

Saige A. McCluskey

PROFESSIONAL HISTORY:

*Risk Management Professionals, Inc.,
Irvine, CA; Project Engineer,*

EDUCATION:

*Bachelor of Science, Chemical Engineering
California State University, Long Beach*

PROFESSIONAL AFFILIATIONS:

*American Institute of Chemical Engineers
(AIChE)*

Ms. McCluskey graduated from California State University, Long Beach with a Bachelor of Science



degree in Chemical Engineering with an emphasis in materials science. Currently, Ms. McCluskey provides technical support as a Project Engineer for Risk Management Professionals.

Since joining Risk Management Professionals, Ms. McCluskey has been immersed in multiple aspects of the United States Environmental Protection

Agency (US EPA) Risk Management Plan (RMP), Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) Program, and California Accidental Release Prevention (CalARP) Program development. Ms. McCluskey has been involved with:

- Process Hazard Analyses (PHAs) including Hazard & Operability (HAZOP) studies, Layer of Protection Analysis (LOPA) studies, and Management of Change (MOC) PHAs
- Hazard Identification (HAZID) facilitation support
- What-If and Checklist Analyses
- Risk Management Plans (RMP) / Process Safety Management (PSM) Programs
- California Accidental Release Prevention (CalARP) Program
- Toxic and Flammable Gas and Liquid Dispersion Modeling
- Regulatory Compliance Auditing and Support

While Ms. McCluskey has experience in diverse product lines, all completed projects have used high-end qualitative and/or quantitative risk analysis techniques for decision-making. She has been involved in a variety of engineering projects across several industries, including the following fields:

- Petroleum and Renewable Fuels (Production, Refining, Storage)
- Solar Power Generation
- Gas Processing/Transportation/Storage
- Chemical Manufacturing
- Ammonia Refrigeration Systems
- Mineral Extraction

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PROJECT EXPERIENCE

Process Hazard Analyses

Ms. McCluskey has been involved in several PHAs and Hazard Reviews (HRs) using the HAZOP, LOPA, and What-If/Checklist methodologies for refineries, gas processing facilities, renewable fuel plants, and mineral extraction facilities as well as for other industry sectors. The following list is representative of projects that Ms. McCluskey has been involved with during the conceptual design stages, detailed design stage, and operating cycle.

- *Amine and Sulfur Recovery Units – Refinery, Garyville, LA* – Provided facilitation support for a HAZOP/LOPA study of a 500,000 barrels per day (bpd) refinery in Louisiana. The scope included three (3) units in total, one (1) amine recovery unit and two (2) sulfur recovery units. A unique approach was taken in the analyzation of the two ‘sister’ sulfur recovery units in which the units were mirrored and evaluated for differences in both design and operation. In doing so, discrepancies between the units were studied to optimize efficiency of operation and uncover latent hazards.
- *Cooling Towers – Refinery, Garyville, LA* – Provided facilitation support for a HAZOP and LOPA study which encompassed a total of eight (8) cooling towers operating at the 500,00-bpd refinery. The study involved a rotating team of facility personnel to provide coverage for the several domains that were directly affected by each cooling tower. Diligent tracking of interconnecting domains and equipment was necessary for potential hazards to be properly analyzed.
- *Boilers – Refinery, Garyville, LA* – Provided facilitation support for a HAZOP and LOPA study which encompassed a total of two (2) Boiler Units and associated auxiliary systems. This study included analysis of dual-operating water softener systems as well as high and low-pressure deaerators. The study involved a rotating team of facility personnel to provide coverage for several domains that were directly affected by each boiler.
- *Cogeneration Unit – Refinery, Salt Lake City* – Provided facilitation support for a HAZOP and LOPA Study which encompassed parallel trains of turbine generators and associated heat recovery steam generators. This study analyzed several

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modes of operation, since the intended total use of the HRSGs had not been determined, to identify potential operating hazards and optimize future operation.

- *Liquid Petroleum Gas (LPG) Unit – Refinery, Martinez, CA* – Provided facilitation support for a HAZOP and LOPA study for the LPG storage and railcar loading processes for a facility in Martinez, California. This study was part of a much larger project, of which Risk Management Professionals had been heavily involved to reposition the existing refinery into a renewable fuels facility. Once completed, the facility will produce approximately 730 million gallons of renewable fuels per year. This study was used as a tool to identify the operational modifications that will be required following the removal of butane loading, decrease in propane production, and introduction of biodiesel processing at the facility.
- *Sunlight Refinery™, Boron, CA* – Provided facilitation support for a HAZOP and LOPA study during the design phase of a Sunlight Refinery™ tower which utilizes advanced computer vision software to align an array of mirrors to reflect sunlight to a target on top of the direct steam generating receiver tower. The study was used as a tool to improve the design and operating efficiency of the steam generating tower and auxiliary equipment.
- *Liquid Petroleum Gas (LPG) Unit – Bakersfield, CA* – Provided facilitation support for a HAZOP and LOPA study for the renewable conversion of a former fossil fuel refinery in Bakersfield, CA. Major pieces of equipment evaluated during the study included propane/butane bullets, diesel storage tanks, naphtha storage tanks, and multiple interconnected vapor recovery systems. The study also included the product loading rack and associated vapor return systems.
- *Natural Gas and Fuel Gas – Bakersfield, CA* – Provided facilitation support for a HAZOP and LOPA study for the renewable conversion of a former fossil fuel refinery. This study analyzed the utilization of fuel gas and natural gas throughout the facility in various burners, heaters, storage tanks (natural gas acting as blanket gas), etc. to identify potential operational hazards. Additionally, the study involved the detailed review of the IFC (Issued for Construction) Piping and Instrumentation Drawings (P&IDs) to ensure the accurate depiction of facility following the

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conversion project. The PHA study was conducted onsite working with engineering contractors and facility personnel.

- *Boilers and Steam System – Bakersfield, CA* – Provided facilitation support for a HAZOP and LOPA study for the renewable conversion of a former fossil fuel refinery. Following the conversion project, the utilization of the two (2) boiler systems at the facility needed to be re-engineered to meet the requirements for renewable fuel production. This PHA was used as a basis to develop the Cause & Effect for the shutdown system associated with each boiler. This study also involved the detailed review of the IFC P&IDs to ensure the accurate depiction of facility following the conversion project.
- *Wastewater Treatment Plant – Bakersfield, CA* – Provided facilitation support for a HAZOP and LOPA study for the renewable conversion of a former fossil fuel refinery. Following the conversion project, the wastewater system needed to be reconfigured to bypass demolished equipment and address new loads. This PHA was used to identify initial design errors, deadlegs, and validate cross-refinery flowpaths. The facility engaged a contracting company to build and operate the reverse osmosis and ultrafiltration processes within the plant; Google Meet was used as a platform to virtually engage the contractors during the study.
- *J-CYP Leach –Bagdad, AZ* - Provided HAZOP on-site technical support for a Project PHA involving the introduction of a proprietary catalyst to increase recovery of residual copper within existing Run-of-Mine (ROM) leach stockpiles. The scope of the project included a new pregnant leach solution (PLS) tank, a new raffinate tank, piping changes to isolate two of Bagdad's four solution extraction (SX) trains, and a solution collection well to minimize the amount of catalyst reporting to the active mining area via seepage. The PHA Team included personnel from three separate corporations; effective teamwork was integral to the success of this study and the project itself.

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CLIENT LIST

The following is a partial list of clients that Ms. McCluskey has managed and/or provided technical support:

Oil and Gas

- Marathon Petroleum Company
- Freeport-McMoRan Oil & Gas
- Hilcorp Alaska, LLC
- Caerus Oil and Gas
- Holly Frontier
- World Energy

Renewable Energy

- Ormat, Inc.
- Heliogen
- Bakersfield Renewable Fuels
- Solar Turbines, Inc.
- Midwest Ag Energy
- SGH2 Energy Global

Ammonia Handling Facilities

- Highridge Provender Partners
- Sunview Cold Storage

Manufacturing/Chemical Processing

- JSR Life Sciences
- Ecolab, Inc.
- Capstan

Mineral Extraction

- Freeport-McMoRan Bagdad Mine