



Pipeline and Hazardous
Materials Safety Administration

Class Locations, HCAs, & Alternatives

Gas Pipeline Class Location Methodology Workshop

***Definitions, Regulations Impacted, and Comparison of
Class Location versus Integrity Management Approaches***



Know what's below.
Call before you dig.

Steve Nanney
April 16, 2014





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Washington Monument/Tidal Basin



Topics

- **Overview – Federal Register (FR) Notice**
- **Class Location Approach**
- **Class Location Change - Possible Impact**
- **Integrity Management (IM) Approach**
- **Alternatives**
- **Summary**



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FR Notice Invited Comments

1. Design factors in densely populated areas: increase or decrease?
2. Class locations be eliminated and use a single design factor with IM requirements expanded beyond HCAs?
3. Single design factor for areas w/large concentrations of populations, such as schools, hospitals, nursing homes, multiple-story buildings, and stadiums?
4. Allowed to increase the MAOP of a pipeline from the present MAOP if a single design factor is created for all levels of population density?

Note: Questions 1 – 4 in 08/01/2013 Federal Register Notice, Docket PHMSA-2013-0161.



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FR Notice Invited Comments

- **Single/Multiple Design Factor Pipelines: considerations**
 - Existing, pre-1970, or new pipelines?
 - Periodic operational Integrity Management (IM) measures
 - Pipe: seam quality, pipe coatings, and girth weld coating quality
 - Root cause analysis: in-service and pressure test failures or leaks
 - Documentation of material strength, wall thickness and seam
 - Test pressure requirements and records

Note: Questions 5 – 15 in 08/01/2013 Federal Register Notice, Docket PHMSA-2013-0161.



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FR Notice Invited Comments

- **Single/Multiple Design Factor Pipelines: considerations**
 - Pipe manufacturing quality controls: steel, seam, toughness, and pressure testing quality
 - Construction: operator qualification program
 - Mainline valve spacing & remote operation for emergency isolation
 - Additional design, construction, and operational criteria for safety
 - IM – robust assessment and remediation criteria for defects

Note: Questions 5 – 15 in 08/01/2013 Federal Register Notice, Docket PHMSA-2013-0161.



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Gas Transmission Class Location

Class Location	Total Miles	%	HCA Miles	%
Class 1	237,169	78.5	1,597	8.2
Class 2	30,507	10.1	1,397	7.2
Class 3	33,360	11.0	15,795	80.9
Class 4	952	0.3	745	3.8
TOTAL	301,988	100	19,534	100



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	Total Miles	Type A Miles	Type B Miles	Offshore Miles
Interstate	5,445	219	136	5,090
Intrastate	11,837	7,339	3,492	1,006
Total	17,282	7,558	3,628	6,096

**Gas Gathering
Mileage**

**Gas Distribution
Mileage**

	Total Miles
Main	1,229,230
Service	872,348
Total	2,101,578



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Class Locations 1 to 4

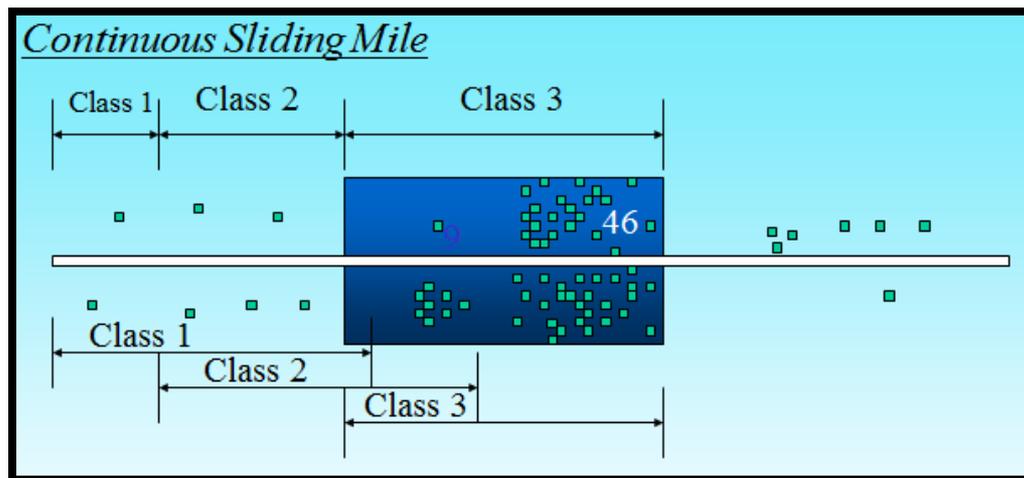




Class Location Definition - §192.5

- The **class location unit** is an onshore area that extends 220 yards on either side of the centerline of any **continuous 1-mile length of pipeline**.

- Class location is determined by the buildings in the **class location unit**. Each separate dwelling unit in a multiple dwelling building is counted as a separate building intended for human occupancy





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Class Location Unit

- ***Class 1 Location:***
 - 10 or less buildings intended for human occupancy or an offshore area.





Class Location Unit

- **Class 2 Location:**
 - Greater than 10 but less than 46 buildings intended for human occupancy.





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Class Location Unit

- ***Class 3 Location:***
 - 46 or more buildings intended for human occupancy





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Class Location Unit

- **Class 3**
 - where the pipeline lies within 100 yards of either a building or a small, well-defined outside area
 - Playground
 - Recreation Area
 - Outdoor Theater
 - Occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12 month period





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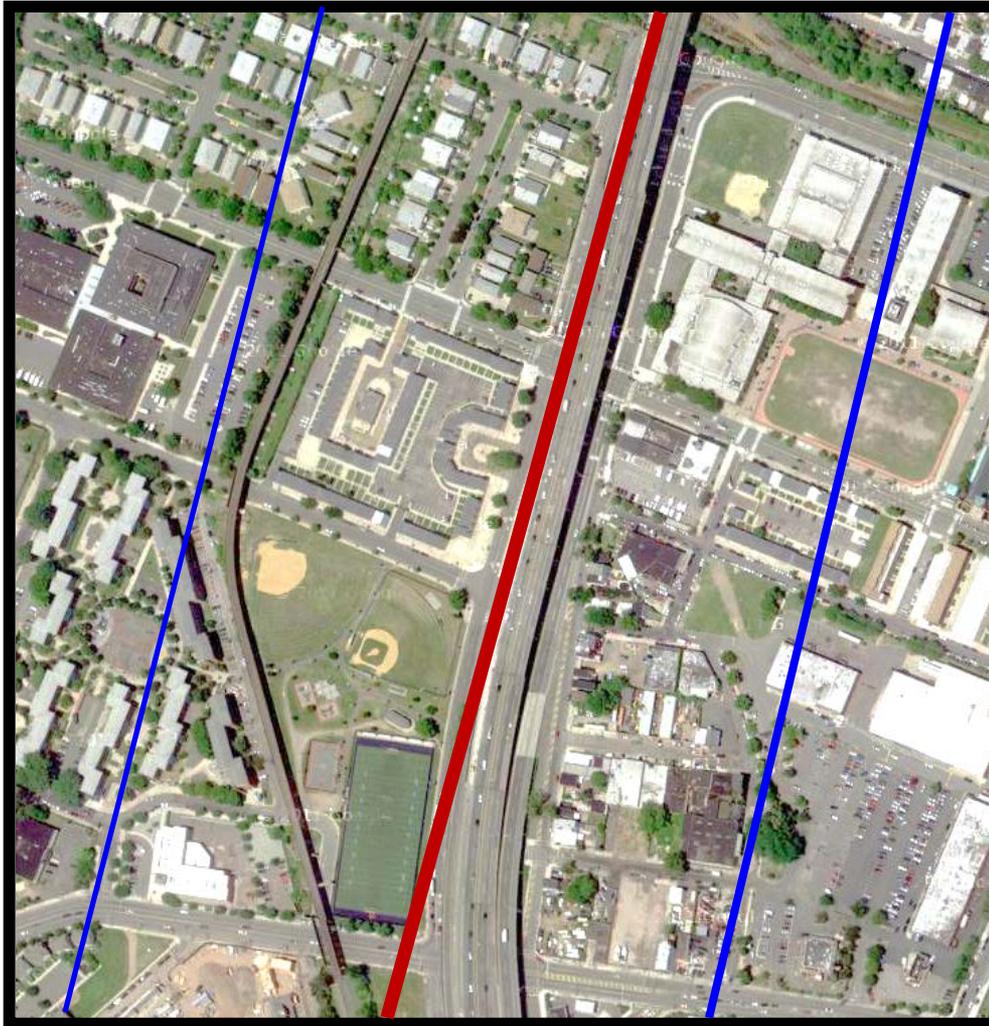
Class Location Unit

- ***Class 4***
- where buildings with four or more stories above ground are prevalent.





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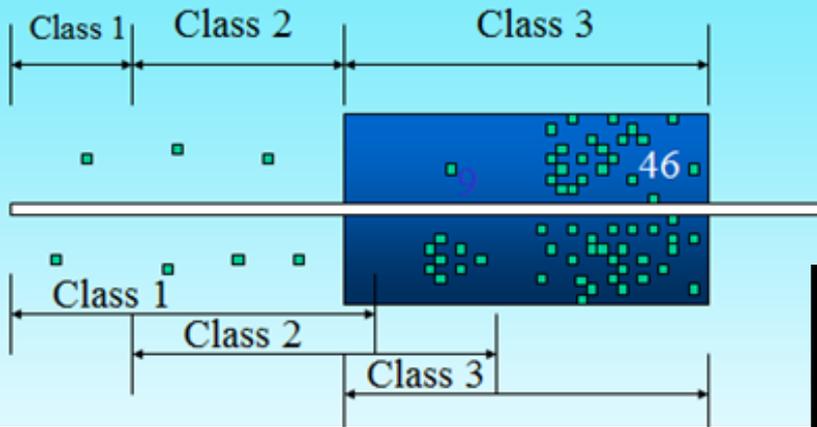
**Class Location
(Shown w/660 ft.
Boundaries)**



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Class Location - Examples

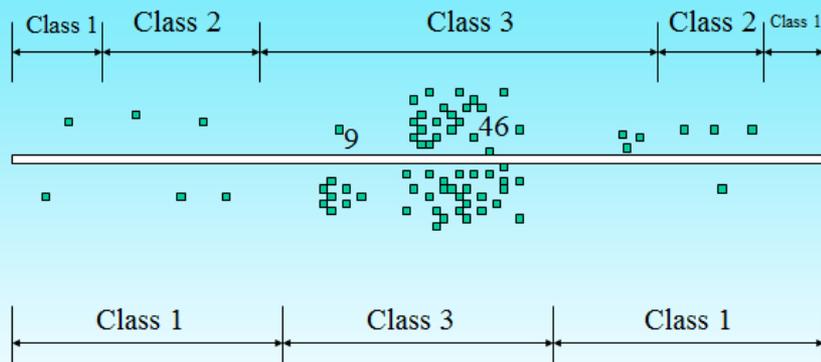
Continuous Sliding Mile Code Allowed Method



Clustering



Continuous Sliding Mile



End-to-End Mile



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Purpose of Class Locations

- **Class locations are used for:**
 - Design
 - MAOP determination
 - Construction
 - Operation & Maintenance

Note: Design and MAOP determination for steel pipelines.



Purpose of Class Locations

- **Class locations are used for:**
 - Design:
 - Safety factors based upon Class location for steel pipelines
 - Class 1 = 0.72
 - Class 2 = 0.60
 - Class 3 = 0.50
 - Class 4 = 0.40
 - Road/railroad Crossings
 - If uncased 1-step down in Class
 - Compressor Stations, Regulating Stations, Measuring Stations, and Offshore Platforms
 - Design factor = 0.50



Purpose of Class Locations

- **Class locations are used for:**
 - Design:
 - **Valve Spacing on Mainline Pipeline**
 - Class 1 = within 10 miles
 - Class 2 = within 7.5 miles
 - Class 3 = within 4 miles
 - Class 4 = within 2.5 miles
 - Gas Gathering
 - Used to determine how onshore gathering lines are regulated
 - Design factor for steel pipelines



Purpose of Class Locations

- **Class locations are used for:**
 - **Maximum Allowable Operating Pressure (MAOP) Determination:**
 - Pipe parameters to calculate pressure
 - wall thickness and grade or strength of pipe
 - Pressure test factors
 - Class 1 = 1.1 or 1.25
 - 1.25 for pipelines with building for human occupancy within 300 feet or converted under § 192.14
 - Class 2 = 1.25
 - Class 3 = 1.50
 - Class 4 = 1.50



Purpose of Class Locations

- **Class locations are used for:**
 - **Construction:**
 - Depth of Cover – depending on actual conditions
 - Class 1 = 30-inches (rock 18-inches)
 - Class 2 through 4 = 36-inches(rock 18-inches)
 - Girth Weld Non-Destructive Inspection
 - Class 1 = 10 percent of welds
 - Class 2 = 15 percent of welds
 - Class 3 and 4 = 100 percent of welds



Purpose of Class Locations

- **Class locations are used for:**
 - **Operation & Maintenance:**
 - Line Patrols - frequency
 - Leakage Surveys - frequency
 - Pipeline Markers
 - Overpressure Protection
 - Remaining Strength Calculations
 - Integrity Management (IM)
 - High Consequence Areas (Method 1)



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Part 192 Impacted by Class Location

Subpart A – General – *Class Location*

Subpart B – Materials

Subpart C – Pipe Design – *Pipe Characteristics (thickness, grade),
Class Factors and Design Pressures*

Subpart D – Design of Pipeline Component – *Design Pressures*

Subpart E – Welding of Steel in Pipelines – *Non-destructive Tests*

Subpart G – General Construction – *Depth of Cover*

Subpart I – Corrosion Control – *Remaining Strength and Repairs*

Subpart J – Test Requirements – *Test Pressure Factors*

Subpart K – Uprating – *MAOP and Test Pressure*

Subpart L – Operations – *MAOP, Class Location and Odorization*

Subpart M – Maintenance – *Inspection Intervals*

Subpart O – Gas Transmission Pipeline IM - *HCA's – Method 1*



Partial List of Part 192 Sections Impacted

- § 192.5 – Class Locations
- § 192.8 – How are onshore gathering lines and regulated onshore gathering lines determined?
- § 192.111 – Design factor (F) for steel pipe
- § 192.179 – Transmission line valves
- § 192.243 – Nondestructive testing – girth welds
- § 192.327 – Depth of cover
- § 192.485 – Remaining strength and remedial measures
- § 192.609 – Change in class location: Required study
- § 192.611 – Class change: Confirmation/revision of MAOP
- § 192.619 – MAOP determination



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Partial List of Part 192 Sections Impacted

- **§ 192.620** – Alternative MAOP
- **§ 192.625** – Odorization
- **§ 192.705** – Patrolling
- **§ 192.706** – Leakage surveys
- **§ 192.707** – Line Markers
- **§ 192.713** – Permanent field repairs of imperfections/damages
- **§ 192.739** – Overpressure protection – pressure settings
- **§ 192.903** – High Consequence Area – Method 1
- **§ 192.933** – Integrity assessments of anomalies
- **§ 192.935** – What additional P&M M must an operator take?



Class Location

- As more people live or work near the pipeline a class change may occur.
- **Class location change – Present Options:**
 - Reduce the pipeline segment MAOP;
 - Replace the existing pipe;
 - **Allows use of new material & construction technologies**
 - No action if MAOP is commensurate with new Class loc.
 - Conduct a pressure test to establish MAOP for a class change (1-class change bump); or
 - Special Permit – has been used by some operators.



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Integrity Management (IM) Approach and Usage of High Consequence Areas



Integrity Management (IM) Approach

- **Gas IM:**

- Uses HCAs to identify areas of higher consequence along pipelines.
- HCAs are defined by number of buildings or identified sites, where people live or congregate within a calculated potential impact radius (PIR).
- **PIRs are calculated based on pipe diameter, MAOP, and heat of combustion for natural gas.**
- PIR defines a circle with the pipeline being the center.
- $\text{PIR (feet)} = 0.69 \sqrt{\text{pressure (psi)} \times (\text{pipe diameter-inch})^2}$



Integrity Management Approach

- **Pipeline segments in HCAs are:**
 - subject to ongoing integrity/threat assessments, remediation of anomalies, and preventative and mitigative measures designed to reduce risk.
- **HCAs require an operator to:**
 - assess and remediate the pipeline segment, but are not used to design, establish MAOP, pressure test, or perform operation or maintenance activities.



High Consequence Area

HCAAs must be identified in a Gas Operator's IM program and are defined by 2 methods as follows:

- **Method 1**
 - Existing Class 3 or 4 area, or
 - PIR > 660 ft. with ≥ 20 buildings for human occupancy in Class 1 or 2 location, or
 - PIR contains an Identified Site in Class 1 or 2 location
- **Method 2**
 - PIR contains ≥ 20 buildings for human occupancy, or
 - PIR contains an Identified Site



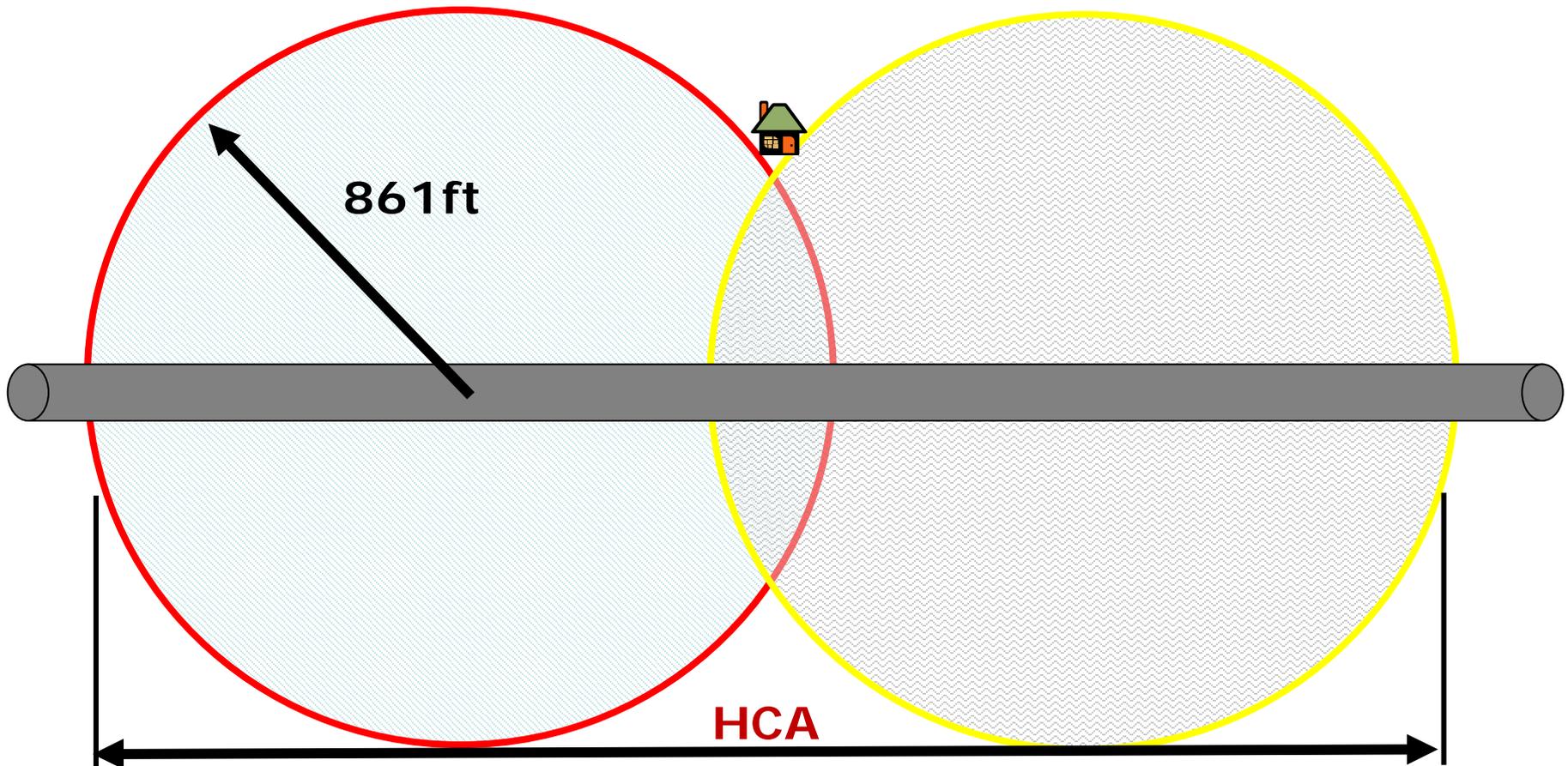
HCA - Identified Site

- **Areas with ≥ 20 persons for at least 50 days in a 12 month period**
- **Buildings with ≥ 20 persons for at least 5 days for 10 weeks in a 12 month period**
- **Facility occupied by persons who are confined, mobility impaired, or would be difficult to evacuate**



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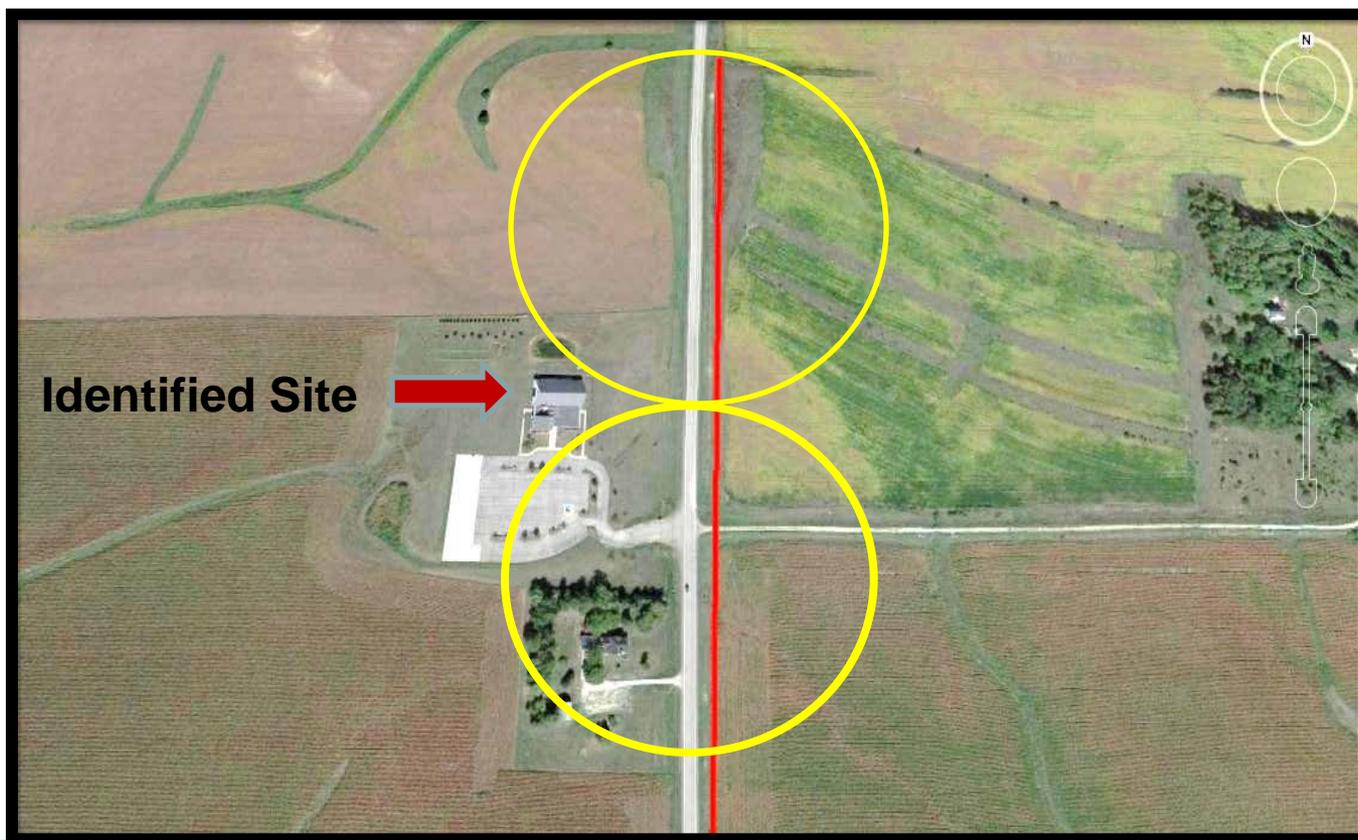
Method 2 – PIR Contains Identified Site





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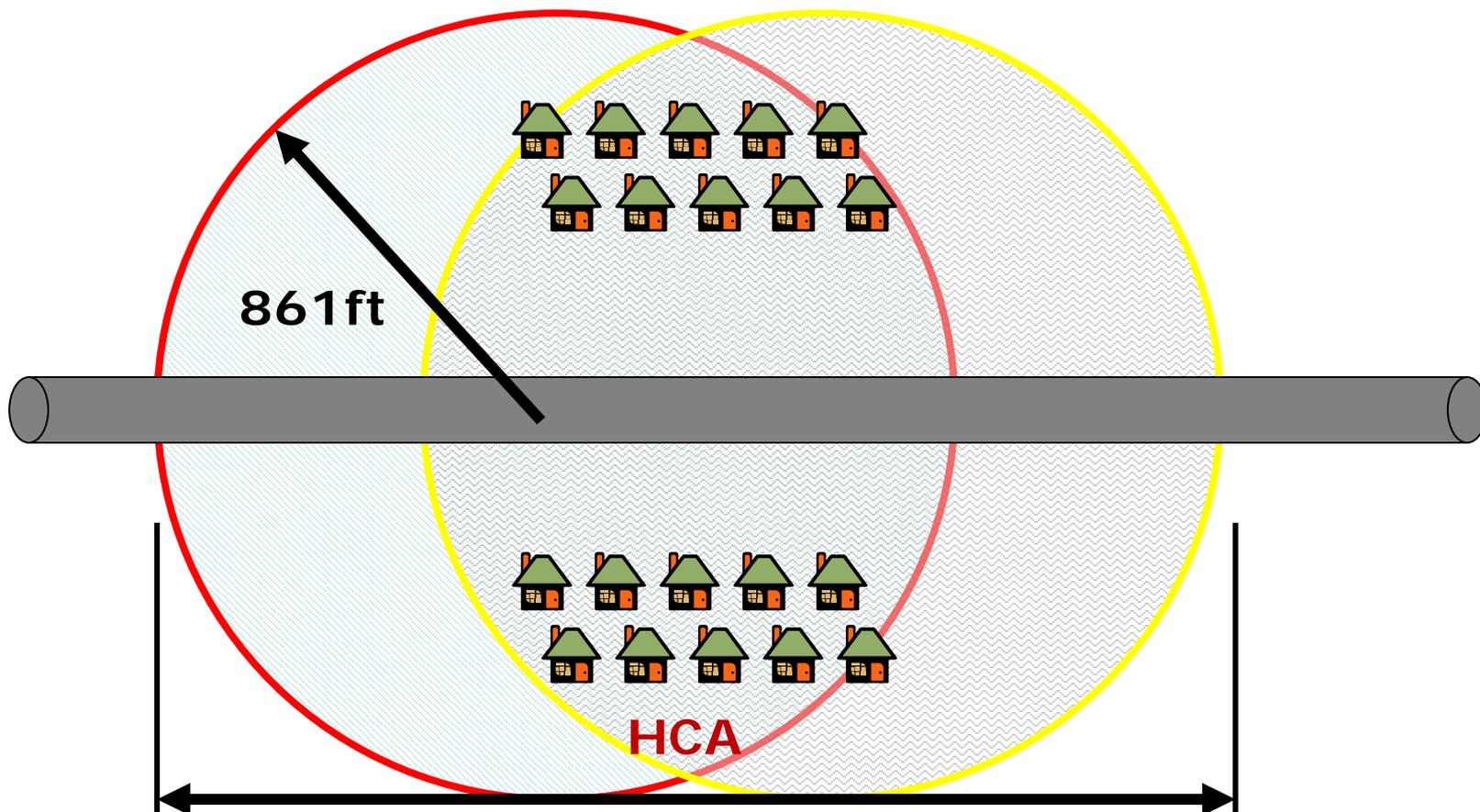
Class 3 Location or HCA – Identified Site





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Method 2 – PIR Contains ≥ 20 Buildings





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Class 2 Location or HCA - Method 2





Purpose of HCAs in IM Programs

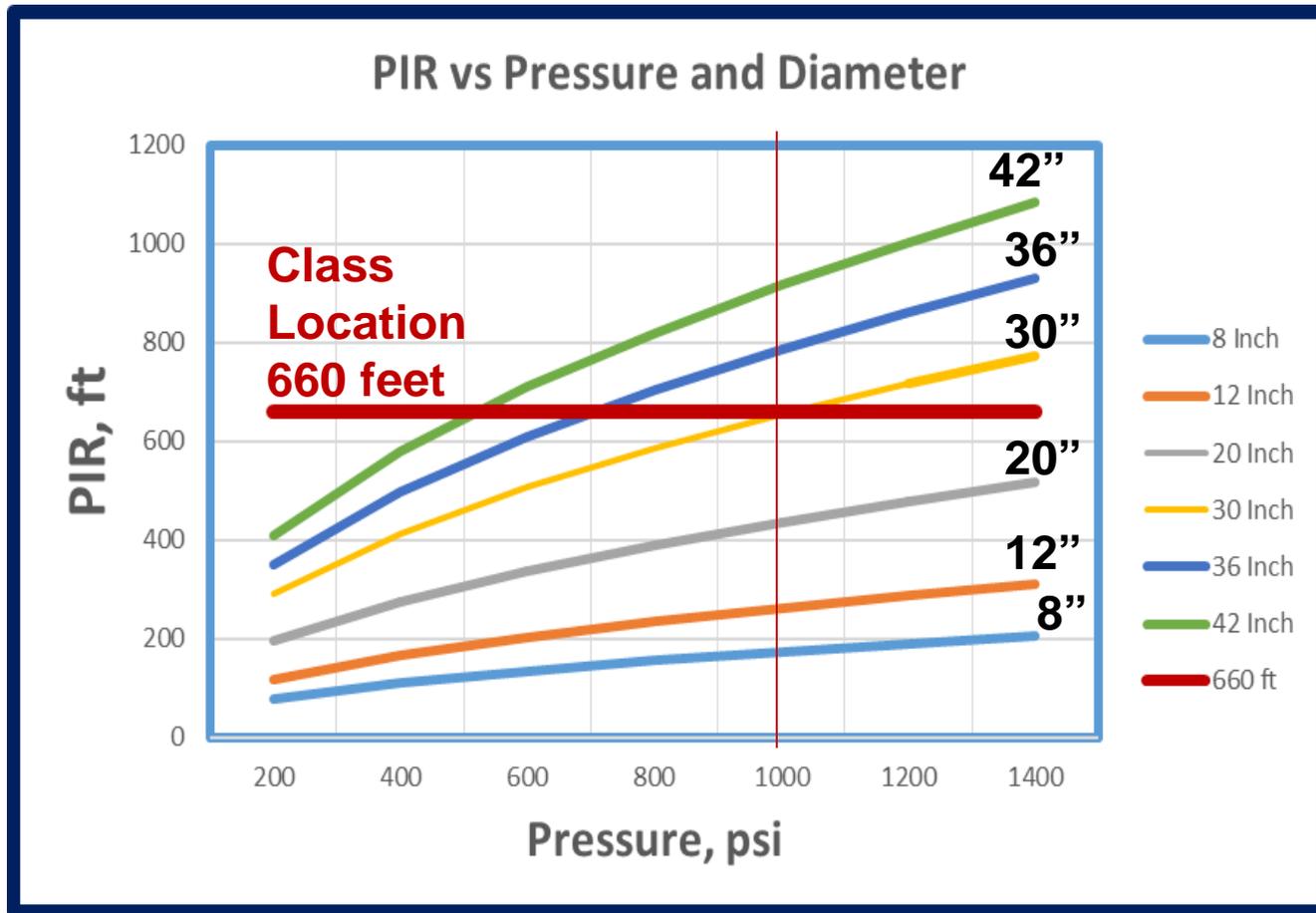
- **HCAs:**

- Determines if a pipeline segment is in an IM program and required to have:
 - On-going risk and threat assessment
 - On-going integrity assessments
 - Remediation of certain conditions
 - Additional preventive and mitigative measures (P&M M)
- Assessments using Pressure Test, In-line Inspection, Direct Assessment, or Other Technology
- Assessment timing and remediation of anomalies



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IM - Potential Impact Radius



$$\text{PIR (feet)} = 0.69 \sqrt{\text{pressure (psi)} \times (\text{pipe diameter-inches})^2}$$



Alternatives - examples

- **No Class Locations**
 - Single design factor for all pipeline locations
 - Higher design factor for stations, highway crossings, etc.
- **Sliding Mile Based upon Potential Impact Radius**
 - Expand or decrease width of sliding mile based upon PIR
 - Re-define class locations based upon PIR range
- **Expand Class Locations**
 - Additional Class locations – for higher PIRs
 - Class 5 through 7 – lower design factors
- **Class Locations –**
 - No or Minor Changes (tiered width boundaries)





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No Class Locations – example

- **Single Design Factor**



Class 1



Class 2



Class 3



Class 4

- **Should a single design factor be applied to class locations?**
- **If so, what design factor should be used?**
- **Should IM Programs be expanded to cover more areas such as all of the existing Class 3 and 4 locations?**



Sliding Mile Based on PIR - example

- **Another alternative method is to use the Integrity Management PIR method in conjunction with a sliding mile approach:**
 - Class 1 – sliding mile has no buildings for human occupancy
 - Class 2 – sliding mile has XX buildings for human occupancy
 - Class 3 – sliding mile has \geq XX buildings
 - Class 4 – Any X buildings above X stories
 - Identified Site – in any Class location
- **The width of the sliding mile is based on the PIR**



Expand Class Locations

Commenters on the ANPRM recommended that PHMSA create additional Class Locations for densely populated areas.

- Define a Class Location density for each new class location
- Establish a new design factor for each new Class Location



Expand Class Locations - example

- **Present Class Locations**
 - Class 1 – ≤ 10 dwellings
 - Class 2 - > 10 but ≤ 45 dwellings
 - Class 3 - ≥ 46 dwellings ,
 - park, playground, outdoor theater, or place of public assembly
 - Class 4 – buildings with 4 or more stories are prevalent
- **New Class Locations - example**
 - Redefine Class location steel design factors and add a Class 5, 6 and 7 for higher population areas
 - Refine class location dwelling area from 220 yards to other values based upon diameter and pressure



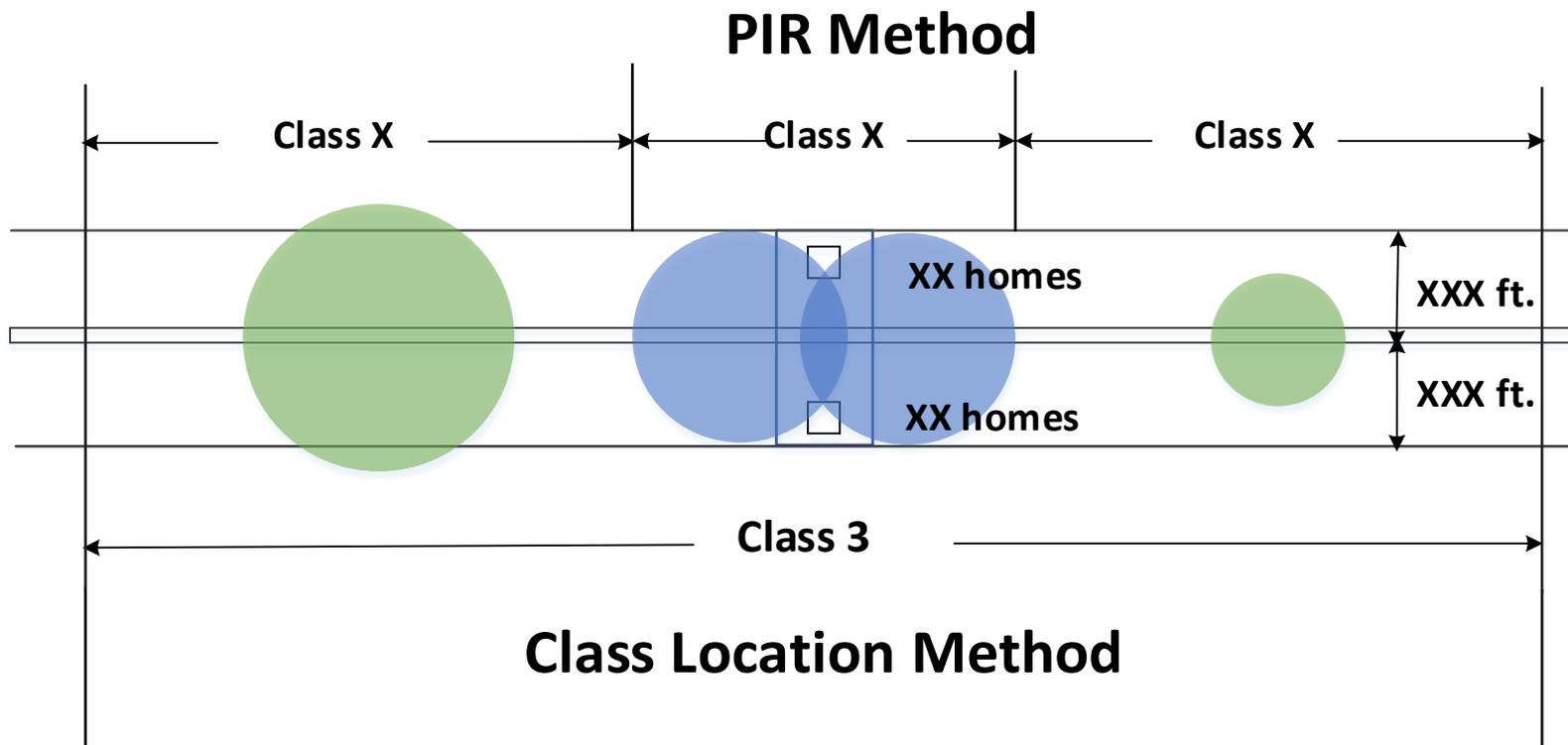
Class Location – No or Minor Changes

- **Option 1 – no changes**
- **Option 2 – update based upon**
 - Usage of Higher MAOPs since Code was adopted
 - In 1970s most pipeline MAOPs were under 1000 psi
 - Most in populated areas were smaller diameter and pressure
 - Today - 30-inch plus diameter and higher pressures are becoming more common in populated and City areas.
 - Usage of Sliding Mile and PIR Calculation
 - Based upon current or expanded Class location and IM combined



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**Pipeline with PIR XX ft.
≥ XX Buildings Intended for Human Occupancy (BIHO)**





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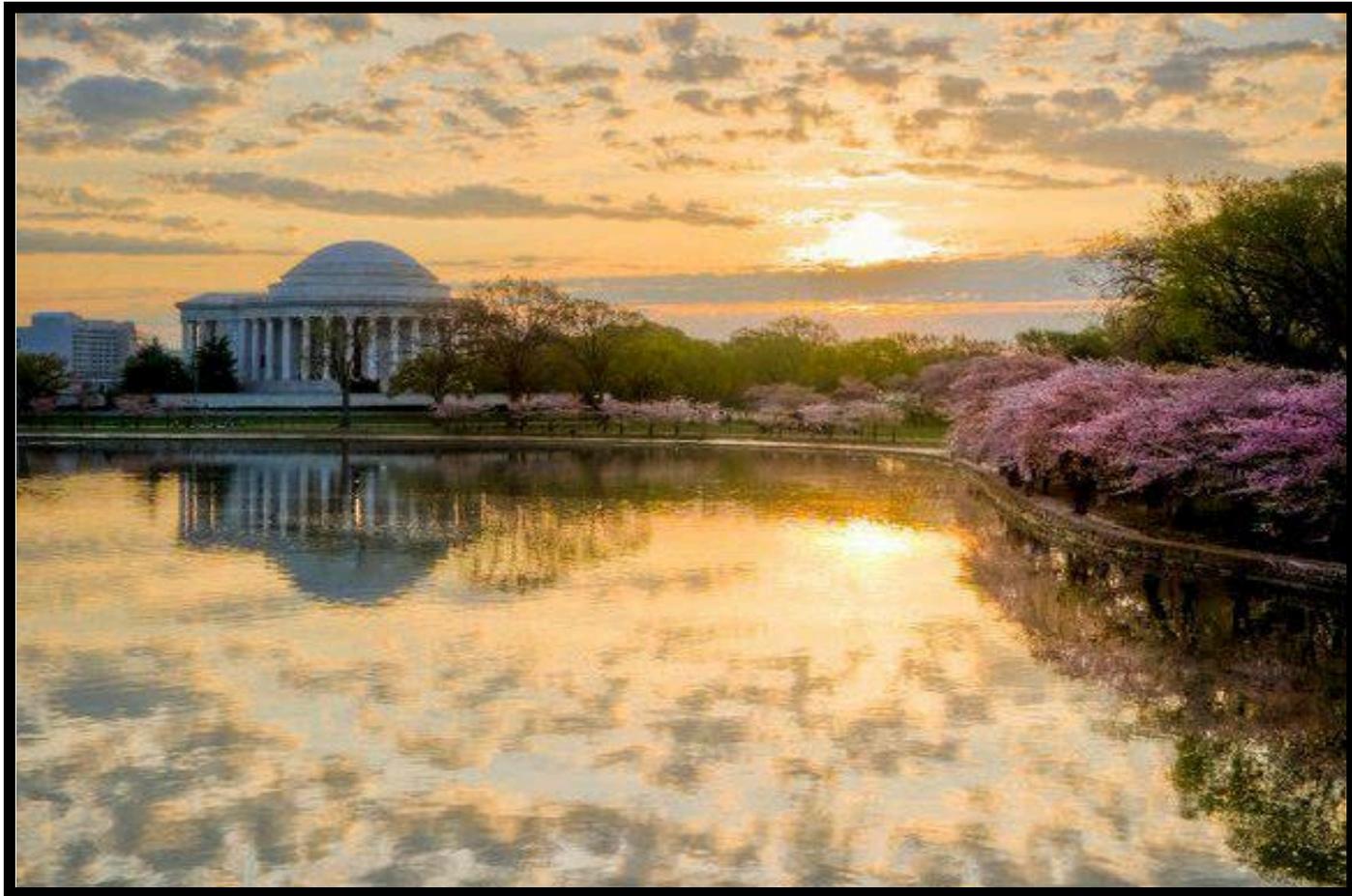
Summary

- **Where do we go?**
 - No Class Location
 - Class location (No Change)
 - Class Location Modified/Expanded
 - HCAs and PIR modified
 - Other Alternative Methods
- **How should it apply?**
 - Gas Transmission
 - Gathering or Distribution
 - Interstate and Intrastate
 - Operating Stress Level
 - Diameter or MAOP
 - Existing, Pre-1970 or New Pipelines





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Jefferson Memorial / Tidal Basin

Photo courtesy of Buddy Secor



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Thank you



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