Pipeline Asset Integrity

overall integrity management of pipeline systems

Tony Yacob, C.Eng

Pipeline Engineering Specialist

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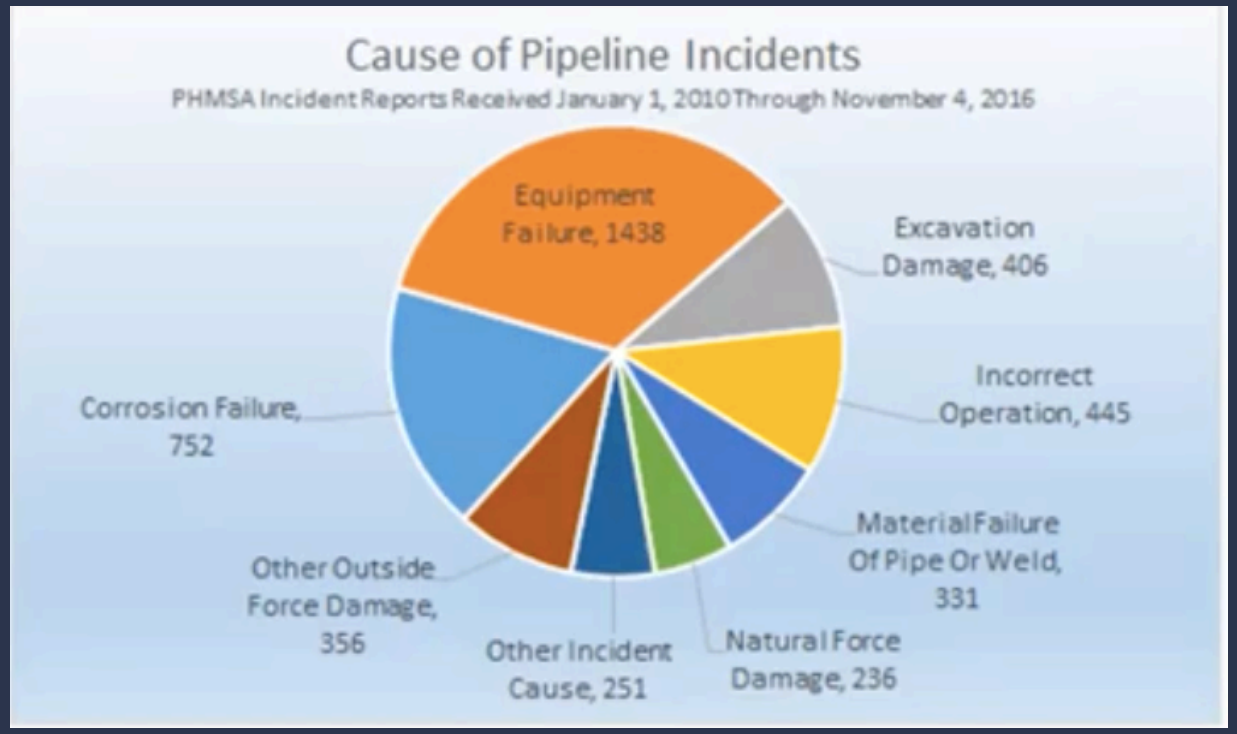
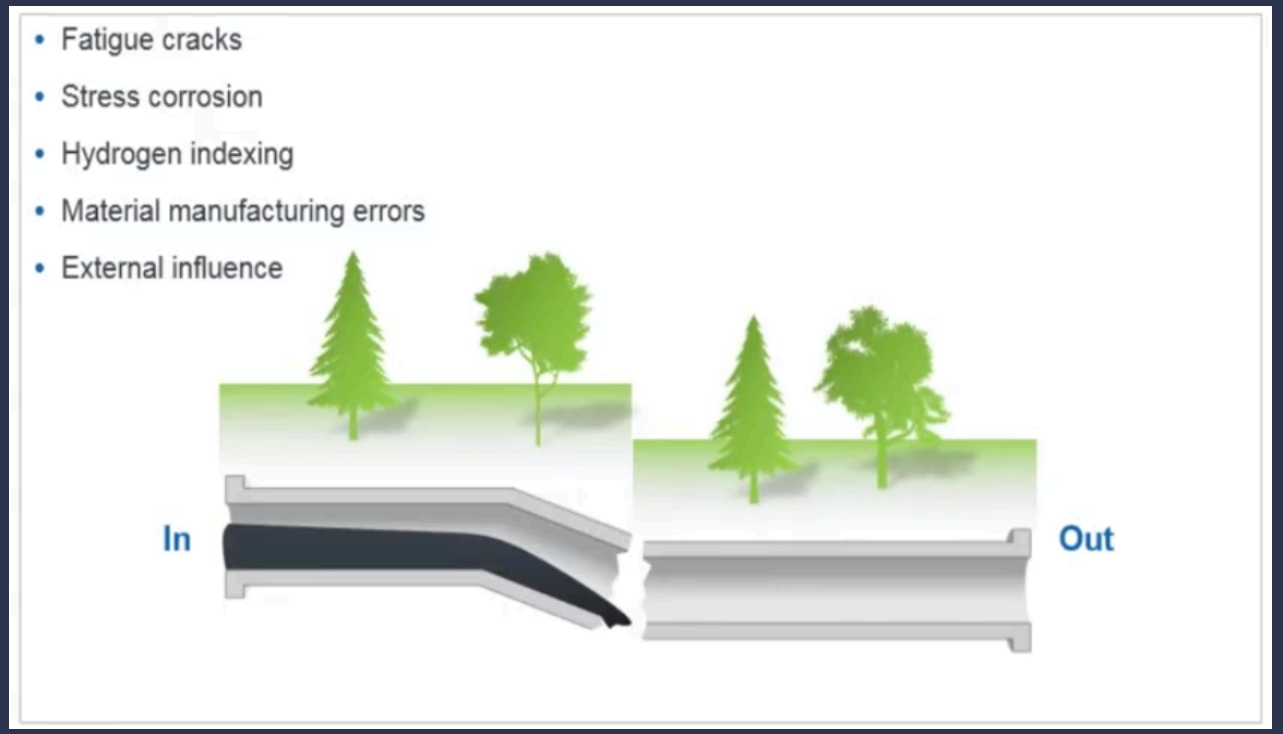
Agenda

- Pipeline Integrity Management System – Why / When / How
- Workflow for Overall Management of Integrity for Pipeline Systems
  - Foundation
  - Development Strategy
  - Planning and Scheduling
  - Execution
  - Tracking
  - Performance Management and Integrity Review
- Leak Detection
- Q & A

Pipeline Incidents / Cause of Leaks





[Ring of Fire video](https://www.youtube.com/watch?v=oE_3mrBZiEU)
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Objective of an Integrity Management for a Pipeline System

The objective is to deliver a safe design and quality build of the pipeline systems for safe operation during the asset life

should be structured to deliver;
- safe design
- quality build
- safe operations (no leaks)

Conformance - Delivery of the IM Strategy should conform to certain practice, standards and Codes (i.e., Opt'g Management System)

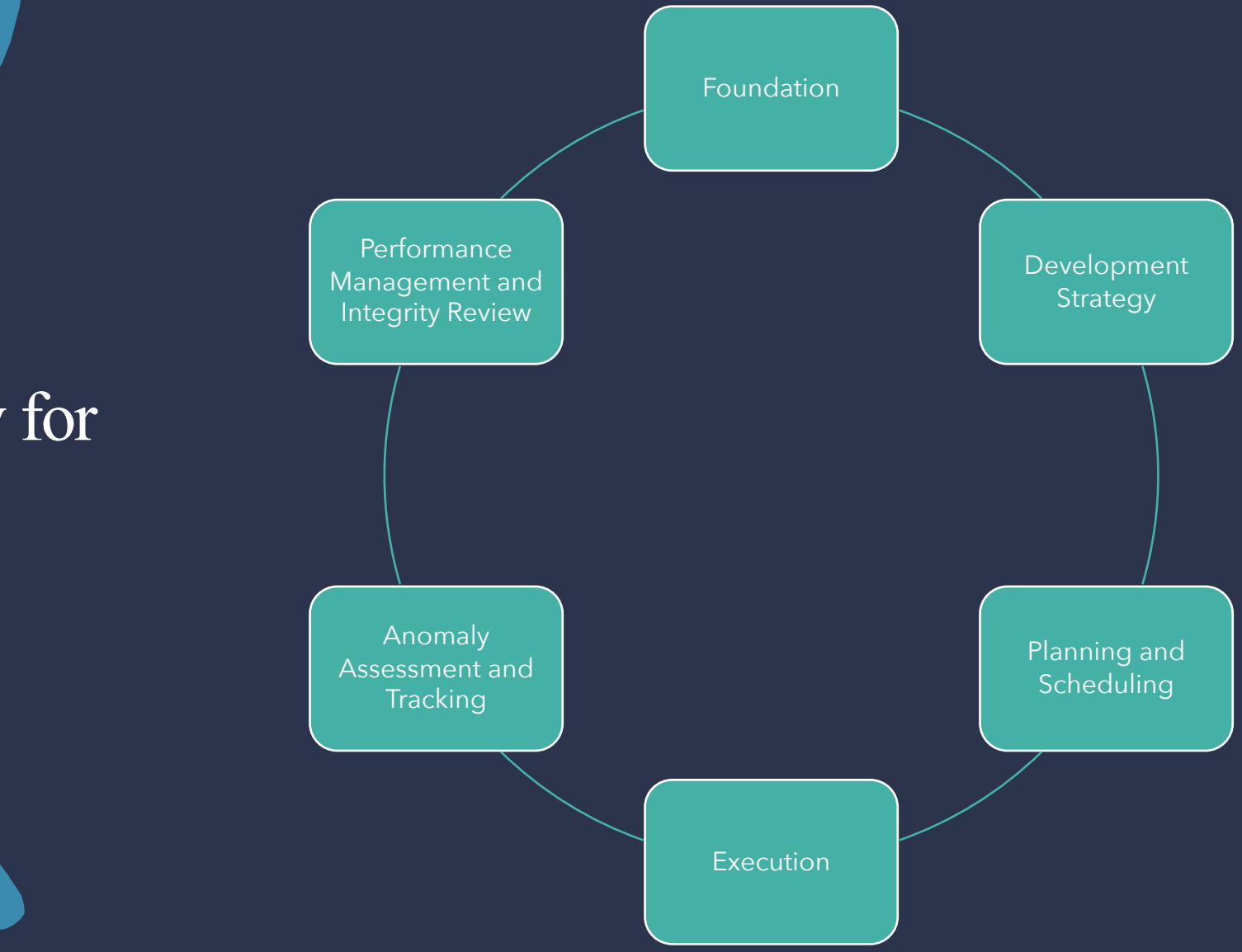
Integrity Management Strategy should be built to conform to specific Practice, Standards and Codes. For example;

ASME B31.8S; Pipeline Integrity Management

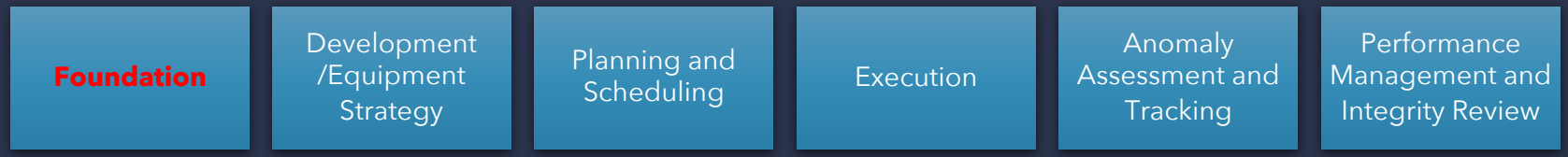
API 570; Piping Inspection Code for in-service Inspection, Rating, Repair and Alteration

API 579; Fitness for Service Assessment – assess equipment for fitness and life extension

Workflow for Overall Management of Integrity for Pipeline Systems



Workflow for Overall Management of Integrity for Pipeline Systems



Activity Integration - Strategic

- Asset Development Plan (ADP) – Life Cycle
- Statement of Requirements (SOR)
- Investment Case
- Risk Management

Foundation Information

- Organization
- Accountability and Responsibilities

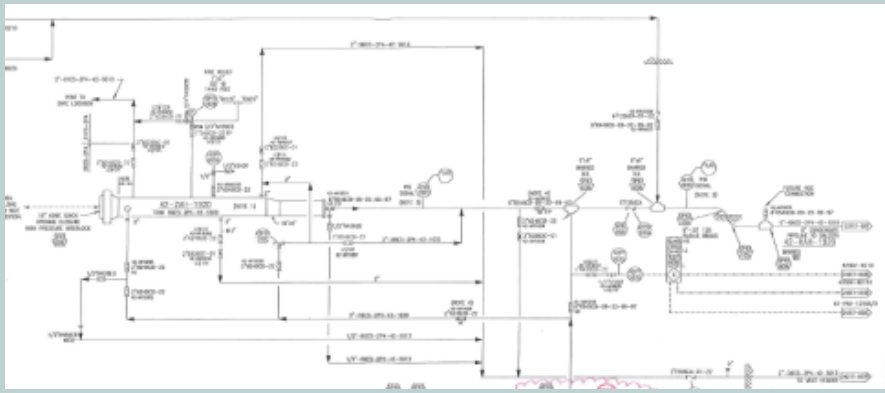
Foundation Information

- System Information
- System Boundaries
- Data Management (Document Control)
- Equipment Register

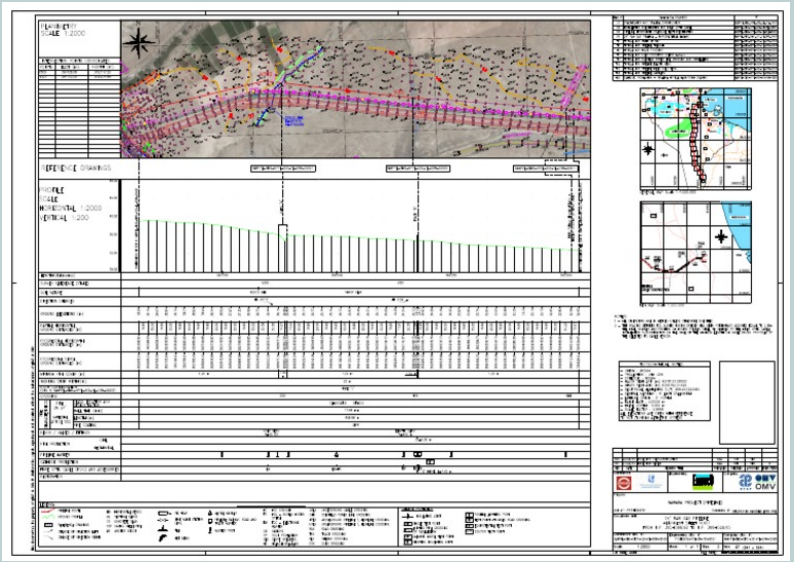
Pipeline Asset Register

- System description
- Materials
- Design Basis
- Pipeline Specifications
- Pipeline Manufacture
- Pipeline Installation Method
- Hydrostatic Testing
- Valves
- Protective Systems – Isolation / Depressurisation
- Engineering / Safety Studies
- As-built drawings
- Alignment Sheets
- Operation & Maintenance Dossier

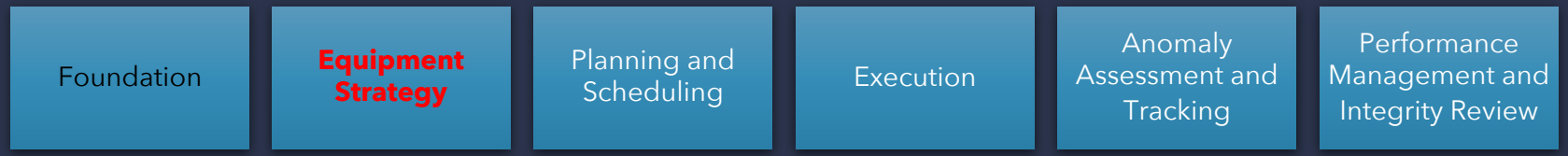
- Example of Typical P&ID drawing



- Example of Typical Alignment Sheet



Workflow for Overall Management of Integrity for Pipeline Systems



Equipment Strategy
Capture Learning

- Lessons learned
- Implementation plan for applicable lessons
- Self Verification
- **Risk Assessments**

Equipment Strategy
Define Operating Context

- Care plans for equipment needed to deliver safe, reliable and efficient operations
- Address the risks identified during project stages and operations
- Equipment Strategies include adequate detail about equipment functional performance requirements

Management of Change
Define Operating Limits

- Scope Change
- Technical Queries
- Deviations
- Concessions
- Vulnerabilities
- Enduring risks
- Interface Management

Workflow for Overall Management of Integrity for Pipeline Systems

Foundation | Equipment Strategy | **Planning and Scheduling** | Execution | Anomaly Assessment and Tracking | Performance Management and Integrity Review

Work Management - Identify Work

- FMECA
- Foundation Risk Assessment
- Risk Based Inspection

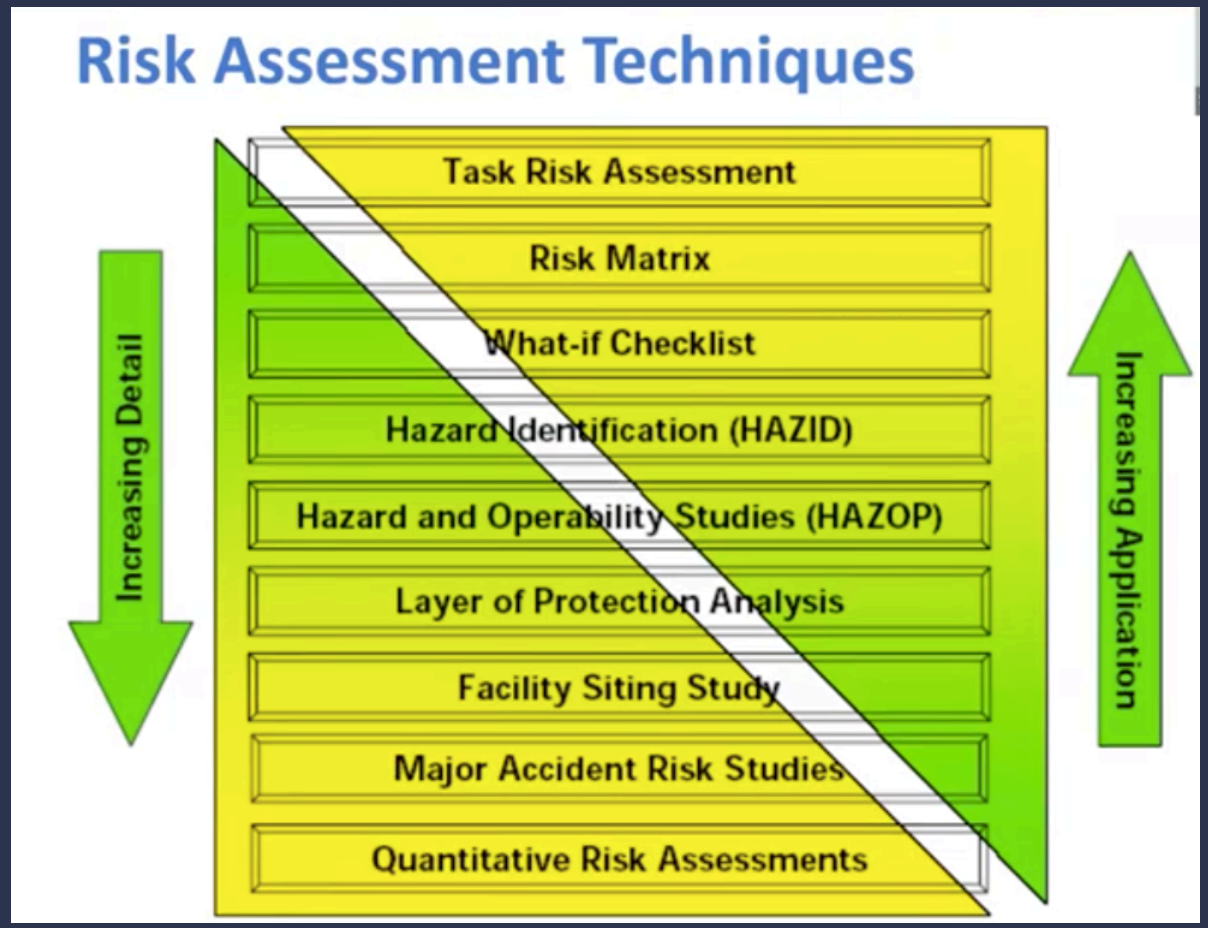
Work Management - Validation Work

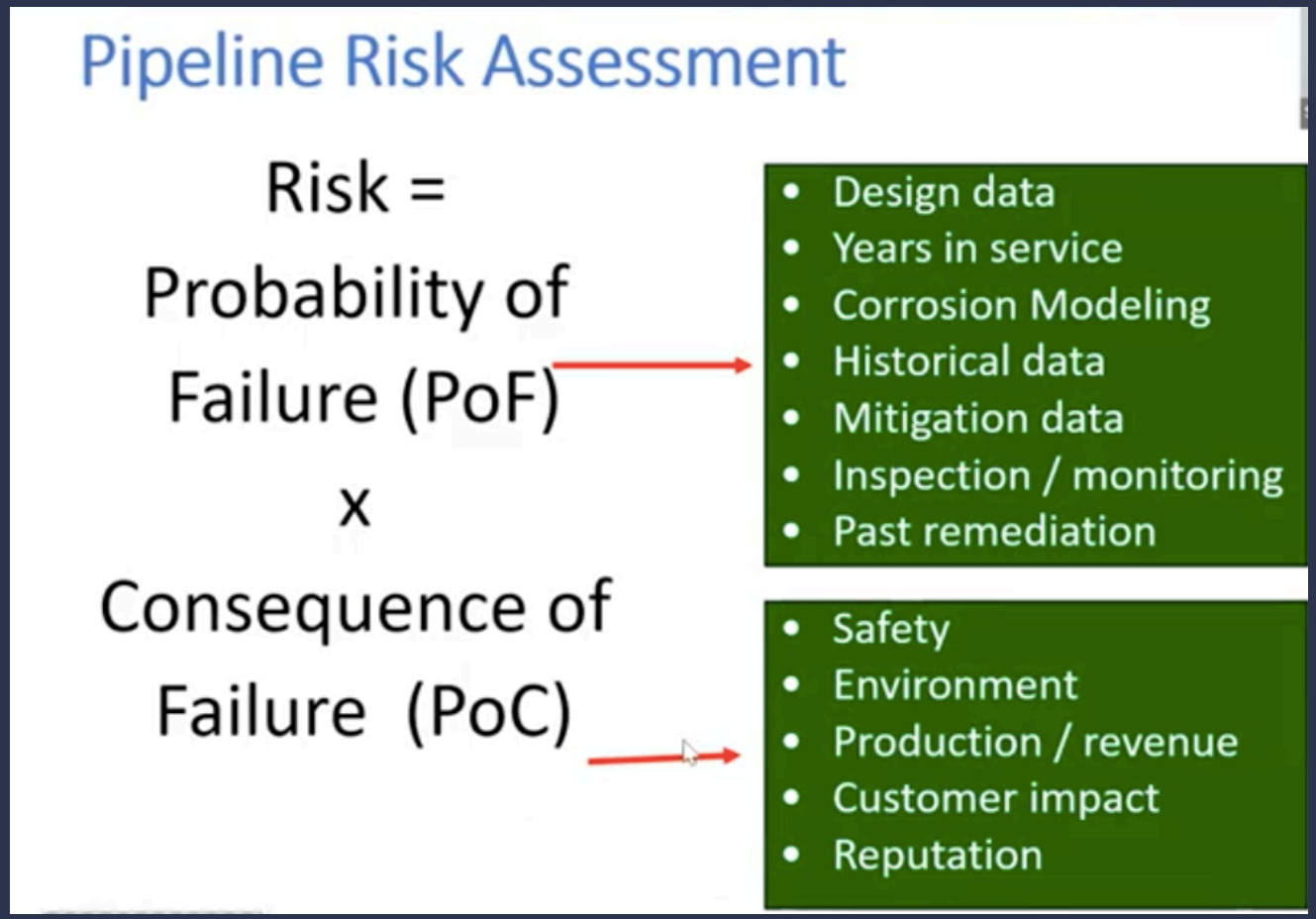
- Validation allows the work to be planned and executed efficiently. In order for the work to be validated, any relevant technical MoCs are at Approved status
- Management of Change conformance

Work Management - Plan & Schedule Work

- Activity Integration
- Scope Definition (Inspection)
- Develop the scope of work including the operations, resources, materials, special tools and services needed to inspect, maintain, repair and/or restore equipment to a safe and reliable condition
- Develop Work Packs

Pipeline Risk Assessment





Workflow for an Overall Management of Integrity for Pipeline Systems

Foundation | Equipment Strategy | Planning and Scheduling | **Execution** | Anomaly Assessment and Tracking | Performance Management and Integrity Review

Monitor Operating Limits

- Equipment strategy needs to define **safe operating limits**, **realistic performance targets** and **reliability requirements**
- Set the **operating limits register** (pressure, temperature, flows and monitoring for corrosion / hydrate management)

Control of Work

- Authorize Work Permit {*Inspection, test, maintenance and repair work has the potential to introduce risk and harm to people, the environment and damage to equipment*}

Work Management Execute Work

- After successfully completing Activity Planning, the activity enters an implementation and operation phase
- This phase starts with obtaining detailed procedures or sufficiently detailed work instructions and conducting risk assessments
- If new risks emerge during the task execution, the risk is reassessed, and any changes managed through the MoC system

Work Management / Complete & Close Work

- Complete work scope is marked as complete in the work management system
- Costs of execution are tracked and reported against each system and equipment type and reported back to the relevant Control
- Lessons learned. logged
- Engineering teams assess the deliverables to check and confirm all specified tasks have been completed as planned and then close in the work management system.

Workflow for Overall Management of Integrity for Pipeline Systems

Foundation | Equipment Strategy | Planning and Scheduling | Execution | **Anomaly Assessment and Tracking** | Performance Management and Integrity Review

Identification

- Typical sources for detecting anomalies:
  - process operating conditions
  - hydraulic fluid usage and system pressure
  - power and communication signals
  - choke performance
  - valve body and small-bore tubing inspections, signatures and leak tests
  - instrumentation availability, status and faults
  - CP survey
  - chemical injection
  - visual inspections (topsides and subsea inspection data)
  - In-line Inspection (ILI)
  - pipeline geohazard inspection and monitoring data
  - riser monitoring
  - Right of Way (RoW) surveillance.

Assessment

- Anomalies considered for assessment fall within threat categories:
  - time dependent
  - time independent
  - stable.

Information

- Based on the assessment outcome and risk assessment, a notification relating to the condition of the equipment is raised in a timely manner. Information may include the following:
  - recommendation to promptly remove equipment from service
  - emerging Risk Notification
  - operational Risk Assessment
  - regulatory notification
  - no further action.

Immediate Action

- Once notifications have been completed, further follow up actions are completed in a timely manner by the relevant responsible person. Action may include the following:
- initiate a further inspection
- operations surveillance
- removal of equipment from service or change operating conditions

Workflow for Overall Management of Integrity for a Pipeline System

Foundation | Equipment Strategy | Planning and Scheduling | Execution | Anomaly Assessment and Tracking | **Performance Management and Integrity Review**

Integrity Learning

- The Performance Improvement Cycle (PIC) helps to identify, prioritise, and implement planned improvement - for example:
- evaluate risks
- confirm the effectiveness of inspections, testing and corrective actions set by the Equipment Strategies to support continued fitness for service
- incorporate feedback from execution into future execution plans, CoW plans
- update the Equipment Strategy aspects (tasks and intervals)
- if relevant, share lessons learned from RCFA, High Value Learning (HVL), anomaly management, or industry incident investigations - update standing practices if applicable
- incorporate industry, Joint Industry Project (JIP) and supplier provided insights and update the Equipment Strategy or execution plans.
- Feedback and lessons learned are provided to projects

System Health Management & Reporting

- System health management is a continuous process
- KPIs for monitoring system health and elevating risks

Integrity Review

- The purpose of the integrity review is to:
  - identify and agree any corrective actions for barrier performance degradations
  - identify if the barriers under review are fit for purpose to manage the current risk profile for Life of Field and agree actions for improvement, modification or additional barrier creation
  - agree that the system is fit for continued operation for he subsequent operating ear.

➢Self Verification

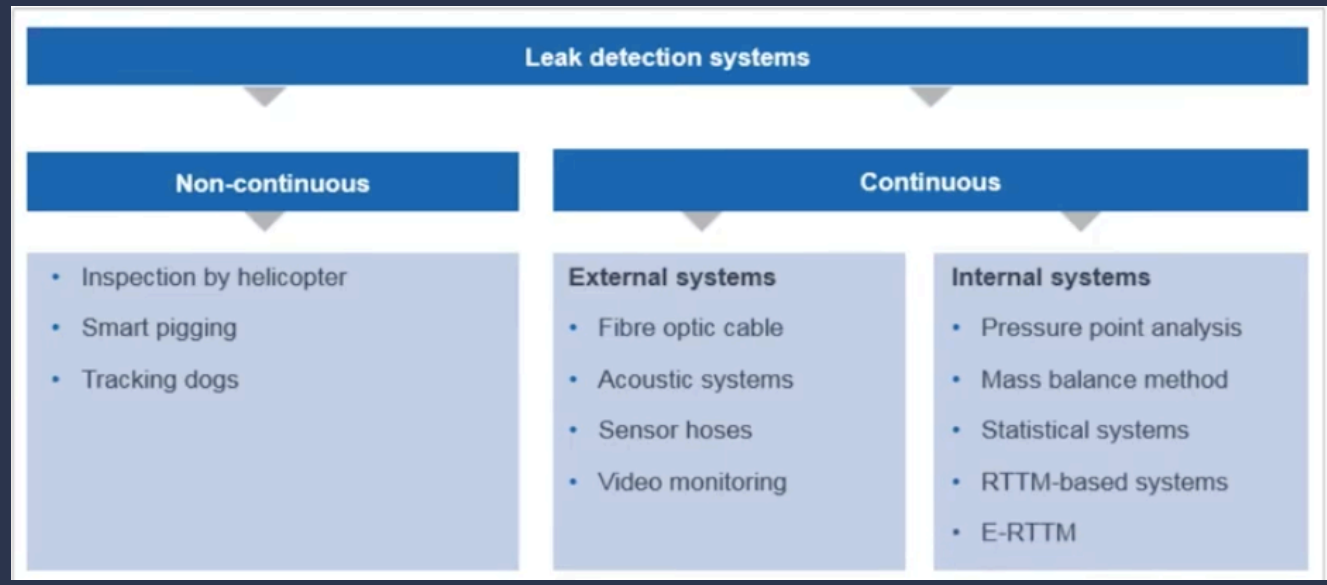
- Self-verification is a periodic review performed to verify in a systematic way that work is executed in conformance to approved operating management system or standards
- Validate that barriers are fit for service

Leak Detection

Introduction

Why leak detection?

- Protection from people and the environment
- Damage to image
- Repair costs
- Indemnity
- Breakdown
- Lost value



Summary

- Takeaways
- Pipeline Incidents / Cause of Leaks – HSSE / Reputation / Production Loss ($$$)
- Management of Integrity of a Pipeline Systems - Plan, Organize, Direct and Control
- Leaks detection – latest techniques
- Q&A