

# **NPMS Operator Workshop November 18, 2015**

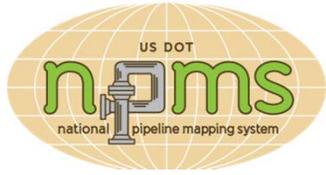
**Welcome, callers. Your lines will be muted except for designated Q&A periods which will occur approximately every 30 minutes.**



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation

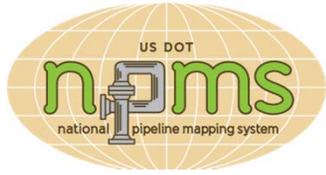




# Safety and Logistics

- Emergency Exits
- Restrooms
- 15 minute break in the morning and afternoon, lunch will be 12:00-1:00

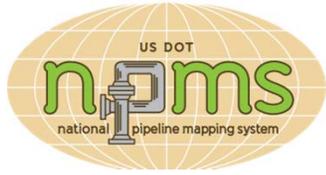




# Need for Workshop

- Operators use different systems and methods to prepare their NPMS submissions
- Operators are concerned about the size of their submissions becoming unmanageable if additional data is collected by the NPMS in the future
- PHMSA needs to gather information about operators' data which will help us design our internal systems and processes most effectively

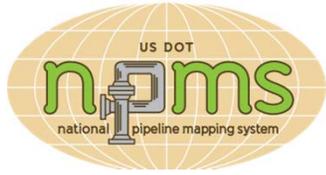




# Need for Workshop

- PHMSA staff and operators need to discuss the details of Appendix D: submitting NPMS data in LRS format
- A dialogue about “predominant” as it relates to NPMS data is needed





# Overview

Discussion format

## Morning

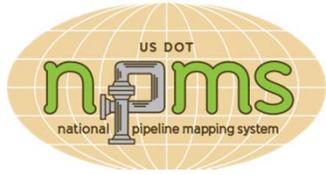
- Introduction, goals, and desired outcomes
  - NPMS innovation showcase
- Geospatial data format and LRS submissions
  - LRS 101 for those unfamiliar with the technology

## Lunch 12:00-1:00

## Afternoon

- Segmentation in geospatial data
- Generalizing values (predominance)
- Q&A and wrap-up

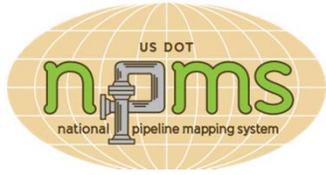




# Discussion Leaders

- Amy Nelson, PHMSA GIS Manager
- Leigha Gooding, PHMSA GIS Specialist
- Katie Field, Michael Baker International
- Bellinda Monge, Michael Baker International
- Ron Brush, New Century Software
- Chuck Wright, New Century Software

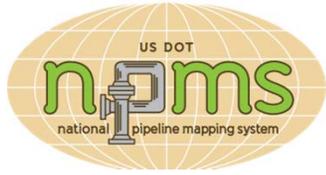




# Boundaries

- Discussion will be limited to technical aspects of preparing operators' data for current or future NPMS submissions
- This is not the forum to discuss any of the proposed attributes or standards in the NPMS Information Collection
  - Comment period was extended until 11/25
- OK for onsite participants to ask questions at any time, but we have to keep the callers to designated slots to reduce background noise

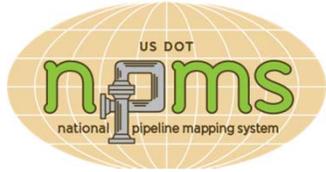




# Goals and Outcomes

- Understand how operators are storing data and preparing their NPMS submissions
- PHMSA gathers information about operators who use LRS; Operators gain a better understanding of how LRS format submissions could be prepared
- Understand how operators segment pipelines and
- Gain a better understanding as to whether collecting “predominant” values is feasible or useful





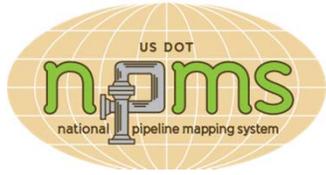
Q&A regarding introduction  
(Questions from the room  
will be taken first, then  
phone lines will be open)



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# NPMS Technology Showcase

Leigha Gooding (PHMSA) & Chuck Wright (New Century Software)

- 30-minute showcase of select NPMS projects in order to:
  - Illustrate how we address existing data challenges
  - Foster transparency and trust by explaining what we do with operator data submissions
  - Help operators understand the reasoning behind NPMS requirements and the questions we ask while processing operator data submissions

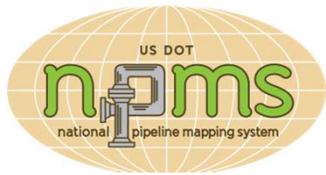


U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation







# Submission Manager

Submission Manager

Home Submissions

Send To Change Detection    Validate M Values    Delete Submission    Active Submissions    Refresh Grid    Send To IU Assignment    Transfer IU Archives    Delete Pipe Segments  
 View CD Results    Load To Production\*    All Submissions    View IU Assignment Results    Regenerate Events and DL  
 Delete CD Results    Add New Submission    In Load Submissions    Replace IU (MIDYR)

Change Detection    Submissions    View    IU Assignment    Pipeline

Submissions

Submission ID	Operator ID	Status	Segment Count	Submission Received Date	Submission Received Type	Production Notes
32538-0002	32538	NO CHANGE; READY FOR PROD DB EDIT		12/12/2014	NC	
39124-0001	39124	SUB RECVD; READY FOR REVIEW		12/11/2014	DATA SUB	
15786-0005	15786	IN PRODUCTION DB; IU COMPLETE		12/11/2014	NC	NC
31460-0004	31460	IN PRODUCTION DB; IU COMPLETE		12/09/2014	NC	NC
26045-xxx1	26045	NOTES		12/09/2014	NOTE	
MIDYR-0202	26065	NOTES		12/04/2014	NR EDIT	
MIDYR-0201	9175	NOTES		12/04/2014	NR EDIT	
MIDYR-0200	11551	NOTES		12/04/2014	NR EDIT	
39085-xxx2	39085	NOTES		12/04/2014	NOTE	
26039-xxx1	26039	NOTES		12/04/2014	NOTE	
31699-0003	31699	IN PRODUCTION DB; IU COMPLETE		12/04/2014	REMOVAL OF OPID	DEL ALL
32232-xxx1	32232	NOTES		12/04/2014	NOTE	
32232-0002	32232	IN PRODUCTION DB; IU COMPLETE		12/04/2014	NC	NC

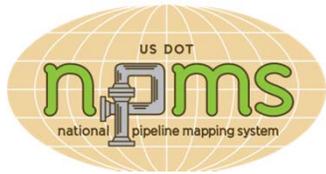
Export to Excel



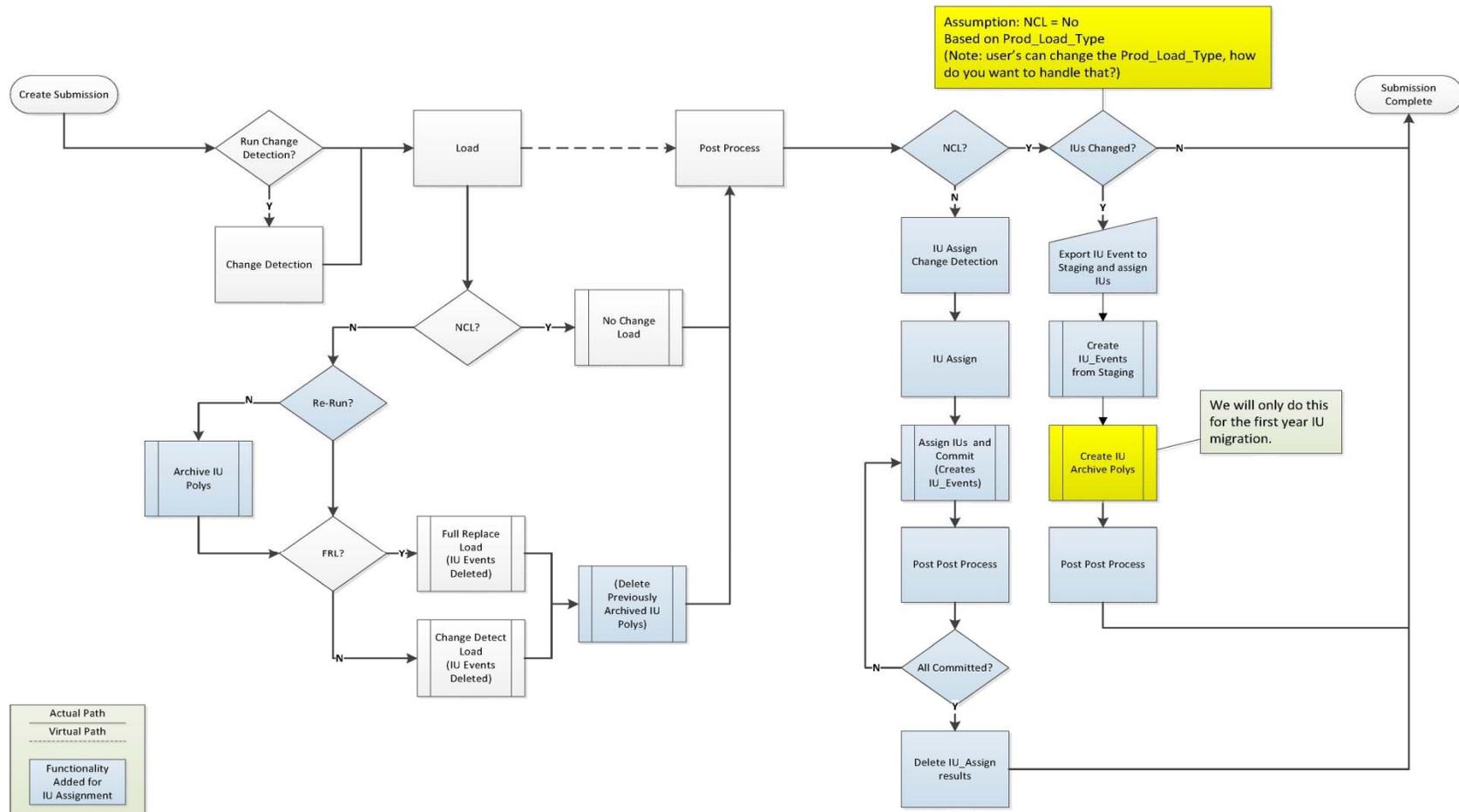
U.S. Department of Transportation  
 Pipeline and Hazardous Materials  
 Safety Administration

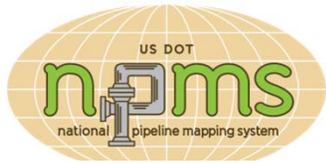
To Protect People and the Environment From the Risks of  
 Hazardous Materials Transportation



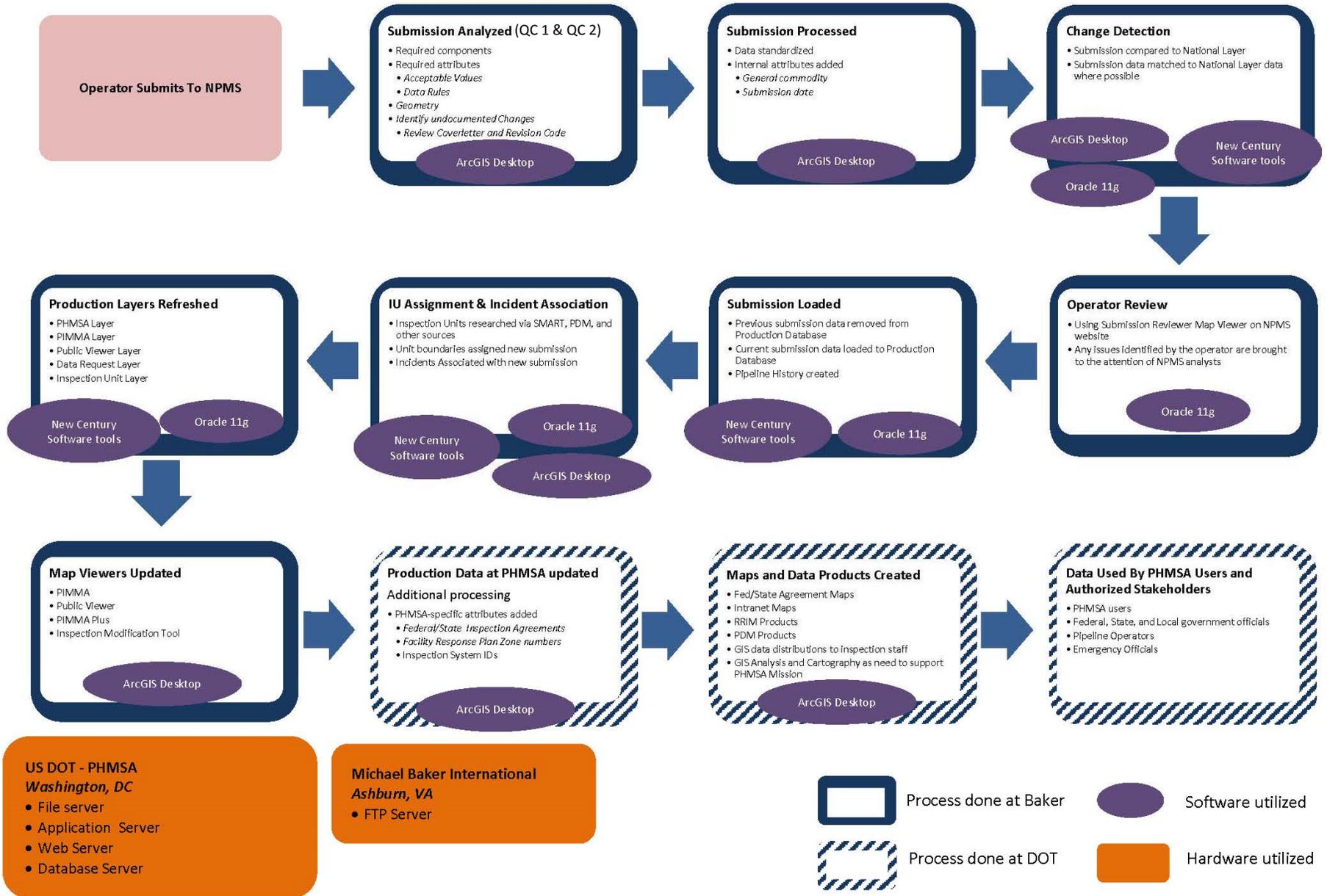


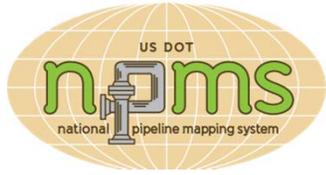
# Submission Automation...to an extent





# General Submission Workflow

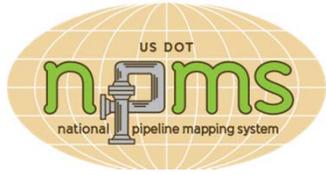




# Creating Pipeline History

- Challenge: Record history of pipeline changes when NPMS data is replaced on a yearly basis.
  - Acquired or divested
  - Changes in status
  - Change in commodity
  - Improved spatial location or re-routes
- Solution: Change Detection
  - Custom tool
  - On a per-segment basis, matches this year's submission to pipelines in the NPMS national layer
  - Matches by a combination of spatial location and attribute values

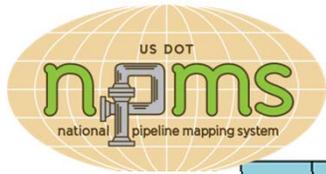




# Change Detection Matching

- Submission feature is buffered to determine what NPMS features are nearby.
  - Buffer is iteratively increased if no NPMS features are found.
- 14 use case (UC) scenarios are used to identify if there is a match or not.
  - For all submission segments
  - For all NPMS national layer segments for that OPID
- Each UC has an associated confidence level
  - Green: high confidence; no analyst interaction needed
  - Yellow: fairly certain but requires analyst confirmation
  - Red: low confidence or no match; analyst interaction needed

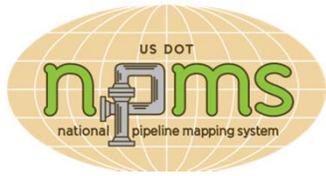




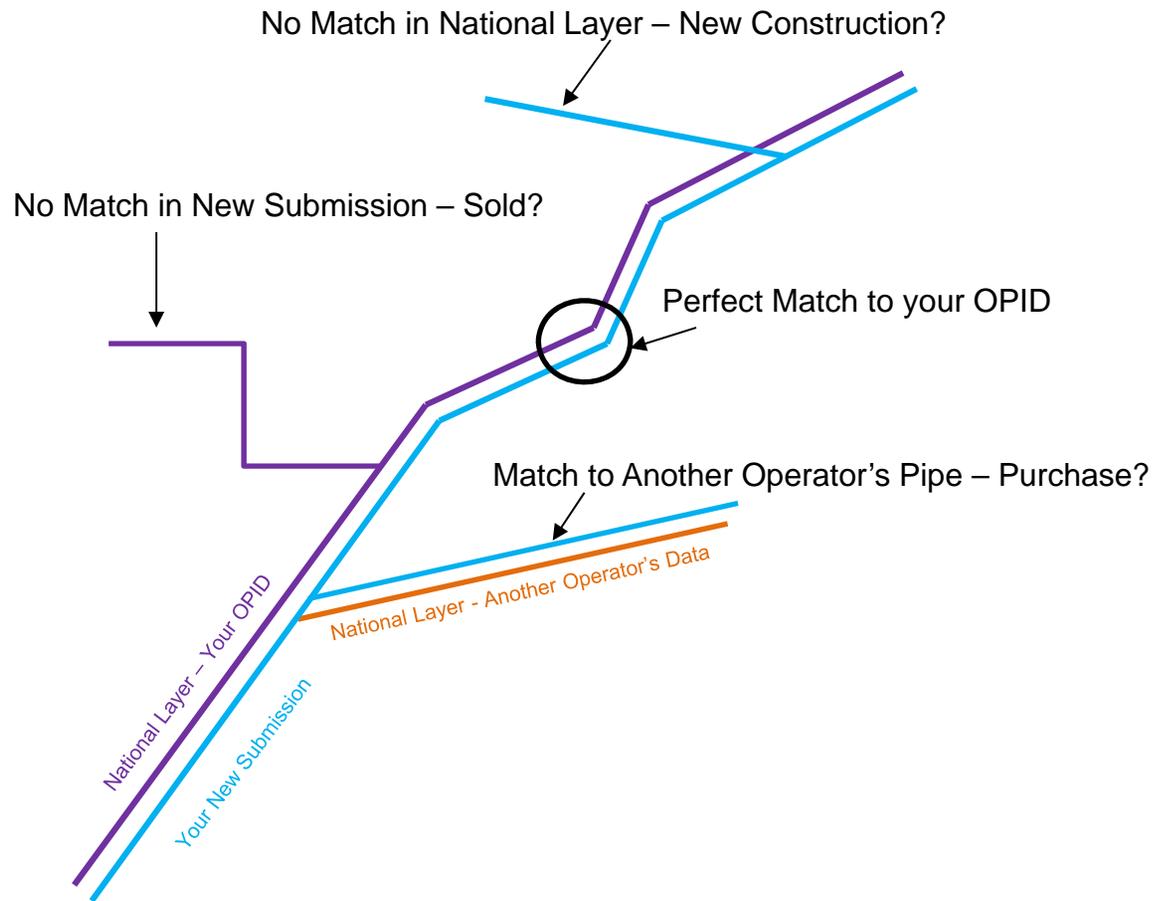
# Example Use Cases

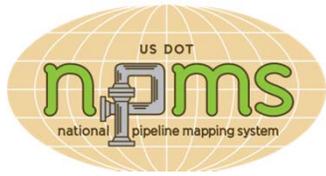
ID	Scenario Description	Flag	Load Instruction Returned by Detection Engine	Comment
UC1	Submission segment and production segment match 1:1 OPIDs match exactly REVIS_CD of submission is NOT "J" or "C" STATUS_CD of production segment is not "B".	Green	Update.	Analysts take no action unless another action determines that the match is incorrect (such as a UC1B).
UC2	Submission segment and production segment match 1:1 OPIDs match exactly REVIS_CD of submission is "J" or "C" STATUS_CD of production segment is not "B".	Red	Update	Revision codes of "J" or "C" are not correct if segment matches existing production segment. Analyst determine if the submitted pipeline is a match to the existing production feature; analyst may need to contact the operator for clarification.
UC3	Submission segment has no 1:1 match found in production for any OPID REVIS_CD of submission is "J" or "C" STATUS_CD of production segment is not "B".	Yellow	Create	Analyst will confirm this submission feature does not match an existing production feature (e.g., submission feature is so different spatially that it was not considered a match).
UC4	Submission segment has no 1:1 match found in production for any OPID REVIS_CD of submission is NOT "J" or "C" STATUS_CD of production segment is not "B".	Red	Create	Analyst will confirm this submission feature does not match an existing production feature (e.g., submission feature is so different spatially that it was not considered a match). If no existing production data is found, Analyst will follow up with operator. For a new submission (by a new operator), operator will clear the flags.
UC5	Production segment with current OPID has no 1:1 match found in submission data.	Red	Change to Sold	Analyst will follow up with operator to confirm. (Line might have been sold, removed, or re-jurisdictioned.)
UC6	Submission segment and production segment match 1:1 OPID of submission = 88888, OPID of production does not match the OPID of the submission data being processed. Operator Name field of submission segment is "SOLD".	Red	Update	Incoming sold lines only match a different OPID in production (e.g., trying to sell somebody else's lines). Analyst to confirm if submission operator has rights to mark lines as sold.
UC7	Submission segment and production segment match 1:1 OPID of submission = 88888, OPID of production is same OPID as the incoming submission OPID.	Green		Line apparently sold; Because OPID of production segment matches, detection engine can assume Analyst notified before data was added to submission database and the Analyst is confident



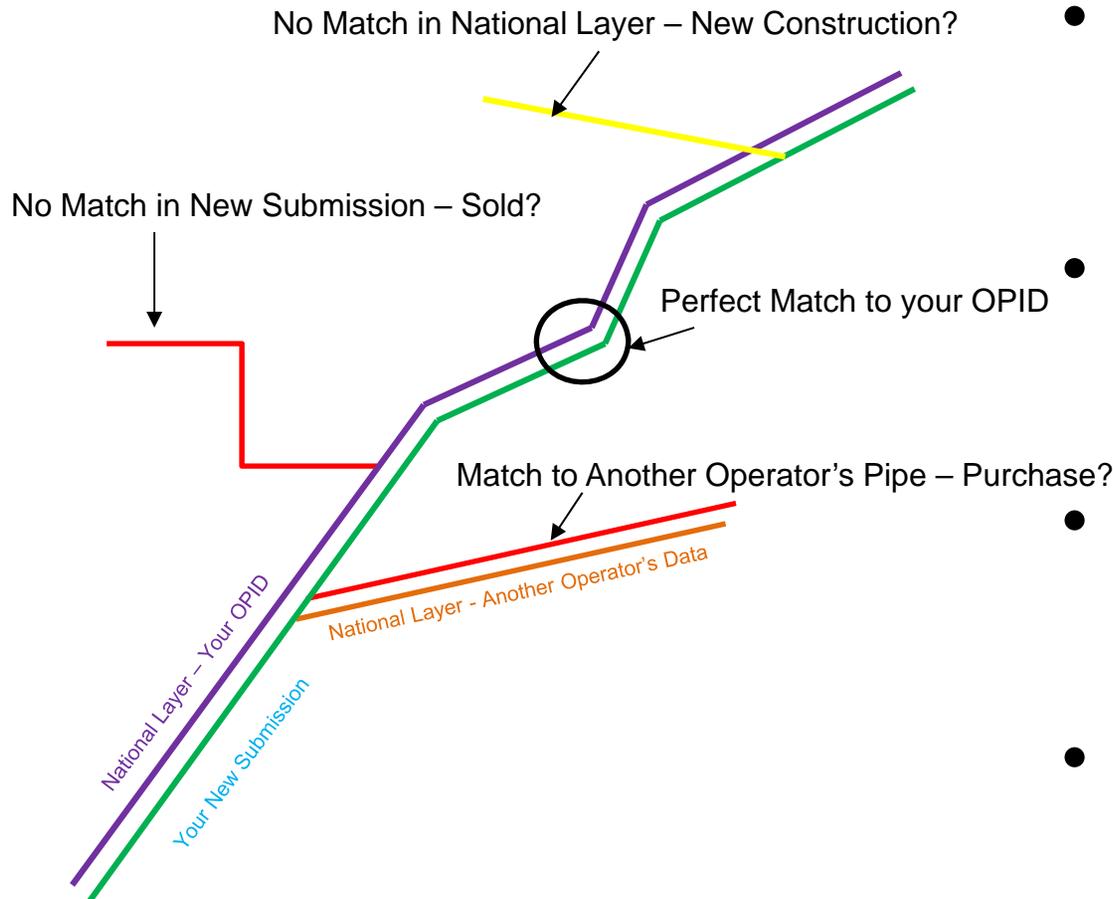


# Change Detection Example





# Change Detection Example



- UC 1 - Segment match

Submission segment and NPMS segment match 1:1  
 OPIDs match exactly  
 REVIS\_CD of submission is NOT "J" or "C"  
 STATUS\_CD of NPMS segment is not "B".

- UC 3 - New construction

Submission segment has no 1:1 match found in the NPMS for any OPID  
 REVIS\_CD of submission is "J" or "C"  
 STATUS\_CD of NPMS segment is not "B".

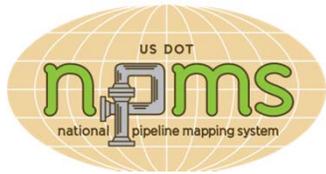
- UC 5 - No match; Change to sold

NPMS segment with same OPID has no 1:1 match found in submission data.

- UC 10 - Segment match; Different OPID

Submission segment and NPMS segment match 1:1  
 OPIDs DO NOT MATCH  
 REVIS\_CD of submission is NOT "J" or "C"  
 STATUS\_CD of NPMS segment is not "B".





# Change Detection Interface

Submission Manager

Home | Change Detection

Delete CD Results | Filter Selection | Match Via Search | Swap Matched Rows | Zoom | Show Selected | Zoom | Show Selected  
 Abandon Segments | Refresh Grid | Match Feature to Row | Match Layer Features | Select | Delete Selected for CD ReRun | Select | Show Selected  
 Compare Attributes | Validate Results

Change Detection Report Actions | Edit Matches | Submission ArcTools | Production ArcTools

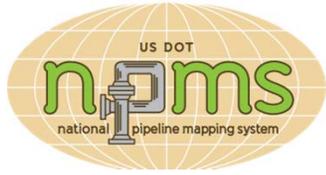
Submissions | CD Results: 31312-0010

Result | Use Case

Result	Load Instruction	Use Case	Oper Sub ID	Sub OPID	Sub Miles	Prod Event ID	Prod OPID	Prod Mile
Green (2 items)								
UC1 (7 items)								
Green	UPDATE	UC1	3237727	31312	0.047530	550734	31312	
Green	UPDATE	UC1	3237724	31312	0.009680	32974318	31312	
Green	UPDATE	UC1	3237745	31312	0.248740	551761	31312	
Green	UPDATE	UC1	3237746	31312	1.477060	551858	31312	
Green	UPDATE	UC1	3237747	31312	0.027230	551859	31312	
Green	UPDATE	UC1	3237753	31312	0.052790	551629	31312	
Green	UPDATE	UC1	3237754	31312	0.093700	551631	31312	
UC101 (2 items)								
Red (8 items)								
UC1 (5 items)								
UC10 (2 items)								
UC100 (1 item)								
Red	CREATE	UC100	3237741	99999	0.068040			

Export to Excel

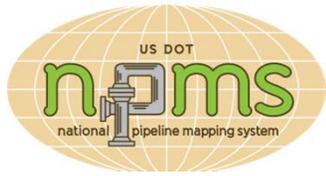




# Impact of Change Detection Matching

- When the submission data is loaded to our LRS-production environment, a unique ID is transferred from the existing feature to the matching submission feature.
- Resulting in spatial and attribute History on the pipeline
  - Allows PHMSA to look back in time to see how...
    - The spatial location has changed
    - The attributes have changed (OPID, commodity, status, etc.)
  - Support's PHMSA's goal of being pipe-centric, rather than OPID-centric

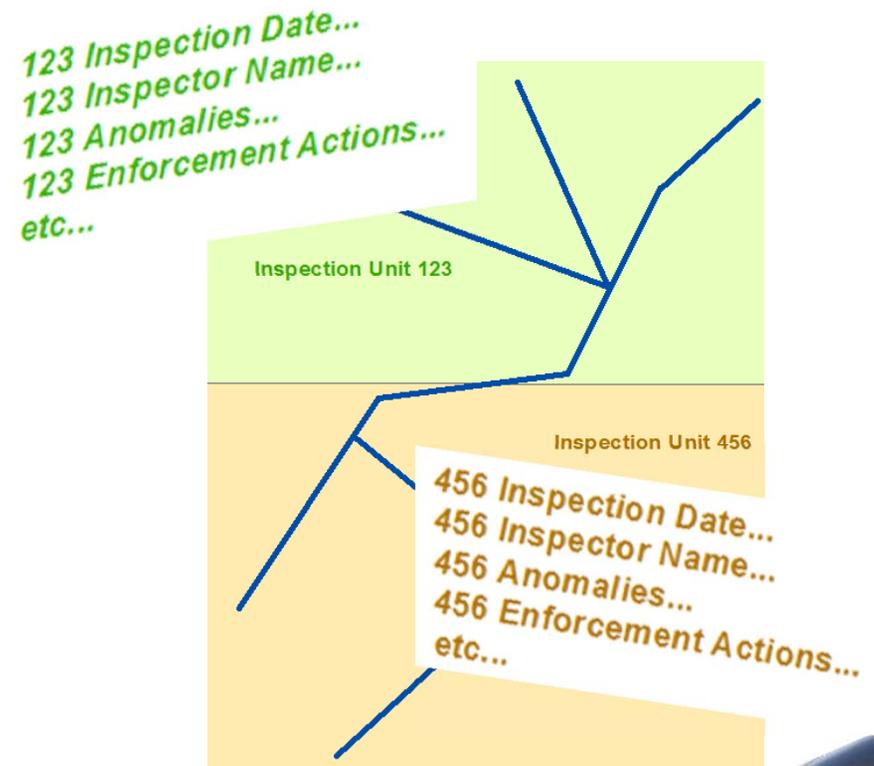


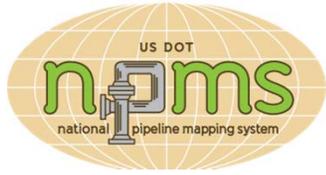


# Inspection Unit Assignment

Purpose – Link inspection records to NPMS pipes

- Tag every pipeline with the correct Inspection Unit ID (event along centerline)
- Enable spatial visualization and analysis of inspection information
- Support inspection planning and risk ranking

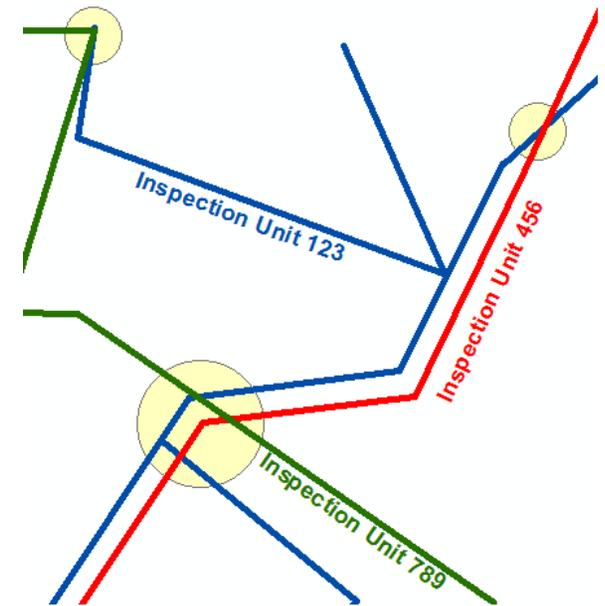


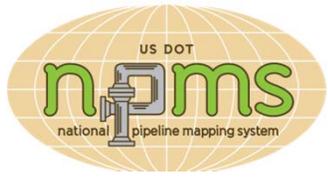


# Inspection Unit Assignment

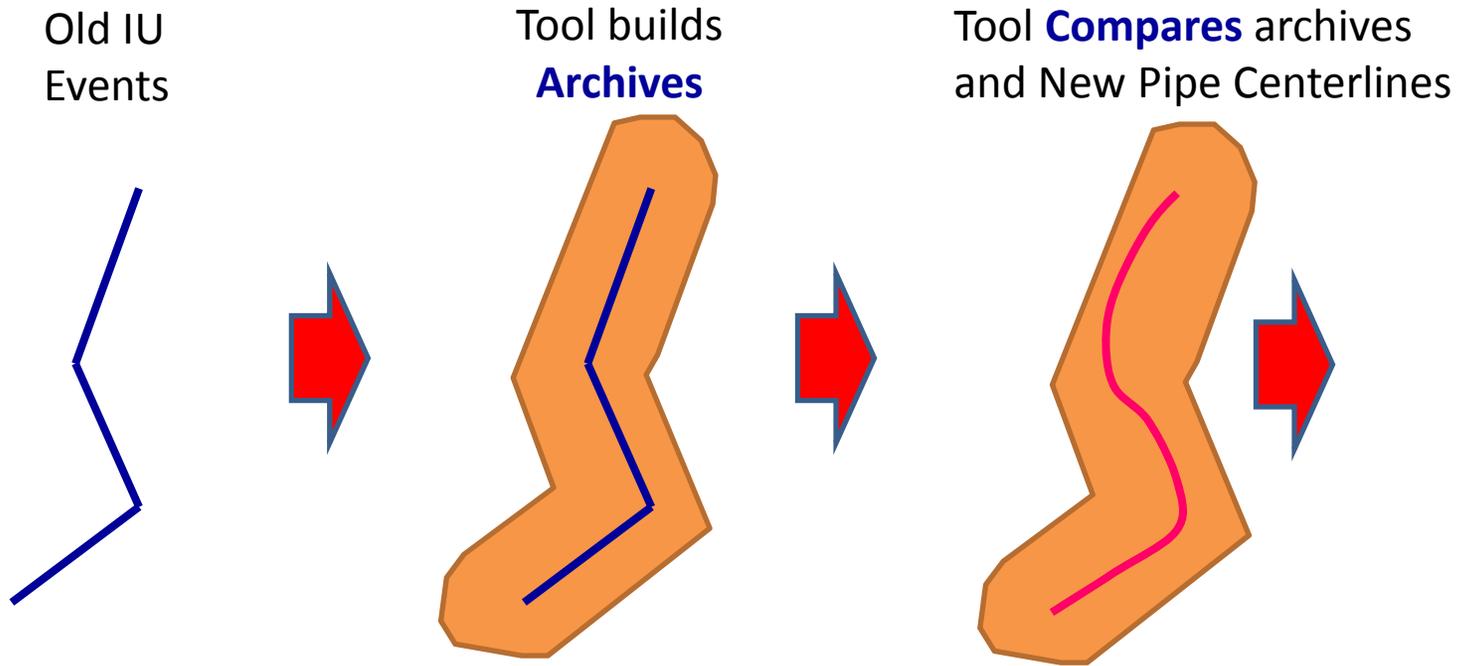
## Challenges

- Operator could not submit this attribute
- NPMS could not rely on consistent geometry, attributes or segment IDs year after year
- Similar parallel or intersecting pipes can belong to different inspection units
- 1 centerline can belong to many inspection units
- Inspection Unit boundaries change





# Inspection Unit Assignment



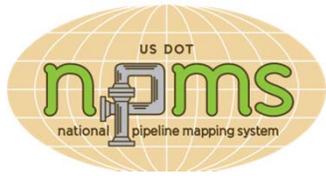
Archive → Compare → Assign → Analyst-Review → Commit



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# Inspection Unit Assignment

Tool **Assigns** potential Inspection Units with confidence levels to each pipe centerline using available attributes, locations and use cases

ASGNSTATUS	IU_ID	MULTI_MATCH	OPID	SYS_NM	PLINE_ID	DIAMETER	CMDTY_GEN	INTERSTATE
GREEN	12345		32541	DOW SH NGL	DOW SH	6.00	LIQUID	N
GREEN	12345		32541	DOW SH NGL	DOW SH	6.00	LIQUID	N
GREEN	12345		32541	DOW SH NGL	DOW SH	6.00	LIQUID	N
RED - MULTI	-1		32541	MARKHAM NGL	MARK 6	6.00	LIQUID	N
RED - MULTI	-1		32541	MARKHAM NGL	MARK 6	6.00	LIQUID	N
RED - NONE	-1		32541	DOW KS NGL	DOW 6	6.00	LIQUID	N
RED - NONE	-1		32541	DOW KS NGL	DOW 6	6.00	LIQUID	N
YELLOW	-1		32541	DOW KS NGL	DOW 6	6.00	LIQUID	N
RED - MULTI	-1		32541	DOW KS NGL	DOW 6	6.00	LIQUID	N
RED - MULTI	-1		32541	DOW KS NGL	DOW 6	6.00	LIQUID	N

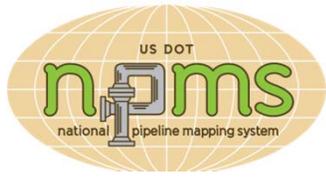
Archive Compare **Assign** Analyst-Review Commit



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

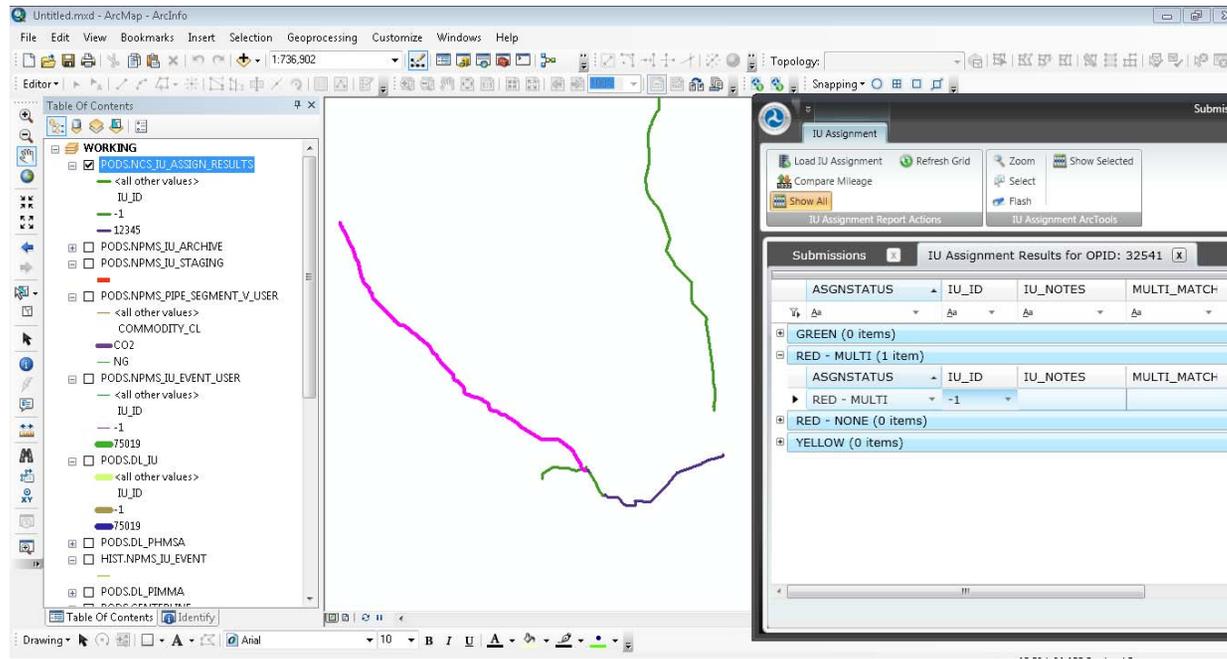
To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# Inspection Unit Assignment

Analyst **Reviews** report and interacts with map to finalize inspection unit assignments and boundary points on each pipe centerline



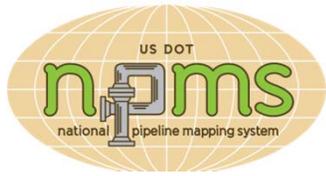
Archive Compare Assign **Analyst-Review** Commit



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

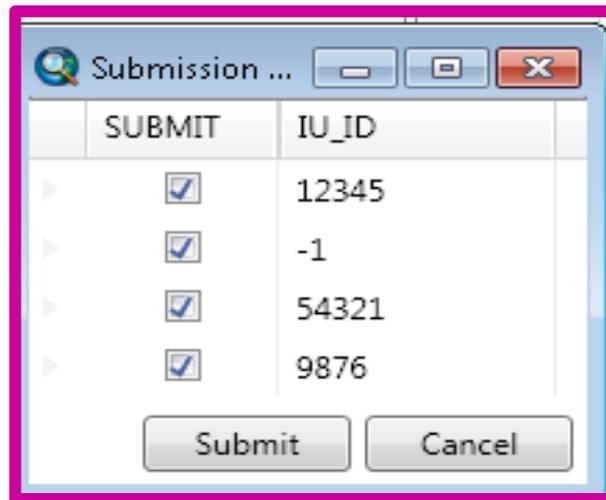
To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# Inspection Unit Assignment

**Commit** final unit assignments and event boundaries to production database



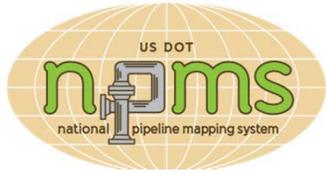
Archive ▶ Compare ▶ Assign ▶ Analyst-Review ▶ **Commit**



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# Inspection Unit Modification Tool

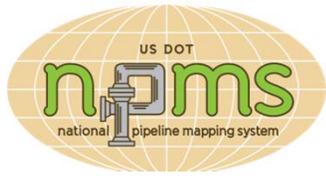
## Purpose

- Capture and communicate spatial changes to unit boundaries

## Challenge

- Inspection personnel define and change inspection unit boundaries from field office locations across the country, many with little to no GIS experience
- The NPMS database is only edited by GIS personnel at headquarters





# Inspection Unit Modification Tool

The screenshot displays the 'Inspection Unit Modification Tool' interface. On the left, a map shows the location of the modification point near Steamboat Springs and Stagecoach State Park. The main window is titled 'Modification Point Notes' and contains the following fields:

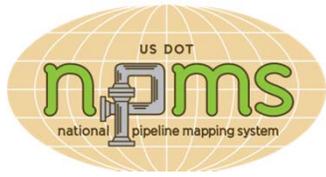
- New Unit ID: 73658
- New Operator ID: 300
- Old Unit ID: (empty)
- Modification Purpose: NEW UNIT BOUNDARY
- Notes about the Purpose: Start unit here
- Modification Location: BREAK PIPELINE AT THIS STREET
- Notes about the Location: Sunset Blvd
- Modification Direction: ALL DATA GOING EAST OF THIS POINT
- Notes about the Direction: include pipelng moving east from this location

On the right, a 'Unit History' table is displayed:

UNIT ID	NEW UNIT NAME	REGION	UNIT HISTORY ACTION
73658	SC	SOUTHERN	CREATE NEW UNIT OR OPERATOR
1882	MS, AL		UNITNAMECHANGE
1872	MS		UNITNAMECHANGE
74359	TRENTON GATHERING SYSTEM	CENTRAL	CREATE NEW UNIT OR OPERATOR
74360	KANSAS GATHERING SYSTEMS	CENTRAL	CREATE NEW UNIT OR OPERATOR

Below the table, there is a note: "Please contact [Leigha.Gooding@dot.gov](mailto:Leigha.Gooding@dot.gov) for questions regarding these tasks." and a section for viewing pipelines associated with the modification unit, along with buttons for 'Main Menu', 'Back', and 'Go'.



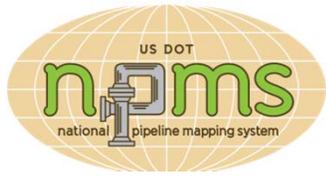


# Gas and Liquid Incident Association Tool

The screenshot displays the 'Submission Manager' interface. At the top, there is a map showing a network of pipelines in red and yellow over an aerial view. Below the map is a toolbar with various functions like 'Show All Accidents', 'Refresh', 'Filter Selection', 'Match Grid Selection', 'Match Feature Selection', 'DL Phmsa Link', 'Clear Link', 'Filter Selection', 'Zoom', 'Select', 'Flash', 'Show Selected', and 'Pipe Segment ArcTools'. Below the toolbar is a table with columns: REPORT NUMBER, NPMS STATUS, ASSOCIATION, PIPE EVENT ID, OPER SUB ID, INITIAL DATE, and INITIAL NOTE. The first row is highlighted with a blue background and contains the value '20150250 READY FOR INITIAL ASSOCIATION Y'. Below this is another table with columns: EVENT\_ID, Operator ID, Operator Name, System Name, Sub System Name, Pline ID, Diameter, Miles, and Comm. The first row is highlighted and contains: 39118181, 31618, ENTERPRISE PROD, EAGLE FORD NGL F, EAGLE FORD YOAK, 3510, 24.00, 35.30, NGL. The second row contains: 13978946, 31618, ENTERPRISE PROD, SEMINOLE, SEMINOLE MAINLII 1, 14.00, 546.24, LPG. The third row contains: 19688773, 31618, ENTERPRISE PROD, EAGLE FORD NGL F, EAGLE FORD NEED, 3530, 16.00, 7.20, NGL.

- Link incidents to pipelines
- Build history of incidents for a pipe, not only an operator
  - Pipe centric data
- Tool accommodates initial data production and maintenance after change detection on new submissions every year





# PIMMA +

- Open GIS, Google base maps, dynamic search box and right-click menus
- View and query pipe history, inspection unit and accident association data
- Queries allow for multiple user-defined criteria
- Incorporates information from inspection databases

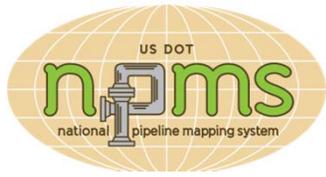
The screenshot displays the PIMMA+ web application interface. On the left, a map of the United States is shown with a right-click menu open, listing options such as 'Display Pipelines by OPID', 'Query Accidents (Liquid)', and 'Query Pipeline History'. In the center, a 'Query Accidents (Liquid)' dialog box is open, allowing users to select query criteria for elements like OPID, Year of Occurrence, Date of Occurrence, Onshore State, Number of Barrels Lost, Number of Fatalities, Number of Injuries, and Cause. On the right, a 'Display Pipelines by Attributes' dialog box is open, allowing users to select elements for querying, including OPID, Commodity, Pipeline Status, and Inspection Unit. The interface includes a 'Map Layers' panel, a 'Query Tools' panel, and a status bar at the bottom showing 'Ready' and 'Zoom Level: 5 of 19 (1-13,867,009)'.



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# PIMMA +

- PIMMA+ on DOT network for internal use by PHMSA
- Updating PIMMA on NPMS website with similar technology and select data and query access in Spring 2016
- Also planning a mobile application

The left screenshot displays the PIMMA web application interface. It features a 'Query Accidents (Liquid)' table with columns for 'REPORT\_REC#', 'YEAR', and 'YEAR'. Below it is a 'Query Pipeline History' table with columns for '2010', '2011', '2012', '2013', '2014', and '2015'. The right screenshot shows a 'Show Pipeline History' window overlaid on a map. The window contains a table with the following data:

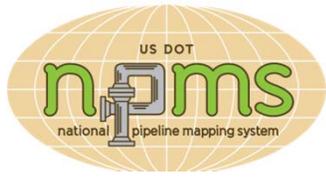
OPID	System Name	Subsystem Name	Pipeline ID
32147	COOK INLET GATHERING 10IN-16IN...	TRADING BAY PRODUCTION FACILI...	2343
32147	COOK INLET GATHERING 10IN-16IN...	TRADING BAY PRODUCTION FACILI...	2832
32147	COOK INLET GATHERING 10IN-16IN...	TRADING BAY PRODUCTION FACILI...	3075
32645	COOK INLET GAS GATHERING SY...	TBPF - GRANITE POINT	1
32645	KENAI BELUGA PIPELINE	WEST CIGGS	12



U.S. Department of Transportation  
 Pipeline and Hazardous Materials  
 Safety Administration

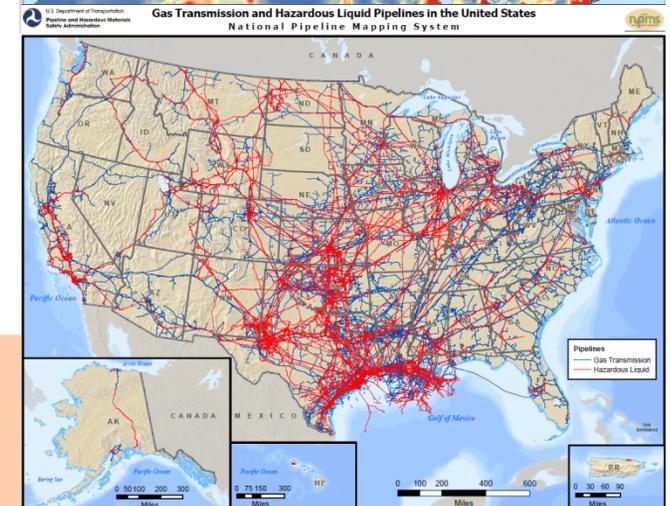
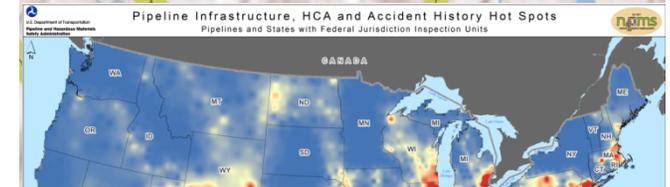
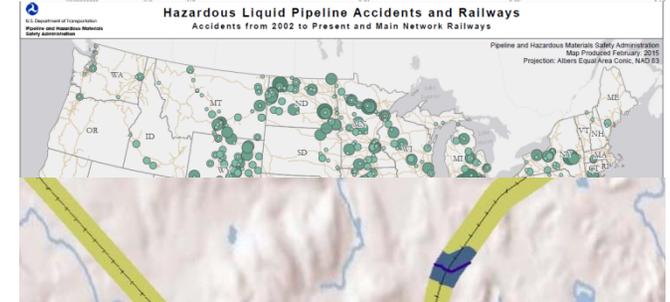
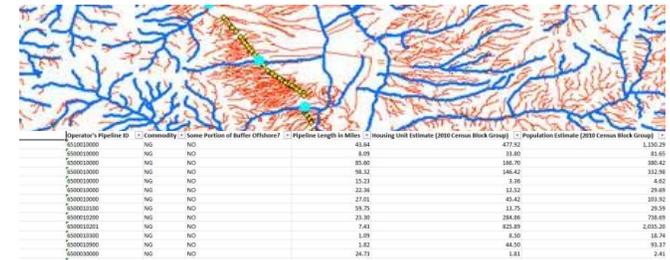
To Protect People and the Environment From the Risks of  
 Hazardous Materials Transportation

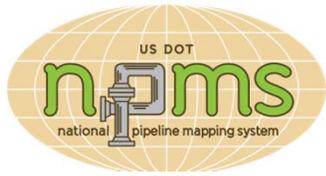




Typical projects using data from nearly 1200 operators:

- Hotspot analysis to identify best locations for new inspectors and PHMSA offices
- Estimated dwelling and population counts near pipelines
- Analysis to support rulemakings and engineering research
- Highway, railway and waterway analysis
- Accident and natural disaster preparedness and response mapping
- Risk ranking and inspection planning





## Questions?

*Phone lines will be open after taking questions from the room*

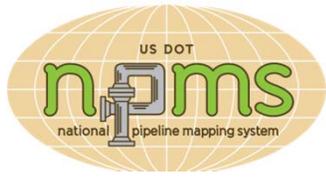
*A 15- minute break will follow the question period*



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# Overview of Pipeline Linear Referencing

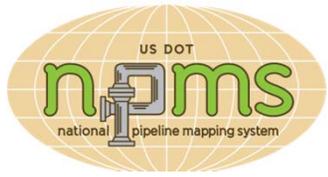
Ron Brush  
New Century Software



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation

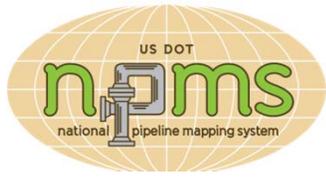




# Goals

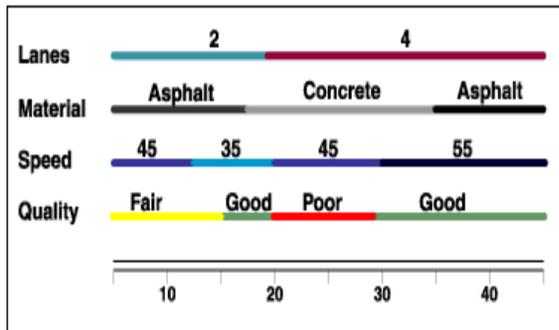
- Define common terminology
  - Line, Route, Measure, Continuous Station, Engineering Stationing, Station Equation, Piggable Segment
  - Same definitions as PODS; familiar terms
- Linear referenced Pipe Centerline
- Point and Linear Events (not time-based events)
- Examples
  - PODS Relational
  - PODS Spatial
  - APDM
  - UPDM





# Linear Referencing

- One master Centerline is used to identify the geographic and linear referenced location of the pipeline
- Point and linear features are positioned on the centerline using the linear referenced location
- Used to determine relative linear position of features along a centerline



[http://resources.arcgis.com/EN/HELP/MAIN/10.1/index.html#/What\\_is\\_linear\\_referencing/003900000001000000/](http://resources.arcgis.com/EN/HELP/MAIN/10.1/index.html#/What_is_linear_referencing/003900000001000000/)



<http://www.upstatenyroads.com/signshop58.shtml>



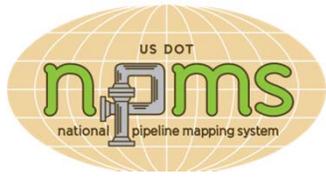
U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





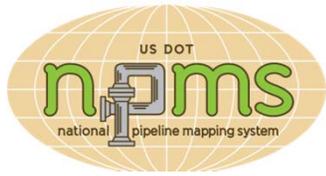




# Common Linear Referencing Methods

- As-built Engineering Stationing
- Milepost
- Continuous Stationing

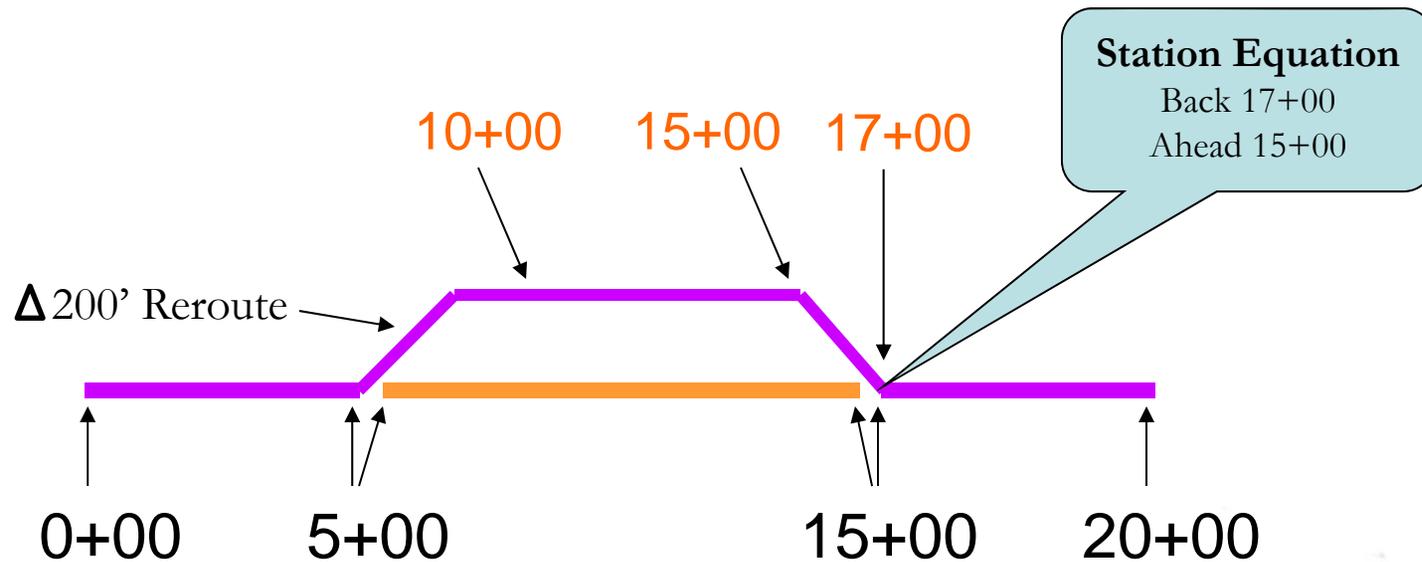


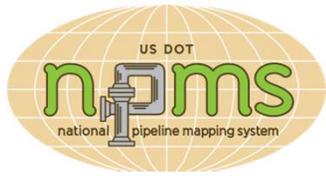


# Engineering Station Example

## Original As-built stationing

	<u>Line</u>	<u>Route</u>	<u>Series</u>	<u>Stationing</u>	
	AB	99	100	0+00 to 17+00	(Active pipe)
	AB	99	200	15+00 to 20+00	(Active pipe)
	AB	100	9000	5+00 to 15+00	(Abandoned pipe)

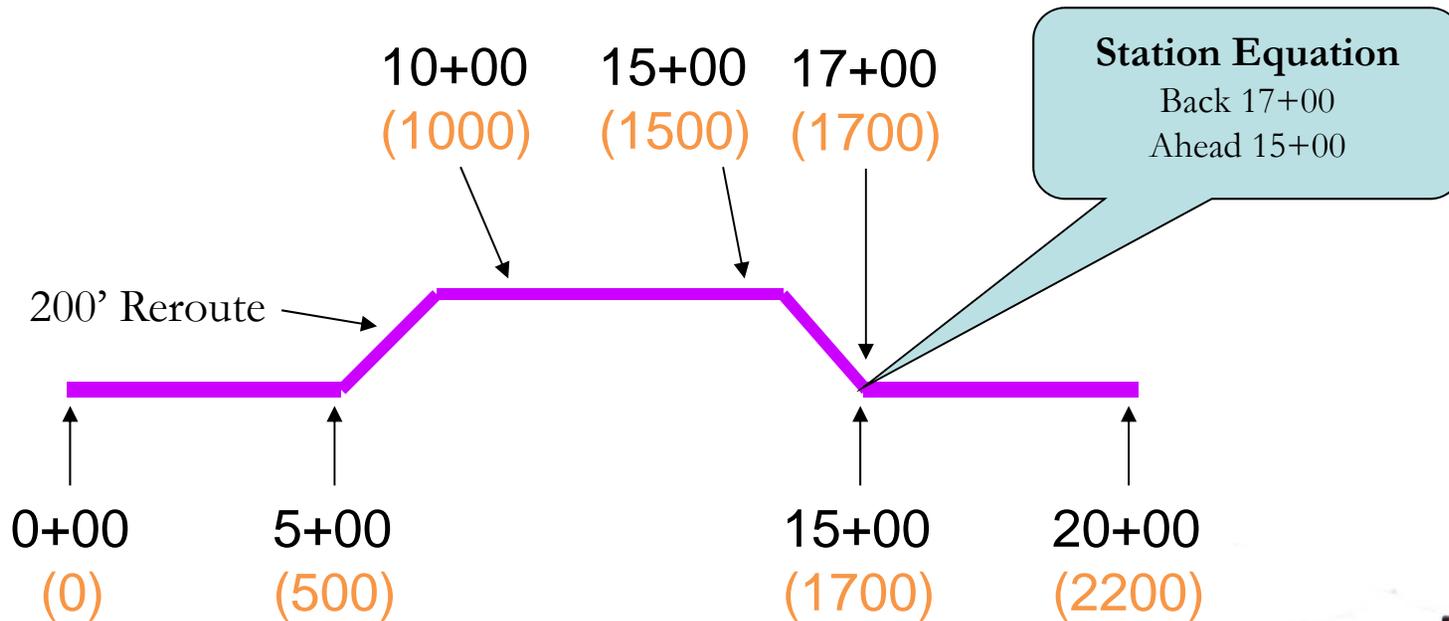


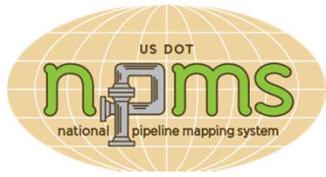


# Continuous Stationing Example

True 3-D length of pipe Route from beginning (in Orange)

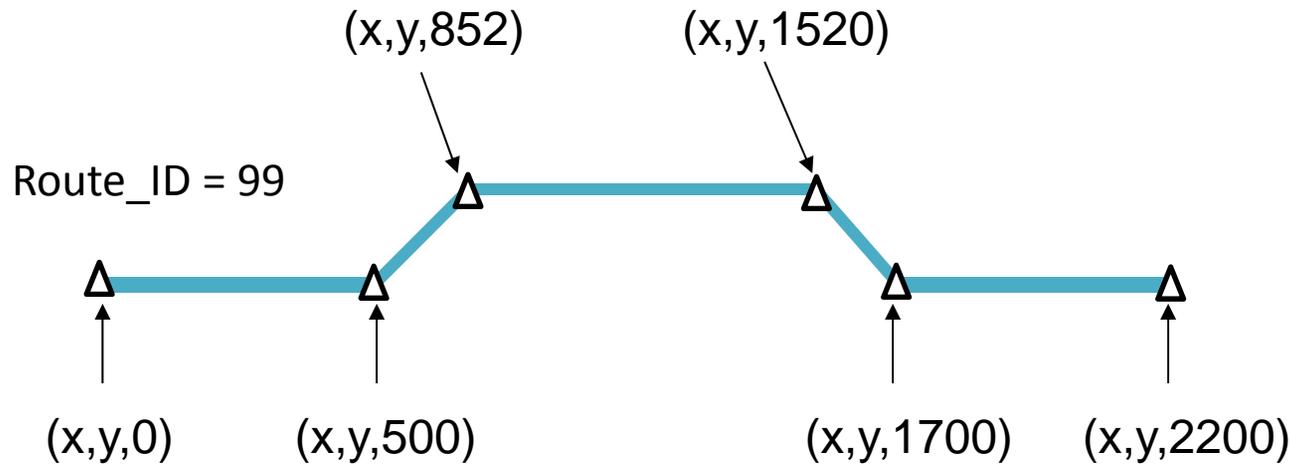
Line	Route	Series	Stationing	Measures
AB	99	100	0+00 to 17+00 (Active pipe)	0 to 1700
AB	99	200	15+00 to 20+00 (Active pipe)	1700 to 2200

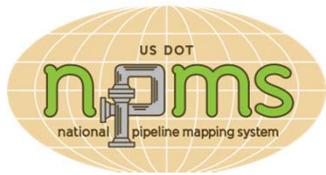




# Graphic Centerline Example

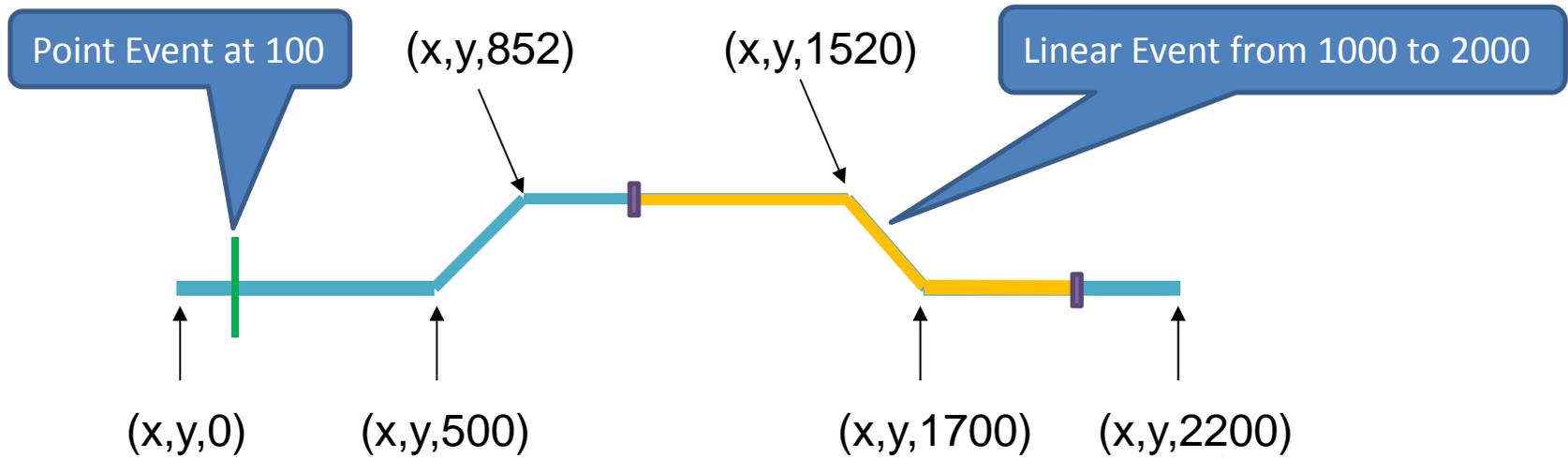
- Centerline = Route
- Unique Route ID
- Each Centerline Vertex has 3 coordinates (PolylineM)  
(Latitude, Longitude, Measure) or (X, Y, M)
- Measures must be monotonic increasing
- No multi-part features

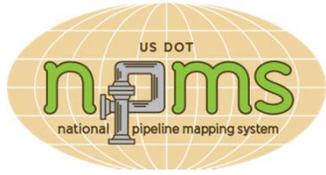




# Linear Event Example

Line_ID	Route_ID	Begin Measure	End Measure	DIAMETER	WALL TH	PIPE JOIN
1	99	0	1000	20"	0.281"	W
1	99	1000	2000	20"	0.312"	W
1	99	2000	2200	20"	0.281"	W



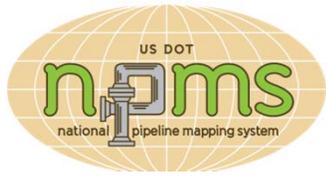


# LRS Events

## Point and Linear Events

- Linear Events cannot span routes
- Begin Measure < End Measure
- Only the centerline is spatial (PolylineM)
- NPMS Event tables are non-spatial





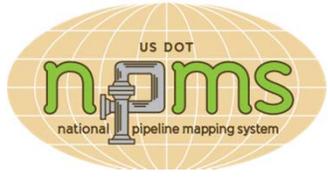
# Data Models used in the Pipeline Industry



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# About PODS



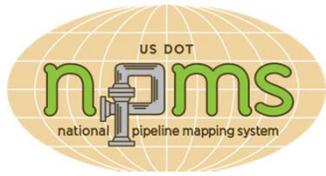
- Not for profit industry trade association
- 60+ Operator members
- 95 Vendor members
- 2 Models
  - PODS Relational
  - PODS Spatial



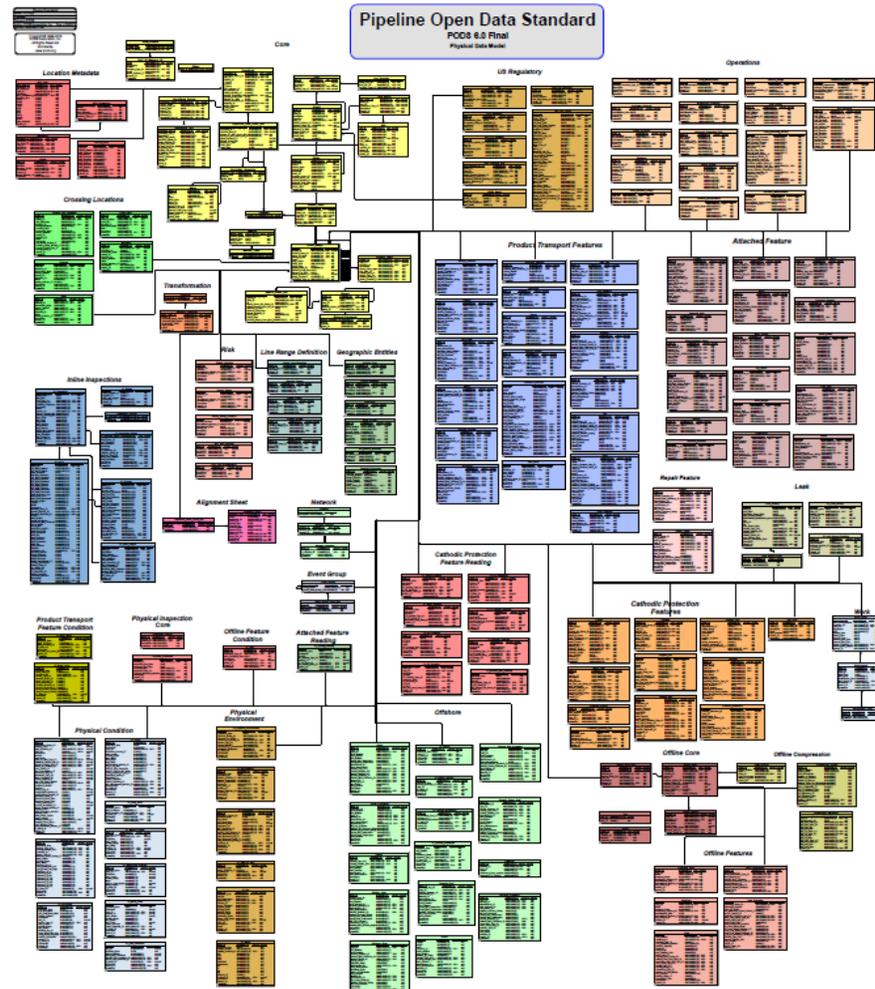
U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation





# PODS Relational 6.0



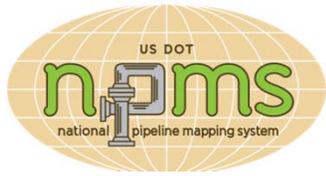
- Usually “Spatialized”
- LRS Data Model
- Point and Linear Event tables
- DB Transactions
- Widely used in US



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation

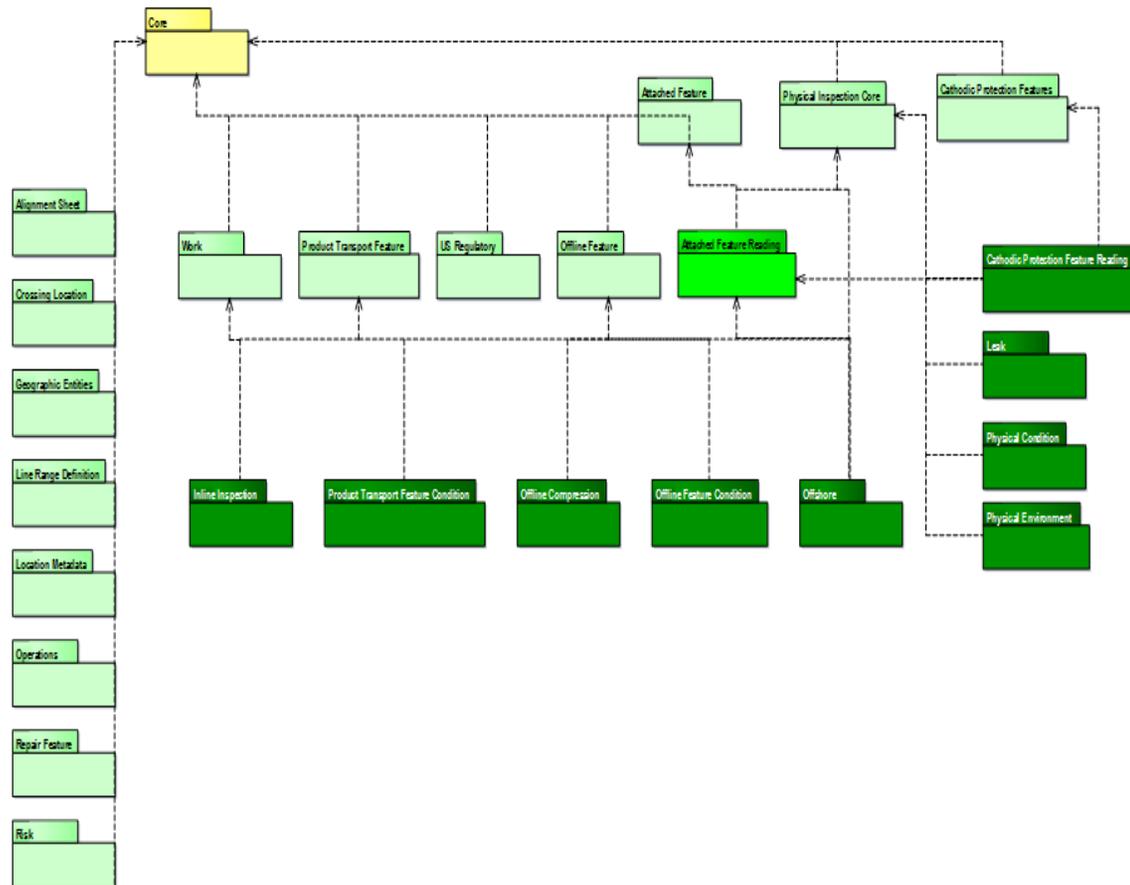




# PODS Spatial 6.0

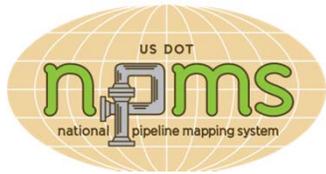


Modularized Model diagram



- Uses APDM Core tables
- LRS Data Model
- Point and Linear Event tables
- Esri Geodatabase

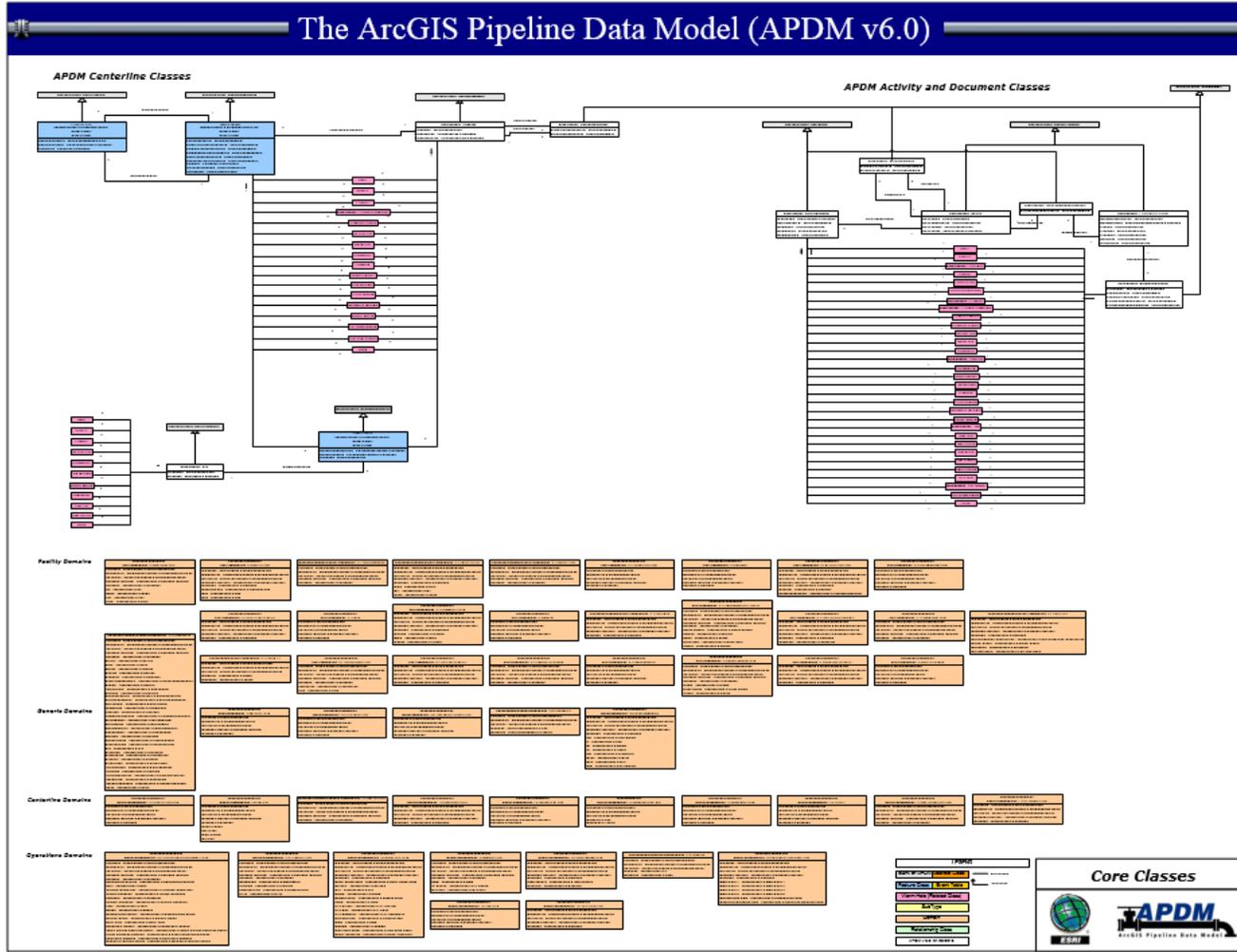




# APDM

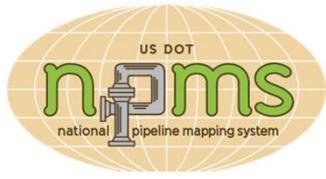


[www.apdm.net](http://www.apdm.net)



- LRS Data Model
- Point and Linear Event tables
- Esri Geodatabase





# UPDM

**Utility & Pipeline Data Model**

Geodatabase Summary Objects

**Inline Devices**

**Flow Control Devices**

**Pipes**

The image displays a detailed Esri Geodatabase schema for the Utility & Pipeline Data Model. It is organized into three main sections: 'Inline Devices', 'Flow Control Devices', and 'Pipes'. Each section contains multiple tables with columns for attributes such as ID, Name, Description, and various technical specifications. The tables are presented in a grid-like layout, showing the hierarchical structure of the data model. The 'Pipes' section is particularly extensive, containing numerous tables that define the geometry, materials, and operational parameters of the pipeline network.

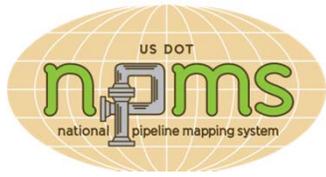
- Utilities & Pipelines
- Brand new model
- LRS Data Model
- Point and Linear Event tables
- Esri Geodatabase



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation



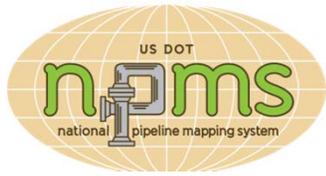


# NPMS Uses PODS



- Implemented in 2011
- 520k miles of US regulated pipelines
- Standard PODS 4.02 Relational (Spatial)
- PODS Events are GDB Feature Classes
- NPMS is Linear Referenced
- Spatial History of all submissions
- Custom Event tables added for NPMS
- Uses DynSeg (Derived Layers) to distribute data within PHMSA



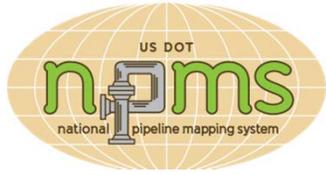


# How operators prepare NPMS submissions

- Which GIS or other software packages (ESRI, CAD, and data models such as PODS and APDM) are you using now?
- Are you using custom-designed tools to prepare your NPMS submission?
- Which would you use in the future once the Information Collection becomes final?
- How much time do you spend preparing a submission and who else is involved?
- Do you prepare the Annual Reports at the same time?
- Do you extract the data on 12/31 or do you wait until all backlogged data has been entered?

*Open phones after onsite attendees speak*





# Proposed Information Collection

## NPMS Submission Formats



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation



# Traditional Submission Format (Non-LRS)

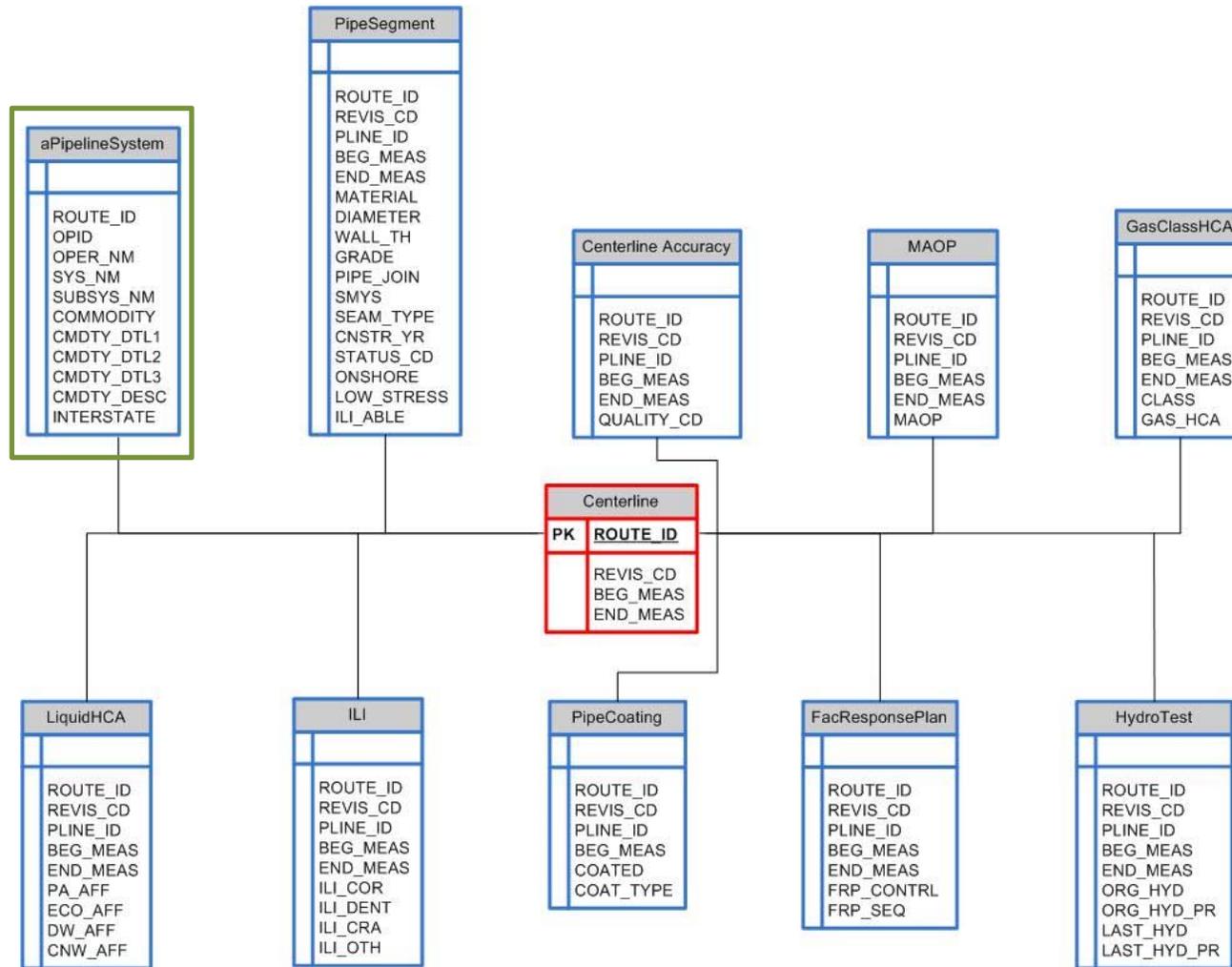
## (Appendix A)

PIPELINE DATA	
PK	OPER_LINK
	OPID
	OPER_NM
	SYS_NM
	SUBSYS_NM
	PLINE_ID
	ROUTE_ID
	COMMODITY
	CMDTY_DTL1
	CMDTY_DTL2
	CMDTY_DTL3
	CMDTY_DESC
	INTERSTATE
	REVIS_CD
	MATERIAL
	DIAMETER
	WALL_TH
	GRADE
	PIPE_JOIN
	SMYS
	SEAM_TYPE
	CNSTR_YR
	STATUS_CD
	ONSHORE
	LOW_STRESS
	ILI_ABLE
	QUALITY_CD
	MAOP
	CLASS
	GAS_HCA
	PA_AFF
	ECO_AFF
	DW_AFF
	CNW_AFF
	ILI_COR
	ILI_DENT
	ILI_OTH
	COATED
	COAT_TYPE
	FRP_CONTROL
	FRP_SEQ
	ORG_HYD
	ORG_HYD_PR
	LAST_HYD
	LAST_HYD_PR

- One table
- Spatial
- No Linear referencing
- Highly segmented

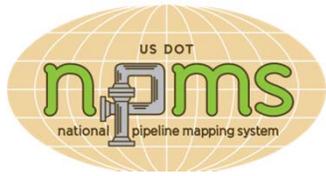


# New LRS Submission Format (Appendix D)



- New optional format
- One Parent Table
- One Spatial Centerline
- Nine event tables
- Linear referencing
- Easier if you have an LRS model
- 33 attributes
- More tables – Less segmented





# Template

[https://www.npms.phmsa.dot.gov/Documents/Draft\\_OperStandards\\_FGDB\\_Template.zip](https://www.npms.phmsa.dot.gov/Documents/Draft_OperStandards_FGDB_Template.zip)

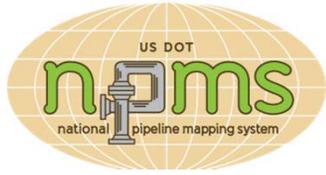
Name	Type
aPipelineSystem	File Geodatabase Table
BreakoutTank	File Geodatabase Feature Class
Centerline	File Geodatabase Feature Class
CenterlineAccuracy	File Geodatabase Table
FacResponsePlan	File Geodatabase Table
GasClassHCA	File Geodatabase Table
GasPlant	File Geodatabase Feature Class
GasStorageField	File Geodatabase Feature Class
ILI_DA	File Geodatabase Table
InstallationMethod	File Geodatabase Table
LeakDetectMethod	File Geodatabase Table
LiquidHCA	File Geodatabase Table
LNGExclusionZone	File Geodatabase Feature Class
LNGImpoundment	File Geodatabase Feature Class
LNGPlant	File Geodatabase Feature Class
MAOP	File Geodatabase Table
OperatorContact	File Geodatabase Table
Pipe_Segment	File Geodatabase Table
PipeCoating	File Geodatabase Table
PressureTest	File Geodatabase Table
PumpComp	File Geodatabase Feature Class
Refinery	File Geodatabase Feature Class
SpecialPermit	File Geodatabase Table
Valve	File Geodatabase Feature Class



U.S. Department of Transportation  
 Pipeline and Hazardous Materials  
 Safety Administration

To Protect People and the Environment From the Risks of  
 Hazardous Materials Transportation

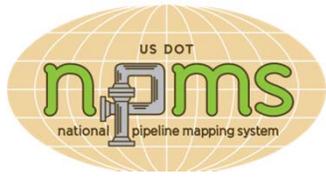




## How to prepare a traditional submission (if you do not have LRS)

- Take snapshot of data
- Prepare as you do now, with all 33 attributes (overlay/intersect/merge)
- QC Review
- Package and Submit

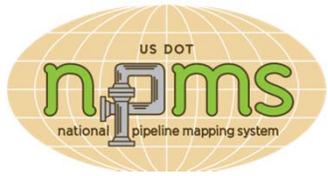




# How to prepare a traditional submission (if you have LRS)

- Take snapshot of GIS
- Select all required attributes
- Combine by Dynamic Segmentation
  - Perform field calculations as needed
  - Export Spatial representation (GDB file)
- QC Review
- Package and Submit





# Dynamic Segmentation

Diameter

20"				
-----	--	--	--	--

Wall Thickness

0.281"		0.312"		0.281"
--------	--	--------	--	--------

Coating

FBE		CTE		
-----	--	-----	--	--

Class Location

1	2		3	
---	---	--	---	--

Gas HCA

No	Yes	No		Yes	No
----	-----	----	--	-----	----

MAOP

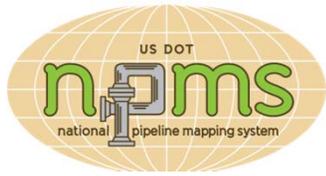
1052	877		1123	877	731
------	-----	--	------	-----	-----

Last Corr. ILI Insp.

2012				
------	--	--	--	--

20" x .281 FBE Class 2, Not in HCA, MAOP 877 Last Corrosion Insp 2012



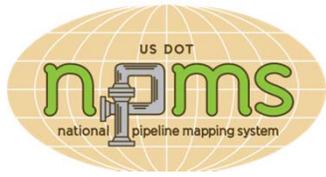


# Dynamic Segmentation

Diameter	20"										
Wall Thickness	0.281"			0.312"				0.281"			
Coating	FBE				CTE						
Class Location	1		2			3					
Gas HCA	No	HCA		No			HCA		No		
MAOP	1052	877			1123		877		731		
Last Corr. ILI Insp.	2012										
Result	1	2	3	4	5	6	7	8	9	10	

20" x .281 FBE Class 2, Not in HCA, MAOP 877 Last Corrosion Insp 2012

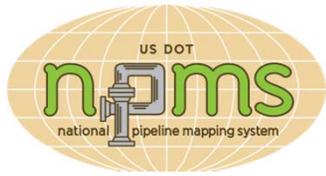




# How to prepare an LRS submission

- Take snapshot of GIS
- Export attributes from event table views
  - Use Route and Measure, not Engineering Station
  - Perform field calculations as needed
- Export centerline (GDB file)
- QC review
- Package and Submit



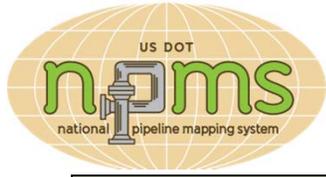


# Example table mapping PODS to NPMS



PODS Event Table	NPMS LRS Event Table
Pipe_Segment	PipeSegment
MAOP_Rating	MAOP
DOT_Class	GasClassHCA
HCA_CA_Boundary	LiquidHCA
ILI_Inspection	ILI
External_Coating	PipeCoating
Test_Pressure	HydroTest

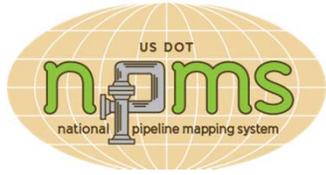




# NPMS to PODS Table Mapping

Additional Attributes	NPMS Table	NPMS Field	Phase	PODS Table	PODS Column
New positional accuracy standard	CenterlineAccuracy	QUALITY_CD	3	<does not exist>	<does not exist>
Diameter becomes mandatory	PipeSegment	DIAMETER	1	Pipe_Segment	Outside_Diameter_CL
Commodity detail	aPipelineSystem		1	Product_Range	Product_Type_CL
Pipe material (e.g. cast iron, steel)	PipeSegment	MATERIAL	1	Pipe_Segment	Material_CL
Pipe grade	PipeSegment	GRADE	1	Pipe_Segment	Pipe_Grade_CL
Highest percent operating SMYS	PipeSegment	SMYS	1	Pipe_Operating_History	
MAOP or MOP	MAOP	MAOP	1	MAOP_Rating	MAOP_Rating or MOP
Seam type	PipeSegment	SEAM_TYPE	1	Pipe_Segment	Pipe_Long_Seam_CL
Year of installation (predominant=90%)	PipeSegment	CONSTR_YR	1	Pipe_Segment	Date_Installed
Wall thickness	PipeSegment	WALL_TH	1	Pipe_Segment	Nominal_Wall_Thickness_CL
Pipe joining method	PipeSegment	PIPE_JOIN	1	<does not exist>	<does not exist>
Pipe status code	PipeSegment	STATUS_CD	1	Status_Range	Operating_Status_CL
Onshore/offshore	PipeSegment	ONSHORE	1	Exposure	Onshore_LF
Hazardous Liquid Low Stress (<20%)	PipeSegment	LOW_STRESS	1	<Calculated>	
Piggable? (Inline Inspection)	PipeSegment	ILI_ABLE	1	ILI_Range	Smart_Piggable_LF
Class location	GasClassHCA	CLASS	1	DOT_Class	Rating_CL
Gas HCA segment y/n	GasClassHCA	GAS_HCA	1	HCA_Boundary	Type_CL
Segment "could affect" an HCA - Populated Area	LiquidHCA	PA_AFF	2	HCA_CA_Segment	Type_CL
Segment "could affect" an HCA - Ecologically Sensitive Area	LiquidHCA	ECO_AFF	2	HCA_CA_Segment	Type_CL
Segment "could affect" an HCA - Drinking Water	LiquidHCA	DW_AFF	2	HCA_CA_Segment	Type_CL
Segment "could affect" an HCA - Commercially Navigable Waterway	LiquidHCA	CNW_AFF	2	HCA_CA_Segment	Type_CL
Year of last corrosion ILI inspection	ILI	ILI_COR	2	ILI_Inspection	End_Date
Year of last dent ILI inspection	ILI	ILI_DENT	2	ILI_Inspection	End_Date
Year of last crack ILI inspection	ILI	ILI_CRAC	2	ILI_Inspection	End_Date
Year of last other ILI inspection	ILI	ILI_OTH	2	ILI_Inspection	End_Date
Coated/uncoated & cathodic protection	PipeCoating	COATED	2	<Calculated>	
Type of coating	PipeCoating	COAT_TYPE	2	External_Coating	Type_SCL
FRP control number, if applicable	FacResponsePlan	FRP_CONTRL	1	<does not exist>	<does not exist>
FRP sequence number, if applicable	FacResponsePlan	FRP_SEQ	1	<does not exist>	<does not exist>
Year of original pressure test	HydroTest	ORG_HYD	3	Test_Pressure	Test_Date
Original pressure test pressure	HydroTest	ORG_HYD_PR	3	Test_Pressure	Test_Pressure
Year of last pressure test	HydroTest	LAST_HYD	2	Test_Pressure	Test_Date
Last pressure test pressure	HydroTest	LAST_HYD_PR	2	Test_Pressure	Test_Pressure



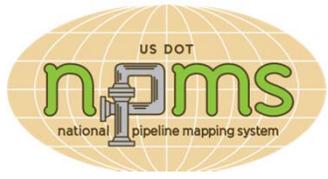


# PODS Event Tables

(15 event tables – 33 attributes)

- DOT Class
- Exposure
- External Coating
- HCA Boundary
- HCA CA Boundary
- ILI Inspection
- ILI Range
- MAOP Rating
- Pipe Operating History
- Pipe Segment
- Product Range
- Status Range
- Test Pressure
- + 2 New

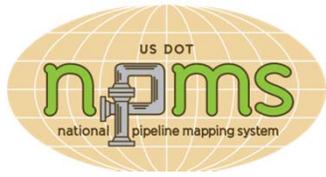




# Benefits of LRS Submissions

- Easier
  - LRS to LRS format, direct data export
  - Easier to QC – record counts & mileage
  - Facilitates communication with NPMS
- Faster
  - More tables but fewer rows of data
  - Repeatable process – minimal data manipulation





# Questions?

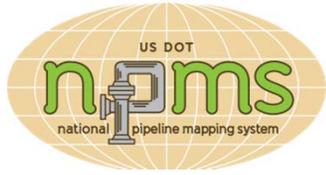
*Phone lines will be open after  
taking questions from the room*



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation

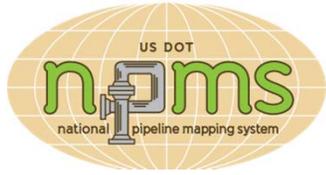




# Segmentation in Geospatial Data

- How the NPMS defines “pipeline segment”
- How segmentation negatively impacts the NPMS
- How the NPMS currently handles your segmentation
- How the proposed Information Collection will impact your segmentation
- Operator Panel and Q&A:
  - How do you determine segmentation?





# Definition of a Pipe Segment

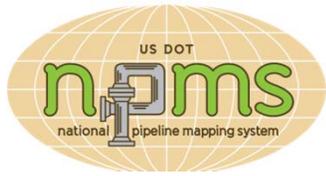
According to the NPMS, a pipeline segment is...

- Part or all of a pipeline system
- Must be uniquely identified
- Single part, linear feature, only 2 ends, no branches
- Can be straight or have multiple vertices
- Section of pipe with common attribute values
- *The number of pipeline segments should be kept to a minimum necessary to represent the pipe and it's attributes*

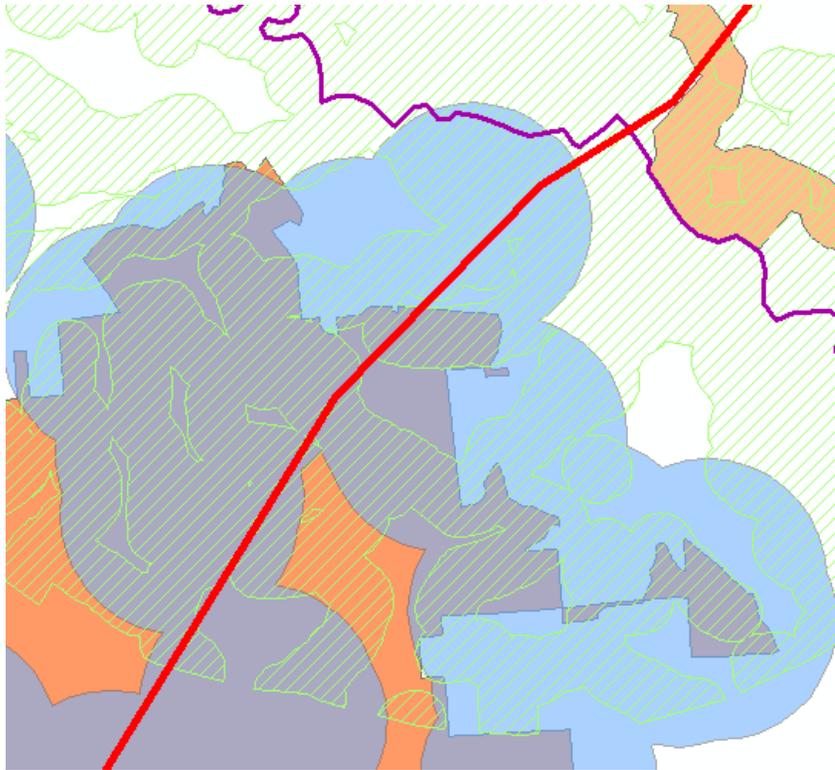
**BOTTOM LINE:** A pipeline system should be broken into multiple pipeline segments for only two reasons:

- 1) to represent a branch or intersection with another pipe
- 2) to allow for an attribute change





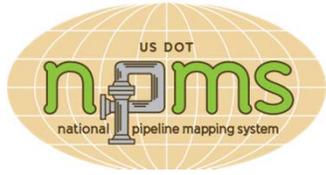
# Segmentation hurts...



Impacts to:

- Web map viewer performance
- Query performance
- Database performance



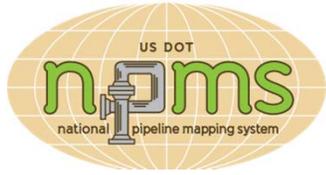


# How your segmentation impacts the NPMS

## Impacts of unnecessary and inconsistent operator segmentation

- Submission Processing
  - Slows the processing workflow
  - Can increase analyst's dependency on operators
  - Potential for confusion and poor assumptions
  - Inhibits Change Detection matching; impacts History quality
- Production Database Data Storage
  - Clunky and slower
- End user products
  - PIMMA and Public Viewer are slower to draw and return query results
  - History not as reliable or effective

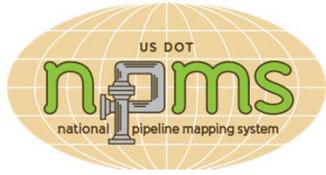




# How the NPMS currently handles your segmentation

- Submission Processing
  - Goal – operator segmentation retained in centerline
  - Exceptions - Spatial edits to accommodate our LRS database
    - Repair Geometry
    - Explode Multi-Part Features
    - Delete features smaller than 0.00005 mi (0.26 ft)
- End user products
  - Multiple outputs created by dynamic segmentation - each serving a different purpose
    - “Derived Layers”
  - Example: PIMMA and Public Viewer Derived Layers are segmented on county boundaries

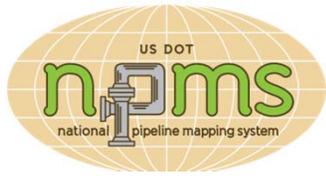




# How the proposed Info Collection impacts segmentation

- We understand that the collection of additional attributes will greatly increase segmentation
- Our solution: The LRS submission format
  - Leverages how operators store their data
  - Reduces the number of segments in centerline
  - Speeds up processing time
  - Avoids the need for analyst to manipulate submission segmentation (unlike the traditional method)
  - NPMS can create Derived Layers with event table attributes as needed



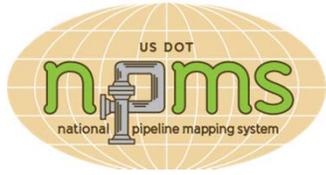


# Derived Layers

Pipe Route # 123	[Solid blue bar]									
Wall Thickness	0.281"			0.312"				0.281"		
Coating	FBE				CTE					
Class Location	1		2			3				
Gas HCA	No		HCA		No			HCA		No
MAOP	1052		877		1123		877		731	
Last MFL ILI Insp.	2012									
Result	1	2	3	4	5	6	7	8	9	10

**1 Route turns into 10 segments**

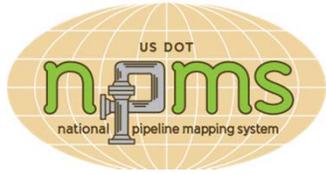




# If you do not use the LRS submission format...

- The NPMS will force your data into our LRS data model
- The NPMS will redefine and remove segmentation
- The NPMS will require more time to process your submission (ultimately impacting all operators)

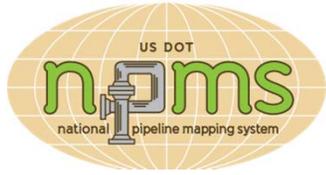




# Segmentation Discussion

- Operator Panel, in person comments, then phone comments
  - How do you determine data segmentation?
  - Thoughts or questions related to segmentation?
  - Suggestions for improvements?

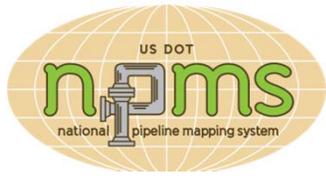




# “Predominant”

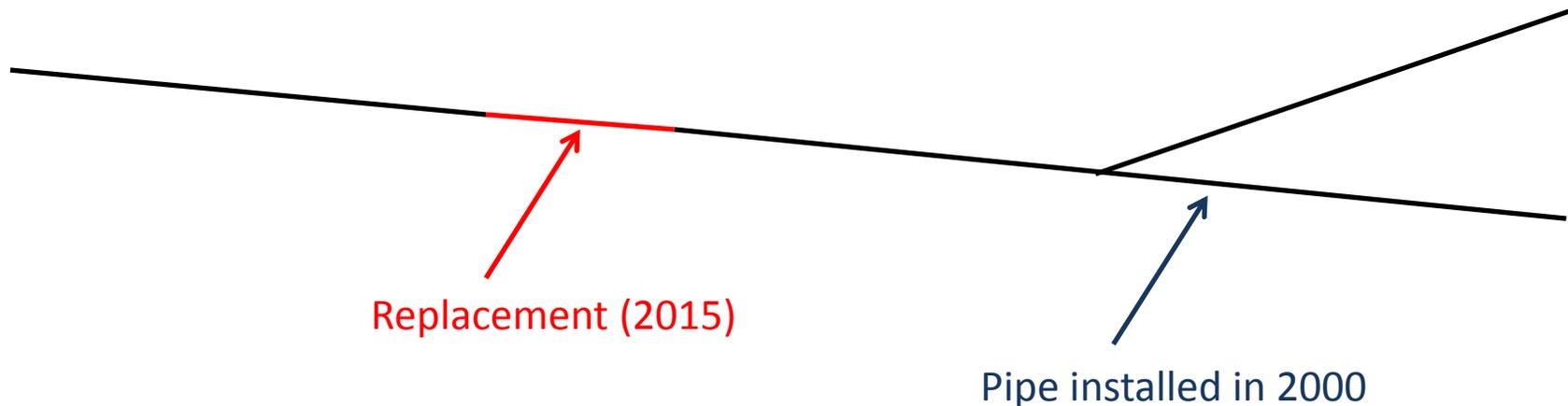
- Predominant refers to collecting generalized values for an attribute
- PHMSA’s intent was to ease the burden on operators and to avoid unnecessary segmentation
- No elements in current NPMS submissions are collected as predominant
- **Only two elements in the Information Collection are marked as predominant: decade of installation and pipe grade**

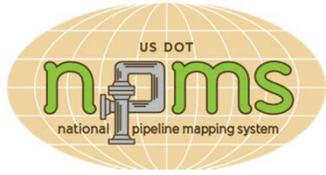




# Example: decade of installation

- Small sections of pipe are often replaced
- Under working definition in Info Collection, a small replaced segment would be reported as the same decade of installation as the underlying pipe
- **This would reduce segmentation in NPMS submissions/data, but is it desirable or useful to operators? How is this data stored in your systems?**



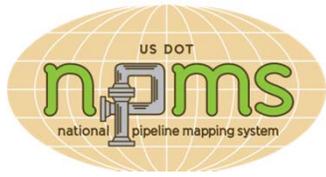


# Discussion

- Operators will always have the option of submitting actual, not predominant, values. Is submitting predominant values feasible or desirable for operators?
- Should PHMSA delete all references to predominance in the NPMS Information Collection?

(Comments will be taken from the room first, then phone lines will be opened)



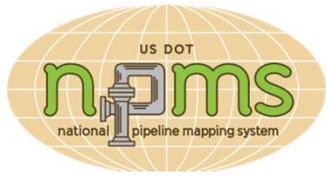


# Conclusions: Q&A

- What other concerns do you have about the NPMS submission process post-Info Collection?
- Are there potential roadblocks we have not yet discussed?

***We will only address comments on the submission process, not the Info Collection in general***

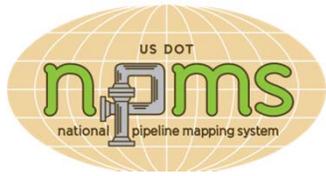




# Operator Webinars

- 2 webinars will be held in January; NPMS staff will discuss common submission issues and suggested solutions
- 2015 Liquid Operator Webinar (.ppt) is available in Pipeline Operator section of NPMS Website
- An email will be sent to Technical Contacts on NPMS submissions as well as to this workshop's participants with details once we set the dates

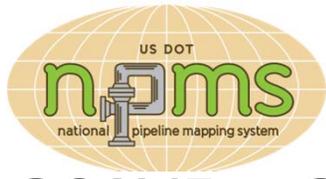




# OSAVE

- Operator Submission and Validation Environment
- Coming in early 2016
- A web-based interface used to upload your new full replacement submission or to make minor attribute and removal changes to your last submitted data
  - Traditional submissions will still be accepted
- NPMS staff will send an email about training resources

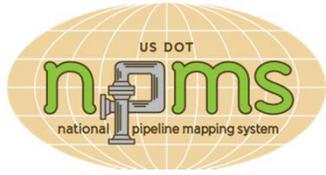




## **OSAVE -- Operator Submission and Validation Environment**

- Online submission environment with 2 workflows:
  1. Upload the GIS data file for your full replacement submission
    - OSAVE will run QC scripts and report issues back to the operator via an email report
  2. Report changes to your existing data using a map environment
    - In lieu of a Full Replacement Submission
    - You must only have attribute changes or pipeline removals
    - If you have spatial changes or new pipelines you need to make a full replacement submission
    - Will be most helpful to operators with small changes
- Both workflows allow you to complete certain components online
  - Metadata
  - Cover Letter/ Transmittal Letter
  - Contact Information





# Closing

- Submit comments on the Information Collection 60-day notice to the docket by 11/25
- We will post presentations and meeting minutes to this workshop's registration page by Monday COB

*Phone lines open for Q&A*

***Thanks for your participation!***

**[Amy.Nelson@dot.gov](mailto:Amy.Nelson@dot.gov); 202-493-0591**



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration

To Protect People and the Environment From the Risks of  
Hazardous Materials Transportation

