

National Spatial Data Infrastructure

Environmental Hazards Geospatial Data Content Standard – Working Draft

**Facilities Working Group
Federal Geographic Data Committee**

August 1998

Federal Geographic Data Committee

Department of Agriculture • Department of Commerce • Department of Defense • Department of Energy
Department of Housing and Urban Development • Department of the Interior • Department of State
Department of Transportation • Environmental Protection Agency
Federal Emergency Management Agency • Library of Congress
National Aeronautics and Space Administration • National Archives and Records Administration
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Federal Geographic Data Committee

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For more information about the committee, or to be added to the committee's newsletter mailing list, please contact:

Federal Geographic Data Committee Secretariat
c/o U.S. Geological Survey
590 National Center
Reston, Virginia 22092

Telephone: (703) 648-5514

Facsimile: (703) 648-5755

Internet (electronic mail): gdc@usgs.gov

Anonymous FTP: <ftp://fgdc.er.usgs.gov/pub/gdc/>

World Wide Web: <http://fgdc.er.usgs.gov/fgdc.html>

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APPENDICES:

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APPENDIX B. ENVIRONMENTAL HAZARDS ATTRIBUTES (NORMATIVE)

APPENDIX C. ENVIRONMENTAL HAZARDS DOMAIN (INFORMATIVE)

APPENDIX D: ENTITY RELATIONSHIP MODEL (INFORMATIVE)

1. PARTS OF THE STANDARD

The Environmental Hazards Data Content Standard consists of a main body and four Appendices. The main body of the Environmental Hazards Data Content Standard defines the purpose of the Standard and describes the process followed during it's development, the organizations involved in it's development and maintenance, and it's relationship to other standards. Appendix A contains a comprehensive Feature Types report which lists the feature type names and definitions, the object types, and their associated attribute tables. Appendix B is a complete listing of attributes associated with feature types and each attribute's name as well as definition, data type, character length, and associated domain names. Appendix C contains a Domains report, with a complete listing of domain names along with definitions and potential values for each domain. Appendices A and B are normative and therefore mandatory parts of the standard. Appendix C is intended to be strictly informative, leaving the domain field open for all users of this standard. Appendix D contains an entity relationship model for the Environmental Hazards Data Content Standard which is also informative. A number of domain lists include proper names and are intended to be exemplary. However, proper names may vary between organizations based on their geographic locality.

2. DEFINITIONS

For the purpose of this Environmental Hazards Standard, the following definitions apply.

2.1 **Attribute** - a defined characteristic of an entity type (e.g., an attribute for an electrical cable entity type would be the material composition of the cable).

2.2 **Attribute value** - a specific quality or quantity assigned to an attribute for a specific entity instance (e.g., *electrical cable material* = Cu).

2.3 **Data Content Standard** – semantic definitions for a set of real world spatial phenomena of significance to a community. Data Content Standards may be organized and presented in a specified logical data model, such as an entity-relationship model or IDEFIX model.

2.4 **Domain** – a set of possible data values for an attribute. Domains that are enumerated have a specified list of all permissible values. A domain that is not enumerated still identifies the possible data values by reference or procedure. Domains include tables such as: units of measure, types, styles, status, names, methods, materials, dispositions, dimensions, data, classes, etc. (e.g., *electrical cable material* : [Al, Fe, Pb, steel, Cu, ...]).

2.5 **Entity class** – a logical group of related entity types (e.g., grouping of water system components into a class, such as *water_hydrant*, *water_line*, *water_pump*, *water_reservoir*, and *water_tank*).

2.6 **Entity instance** – a real-world spatial phenomenon about which data is collected, maintained, and disseminated (e.g., “McMillan Water Reservoir”). Entity instances are the geospatial objects that are graphically delineated in a spatial database.

2.7 **Entity type** – a definition and description of a set (class of real world phenomena) into which similar entity instances are classified (e.g., *water_reservoir*).

2.8 **Environmental Hazards** - natural and manmade substances, materials, and conditions that are, or have the potential to be, detrimental to life and ecosystems on the earth.

2.9 **Geospatial data** - data with implicit or explicit reference to a location relative to the earth.

2.10 **IDEF modeling** - Integrated Definition (IDEF) is the name given to a family of over 30 graphical modeling techniques. The IDEF₀ and IDEF_{1x} are the best known of these techniques. IDEF₀ techniques are used to describe business processes or activities for reengineering a function. IDEF_{1x} techniques are used to define business rules and create a logical data model.

2 INTRODUCTION

2.6 OBJECTIVES

The purpose of the Environmental Hazards Geospatial Data Content Standard (hereafter called Environmental Hazards Standard) is to establish a consistent approach to sharing information about natural and manmade substances, materials, and conditions that are, or have the potential to be, detrimental to ecosystems on the earth. The Standard specifies the names, definitions and domains for Environmental Hazards that can be geospatially depicted as feature types and their non-graphical attributes.

3.2 GOALS

The goals of the Environmental Hazards Standard are:

1. To compile common definitions for environmental hazard data elements that will facilitate the effective use, understanding, and automation of information about environmental hazards associated with spatial instances.
2. To standardize entities, attributes, and domain values that will facilitate the creation, management, and data sharing of environmental hazard data.
3. To resolve discrepancies related to the use of similar terms, thereby minimizing duplication within and among systems.

3.3 SCOPE

This Environmental Hazards Standard includes the management of information about hazardous chemical and biological substances as well as hazardous materials and physical conditions that affect the earth's ecosystems. This standard does not address natural disasters (e.g., volcanoes, and earthquakes).

The Environmental Hazards Standard addresses data concerning:

1. Pollution – The evaluation and investigation of environmentally hazardous pollutants related to air, sediment, surface water, and ground water.
2. Solid Waste – Features associated with the collection, storage, and disposal of discarded solid, semi-solid, liquid, or containerized gaseous wastes, which may or may not be hazardous.
3. Container Materials – Features associated with container and bulk products or substances, which are in use or abandoned. These features, which through contact with hazardous material, require proper precautions and may be hazardous to the environment. Storage tanks subject to compliance with environmental regulations, are included here.
4. Hazardous Waste Remediation – Remediation efforts regulating hazardous material.
5. Safety - Preparedness and protection from hazards as they relate to Facility Management (FM).

3.4 APPLICABILITY

The Environmental Hazards Standard is applicable for those who capture or use environmental data about spatial instances in support of planning and life-cycle management application (i.e. planning, analysis, simulation,

design, facility mapping). The Standard has been designed to be used to support large system development efforts or smaller efforts utilizing Commercial Off the Shelf (COTS) Geographic Information System (GIS) and Computer Assisted Drafting and Design (CADD) software products.

3.5 STANDARDS DEVELOPMENT PROCESS

The Environmental Hazards project team under the guidance of the Facilities Working Group developed this standard. During the development process, the project team examined the information and structure of the Tri-Service Spatial Data Standards (TSSDS). Only the logical data model (feature, attribute, domain information) of the TSSDS was adopted for Environmental Hazards Standards. The project team decided that the physical data model contained in the TSSDS, which supports specific implementations (i.e., generates feature schemas for a number of common relational GIS/CADD systems), was inappropriate for a National Spatial Database Infrastructure (NSDI) Standard. The initial information from the TSSDS was reviewed and revised by the Environmental Hazards project team. Information from the Environmental Protection Agency (EPA) and Defense Information System Administration (DISA) databases were also incorporated into the Standard. In order to facilitate future integration between standards, revisions to the Environmental Hazards Standard have, in turn, been mirrored within the TSSDS.

The Environmental Hazards project team had participants from Federal agencies, professional societies, local governments, and private industry. Specifically, the following organizations were significantly involved in the development of this standard:

American Public Works Association

Applied Geographic, Inc.

Bureau of the Census

Defense Information System Administration

Environmental Protection Agency

Federal Aviation Administration

Tri-Service CADD/GIS Technology Center

U.S. Army Corp of Engineers

3.6 RELATIONSHIP TO OTHER STANDARDS

TSSDS 1.8, 1998, Tri-Service Spatial Data Standard

EPA Order 2180.1, June 26, 1987 standard for Chemical Abstracts Service Registry Number Data Standard

ANSI X3.50-1986, American National Standard for Information Systems

NIST Special Publication 811, 1995 Edition, Guide for the Use of the International System of Units (SI)

3.7 MAINTENANCE

The Department of Defense, U.S. Army Corps of Engineers maintains the Environmental Hazards Data Standard for the Federal Geographic Data Committee with support from the Tri-Service CADD/GIS Technology Center. All general questions concerning this standard should be addressed to:

U. S. Army Corps of Engineers
General Engineering Branch
20 Massachusetts Avenue, NW
Washington, DC 20314-1000

All technical question pertaining to this standard should be directed to:

Tri-Service CADD/GIS Technology Center

ATTN: CEWES-IM-DA

3909 Halls Ferry Road

Vicksburg, MS 39180-6199

4. LOGICAL DATA MODEL

Agreement on a common format is not sufficient to ensure that the geospatial information transferred is meaningful to both the sender and the receiver. In order to share spatial data, as in the use of the Spatial Data Transfer Standards (SDTS), a common data model should be defined and used. In addition, semantic content of a spatial database (i.e., the entities and associated attribute and attribute value information) must be well defined and agreed upon by an application community in the form of a content standard and/or included in the metadata for a given database. Part 2 of the SDTS is a formal attempt to develop a standardized list of entities. Application communities that want to share geospatial information would then use this model to develop more detailed data content standards based on the SDTS data model.

The Environmental Hazards Standard data model (Figure 1) is based upon the SDTS geospatial data model as presented in Parts 1 and 2 of the SDTS. The SDTS data model depicts the real world in terms of features that are characterized by attributes that may be assigned domain values. The Environmental Hazards Standard defines feature types with their attributes and specifies the domain (range or list) of attribute values. Additionally, this standard incorporates several extensions to the SDTS data model including the concept of linking specific attributes to specific feature types.

Environmental Hazards Data Model

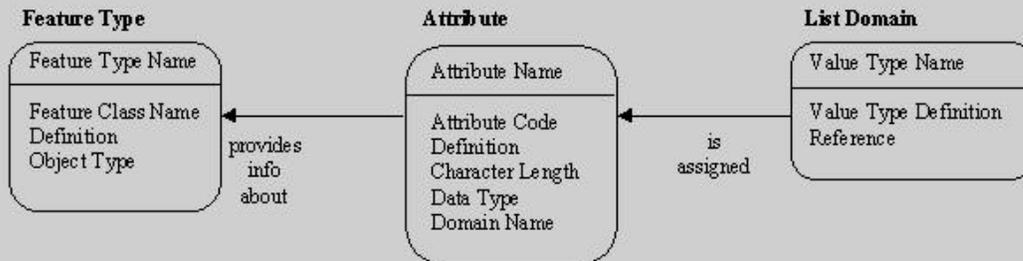


Figure 1

5. IMPLEMENTATION

The Environmental Hazards Standard has been implemented in GIS and CADD/Facilities Management systems using the TSSDS for specific implementation guidance. Detailed information about implementing the Environmental Hazards Standard using the TSSDS physical model is available for several GIS software products such as ARC/INFO and ArcView, developed by Environmental Systems Research Institute, Inc. and Integraph's MGE GIS systems. This information is available as an example of how to implement the Standard and is not intended to mandate or recommend vendor specific software.

6. REFERENCES

Tri-Service CADD/GIS Technology Center (1998) "Tri-Service Spatial Data Standards," release 1.75.

Tri-Service CADD/GIS Technology Center (1997) "Tri-Service Spatial Data Standards ArcView Technical Implementation Guide."

Tri-Service CADD/GIS Technology Center (1997) "Tri-Service Spatial Data Standards ARC/INFO Technical Implementation Guide."

Tri-Service CADD/GIS Technology Center (1997) "Tri-Service Spatial Data Standards Modular GIS Technical Implementation Guide."

National Institute of Standards and Technology (1992) Federal Information Processing Standard Publication 173 (Spatial Data Transfer Standard), U.S. Department of Commerce.

AR50-6

AR200-1, Army Environmental Reference (Feb 1997 update), Environmental Protection and Enhancement.

AR385-69

American Society for Testing and Materials (ASTM)

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLA)

CFR 32-626/627

EPA-CFR 40