

## Functional Safety Safety Instrumented Systems



### Application Experience

- Ammonium Nitrate Processing
- Batch Resin Reaction
- Benzene Reduction
- Butane Isomerization
- Caprolactam Production
- Crude Processing
- Electrostatic Precipitator
- Flare Gas Recovery
- Hyam Reactor
- Hydro-metallurgical Processing
- Low Sulfur Gasoline
- Naphtha Hydrotreater
- Polyethylene Fiber Production
- Solvent Deasphalting
- Sulfur Trioxide Unloading

CH2M HILL is your one-stop resource for functional safety implementation. We are skilled in identifying and evaluating process risk, experienced in implementing systems that reduce risk, and committed to helping our clients build, operate, and maintain safe and reliable plants.

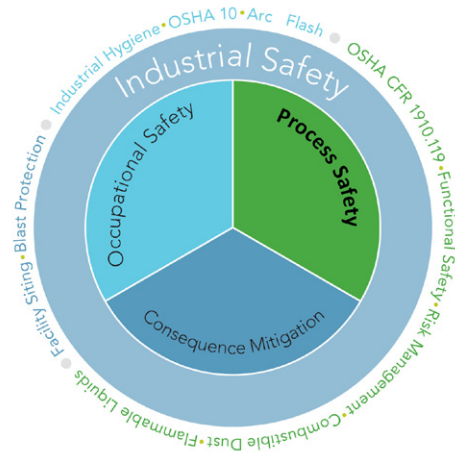
### Why Should I Implement Functional Safety?

Although compliance with ANSI/ISA 84.00.01 (IEC 61511) is optional, considerable benefits are realized from implementing functional safety, including the following:

- Ensure risk reduction decisions are based on analysis, not perception. Safety dollars are preferentially spent to deliver the most benefit.
- Establish a culture of proactive protection vs. responsive mitigation. Stop events before they happen, prevent injuries, and save lives.
- Assure safety instrumented functions (SIFs) have on-demand reliability, appropriate redundancy, and maximum availability.
- Reduced false trips, thereby reducing startup/shutdown risks, raw material waste, and lost production.
- Replace SIF components on a planned and appropriate cycle. Avoid planned downtime and expediting costs that occur when a safety critical system fails unexpectedly.
- Reduce insurance premiums, over and under engineering, and protect personnel and assets.

### Where to Consider Functional Safety

- Toxic materials unloading and handling
- Runaway reaction prevention and quench
- Decomposition reaction prevention and quench
- Dust explosion management
- Combustible gas detection
- Rotating equipment interlock protection



## Our Safety-focused Culture

CH2M HILL incorporates risk reduction practices at all phases of work.

### Conceptual Design

- Risk identification and consequences analysis (PHA)
- Layer of protection assesment (LOPA)
- Safety integrity level (SIL) determination

### Detailed Design

- Definition of safety instrumented systems (SIS) requirements
- SIF design
- SIL verification calculations
- Determination of maintenance and testing frequencies

### Installation, Operations, and Maintenance

- Factory acceptance testing
- Commissioning, pre-startup testing, and validation
- Maintenance and testing procedures

## Functional Safety Clients

- BP
- ConocoPhillips
- Cytec Industries
- DSM
- PCS Nitrogen
- Shell Oil Products
- Solvay Advanced Polymers
- Tesoro Refining and Marketing Company
- The Doe Run Company
- Valero Energy Corporation

## Safety Life-cycle Experience

- SIL implementation master planning
- Facilitate process hazard reviews including SIL determination
- SIL gap analysis and preliminary design for facility
- Define general system requirements for a safety instrumented system
- Establish SIL verification documentation requirements
- Develop master safety requirements specifications for Logic Solver
- Establish safety system performance criteria
- SIL 1, 2 verification calculations
- Prepare SIF specific safety requirements specification
- Detailed design of field components, PLC, DCS, and logic relays
- Field support for implementation and startup
- SIS orientation and training

## About CH2M HILL

Headquartered near Denver, Colorado, employee-owned CH2M HILL is a global leader in full-service consulting, program management, design, construction, and operations for public and private clients. With \$6.3 billion in revenue and more than 23,500 employees worldwide, CH2M HILL delivers innovative, practical, sustainable solutions—helping clients develop and manage infrastructure and facilities that improve efficiency, safety, and quality of life. The firm has long been recognized as a most-admired company and leading employer, including being named by FORTUNE magazine as one of the 100 Best Companies to Work For (2009). CH2M HILL is an industry-leading program management, construction management, and design firm as ranked by *Engineering News-Record* (2008).

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