National Pipeline Mapping System (NPMS)

Repository Standards

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This document was prepared by the second Joint Government/Industry Pipeline Mapping Quality Action Team II (MQAT II). The Team is sponsored by the U.S. Department of Transportation's Office of Pipeline Safety (OPS), the American Petroleum Institute, the American Gas Association, and the Interstate Natural Gas Association of America. Representatives on the Team include OPS, the Bureau of Transportation Statistics (BTS), the Department of Energy (DOE), the U.S. Geological Survey (USGS), the Federal Energy Regulatory Commission (FERC), state representatives from California, Louisiana, New York, and Texas, and representatives from the pipeline industry.

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Repository Standards - Draft

The repository standards consist of four sections:

1. General Topics
2. Data Formats
3. Metadata
4. Attribute Data
5. Data Flow
6. Descriptive Process
7. Validation and Processing of Submitted Data

Section 1 - General Topics

These standards were created with input from the pipeline industry and government agencies. They address the design of the National Pipeline Mapping System (NPMS) and how a state or national repository will process, exchange, distribute, and warehouse pipeline data. The NPMS will include natural gas transmission and liquid trunk pipeline data, and LNG facility locational data.

Pipeline operators will provide either paper or electronic pipeline locational data to a state or national repository. The operator will provide data that meets the Standards for Paper Data Submissions and Standards for Electronic Data Submissions. These standards represent a guideline for preparing and submitting paper maps, electronic data, and associated attribute data for inclusion in the NPMS repository. The repository understands that the pipeline company maps and digital data vary among operators, and that there is a need to be flexible in working with the pipeline operators. On a case by case basis, the repository will review and approve data that deviates from the data standards. The operator will only be required to work with the repository to ensure compliance with the standards and a smooth incorporation of the operator's data into the repository.

The goal of the NPMS is to create a pipeline data network with an accuracy of plus or minus 500 feet. However, some pipeline operators may not be able to meet this level of accuracy for certain pipeline segments. In these instances, the repository may accept pipeline positional accuracy beyond the plus or minus 500 feet. It is anticipated that there will be a greater level of accuracy of data in urban areas. Every pipeline operator that cannot currently provide the 500 foot level of accuracy should be moving toward that goal. Eventually, as the National Pipeline Mapping System evolves, the plus or minus 500 foot accuracy may be required.

The NPMS will consist of multiple state repositories and a single national repository. The state repositories will process the information for pipelines within their state boundaries and the national repository will process the information for all other pipelines. The national repository will serve as the final processing and storage facility for all pipeline data. The national repository will also be responsible for collecting information from participating state repositories to create a seamless national pipeline

layer.

Section 2 - Data Formats

Pipeline operators currently have data in a variety of paper and electronic formats. The Standards for Paper Data Submissions and the Standards for Electronic Data Submissions were developed to provide pipeline operators with common formats for submitting pipeline data. The standards provide the necessary data framework for the NPMS while allowing flexibly where possible.

The following sections outline the various data formats that will be accepted by the NPMS. The data structures are described in further detail in the Standards for Paper Data Submissions and the Standards for Electronic Data Submissions.

Electronic Data:

Electronic pipeline and LNG data will be submitted in ASCII fixed length format or a pre-approved standard GIS or CADD export format. Examples of potential formats include Integraph (IGDS, ISFF, MGE, FRAMME), AutoCAD (DWG, DXF), MapInfo (MIF), and ESRI (E00, SDE, SHP). Data will be submitted via CD-ROM, 1.44 meg diskette, or modem using FTP. Additional GIS and CADD export formats and media will be identified by the MQAT II.

Paper Maps:

Paper pipeline and LNG data will be submitted on U.S. Geological Survey (USGS) 7.5 minute / 1:24,000 scale Topographic maps. Where the 1:24,000 scale maps do not exist (i.e., Alaska, Puerto Rico, offshore), the operator will use the largest scale USGS maps available.

Section 3 - Metadata

Electronic and paper pipeline and LNG data will be accompanied by metadata. Metadata describes the content, quality, condition, and other characteristics of the data. Metadata will be submitted in hardcopy and electronic format. Hardcopy metadata will be submitted on the Data Transmittal Forms that have been developed by the MQAT II. This hardcopy data will have to be input into an acceptable electronic template. Electronic metadata will be submitted in an acceptable electronic template. All electronic metadata will have to be related to the graphical and attribute data according to the standards.

Section 4 - Attribute Data

Submitted pipeline and LNG data will be accompanied by attribute data. Attribute data describes information such as the pipeline's ownership, commodity, and status. The attribute data will be in an electronic format and may be stored in an electronic spread sheet or relational database management system.

Data Repository "Physical Model"

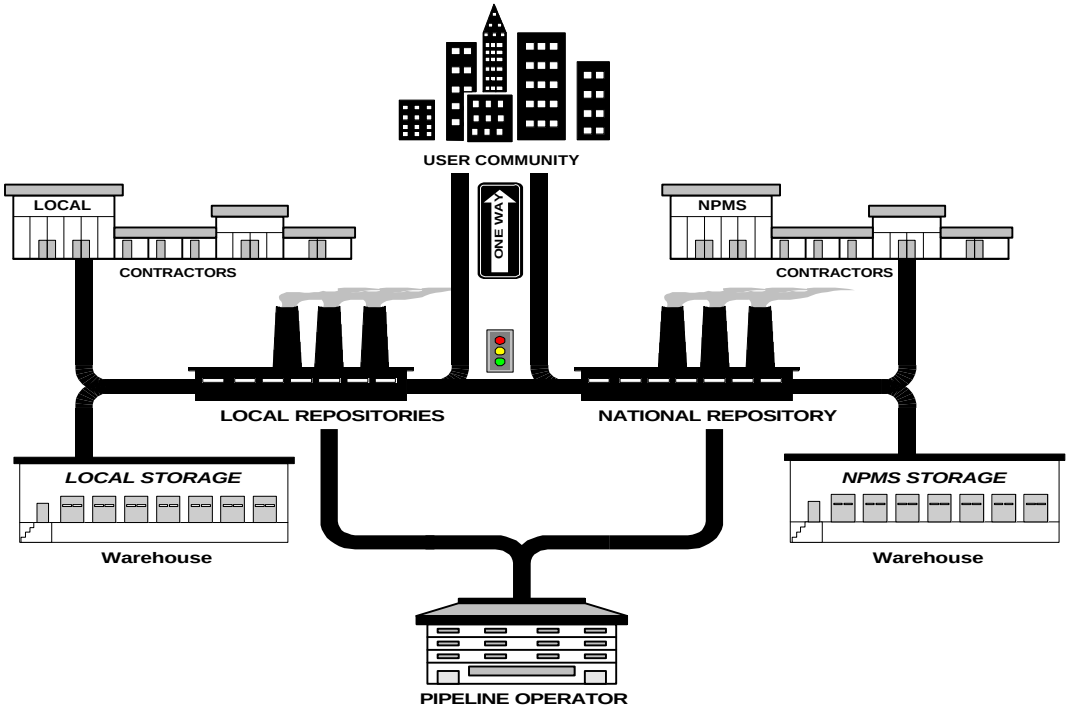
Field Name	Field Type	Field Length	Domain	Required Field
NPMS.XXX "Graphics Attribute Table"				
FNODE	N	4	Self Generating	Y
TNODE	N	4	Self Generating	Y
RPOLY	N	4	Self Generating	Y
LPOLY	N	4	Self Generating	Y
LENGTH	N	12	Self Generating	Y
NPMS#	N	4	Self Generating	Y
NPMS-ID	N	4	Self Generating	Y
* LINK_ID	N	8	Integer	Y
* SUB_REPOS_CD	C	2	Alpha/Numeric	Y
* OPER_CO_ID	C	12	Alpha/Numeric	Y
* FACIL_ID	C	20	Alpha/Numeric	Y
OPERATOR.DAT "Operator Name Table"				
* OPER_CO_ID	C	12	Alpha/Numeric	Y
OPS_CODE	C	5	Alpha/Numeric	Y
OPER_NAME	C	40	Alpha/Numeric	Y
SUB_REPOS.DAT "Sub Repository Identifier Table"				
* LINK_ID	N	8	Integer	Y
* SUB_REPOS_CD	C	2	Alpha/Numeric	Y
OPER_CO_ID	C	12	Alpha/Numeric	Y
FACIL_ID	C	20	Alpha/Numeric	Y
SUB_LINK_ID	N	8	Integer	Y
SUB_OPER_ID	C	12	Alpha/Numeric	Y
SUB_FACIL_ID	C	20	Alpha/Numeric	Y

Table 1 demonstrates how a repository is to define and relate the attribute tables. The table shows how the attribute data, attached to the graphical file, is related to other attribute tables containing additional pipeline data. The “OPER_CO_ID” is used to relate the Graphics Attribute Table with the Operator Name Table. The “LINK_ID” and the “SUB_REPOS_CD” are used to relate the graphics attribute table with the Sub Repository Identifier Table.

Section 5 - Data Flow

The MQAT II has developed a two-tier flow diagram to show how data, submitted from different pipeline operators, is processed simultaneously at the state repositories and the national repository. Pipeline operators will submit their data to either a state repository or a national repository. These repositories will process the data according to the repository standards. All data will pass through a final series of quality control checks before the data is made available to users. A repository may process the data in-house or by utilizing a contractor. Diagram 1 below demonstrates the generalized data flow plan for the NPMS:

NATIONAL PIPELINE MAPPING SYSTEM
GENERALIZED DATA FLOW DIAGRAM



MQAT 2 Jun 97

Diagram 1

Various states currently mandate that pipeline operators submit specific types of pipeline location and attribute data for pipelines within their state's boundaries. The MQAT II is working to consolidate the NPMS requirements with these state mandates. This will minimize the burden on the pipeline industry and reduce duplication.

A pipeline operator will submit pipeline data to a state repository for the segments of pipeline that pass through an area covered by a state repository. A pipeline operator will submit pipeline data to the national repository for all pipeline segments not covered by a state repository. Some operators may wish to submit all of their pipeline data to a single location. The MQAT II is working on how this process will occur.

Section 6 - Descriptive Process

Pipeline operators will submit data in both electronic and paper format. The submissions will contain the location of in-service gas transmission and liquid trunk pipelines, or liquefied natural gas facility operated by the submitting operator. Upon receipt, the repository will determine if the submission meets the standards. If it does, the repository will begin to process the data according to the repository standards. Diagram 2 illustrates, in slightly greater detail than Diagram 1, the flow of data through the repositories:

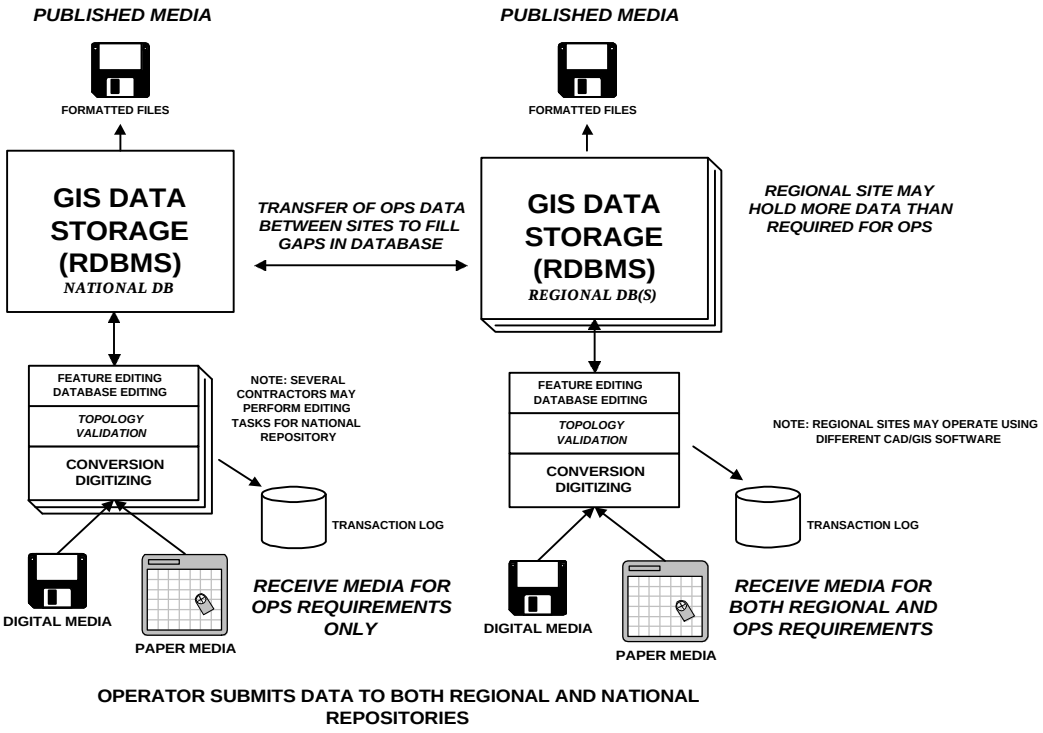


Diagram 2

As Diagram 2 illustrates, the repositories will receive both digital and paper media. The repository will either convert the digital data or digitize the paper maps according to the repository standards. A repository will have flexibility in the software and hardware that is used to convert and digitize the data. Topology will be created on the digital line and point files. A quality control (QC) check will identify feature (lines and points) and database (attribute) edits to be performed. A transaction log will be created to record all digital processes performed on the digital data.

The QCed data is temporarily stored in a national or regional (state) database. This storage is required to allow the comparison of state and national data at the national repository. The national repository will perform the final QC and provide the final database back to the state repository. The data may then be made available to the end users.

Section 7 - Validation and Processing of Submitted Data

The repositories will validate and process the operator submitted data according to the following procedures. These procedures detail the steps to be completed for both electronic and paper data submissions. Procedure 1 outlines how a national or state repository will process electronic data submitted by a pipeline operator. Procedure 2 outlines how a national or state repository will process paper data submitted by a pipeline operator. Procedure 3 outlines how the national repository will process the electronic data that it receives from a state repository.

Procedure 1: For Operator Electronic Data Submissions

- Check the electronic media that contains the files for viruses. If a virus is detected, contact the operator.
- Determine if the Data Transmittal Form is complete and meets the Standards for Electronic Data Submissions. If incomplete or if there are questions, contact the operator. The information from the Data Transmittal Form will be input into a metadata template provided by the OPS.
- If the operator submits hard copy attribute data, determine if the data content meets the Standards for Electronic Data Submissions. If not, contact the operator. The attribute data will be entered into an electronic file provided by the OPS. The data will be stored in relational database management system (RDBMS) tables as defined in the Repository Standards.
- Download the data from the electronic media.
- Determine if the submitted graphical data meets the Standards for Electronic Data Submissions for format. If not, determine if the graphical file can be easily modified to meet the standards. If not, contact the operator.
- Determine if the submitted digital attribute file meets the Standards for Electronic Data Submissions for format and content. If not, determine if the attribute file can be easily modified to meet the standards. If not, contact the operator.
- Construct the attribute tables according to the Repository Standard.
- Import the graphical file, the attribute file, and the metadata file. Depending on the format of the submitted data and the software used, different procedures will be needed to accomplish this process.
- Review the metadata file and compare for accuracy with the graphical file. Conduct a quality control (QC) process. Check the digital file for projection, latitude/longitude, and North American Datum (NAD). If the file does not meet the Standards for Electronic Data Submissions, can the file be easily modified and used? If not or if there are other discrepancies, contact the operator.

- If required, project the graphical file to NAD 83, using NADCON software, and geographic coordinates.
- Link the graphical, attribute, and metadata files according to the Repository Standards.
- QC that the linking worked properly between the files. Set up the relates between the graphical and attribute files. Query on lines and/or points to ensure that all the data displayed from the related tables is the correct attribute data for the selected features.
- Create line or point topology as needed.
- Create a check plot, for each graphical file, for the operator to QC. The plot is to include the pipelines and/or LNG facilities overlaid with a digital line graph (DLG) file that will be supplied by the OPS. The check plot should also include the Facility ID for each line and/or point. Send to the operator for comments and corrections.
- Incorporate operator modifications to either the graphical data or Facility ID attribute values. Edit the contact data in the metadata file according to the Repository Standards. Warehouse the operator contact data in a related RDBMS table.
- Edgematch pipeline segments, by Facility Name, with adjacent pipeline segments.
- Append the individual graphical files, by Facility Name, into one graphical file.
- Create a final plot of each pipeline, by Facility Name, overlaid with a digital DLG file that will be supplied by the OPS.

Procedure 2: For Operator Paper Data Submissions

- Determine if the submitted hard copy map meets the Standards for Paper Data Submissions. If it does not meet the standard, determine why. If the format is correct but there are questions regarding the identification of the pipeline(s) or LNG facility, then contact the operator for clarification. If the format is other than 7.5' quad, is the map usable? Are there at least four geo-referenced control points on the map? If so, an attempt should be made to use the submitted map(s). If there are no geo-referenced control points or less than four control points, notify the operator that the submission does not meet the Standards for Paper Data Submissions.
- Check the electronic media that contains the attribute table(s) for viruses. If a virus is detected, contact the operator.
- Determine if the Data Transmittal Form is complete and meets the Standards for Paper Data Submissions. If incomplete or if there are questions, contact the operator. The information from the Data Transmittal Form will be input into a metadata template provided by the OPS.
- If the operator submits hard copy attribute data, determine if the data content meets the Standards for Paper Data Submissions. If not, contact the operator. The attribute data will be entered into an electronic file provided by the OPS. The data will be stored in relational database management system (RDBMS) tables as defined in the Repository Standards.
- Determine if the submitted digital attribute file meets the Standards for Paper Data

Submissions for format and content. If not, determine if the attribute file can be easily modified to meet the standards. If not, contact the operator.

- Prior to setup and digitizing, review the metadata file and compare for accuracy with the hard copy map. Conduct a quality control (QC) process. If working with a copy of a 7.5' quad, validate that the scale of the map is intact. QC the accuracy of the submitted metadata with the hard copy map. Check the NAD. If the submitted map is other than 7.5' quad, check for control points in latitude/longitude, scale, NAD, and projection. If there are any discrepancies, contact the operator.
- Digitize the paper maps. Setup the computer system and secure the map on the digitizing board.
  - Register the map, trying to minimize the root mean square (RMS) error. Record the RMS error attained for each map digitized. If, on the first attempt at registering, the RMS error is greater than 25 feet (ground units), re-register and attempt to attain a lower RMS error. If the error remains high, digitize and record the RMS error.
  - Digitize the lines or points. In order to accurately portray the line digitally, the digitizer should digitize the centerline of the drafted line and capture the maximum number of shape points along the line. Coincident digital lines are not allowed. For the point data, the digitizer should capture the center of the points drafted.
  - After digitizing the lines and/or points into the system, QC to ensure that all lines and/or points were captured digitally from the paper map.
- Create topology for lines and/or points. Topology should be created utilizing the minimum tolerance values, allowed by the software, for the process.
- Define the graphics attribute table according to the Repository Standard. In the graphical file, code the lines and/or points for the attributes specified in the Repository Standard. This will allow the linking of the graphical line and/or point data with the attribute data.
- If needed, project the graphical file into NAD 83 and geographic coordinates; QC the graphical file to ensure that it projected correctly. Display the graphical file and visually compare with the source to check for obvious distortions due to a projection error.
- Display the graphical file with adjacent graphical files to check for spatial correctness. If there are projection or spatial correctness errors, check the latitude/longitude control point values; if possible, re-project the graphical file. If the errors are in the original operator graphical data file, contact the operator.
- Edit the graphical file for corrections. Edit for overshoots, undershoots, missing data, and misaligned data. Edgematch and rubber sheet to adjacent maps.
- Link the graphical, attribute, and metadata files according to the Repository Standards.
- QC that the linking worked properly between the files. Set up the relates between the graphical and attribute files. Query on lines and/or points to ensure that all the data, displayed from the related tables, is the correct attribute data for the selected features.

- Rebuild topology.
- Create a check plot, for each graphical file, for internal QC. The check plot is to include the lines and/or points and the Facility ID value for each line and/or point. Overlay check plots with the source and QC line and/or point work and verify the Facility ID value against the original source. Make corrections as needed.
- Create a check plot, for each graphical file, for the operator to QC. The plot is to include the pipelines and/or LNG facilities overlaid with a DLG file that will be supplied by the OPS. The check plot should also include the Facility ID for each line and/or point. Send to the operator for comments and corrections.
- Incorporate operator modifications to either the graphical data or Facility ID attribute values. Edit the contact data in the metadata file according to the Repository Standards. Warehouse the operator contact data in a related RDBMS table.
- Edgematch pipeline segments, by Facility Name, with adjacent pipeline segments.
- Append the individual graphical files, by Facility Name, into one graphical file.
- Create a final plot of each pipeline, by Facility Name, overlaid with a DLG file that will be supplied by the OPS.

Procedure 3: National Repository Procedures for Processing State Repository Data

- Check the electronic media, that contains the files, for viruses. If a virus is detected, contact the state repository.
- Download the data from the electronic media.
- QC that the electronic graphical, attribute, and metadata files are in the proper formats. If not, contact the state repository.
- Import the graphical, attribute, and metadata files. Depending on the format of the submitted data and the software used, different procedures will be needed to accomplish this process.
- Link the graphical, attribute, and metadata files according to the Repository Standards.
- QC that the linking worked properly between the files. Set up the relates between the graphical and attribute files. Query on lines and/or points to ensure that all the data displayed from the related tables is the correct attribute data for the selected features.
- Create line or point topology as needed.
- Edgematch pipeline segments, by Facility Name, with adjacent pipeline segments.
- Append the individual graphical files, by Facility Name, into one graphical file.
- Create a final plot of each pipeline, by Facility Name, overlaid with a digital DLG file that will be supplied by the OPS.

Acronyms

AA	Anhydrous Ammonia
AGA	America Gas Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCII	American Standard Code for Information Interchange
BTS	Bureau of Transportation Statistics
CAD	Computer Aided Drafting
CADD	Computer Aided Drafting and Design
CO2	Carbon dioxide
CRD	Crude oil
DLG	Digital Line Graph
DOE	Department Of Energy
DOT	Department Of Transportation
DXF	Drawing Interchange File or Drawing Exchange File
FERC	Federal Energy Regulatory Commission
FGDC	Federal Geographic Data Committee
FIPS	Federal Information Processing Standards
GIS	Geographic Information System
GPS	Global Positioning System
HG	Hydrogen gas
HVL	Highly volatile liquid
INGAA	Interstate Natural Gas Association of America
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MQAT	Joint Government-Industry Pipeline Mapping Quality Action Team
NAD 27, 83	North American Datum (of 1927 or 1983)
NG	Natural gas
NGL	Natural gas liquids
NPMS	National Pipeline Mapping System
OMB	Office of Management and Budget
OPS	Office of Pipeline Safety
PRD	Product
ROW	Right-Of-Way
RSPA	Research and Special Programs Administration
SQL	Structured Query Language
USGS	United States Geological Survey

Glossary of Pipeline GIS-Related Terms

Accuracy	The degree of conformity with a recognized or established standard.
Accuracy (absolute)	The accuracy of a map in representing the geographic location of an object relative to its true location on the surface of the earth. Absolute accuracy is based on geographic coordinates.
Accuracy (relative)	The accuracy of a map in representing the geographic location of an object relative to the locations of other objects.
Aerial photo	Photograph of part of the earth=s surface taken by an aircraft-supported camera.
Alignment sheets	A general purpose drawing designed to be used by company personnel during the operation and maintenance of the pipeline.
Alphanumeric	Consisting of both letters and numbers, as well as some punctuation symbols.
Area	A generic term for a bounded, continuous, two-dimensional object that may or may not include its boundary.
ASCII	American Standard Code for Information Interchange. A popular standard for the exchange of alphanumeric data.
Attribute	Characteristic that help describe the data.
Base map	A map containing visible surface features and boundaries that is used for local reference.
Benchmark	A point of known location used as a reference point.
CAD or CADD	Computer Aided Drafting (CAD) and Design (CADD) - an automated system for the drafting and display of graphic oriented information.
Control point	A point of known vertical elevation and/or horizontal position.
Conversion	The process of transforming information from one form to another, i.e. analog (paper) data into digital data.
Coordinates	Pairs of numbers expressing horizontal distances along orthogonal axes.
Crude oil	Liquid petroleum as it comes out of the ground, as distinguished from refined oils manufactured out of it.
Database	Structured collection of data defined for a particular use, user, system, or program; it may be sequential, network, hierarchical, relational, or semantic.
Data capture	Process of converting hard copy maps into a digital format.
Data dictionary	A listing of each data field and a definition or description of what is contained in that field.
Data set	A collection of related data.
Datum (geodetic)	Level surface to which elevations are referenced, such as mean sea level; frame of reference for measuring a location on the surface of the earth.
Digital	The discrete numerical representation of data.
Digital centerline	Series of connected data elements representing the pipeline.
Digital orthophotos	A digital image of an aerial photograph in which the displacement caused by the camera tilt and by terrain have been corrected.
Digitize	The process of converting hard copy manual drawings into digital format.
Display	A computer monitor screen or image produced on the screen.
DLG	Digital Line Graphs - digitized data from USGS base map categories, including transportation, hydrology, elevation contours, and public land survey boundaries.
Domain	Identifies valid values for a metadata element.
DXF	Drawing eXchange Format - a graphic file and data interchange standard.
Facilities	Parts of the pipeline system, such as the pipe, valves, compressor stations, etc.
FGDC	Federal Geographic Data Committee - established though OMB and charged with coordinating the development, use, sharing, and dissemination of geographic data.
File	A collection of records (data) treated as a unit.
Format	How the information is stored - paper, electronic, or digital.
Free date	Calendar date specifying on of the following: 1. Year (formatted YYYY) 2. Year and month (formatted YYYYMM) 3. Year, month and day (formatted YYYYMMDD)
Free real	Numbers with decimal places that describe the individual data element.
Free text	Words or numbers that describe the individual data element.
Geodetic control	Surveying and monumental points on the earth's surface whose location is established in

	accordance with national standards.
Geographic	Referring to coordinate systems, latitude/longitude or comparable geographic grid location reference.
Geospatial data	Information that identifies the geographic location and characteristics of natural or constructed features and boundaries on the earth.
GIS	Geographic Information System - computer hardware, software, geographic data used to capture, store, update, maintain, analyze, and display graphically referenced information.
GPS	Global Positioning System -survey instrument/process using satellite generated timing data to establish either ground or aerial coordinates.
Graphic element	Points, lines, arcs, symbols, etc., that are displayable.
Hardcopy	A permanent image such as a plot or printout.
Hardware	The physical components of the computer system or network such as the computer, printer, plotter, and terminal.
Hazardous liquid	Petroleum, petroleum products, or anhydrous ammonia.
Highly volatile liquid	Also referred to as HVLs. A hazardous liquid that will form a vapor cloud when released to the atmosphere and has a vapor pressure exceeding 276 kPa (40 psia) at 37.8E (100E F) Note: natural gas liquids are also HVLs .
Interstate	A pipeline or part of a pipeline that is used in the transportation of natural gas, hazardous liquid, or carbon dioxide in interstate or foreign commerce.
Latitude	Distance measured north or south of the equator.
Liquefied Natural Gas	Also referred to as LNG. Natural gas that has been cooled to about -160 degrees Centigrade for storage or shipment as a liquid.
Liquefied Petroleum Gas	Butane and propane separated from natural gasoline and sold in liquid form as fuel. Commonly referred to as bottled gas, tank gas, or simply LPG.
Longitude	Distance measured east or west from a reference meridian (usually Greenwich).
Map	A spatial representation, usually graphic on a flat surface, of spatial phenomena.
Media	The physical devices used to record, store, or transmit data.
Metadata	Documented descriptions of the information, such as the timeliness of the data, attribute sources, accuracy of the data, etc.
MQAT	Joint Government-Industry Pipeline Mapping Quality Action Team. Sponsored by OPS, API, and AGA/INGAA.
NAD 27, 83	North American Datum (of 1927 or 1983) - two mathematical representations of the surface of the earth.
Natural Gas Liquids	Also referred to as NGLs. Can be ethane, butane, propane, or a propane-butane mix.
NPMS	National Pipeline Mapping System - a pipeline database that will indicate the location, commodity, operator, and contact person for transmission pipelines and LNG facilities operating in the United States.
One-Call	Service to notify underground utilities of planned excavations.
Operator	A person who owns or operates a pipeline and engages in the transportation of gas.
Orthophoto	Photo with camera tilt and relief displacements removed, resulting in a scale-correct image.
Overlay	Simultaneously viewing two or more digital data sets of similar geographic areas.
Pipeline/pipeline system	All parts of those physical facilities through which gas or hazardous liquid moves in transportation.
Point	A zero dimensional object that specifies geometric location. One coordinate pair specifies the location.
Quadrangles (Quads)	Typically refers to the USGS map sheets in the 7.5 minute quad series or the 15 minute quad series. Also known as topographic maps.
Quality	An essential or distinguishing characteristic needed for cartographic data to be fit for use.
Repository	An entity(s) designed to maintain, store, and warehouse data.
ROW	Right-Of-Way - a section of land designated for use by a pipeline.
Scale (large)	Small map area showing greater detail (1:2400).
Scale (small)	Large map area with less detail (1:100,000).
Software	General name for computer programs and programming languages.
Spatial data	Data about the location of objects and their relationship with one another.
SQL	Structural Query language - an ANSI standard high level database language.
Thematic	Depicting particular features or concepts.
Topographic maps	Map showing horizontal and vertical (contours) indicating lines of equal surface elevation.
Topography	Shape of configuration of the land surface. Represented by contour lines in map form.
Topology	Descriptions of geographic relationships of features, especially what features are adjacent to or connected to another feature.
Vector	Data composed of individual coordinate points and lines whose endpoints are defined by

coordinate pairs.