



Mechanical Integrity Lessons Learned from API Process Safety Site Assessments

Driving Operational Excellence




Discussion Topics

- What is API's Process Safety Assessment Program (PSSAP)?
- Fixed equipment mechanical integrity (FEMI) benchmarking results
- FEMI opportunities trending in industry
- What is working well




PSSAP Program Overview

- A deep dive into proactive PS elements
- Standard protocol developed by industry
- Voluntary, not a PSM audit
- 7-person team, 5 days on site
- Questions are weighted by risk (1 to 4)
- Questions are scored by assessors (0 to 4)
- Scores show strengths and weaknesses
- Benchmarking against others




Process Safety Elements Assessed

- 1) Process Safety Leadership
- 2) Operating Practices
- 3) Fixed Equipment MI
- 4) Safe Work Practices
- 5) Management of Change
- 6) Process Hazard Analysis
- 7) Facility Siting



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Process Safety Program Sustainability



IIHOS

How the scoring works

- Weighted (1-4)
- Scored (0-4)
- Weight x Score

Blue	96 – 100%
Green	75 – 95%
Yellow	50 – 74%
Orange	25 – 49%
Red	0 – 24%

75% is good!



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Assessment		Rating	Weight	Score	Notes/Findings	Observations	Instructions
Does the site have written management systems for operating procedures that include the following components?							Review the written Operating Procedures Document and determine if it contains: Safety, Environmental, Accountability, Safety of Operations, Emergency Procedures, and Operating Units.
1.0	• Safety, Environmental, and Accountability • Safety, Environmental, Accountability, and Operating Units • Use of operating procedures	4.0	2.0	10	100%		Review the written Operating Procedures Document and determine if it contains: Safety, Environmental, Accountability, Safety of Operations, Emergency Procedures, and Operating Units.
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Keys to Program Success

- Credible 3rd party assessors with YEARS of practical experience
- It's not an audit; more open to share information
- Sites comment that it is more like a 2-way conversation than an audit/assessment
- Practice sharing by the assessors
- ~60 sites and growing





Benchmarking



PSSAP FEMI Program Topics

- Documented management systems
- Pressure vessels
- Piping
- Storage tanks
- Fired heaters and boilers
- Overpressure protection
- Deadlegs
- Injection and mix points
- PMI
- RBI
- Bolted joint assemblies
- CUI/CUF
- Buried vessels and piping
- Staff knowledge and training
- Damage mechanisms
- Cathodic protection
- Refractory inspections
- Process hoses
- Structures
- Temporary equipment
- Temporary repairs (clamps)
- IOWs
- Chemical treatment
- Piping spec break points
- Baseline thickness data
- Hydroprocessing equipment
- Flare systems / stacks
- Critical check valves
- FEMI program audits



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PSSAP FEMI Data

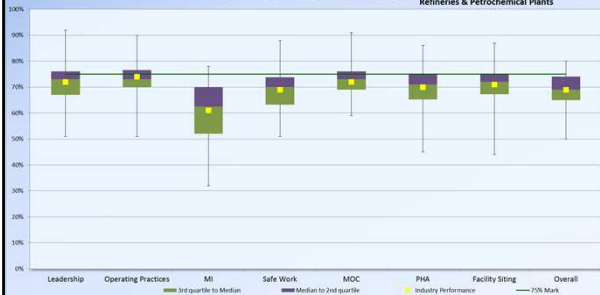
- FEMI scores lag behind other process safety elements
- Likewise, a significant percentage of process safety incidents are FEMI-related



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Protocol Score Ranges for Industry

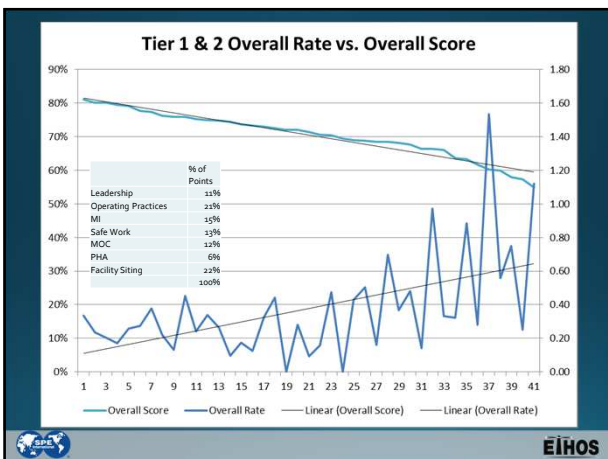
Based on 59 Assessments Industry = Refineries & Petrochemical Plants



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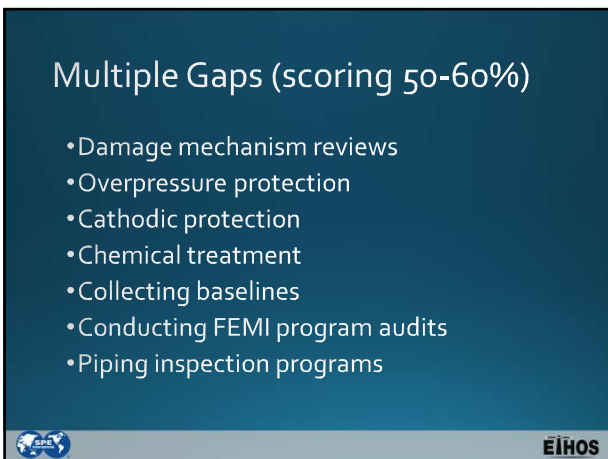












Piping Inspection Program OFIs

- Injection and mix points
- Deadlegs
- Buried piping
- Small bore piping
- Corrosion under insulation
- Contact point corrosion
- Spec. breaks



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What IS working well...

- Management support for FEMI programs
- Knowledge and training of FEMI staff
- Access to 3rd party expert support
- Reduction in overdue inspections
- Reaction to major failures in industry

But, NO FEMI program average score meets expectations (i.e., $\geq 75\%$)

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FEMI Sector Scores

Mechanical Integrity - Sectors	Industry
Documented MI Management Systems	64%
Pressure Vessels	66%
Piping and Piping Components	61%
Atmospheric Storage Tanks	64%
Fired Heaters and Boilers	67%
Over-pressure Protection	57%
Deadlegs	54%
Injection Points	58%
Material Verification (PMI)	62%
RBI Methodology	62%
Bolted Flange Joints and Gasketing	73%
Corrosion Under Insulation and Fireproofing	57%
Buried vessels and piping	53%
Damage Mechanisms	60%

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FEMI Sector Scores

Cathodic Protection	54%
Refractory Inspection	67%
Process Hoses	46%
Structures	61%
Temporary Equipment	62%
Clamps and other temporary repairs	70%
Integrity Operating Windows	45%
Chemical Treatment	60%
Piping specification break points	64%
Baseline Inspection Thickness Measurements	58%
Hydroprocessing	66%
Flare systems and stacks	62%
Critical Check Valves	41%
Sufficient Knowledge, Training, etc.	70%
Fixed Equipment MI Audits	56%



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Conclusion

- PSSAP is helping industry drive improvements
 - Hazard ID documents
 - Process safety bulletins
- The data shows FEMI is lagging other process safety elements
- There are several FEMI-related areas to focus improvement efforts



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Questions?



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THANK YOU



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