dependent upon the category of geoscience data. Basic groupings are geoscience test, resource extraction facility, and waste storage.

5.5.4 *Use of Location*—The use of location is dependent upon the category of geoscience data. Basic groupings include monitoring, resource extraction, and construction.

5.5.5 *Reason for Data Collection*—The reason for data collection is dependent upon the category of geoscience data. Basic groupings include regulatory, research, and resource evaluation.

5.5.6 *Category Specific Geoscience Data Elements*—Many categories of investigations require the addition of one or more data elements to fully identify and catalog the geoscience information.

NOTE 13—An example of investigation specific minimum set of data elements is given in a report by the Environmental Protection Agency (EPA) titled "Definitions for the Minimum Set of Data Elements for Ground Water Quality" **(21)**. The additional information assists in cataloging ground-water quality data. Also see Practice D 5254, Guides D 5408, D 5409, D 5410, and D 5474, and Practice D 5911.

5.5.6.1 A cataloging system for denoting the geographic area of a hydrologic location.

NOTE 14—For example, the hydrologic unit cataloging code used in the United States to identify the surface stream basin where the ground-water site is found **(30 and 31)**.

5.5.6.2 Use of material extracted from a resource location.

NOTE 15—For example, a statement of the use of the water or rock extracted from a location.

5.5.6.3 The cultural designation for an archaeological location.

NOTE 16—For example, a Clovis or a Hopewellian and Mississippian site.

5.5.6.4 Identification of material deposited at a waste disposal facility.

NOTE 17—For example, municipal solid wastes or radioactive materials.

5.5.6.5 Identification of the contamination at a polluted location.

NOTE 18—For example, hydrocarbons or radionuclides.

5.5.6.6 Identification of the type of laboratory analyses results.

NOTE 19—For example grain size, atterburg limits, or water content.

6. Keywords

6.1 coordinates; geoscience investigation; geoscience location; key data elements; rock; soil; underground fluids

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