PIPELINE INTEGRITY MANAGEMENT SYSTEM (PIMS)

N Bose Babu
General Manager (TS and O&M), Director, GITL/GIGL

Disclaimer:

The views and opinions expressed are solely those of the presenter and do not represent the views or opinions of any company or entity that the presenter is associated.
Objective:

Prevention of Pipeline failures through Integrity Management System.

What happens when disaster strikes...
What is Integrity Management System?

“A comprehensive, systematic and integrated process that includes all the activities that are required to prevent a failure”
Background of Integrity Management

- **ASME B31.8 S, was first issued in 2001** - this standard was non-mandatory and is designed to supplement ASME-B 31.8 and applies to onshore pipelines that transport Natural Gas.

- PNGRB regulation for Integrity Management System notified in the year 2012.

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Why do we need IMS?

- To define a systemic approach.
- To identify the potential risk by way of threats and applying preventive methods.
- Any failure of pipeline what so ever reasons may result in loss of commodity (Natural Gas), effect on environment, loss of property and life.
- The reputation of the organization be at stake.
Integrity Management System: is a life cycle approach

It involves all aspects of the Pipeline system right from Design, Construction, Operation & Maintenance (O&M) and Integrity Management.

IMP - Process Flow Diagram

1. Identifying potential pipeline impact by threat
2. Gathering, reviewing, and integrating data
3. Risk Assessment
   - All threats evaluated
     - NO
     - YES
       - Integrity Assessment
6. Responses to Integrity assessments and

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1. Document Program
   Plan, Implementing Procedure, and Qualification Criteria

2. Identify covered tasks and related evaluation methods

3. Identify persons performing covered tasks

4. Evaluate and Quality persons, Performing covered tasks, including recognizing and reacting to abnormal operating conditions

5. Continued / Periodic Evaluation of persons performing covered tasks

6. Monitor program performance identify and analyze potential improvements

7. Maintain program records

8. Manage Change

9. Field Verification Inspection

No Longer Qualified

YES

Should person be reevaluate d?

NO

Collection of Data

Gathering, Reviewing and Integrating Data

- Data Requirements
- Data Sources (from where)
- Data Collection, Review and Analysis
- Data Integration

“Complete and Accurate data is the key to a successful IMP program”
Integrity Management Program Elements

- Integrity Management Plan
- Performance Plan
- Communication Plan
- Management of Change
- Quality Control Plan
Integrity Management Plan

- Development of Plan
- Updating the Plan
- Plan Framework
  - Gathering, Reviewing and Integrating Data
  - Assess Risk
  - Integrity Assessment
  - Responses to Integrity Assessment, Mitigation (Repair and Prevention), and Intervals

Performance Plan

- Help an operator answer the following Questions:
  - Were all integrity management program objectives accomplished?
  - Were pipeline integrity and safety effectively improved through the integrity management plan

- Performance Measures Characteristics
  - Process or Activity Measures
  - Operational Measures
  - Direct Integrity Measures
Continue...

- Performance Measurement Methodology
  - Performance Measurement
    - Intra-system
    - Industry Based
  - Performance Improvement

Communication Plan

- External Communication
  - Landowners and Tenants long the Rights-of-way
  - Public Officials other than Emergency Responders
  - Local and Regional Emergency Responders
  - General Public

- Internal Communication
  - Operator management and other appropriate operator personnel MUST understand and support the Integrity Management Plan
Management of Change Plan

- Reason for change
- Authority for approving Changes
- Analysis of Implications
- Acquisition of required work permits
- **Documentation**
  - Document is a KEY to QUALITY... in other words...
  - *If it isn't documented, it didn't happen.*
- Communication of change to affected parties
- Time limitations
- Qualification of staff

Quality Control Plan

- Def: Documentation proof that the operator meets all the requirements of their integrity management program
- **Requirements of QCP:**
  - Documentation
  - Implementation
  - Maintenance
- Responsibilities and Authorities shall be **CLEAR**
- Requirement of **Competent** Personnel
Risk Identification

*RISK = Probability * Consequences*

Any Pipeline segment the Risk Identification is a MUST

The Risk can be categorized into three levels:

- **Low = 1** (Rural location, little or no population, small diameter pipe low operating pressure.)
- **Medium = 2** (Residential location, medium diameter pipe, and medium operating pressure.)
- **High = 3** (Mostly multi-story buildings, Large diameter pipe, and High operating pressure.)
Risk Ranking Matrix

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consequence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1 x 1</td>
<td>1 x 2</td>
<td>1 x 3</td>
</tr>
<tr>
<td>Medium</td>
<td>2 x 1</td>
<td>2 x 2</td>
<td>2 x 3</td>
</tr>
<tr>
<td>High</td>
<td>3 x 1</td>
<td>3 x 2</td>
<td>3 x 3</td>
</tr>
</tbody>
</table>

Risk Assessment

“A systematic process in which potential hazards from facility operation are identified, and the likelihood and consequences of potential adverse events are estimated” – Management is that how resources are allocated.
What Can A Risk Assessment Do??

- Where will the next failure happen?
- Where are the hot spots?
- How many failures next year?
- What is the best use of my resource?
- What are the priorities?
- When will a failure occur?

"A risk assessment, no matter what method, cannot be precise because risk is not a precise concept."

Risk Assessment - Technical Approaches

- Knowledge-based
  - Subject Matter Experts develop ranking based on experience

- Scenario-based
  - Events analysis, fault trees, or failure-mode-and-effects analysis

- Relative Risk Model
  - Numerical score from algorithm that uses weighting factors on multiple attributes, based on actual data

- Probabilistic Model
  - Detailed statistical data about actual attributes used to estimate absolute risk
Risk Mitigation Process for NG Pipelines

Are pipelines located in high consequence areas?
- YES
  - Identify pipeline threats and perform risk assessments
  - Conduct baseline assessments, assessing pipelines with the greatest risk first.
  - Repair or replace any defective pipeline segments.
  - Perform preventive and mitigative measures.
  - Reassess pipelines as required.
- NO
  - Report this information. Evaluate pipelines periodically for new high consequence areas.

Direct Assessment: Hydro testing

All pipelines shall be hydro tested to 1.25 to 1.5 times of Design Pressure before putting into operations.

Hydro test Planning:
- Minimum pressure test requirements are given in the regulations, as well as in industry standards and recommended practices.
- API 1110 “Pressure Testing of Liquid Petroleum Pipelines”.
- Several threats can be removed by Hydro testing.
- The higher the test pressures the better safety factor.
Pipeline Threats

Different Threats

- Time Dependent
  - External Corrosion
  - Internal Corrosion
  - Stress Corrosion Cracking (SCC)

- Manufacturing Related Defects
  - Defective pipe seam
  - Defective pipe

- Welding/Fabrication Related
  - Defective pipe girth weld
  - Defective fabrication weld
  - Wrinkle bend or buckle
  - Stripped threads/broken pipe/coupling failure

- Equipment
  - Gasket O-ring failure
  - Control/Relief equipment malfunction
  - Seal/pump packing failure
  - Miscellaneous

- Stable
**Threats...**

**Time Independent**

- Third party / Mechanical damage
  - Damage inflicted by first, second, or third parties (instantaneous/immediate failure)
  - Previously damaged pipe (delayed failure mode)
  - Vandalism
- Incorrect operations
- Weather related outside force
  - Cold weather
  - Lightning
  - Heavy rains or floods
  - Earth Movements

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**If there are two or more ways to do something, and one of those ways can result in a catastrophe, then someone will do it...!!!**

*(Murphy's Law of Catastrophe)*

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**Mechanical Damages**

*the best defense against threat is Prevention*

- World wide approx. 35% of Cross country pipelines incidents are caused due to Mechanical Damages
- India – “?”, US – 35%, Europe – 50%

*PNGRB is now maintaining the data of pipeline failures.*

Heavy penalties be imposed on the agencies who damage the pipelines and the amount recovered to be spend for training the service providers and also to provide awareness to the local public.
Steps in Pipeline Repair

1. Locate damage
2. Assess severity of damage (e.g. corrosion, mechanical damage, etc.) and determine if and which repair is possible
3. Calculate required number of composite wraps (see code or manufacturer’s guidelines for respective repair type)
4. Clean, dress, inspect, and prepare pipe (surface preparation critical)
5. Install repair
6. Allow fillers and adhesives to cure per manufacturer’s Recommendations
7. Restore backfill and re-pressurize

Do you know “what data you want to collect when there is any excavation on Buried Pipeline??

Yes
- You are really LUCKY!!

No
- Coating thickness, bonding (peel test), pipe wall thickness, buried conditions, depth of pipeline.
- Do not forget to take a photograph before back fill.
- Keep dig sheet ready in future

*Note: Collect as much information as possible whenever you excavate the pipeline*
Do we have competent personnel for assigned task?

- Personal Qualification for all critical activities is very essential...
  (PI Ref. B31.8Q for personnel qualification)
- What is Competency Matrix...???
- Why do we need this ???

**Note:** one person can do supervision only of “n” number of personnel OR in a particular area

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Pipeline Integrity Management Related Web Sites.

- [www.cga.org](http://www.cga.org) – Common Ground Alliance
- [www.cga-dirt.org](http://www.cga-dirt.org) – Common Ground Alliance – DIRT Reports
- [http://api.org](http://api.org) – ASME Codes & Standards
- [http://www.egig.nl](http://www.egig.nl)
- [www.cga.org](http://www.cga.org) – Common Ground Alliance
- [www.pipeliineawareness.org](http://www.pipelineawareness.org) – Pipeline Association for Public Awareness
- [www.cga.org](http://www.cga.org) – Common Ground Alliance
- [http://cga.org](http://cga.org)
- [http://api.org](http://api.org)
- [http://dirt.org](http://dirt.org)
- [http://www.egig.nl](http://www.egig.nl)
Summary

- Global experience shows that the Integrity Management program approach has proven in prevention of incidents.
- The Quality of Pipelines are getting better day by day.
- By effective implementation of Pipeline Integrity Management System, reduce the risk of pipeline failures.

Question & Answers

you can reach me at bosebabu@gspc.in
Thank you...  
Jaihind