

STEVEN T. MAHER, PE CSP

PROFESSIONAL HISTORY:

Risk Management Professionals, Inc.;
Mission Viejo, CA; Principal Consultant;
Process Safety; 1995-Present

EQE International, Inc.; Irvine, CA; Technical
Manager; 1993-1995

Westinghouse Risk Management Services;
Pittsburgh, PA; 1983-1993

Westinghouse Safety; Pittsburgh, PA; 1980-
1983

EDUCATION:

Master of Science, Mechanical Engineering,
Carnegie-Mellon University, Pittsburgh,
PA, 1983

Bachelor of Science, Mechanical
Engineering, Duke University, Durham,
NC, 1979

CERTIFICATION:

- *Professional Engineer - Chemical Engineering – California*
- *Professional Engineer - Mechanical Engineering – Pennsylvania*
- *Certified Safety Professional - Systems Safety*
- *Sandia RAM-WSM Methodology Certification*
- *Incident Command System IS-100*
- *National Incident Management System (NIMS) IS-700*
- *National Response Plan (NRP) IS-800*

PROFESSIONAL AFFILIATIONS:

- *American Petroleum Institute's Safety and Fire Protection Subcommittee*
- *American Society of Mechanical Engineers (ASME) & the Risk Analysis Task Force*
- *Center for Chemical Process Safety*
- *Local Chapter of the Society for Risk Analysis*
- *Refrigerating Engineers and Technicians Association (RETA)*

Mr. Maher has over 25 years of experience in safety, involving both qualitative and quantitative risk assessment. For the past 22 years, he has been responsible for the project management and technical performance of a broad spectrum of process safety, risk management, security vulnerability assessment, emergency preparedness, and loss prevention projects for the following systems:

- petroleum (production, refining, offshore)
- chemical
- potable water treatment and distribution systems
- wastewater treatment and distribution systems
- chlorination systems
- anhydrous ammonia systems
- power generation
- waste repository/storage/processing
- aerospace

Mr. Maher has played an active role in “setting the pace” for helping industry address process safety and risk management regulatory requirements. These activities have included serving on prestigious guideline development and best practices steering committees, such as the Center for Chemical Process Safety. Mr. Maher also authored one of the sections in the “LEPC Region I – California Accidental Release Prevention Program (CalARP) – Implementation Guidance Document”.

Mr. Maher is actively involved in the development and implementation of key safety and security programs. He has published and presented numerous technical papers to the safety community, a list of which is provided in this resume. He has also authored/co-authored process safety books and technical manuals/guidebooks.



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PROJECT EXPERIENCE:

Mr. Maher has significant experience and involvement in the following topical areas:

- Development and Implementation of Comprehensive Process Safety Programs, including but not limited to Risk Management & Prevention Program (RMPP), Process Safety Management (PSM), Risk Management Program (RMP), and CalARP.
- Hazard Mitigation Plans (HMP) and associated Pre-Disaster Mitigation (PDM) Grant Programs
- Security Vulnerability Assessments (SVA)
- Auditing of RMP and PSM Programs (e.g., all aspects of Prevention Programs, all aspects of CalARP and RMP Programs)
- Hazard and Operability (HAZOP) Studies and Other Process Hazard Analysis (PHA) Techniques
- Emergency Response Program Development
- Emergency Preparedness Training (including NIMS and SEMS)
- Mechanical Integrity (MI) Programs and Training
- Risk Communication
- Quantitative Risk Assessment (QRA)
- Project Management
- Facility Siting Studies
- Fault Tree Analysis
- Event Tree Analysis
- Fault Tree Linking
- System Reliability Analysis
- Hazards Identification Techniques
- Seismic Hazard Assessment Support
- Probability and Statistics
- Failure Modes, Effects, and Criticality Analysis
- Reliability Data Base Development
- PRA Theory & Software Training
- NASA & Military Standards

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- Common Cause Failure Analysis
- Software Development
- Human Reliability Analysis
- Implementation of DOE Regulatory Requirements

Mr. Maher has been involved in a variety of activities associated with HMP & PDM Project Grant Applications and Notice of Interest (NOI) submittals, the development of Security Vulnerability Assessments (SVAs) utilizing the RAM-WSM methodology for numerous water facilities, Urban Area Response Plan Development /Assessment, Emergency Response Plan development and updates, Urban Water Management Plans (UWMPs), process safety, and risk management. Mr. Maher has been instrumental in the development / update of numerous Emergency Response Plans, Fault Tree Analyses, Facility Prioritization, Facility Characterization, (including Scenario Identification and Analysis (SIA)), and Risk Assessment. Mr. Maher has been on the HMP Project Team and his experience encompasses the entire spectrum of HMP-related technical skills:

- Quantitative Risk Assessment (e.g., equipment failure probabilities, structural failure probabilities, consequence assessment, statistical modeling approaches)
- Benefit-Cost Analysis (BCA)
- Probability and Statistics
- Natural Hazards
- Scenario-Based Analyses that Include HMP Scenarios
- Understanding of Engineered Systems

Mr. Maher has addressed key Chemical Facility Security Vulnerability Assessment (SVA) issues in the work products produced by Risk Management Professionals since the late-1990's:

- Performance of Process Hazard Analyses (PHAs) that have included the assessment of site security issues and hazards precipitating from deliberate acts
- Creation of Emergency Response Plans that have specifically addressed: "Threats/Civil Disorder", "Potential Security Breach or Imminent Danger to Personnel (e.g., hostages, armed individual)", "Unusual Incident/Attack (e.g., bomb, biological, chemical, nuclear, physical electronic)", and "Procedures for Handling Demonstrations, Threats of Violence, or Civil Disorder"
- Creation and implementation of risk communication plans for facilities that have addressed questions about the facility's preparedness to address deliberate acts

Mr. Maher has played a lead role (typically as Project Manager and Key Technical Resource) in nineteen (19) Security Vulnerability Assessments (SVA) that applied the RAM-WSM methodology developed by Sandia

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National Laboratories for potable water treatment and distribution systems. Mr. Maher has also provided technical support to over a dozen additional potable water treatment and distribution systems. Specific to SVAs, Mr. Maher's key specialties have included:

- Application of a Pair-Wise Analysis Approach to Facility Prioritization
- Scenario Identification and Analysis
- Fault Tree Analysis
- Emergency Response Plan Development

In addition to a wide range of PSM and RMP applications at a number of different facilities, Mr. Maher has been the Program Manager and a key technical resource for a multi-year project that has involved a comprehensive and independent evaluation of all safety and environmental activities at a refinery in Los Angeles County, making necessary recommendations, and monitoring implementation. In addition to technical activities, this project has also involved a high degree of interface with the Court, as well as legal and political representatives. The broad scope of this project encompassed all key safety and environmental elements of plant design and operations including Process Safety Management (PSM), Risk Management and Prevention Programs (RMPP), and Risk Management Program (RMP). This rigorous multi-phase project has involved multiple organizations within a major corporation and several subcontractors. Efforts included a key role in the risk comparison of a modified HF alkylation process vs. sulfuric acid alkylation, including a comprehensive Quantitative Risk Assessment (QRA). Subsequently, the QRA models were used to significantly improve operating margin and efficiency, by quantitatively comparing various combinations of additive concentration vs. risk benefits associated with improved mitigation features. As part of this project, Mr. Maher also played a key role in risk communication, in televised public forums and in industry panel discussions.

Mr. Maher has been involved in several projects that have used high-end quantitative risk analysis techniques for decision-making, and where risk communication issues were paramount to the success of the projects. He has served as the facilitator for a number of Hazard and Operability (HAZOP) Studies. He has also been an instructor for a number of courses and focused technical seminars on topics associated with HAZOP Studies and Quantitative Risk Assessment.

Mr. Maher played a key role in the definition and implementation of a comprehensive PSM Program for several offshore and onshore exploration and production facilities for a Southern California petroleum company. As part of this project, Mr. Maher also developed comprehensive Emergency Response Plans (ERP), supported pre-startup safety reviews, tracked and closed PHA recommendations, performed a PSM audit, and provided training for the majority of PSM elements. Mr. Maher also spearheaded PHA activities associated with the start-up of a gas processing facility.

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Mr. Maher has functioned as the program manager and key technical resource for a comprehensive PSM Program development and implementation project for a gas processing facility in Southern California. Mr. Maher has also functioned as the program manager and key technical resource for a comprehensive PSM/RMP Program development and implementation project for a military laser weapons testing facility in Southern California that stored and processed a number of unusual potentially hazardous chemicals.

Mr. Maher was the primary author for a "Risk Communication Guide for State & Local Agencies" (December 1999) that provides a comprehensive summary of the best agency risk communication practices for potential emergencies/disasters. A sequel "Practical Guide to Risk Management Communications" focusing on US EPA and CalARP Risk Management Program Public Meeting communication requirements was published in January 2000.

At the leading edge of practical risk assessment applications, in 1990, Mr. Maher was a key instructor in the formulation of a landmark ASME's Professional Development Course: "Risk-Based Decision-Making for Power and Process Facilities".

Mr. Maher was the 1998-1999 Program Year Chapter President of the Southern California Society for Risk Analysis, and served on the committee formulating methodologies for the implementation of the CalARP Program in Los Angeles County. Mr. Maher wrote one of the chapters in the LEPC Guidance Document.

Mr. Maher provided the lead technical support for the development of the Westinghouse HAZTEK™ HAZOP Software and the Risk Management Professionals PHAPlus™ PHA documentation & management software system.

Below is a list of Mr. Maher's specific project involvement:

Hazard Mitigation Grant Applications and Notice of Interest (NOI) Submittals - Mr. Maher was part of the team that won 92% of the 2005 PDM Project Grant applications in California for its clients. Mr. Maher was part of the team that developed the unique approach to the performance of Benefit-Cost Analysis (BCA) for utility systems (e.g., the VVWD HMP). Using detailed techniques and a practical approach, the Risk Management Professionals team approach to developing Hazard Mitigation Plans has been highlighted by OES as the model to follow.

Urban Area Response Plans (UARPs) - Mr. Maher is the Project Director for a high visibility project involving 17 Cities and 4 major County Departments, that as a team, are developing an Urban Area Response Plan to address Weapons of Mass Destruction (WMD) that include CBRNE and IEDs. This project requires the gathering, organizing, and dissemination of vast amounts of information. A Response Capabilities Report and a Gap Analysis Report are one of the end products of this Project.

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Risk Management Program (RMP) – Mr. Maher has been involved in many RMP development and implementations, including activities such as off-site consequence analysis and dispersion modeling. Projects include:

- Military Laser Weapons Testing Facility
- Anhydrous Ammonia Distribution System
- Liquefied Natural Gas Storage & Dispensing System
- Several Anhydrous Ammonia Refrigeration Systems
- Toluene Dilsocyanate Distribution System
- Several Chlorine Water Treatment Facilities (specific support defined below)
- Chlorine Production/Storage Facility
- Onshore Crude Sweetening/Sulfur Removal Facility
- Southern California Chemical Storage and Production
- Refinery Sulfur Recovery Facility (hazard assessment only)

For all of the above water treatment (chlorine) facilities, program management support was provided. Specific technical support was provided to the water treatment (chlorine) facilities as follows. For eight facilities, a hazard assessment was performed, defining potential release scenarios. Program plan development and contract support was also provided, as well as, technical guidance in defining appropriate dispersion modeling parameters. For two different water utilities, technical guidance in the performance of the PHA was provided, as well as a separate quality review. For another facility, a comprehensive program and management plan was developed. For another chlorine facility, a detailed fire and toxic chemical protection evaluation was performed, along with a review of chemical detection/warning systems.

In response to the requirements of PL 106-40, Mr. Maher was directly involved in the public presentation of several Risk Management Programs.

CalARP - Mr. Maher has served as the Project Manager and Advisory Engineer for the development and submittal of numerous CalARP and RMP documentation; development and update of the Emergency Response Plans; PHA studies; and Offsite Consequence Analysis.

Urban Water Management Plans (UWMPs) - Mr. Maher has provided key support to several UWMPs including the City of Manhattan Beach, City of Camarillo, Yorba Linda Water District, and City of El Segundo.

Qualitative hazards analyses using PHA techniques - Mr. Maher conducted the PHA for various petroleum facilities:

- Solvent Well Injection System

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- Oil Field Waterflood Project
- Crude Oil Topping Plant
- Gas Conditioning Facility
- Drill Sites

Qualitative hazards analyses using HAZOP techniques - In addition to providing training to the engineering team, Mr. Maher served as team leader (HAZOP Facilitator) for the following systems:

- Alkylation Units
- Butamer Unit
- Crude Units
- Sulfuric Acid Storage and Distribution
- Propane Deasphalting Unit
- Sulfur Recovery Units and Complexes
- Sour Water Stripping Units
- Proposed Refinery Conversion from an Anhydrous HF Alkylation Process to MHF
- 10-Ton Chlorine Processing Systems at 3 Regional Water Reclamation Facilities
- One-Ton Chlorine Processing Systems at multiple Water Reclamation Facilities
- One-Ton Chlorine Processing Systems at multiple Water Treatment Facilities
- Anhydrous Ammonia Refrigeration Systems
- Propane Storage and Distribution Systems
- Toluene Di-Isocyanate Distribution System
- Vacuum Units
- Gas Conditioning/Processing Plants
- Offshore Platforms
- Delayed Coking Units & Focused Upgrades to Coking Units
- Onshore Crude Sweetening/Sulfur Removal Facility
- Field Production Facilities
- Coker Unheading System

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- Slop Reprocessing Units
- MEK Dewaxing Unit
- Unifiner
- Steam Reforming System for a Paper Mill in the Eastern United States
- Major Grass Roots Refinery in Venezuela (Coker, Hydrogen Plant, Utilities Plant, Wastewater Treatment System)
- Extensive Upgrade to a World-Class Synthetic Fuels Plant (Fluidized Bed Coker, Fractionator, Light-Ends Recovery)
- Fluidized Catalytic Cracking Unit
- Hydrotreating Units
- Platforming Unit
- Coker Drilling Shelter
- Tankage, Transfer, and Storage Systems
- Oil Field Remediation Systems
- Fuel and Oxidizer Subsystems for Rocket Propulsion Systems
- Refinery Electric Power Distribution System
- Loading and Unloading Processes
- Chemical Storage and Transfer
- Highly Hazardous Materials used in Semiconductor Manufacturing Systems
- Fuel Oil Distribution System
- Energetic Materials Manufacturing Systems
- Multiple PHAs for Exotic Chemicals Used for Military Laser Systems
- UO₃ Processing Plant

Following an accident, Mr. Maher was requested to facilitate the HAZOP Study of the redesigned/rebuilt refinery processing unit. This high profile job not only precipitated in meaningful and sensible recommendations, but also independently identified the original hazard scenario.

Quality Assurance Review - Mr. Maher has performed quality assurance reviews of various PHA efforts for clients in petroleum and water facilities.

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PSM/RMP Auditing Services - Mr. Maher has provided program auditing services to many clients. A recent project involved a PSM Audit conducted for a refinery. As a spin-off from this audit, many cost-effective modifications to the Mechanical Integrity Program are expected to result in significant savings to the client, as well as address long-term contentious issues between the Operations and Maintenance Departments. Mr. Maher has also performed PSM/RMP Audit for two facilities manufacturing energetic materials in the Western United States, for a mining facility processing dozens of types of hazardous materials, for a world-scale aluminum production facility, for two weapons development and testing facilities in the Western United States, and for multiple chlorination facilities at a water district in Southern California.

Mr. Maher has served as the Project Engineer for Irvine Ranch Water District to develop and perform updates of the Emergency Response Plan and conduct a Safety Management Systems Audit.

PHA Revalidation and Update – Mr. Maher’s activities in this area include the following processing units:

- Alkylation Unit
- Butamer Unit
- Crude Units
- Vacuum Units
- Hydrogen Unit
- Unifiners
- Light Naphtha Stabilizer Units
- Merox Unit
- Jet Fuel Treating Unit
- HydroDesulfurization Unit
- Propane Deasphalting Unit
- Sulfur Recovery Units and Complexes
- Amine Unit
- Gas Conditioning/Processing Plants
- Well Production Field
- Onshore Crude Sweetening/Sulfur Removal Facility
- Energetic Materials Manufacturing Systems
- UO₃ Processing Plant

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Security Vulnerability Assessment - The Process Hazard Analysis (PHA) activities performed by Steve Maher have always included a security component. This security assessment has always involved a visual inspection of the facility, and a PHA Team discussion of potential hazards associated with deliberately-induced events, identification of existing safeguards to minimize the potential for hazard, and the evaluation of any necessary improvements to security systems or practices to minimize the potential for hazard. Over the years, as industry has gradually become more sensitized to the potential for hazard (and the potential for liability) from either externally- or internally-based deliberately-induced events, these evaluation efforts have also been stepped-up, to match. The September 11, 2001 World Trade Center Tragedy further sensitized industry to the importance of assessing potential security vulnerabilities, and hazard assessment efforts were fortified to address the need for Security Vulnerability Assessment (SVA). As an example, during a recent PHA activity, SVA techniques were actively applied to assess potential vulnerabilities at a Southern California Oil and Gas Processing Facility. By folding the SVA into the PHA, the needs of SVA were efficiently accommodated using the momentum, process knowledge, and previous experience of the PHA Team (dealing with the nearby community, and attempted and successful perimeter breaches). As a result, the effectiveness of the facilities' security system and practices were evaluated, and additional protection measures were recommended to address potential vulnerabilities.

In addition to applying SVA to a number of chemical facilities, Mr. Maher worked on the following potable water treatment and distribution system SVA:

- Major Water Department in the County of Los Angeles:
- City of Santa Ana
- City of Orange
- Mesa Consolidated Water District
- Three Valleys Municipal Water District
- Placer County Water Agency
- City of Roseville
- Carlsbad Municipal Water District
- City of Tustin
- City of Redlands
- In the following, related projects, Mr. Maher has also played a lead role (either as Project Manager or Key Technical Resource):
 - City of Manhattan Beach
 - City of Camarillo

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- Channel Islands Beach Community Services District
- City of Port Hueneme
- Port Hueneme Water Agency
- Lincoln City
- City of Paso Robles
- City of El Centro
- Valley County Water District

Risk Management & Prevention Program (RMPP) - Mr. Maher has performed a comprehensive HAZOP Study and supported the associated RMPP update for an offshore production and onshore processing complex in Santa Barbara County.

Process Building/Facility Siting Activities - The following summarizes some key building/siting projects led by Mr. Maher:

- A thermal, fire-load analysis, as well as overpressure calculations and addressing toxic release issues for a proposed extension of a community road adjacent to a light hydrocarbon tank farm. Evaluation of siting issues was the primary concern.
- Development of building/facility siting checklists, which was incorporated into the PHAPlus™ Software System, used for process plant Process Hazard Analysis (PHA).
- One of the developers of some of the first materials for the CCPS Guidebook “Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires”.
- Use and refinement of extensive building/facility siting checklists for a major petroleum company in multiple PHAs at their Los Angeles Refinery.
- Development and application of a landmark screening approach for the prioritization of hazards throughout an entire refinery – “Selection of Critical Equipment and Structures” – Many of these concepts are addressed through contemporary facility/building siting approaches. This approach pre-dated API RP 752; however, the results were recently compared to a more recent siting analysis of the same systems, and very few changes were needed.
- [multiple projects] Atmospheric dispersion modeling of hazardous materials for a number of projects, including toxic chemicals and light hydrocarbons.
- [multiple projects] The application of high quality Process Hazard Analysis (PHA) has always involved an evaluation of potential building/facility siting vulnerabilities, qualitatively addressing the same issues that are in contemporary facility/building siting approaches.

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Emergency Response Plan (ERP) - The following summarizes some of Mr. Maher's ERP development projects:

- Author of Chapter 8 ("Emergency Response Program") of the California Region I LEPC California Accidental Release Prevention Program (CalARP) Implementation Guidance Document.
- Performance of PSM/RMP Prevention Program Audits addressing the Emergency Planning and Response Element, and other compliance reviews. Projects include:
 - Multiple Water and Wastewater Treatment Facilities for Multiple Companies
 - Refinery in Montana
 - Refinery in Southern California
 - Energetic Material Manufacturing Facility in Arizona
 - Energetic Material Manufacturing Facility in Nevada
 - World-Scale Aluminum Production Facility in Louisiana
 - 3 Cogeneration Facilities
 - Weapons Development & Testing Facility in Southern California
 - Weapons Development & Testing Facility in New Mexico
- Development of comprehensive Emergency Response Plans. Projects include:
 - 5 onshore production facilities, 3 offshore production facilities, and 2 onshore gas processing facilities for a Southern California Energy Company
 - Southern California Gas Processing Facility
 - Southern California Refinery
 - 15 Water Treatment Plants for 5 Utilities
 - 3 Ammonia Refrigeration Facilities
 - 1 Ammonia System for Water Treatment
 - Central California Marine Terminal
 - Central California Remediation Site
 - Chemical Plant in Southern California
 - Energetic Material Manufacturing Facility in Arizona

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- Performance of a comprehensive evaluation of the Emergency Response Program for a Southern California Refinery as an independent third party, to resolve a legal dispute.
- Consulting with facilities regarding emergency response planning, capabilities, and the effectiveness of mitigation systems.
- Providing Emergency Response Team training and Emergency Response Plan deployment.

Facility PSM Program Development –Mr. Maher was involved in the development and implementation of a comprehensive PSM Program for the following facilities:

- Southern California Gas Processing Facility – activities included:
 - PSM Baseline Audit
 - Collection and Assembly of Process Safety Information (including an electronic roadmap and database management system)
 - Development of Complete Operating Procedures (including links to other information via the facility IntraNet)
 - PHA Review and Validation
 - PSM Training Procedure (including a training tracking tool)
 - Contractor Safety Issues
 - Pre-Startup Safety Review Procedure
 - Mechanical Integrity Program
 - Management of Change Program Validation
 - Incident Investigation Procedure
 - Emergency Planning and Response Program (including the development of emergency procedures)
 - Compliance Audit Procedure
- Southern California Military Laser Weapons Testing Facility – This facility stores and processes a number of unusual potentially hazardous chemicals. This project involved the development of a comprehensive and integrated PSM/CalARP-RMP Program. By integrating the PSM and CalARP-RMP Program, we were able to make use of a number of common features to maximize implementation efficiency. This program involved the following key elements:
 - PSM/RMP Baseline Audit
 - RMP Hazard Assessment (worst-case and alternative release scenarios)

- PSM/RMP Employee Participation Plan
- PSM/RMP Process Safety Information (including an electronic roadmap and database management system)
- PSM/RMP Operating Procedures Review
- PSM/RMP Process Hazard Analysis – Conduct PHAs for many different storage and process systems
- PSM/RMP Training Program, Procedure, and Implementation
- PSM/RMP Contractor Safety Procedures and Training
- PSM/RMP Pre-Startup Safety Review Procedure
- PSM/RMP Mechanical Integrity Program Update
- PSM Hot Work Program Update
- PSM/RMP Management of Change Procedure
- PSM/RMP Incident Investigation Procedure
- PSM Emergency Response Plan Update
- PSM/RMP Compliance Audits Program Update
- RMP Emergency Response Plan
- RMP Risk Management Plan Development

A similar PSM Program was created for another military weapons testing facility in the southwestern portion of the United States.

- Southwest Chemical Company – This chemical company uses “energetic materials” to manufacture consumer products. Mr. Maher worked with this company to assess the PSM Program to evaluate the validity of key PSM issues raised by an outside party. This was done in the wake of several OSHA citations. As a result of Mr. Maher’s efforts, both Parties were able to better understand the PSM Program in light of the regulatory requirements and forged an improved relationship for addressing plant safety issues. In addition key citation items were removed or reduced.
- Southern California Petroleum Company – As part of its program to address Federal OSHA and Cal-OSHA PSM requirements, as well as its own internal initiatives, Mr. Maher helped define and implement a comprehensive PSM Program for several offshore and onshore exploration and production facilities. The specific activities involved:
 - Definition of PSM Program Plan

- Support of periodic Business Unit PSM status meetings
- Resolution of PSM-related issues with contractors
- Facilitation of HAZOP studies
- Development of Emergency Response Plans and Procedures
- Support of Management of Change evaluations
- Support of Pre-Startup Safety Reviews
- Tracking and Closing PHA Recommendations
- PSM Audit
- Spearheaded PHA Activities Associated with the Start-up of a Gas Conditioning Facility
- Blanket PSM Training: PSM Overview and Regulatory Requirements, PHA, Management of Change, Management and Organizational Policies, Employee Participation, Process Safety Information, Operating Procedures, Safe Work Practices and Hot Work Permit Systems, PSM Training Requirements, Contractor Safety, Incident Investigation, Emergency Planning and Response, Compliance Auditing, Pre-Startup Safety Review, Mechanical Integrity

Fault Tree Analysis - Another significant project involved a fault tree analysis optimizing the design of the next generation of offshore oil platform safety shut-down systems. Mr. Maher served as the program manager and technical lead for the project, which involved a quantitative hazard evaluation of 3 standardized offshore platform designs. Platform risk was determined through the assignment of specific consequence categories to each hazard type. The study resulted in the determination of the impact on hazard frequency, equipment unavailability, and nuisance shut-down frequency from variances in such items as redundancy, equipment type, and test and inspection frequencies. This resulted in clear specifications to the designer and management for the optimized design and operation of the next generation of offshore platforms.

Mr. Maher performed a quantitative availability evaluation of a cooling water system for an oil-from-oil-sands facility using fault tree techniques. The cooling water system consists of a series of fan coolers enclosed within a cooling tower, turbine- and motor-driven pumps, and associated piping.

Quantitative Risk Assessment (QRA) - Mr. Maher was involved in several QRA projects as follows:

- Industrial Space Facility: QRA was performed for use in design optimization and evaluating cost and weight tradeoffs. The scope of the project included: personnel and vehicle safety, loss of critical mission support capabilities, and equipment damage. The results of this project were used by management to quantitatively balance risk and reliability options. Other activities included: a comprehensive hazards identification, identification of system weaknesses, input to operator

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training and emergency pre-planning, systems integration, and identification of limiting conditions for operation.

- Two 4-loop commercial nuclear power facilities: QRA was performed to calculate the impact (risk) on the public from severe accidents. The methodology employed was consistent with that endorsed by industry experts as the most current and up-to-date recommended for commercial nuclear power facilities for this application. As part of this assignment, a new approach for treating the impact of cooling tower performance on the unavailability of the Cooling Water System was employed.
- Level 1 PRA: Quantitative Risk Assessment of a 4 loop European commercial nuclear power facility. The primary approach for this project was based on fault tree linking.
- Level 3 PRA: Served as Technical Project Manager and Analyst for a rigorous 2-year, multi-phase project involving the Quantitative Risk Assessment of a 4 loop US commercial nuclear power facility to calculate total risk to the public. Fault tree linking methods were used to calculate the frequency of severe damage to the reactor core and overall plant risk.
- DOE Nuclear Waste Isolation Site: Quantitative risk and operability analysis to be used by plant management prior to start-up. The results of this project were used to prioritize design, construction, and operations changes during the startup phase and later to optimize reliability and maintain risk at an acceptable level during operation of the facility.

Training - Mr. Maher was a key Instructor for the “Overview of Process Safety Management” course at the University of Southern California’s Institute of Safety and Systems Management. In addition, Mr. Maher has conducted training courses involving the following subjects.

- Process Safety Management (PSM)
- Hazard and Operability (HAZOP) Studies
- PHA Facilitation
- Compliance Auditing
- Emergency Response Planning
- Management of Change
- Fault Tree Analysis
- Event Tree Analysis
- Data Base Development (API Workshop)
- Fault Tree and Event Tree Analysis Software
- Quantitative Risk Assessment (QRA)

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- Risk-Based Decision-Making for Power and Process Facilities (ASME Short Course)
- Probability and Statistics
- Common Cause Failure Analysis
- Contractor Safety
- Safe Work Practices & Hot Work Permit Systems
- Operating Procedures
- Pre-Startup Safety Review
- PSM Training
- Mechanical Integrity
- Incident Investigation
- Process Safety Information
- QRA Software Training

PUBLICATIONS:

Guidance Document Development

Steve Maher's experience encompasses over two decades (since 1983) of direct process safety and risk management support to industry and the regulatory communities. This period was marked by a significant paradigm shift in views on the root causes of various accidents (e.g., the Bhopal and Mexico City events triggering fundamental changes in the way that we view safety, the formation of the Center for Chemical Process Safety, API's development of RP 750, PSM/RMP/CalARP promulgation, and the increased application of selective Quantitative Risk Assessment applications). Mr. Maher was fortunate to have been directly involved during this critical period, served on the first Technical Steering Committee for the CCPS, and has participated in the development of key guidebooks that have served both the industrial and regulatory communities. This experience has also provided a platform for the formulation of key approaches that have served Risk Management Professionals' ability to provide high quality Security Vulnerability Assessment products to utility and other industries.

- **Risk Communication Guide for State and Local Agencies (published by the California Governor's Office of Emergency Services)** – Primary Author of this Peer-Reviewed Methodology Guidance Document – Peer-Review encompassed Southern California Regulatory Authorities, Industry, and Consulting Organizations
- **Evaluation of Plant Buildings for Potential Explosions** (participation-only)

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- **CCPS Book on Process Building Siting** (participation-only)
- Primary Author of Westinghouse Guidelines for:
 - Common Cause Analysis** – Analytical Guidance
 - Failure Modes, Effects, and Criticality Analyses** – Analytical Guidance
 - Plant Walkdown Methodologies** – Methodology Guidance
 - Risk Assembly** – Analytical Guidance
- **Internal Fire Walkdowns** – Primary Author – Methodology Guidance
- **Internal Flooding Walkdowns** – Primary Author – Methodology Guidance
- **Internal Events Walkdowns** – Primary Author – Methodology Guidance
- **Other External Events Walkdowns** – Primary Author – Methodology Guidance
- **Region I LEPC CalARP Implementation Guidance Document** – Chapter 8, Emergency Response Program – Primary Author of this Peer-Reviewed Methodology Guidance Document – Peer-Review encompassed Southern California Regulatory Authorities, Industry, and Consulting Organizations
- **Process Safety Tech Tips – Operating Procedures Best Practices** – Compilation of Best Prevention Program Practices Provided to a Number of Companies and Agencies
- **Process Safety Tech Tips – Training Program Best Practices** – Compilation of Best Prevention Program Practices Provided to a Number of Companies and Agencies
- **Quantitative Risk Assessment Guidance Document for a Refinery Hydrofluoric Acid Alkylolation Unit** – Analytical Guidance Document Currently Being Produced for a Southern California Refinery
- **Security Vulnerability Assessment (SVA) Physical Protection System (PPS) Best Practices for Potable Water Facilities** – Internal Compilation Created to Enhance SVA Product Quality

Books, Papers, and Courses Taught

"Risk Management of a Fuel Gas Conditioning Facility Using Fault Tree Analysis," presented at the CSChE 35th Canadian Chemical Engineering Conference, Calgary, Alberta, October 1985 also published in the Canadian Journal of Chemical Engineering, volume 64, pgs 848-853, October 1986.

"Reliability and Hazards Assessment of a Central Cooling Water Supply System," presented at the CSChE 36th Canadian Chemical Engineering Conference, Sarnia, Ontario, October 1986.

"Risk Management of a Petroleum Refining Facility Using Fault Tree Analysis," presented at the 6th International Symposium on Offshore Mechanics and Arctic Engineering (OMAE), Houston, Texas, March 1987.

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"The Application of Risk Assessment to a Hoist Handling Radioactive Waste at a National Repository," ANS/ASME Nuclear Power Symposium, Myrtle Beach, South Carolina, April 1988.

"Relief Valve Testing Interval Optimization Program for the Cost-Effective Control of Major Hazards," Second Symposium on Preventing Major Chemical Accidents, Oslo, May 1988.

"On the Use of Training Simulators for Accident Analysis and Training", February 1990.

"Decision Analysis Using Risk Management Techniques," Twenty-First Annual Pittsburgh Conference on Modeling and Simulation, Pittsburgh, Pennsylvania, May 1990.

"Tools to Enhance the Flexibility of Risk Assessment and Hazards Identification," AIChE 1990 Summer National Meeting, San Diego, August 1990.

"Offshore Platform Safety Shutdown System Effectiveness," Safety Developments in the Offshore Oil and Gas Industry, Institution of Mechanical Engineers, Glasgow, Scotland, April 1991.

"Systematic Probabilistic Safety Assessment Overview, Ongoing Activities and Lessons Learned," Jahrestagung Kerntechnik '91, Bonn, May 1991.

"The Integration of Quantitative Risk Assessment and Reliability Centered Maintenance to Optimize Platform Design and Operations", Safety and Reliability Society Symposium 1991, London, England, September 1991.

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California Risk Management Planning 1996 Workshops, Hazard and Operability (HAZOP) Studies, October 16, 1996.

Southern California Society for Risk Analysis - Specialty Workshop on US EPA's Risk Management Program, "Prevention Program," December 14, 1996.

"Effective Approaches to PHA Revalidation," Southern California Section of the American Institute of Chemical Engineers, October 28, 1997.

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