

Designing for Health & Safety

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CDM

Introduction

- Purpose
- Why Design for Safety?
- Design Planning and Examples
- Unplanned Maintenance



Purpose of Safety Through Design

- Reduce **Probability** of incident, injury or illness
- Minimize **Severity** of harm



Purpose of Safety Through Design



According to the First Edition of the American National Safety Council's Accident Prevention Manual in 1946:

“To secure the highest efficiency in plant operations, provisions for workers’ safety must be included in the design and layout.”

Why Design for Safety?



The Safety Hierarchy:

- 1) Eliminate the Hazard (Through Design)
- 2) Substitution
- 3) Guarding and Warning Systems
- 4) Administrative Controls
(work methods, training)
- 5) Personal Protective Equipment (PPE)

Highly Effective



Least Effective

WHY?

HUMAN NATURE

Why Design for Safety?

- Reduce the **probability** and **severity** of deaths, injuries, and/or illnesses
- Less Expensive
- Less Delay
- Streamline SOPs
- Built into the Job



Design Planning



Design Planning

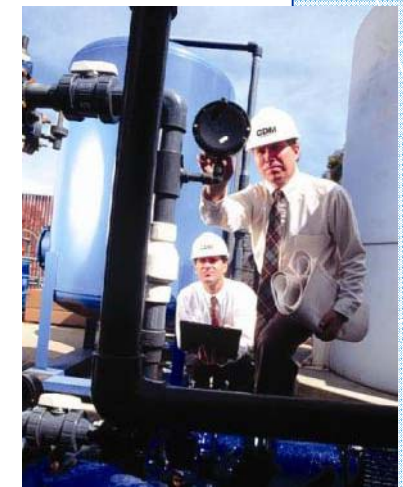
- New Technologies
- Architecture
- Unplanned Maintenance



New Technologies



- Current and Future Regulatory Requirements
- Reliability / Reliable Product
- Flexibility
- Redundancy
- Methods



Example of Flexibility and Redundancy

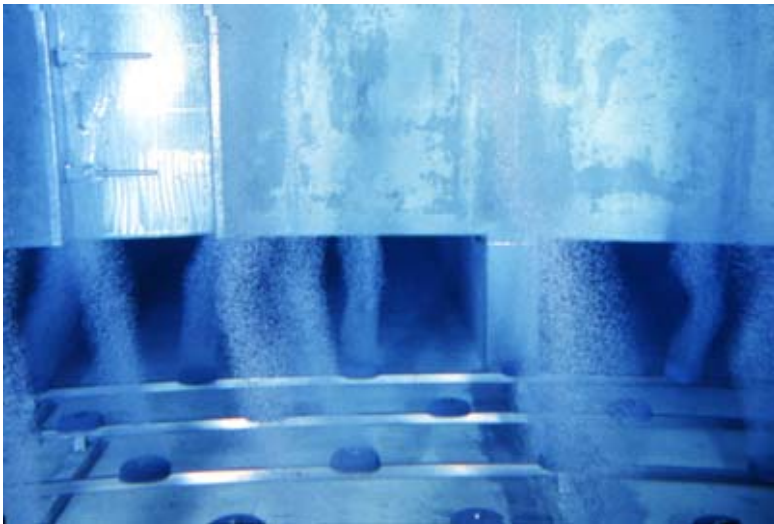
- Increases Safety in Emergency Situations



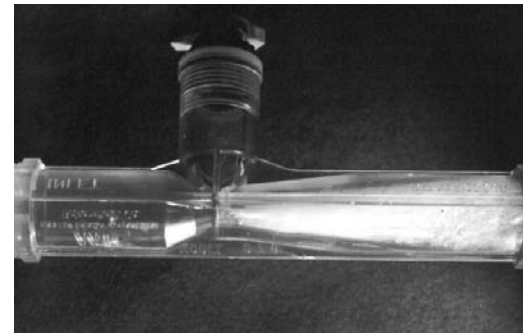
New Technology Methods - Ozone



Fine Bubble Diffusion



Sidestream Injection



Diffusion vs. Side Stream Injection (Safety Considerations)



DIFFUSION



Gaskets need replacing often



Requires confined space entry into basins



Ventilate vs SCBA

SIDE STREAM



Much less maintenance



Still potential CSE



Inspect from outside



More energy



In general, considered less hazardous to workers

Architecture

- Regulations
- Administrative / Public Areas
- Lunchroom
- Laboratories
- Maintenance Areas



Going “Green”

- Not just sustainable supplies and energy conservation
- Green Building (i.e. Green Building Council, LEED)
- Enhance Health
 - Retention
 - Satisfaction
 - Less turnover
- Employee health and safety
 - Lighting
 - Air Quality
 - Thermal Comfort



Public Viewing Areas



Hallways / Pipe Galleries



Pipe Gallery



Pump Access / Removal



- Installation of Hoist / Local Crane System vs. Contracting Crane
 - Importance of Maintenance
- Doorways
- Removable Roof / Opening Roof
- Concrete Approach / Driveway
- Remote – More Control
- Safety Net
- Examples



Pump Access / Removal



Pump Access / Removal



Example: Large Pump Station



Spacing / Layout / Working Space



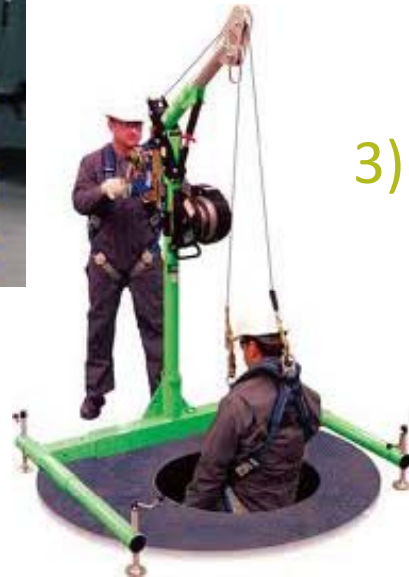
- Room for Maintenance
- Room for Removal



Confined Spaces

- Fatalities Due to:

- Maintenance / Repair
- Rescue



- 1) Eliminate the Confined Space
- 2) Eliminate Need for Entry
 - Motorize Valves
 - Built-in Cleaning System
 - Move Metrics Outside
- 3) Accessibility and Ventilation
 - Ventilation
 - Rescue System
 - Working Space



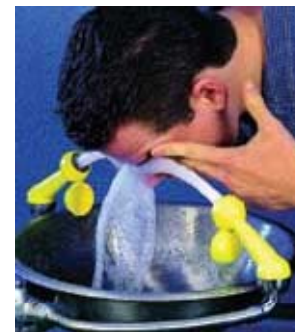
Confined Spaces

- Ergonomic Issues



Other Design Considerations

- Alarms on activated emergency eyewashes and showers
- Covered unloading area
- Calibration column on a feed pump



Unplanned Maintenance

- Specially Evaluate
- Hard to Identify
- Hazards Include:
 - Inadequate Isolation of Hazardous Energy Sources
 - Hazardous Atmospheres
 - Poor / Difficult Access
 - Awkward Positions
 - Improper Tool Selection / Availability
 - Inadequate Machine Guarding



Summary

- Consider Safety Continuously Throughout Process
- Hold Engineers, Designers, Subcontractors, Vendors Responsible for Safety
- Don't "add on safety later"
- It's Never Too Late!



QUESTIONS AND ANSWERS