AN INNOVATIVE APPROACH TO IMPROVED PIPELINE INTEGRITY MANAGEMENT
PRESENTERS

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G2 Integrated Solutions
G2 Integrated Solutions delivers expertise to pipeline operators, utility companies, and other energy stakeholders in seven specialized service disciplines:

• Asset Integrity
• Engineering
• Geospatial Systems and Services
• Regulatory Compliance
• Field Services
• Technology Services
• Strategic Consulting

G2-IS has offices located in Houston, Texas (Corporate Headquarters), Angleton, Texas, Concord, California, and Denver, Colorado.

For more information visit www.G2-IS.com
AN INNOVATIVE APPROACH TO IMPROVED PIPELINE INTEGRITY MANAGEMENT
INTEGRITY MANAGEMENT PROGRAM
PROGRAM IMPROVEMENT - MATURITY CURVE

Improve Process

Reduce Exposure

Exposure

Meets Requirements
Gaps Exist, but are Known
Most Processes In-Place
Continuously Improving
Fully Integrated in Enterprise

1. Compliant
2. Developing
3. Competent
4. Optimizing
5. Excellent

- Safety
- Efficiency
- Compliance
- Failure Risk
- Availability
- Staff Attrition
- Reputation

Reactive
Predictive
INTEGRITY MANAGEMENT PROGRAM

THE ROLE OF PROCESS IMPROVEMENT IN PROGRAM MATURITY

Exposures

• Safety
• Efficiency
• Compliance
• Risk
• Availability
• Staff Attrition
• Reputation

Potential Issues

Integrity Related
Break-Downs or Events
Related to People,
Process & Technology

Integrity Management Processes

Training Processes
People Processes
System Processes
Material Processes
INTEGRITY MANAGEMENT PROGRAM
MATUREITY CURVE

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1 2 3 4 5
Compliant Developing Competent Optimizing Excellent

Reactive Predictive

INTEGRATED SOLUTIONS
KEY ISSUE #1 – RECENT INCIDENTS
THE ROLE OF PROCESS

Consider how process break-downs were significant contributors in recent incidents…. 
The company’s pipeline integrity management program, which should have ensured the safety of the system, was deficient and ineffective because it:

1. Was based on incomplete and inaccurate pipeline information
2. Did not consider the design and materials contribution to the risk of a pipeline failure
3. Failed to consider the presence of previously identified welded seam cracks as part of its risk assessment
4. Resulted in the selection of an examination method that could not detect welded seam defects
5. Led to internal assessments of the program that were superficial and resulted in no improvements.
The probable cause of the pipeline rupture was corrosion fatigue cracks that grew and coalesced from crack and corrosion defects under disbonded polyethylene tape coating, producing a substantial crude oil release that went undetected by the control center for over 17 hours. The rupture and prolonged release were made possible by…

1. Deficient integrity management procedures, which allowed well-documented crack defects in corroded areas to propagate until the pipeline failed.

2. Inadequate training of control center personnel, which allowed the rupture to remain undetected for 17 hours and through two startups of the pipeline.

3. Insufficient public awareness and education, which allowed the release to continue for nearly 14 hours after the first notification of an odor to local emergency response agencies.
KEY ISSUE #2 - SHORTFALLS OF RISK ANALYSIS

THE ROLE OF RISK IN INTEGRITY PROCESSES

• Are you using risk results to drive risk mitigation decision-making processes?
• Are results timely and being used by other integrity processes?
• Given the investment you may be making in risk analysis, how are risk results used to drive overall program improvement?
KEY ISSUE #3 – REGULATORY INITIATIVES

NEW RULES

• Gas Mega-Rule Key Process Areas Impacted
  o repair criteria for both HCA and non-HCA areas
  o assessment methods
  o validating & integrating pipeline data
  o risk assessments
  o knowledge gained through the IM program
  o corrosion control
  o management of change
  o gathering lines
  o safety features on launchers and receivers

• API RP 1173 Pipeline Safety Management Systems
  o industry response to recent incidents
  o Process is mentioned 111 times
INTEGRITY MANAGEMENT PROGRAM
APPLYING A PROCESS BASED APPROACH

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A PROCESS BASED APPROACH

REDUCING EXPOSURE
BY IMPROVING PROCESS
Key Take-Aways

- Explanation of Approach
- Example with Templates
- Recommended Resources
TYPICAL INTEGRITY PROGRAM
INTEGRITY PROGRAM ELEMENTS

Integrated Program Layers

Risk Management
Assessment Management
Mitigation Management
Dig & Repair Management
.. more ...

Document Management
Data Management
Change Management
Communications Management
.. more ...

Governance Programs

Functional Programs

Drivers
• Business
• Public
• Regulators

Objectives
• Efficiency
• Compliance
• Safety
• Reliability
• Reputation
• Availability
• Knowledge

Resources ($ PPT)
• People
• Process
• Technology
TRADITIONAL RISK VIEW
USING FAILURE RISK TO DRIVE IMPROVED PROGRAM RESULTS

- Resources are Generally Directed to Areas Exceeding Thresholds along Asset

Risk-Based View

Asset Failure Risk Exposure (normalized $/mile)

Failure Risk

Failure Risk

Current

Target

Performance Gap

$ PPT Spend

Risk-Based View
TRADITIONAL RISK VIEW
USING FAILURE RISK TO DRIVE IMPROVED PROGRAM RESULTS

- Determine Exposure - Asset Failure Risk ($/mile-time, 0-10, matrix, etc.)
- Identify Current vs. Target Exposure (performance gap)
- Close Gap thru $ PPT Spend – ($/mile-time, $/project, $/asset, etc.)
- Determine Benefit – Reduction in Exposure
A PROCESS BASED VIEW
IMPROVING RESULTS THRU IMPROVED PROCESS

- In this Case, Failure Risk is Actually Managed within Programs
- Programs & Underlying Processes are where the Real Work Happens
- Improving Risk Results happens by working on these Processes
PROCESS BASED VIEW
REDUCING EXPOSURE IN OTHER AREAS

Improving Efficiency

Improving Asset Availability
A PROCESS BASED VIEW
AGGREGATING METRICS

- Aggregated View – A Complete Picture of Exposures
- Drive Improvement thru Improved Program Processes
- Build Mitigation Strategy from the Program View

Program-Based View
INTEGRITY MANAGEMENT PROGRAM
MATURITY CURVE

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THE PROCESS APPROACH

AN EXAMPLE
A FOUR STEP COLLABORATIVE APPROACH
AN APPROACH FOR IMPROVED PROCESS PERFORMANCE

Discover your Processes

Measure your Processes

Implement Improvements

Discover Improvements
KEY RESOURCES
PROCESS BASED PRACTICES

Documents
• API RP 1173 Pipeline Safety Management Systems
• ISO 55000 Asset Management
• IAM Asset Management – An Anatomy
• PHMSA & NEB Pipeline Regulations & Protocols
• PHMSA Advisory Bulletin ADB-2012-10

Web-Sites
• ProcessExcellenceNetwork.com (Process Best Practices)
• APQC.org (American Productivity and Quality Council)
• BPM.com (Business Process Best Practices)
• TheIAM.org (Institute of Asset Management)
AN EXAMPLE
APPLY APPROACH TO A PROGRAM

- Select the Dig & Repair Program

<table>
<thead>
<tr>
<th>Exposure (normalized $/mile)</th>
<th>$ PPT Spend</th>
<th>Failure Risk</th>
<th>Cost or Efficiency</th>
<th>Availability</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dig &amp; Repair Program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosion Program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Records Program</td>
<td></td>
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<tr>
<td>OQ Program</td>
<td></td>
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<tr>
<td>MOC Program</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Public Aware Program</td>
<td></td>
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</tr>
</tbody>
</table>

Program-Based View

Performance Gap

Current

Target
STEP 1
COLLABORATIVE PROCESS DISCOVERY

Discover your Processes
Measure your Processes
Implement Improvements
Discover Improvements
DISCOVER YOUR PROCESSES
DEVELOP PROGRAM CANVAS THROUGH WORK-SHOPS

• Bring Program Stakeholders Together
• Use a Moderator to Facilitate Discussion
• Identify:
  o Program Initiation & End Points
  o Key Human & System Activities
  o Key Inputs & Outputs
  o Key Rule-Sets (Decision-Making)
  o Supporting Systems
  o Integrated Programs
• Keep the Canvas to One Page

Key Objective
Achieve agreement with stakeholders on program scope and common language/vocabulary to support discussions around program improvement
STEP 2
DEVELOP METRICS AND MEASURE YOUR PROCESSES

Discover your Processes

Implement Improvements

Measure your Processes

Discover Improvements
MEASURE YOUR PROCESSES

DEVELOP METRICS TO IDENTIFY IMPROVEMENT OPPORTUNITIES & PERFORMANCE GAPS

• Identify Metrics that Define State of Program & Processes
  o Identify Area (Safety, Efficiency, Availability, etc.)
  o Ability to get Metric (Data Availability, Confidence, etc.)
  o Units (Ability to Normalize, Meaningful, etc.)
  o Leading vs. Lagging (Leading more Effective?)
  o Reasonable Number (Select a Few for Each Area to Start)
  o Actionable (Metrics Should be Actionable)

Key Point

“If you can't measure it, you can't improve it”
- Peter Drucker
**MEASURE YOUR PROCESSES**

**DETERMINE APPROPRIATE METRICS**

<table>
<thead>
<tr>
<th>Metric Category</th>
<th>Example Metrics – Leading\Lagging</th>
<th>Current</th>
<th>Target</th>
<th>Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Efficiency</strong></td>
<td>• Lessons Learned (number/project)</td>
<td>4</td>
<td>10</td>
<td>6</td>
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<tr>
<td></td>
<td>• Cost per Dig ($/dig)</td>
<td>450,000</td>
<td>&lt;300,000</td>
<td>150,000</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td>• Pre-Planning Meetings (number/project)</td>
<td>0</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>• Lost Revenue ($/year)</td>
<td>500,000</td>
<td>&lt;100,000</td>
<td>400,000</td>
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<tr>
<td><strong>Failure Risk</strong></td>
<td>• Current Mitigated Exposure ($/asset-yr)</td>
<td>200,000</td>
<td>150,000</td>
<td>50,000</td>
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<tr>
<td></td>
<td>• Data Quality Gaps (number/mile)</td>
<td>20</td>
<td>0</td>
<td>20</td>
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<tr>
<td><strong>Compliance</strong></td>
<td>• Unacceptable Internal Audits (number/yr)</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>• Fines ($/year)</td>
<td>500,000</td>
<td>&lt;50,000</td>
<td>450,000</td>
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</table>
MEASURE YOUR PROCESSES
RELATE METRICS TO EXPOSURES

Exposure (normalized $/mile)

- Failure Risk
- Cost or Efficiency
- Availability
- Compliance

Dig & Repair Program

- Exposure to Cracking Failure ($/mile)
- Cost per Dig Exposure ($/mile)
- Exposure to Service Interruptions ($/mile)
- Exposure to Audits & Fines ($/mile)

Improve Process
STEP 3
COLLABORATIVE DISCOVERY OF IMPROVEMENTS

Discover your Processes

Manage Improvements

Discover Improvements

Measure your Processes
DISCOVER IMPROVEMENTS
A COLLABORATIVE APPROACH

• Discuss & Document Opportunities for Improvement
• Focus on the Elements within the Program Canvas
• Vet Opportunities and Mitigation Options
• Generate 50-100 Improvement Ideas per Program
## DISCOVER IMPROVEMENTS

### IMPROVEMENT EXAMPLES (ALSO CALLED BACKLOG USER STORIES)

<table>
<thead>
<tr>
<th>Structure Item</th>
<th>Efficiency</th>
<th>Failure Risk</th>
<th>Compliance</th>
<th>Availability</th>
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</thead>
<tbody>
<tr>
<td>Story</td>
<td>We have had problems with Sleeve material delays during dig repairs in the Western region. I would like 100% assurance that sleeve materials will be available at least 5 days prior to scheduled dig related repairs.</td>
<td>We sometimes find evidence of cracking near repair weld areas. This was not previously known and we would like to plan for potential crack areas prior, ensuring we have the proper procedures &amp; materials on-hand to address higher risk repairs.</td>
<td>We have had problems with demonstrating traceability of repairs to auditors.</td>
<td>Assessment digs are scheduled during peak use which causes lost tariff revenue. I would like to schedule assessments &amp; repairs during low utilization time periods.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Events</th>
<th>5</th>
<th>1</th>
<th>10</th>
<th>1</th>
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<table>
<thead>
<tr>
<th>Event Cost</th>
<th>80,000</th>
<th>500,000</th>
<th>100,000</th>
<th>250,000</th>
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<table>
<thead>
<tr>
<th>Exposure</th>
<th>400,000</th>
<th>500,000</th>
<th>1,000,000</th>
<th>250,000</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Mitigation Option</th>
<th>Provide Actual Material Inventory Pre-Notification to Project Manager</th>
<th>Hire Risk Engineer Expert to Perform Crack Analysis &amp; Susceptibility</th>
<th>Put in Place a System to Trace Field Activity to Materials</th>
<th>Insert Penalty Clause for ILI Contractor Late Reports</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Mitigation Cost</th>
<th>90,000</th>
<th>150,000</th>
<th>250,000</th>
<th>50,000</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Mitigation Effectiveness</th>
<th>80%</th>
<th>80%</th>
<th>80%</th>
<th>50%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Exposure Reduct. &amp; ROI</th>
<th>320,000</th>
<th>400,000</th>
<th>800,000</th>
<th>125,000</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Priority</th>
<th>Must</th>
<th>Must</th>
<th>Should</th>
<th>Should</th>
</tr>
</thead>
</table>
PROGRAM CANVAS

HEAT MAP

Dig & Repair Program – Canvas

- High Exposure
- Medium Exposure
STEP 4
MANAGE IMPROVEMENTS

Discover your Processes

Measure your Processes

Discover Improvements

Manage Improvements
STEP 4
CURRENT VS. TARGET

Example Pipeline System
Dig & Repair Program
Base Exposure

Performance Gap

Current

Target
STEP 4
SELECT IMPROVEMENTS TO MEET TARGET

Priority Matrix

- Improvement Opportunity

Exposure Reduction ($)

Improvement ROI (Benefit/Cost)

- Must
- Could
- Should
- Won't

0.01 0.10 1.00 10.00 100.00

INTEGRATED SOLUTIONS
STEP 4
SELECT STORIES TO MEET TARGETS
STEP 4
REducing or Managing Exposure

Example Pipeline System
Dig & Repair Program
Base Exposure

Performance Gap

Base Exposure vs. Target Exposure

Primary Objective
- Improved Risk
- Improved Efficiency
- Improved Compliance
- Improved Availability

1 Must
SUMMARY
AN APPROACH FOR IMPROVED INTEGRITY MANAGEMENT

• Improve Process
• Reduce Exposure
• Leverage Existing Resources
• Improve Program Success
PARTICIPANT SURVEY & QUESTIONS

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