

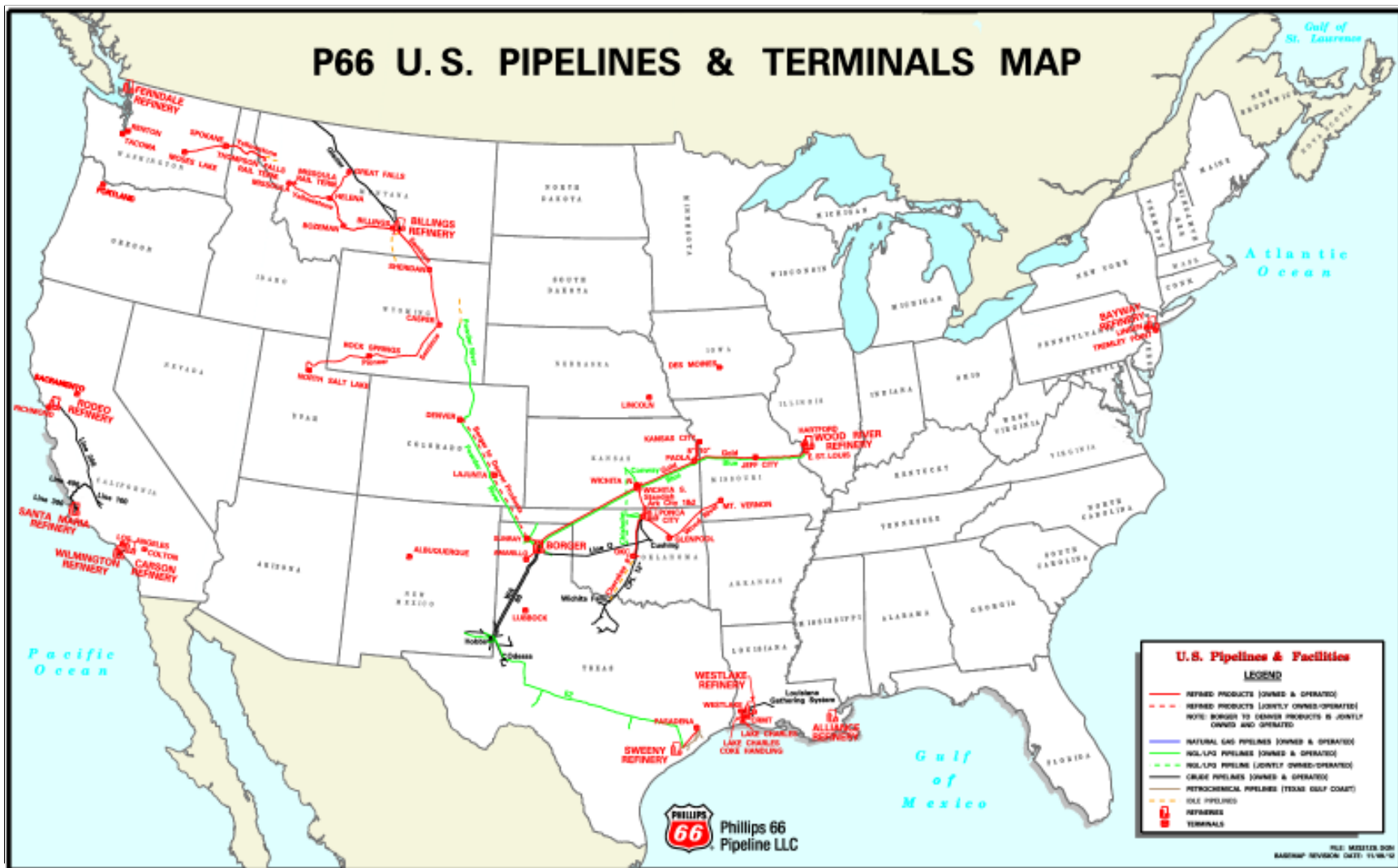


FACILITY PIPING, A RISK ASSESSMENT APPROACH



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P66 U.S. PIPELINES & TERMINALS MAP



UNKNOWNNS WHICH NEED TO BE ANSWERED

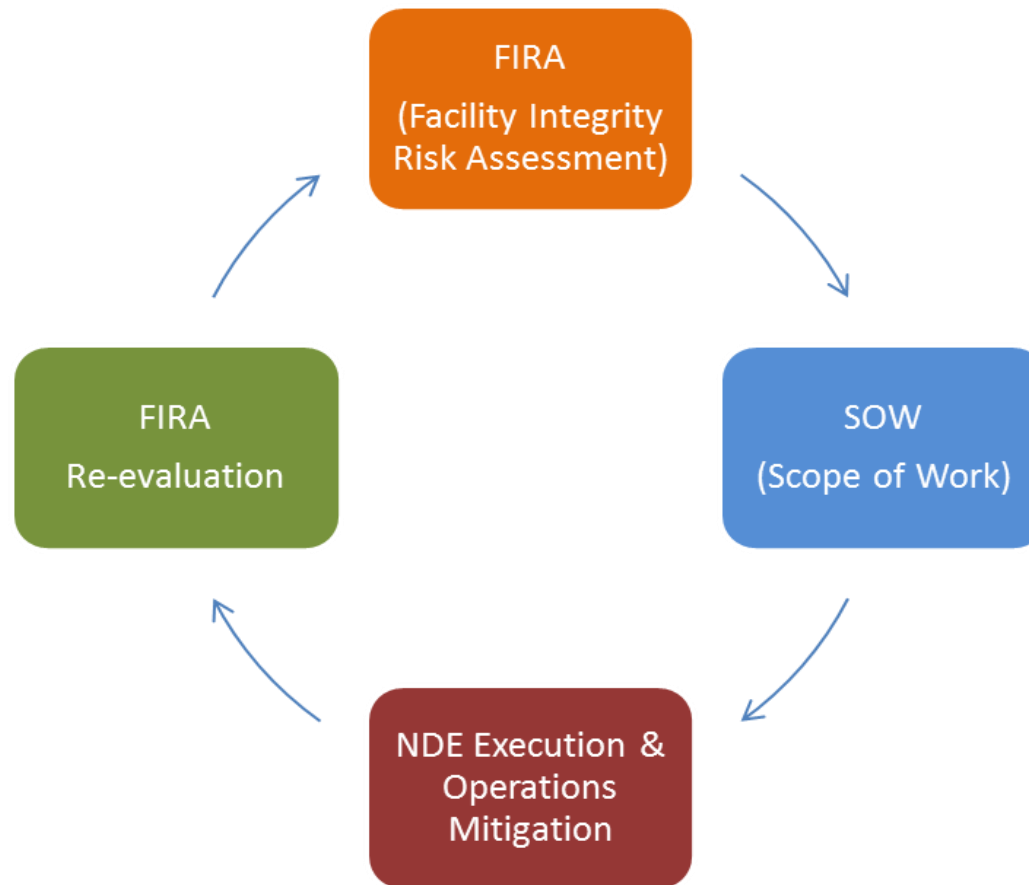
- Where to start?
- What type of risk assessment would fit the facility setting?
- What tools are there to reduce risk?
- What inspection scope of work would provide the best evaluation of facility condition?
- What frequency would be needed to sustain facility integrity?



AGENDA

- Risk Reduction Process
- Risk Assessment Tool
- Consequence of Failure
- Likelihood of Failure
- Mitigation
- Success Stories
- Summary

Risk Reduction Process



RISK ASSESSMENT TOOL

- Establish a Risk Assessment Procedure
- Use of Corporate Risk Matrix
- Establish Consequences of Failure
 - HCAs
 - Business Impact
- Establish Likelihoods of Failure
 - External Corrosion
 - Internal Corrosion

Risk Matrix						
L I K E L I H O O D	5	II 5	II 10	III 15	IV 20	IV 25
	4	I 4	II 8	III 12	III 16	IV 20
	3	I 3	II 6	II 9	III 12	III 15
	2	I 2	I 4	II 6	II 8	II 10
	1	I 1	I 2	I 3	I 4	II 5
		1	2	3	4	5
		CONSEQUENCE				

Risk:
(Likelihood X
Consequence)

CONSEQUENCES OF FAILURE

- High Consequence Areas
 - Drinking Water
 - Sole Source Aquifers
 - High Population Areas
 - Ecological Areas
- Product Type
- Manned / Unmanned Sites
- Business Impact



LIKELIHOOD OF FAILURE MODEL STRUCTURE

2 Threats

- Internal Corrosion
- External Corrosion

4 Sub-Threats

- Aboveground Internal Corrosion
- Aboveground External Corrosion
- Buried Internal Corrosion
- Buried External Corrosion

5 Likelihood Categories

- Facility Location
- Design and Piping Configuration
- Operations
- Current Mitigation Practices
- Failure Data

11 Likelihood Elements

1. Environment & Conditions
2. Piping Supports
3. Soil to Air Interfaces
4. CUI
5. Coating Buried Piping
6. Product Corrosiveness
7. Flow Type
8. Monitoring & Protection Programs
9. Inspection & Testing
10. Piping Work Process
11. Corrosion Incidents History

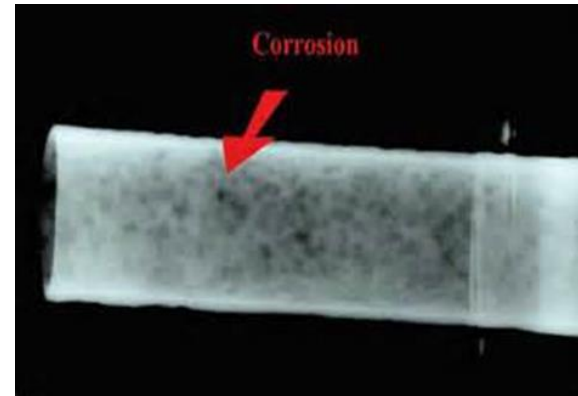
LIKELIHOOD OF FAILURE WEIGHTS

Elements	15% Above Ground- External	20% Above Ground- Internal	43% Buried- Internal	22% Buried- External
1. Environment & General Facility Conditions	29%	18%	18%	27%
2. Piping Supports (External Corrosion)	10%	0%	0%	0%
3. Soil to Air Interface (External Corrosion)	8%	0%	0%	0%
4. Corrosion Under Insulation (CUI)	6%	0%	0%	0%
5. Buried Coating	0%	0%	0%	9%
6. Product Corrosivity	0%	13%	13%	0%
7. Flow Type	0%	9%	10%	0%
8. Monitoring & Protection Program	0%	20%	20%	17%
9. Inspection and Testing	23%	22%	21%	25%
10. Facility Piping Work Processes	8%	6%	6%	7%
11. Corrosion Incident History	17%	13%	13%	16%

MITIGATION OF INTERNAL CORROSION

DEAD LEGS AND UNDERUTILIZE PIPING FOCUS

- Design
- Removal
- Purge & Isolation
- Operational
 - Flushing
- Chemical Treatment
- Inspection
 - Increased Inspection Cycles
 - Specific High Effectiveness NDE



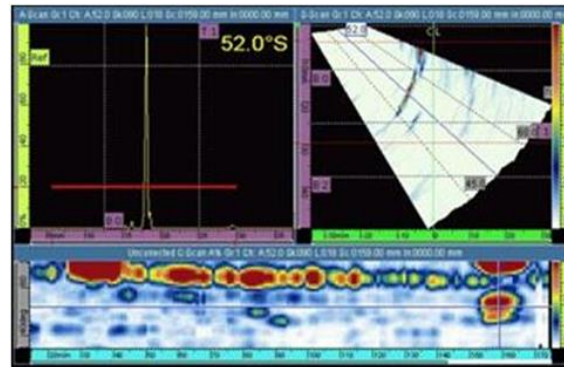
MITIGATION OF EXTERNAL CORROSION

- Piping Supports Design
- Maintain Good Thermal Insulation
- Coatings & Thermal Insulation Specs
- Cathodic Protection (CP)
- Inspection
 - CP Surveys
 - Increased Inspection Cycles
 - Specific High Effectiveness NDE



HIGH EFFECTIVENESS NDE & SURVEYS TO REDUCE RISK

- Profile Radiography
- GWUT (Guided-Wave)
- Phased Array
- Long or Short Wave UT
- EMAT
- ILI – MFL / UT Tools
- NDE Robots / Crawlers
- Tracer Gas Leak Detection
- P/S Potential Surveys
- ACVG / DCVG



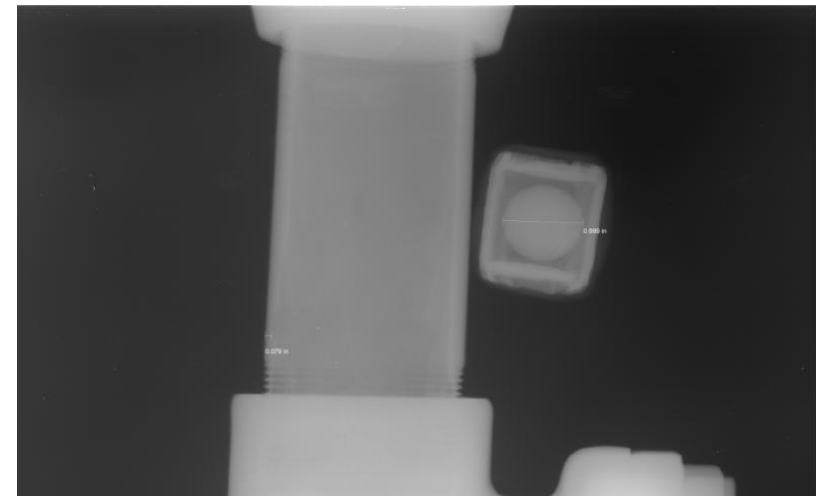
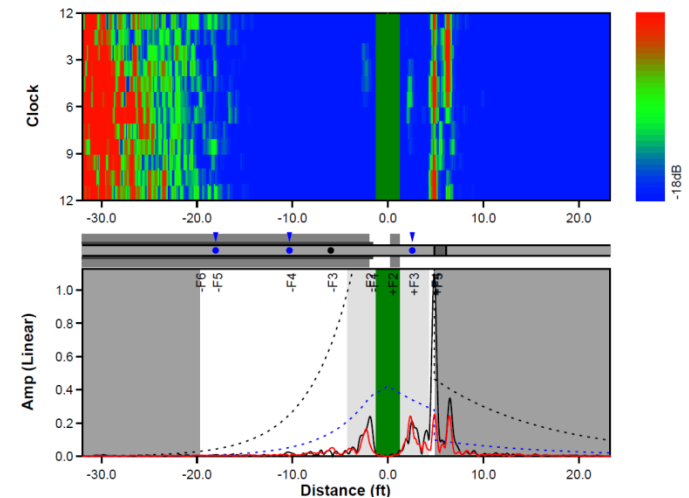


NDE SCOPE OF WORK TO REDUCE RISK

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NDE SUCCESS STORIES

- GUL Indication
 - 3 Medium (Cat 2) Indications 30% to 49% Wall Loss
- Profile RT
 - Drain was at 50% wall loss
- Tracer Gas
 - Leaking Sample Shack drain piping



SUMMARY

- Start evaluating likelihood of failure in facilities in HCA, then calculate relative risk and prioritize risk mitigations
- Use a scalable simplified risk assessment model based on threats that cause the majority and most severe failures in facilities
- Use a combination of tools making sure that the effectiveness of the mitigations are confirmed including high effective NDE methods
- The NDE scope of work targets high likelihood of failure configurations / locations generating a CML coverage based on the consequence of failure
- A risk based frequency from 3 to 10 years corrected with corrosion based frequency, whichever is shorter

Questions

