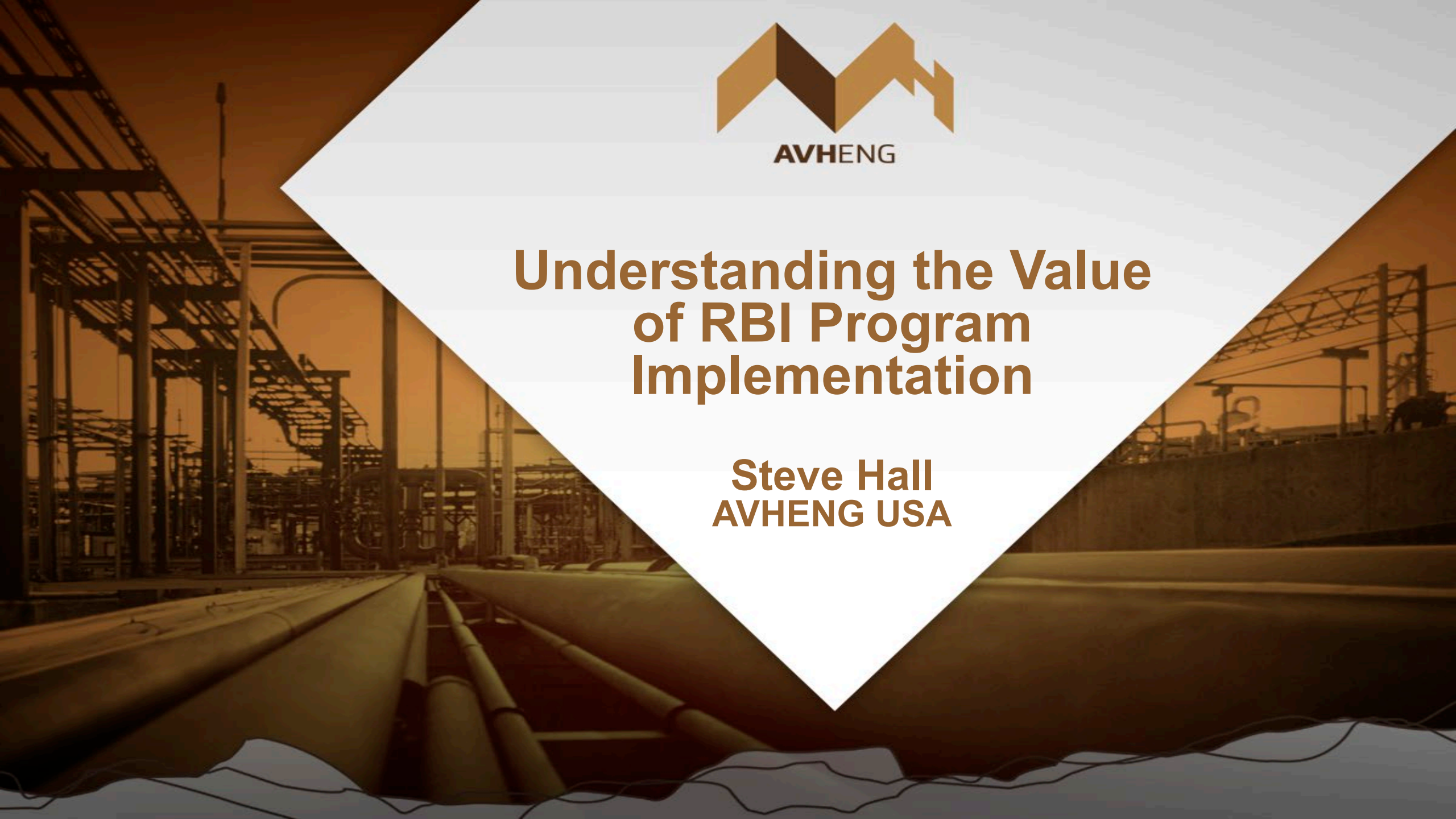

AVHENG

Understanding the Value of RBI Program Implementation

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Introduction

Observations over 20+ years of managing and auditing RBI assessments for a wide variety of facilities in North America and the Mid-East have revealed the following issues:

1. **Client management of programs is diffuse.**
2. **Program technical requirements not clearly defined or changed over time.**
3. **Required front-end tasks not addressed.**
4. **Assessment and implementation of work processes not optimal.**
5. **Sustainment programs lack long-term follow-through.**

Root Causes

- Client management of cost and contract performance lacks means of control over engineering and site resource utilization.
- Limited understanding by team members of the goals for implementing an RBI program.
- Over-reliance on “book smarts” over “street smarts”. Experience is key.
- The worth of program implementation is not addressed or is ill-defined.
- Tendency to indulge in over-engineering.

Avoid the Pitfalls

- **Define RFQ work scope:**
  - **Determine what is to be included. What is required over “nice to have”.**
  - **Define a unified client organization to manage technical, cost, and schedule aspects.**
- **Evaluate tender responses to insure a positive return on investment:**
  - **Work process optimized?**
  - **Task labor hours consistent with industry norms?**
  - **Does the vendor team have experienced individuals in critical positions?**
  - **If software is required, it should be evaluated against a set of specific criteria.**
- **Ensure that a sustainment program is implemented, and it is included as a facility management KPI.**

Work Scope Development Prerequisites - 1

- **Clearly define project goals:**
  - **Meet regulatory goals**
  - **Optimize site inspection program – reduce cost over time without increase in risk and lost production.**
- **Set up a unified project organization to manage technical, cost, and schedule aspects:**
  - **Develop project team with a single individual tasked with responsibility to execute the project cost-effectively**
  - **Provide that individual with the *authority* to manage resources.**

Work Scope Development Prerequisites - 2

- **Determine desired deliverables:**
  - RBI assessment of equipment and piping. Equipment only? Piping only?
  - Inspection plans? Iso development? CML locations?
  - Integrity operating window (IOW) development? Implementation?
  - Initial visual and/or NDE inspection management and performance?
  - Software?
- **Ascertain the quality and accessibility of mechanical, operating, and maintenance data:**
  - Electronic media (PDF format; spreadsheet, etc.)
  - Hard copy
  - Current storage (on-line, library, filing cabinet, desk drawers, single individual, boxes in storeroom)
  - Ability to set up project electronic data transfer point (e.g., FTP site, Dropbox, etc.)

Work Scope Development Prerequisites - 3

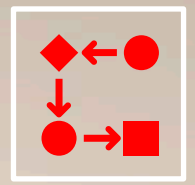
- **Determine Coverage**
  - **Unit type (process, utility)**
  - **Fixed Equipment**
  - **Piping Circuits**
  - **PRDs**
  - **650 Tanks**
  - **Rotating Equipment (API 691)**

Optimize Work Process - 1

Define joint project team interfaces and responsibilities

Develop and approve Level III project schedule

Collect and organize data



Define and document corrosion loops

Define and document piping circuits (if in scope)

Optimize Work Process - 2

Document Design and O&M data; upload into RBI software

Determine consequence based on material balance, release type, and inventory

Determine likelihood considering the most likely damage mechanisms

Undertake joint damage mechanism review

Calculate item risk

Optimize Work Process - 3

Develop Corrosion Control Document (CCD)

Develop and implement IOWs (if in scope)

Determine inspection program requirements based on item risk

Develop inspection isos with CML markup

Perform baseline Visual and NDE Inspections

Determining Program Worth

- **Implementing an RBI inspection program is an investment.**
- **Industry is reluctant to discuss RBI program value proposition.**
- **Implemented and sustained correctly, RBI implementation can result in:**
  - **Increased safety through application of appropriate inspection techniques at the right location.**
  - **Reduction in maintenance costs over time through alignment of the inspection program with item risk.**
  - **Operator understanding improved through IOWs.**

What Does an RBI Program Cost?

- **Dependent on work scope, equipment count, and data accessibility.**
- **Typical RBI assessment program requirements:**
  - **Equipment: 2-3 hours per equipment item**
  - **Piping: 3-4 hours per circuit (assumes definition and documentation of circuits)**
  - **Pressure Relief Devices (PRD): 2-3 hours per PRD**
  - **Corrosion Control Document (CCD): 40-60 hours per facility/unit**
  - **IOWs: 2-6 hours per corrosion loop**
  - **Project Management Allowance: 7.5% to 10% of cost**
  - **Travel Costs**
  - **Software License Cost**

What is the Return on Investment?

Option	Description	20-Year Cost Savings: FE	20-Year Cost Savings: w/Piping	20-Year Cost Savings: 200 Circuits	NPV (10%)	IRR
1	Full RBI strategies/5yr average	$ 35,189,867	$ 42,503,435	$ 49,017,004	$ 11,190,262	54%
2	Restricted RBI, 10yr max/5yr average	$ 32,498,667	$ 39,812,235	$ 32,063,378	$ 10,455,447	53%
Piping	Average 2k per circuit/5yr historical (2,008)	$ 7,313,569				
	Average 2k per circuit/5yr historical (200)	$ 13,827,137				
	Site Implementation Cost	$ 435,289				

Scope – Fixed Equipment: 501; Circuits: 2,008

Equipment Counts: Air Cooler - 28; HX - 152; Fired Heater - 19; Pressure Vessel - 234; Tank - 42; Tower - 26

Avg. Insp. Cost: Air Cooler - $12,000; HX - $61,000; Fired Heater - $90,000; Pressure Vessel - $27,000; Tank - $125,000; Tower - $260,000; Circuit - $2,000

RBI Software Considerations

- Is the software the IM program or does it support the IM program?
- What are your requirements and why?
  - Quantitative, Semi-Quantitative, or Qualitative
  - Inspection planning and management
  - Integration with other tools
  - Corporate IT requirements
  - Training
- Obtain license or vendor provide.
- License Cost – Avoid “bells and whistles”.

Sustainment - Barriers

- **Sense that once initial implementation is complete, the risk remains static or the process will take care of itself.**
- **Difficult to maintain and manage over a long period:**
  - **Lack of site champion to steward over a long time period – often assigned as "additional duty".**
  - **Lack of budgeted resources.**
  - **Lack of authority for effective management.**
  - **Program is not part of the MOC process.**
  - **Insufficient site resources.**
  - **Lack of support from upper management.**

Sustainment - Requirements

- Include RBI reassessment as part of MOC process.
- Reassessment triggers:
  - Inspection results
  - Change in design and/or operations
  - Change in feed stock and/or product slate
  - Change in regulatory requirements
- Assign an individual with the authority/responsibility for managing program.
- Include ongoing sustainment as facility management annual KPI.
- Include in annual resource budget.

Thank You

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