API RP 1175
Pipeline Leak Detection-Program Management
Workshop

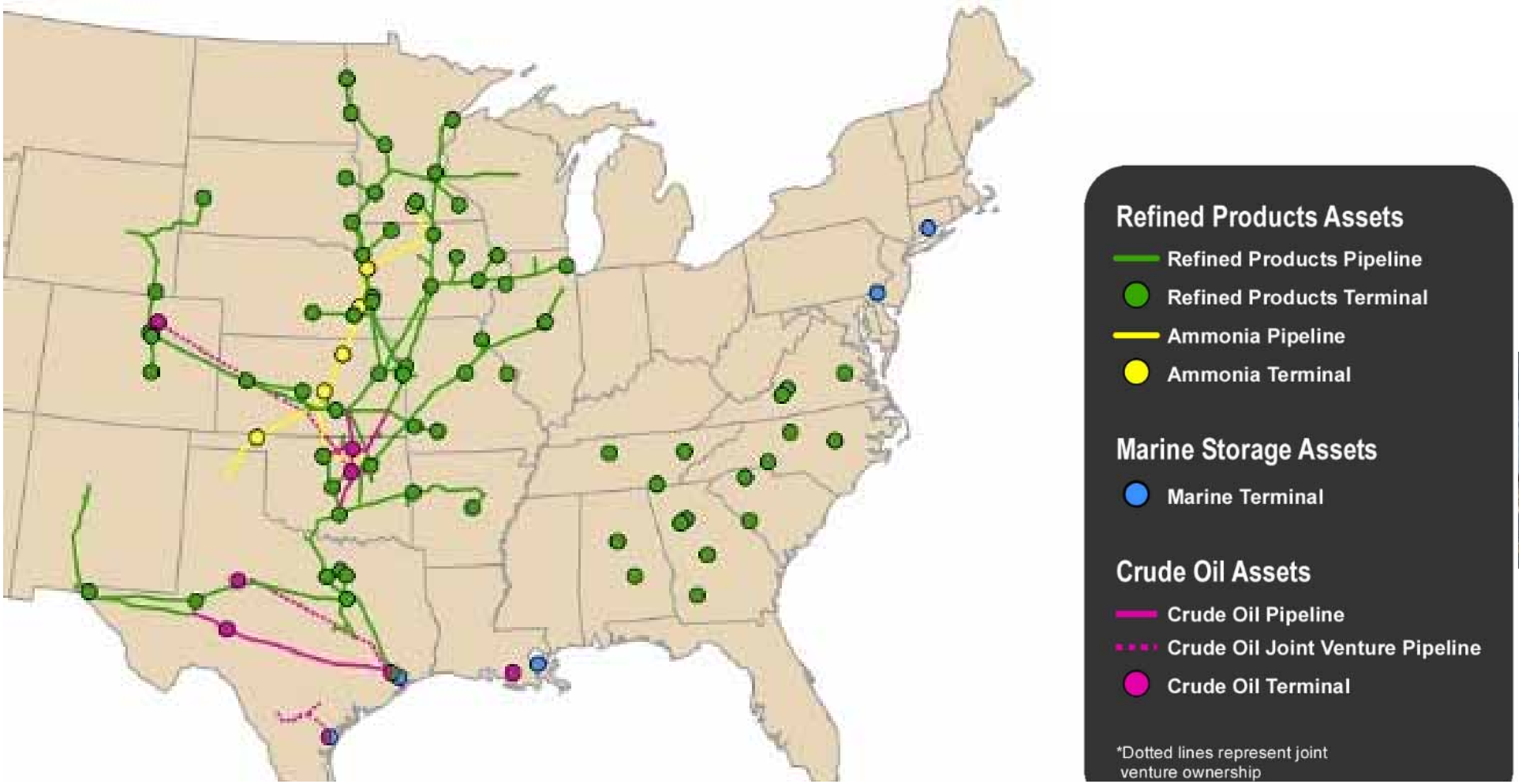
Wednesday and Thursday, April 26th and 27th, 2017

RISK-BASED APPLICATION OF LEAK DETECTION

Enhancing Integration With the Integrity Management Plan

Magellan Midstream Partners

Moving What Moves America



Robert Craig

- Supervisor, Operations Control - Applications
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  - Controller and Supervisor Training
  - Work Order and AO initiation
  - Leak Detection
  - Alarm Management

API 1175 Compliance

- Detailed analysis with original document
- Fed into the API 1175 Gap Analysis Spreadsheet
- Reviewed with several levels of management
- Beginning to address areas of opportunity

Risk-Based Application of Leak Detection

- Magellan Integrity Management Plan
- Complies with API 1160 RP
- Documenting risk process
- Further integration

API 1175 Alarm Management

- When a Controller receives a CPM alarm, they shut down the affected pipeline (as outlined in the API1175 Recognition and Response section). The Controller analyzes and escalates as appropriate per Magellan's alarm-response table.
- Identification of false positive alarms for IMP review process
- All alarms analyzed per the API 1130 RP
- Corrective actions are taken promptly

REVIEW

- Magellan is performing a thorough review of API 1175 survey results
- Addressing areas of opportunity
  - Includes improved documentation of IMP risk model's application to CPM and SCADA based leak and rupture detection
- Modifying SOP's
  - Improved alignment of company goals across departments to fully adhere to RP

Thank You!

Questions?

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LEAK DETECTION TECHNOLOGY SELECTION USING A RISK-BASED APPROACH

NIKOS SALMATANIS

Wednesday and Thursday, April 26th and 27th, 2017

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About this Presentation

- "A weak risk management approach is effectively the biggest risk in the organization," The Failure of Risk Management: Why It's Broken and How to Fix It, by Douglas Hubbard
  - This presentation will provide a Pipeline Operator's insight on the selection of leak detection systems (LDSs) while using a risk-based approach.

- As part of the presentation,
  - Insights into a Pipeline Operator's attempt to estimate the unmitigated and mitigated consequences of different leaks at different locations on the pipeline to outline what actions will reduce the calculated risks.
  - The Pipeline Operator will show how one or more layers (i.e. leak detection technologies) are considered.

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"Life does not come with a manual. We write our own experience and wisdom from lessons learned" - *Unknown Author*

What is the API RP 1175 Selection Process?

- Align with the Company Culture and Strategy
- Incorporate Regulatory Requirements, Best Practices, and Company Requirements
- Perform the Overall Risk Assessments
- Modify to Cover Particular Requirements of Individual Pipelines
- Link Performance KPIs, Metrics, and Targets
- Evaluate Best Available Technology(ies)
- Periodic Review of Selection via Leak Detection Capability Evaluation (LDCE).

Apply this selection process to validate and ensure this part in the Leak Detection Program meets these industry best practices

THE RELATIONSHIP WITH COMPANY CULTURE

- Safe Operations
  - A risk-assessment process is in place to periodically identify, assess and mitigate the safety and health risks related to facility operations and modifications.
- Reliability & Efficiency
  - A process is in place to identify critical structures, equipment and work processes. Possible failure modes and effects are analyzed and steps are taken to prevent the failure or mitigate the effects.
- Environmental Stewardship
  - A process is in place to assess and mitigate risks and impacts to human health and the environment (including natural resources) associated with operations, emissions, releases and wastes.

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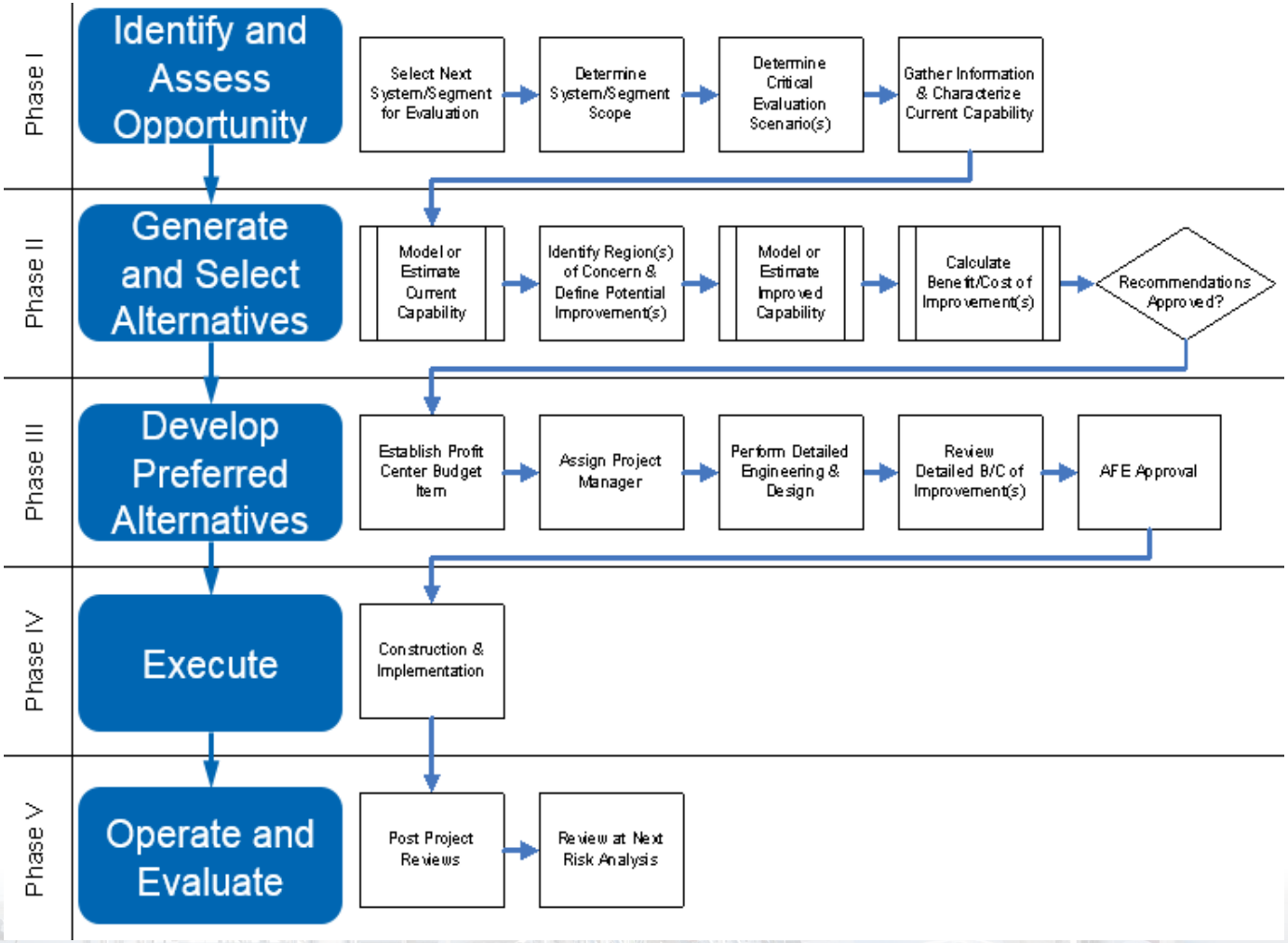
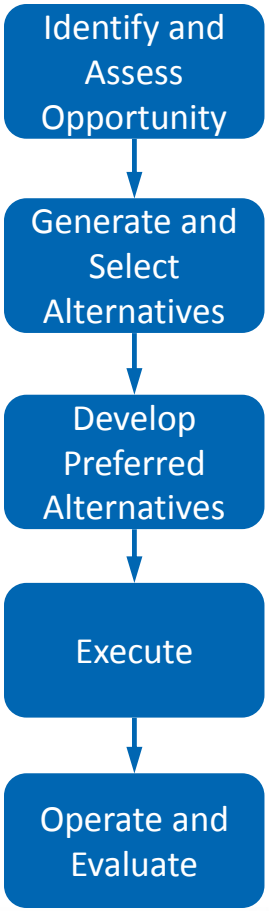
A strong company culture promotes prompt action and has the potential to reduce the consequences of a leak

The LDCE Process – A Risk-Based Approach



Continued alignment with Company Enterprise Processes

The LDCE Process – A Risk-Based Approach



1. Select a Pipeline system based on the IMP Risk Assessment.
2. Consider results and impact factors on the pipeline system.
3. Document all types of Leak Detection (LD) capabilities used.
4. Estimate LD capabilities on the pipeline system.
5. Develop a set of "scenarios of concern" to be used as a basis for the evaluation of the LD capabilities.
6. Based on the analysis above and a set of "scenarios of concern", determine if the LD capabilities are able to meet the Company Compliance and Metrics, KPIs, and Targets.
7. If so; document per the LDCE and go to step 7.
8. If not; generate a list of LDCE "preventive and mitigative measures (PAMMs)," and go to step 7.
9. Submit to Management for approval of the LDCE PAMMs for the pipeline system.
10. Document the adequacy (risk tolerance), capability, and effectiveness of the LD capability and submit to the Risk Analysis Team.
11. Submit any and/or all necessary LDCE updates to the person(s) responsible for the "Operational & Maintenance" and PIM documentation.

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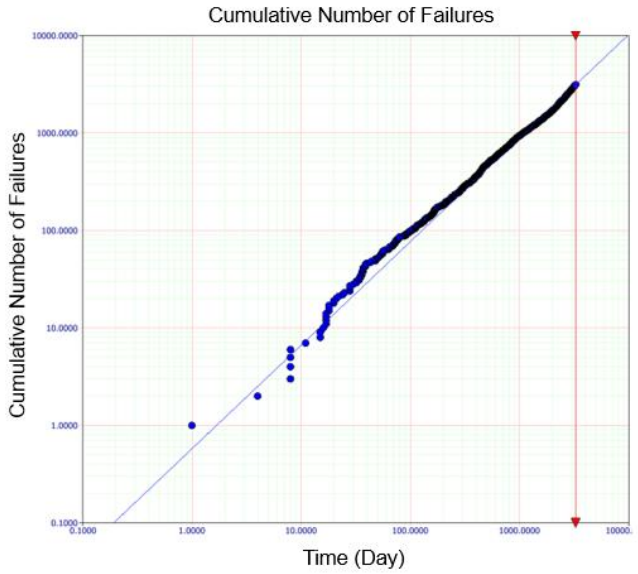
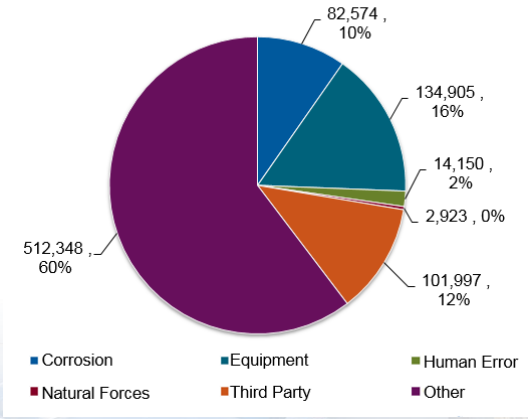
Continued alignment with Company Enterprise Processes

Consequence comparison To Incident Data

Guidance for estimating risk using Risk Matrix

LARGE	MEDIUM	SMALL
LARGE RELEASE (MAXIMUM RELEASE VOLUME): To calculate release volume, consider the following factors: • Pipe size • Diameter • Flow rate • Swiftness of leak detection • Maximum release time • Shut-down time Use worst-case estimates to calculate WCDV (refer to FRP)	**MEDIUM RELEASE (MOST LIKELY RELEASE VOLUME):** To calculate release volume, consider the following factors: • Pipe size • Diameter • Flow rate • Swiftness of leak detection • Maximum release time • Shut-down time Use most-likely estimates or historic data to calculate release volume	**SMALL RELEASE (MAXIMUM UNDETECTED VOLUME):** To calculate release volume, consider the following factors: • Pipe size • Diameter • Flow rate • Swiftness of leak detection • Maximum release time • Shut-down time Determine the maximum release volume that can not be detected by current LD system (note that "small" release for some pipelines can be a significant volume depending on LD capabilities)
LARGE RELEASE (LIKELIHOOD): To estimate the likelihood for catastrophic failure, SMEs must consider the following threats: • stress corrosion cracking • material problems (seam) • third party damage • operator or procedures errors • natural forces damage • fatigue Risk analysis results and risk drivers must be reviewed when evaluating these threats	**MEDIUM RELEASE (LIKELIHOOD):** To estimate the likelihood for most-likely failure, SMEs must consider the following threats: • external and internal corrosion • material problems • third party damage • operator or procedures errors • equipment failures • construction errors Risk analysis results and risk drivers must be reviewed when evaluating these threats	**SMALL RELEASE (LIKELIHOOD):** To estimate the likelihood for most-likely failure, SMEs must consider the following threats: • external and internal corrosion • materials problems • operator or procedures errors • equipment failures • construction errors Risk analysis results and risk drivers must be reviewed when evaluating these threats
LARGE RELEASE (CONSEQUENCE): To estimate the consequence of catastrophic failure, SMEs must consider the following: • Product impact on HCA (product hazard) • Volume released • Proximity to HCA and transport pathways • Terrain and product dispersion • Response capabilities • Clean-up costs HCA maps and modeling results must be reviewed. Possibility of product transfer via small waterways, drainage ditches & farm tile must also be evaluated.	**MEDIUM RELEASE (CONSEQUENCE):** To estimate the consequence of catastrophic failure, SMEs must consider the following: • Product impact on HCA (product hazard) • Volume released • Proximity to HCA and transport pathways • Terrain and product dispersion • Response capabilities • Clean-up costs HCA maps and modeling results must be reviewed. Possibility of product transfer via small waterways, drainage ditches & farm tile must also be evaluated.	**SMALL RELEASE (CONSEQUENCE):** To estimate the consequence of maximum undetected release, SMEs must consider the following: • Product impact on HCA (product hazard) • Volume released undetected • Proximity to DW/ECO and transport pathways • Soil type and product dispersion • Contamination of soil and ground-water • Clean-up costs Possibility of transport to HCAs via ground water & farm tile must be evaluated





Leak detection reduces the consequence portion of a LOC and does not reduce the likelihood of a leak (leak prevention does this).

LD Capability vs. Best Available

↓ Strategies / Alternatives →	1	2	3	4	5	6	7	8	9	10	11	12
Ground/SCADA Surveillance (Daily)	●	●	●	●	●	●	●	●	●	●	●	
Pressure Monitoring	●	●	●	●						●	●	
Pressure Alarms (Analog)	●	●	●	●							●	
Negative Pressure Wave	●			●							●	
Fiber Optic Leak Detection	●										●	
System Balance Log (daily)	●										●	
Manual over/short log (hourly)										●		
Custody Quality Measurement		●	●	●								
Modified Vol. Balance/Calc. Mass Balance		●										
Maintain Back Pressure/Line Pressure		●	●	●							●	
Pressure Measurement at Mainline Tie-Ins		●	●	●							●	
Real Time Transient Model			●									
Hybrid Computerized Pipeline Monitoring				●								
Aboveground Cameras (sensitive areas)					●							
Aboveground Cameras (tank monitoring)						●						
Surface Hydrocarbon Sensors							●					
Open Path Sensors							●					
Sheen Detectors								●				
SmartBall(s)												●

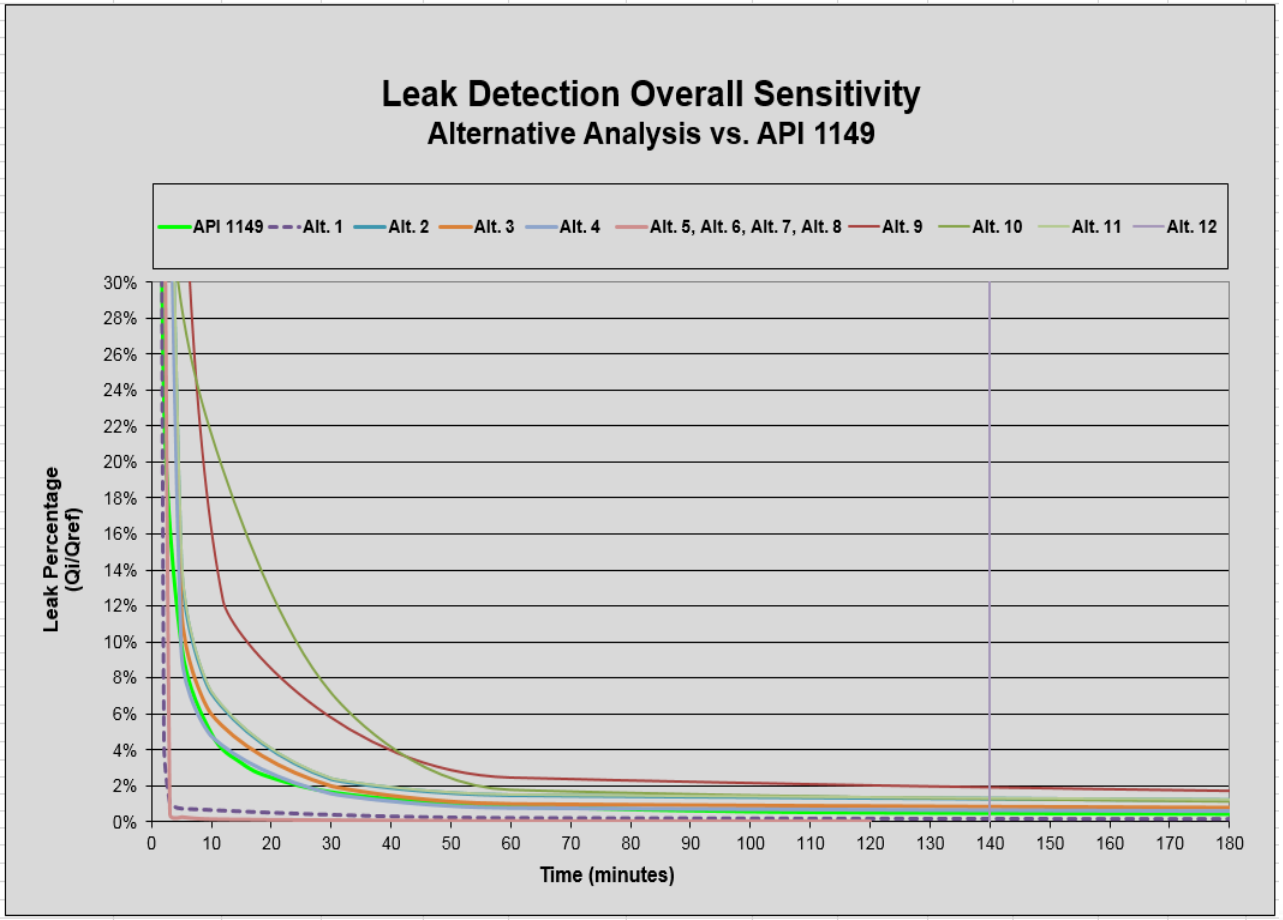
Example Alternative: ***Hybrid System (Statistical w/ mCB & NPW, backpressure and line pressures at mainline tie ins***

- The "Current LD Capability," and other "Best Available Technology," are the "Alternatives," that are and assessed.
  - Illustrates the LD "Strategies," and LD "Alternatives," to mitigate any LD gaps, enhance existing LD capabilities, and reduce the associated risk on the asset.
- A list of selection criteria and considerations, and select the LD satisfying those criterion and considerations.

The leak detection strategy can be satisfied in part by selection of LD that best fit the requirements of the strategy.

GENERATION OF API 1149 CURVES

- Within the LDCE, are several iterations and generations of API 1149 curves determine the sensitivity of each Alternative for detecting leaks.



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Leak Detection Dart Board. How sensitive is the Dart?

Alternative vs. Scenarios of Concern

Alternatives vs Pipeline Failure Modes

↓ Failure Modes — Alternatives →	1	2	3	4[a]	5	6	7	8[b]	9	10	11	12
Rupture resulting from a third-party pipeline strike	●	●	●	●	◖	◖	◖	◖	◖	●	●	○
Crude oil theft through illegal hot-tapping	◖	○	○	◖	◖	○	◖	○	○	○	●	○
Leakage from corrosion (small/medium, aboveground/buried)	◖	○	○	◖	●	◖	◖	◖	○	○	◖	◖
Major road crossings	◖	◖	◖	●	◖	○	○	○	○	◖	●	◖
Minor road crossings	◖	◖	◖	●	◖	○	○	○	○	◖	●	◖
River and canal crossings	○	◖	◖	◖	○	○	○	●	○	◖	◖	◖
Localized community areas	◖	◖	◖	●	◖	○	○	○	◖	◖	●	◖
Idle/shut-in (pressurized)	◖	◖	◖	●	◖	◖	◖	○	○	◖	●	◖
Leak on mainline or trunkline (small/medium)	◖	◖	◖	●	◖	○	◖	○	◖	◖	●	◖
Leak on gathering lines upstream of tie-in (small/medium)	○	◖	◖	◖	◖	◖	◖	○	○	○	○	◖

- The “Scenarios of Concern” (SOC) are the “Failure modes,” that present key risks to the asset.
- Illustrates the adequacy of each LD Alternative relation to “Failure mode and Alternatives,” for closing gaps and enhancing existing capabilities.

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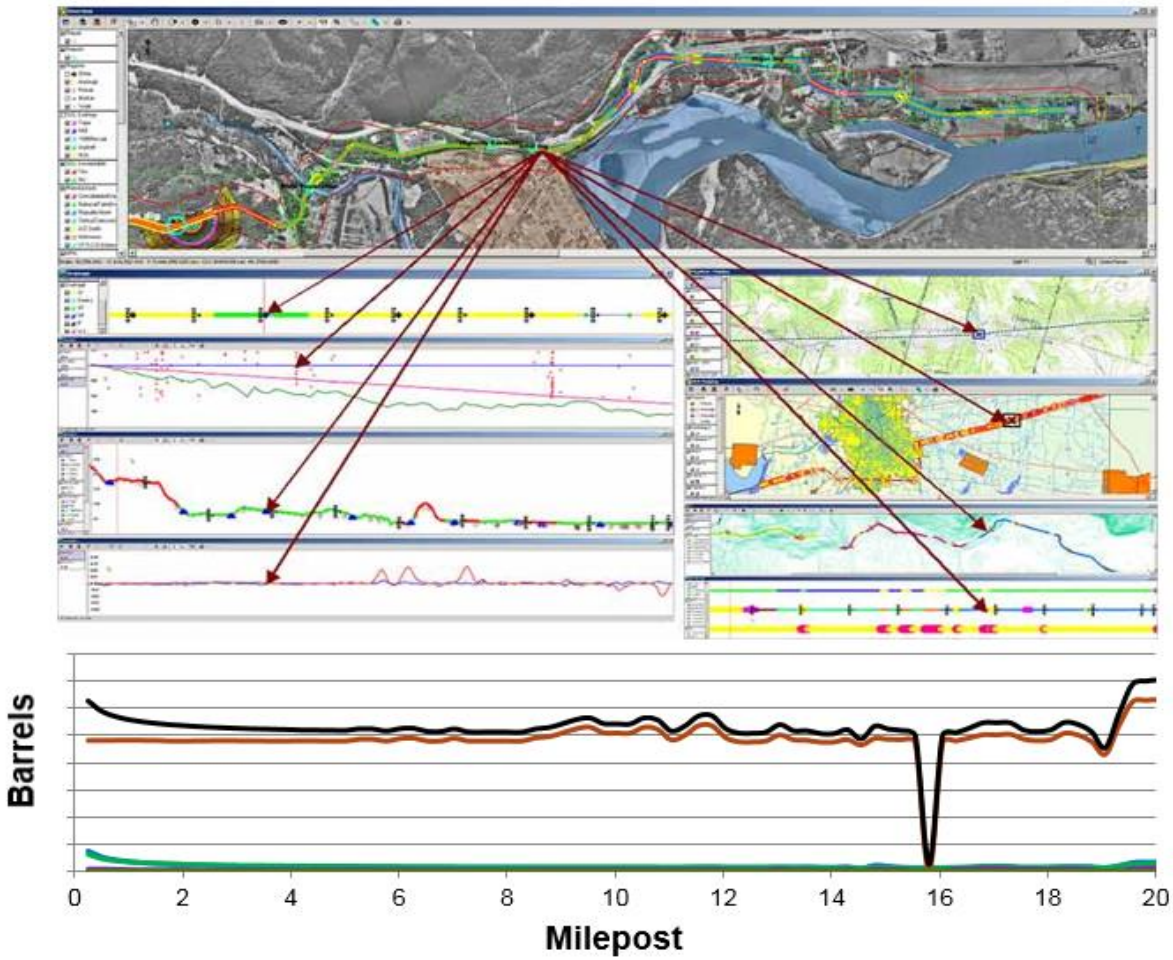
Measuring Leak Detection Adequacy for each Alternative.

Overall Spill Modeling (OSM)

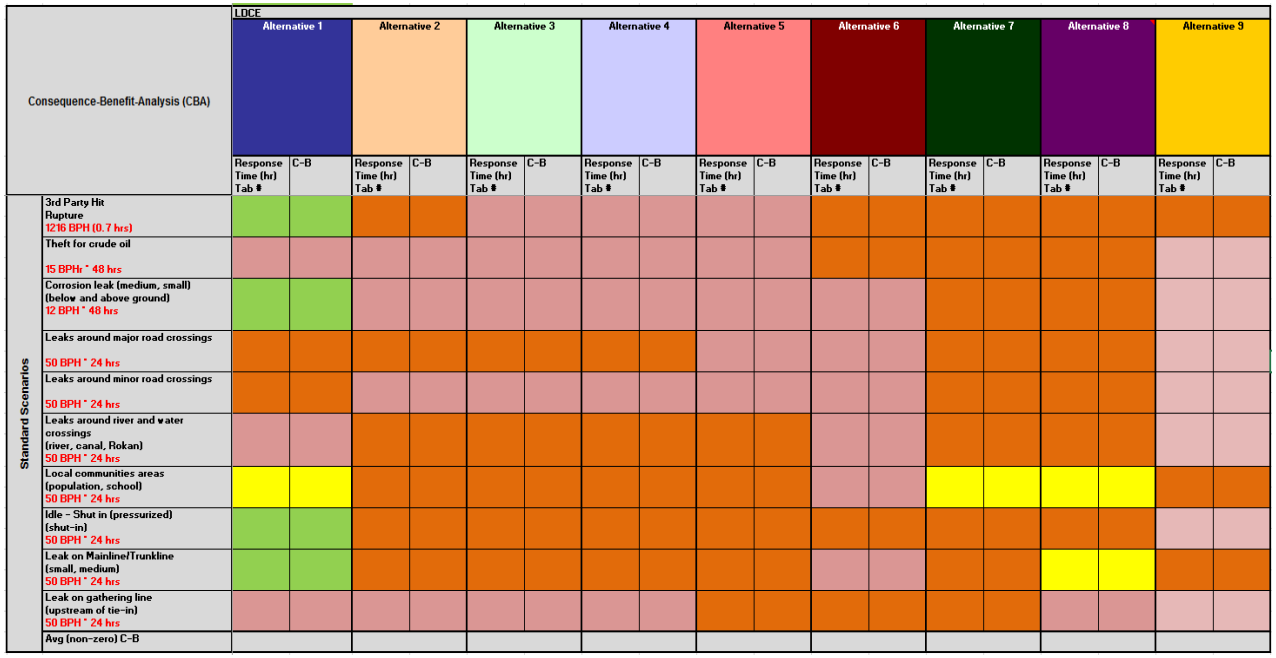
- Estimate loss of containment volume from a full rupture down to a pinhole leak for preferred alternatives, relative to SOC.
  - Assessed the volume lost during discrete stages of an event:
  - Start of leak through to alarm activation (Detection)
  - Alarm activation through to response initiation (Response).
  - Response initiation through to shutdown (Shutdown).
  - Drain down period (Drain-down).



Estimate leak consequences, and help determine the best LD capabilities

CONSEQUENCE-BENEFIT-ANALYSIS (CBA)

- Since the LDCE has the documented:
  - Adherence to Regulations, Best Practices, and Company Requirements
  - Existing LD & Response Capabilities (current mitigation),
  - Scenarios of Concern (based on Risks (Consequence), Leak History, Gaps, etc.),
  - Alternatives proposed "mitigate" those Scenarios of Concern.

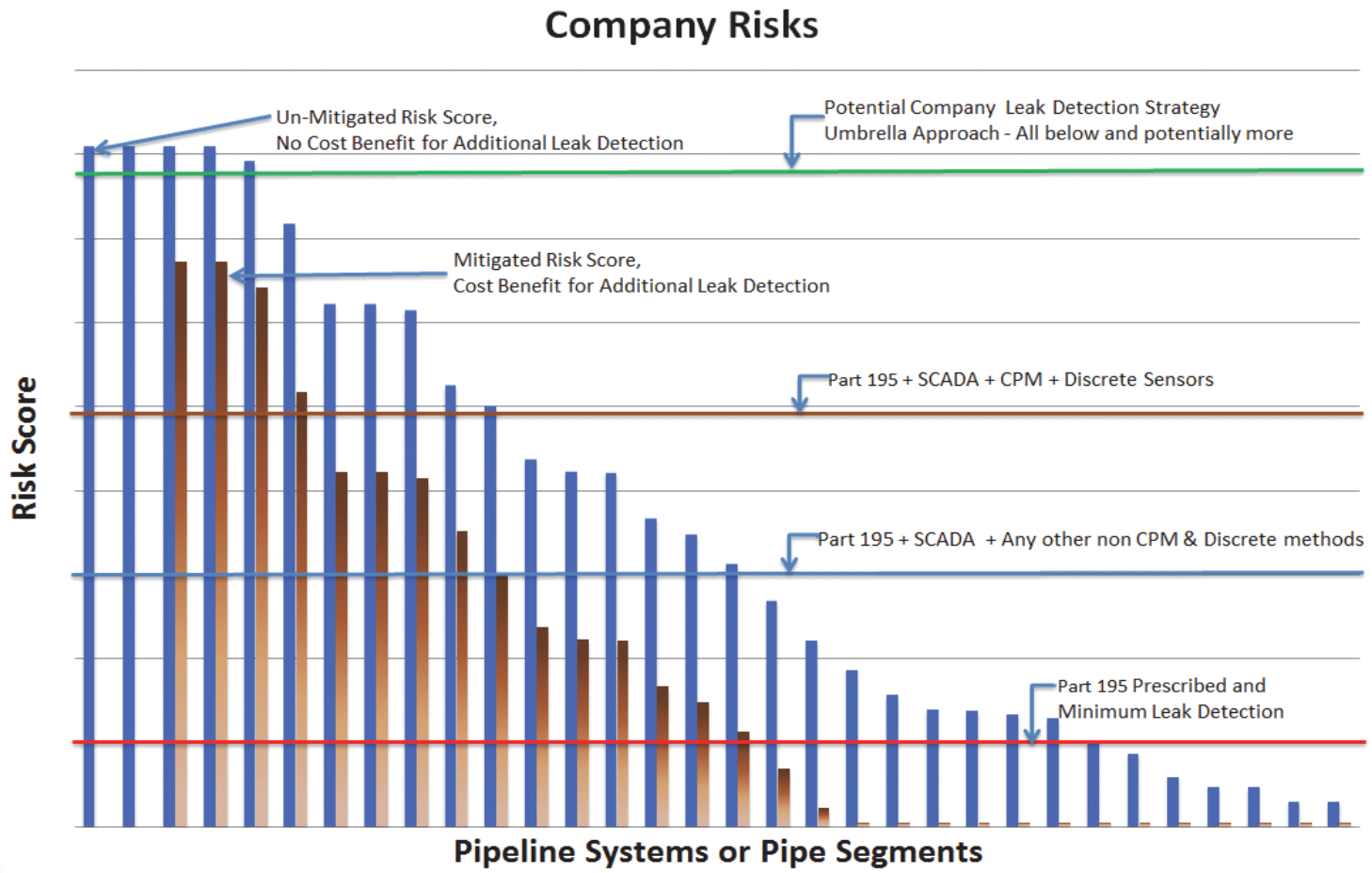


- The Roadmap above, is based on the SOC, response times of the unmitigated vs. mitigated consequences, uses the EPA BOSCEM, PHMSA incident, data analysis, and LD SME numerical recipes and analysis.

Best
Better
Good
Unknown Or Zero

Keep finding ways to enhance your current leak detection capabilities to help drive the Company Spill KPIs down.

Meet Company Compliance and Metrics



- Illustrates one or more layers of LD and Risk Reduction via Consequence Reduction.

Thank You for Attention

Questions / Comments / Suggestions?

Knowledge is the accumulation of facts and data that we have learned about or experienced.

Wisdom is the ability to discern and judge which aspects of that knowledge are true and applicable.

Insight is knowing. Move from *Think* to ***Know.***

"An investment in knowledge pays the best interest" ~ Benjamin Franklin

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Open Session

Wednesday and Thursday, April 26th and 27th, 2017

About this session

- It is the intention of this session to give the industry participants an opportunity to help each other.
- It will help API and the Implementation Team to better understand industry challenges.
- We plan to have 6-15 minute sessions with some thought starter questions provided.

Performance Targets and Metrics

- How do you measure the alignment of your leak detection programs to your risk management plan.
- How do you measure the effectiveness of your LDP's/How often do you measure the effectiveness? (Training? Maintenance? Culture? Strategy?)
- How do you measure the effectiveness of your LDS's/How often do you measure the effectiveness? (Training? Maintenance? Culture? Strategy?)
- How can you support an industry wide benchmarking?

ROLES AND RESPONSIBILITIES

- What kind of leak detection training currently available for your pipeline operators?

- How do you clarify the different training needs of your operators vs. other stakeholder regarding leak detection?

Leak Detection Equipment Maintenance

- What kinds of Maintenance program challenges has the RP produced? How are you dealing with them?

- How do you ensure that the quality of data that is feeding your leak detection systems/processes is credible?

Leak Detection Program Evaluation

- When you think of your Leak Detection Program what gives you anxiety?
- How do you measure that? What is good enough?
- Do you have any lessons to share?
- What successes can you report?

ONGOING IMPROVEMENT

- What company cultural aspects do you have that impede or accelerate a high performance leak culture?
- Where do we as an industry need further technological development?
- Where do you expect to place most of your improvement efforts?
- What else are you doing that's beneficial that's not addressed in the RP?

CLOSING

- What is needed from API to advance implementation of this RP?
- How can the members of industry further help each other?
- How can the vendor community assist in the process?

WORKSHOP CLOSING REMARKS

What's Next?

1. Complete post-workshop on-line survey
2. Remaining Operators to conduct baseline gap assessments by end of Q2 2017 and submit results summary to API
3. Develop and implement actions that will close gaps to conform to API RP 1175 in 2017 - 2018

Upcoming Opportunities

1. Leak Detection Incident Sharing at PIX Houston - Oct 3, 2017
2. Leak Detection Program Management Webinar - Nov 2017

Thanks!!!