

19 AICHe 15TH GLOBAL CONGRESS ON PROCESS SAFETY
Spring Meeting
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**Avoiding Quality Pitfalls for
HAZOP/LOPA Sessions &
Documentation**
(GCPS-2019 – Paper 548413)

Steven T. Maher & Morgan T. McVey
Risk Management Professionals
www.RMPCorp.com

Presentation/Handout – <http://www.RMPCorp.com/Events-and-Resources/Conferences/GCPS/>

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Steven T. Maher, PE CSP
Risk Management Professionals

- 39-Year Engineer – 35 in Process Safety Consulting Specializing in Hazard Analysis and QRA
- Mechanical Engineering
 - BS – Duke University
 - MS – Carnegie-Mellon University
- Professional Engineer – Mechanical & Chemical Engineering
- CCPS Technical Steering Committee – mid-1980s
- Past-President Southern CA Society for Risk Analysis
- Landmark Efforts
 - Platform Safety Shutdown System Effectiveness Study
 - Torrance Refinery Safety Advisor for MHF Conversion
- Paper & Book Publications – See www.RMPCorp.com

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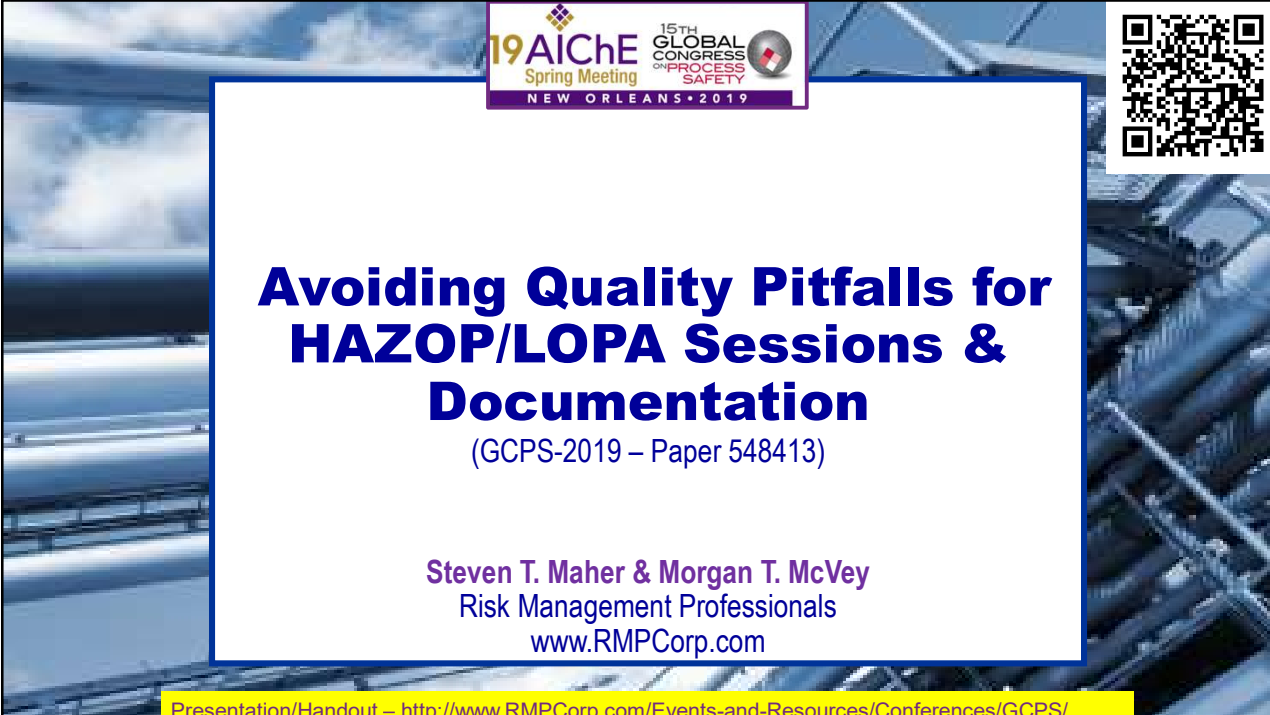


Morgan T. McVey
Risk Management Professionals

- 4 Years in Process Safety Consulting Specializing in Hazard Analysis
- Expertise in HAZOP/LOPA Methodologies
- Chemical Engineering
 - BS – University of California San Diego
- Paper & Webinar Publications – See www.RMPCorp.com



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Key Topics

- Why Quality
- Defining PHA Objectives
- Planning & Preparation Essentials
- Tips for Conducting a Quality PHA
- Documentation Tips
- Priorities for the Quality Assurance Review
- Emphasis Points for Maximizing the Future Usefulness of the PHA
- Questions?



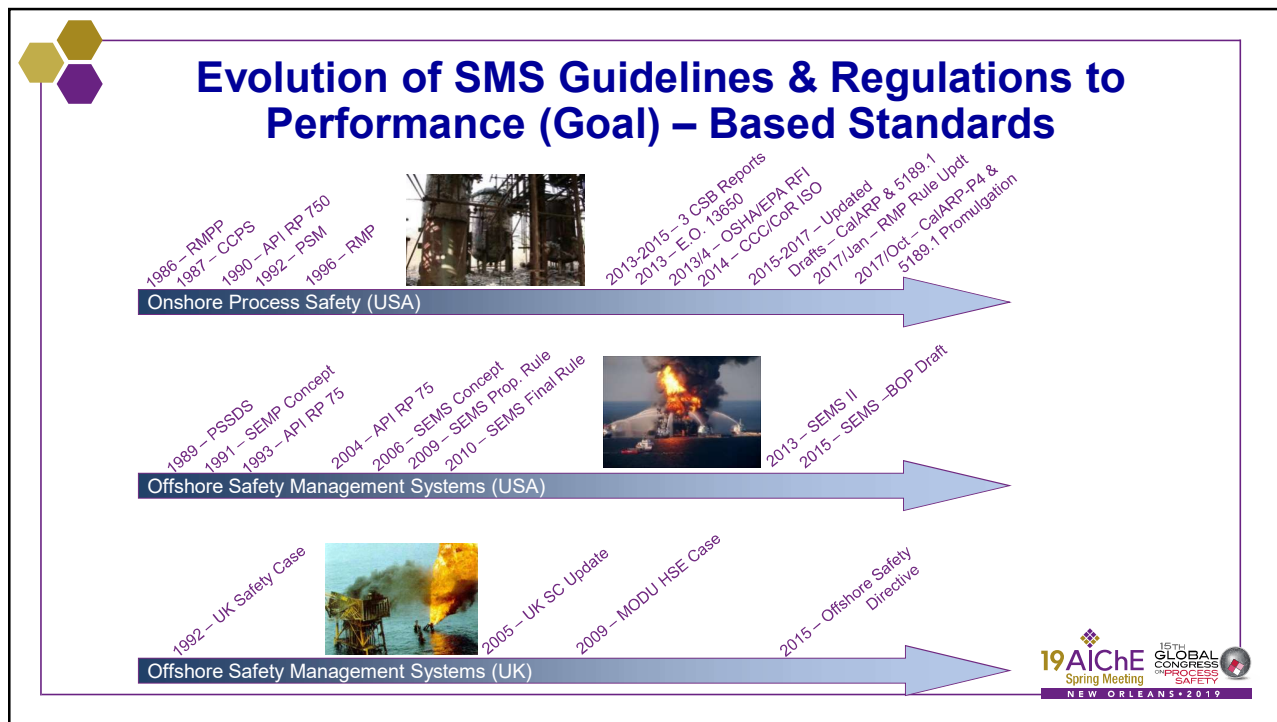
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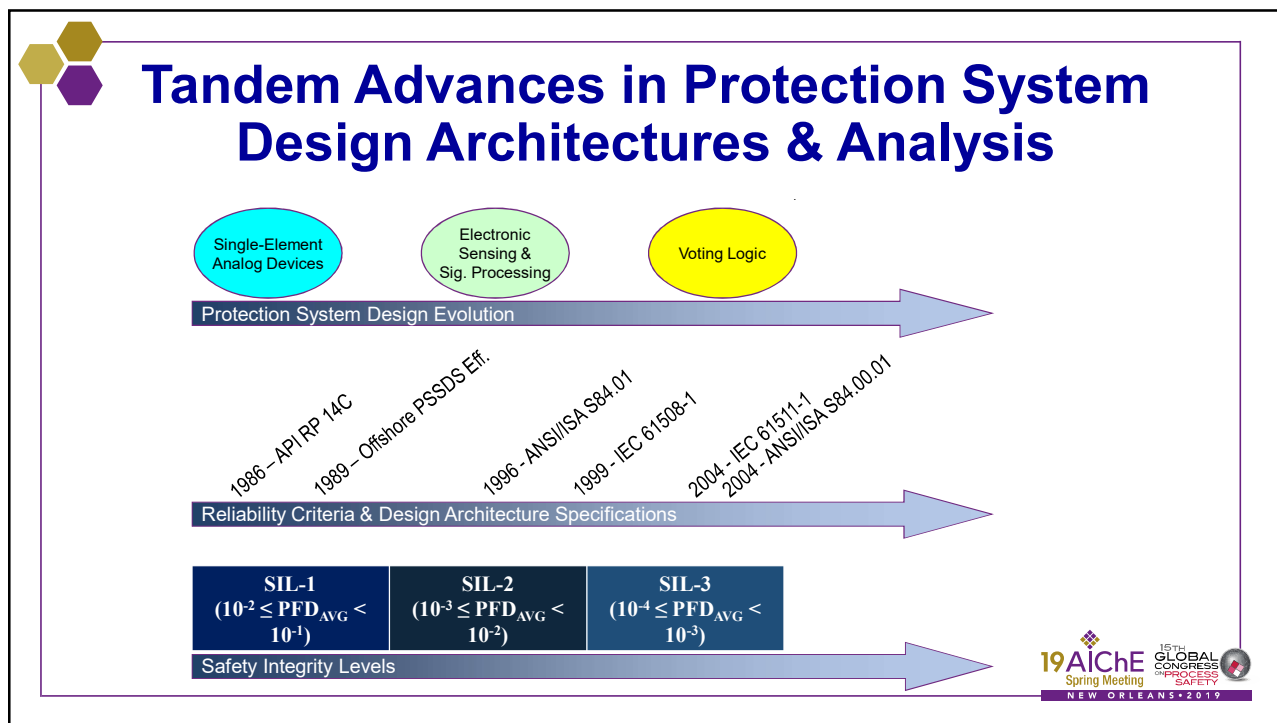
Why Quality Process Hazard Analysis is Important



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HAZOP & LOPA are Core Elements of Hazard Evaluation

The diagram illustrates the core elements of hazard evaluation. At the center, HAZOP and LOPA are connected by a double-headed arrow within a dashed green box. Surrounding this are other methods: What-If, Checklist, FMECA, and CHAZOP. A bow-tie diagram shows the relationship between Threats/Causes, Preventive controls, Top Event, Reactive controls, and Consequence/Impacts. A small table is also included.

Threats/Causes	Preventive controls	Top Event	Reactive controls	Consequence/Impacts
HA (Hazardous Atmosphere)	HA	HA	HA	HA
HA (Hazardous Atmosphere)	HA	HA	HA	HA
HA (Hazardous Atmosphere)	HA	HA	HA	HA
HA (Hazardous Atmosphere)	HA	HA	HA	HA

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Planning & Preparation Essentials

- **Qualified, Experienced, & Prepared:**
 - Technical Experts who Participate in all Phases of the PHA
 - Facilitator
 - Scribe
- Quality-Checked, Complete, & Field-Verified Engineering Drawings
- Access to Other Key Process Safety Information
- PHA & Revalidation Schedule
- Cause Pre-Population

Weighing Scribe Options

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Tips for Conducting a Quality PHA

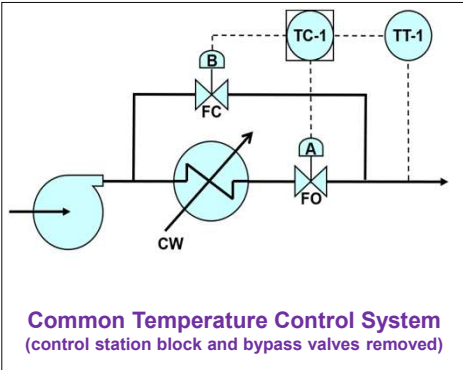


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Tips for Conducting a Quality PHA

- **Technical Details**
 - **Process Design/Limits & Response to Upset Conditions**
 - **Overpressure Ratios**
 - **Cause/Consequence Documentation**
 - **Instrumentation & Setpoints**
 - **Control & Protection System Actions**
 - **Valve Failure Mode Clarity**
 - **Crediting Alarms as Safeguards**
 - **Subcomponent Failure Modes**



Common Temperature Control System
(control station block and bypass valves removed)

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Tips for Conducting a Quality PHA

- PHA Sessions
 - PHA Team Training
 - Session Length Reflecting Process Complexity
 - Node Completeness Checks
 - PHA Revalidation vs. Re-do
 - Node Boundaries
 - Avoid Repeating Scenarios

The diagram shows a green pipe with a T-junction. A vertical pipe is attached to the top. A horizontal pipe passes through the center. A vertical dashed line is drawn through the horizontal pipe, labeled 'Company A Scope' above and 'Company B Scope' below. Two orange arrows point to the dashed line, indicating that this boundary is problematic because it overlaps the responsibilities of both companies.

Node Boundaries to Avoid

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Tips for Conducting a Quality PHA

- Information Dynamics
 - Information Requirements & Prioritized Action Items
 - A “Parking Lot” for Resolvable PHA Issues to Streamline Efforts
 - Manageable Drawing Updates – **Knowing when to Stop**
 - Manageable Information Gaps


A yellow diamond-shaped warning sign with a black silhouette of a cliff edge and a car falling off. The sign is set against a background of a rocky cliff and the ocean.

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Documentation




- **Analysis Completeness**
 - Specific Causes, with Equipment Numbers Identified
 - Identify Probable Worst-Case Consequences
 - Focus on Reliable, Active, Tagged Safeguards with Sufficient Process Safety Time – Link to Cause/Consequence
 - Recommendations (or gap acceptance) Whenever Clearly-Defined Acceptable Risk Level is Not Achieved
 - Valid Operating Modes Addressed
- **Consistency**
 - Risk-Ranking – Consistent & Synchronized with Scenario
 - Level of Detail & Scenario Depth Pivoting on Importance




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Documentation





- **Usability**
 - Recommendations – Understandable, Self-standing, Logical, Complete
- **Traceability**
 - Scenarios – Logically-developed, Complete, Understandable
 - Block Valve Inadvertent Mispositioning
 - Liberal Use of Clarifying Comments
 - Risk-Ranking – Consistent & Matched With Scenario
 - Clear Scope & System Boundaries
 - Prolific Use of Equipment Tag Numbers & P&ID References



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Priorities for QA Review

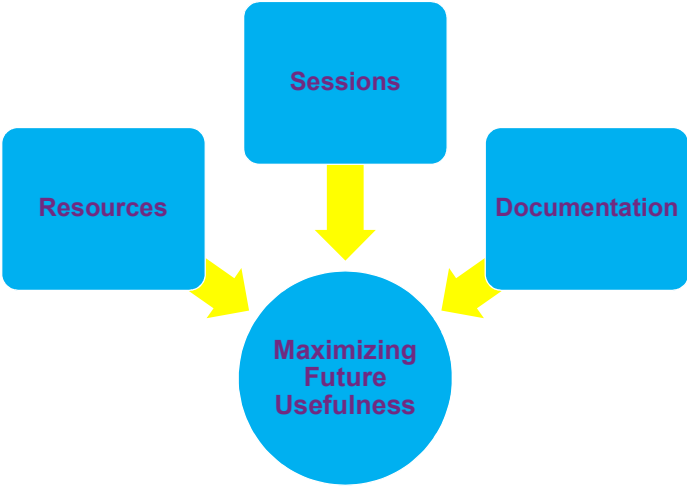
- **Completeness Check** – All Key Causal Events
- **Probable Worst-Case Consequences**
- **Safeguard/IPL Verification** – Especially Independence
- **Scenarios** – Interpretable
- **Risk-Ranking** – Consistent
- **Clear Action Items**
- **Same Initiating Event, but Different Deviation** – Increased potential for confusion and future misuse





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Emphasis Points for Maximizing the Future Usefulness of the PHA




```
graph TD; Sessions[Sessions] --> Center((Maximizing Future Usefulness)); Resources[Resources] --> Center; Documentation[Documentation] --> Center;
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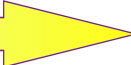



Maximizing the Future Usefulness of the PHA




- Apply Documentation Traceability Tips
- Prolific Use of Equipment Tag Numbers, P&ID References, & Cross-Referencing
- Sensible and Consistent Grouping of Scenarios
- Use Standardized PHA Approach
- Large Nodes Can Allow for a More Holistic Approach
- Qualifications and Experience of Facilitator & Team
- Consider Long-term Use & Strive for “Evergreen” Approach
- Software Longevity & Compatibility

2019 ♦ 2024 ♦ 2029 ♦ 2034 ♦ 2039 ♦ 2044 ♦ 2049 ♦ 2054

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Questions?

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