



# Mechanical Integrity



As manufacturing facilities age, maintaining the Mechanical Integrity (MI) of equipment is critical to process safety. CH2M HILL helps our clients address mechanical integrity concerns with program development, program effectiveness audits, equipment and relief calculations, and corrective action planning.

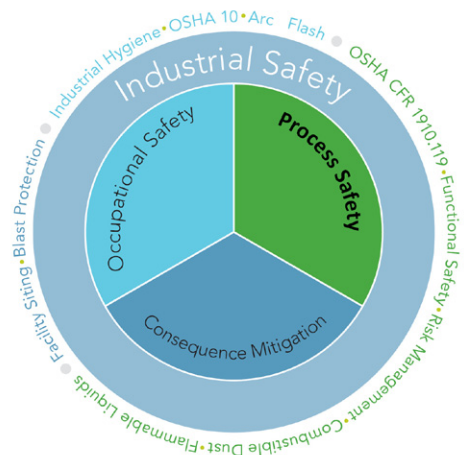
## Why Should I be Concerned About Mechanical Integrity?

Mechanical Integrity program faults represent 19% of the citations under the OSHA National Emphasis Programs (NEP) for Refineries. Incident investigation often find mechanical integrity issues to be a root cause or contributing factor in most catastrophic events.

## Benefits

Mechanical systems designed to contain chemicals within the process, can become less reliable over time. A well planned, structured, and optimized mechanical integrity program combats the effects of aging to provide continued service confidence. Benefits include:

- Appropriately scheduled maintenance on wear components to minimized unplanned failure, efficiency loss, and leaks
- Informed decision making to repair or replace equipment or piping systems before system integrity is compromised
- Confidence that safety instrumented systems will perform as planned when needed
- Assurance that relief systems are sized appropriately for overpressure scenarios
- Procedures that address maintenance issues in a timely and reliable manner
- Well founded basis for specification revision to improve economic life of equipment





### 14 Elements of PSM

- Process Safety Requirements
  - Process Safety Information
  - Process Hazard Analysis
  - Pre-Startup Safety Review
- Written Procedures
  - Management of Change
  - ▶ **Mechanical Integrity**
  - Operating Procedures
- Written Plans of Action
  - Employee Participation
  - Emergency Planning and Response
  - Incident Investigation
- Employee Training
  - Contractors
  - Training (Initial, Refresher, and Supplementary)
- Management Issues
  - Compliance Audits
  - Hot Work Permit
  - Trade Secrets

### Services

CH2M HILL staff possesses the design knowledge to evaluate the effects of time on a process, and the discipline to define programs and procedures to address these effects. Our services include:

- Develop mechanical integrity program
- Prepare maintenance and testing procedures
- Training
- Inspection and testing
- Stress analysis
- Material and corrosion analysis
- Reliability analysis
- Design and verification of safety instrumented systems
- Relief system sizing and documentation
- Forensic analysis
- Control system reliability analysis
- Fit for service analysis

### Clients

- BP Amoco
- Carolina Power and Light
- ConocoPhillips
- DSM
- Lubrizol Corporation
- Questar Gas Management Company
- Roche Carolina
- Rockwell International
- Theragenics Corp.
- The Saline Water Conversion Corporation
- Williams Energy Services

### Application Experience

- Tank and nozzle failure analysis
- Nuclear class 1,2 and 3 piping
- Oil and Gas exploration, recovery, refining and distribution
- Severe service; Arctic to desert
- Marine environment
- Corrosive chemicals
- Resins
- Polymers
- Pharmaceutical

#### 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* (2009).

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