

MAOP/MOP Verification

Natural Gas Transmission & Hazardous Liquids Pipelines

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April 4, 2013
SD/ND/WY Pipeline Safety
Operators Training

Structural Integrity Associates, Inc.

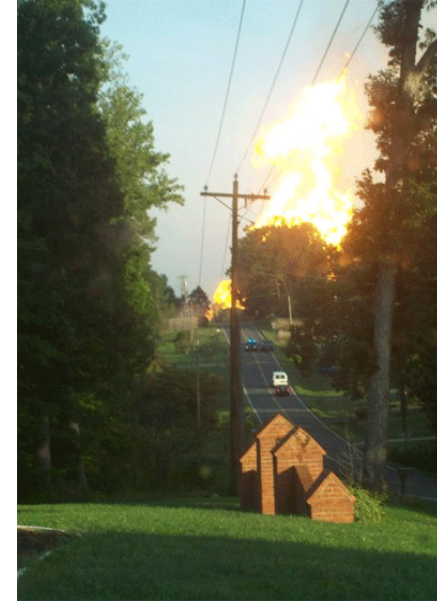
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Agenda

- Overview of the current Public, Media and Regulatory Environment
- MAOP/MOP Verification Best Practices
- AGA Survey Highlights
- Overview of PG&E Mitigation effort

Public, Media and Regulatory Environment



June 10, 1999

Olympic Pipe Line Company pipeline rupture

- 3 killed
- 8 injured
- \$10 Million fine
- \$75 Million settlement to parents of 2 boys

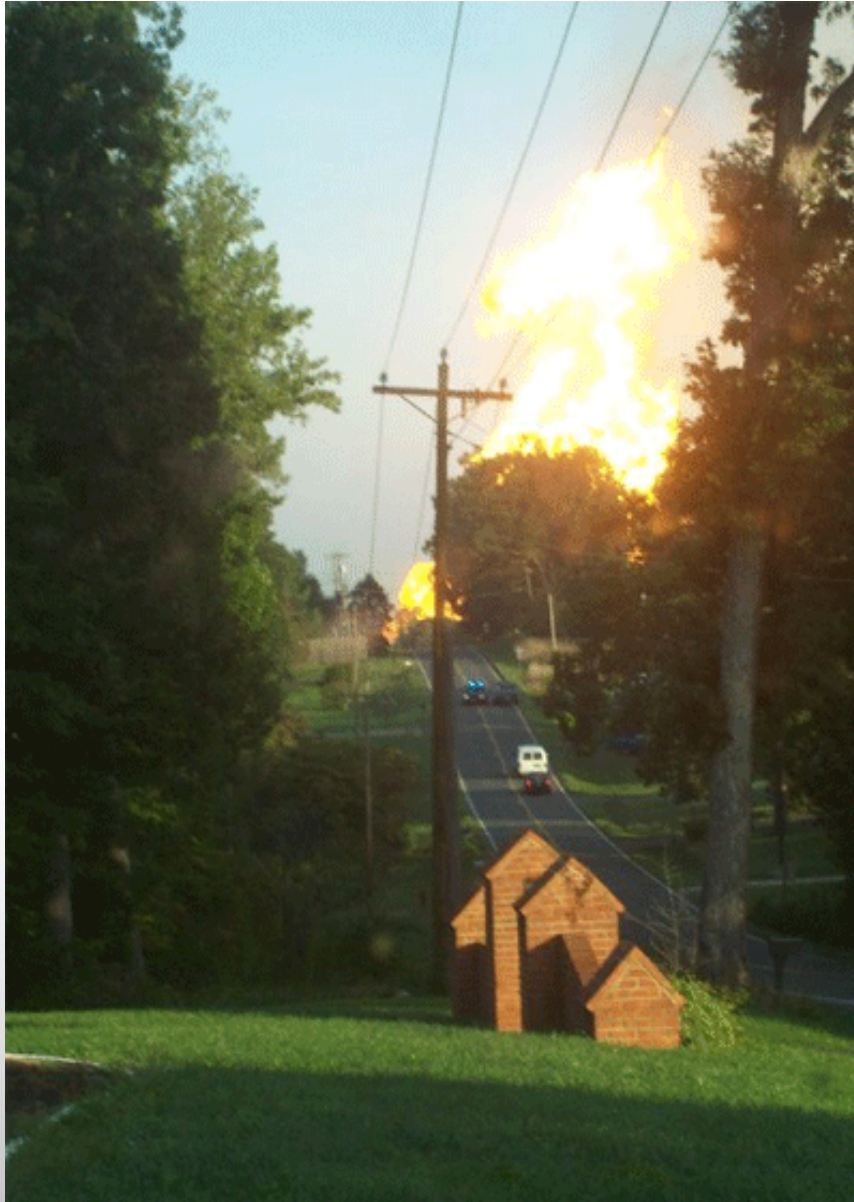


August 19, 2000

El Paso Pipeline - Carlsbad, New Mexico

- 12 deaths
- \$15.5 Million Fine
- The only amount disclosed was a \$14 million settlement for one of the victims.
- $12 \times \$14 \text{ million} = \168 Million?





Incidents Continue

Williams Pipeline
Appomattox,
Virginia

September
14, 2008



5 Injuries, two structures damaged



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July 26, 2010 – Enbridge Pipeline Rupture

Enbridge Energy Partners LLP (Enbridge) reported a 30-inch pipeline ruptured on Monday, July 26, 2010, near Marshall, Michigan.

The release, entered Talmadge Creek and flowed into the Kalamazoo River, a Lake Michigan tributary. Heavy rains caused the river to overtop existing dams and carried oil 30 miles downstream on the Kalamazoo River.

The nation's most costly oil pipeline accident

- Enbridge paid the \$3.7-million penalty levied against it for violations related to the spill.
- The company has spent more than **\$765 million** cleaning up the spill.

Exxon Yellowstone River Leak



- Montana, July 2011
- 1,500 barrels of oil into the Yellowstone River
- \$135 million in cleanup costs
- March 26, 2013 - \$1.7 Million fine proposed by PHMSA

September 9, 2010 Pipeline Rupture – San Bruno, CA

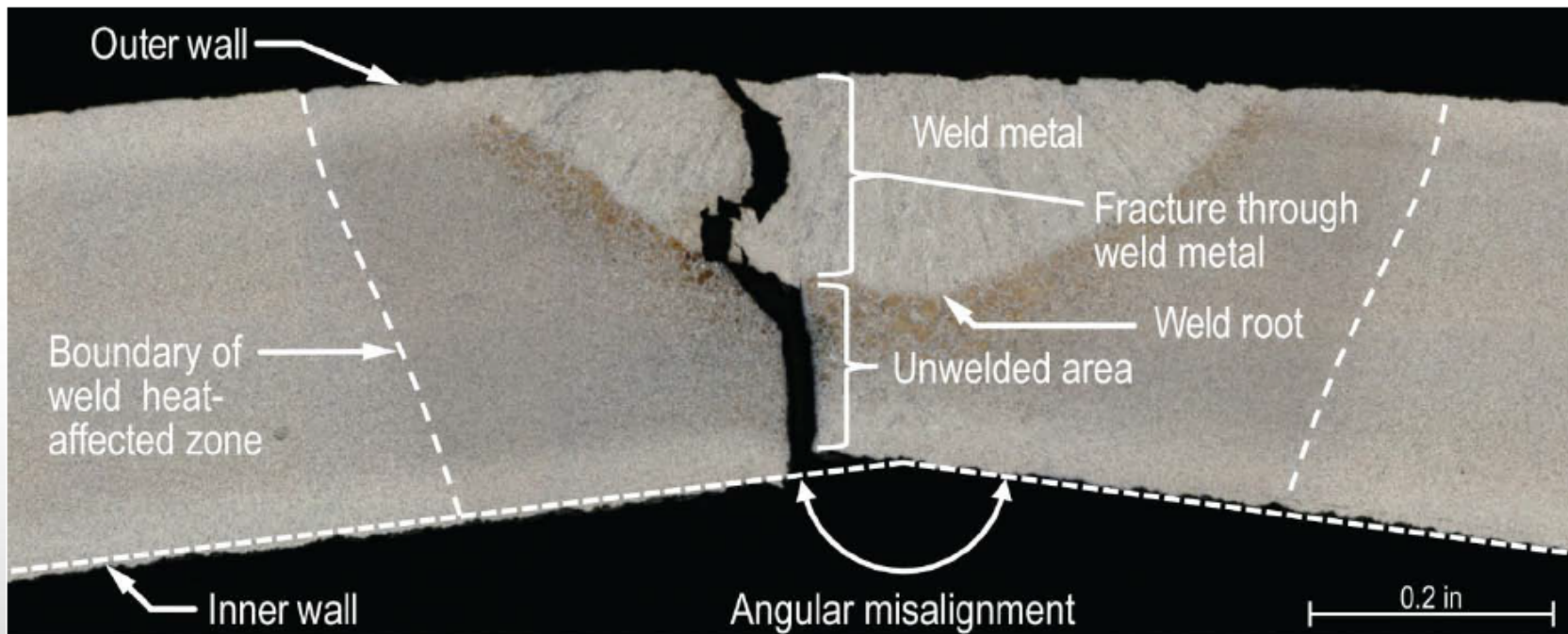








Long Seam



NTSB Report

- Type of System: 30-inch natural gas transmission pipeline installed 1956
- MOP established by historical operating pressure
- Fatalities/Injuries: 8 fatalities, (60 injuries)
- The resulting fire destroyed 37 homes and damaged 18.
- Pressure: 386 psig at time of rupture. MOP of 375 psi
- Longitudinal fracture of pipe
- Unknown Pipe Specifications – did not conform with any generally accepted QC and welding standards
- Recommended elimination of use of Historical Operating Pressure to establish MOP and requirement of pressure test


NTSB Report

- The ineffective enforcement posture of the **California Public Utilities Commission** permitted PG&E's organizational failures to continue over many years.
- The **Pipeline and Hazardous Materials Safety Administration's** enforcement program and its monitoring of state oversight programs have been weak and have resulted in lack of effective Federal oversight and state oversight exercised by the California Public Utilities Commission.

11 days after

PG&E: San Bruno pipe segment not on high-risk list

AP Associated Press

 Buzz up! 0 votes

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 retweet 1

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RELATED QUOTES

PCG	47.21	+0.31
^GSPC	1,184.71	+8.52
^IXIC	2,480.66	+11.89

By JASON DEAREN, Associated Press Writer – Mon Sep 20, 7:37 pm ET

SAN FRANCISCO – A section of natural gas pipeline that exploded south of San Francisco does not appear on Pacific Gas & Electric Co.'s list of its 100 riskiest pipeline segments, the utility company said Monday.

13 days after

Feinstein, Boxer propose tougher gas pipeline regulation in wake of San Bruno blast

September 22, 2010 | 4:19 pm

California's two U.S. senators introduced a bill Wednesday that would impose strict new pipeline safety standards and add federal inspectors in the wake of the Sept. 9 natural gas explosion in San Bruno that killed seven people and burned 37 houses to the ground.

The 23-page bill sponsored by Sens. Dianne Feinstein and Barbara Boxer, both Democrats, would require manual valves to be replaced by automatic electronic valves, mandate in-line inspection devices and require federal officials to set standards for leak detection devices.

The bill, called the Strengthening Pipeline Safety and Enhancement Act, would also double the number of federal inspectors who examine 217,306 miles of interstate pipelines that cross the country and increase the civil penalties for safety violations. There are 100 inspectors now.

SAN BRUNO GAS EXPLOSION

WE ARE HERE TO HELP THOSE INDIVIDUALS AND FAMILIES WHO HAVE BEEN AFFECTED BY THE SAN BRUNO, PG&E FIRE

You are not alone.

We are devastated by the tragic explosion and fire in San Bruno and have clients and family in the affected area. We have already been asked about what we can do to help. And we stand ready to help you. Tell us what you need so we can assist.

Top 500?

Public Perception



New York's old gas lines could explode like pipe near San Francisco

By CHUCK BENNETT

Last Updated: 10:21 AM, September 20, 2010

Posted: 3:37 AM, September 20, 2010

Comments:  17

 Like  Be the first of your friends to like this.

 Tweet

    More  Print

New York's aging natural-gas pipelines are ready to blow, experts warn.

Huge swaths of infrastructure maintained by Con Ed, [National Grid](#) and a handful of interstate distributors are often older than the section of 62-year-old pipe that exploded Sept. 9 in suburban San Francisco, killing four.

"We are looking at catastrophic failure that might be coming. What happened in California is not unthinkable in New York," said Anil Agrawal, professor of civil engineering at City College.

"Our piping infrastructure is very, very old. The biggest problem is we really don't know their condition. We only know about them when there is breakage. We just fix the breakage and wait for the next failure."

Associated Press



San Bruno Pipeline Rupture – Sept 2010

Dow Jones Newswires 10-29-2012

- Lawsuit Damages Estimated at \$1 Billion
- Pipeline Mitigation - \$2 Billion
- Regulatory Fines as great as \$2.2 Billion

MAOP/MOP Verification PHMSA Guidance

January 10, 2011 - PHMSA Advisory Bulletin (ADB-11-01) -
Establishing Maximum Operating Pressure Using Record
Evidence

- Issued to operators of gas and hazardous liquid pipeline facilities
- “Diligently search, review and scrutinize documents and records”
- “These records shall be **Traceable, Verifiable and Complete**” and ... “**ensure company records accurately reflect the pipelines physical and operational characteristics**”
- Pipeline operators are reminded of their responsibilities to identify pipeline integrity threats

PHMSA Advisory Bulletin (ADB-12-06)

- **Traceable records** are those which can be **clearly linked to original information** about a pipeline segment or facility. Traceable records might include pipe mill records, purchase requisition, or as-built documentation indicating minimum pipe yield strength, seam type, wall thickness and diameter. Careful attention should be given to **records transcribed from original documents as they may contain errors**. Information from a transcribed document, in many cases, should be verified with complementary or supporting documents.

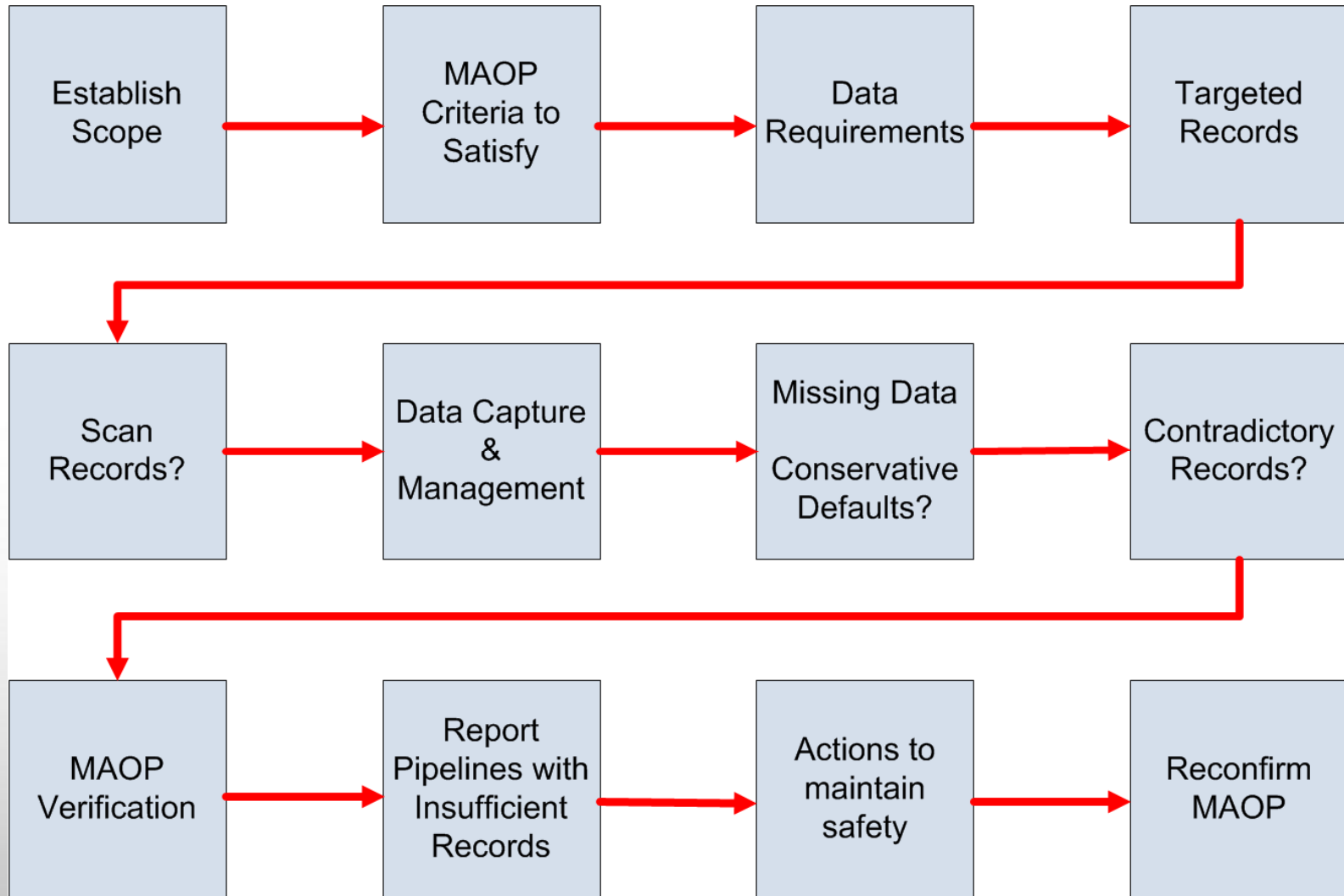
PHMSA Advisory Bulletin (ADB-12-06)

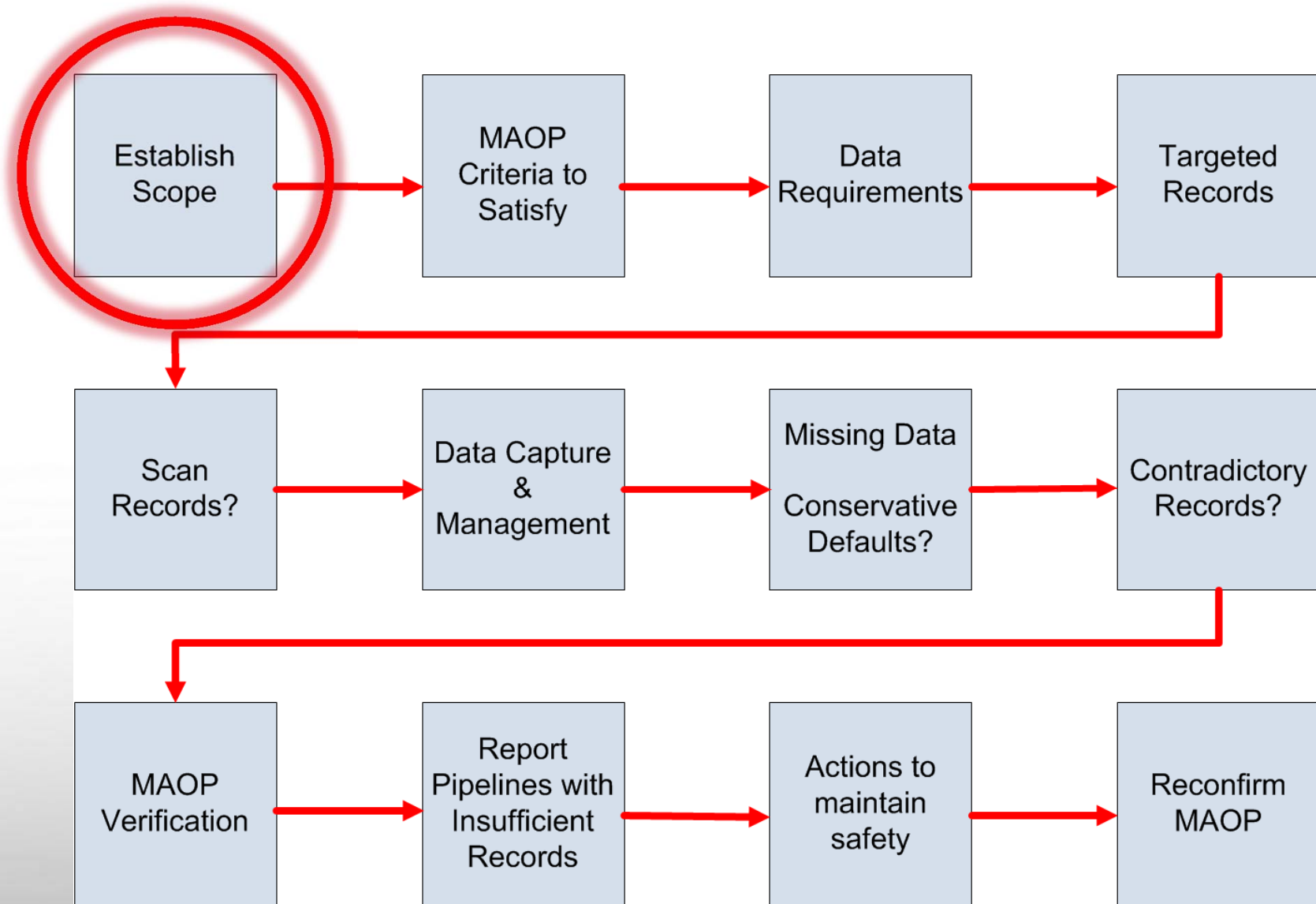
- **Verifiable** records are those in which information is confirmed by other complementary, but separate, documentation.
- July 31, 2012 letter from PHMSA : “...a single quality that is traceable and complete, as evidenced by appropriate markings, would be acceptable.”

PHMSA Advisory Bulletin (ADB-12-06)

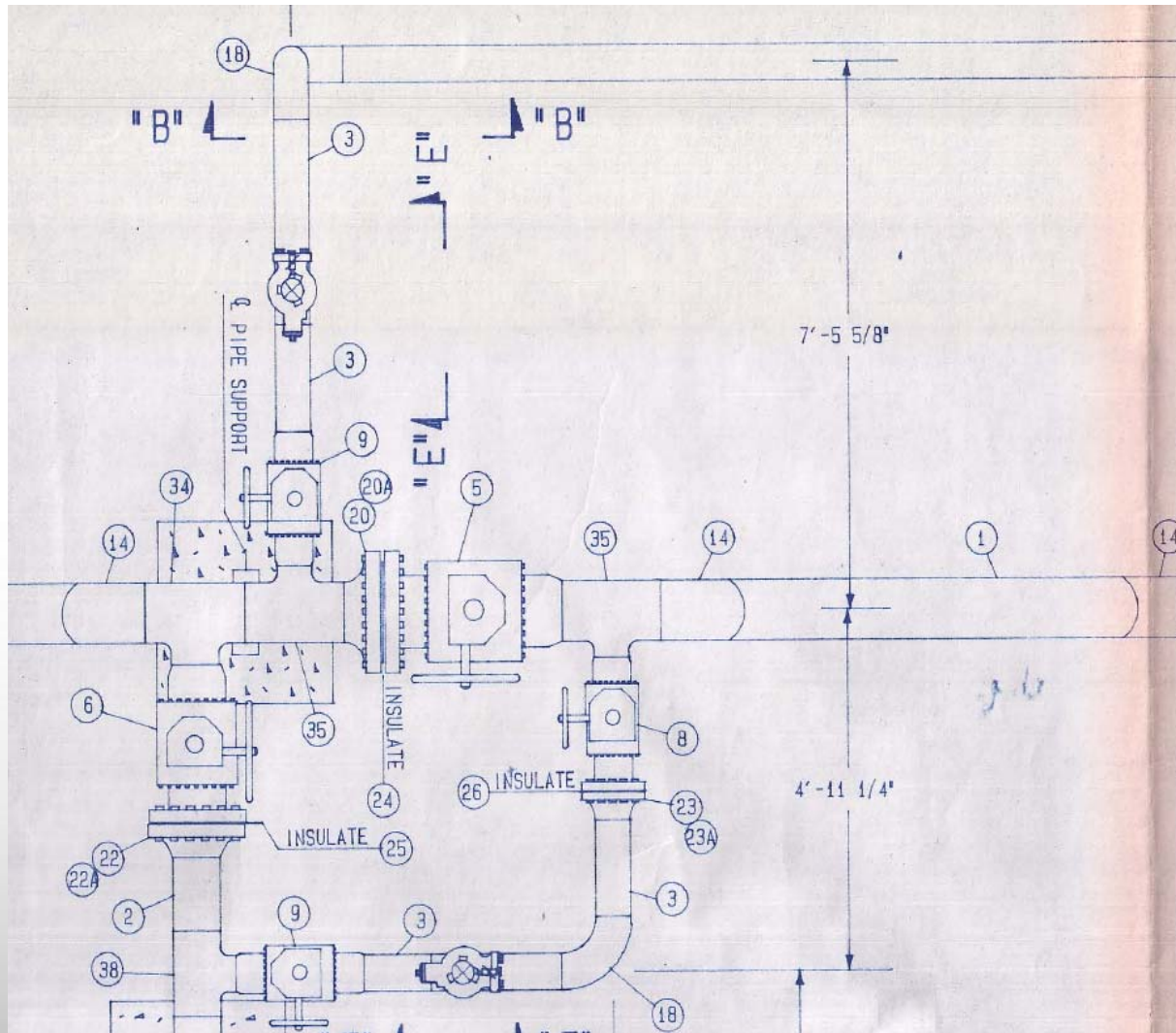
- **Complete** records are those in which the record is finalized as evidenced by a **signature, date or other appropriate marking**. A record that cannot be specifically linked to an individual pipe segment is not a complete record for that segment. Incomplete or partial records are not an adequate basis for establishing MOP. **If records are unknown or unknowable, a more conservative approach is indicated.**

Start with a Specific Plan





SCOPE?



MAOP/MOP Project - SCOPE Options

- Out of Service (but not abandoned) pipelines?
- Conduct Review of record keeping practices for new construction?
- Capture any other readily available “non-MAOP” data during review?
 - Pipe Manufacturer
 - Coating
 - Evidence of x-rays performed
 - Hydrotest Failures

Is Data Available to inform Integrity Management?

TYPE FAILURE AND DESCRIPTION Split in longitudinal seam

FOR LEAKS LIST GALLONS LOST PER HOUR _____ POUNDS PER HOUR _____

PIPE DATA: SIZE 12-3/4" O. D. x 0.203" W. T. x GRADE 5LX-42

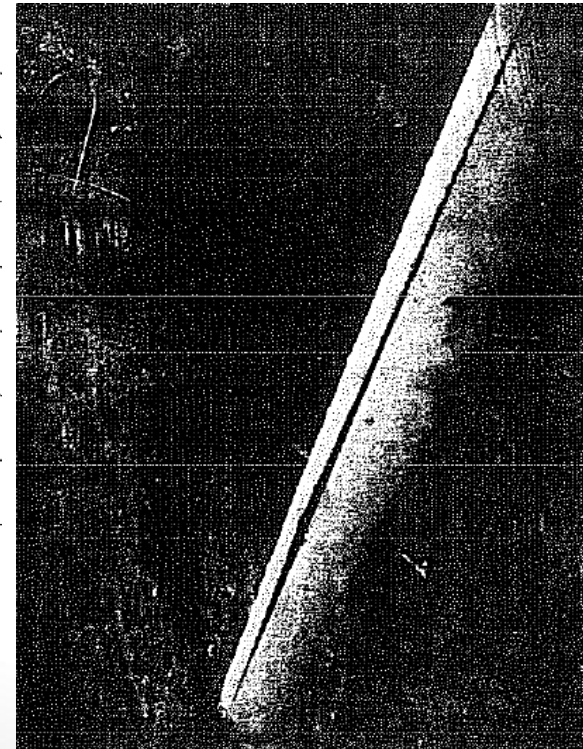
MANUFACTURED BY Toyomenka, Inc.

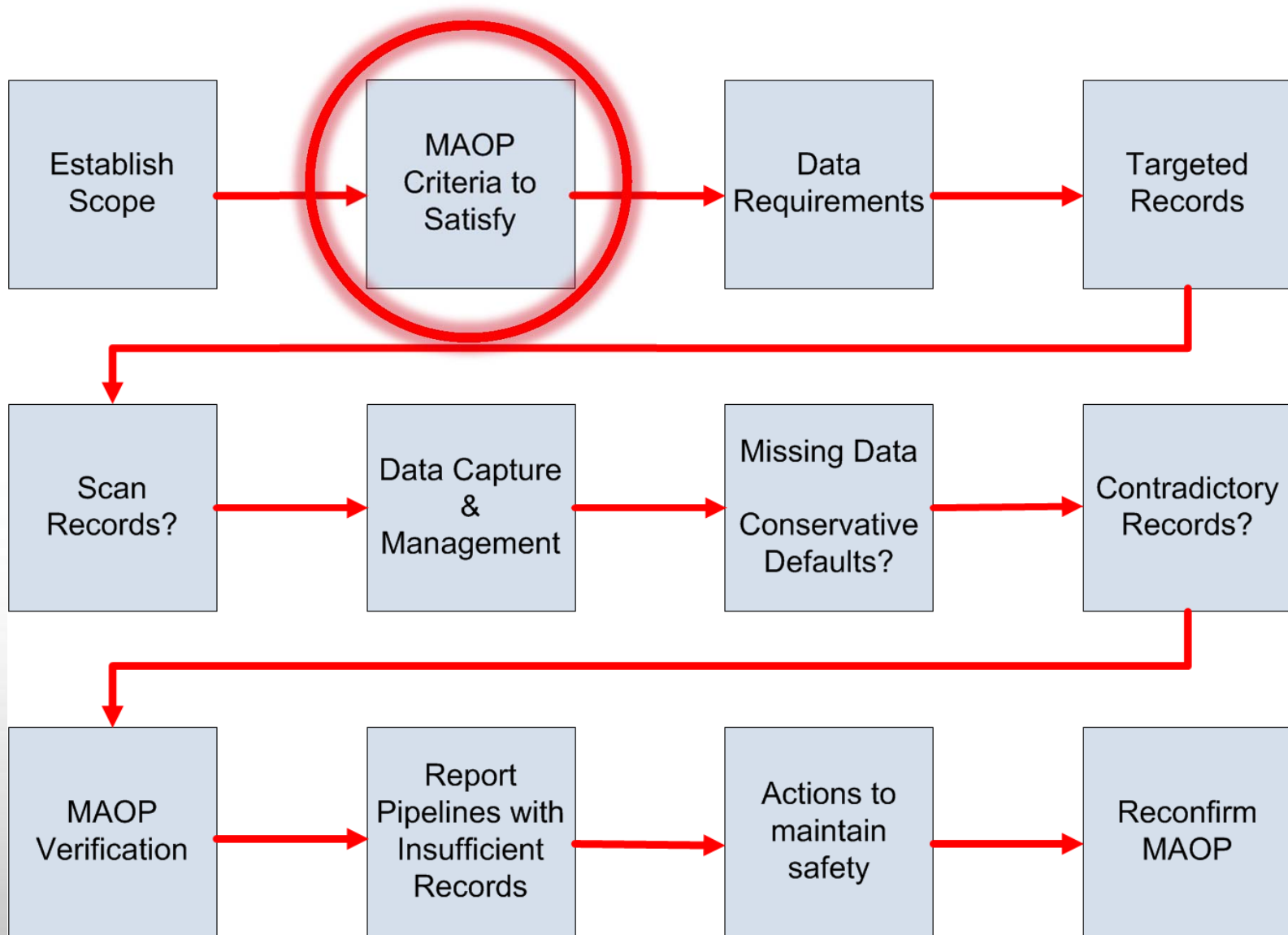
DATE AND TIME REPAIR COMPLETED 12:00 Noon 11-18-68

REPAIR DATA: SIZE 12-3/4" O. D. x 0.203" W. T. x GRADE 5LX-42

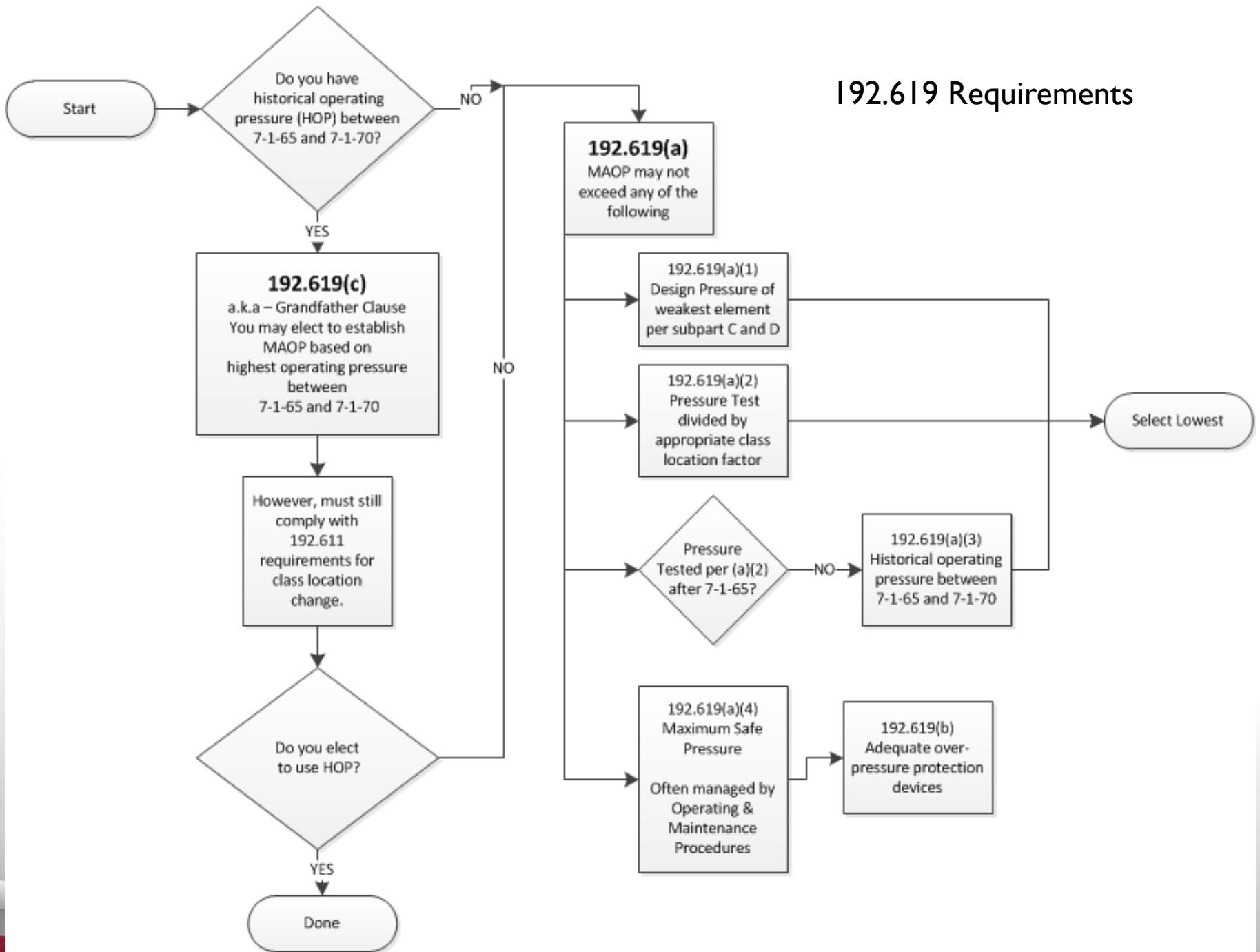
MANUFACTURED BY Toyomenka, Inc.

FAILURE CAUSED BY Lack of fusion





192.619 Requirements



§195.406 MOP

No operator may operate a pipeline at a pressure that exceeds any of the following:

- 1) Internal Design Pressure as per §195.106
- 2) Design Pressure of any other component (valves, flanges, fittings)
- 3) 80% of Test Pressure per Subpart E
- 4) 80% of Factory or Prototype Test Pressure for individually installed component
- 5) 80% of highest documented 4 hour pressure if excluded under §195.302 (b)(1) and (b)(2)(i).

§195.302 (b)(1) and (b)(2)(i) Pressure Test Exclusions.

- interstate pipeline constructed prior to 1/8/71
- interstate offshore gathering line constructed prior to 8/1/77
- Intrastate pipeline constructed before 10/21/85
- Low-stress pipelines constructed before 8/11/94 that transports HVL
- Carbon dioxide pipeline constructed prior to 7/12/91
- **Still must not exceed 80% of highest documented 4 hour pressure demonstrated by recording charts or logs**

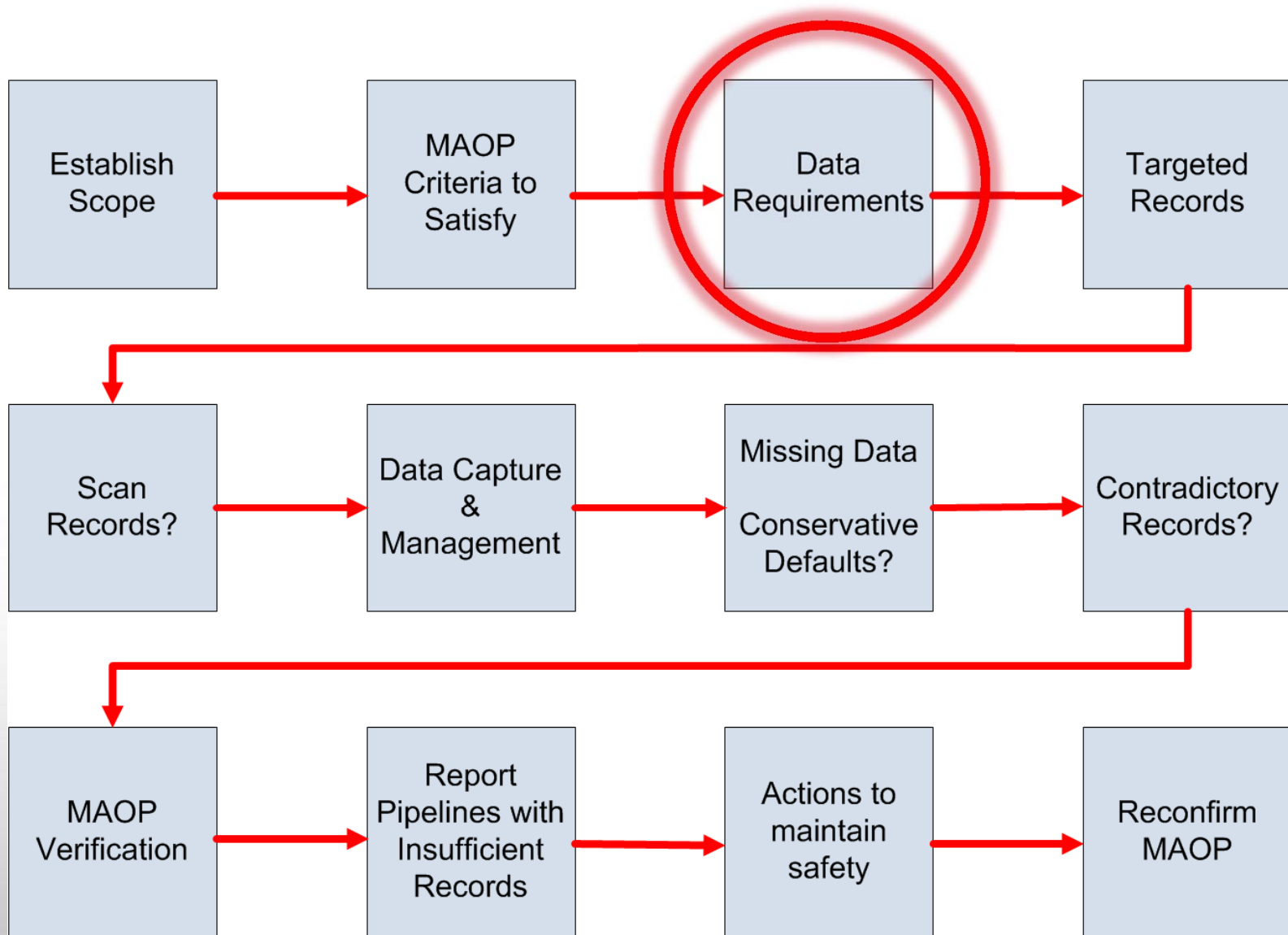
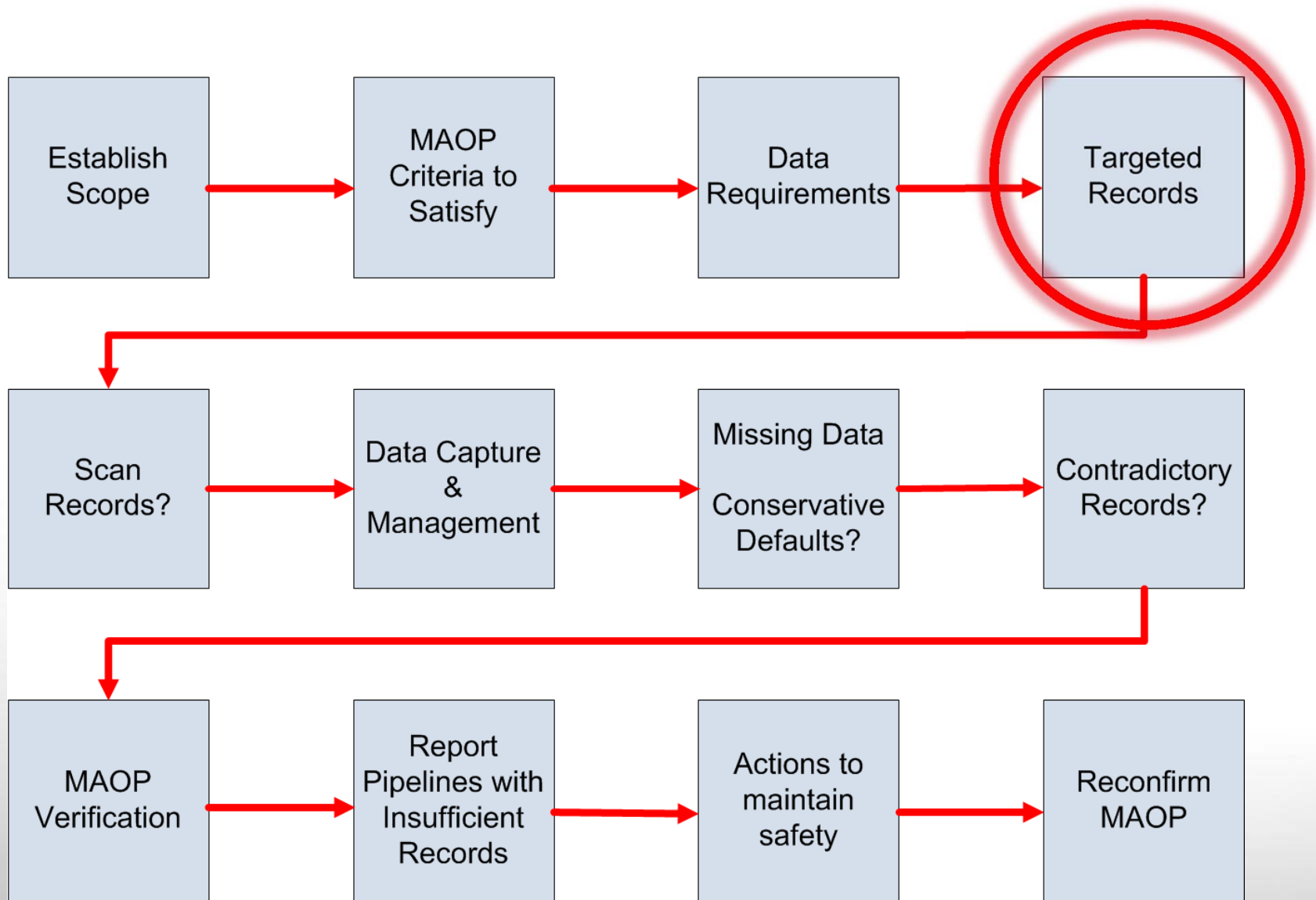


Illustration of Key Data required to support MAOP

- Current Class Location
- Current Pipeline MAOP
- Date of Operation
- Converted under 192.14?
- Pipe Grade
- Pipe Nominal Outside Diameter
- Pipe Wall Thickness
- Pipe Longitudinal Joint Type
- Component Type (e.g. Valve, Flange, Elbow)
- Component Grade
- Component wall thickness
- Component nominal outside diameter
- Component ASA/ASME/ANSI Rating
- Component Max Working Pressure
- Road crossing or encroachment with no casing?
- Railroad crossing or encroachment with no casing?
- Supported by bridge?
- Compressor Station, Regulating Station, or Metering Station?

Illustration of Key Data required to support MAOP

- Minimum Actual Test Pressure
- Pressure Test Date
- Operator Name at Construction
- Name of Operator's employee responsible for making pressure test
- Name of any Test Company used
- Test Medium Used
- Test Duration
- Recording Chart or Record of Pressure Readings?
- Highest Elevation
- Lowest Elevation
- Recorder Elevation
- Leaks and Failures & Disposition noted
- Date that Historic Operating Pressure was recorded
- Historic Operating Pressure
- Update Test Date
- Update Test Pressure



What Records are Applicable? Where are they?



Inventory of Target Data by Record Type

Record Category	Date of Construction/Operation	Pipe Grade / Yield Strength	Pipe Nominal Diameter	Pipe Wall Thickness	Pipe Longitudinal Joint Type	Appurtenance: ASME/ANSI Rating	Appurtenance: Manufacturer Max Pressure
As-Built: Report	X		X	X	X		
As-Built: Drawing	X	X	X	X	X	X	X
Bill-of-Material		X	X	X	X	X	X
Mill Test Report		X	X	X	X		

Illustrative example only

Identification of Valid and “Verified” Record Sources?

MOP Data Target	As-Built: Report	As-Built: Drawing	Bill-of-Material- Design	Bill-of-Material- Requisition	Engineering Design	Mill Test Report	Pressure Test Chart	Pressure Test Report
Date of Construction	1	2					4	4
Pipe Grade	1	2	3	2	3	2		2
Pipe Nominal Diameter	1	2	3	2	3	3		2
Pipe Wall Thickness	1	2	3	2	3	2		2
Min Test Pressure (as constructed)							2	1

Illustrative example only

1	Best Source – Consider Verified if confirmed by other complementary record.
2	Acceptable Source – Consider Verified if confirmed by other complementary record. May be used as a complementary record.
3	May only be used as a complementary record.
4	May not be used

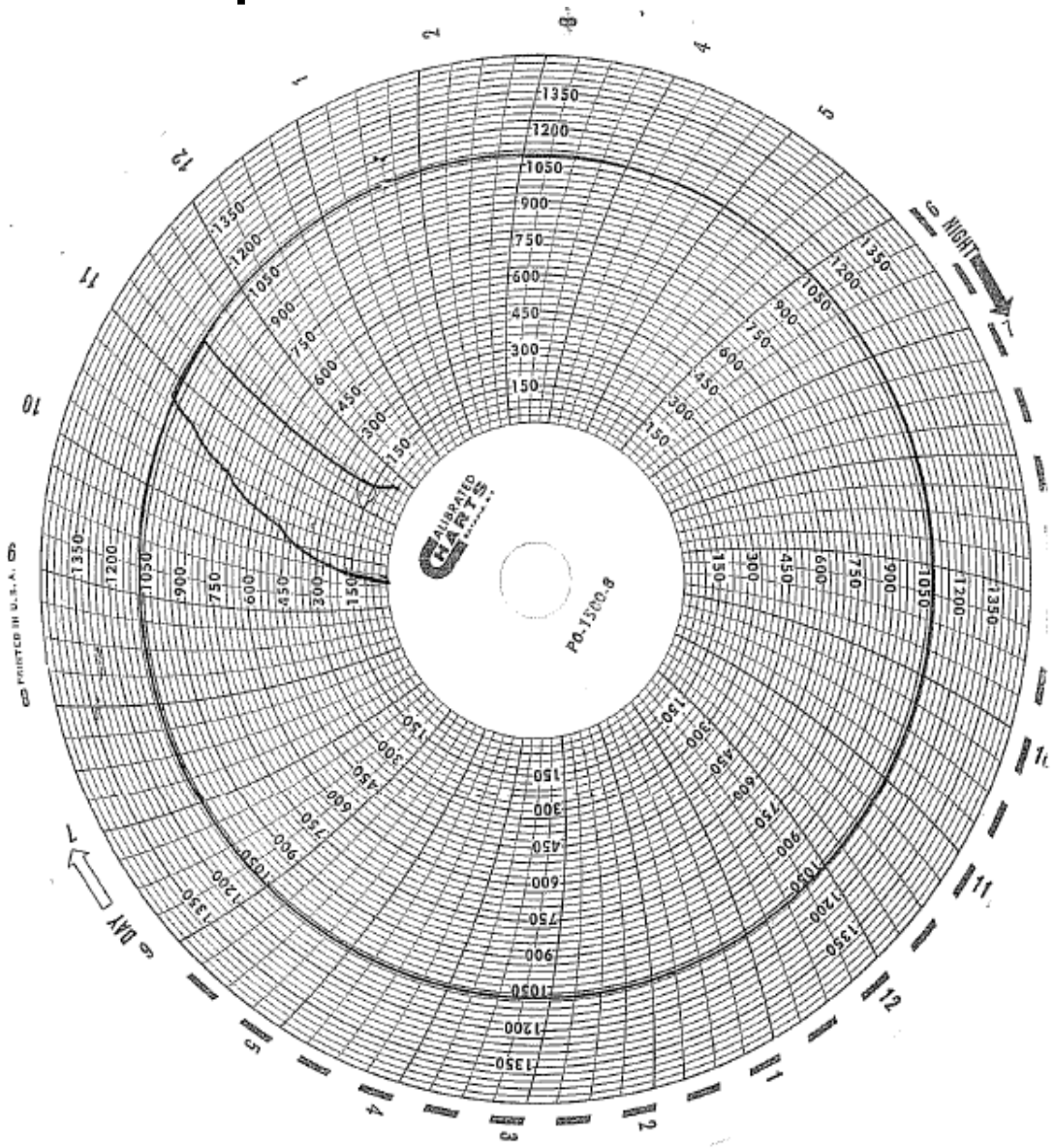
Completeness?

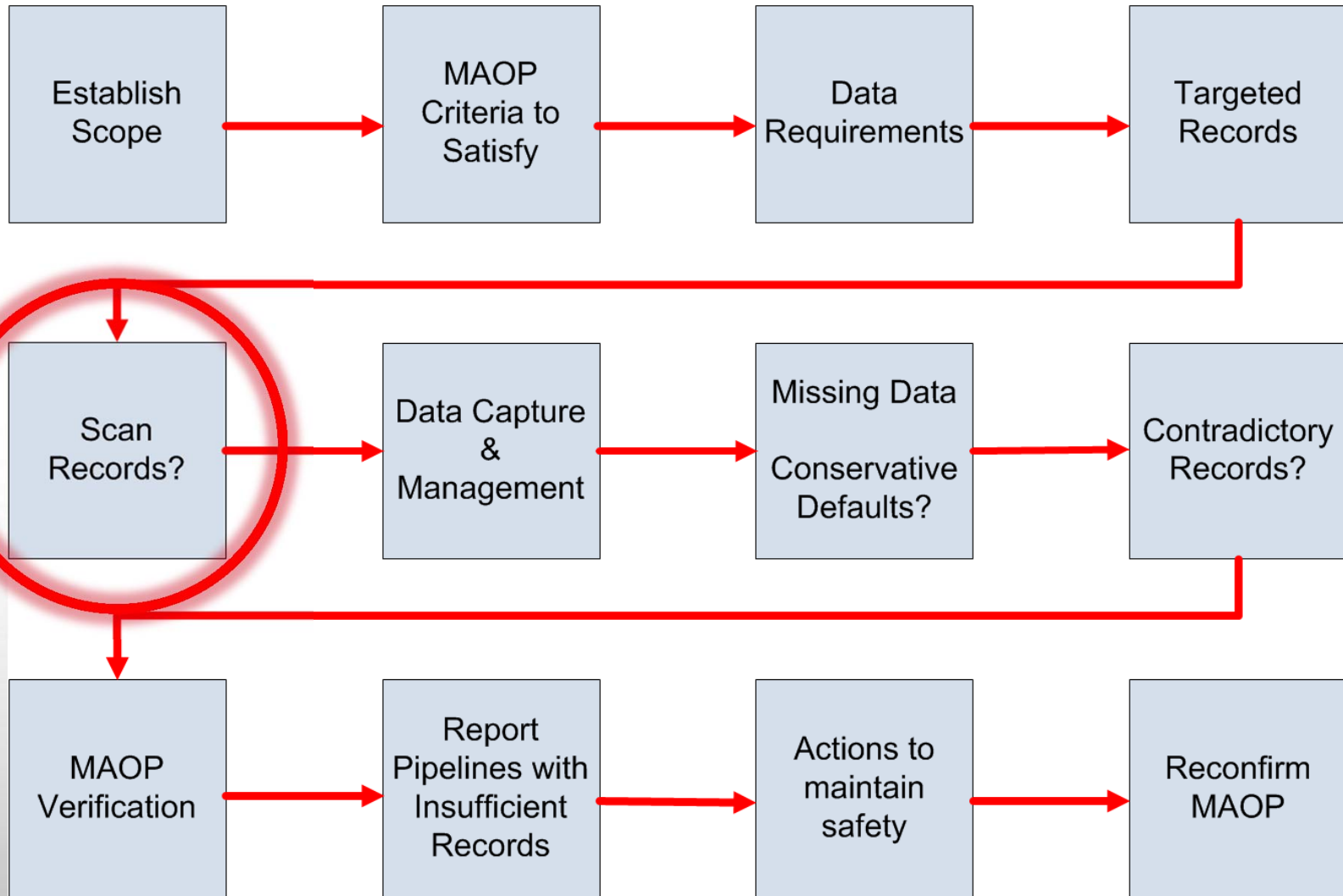
Signature?

Date?

Ability to link
to pipe
segment?

How
documented?



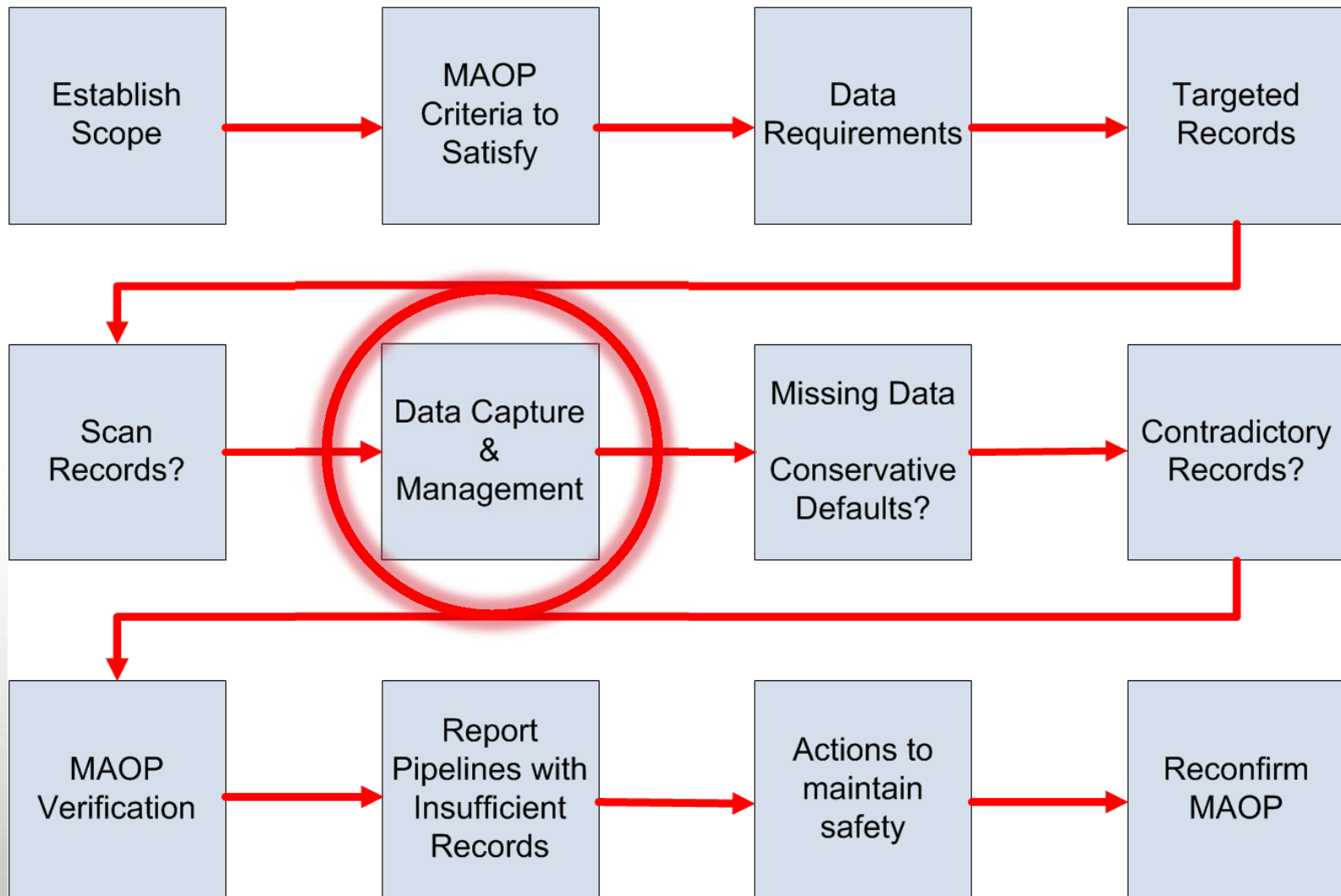


Scanning Records

- ADB-12-06 requires traceable records linked to original info
- The benefit of scanning applicable records is to avoid future loss and establish easier traceability.
- Scanned Images should reside on a server that is backed up for data loss prevention and security.
- Establish protocols for moving, scanning and returning records; this is yet another opportunity to lose key records!
- Avoid confusion, only scan the targeted records you need.

Scanning Records

- Establish metadata system to capture key aspects of every image (e.g. Pipeline #, Project Number, Document Type, Date, Unique ID #, etc.)
- Establish rules for color vs. black and white, two-sided originals, scan resolution, format type, continuity of stapled documents, etc.
- Index each image in a logical manner; consider linking data to the associated image in some manner.
- Consider following same protocol for new construction records.

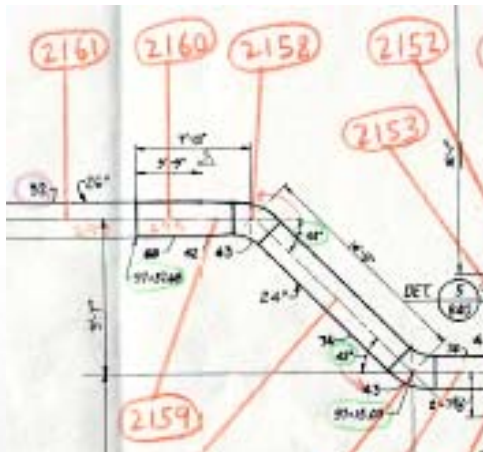
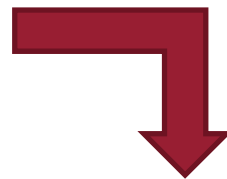


DEADWEIGHT RECORDED READINGS (PFL)

Time	Pressure	Deq. F	T
9:00 am	1276.1	45	F
10:00 am	1276.1	42	F
11:00 am	1274.1	40	F
12:00 am	1273.1	40	F
1:00 pm	1272.1	40	F
2:00 pm	1271.1	38	F
3:00 pm	1270.1	36	F
4:00 pm	1269.1	32	F

Example I

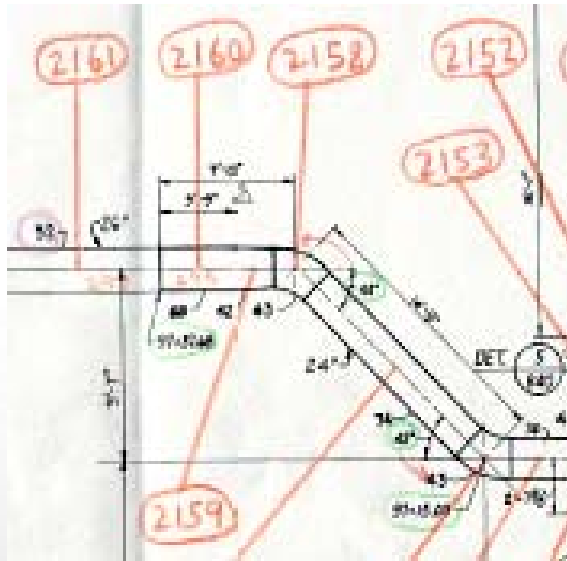
Data from records identified that support pipeline features entered into MS Excel and MOP calculated.



Q344 fx Y-48

PFL Spreadsheet										
		Required Feature Info				Pipe, Valve,				
	Edit	Feature Number	Main Line Size	Type	Beg Station	End Station	Length	W.T.	Pipe Spec	SMYS
344	A	2134	24.00	Bend	1260+63.0	1260+63.6	0.58	0.3750	Y-48	8000
345	A	2135	24.00	Pipe	1260+63.6	1277+26.0	1662.46	0.3120	Y-48	2000
346	A	2136	24.00	Bend	1277+26.0	1277+26.6	0.63	0.3750	Y-60	8000
347	A	2137	24.00	Pipe	1277+26.6	1279+22.4	195.80	0.3120	Y-70	2000
348	A	2138	24.00	Bend	1279+22.4	1279+23.0	0.52	0.3750	Tri-Ten	48000
349	A	2139	24.00	Pipe	1279+23.0	1279+62.5	39.58	0.3120	KaisAloy 50MY	52000
350	A	2140	24.00	Pipe	1279+62.5	1279+65.5	3.00	0.3750	Grade B	52000
351	A	2141	24.00	Pipe	1279+65.5	1280+06.1	40.60	0.5000	API 5LX-X42	42000

Does the Process ID pipeline segments with missing records?



Time	Pressure	Deg. F
9:00 am	1276.1	45 F
10:00 am	1276.1	42 F
11:00 am	1274.1	40 F
12:00 pm	1273.1	40 F
1:00 pm	1272.1	40 F
2:00 pm	1271.1	38 F
3:00 pm	1270.1	36 F
4:00 pm	1269.1	32 F

Example 2

Data from records entered into MS Access.

Data Management and MOP Calculation in MS Access.

Navigation Form

Project Setup
Documents
Review
Quality
Personnel

Equipment Type
 Pipe
 Standard Fitting
 Other Component

Choose Subproject:
8" segment

General | Diam/Wall | Grade | Seam | Coating | Station | Hydrotest | Op Name | Install Date

Work Order: C459938
Image File Name: 0168543.jpg

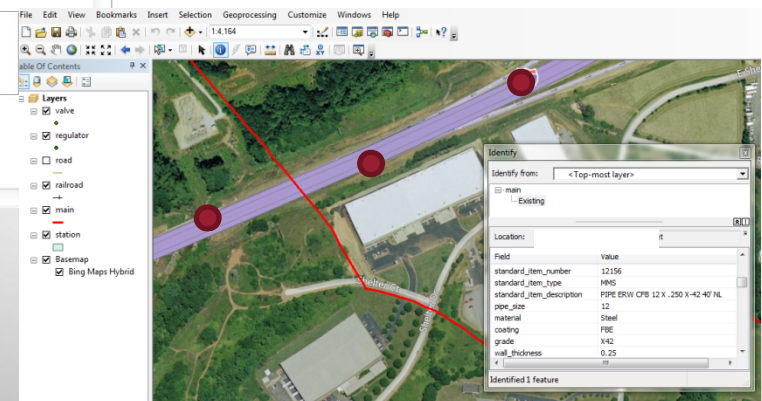
Type: As-Built: Completion Report
Entered by: Steven Biles
QA Status Override: Not Assigned

Date on Document: 4/23/1961
 This project is a conversion-to-service under 192.14 project

Document Signature
 Signed
 Not Signed

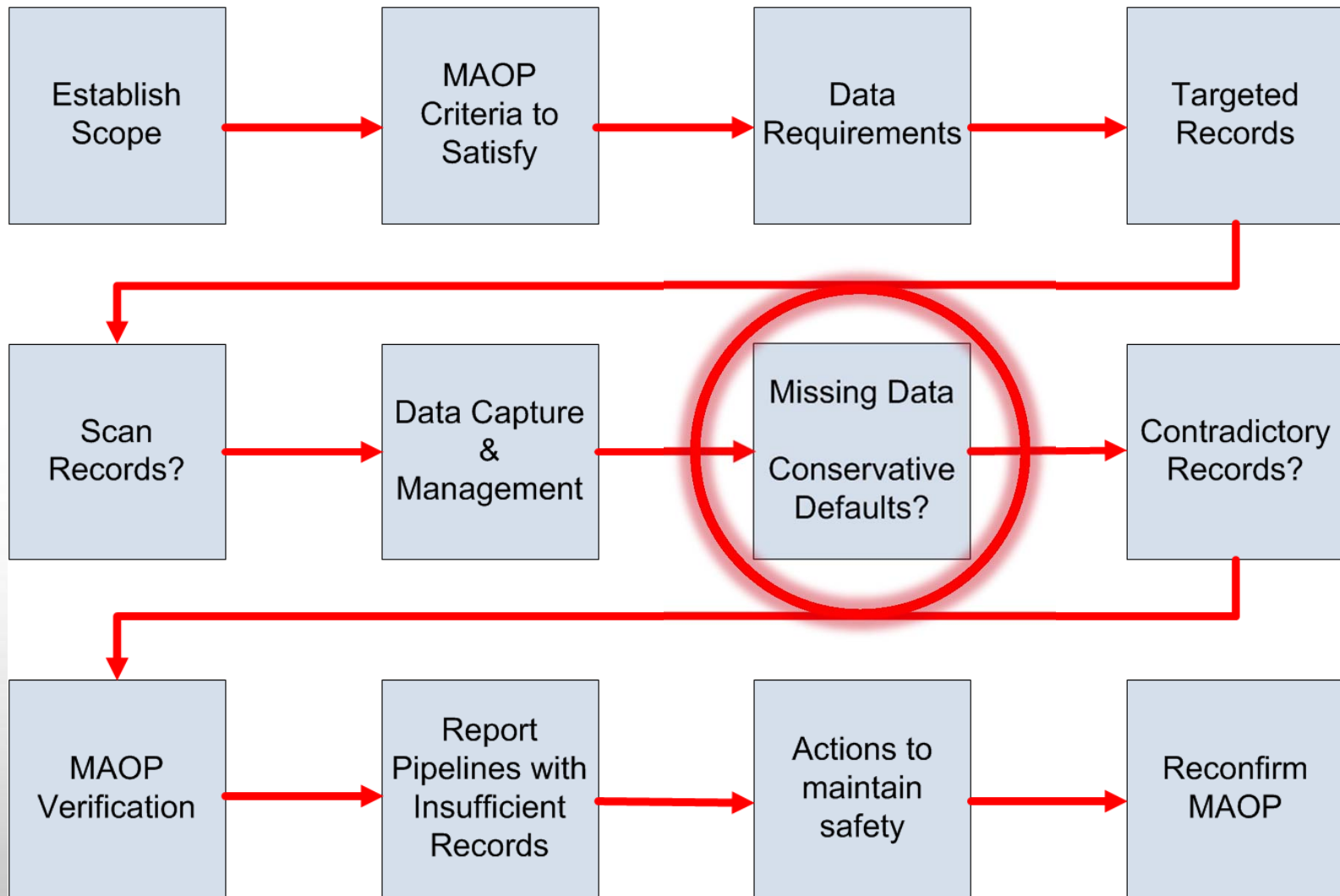
Record: 1 of 1

Final Verified Data resides in GIS



Quality Control Considerations

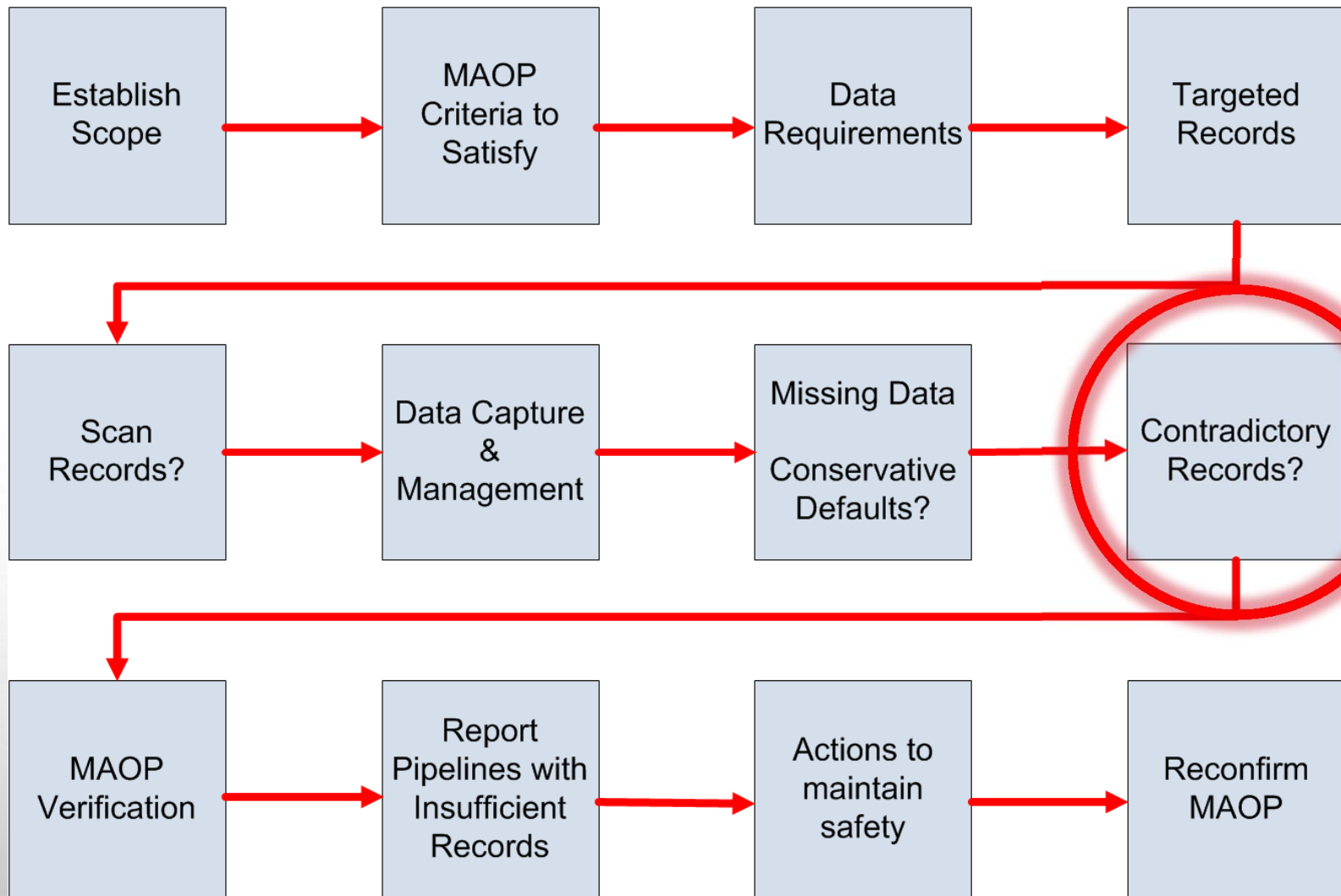
- 100% QC until confidence in process is established
- Records not Meeting Protocols Go through Different Process
 - Operating Experience, Subject Knowledge
 - Engineers



Application of Conservative Defaults?

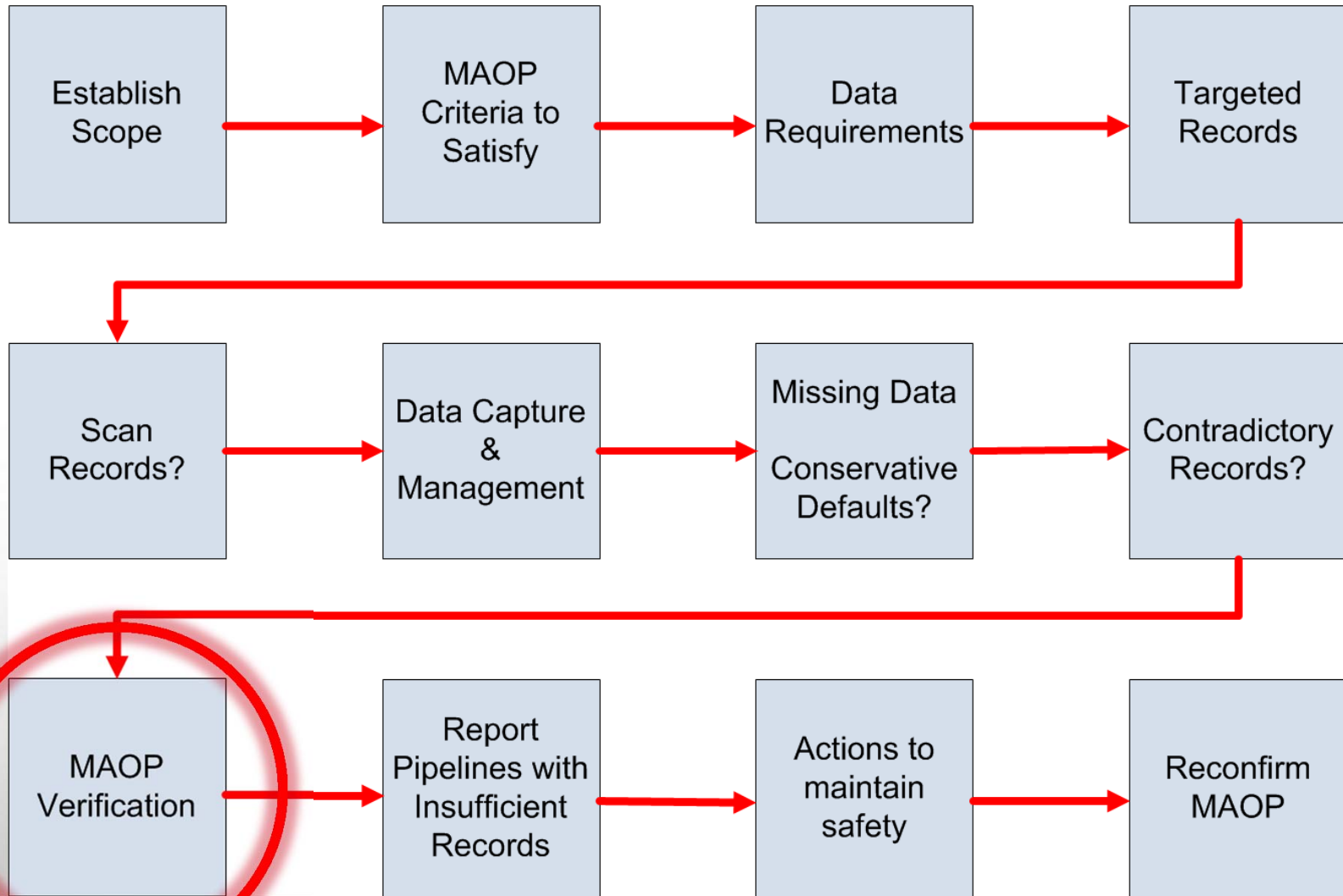
	Key Elements	PHMSA Default If Unknown
Pipe Material Properties	Pipe Nominal Outside Diameter	Not specified
	Pipe Longitudinal Joint Factor	For §195.113 : 0.80 for pipe over 4 inches 0.60 for pipe 4 inches or less
	Pipe Grade	Assume 24,000 psi as per §195.106 and §192.107

Illustrative example



RECORD EVALUATION

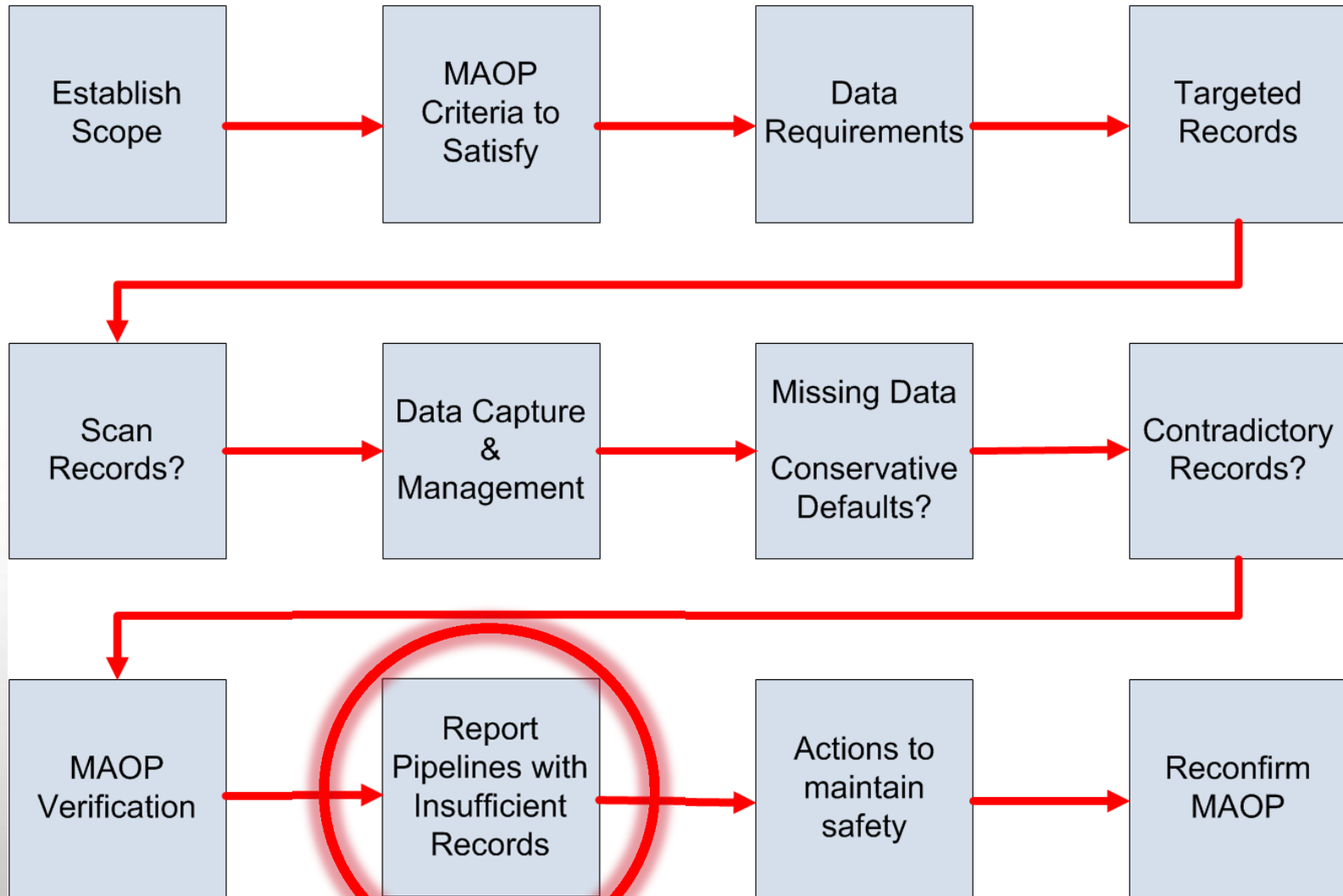
- Data Conflicts (same data element from different records)
- Evaluate Against Records Acceptance Criteria
- Error on the conservative side



MOP CALCULATION & VERIFICATION

- Handwritten, Spreadsheet, Database, linked to GIS??
- Detail Process Flow
- Validation & Verification of spreadsheets or software – Test Cases

Start with a Specific Plan

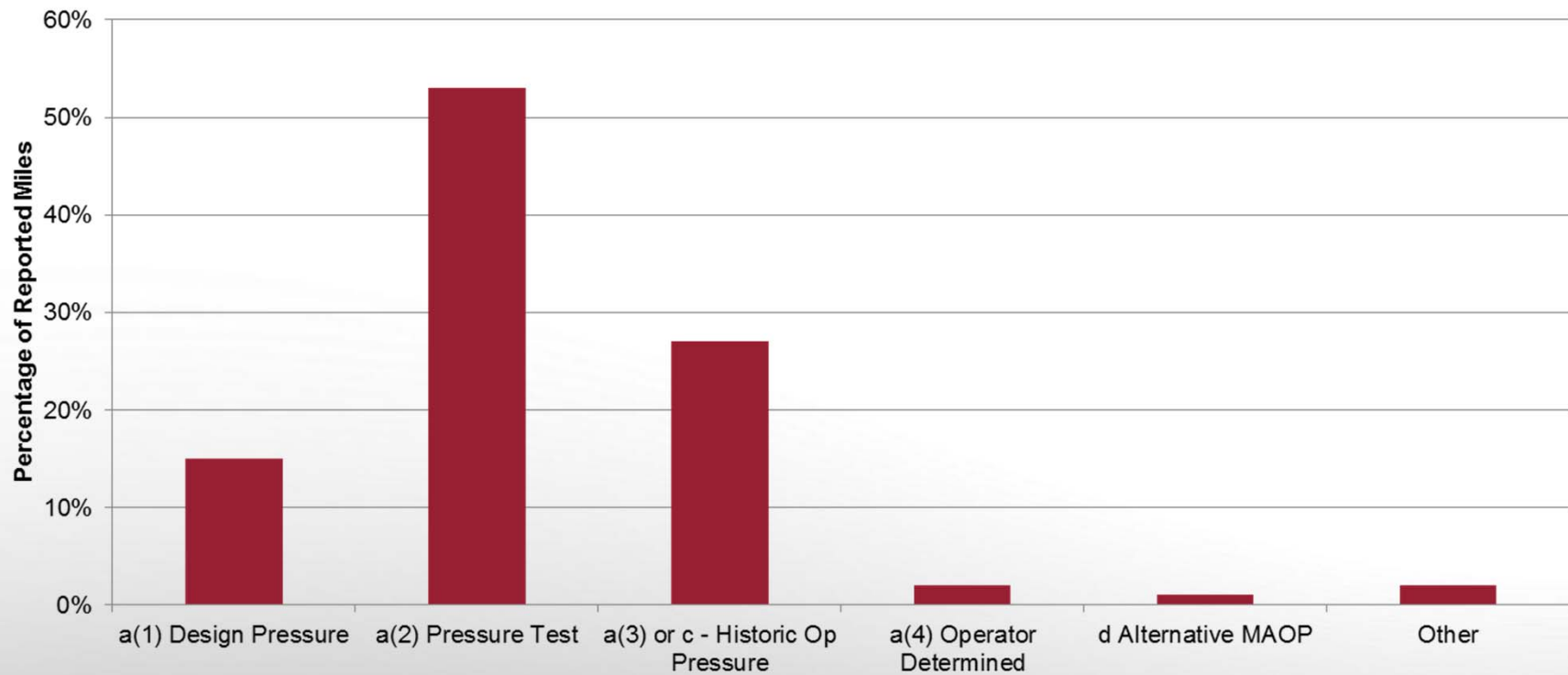


PHMSA Annual Report

Part Q - Gas Transmission Miles by §192.619 MAOP Determination Method														
	(a)(1) Total	(a)(1) Incomplete Records	(a)(2) Total	(a)(2) Incomplete Records	(a)(3) Total	(a)(3) Incomplete Records	(a)(4) Total	(a)(4) Incomplete Records	(c) Total	(c) Incomplete Records	(d) Total	(d) Incomplete Records	Other ¹ Total	Other Incomplete Records
Class 1 (in HCA)														
Class 1 (not in HCA)														
Class 2 (in HCA)														
Class 2 (not in HCA)														
Class 3 (in HCA)														
Class 3 (not in HCA)														
Class 4 (in HCA)														
Class 4 (not in HCA)														
Total	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc
Sum of Total row for all "Total" columns							Calc							
Sum of Total row for all "Incomplete Records" columns							Calc							
Grand Total							Calc							

¹ Specify Other method(s): _____

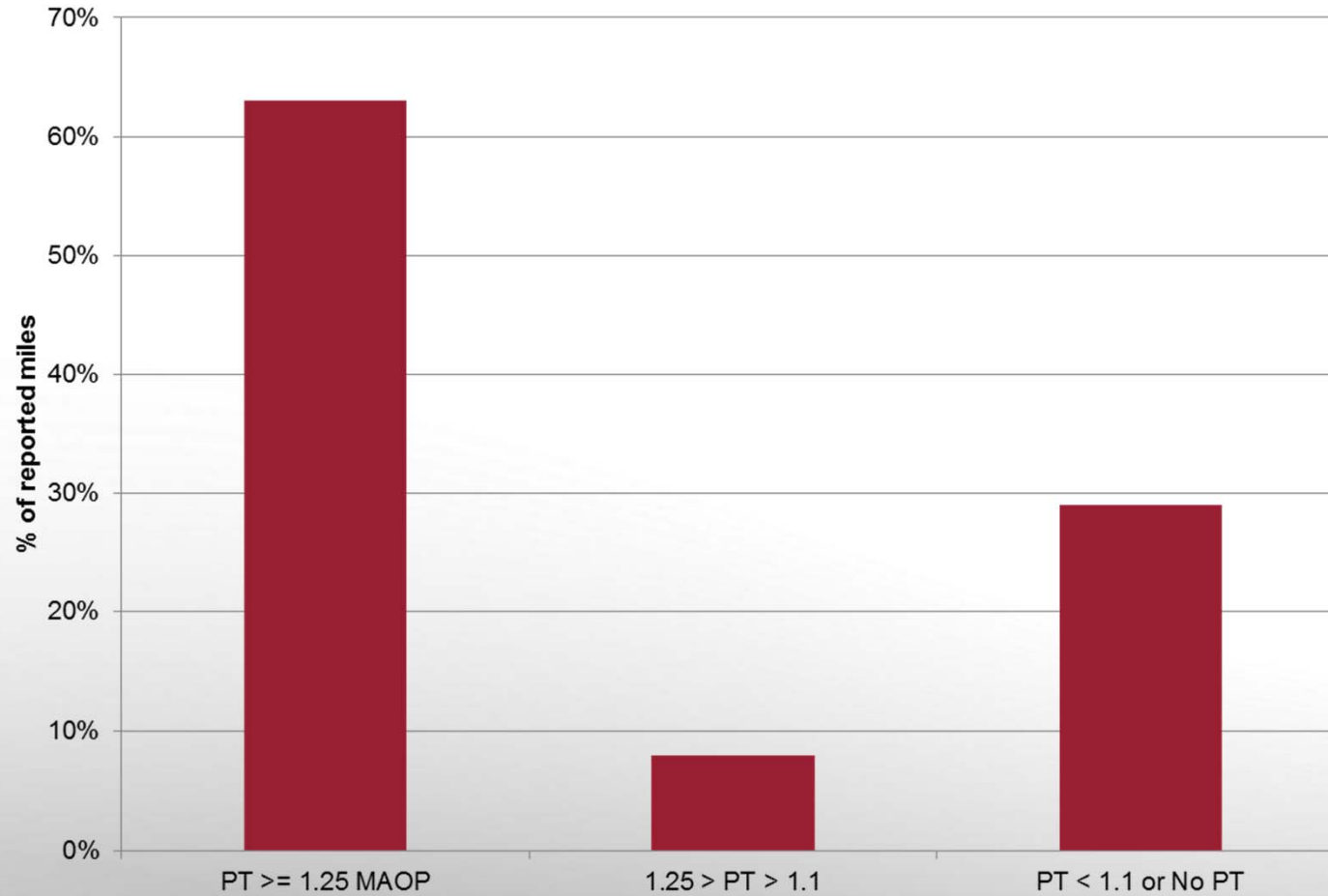
AGA Member Survey - 44 Companies 192.619 Reporting Method



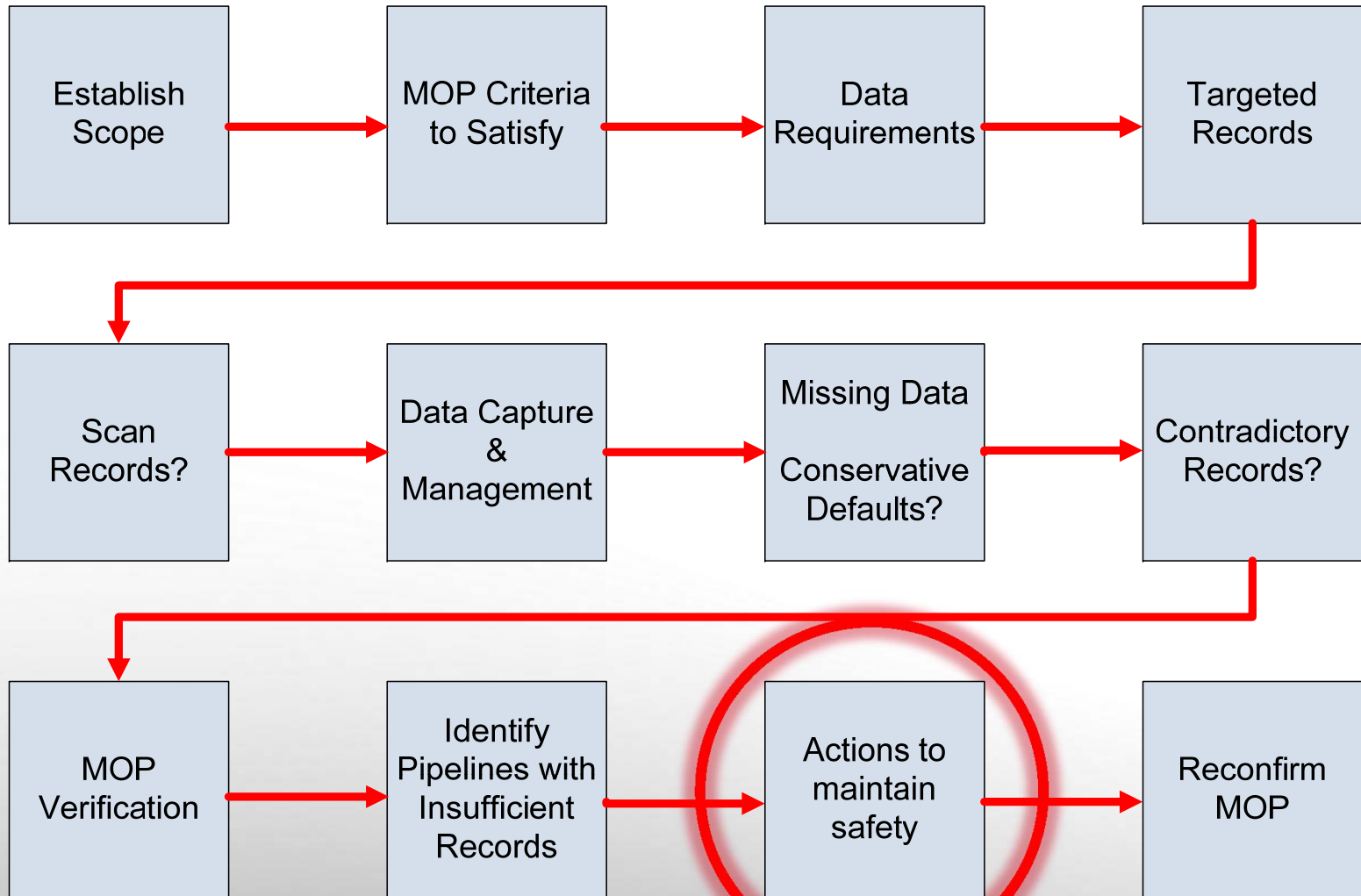
PHMSA Annual Report

Part R – Gas Transmission Miles by Pressure Test (PT) Range and Internal Inspection						
Location	PT ≥ 1.25 MAOP		1.25 MAOP > PT ≥ 1.1 MAOP		PT < 1.1 or No PT	
	Miles Internal Inspection ABLE	Miles Internal Inspection NOT ABLE	Miles Internal Inspection ABLE	Miles Internal Inspection NOT ABLE	Miles Internal Inspection ABLE	Miles Internal Inspection NOT ABLE
Class 1 in HCA						
Class 2 in HCA						
Class 3 in HCA						
Class 4 in HCA						
in HCA subTotal	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>
Class 1 not in HCA						
Class 2 not in HCA						
Class 3 not in HCA						
Class 4 not in HCA						
not in HCA subTotal	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>
Total	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>	<i>Calc</i>
PT ≥ 1.25 MAOP Total		<i>Calc</i>				
1.25 MAOP > PT ≥ 1.1 MAOP Total		<i>Calc</i>				
PT < 1.1 or No PT Total		<i>Calc</i>				
Grand Total		<i>Calc</i>				

AGA Member Survey - 44 Company Pressure Test vs. MAOP



Start with a Specific Plan



Actions to Maintain Safety

PG&E – California (5,800 miles of Transmission)

Pressure Testing or Replacing all Pipelines with no Documented Strength Test

Work Description	2011	2012	2013	2014	Total
<u>Strength Testing</u>					
Miles	236	185	204	158	783
Capital Expenditures (\$ in millions)	\$ 16.2	\$ 15.7	\$ 15.8	\$ 15.9	\$ 63.6
Expenses (\$ in millions)	\$ 121.1	\$ 93.7	\$ 84.5	\$ 93.9	\$ 393.2
<u>Pipeline Replacement</u>					
Miles	0.3	39	64	82	186
Capital Expenditures (\$ in millions)	\$ 15.5	\$ 198.6	\$ 280.1	\$ 340.0	\$ 834.2
Expenses (\$ in millions)	\$ 1.6	\$ 1.2	\$ 1.0	\$ 1.1	\$ 4.9
Miles of ILI upgrades			78	156	234
Valves Automation ACV/RCV	29	46	90	63	228

Source: PG&E PSEP Regulatory Filing

PG&E - 2 Ruptures in two years of testing



- 998 psig at rupture (95% SMYS)
- Seam Failure - Hot Crack and Incomplete Seam weld
- 550 psig at rupture (400 MAOP)
- External damage