



# Maintenance Optimization of Ageing Assets with Fit For Purpose RBI & Corrosion Management Delivery

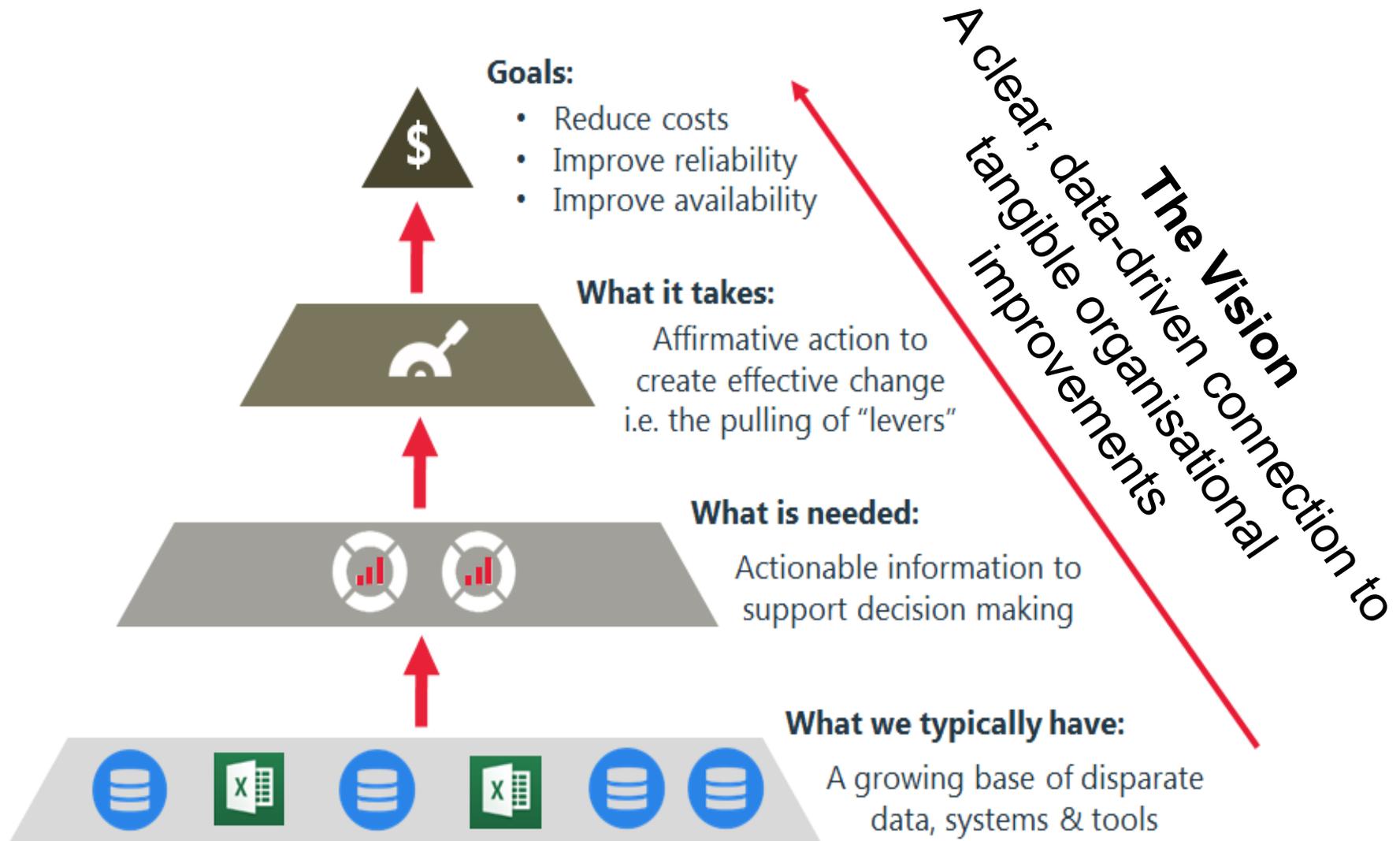
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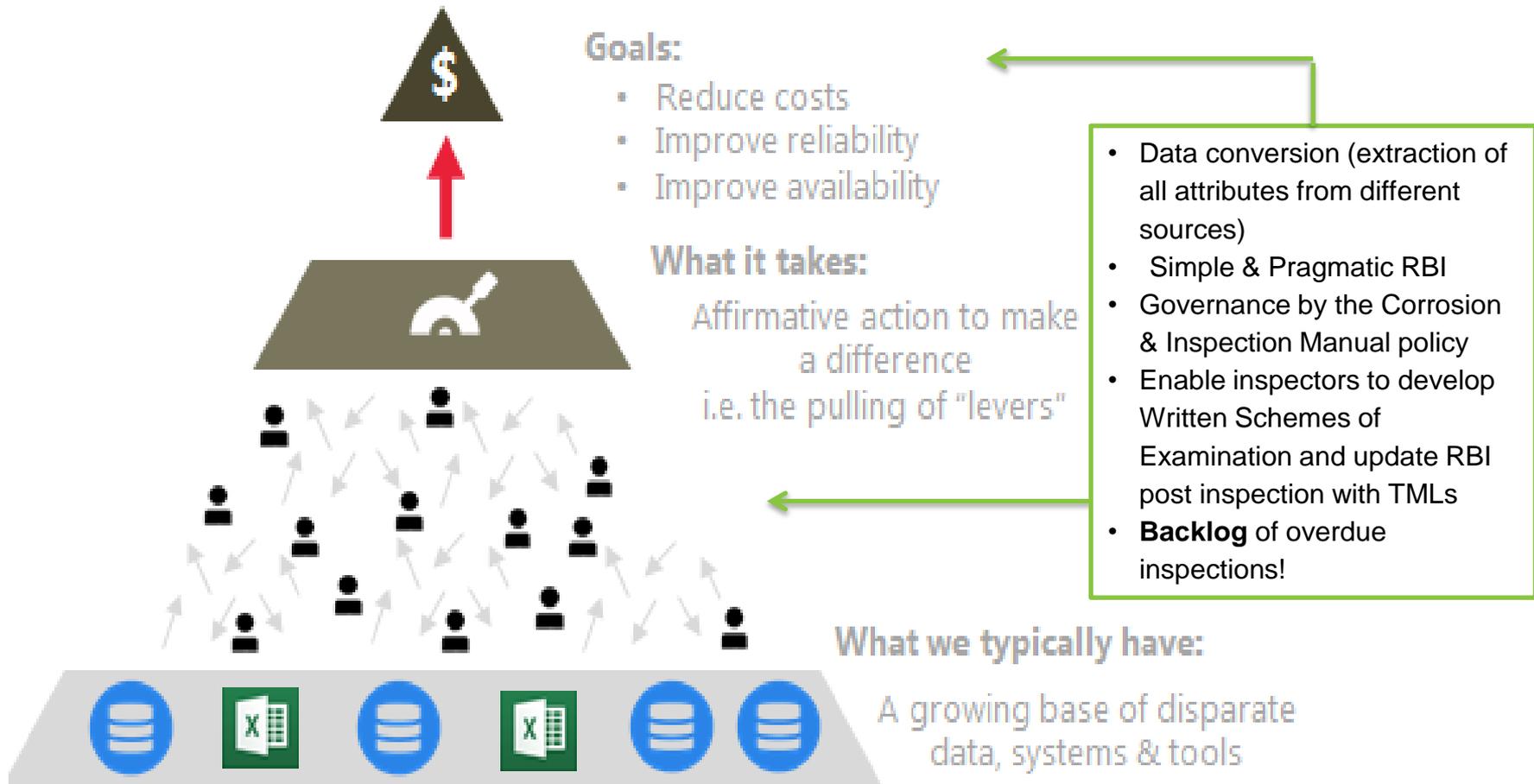
- The Vision
- The Journey
- Risk Based Inspection
- Approach and Methodology
- Deliverables
- Success Factors
- Challenges and Mitigations
- Sample Results
- Interface Integration
- Conclusions



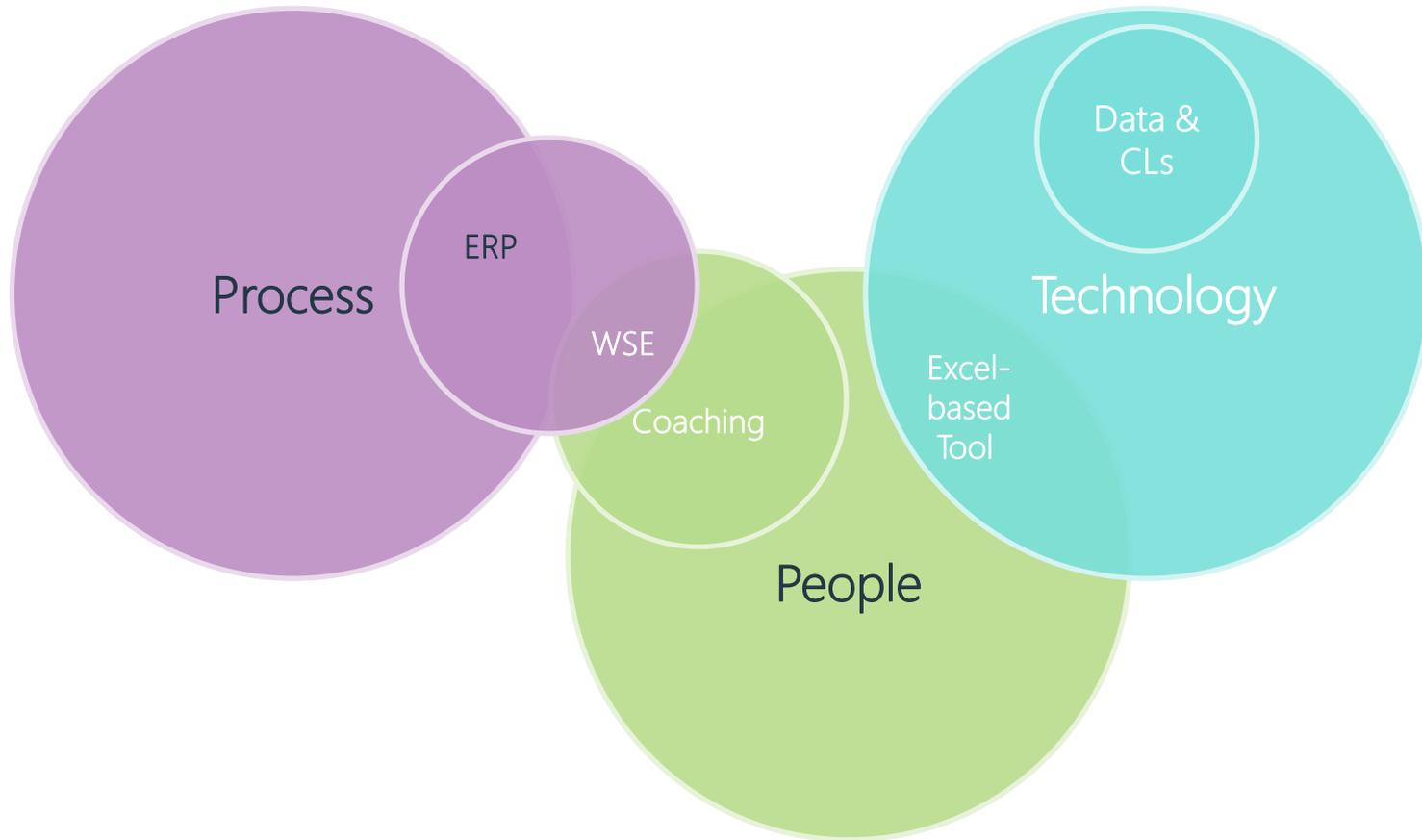
# The Vision



# 'Connecting the Dots'



# The Journey of Project Delivery



# Case Study – Onshore Gas Facilities

 **NACE**<sup>®</sup> JUBAIL SAUDI ARABIA  
INTERNATIONAL SECTION

Risk-based inspection  
RBI program improves  
facility safety at reduced  
cost

# What is Risk?

The product of the **likelihood** that a failure will occur and the **consequence** of that failure

**Risk = probability x consequence**

Consequence can be:

- Injury or death due to fire, explosion, or toxic release
- Harm to the environment
- Financial (revenue loss, repair / replacement costs)

# Typical Benefits of RBI

Regulatory compliance/acceptance

Improved safety and reduced risk

Long-term cost benefits

- Focused inspections
- CML reduction
- Extending intervals beyond 10 years
- Opportunity to reduce internal inspections

Reliability, reduce unexpected failures

Turnaround planning

Use of new inspection (NDE) technology

Informed, documented, defensible decisions

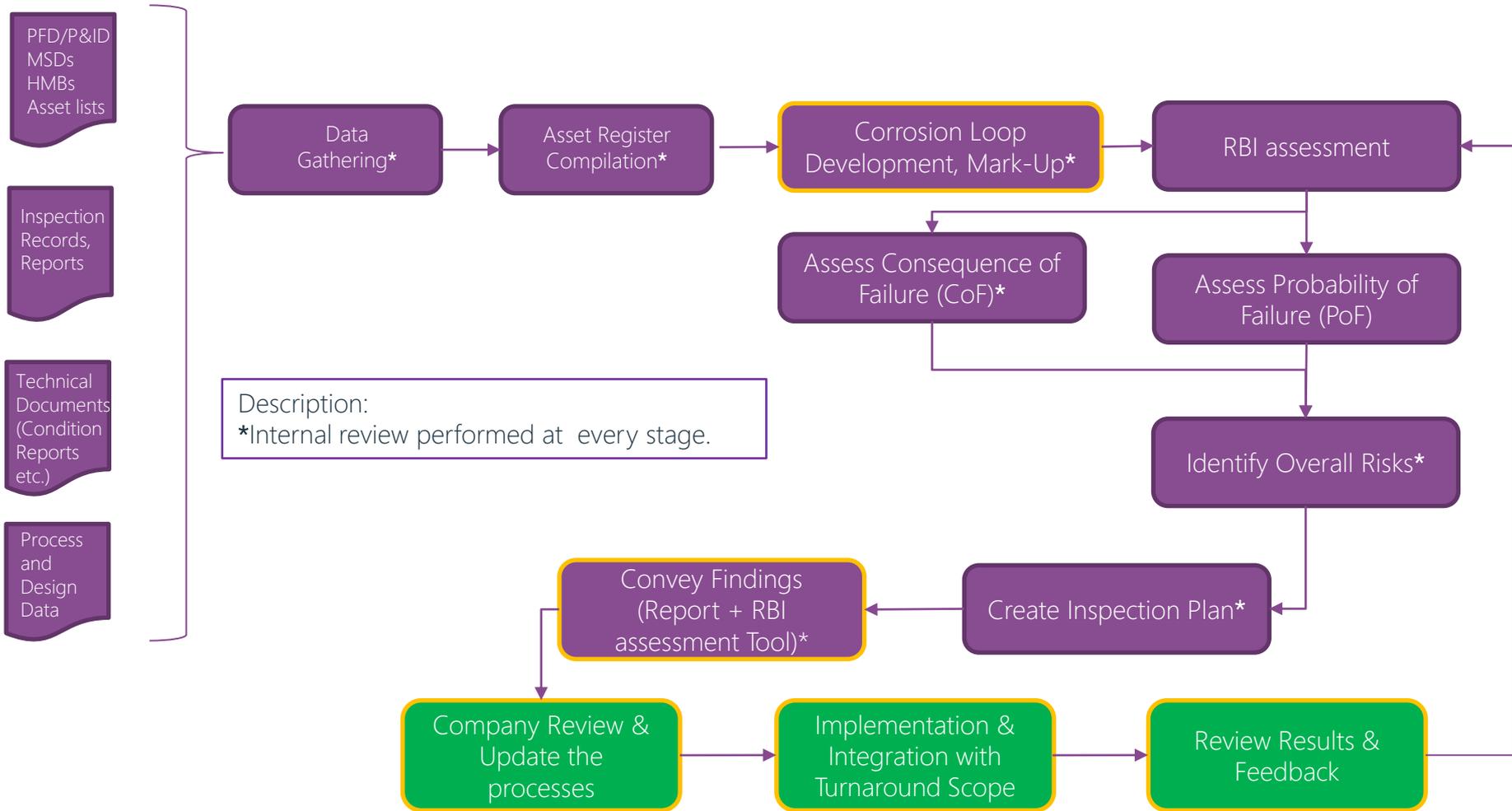
# RBI Scope of Work

## Natural Gas Liquids & Compressor Station Facilities

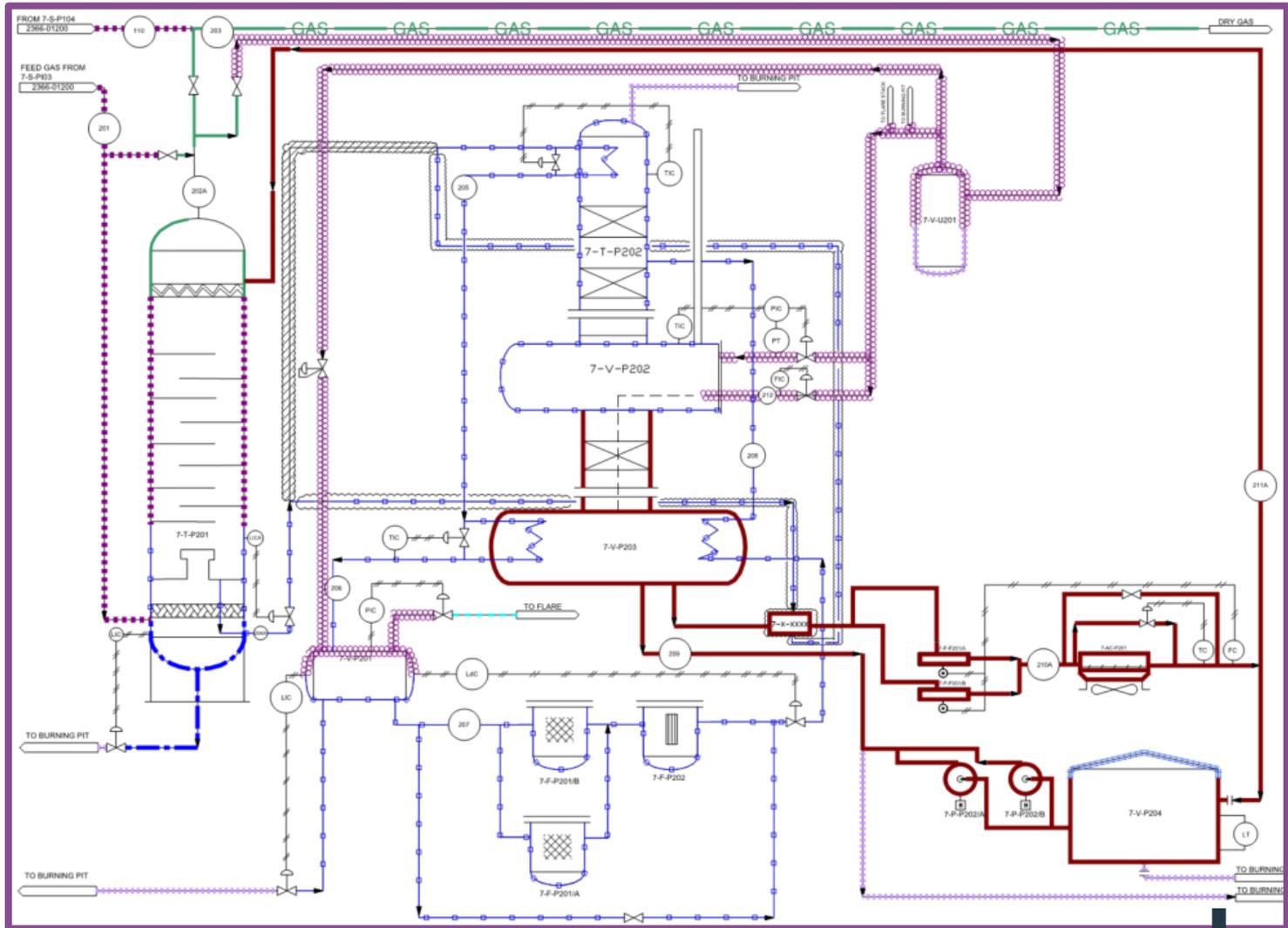
- Over 1000 equipment including:
  - Drums & Vessels
  - Heat Exchangers
  - Storage Tanks
  - Columns
  - Heaters
  - Filters
- Acid Gas Removal
  - Equipment & Piping



# Methodology Work-Flow



# Methodology (Corrosion Loops)

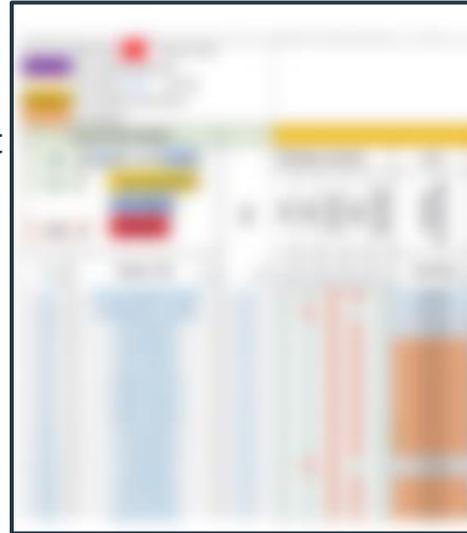


# Summary of Deliverables

- Plant Overview
- Corrosion Loops (Threats & Scope)
- Material Selection Philosophy
- Integrity Operating Windows
- Operating History Highlights
- Inspection History
- Inspection Plan
- Inspections Recommendations

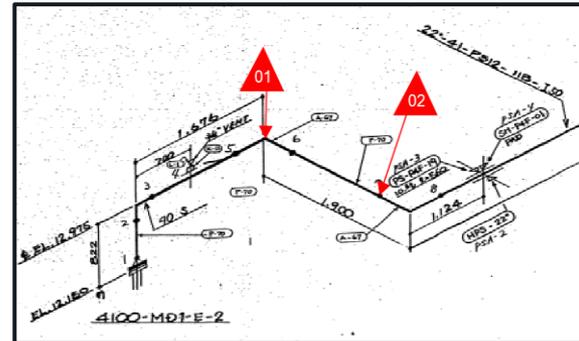
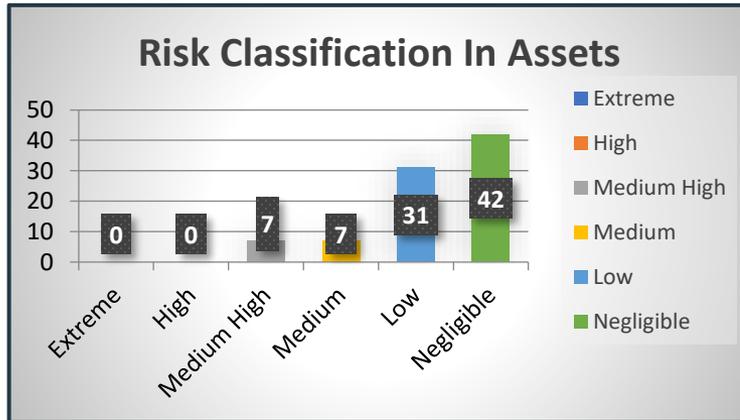
## Corrosion & Inspection Manual:

- Single document that captures all the key integrity issues, IOWs, Inspection Strategies, assumptions



## Excel Based RBI Tool:

- Established RBI Excel tool that automates the RBI assessment
- Ability to generate inspection plans
- Uncovered overdue inspection and damage threats

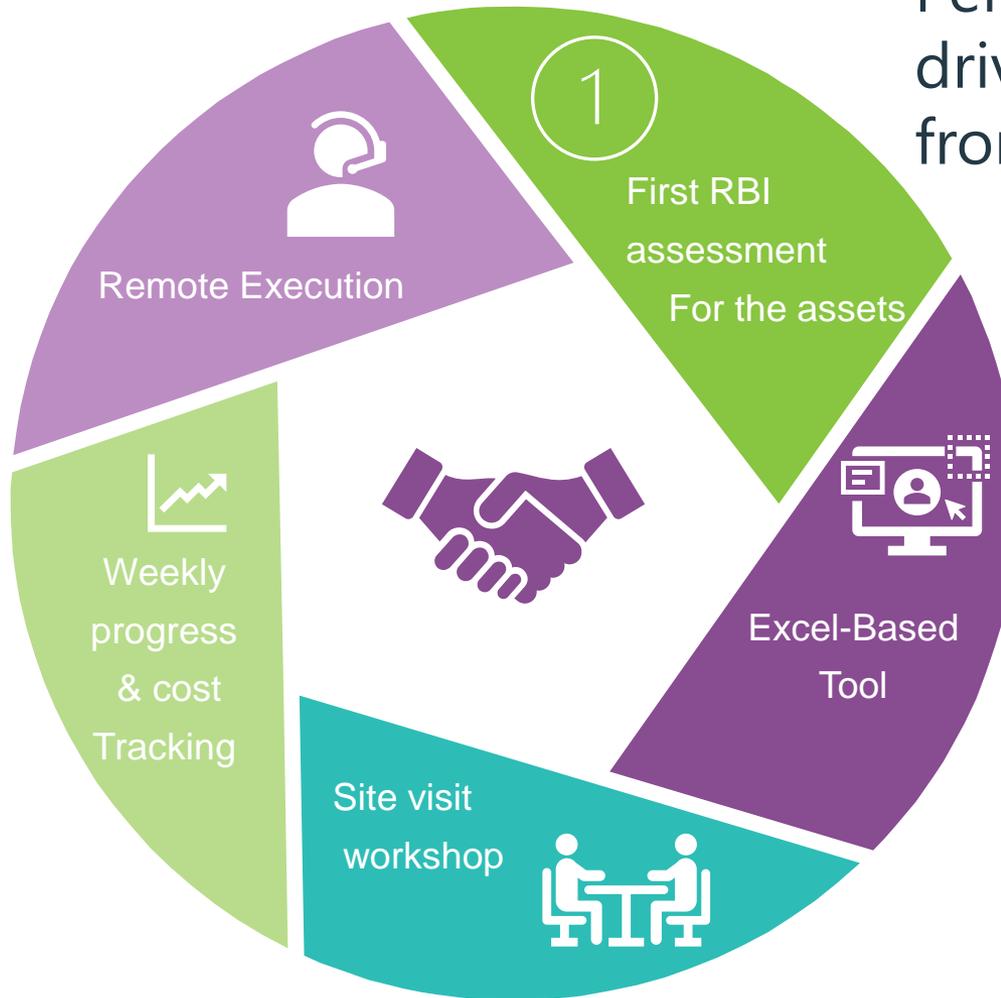


## Corrosion Monitoring Locations:

- Digital Mark-up of CMLs
- Enabler for inspectors to inspect in the right locations

# Success Factors

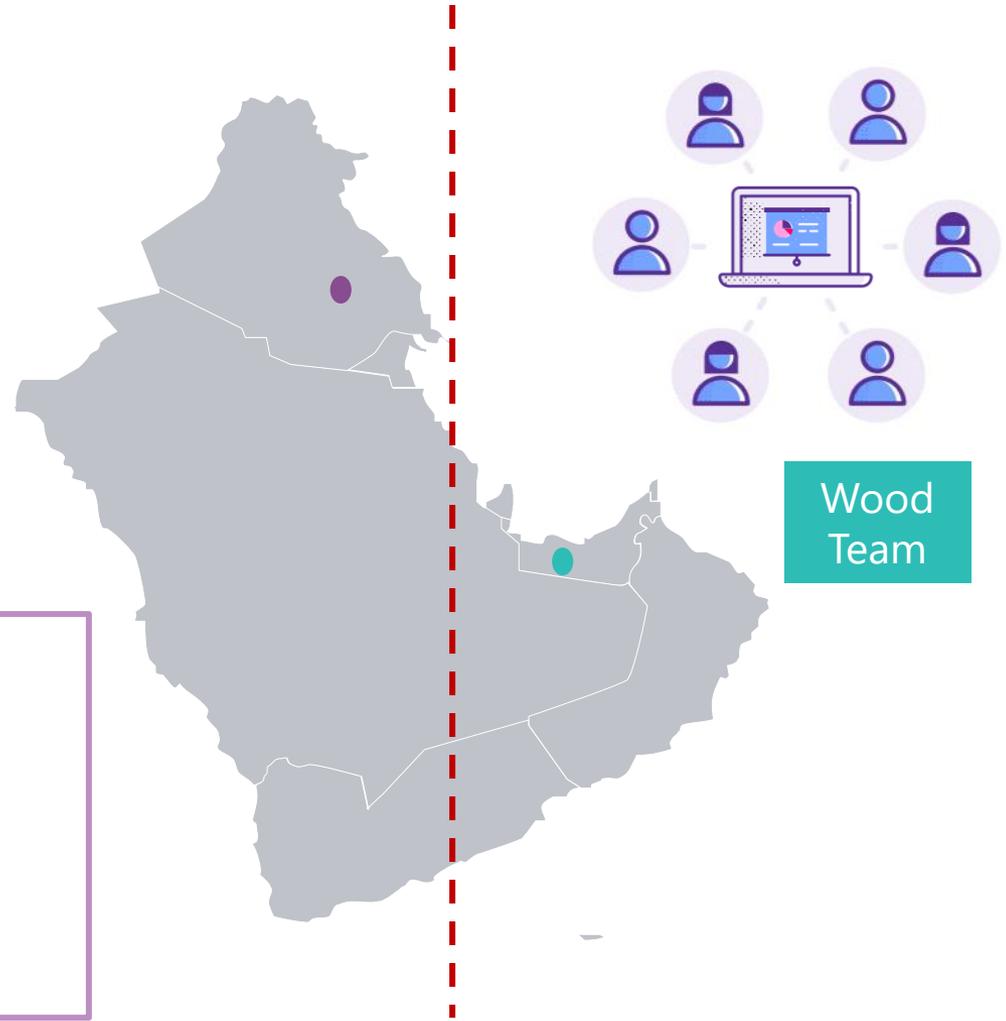
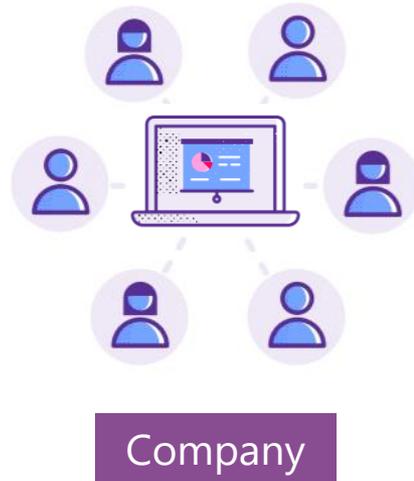
Performance-driven solutions, from start to end.



# Remote Collaboration

- Audio Calls
- Documents SharePoint
- Video Conferencing
- Emailing

# Remote Collaboration Advantages

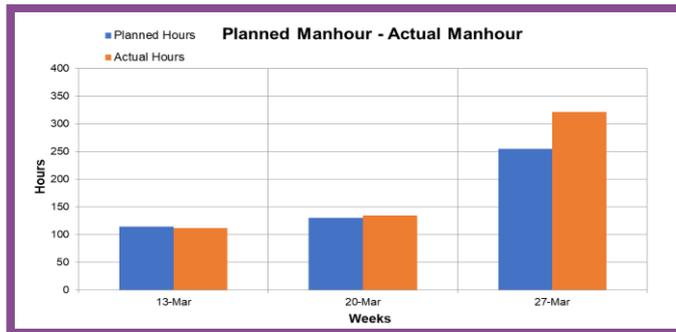


## Advantages:

- Avoiding travel logistics
- Safety
- Economical
- Light on resources
- Saves Time

# Weekly Engagements

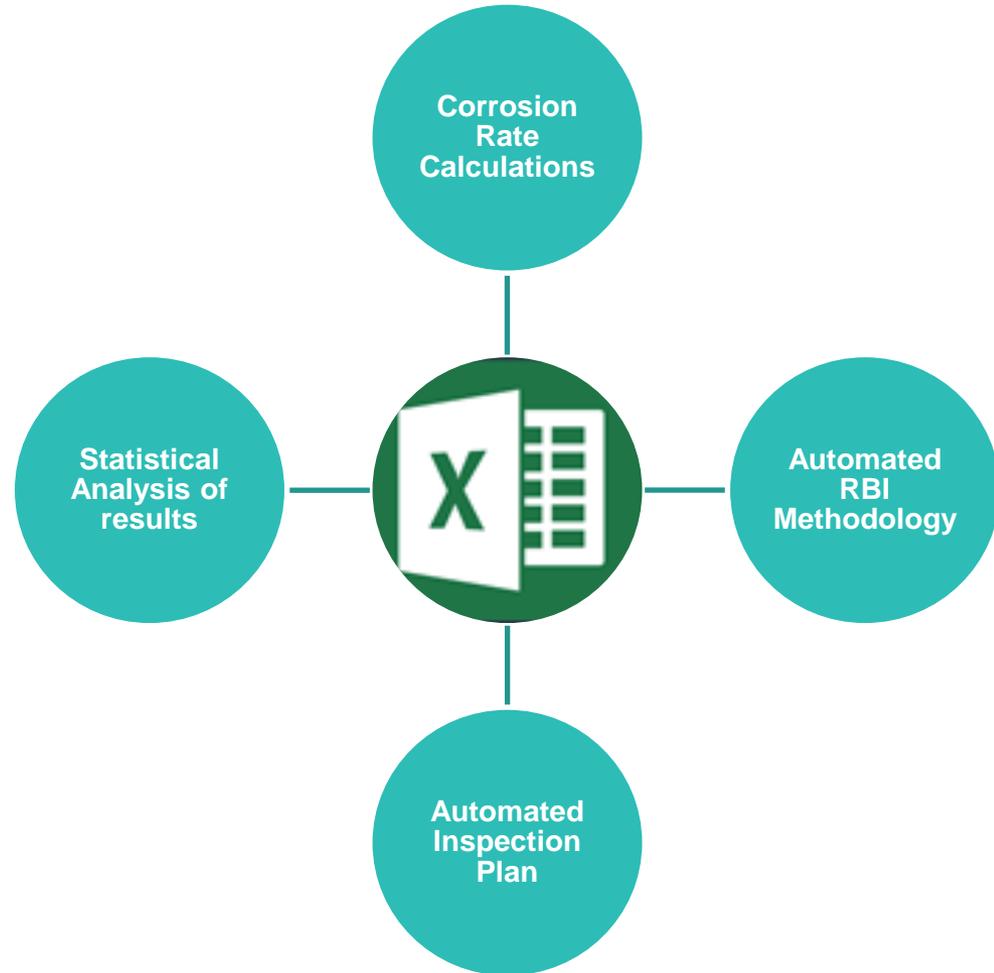
- Progress Review Meetings
- KPIs Management
- Project Risks



# Excel-based RBI Tool



| Asset ID | Asset Name | Asset Type | Asset Class | Asset Age | Asset Condition | Asset Risk | Asset Status | Asset Location | Asset Notes | Asset Date |
|----------|------------|------------|-------------|-----------|-----------------|------------|--------------|----------------|-------------|------------|
| 101      | Asset 1    | Asset 1    | Asset 1     | Asset 1   | Asset 1         | Asset 1    | Asset 1      | Asset 1        | Asset 1     | Asset 1    |
| 102      | Asset 2    | Asset 2    | Asset 2     | Asset 2   | Asset 2         | Asset 2    | Asset 2      | Asset 2        | Asset 2     | Asset 2    |
| 103      | Asset 3    | Asset 3    | Asset 3     | Asset 3   | Asset 3         | Asset 3    | Asset 3      | Asset 3        | Asset 3     | Asset 3    |
| 104      | Asset 4    | Asset 4    | Asset 4     | Asset 4   | Asset 4         | Asset 4    | Asset 4      | Asset 4        | Asset 4     | Asset 4    |



## Advantages of Excel- based RBI Tool

- Reduced manhours and cost
- Optimization of RBI methodology
- Reducing human error in calculations
- Simplifying checking and review process
- Dynamic database which the client can continuously update
- Accessible and user-friendly interface that facilitated RBI Implementation by inspectors

# Site Visit & Workshop



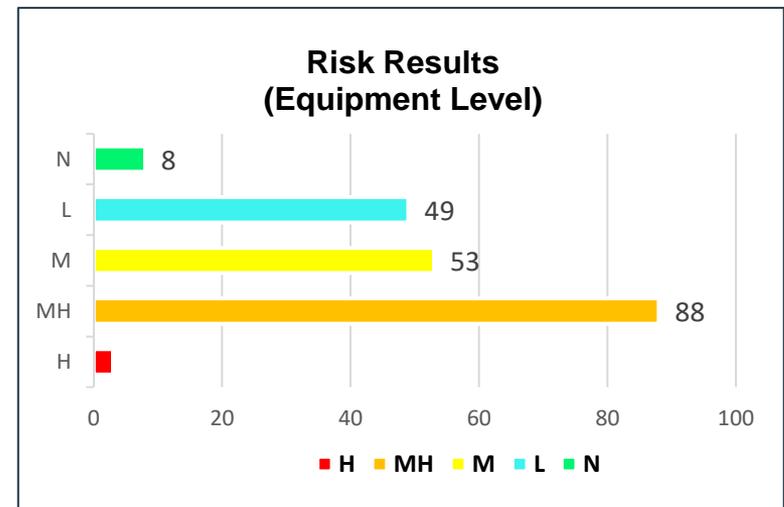
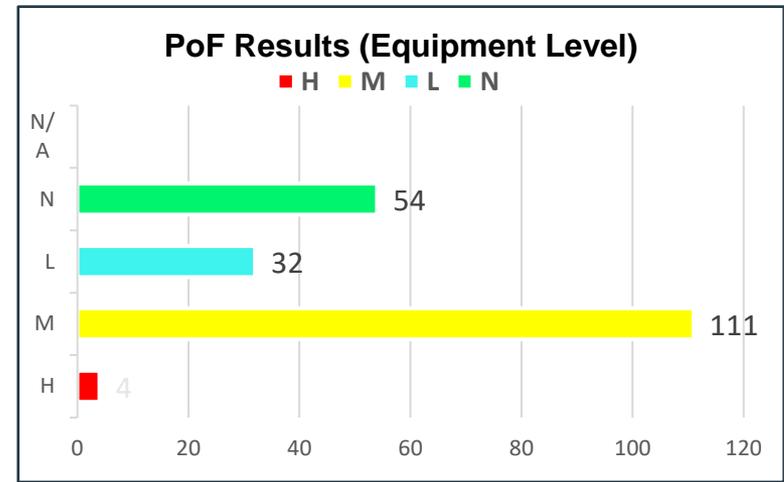
# Challenges and Mitigations

| Challenges   | Mitigations  |
|--|--|
| Data Management  | Regular online technical sessions to align with our stakeholders   |
| File Sharing   | Establishing appropriate SharePoint  |
| Results Presentation   | Prioritizing immediate actions in the action tracker   |
| Safeguarding of the MS Excel Tool (people making changes on the formulas, etc) | Updating the MS Excel tool and putting more controls in place (training of the users and assigning a single focal point) |

# Sample Results : PoF & Risk

- **PoF & Risk Results:**
  - Equipment Level

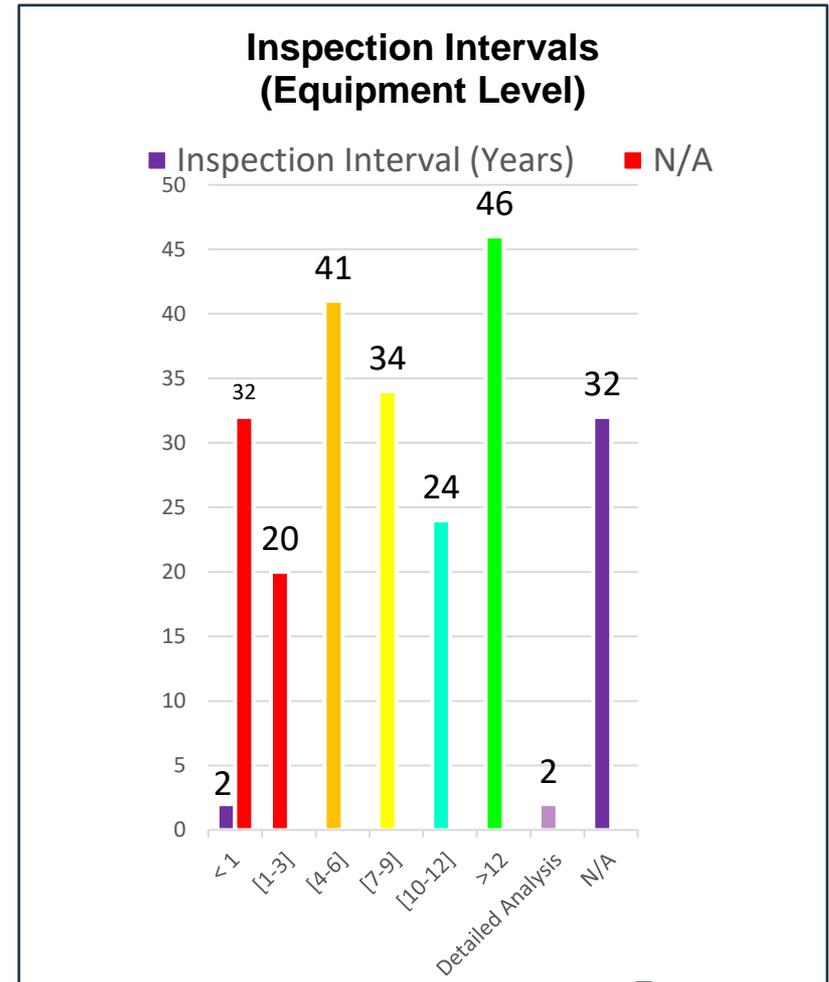
| Category | PoF | Risk |
|----------|-----|------|
| E        | 0   | 0    |
| H        | 4   | 3    |
| MH       | 0   | 88   |
| M        | 111 | 53   |
| L        | 32  | 49   |
| N        | 54  | 8    |
| Total    | 201 | 201  |



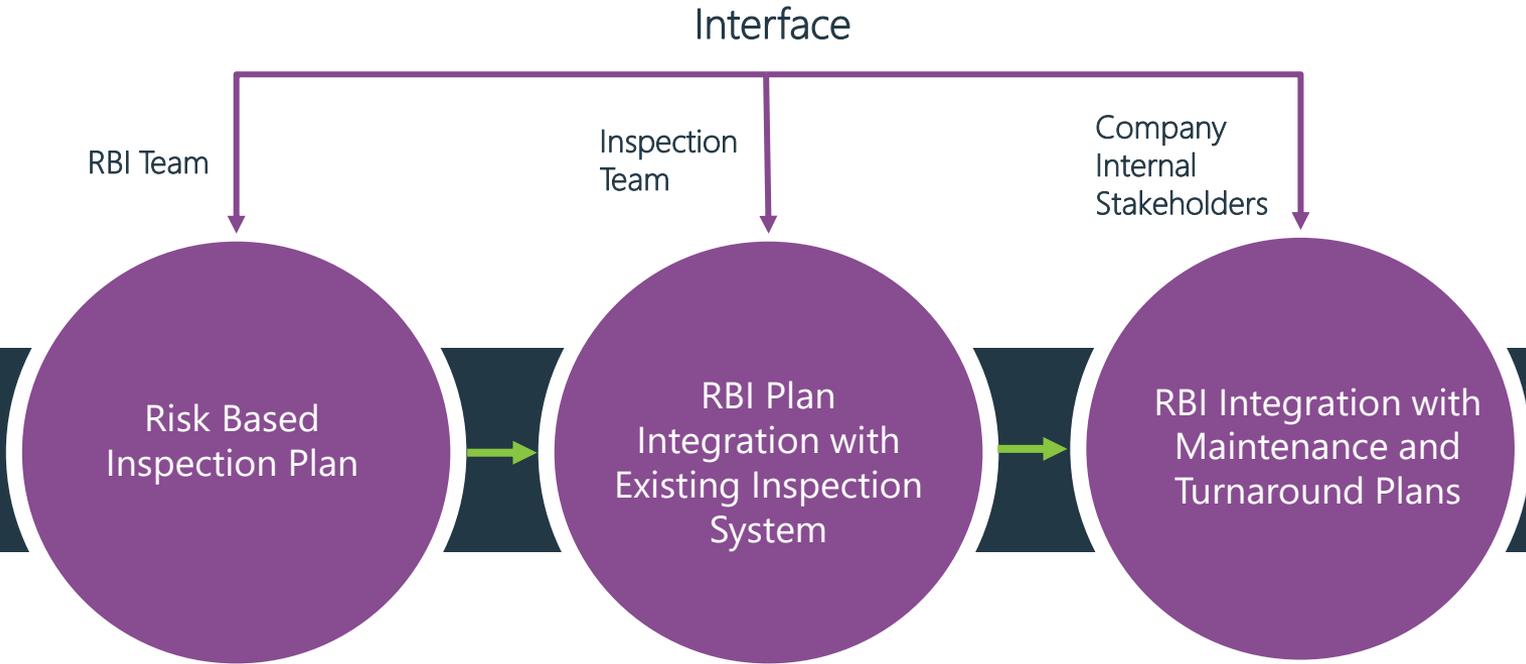
# Sample Results: Inspection Plan

- **Inspection Interval Plan:**
  - Equipment Level

| Inspection Interval (Years) | No. of Equipment |
|-----------------------------|------------------|
| < 1                         | 2                |
| [1-3]                       | 20               |
| [4-6]                       | 41               |
| [7-9]                       | 34               |
| [10-12]                     | 24               |
| >12                         | 46               |
| Detailed Analysis           | 2                |
| N/A*                        | 32               |
| <b>Total</b>                | <b>201</b>       |



# Interface between RBI & Maintenance Optimization



# Conclusions



Pragmatic RBI Approach



Remote Collaboration



Successful Partnership



Integration with the  
Company's Internal Process  
(Maintenance, Turnarounds)



Robust Excel-based  
RBI Tool



Comprehensive Progress  
Tracking

# Q&A



**wood.**