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Piping System Integrity

2016 IDEA Campus Workshop

Monte K. Engelkemier, P.E.

John Molnar-Penn State University

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Agenda

- What is a Piping System Integrity?
- Quick Review of the O&M B31.1 Chapter VII
- Condition Assessment

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What is a Piping System?

- "…piping systems as covered by this Code apply to all piping and their component parts…" ASME B31.1 paragraph 100.1.2
- What are their "component parts"?
  - Pipe, Valves, Flanges, Insulation, Instruments
  - Pipe Supports
  - Surrounding Structure

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What is a Piping System Integrity?

- Piping System Integrity is the practice of keeping the condition (Piping System) of being free from damage or defect, or an unimpaired condition

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Goals of B31.1 O&M

"Thou Shall Know the Condition of Thy Condition"

-Piping Gods (Before We Knew it was Round with a Hole)

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Goals of B31.1 Chapter VII on O&M

- Knowledge/Information
- Code Reference
- Ultimately:

Information Gained = Money $aved

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General

- Managing safe pipe service begins with the initial project concept and continues throughout the service life of the system (typically after we are all retired)
- Any new failure reinforces this protocol

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OPERATION AND MAINTENANCE PROCEDURES

- The Operating Company shall be responsible for the safe operation and maintenance of their power piping.

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Chapter VII & Nonmandatory Appendix V: Operation & Maintenance

- ASME B31.1 addresses the operation and maintenance of power piping 2007 edition.
- The inspection and evaluations methods are acknowledged, but not detailed.
- Wanted Owners to have a plan to address O&M. It didn't need to be a great plan, but something was better than nothing.

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Other ASME Codes with O&M Requirements

- B31.4 – 2002 Pipeline Transportation Systems For Liquid Hydrocarbons and Other Liquids (Chapter VII)
- B31.8 – 2003 Gas Transmission And Distribution Systems (Chapter V)
- B31.11 – 2002 Slurry Transportation Piping Systems (Chapter VII)
- High Pressure System HPS 2003 (Section 5000)

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Condition Assessment

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CONDITION ASSESSMENT

- Why?
- Who?
- Where?
- When?
- What?

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CONDITION ASSESSMENT: The Why

- As discussed, Code recommends piping system be maintained to ensure safe operation of the piping
- Money $aved through proper maintenance

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CONDITION ASSESSMENT: The Who

- The Owner, Plant Personnel, and 3rd Party Consultant can preform routine/periodic assessments
- The Owner and Plant Personnel should be vigilant daily to catalog any item out of the ordinary.

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CONDITION ASSESSMENT: The When

- A condition assessment shall be performed periodically based on condition.
- What is a good period?
  - 3 Years
  - 5 Years
  - 10 Years
  - Weekly?

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CONDITION ASSESSMENT: The Where

- Obviously any where the piping goes
- The surroundings of the piping too

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CONDITION ASSESSMENT: The What

- Besides the piping and components?
- The records

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RECORDS

- The condition assessment reports and any reference documents, such as procedures required by ASME B31.1 paragraph 139, drawings and reports, shall be maintained and accessible for the life of the plant.

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Setting Up the Record Program

- Collect the documents, not all are needed, but try your best because it will be critical in the long run
- Initial Walkdown, typically when Hot
- Follow-up with a Cold Walkdown, try to complete within 12-18 months

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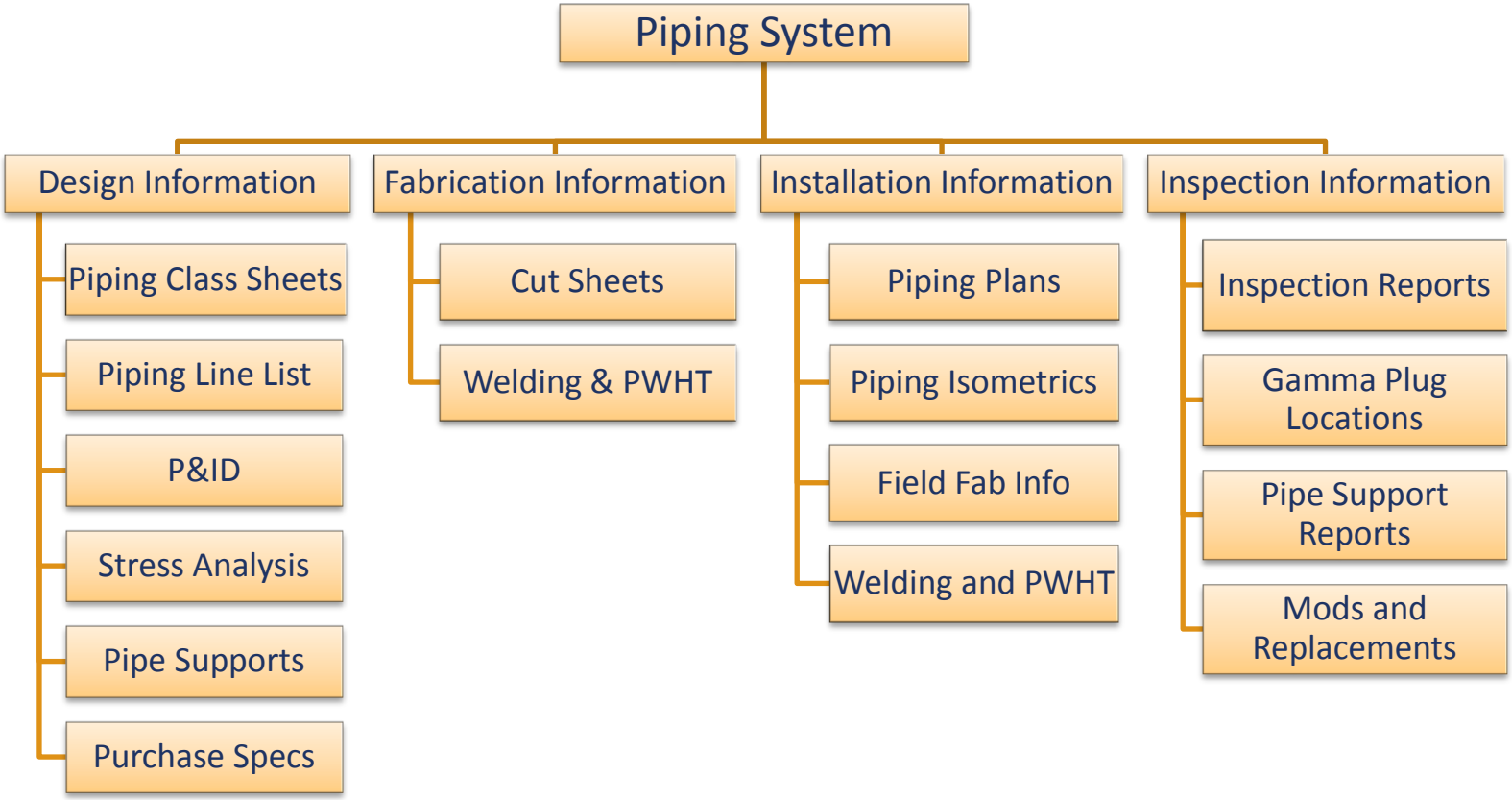
Setting Up the Record Program: Typical Documents



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Setting Up the Program

- System Piping Drawings (Plans/Sections or Isometrics) showing
  - Support Information
  - Expansion Joints
  - Shop and Field Weld Locations
  - Gamma Plug Locations (x-rays)

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Initial Walkdown

- Interview constructor (if possible), plant personnel for any updates or revisions, etc.
- Interview operations for any problems noted
- Make sure all commissioning is complete and temporary pipe/supports removed
- Make sure all springs are unlocked (I found a locked spring in a operating university plant)
- Make sure water lines are filled

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Initial Walkdown

- Typically completed immediately, so most likely the system is energized
- Items Checked
  - Isometrics match actual piping
  - Pipe supports match design drawings
    - Guide lugs
    - Orientation
  - Structural Deficiencies
- Take Photos to document work

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Follow-up Walkdowns

- Initial Walkdown, typically when energized
- Follow-up with a Cold Walkdown (unenergized), try to complete within 12-24 months
- Anytime the system is walkdown for whatever reason, be vigilant in noting irregularities and possible issues

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Reports

- Develop a report to capture all major walkdowns
- Include in that report any issues noted since last major walkdown
- Create an Executive Summary highlighting the more significant findings
- Generate a Punch List of all problems noted with recommendations

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Setting Up the Program

- Initial Walkdown, typically when Hot
- Follow-up with a Cold Walkdown, try to complete within 12-18 months

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Follow-Up Actions By the Plant

- Plants are responsible for all action taken:
  - Decides which repairs/adjustment to make
  - Decides when the actions should be done
- May need to rely on Contractors to develop a SOW based on punch list

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Example of O&M Procedures from Penn State University

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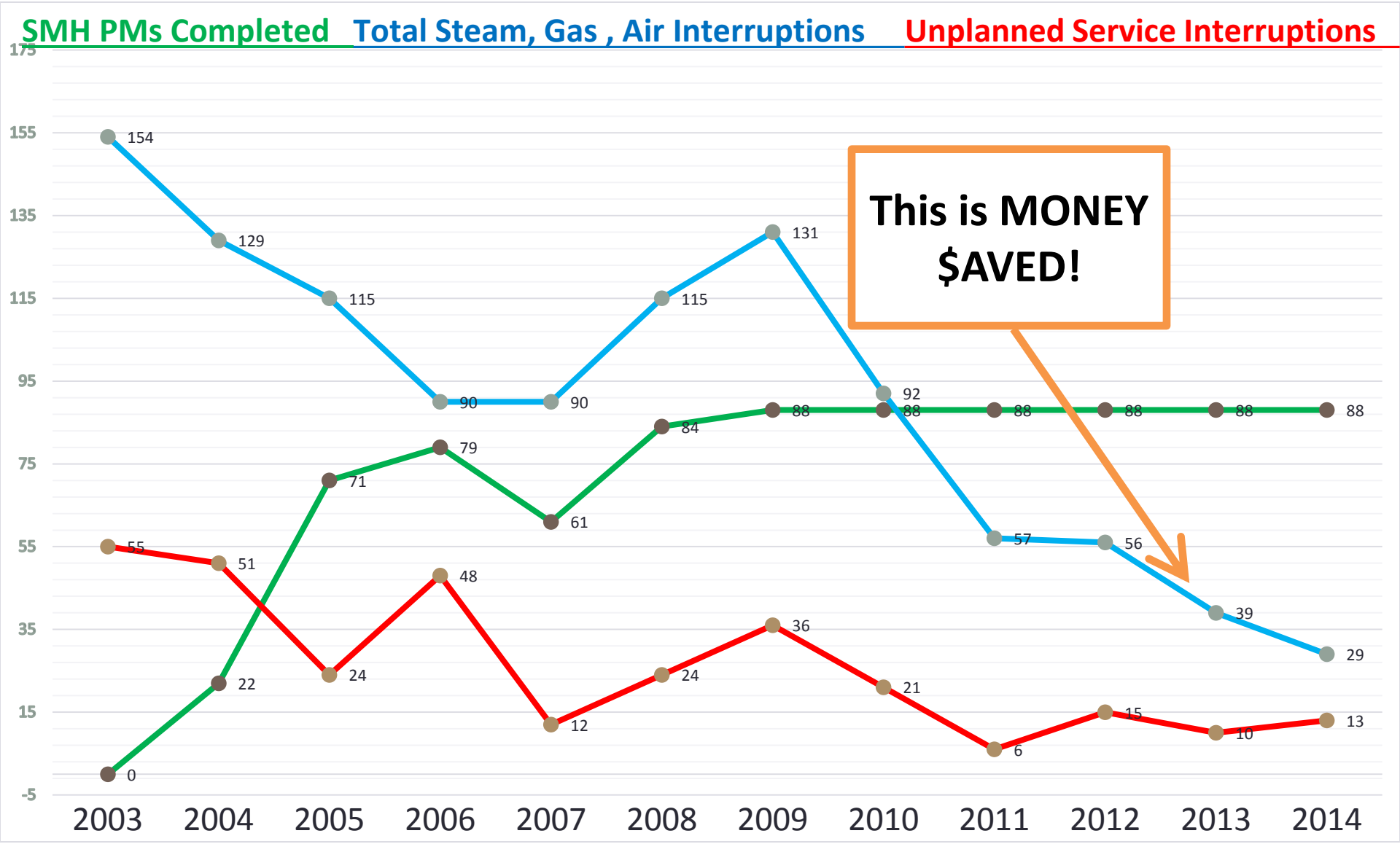
Goal: Inspect and PM one half of the SMHs yearly

Task	SMH PM Job Plan
10	Notify Base of location of open manhole.
20	Set up tri-pod.
30	Fill out Confined Space Entry Permit.
40	Use the attached photos to apply the condition grades to the concrete.
45	Use your best judgment to apply the condition grades to the unit components
50	**1 = BAD CONDITION, See Long Description for recommend actions**
60	**2 = POOR CONDITION, See Long Description for recommended actions.**
70	**3 = FAIR CONDITION, Continue to monitor using current PM frequency**
75	**4 = GOOD CONDITION, Continue to monitor using current PM frequency**
80	Check entrance lid and vent lid. ____Grade
90	Check ladder and rungs. ____Grade
100	Pipe insulation condition ____Grade
110	Check steel supports & anchors. ____Grade
120	Check roof. ____Grade
130	Check walls. ____Grade
140	Check floor. ____Grade
150	Check concrete anchors. ____Grade
160	Check sump pit. ____Grade
162	Lubricate valves using Hi temp grease
165	Operate Valves Create CM for Valves that will not operate or in need of repaired
168	Pack Joint if leaking
170	Steam Expansion Joints_____Grade
171	Compressed Air Piping_____Grade
173	Condensate Piping _____Grade
174	Condensate Piping_____Grade
180	Contains ASBESTOS? ____Yes ____No
190	Clean manhole interior
200	Verify manhole drawing
210	Verify equipment list
220	Secure manhole
230	Notify Base that hole is secure
240	Does equipment need Corrective Maintenance? Yes_____ No_____
250	If Yes, describe work needed_____
260	_____
270	Complete PM Work Order

How PM inspections improved System Operations



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Steps to reduce and predict failures and maintenance costs

- List all failures to see if there is a common point
- Reduce failure points by using other material, different fittings
- Changing piping configuration
- To collect this information we cataloged the entire system

System Asset ID Format

GIS Node to Node ID Format

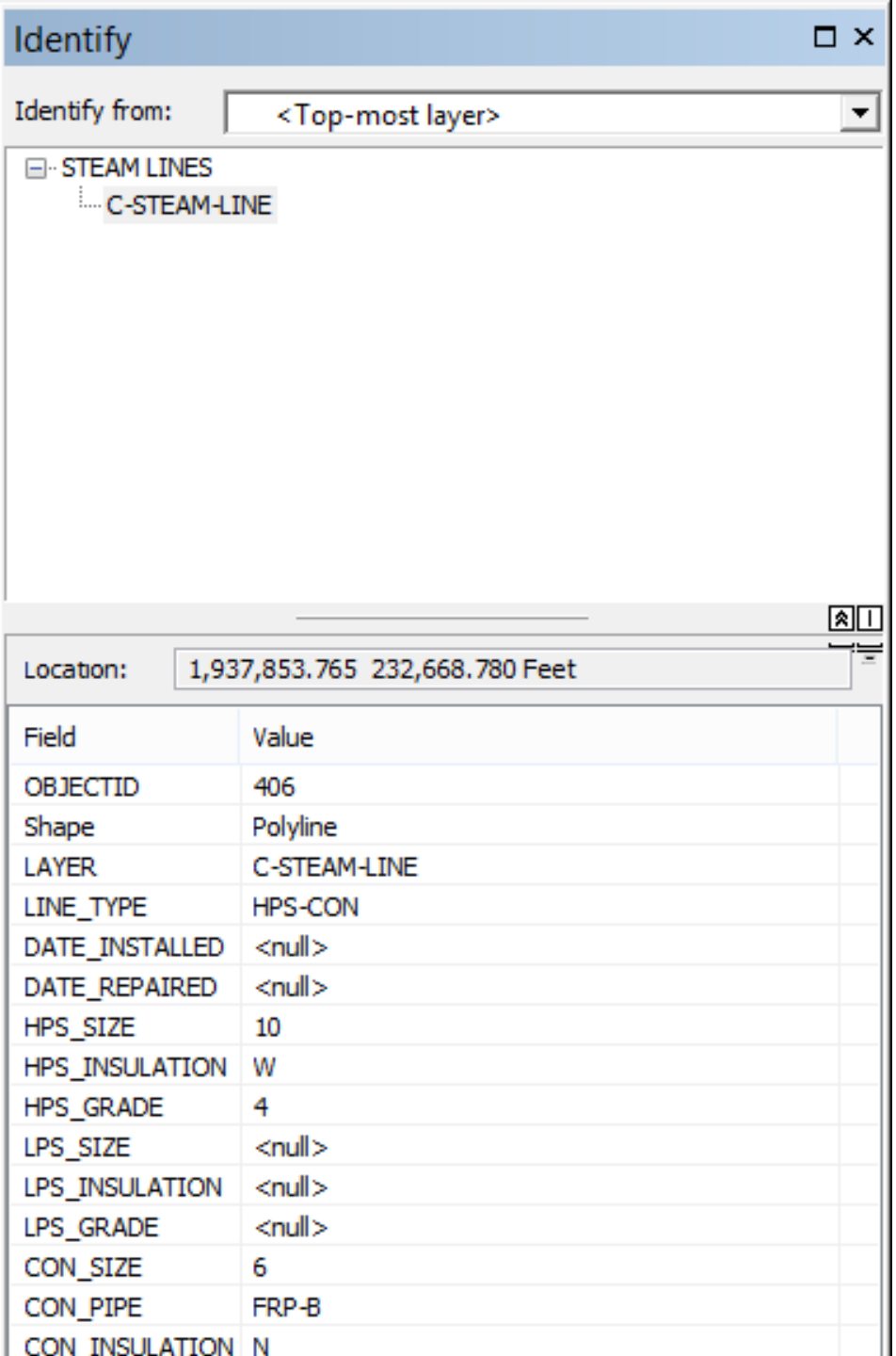
Section of Pipe	Steam Man Hole # or Building	To	Steam Man Hole # or Building
	SMH 120	To	SMH 121

Field 1		Field 2		Field 3		Field 4		Field 5		Field 6
System	-	Pipe	-	Size	-	Instillation Style	-	Grade	-	Year
Example										
H	-	S	-	10	-	W	-	2	-	1970

Abbr	System		Abbr	Pipe		Inchs		Abbr	Insulation Style		Abbr	Details		
L	LPS Steam	-	S	Steel Sch 40	-	2	-	SE	Steel Epoxy Conduit	-	1	Several repairs made in the pass 5 years	-	Year Line was installed
H	HPS Steam	-	F	Fibercast	-	4	-	SH	Steel HDPE Coated	-	2	Single repair made in the pass 10 years	-	
C	Condensate	-	B	Bond Strand		5	-	F	Fiberglass Conduit	-	3	No repair made Line installed in pass 25-50 years	-	
A	Air	-	P	Plastic		6	-	W	White Power Dirtherm	-	4	Line installed in pass 10-25 years	-	
G	Gas	-				8	-	V	Vault	-				
						10	-	T	Walk Tunnel					
						12	-	N	No Insulation					
						14								

GIS Information Form

Node to Node		System	Pipe	Size	Install Style	Grade
SMH	**SMH**					
161	176	H	S	6	SH	5
		C	F	3	N	5
		A	F	2	N	5
SMH	**SMH**					
176	175	H	S	6	SH	5
		C	F	4	N	5
		A	F	2	N	5
SMH	**Building**					
175	Palmer Museum	H	S	6	SH	4
		C	B	2 1/2	N	4
		A	F	1	N	4
SMH	**SMH**					
176	159	H	S	6	SH	5
		C	F	4	N	5
		A	F	2	N	5
SMH	**Building**					
159	Stuckman	H	S	4	SH	5
		C	F	2	N	5
		A	F	2	N	5
SMH	**SMH**					
159	158	H	S	6	SH	5
		C	F	3	N	5
		A	F	2	N	5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Polyline
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Identified 1 feature

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Steam Line Condition Report

# of grade 1 & 2 sections of Low Pressure Steam (LPS) that are under sidewalks or within 2 feet of steps:

1. LPS, 2 in, W, Grade 2, between Spruce and Pine Cottage
2. LPS, 3 in, W, Grade 1, between Pine Cottage and Ritenour
3. LPS, 3 in, F, Grade 1, from MH 225 to Engineering Services
4. LPS, 4 in, W, Grade 2, Ihlseng Bldg.
5. LPS, 4 in, W, Grade 1, Weaver Bldg.
6. LPS, 5 in, W, Grade 2, Fenske Lab
7. LPS, 5 in, SE, Grade 2, MH 195 to MH 217 (Carpenter Bldg.)
8. LPS, 5 in, W, Grade 2, Henderson Bldg.
9. LPS, 6 in, W, Grade 2, Pond Lab
10. LPS, 6 in, W, Grade 2, MH 11 to Steidle
11. LPS, 6 in, SE, Grade 2, MH 71 to Rec Hall

SMH Condition Report

Condition Grading System

0	None installed
1	Bad Condition, Action needed with in 1 year
2	Poor Condition, Schedule for replacement with in 1-5 years, Create CM to reevaluate with in 1 Year
3	Fair Condition, Plan for replacement next 5-10 Years
4	Good Condition, Life expectancy 10-20 years
5	Excellent Condition, Life expectancy 20 to 50 years

SMH #	Location	Walls	Roof	Concrete Anchors	Steel Support	Expansion Joints	Air Pipe	Steam Pipe	Cond Pipe	Insulation
6	South of Foundry	1	1	0	0	4	0	4	0	4
78	East of Ihseng	1	1	0	2	4	2	4	2	4
241	West of Greenburg	1	1	2	2	4	2	4	3	3
59	SE of Pond Lab	2	1	0	0	4	3	3	3	1
7	South of Foundry	1	2	0	0	0	4	4	4	4
219	South of Business Admin	2	2	0	0	0	4	4	4	4
80	NE of Ihlseng	3	3	0	1	0	3	4	3	4
105	NE of Parking Terrace	4	3	0	2	0	4	4	4	4
246	West of Beaver Stadium	4	3	4	4	4	3	4	4	4

Steam Distribution 5 Year Replacement Plan

Low Pressure Steam, in White Powder with Grade 1 or 2: Sections that are under steps or sidewalks

Line Details & Location	Notes	Length of replacement	Cost HDPE 750/FT
LPS, 5 in, W, Grade 2, Henderson Bldg.	Will continue to monitor	170	127500
LPS, 12in, W, Grade 1, MH 9- MH 11	Request for funding is in	345	258750
LPS, 3 in, F, Grade 1, from MH 225 to Engineering Services	Request for funding is in	400	300000
LPS, 2 in, W, Grade 2, between Spruce and Pine Cottage	Request in for Design	60	45000
LPS, 3 in, W, Grade 1, between Pine Cottage and Ritenour	Request in for Design	20	15000
LPS, 4 in, W, Grade 2, Ihlseng Bldg.	Heating system only. Will continue to monitor	150	112500
		Line Replacement Estimated Cost	858,750

Gas Line Replacement Details & Location	Notes	Length of replacement	
MM-WA Electric Engineering West section Gas line 2" steel	Has been repaired 3 times in last 2 years	750	37500

SMH Rebuilds Details Location	Notes	Job Details	Cost/Rebuild
SMH 6 South Of Foundry	Could AB After line is run in Reber North	Replace Walls & Lid	80,000
SMH 7 South of Foundry	Could AB After line is run in Reber North	Replace Walls & Lid	80,000
SMH 216 East of IM Building	Steel Top needs replaced	Project Request in	80,000
SMH 78 East of Ihseng	Walls and Lid Bad	Line also needs replaced	80,000
SMH 241 West of Greenburg	Walls and Lid Bad	Replace Walls & Lid	80,000
SMH 59 South of Pond Lab.	Lid only has 1 Access	Needs new Lid	30,000
		SMH Concrete work	430,000
		Gas Line Replacements	37,500
		Line replacements	858,750
		Steam Distribution 5 Year Replacement Estimate Cost	**1,326,250**

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Conclusions

- The sooner problems are discovered and resolved, the less likely the problems will become major issues
- Long term Owner commitment to the program will help assure safe and reliable operation

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Conclusions

- Walkdown data can be used to track the piping system over the long term
- Highlight changes that indicate long term problems

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Best of all $AVE MONEY

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Thank-you!

Questions???

Contact Information:

Monte K. Engelkemier, P.E.

engelkemierm@stanleygroup.com

563-264-6641 work