PNWS – AWWA
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EUGENE, OREGON

Chemical Feed System Operation and Design Considerations

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Agenda

- Chemical Delivery and Storage
  - Chemical Delivery
  - Bulk Storage Considerations
  - Chemical Containment
  - Dry Chemicals & Polymers
- Chemical Metering and Delivery
  - Chemical Metering Pumps
  - Chemical Feed Piping
  - Feed Piping Leak Containment
- Chemical Feed Optimization
  - Inventory Measurement
  - Chemical Feed Control Strategies
  - Dose Optimization

Delivery and Storage

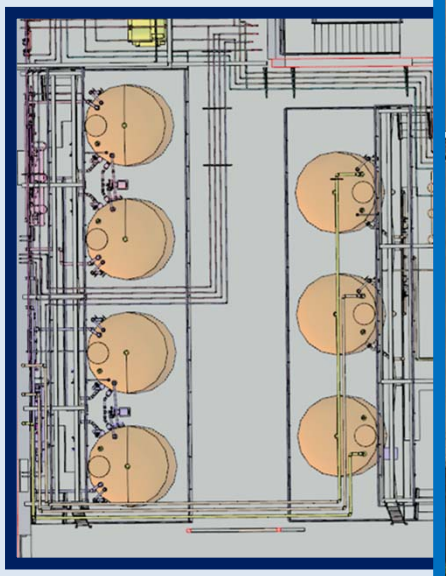
Pumps

Instrumentation

CHEMICAL DELIVERY AND STORAGE

Delivery and Storage Challenges

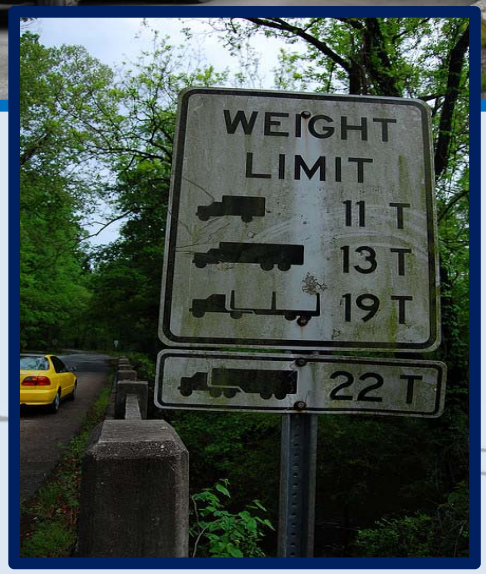
- Truck access
- Indoor vs. outdoor installation
- Acid and base general layout
- Tank materials
- Containment
- Tank Maintenance



What are some other chemical delivery and storage challenges?

Bulk Tank Delivery

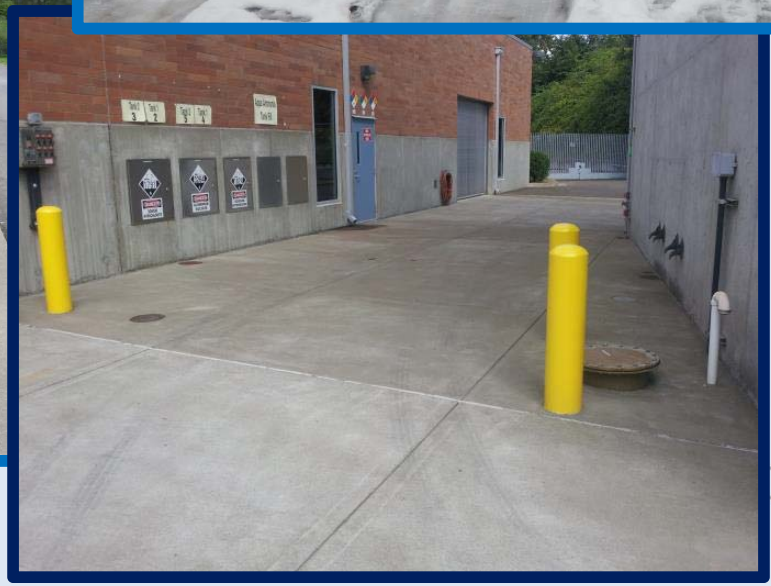
- Truck Routes
- Truck Site Access
- Commercial Vs. Residential environment
- Supplier Availability
  - Their Specific Requirements
  - Order Lead time



What are some other chemical delivery and storage challenges?

Bulk Tank Delivery Continued

- Traffic patterns
- Covered truck pad
- Spill containment and management



Bulk Tank Delivery Offloading

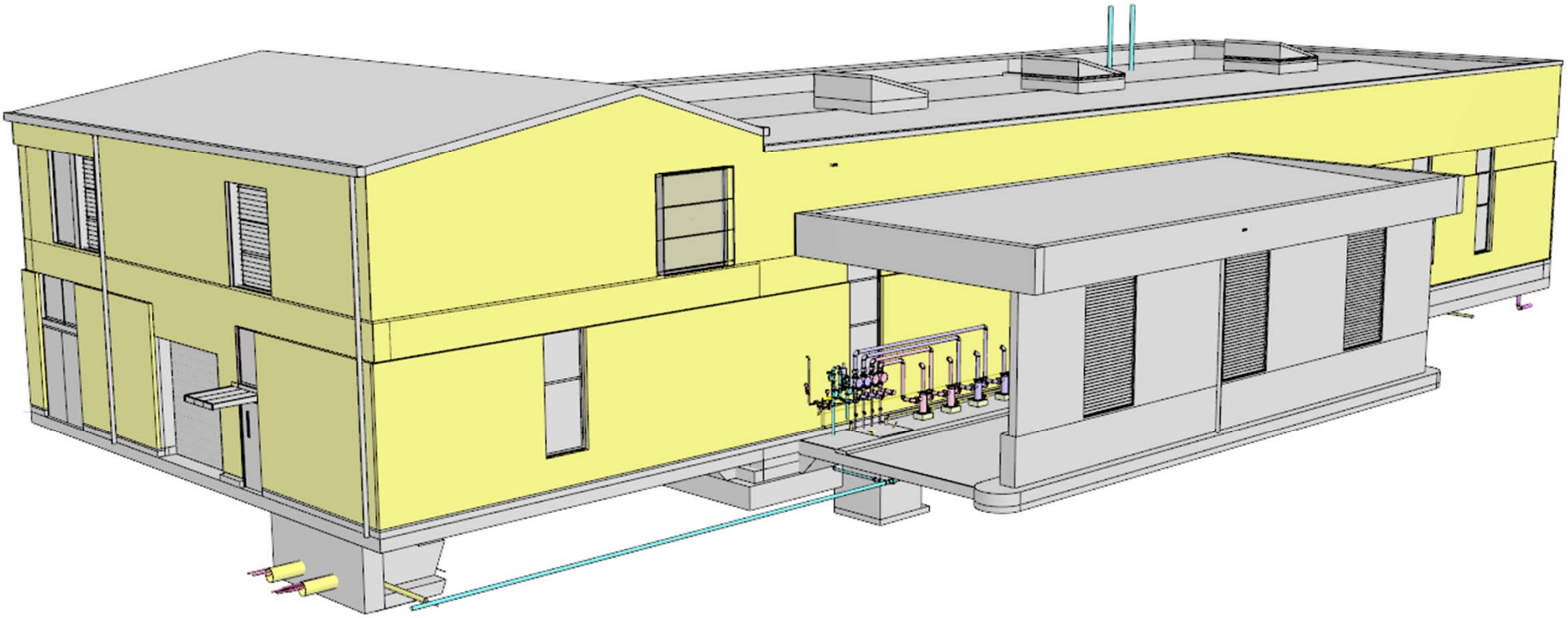
- Bulk tank volumes
- Overfill protection
- Freeze protection
- Truck Sampling

Bulk Tank Delivery Safety

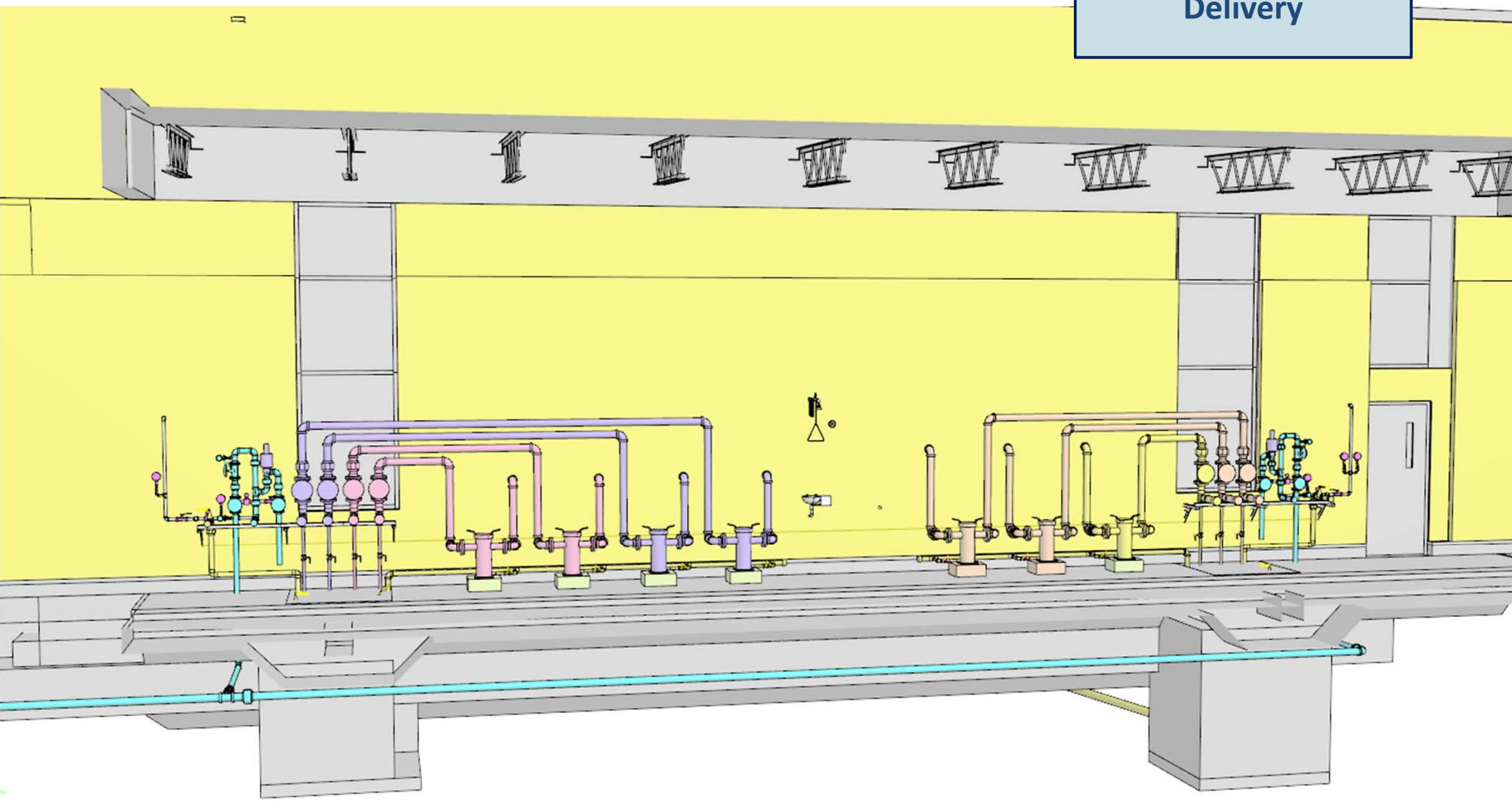
- Eyewashes and showers
- Tempered water
- Remote or local alarming
  - Fire Code Requirements
- Lighting

What PPE is required during chemical deliveries?

Delivery



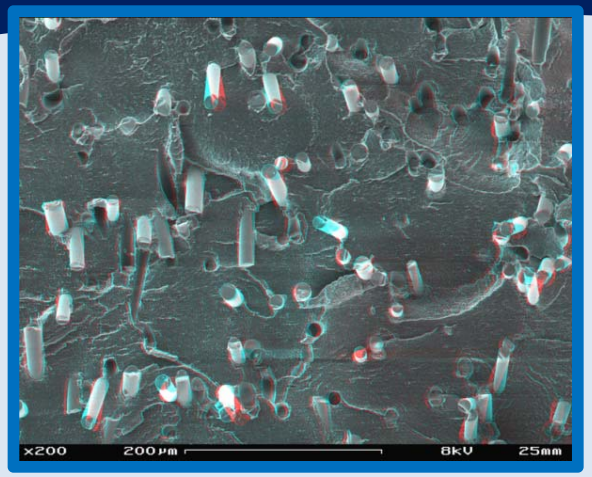
Delivery

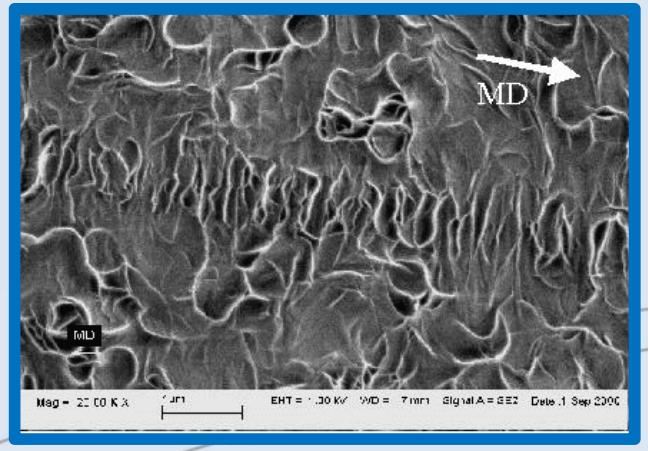


Bulk Tank Location

- **Indoor Vs. Outdoor**
  - Corrosion
  - Insulation/ Temperature Control
  - Appropriate Weather
  - Cost

Bulk Tank Material



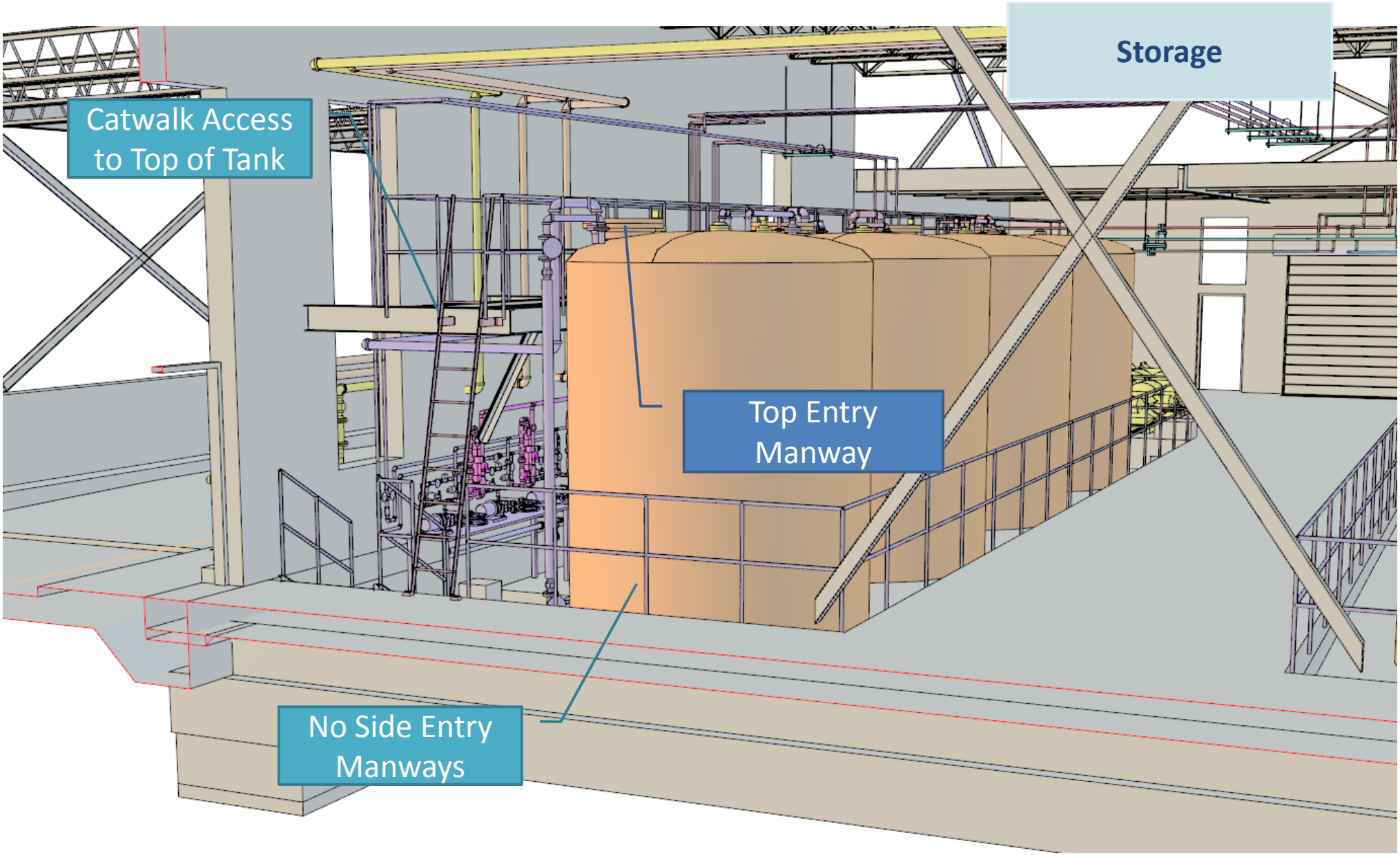


- **Material Compatibility & Longevity**
  - FRP, HDPE, LDPE, lined steel
  - Indoor vs. Outdoor locations
  - Capital and Maintenance Cost.

Which materials have worked best in your experience?

Bulk Tank Inspection & Maintenance

- Top or side entry
- Access catwalk
- Tank Replacement
  - Containment Considerations


Storage
Catwalk Access to Top of Tank
Top Entry Manway
No Side Entry Manways

Chemical Containment

- Regulatory requirements
- Indoor vs. outdoor locations
- Fire Protection
- Containment for tanks and pumps
- Tank Replacement

Chemical Containment

- Fire Code
  - Oregon: Chapter 27 – Hazardous Materials
  - Secondary containment required when vessel exceeds 55 gallons or aggregate capacity of multiple vessels exceeds 1,000 gallons

Containment Volume

- Indoor Storage: Designed to contain a spill from the largest vessel plus the volume of fire sprinkler water for a period of 20 minutes.
- Outdoor Storage: Designed to contain a spill from the largest vessel plus the volume of a 24-hour rainfall from a 25-year storm.

Containment Walls

Sunken Containment

Containment

Tote (IBC) Containment

Containment

Grated Containment Sump

No Containment

Containment Pallet

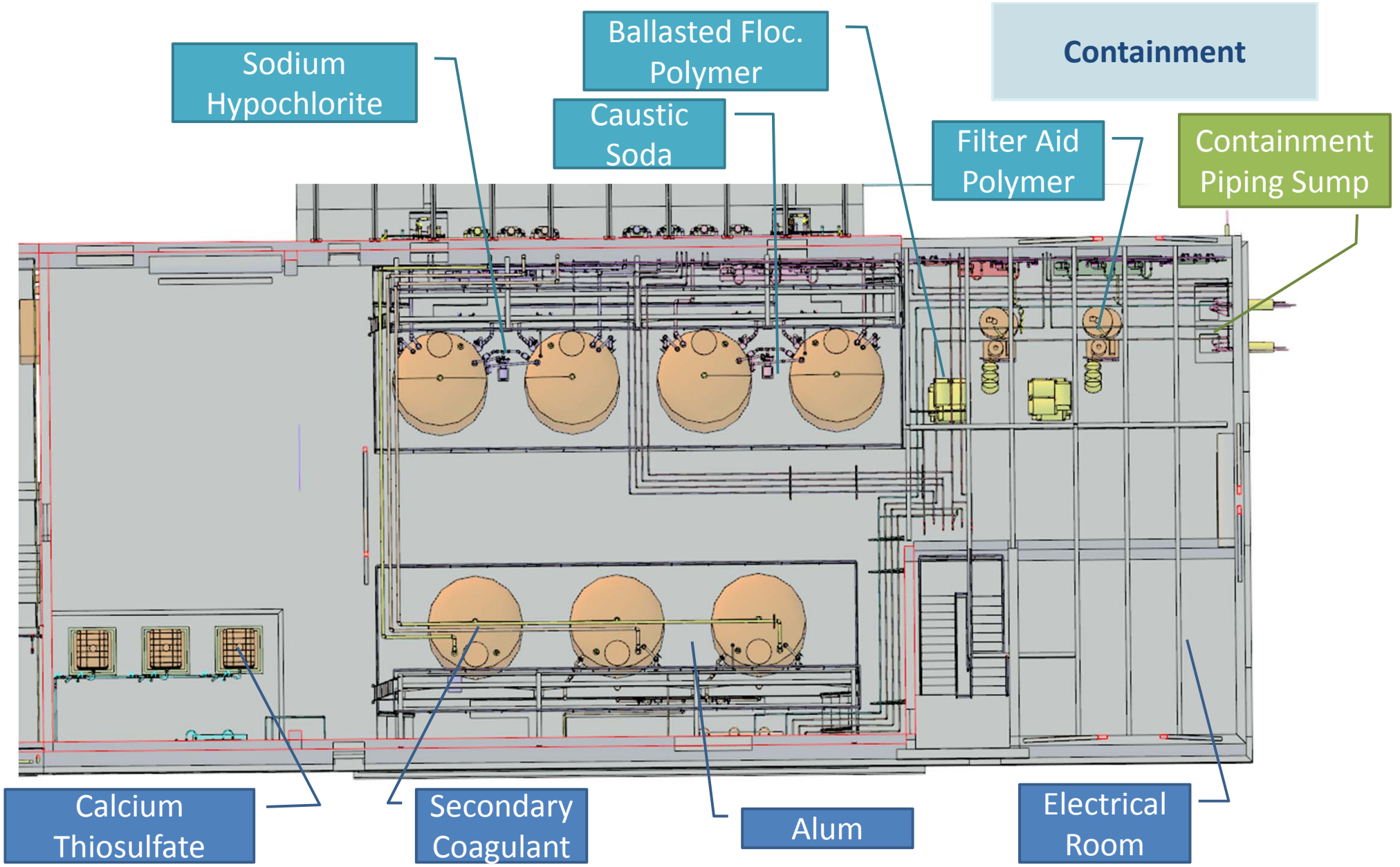
Which containment system do you prefer? Why?

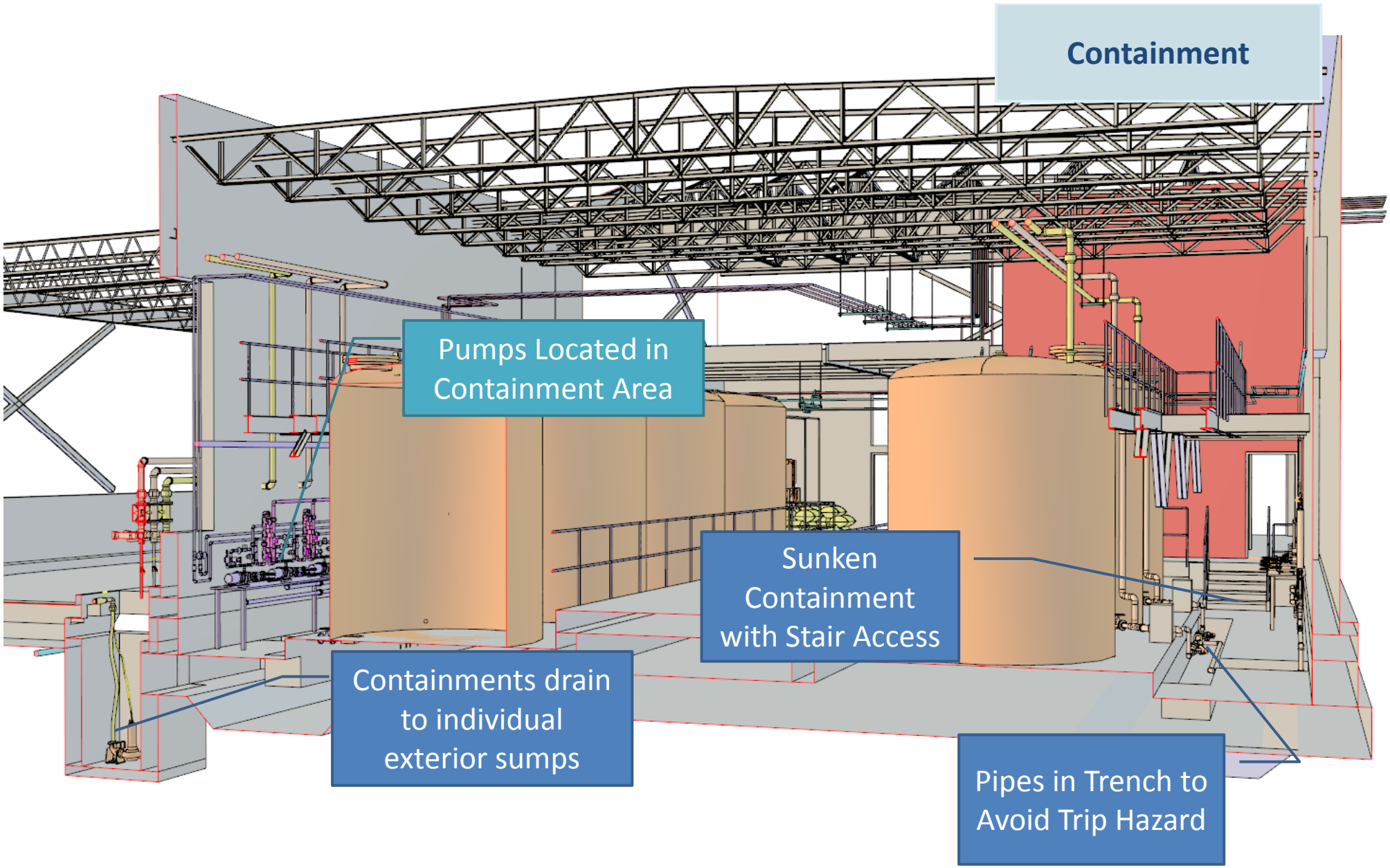
Other Considerations for Totes

- **Handling and Storage**
  - Forklift access
  - Loading dock
  - Containment berms
- **Inventory Control**
  - Manifold tote connections
  - Weigh scales

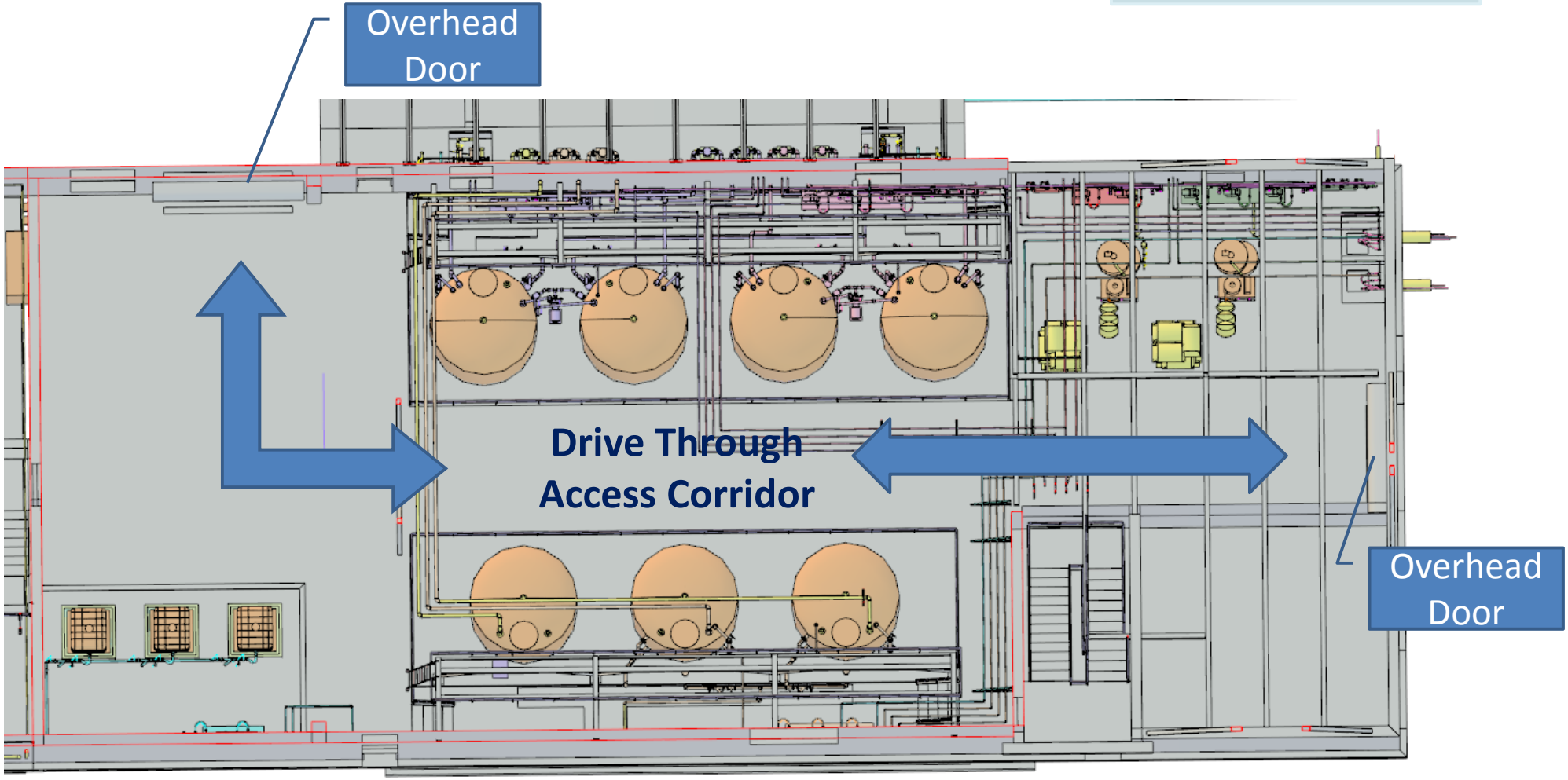
Dry Chemicals & Polymers

- Lifting Safety
  - 50lb Bags Vs. Super Sacks
- Polymer Mixing Systems
  - Dry Vs. Emulsion
  - Vacuum assisted hopper


Containment
Sodium Hypochlorite
Ballasted Floc. Polymer
Caustic Soda
Filter Aid Polymer
Containment Piping Sump
Calcium Thiosulfate
Secondary Coagulant
Alum
Electrical Room


Containment
Pumps Located in Containment Area
Sunken Containment with Stair Access
Containments drain to individual exterior sumps
Pipes in Trench to Avoid Trip Hazard

Other Storage Considerations



Delivery and Storage

Pumps

Instrumentation

CHEMICAL METERING AND DELIVERY

Pumping and Feeding Challenges

- Diaphragm Vs. Peristaltic Vs. Gear Pumps
- Integral pump controls Vs. External Local Control Station
- Pump Mounting in Relation to Tank Invert
- When to Use Carrier Water?
- Piping Containment

What are some other chemical pumping and feeding challenges?

Chemical Metering Pumps

- Diaphragm or Peristaltic (Hose) or Gear Pumps?
- Pump Maintenance

Which type of chemical pump do you prefer? Why?

Metering Pump Controls

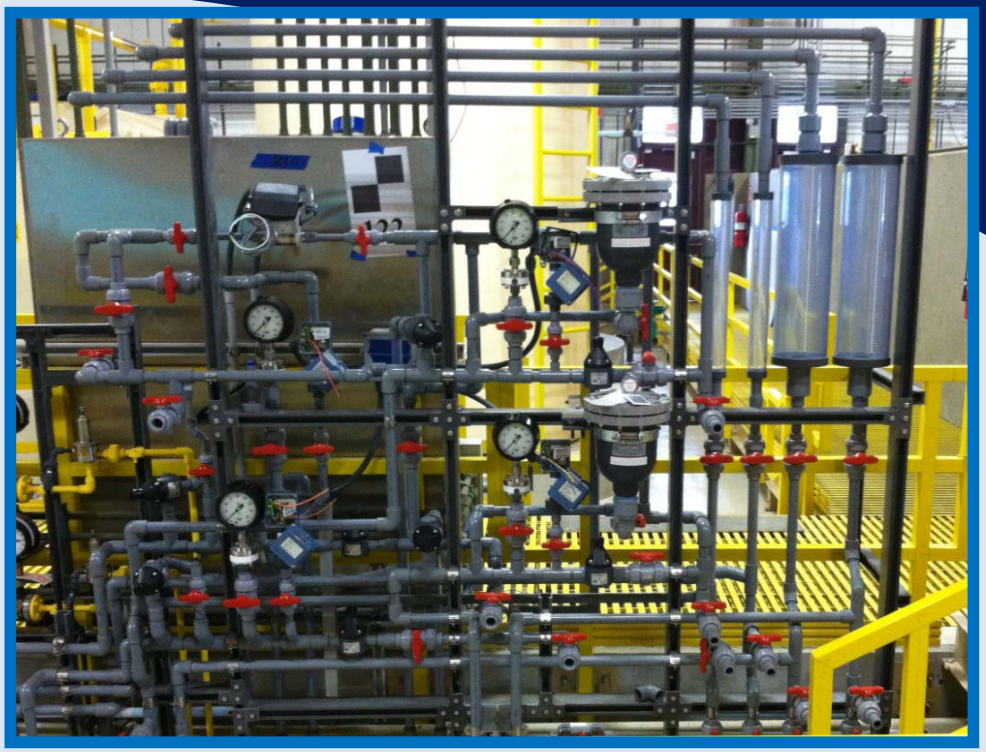
- Integrated or centralized local control?
- Flow measurement / detection
- Pump Calibration

Pump Placement

- Position is important
  - Not all pumps provide positive suction
    - Raise the tanks or…
    - Lower the pumps
  - Spill control and safety
  - Maintenance access
  - Wash-down and sump placement

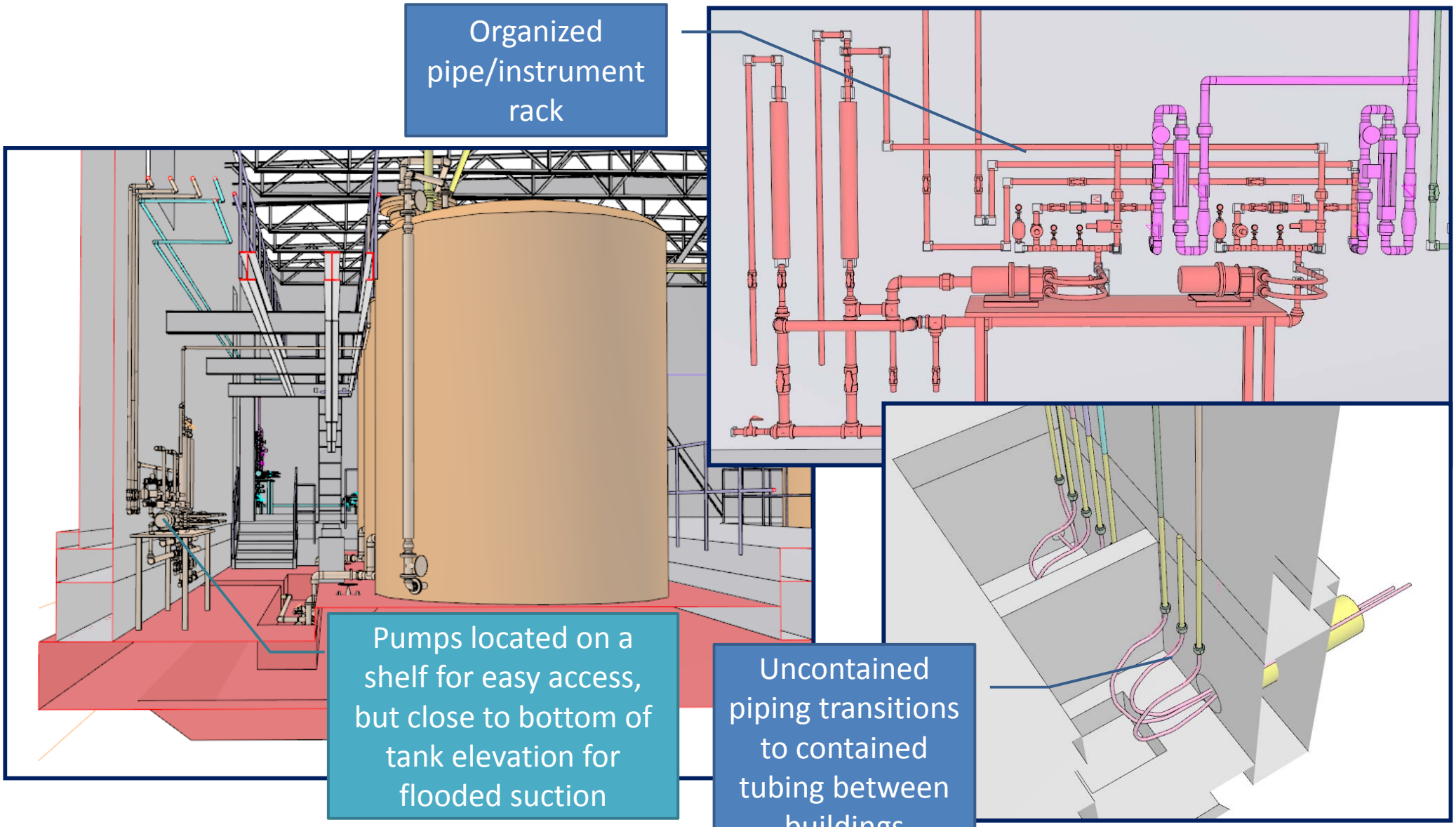
Piping

- Flexibility Vs. Complexity
- Access to piping for maintenance
- Off-gassing
  - Sloped runs
  - Eccentric reducers
  - Vents at high points & Vented Valves



Piping Leak Containment

- Leak Containment
  - Clear PVC
  - Double or single wall
  - Spill control and safety
  - Maintenance impacts


Organized pipe/instrument rack
Pumps located on a shelf for easy access, but close to bottom of tank elevation for flooded suction
Uncontained piping transitions to contained tubing between buildings

Delivery and Storage

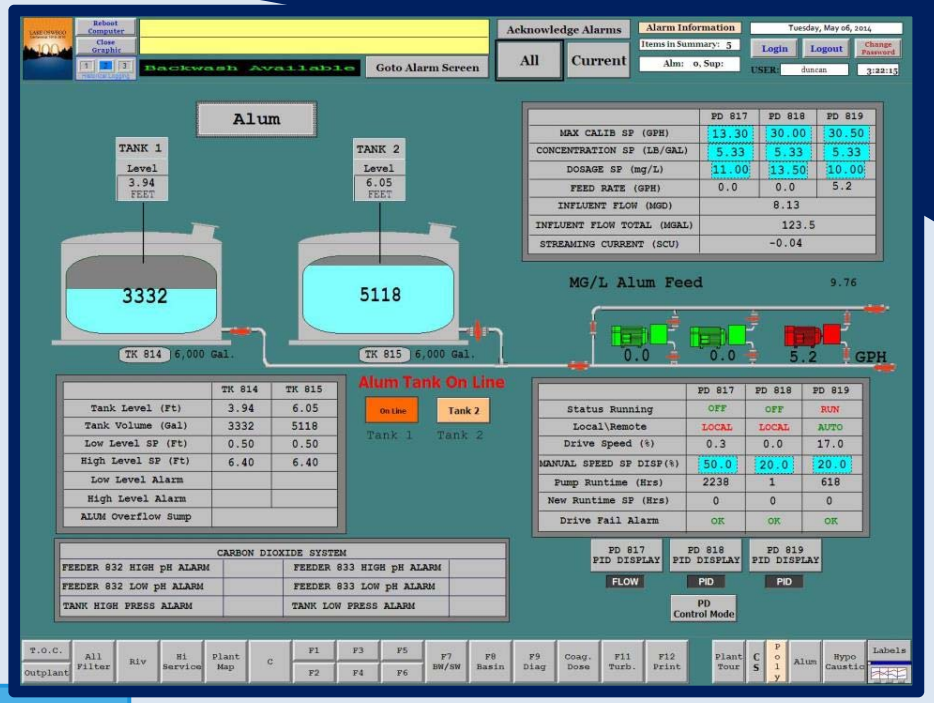
Pumps

Instrumentation

CHEMICAL FEED OPTIMIZATION

Chemical Feed Control

- Tools for inventory management
  - Analyzers and Control Elements
  - Programming and Automation
- Process Control for efficient chemical use



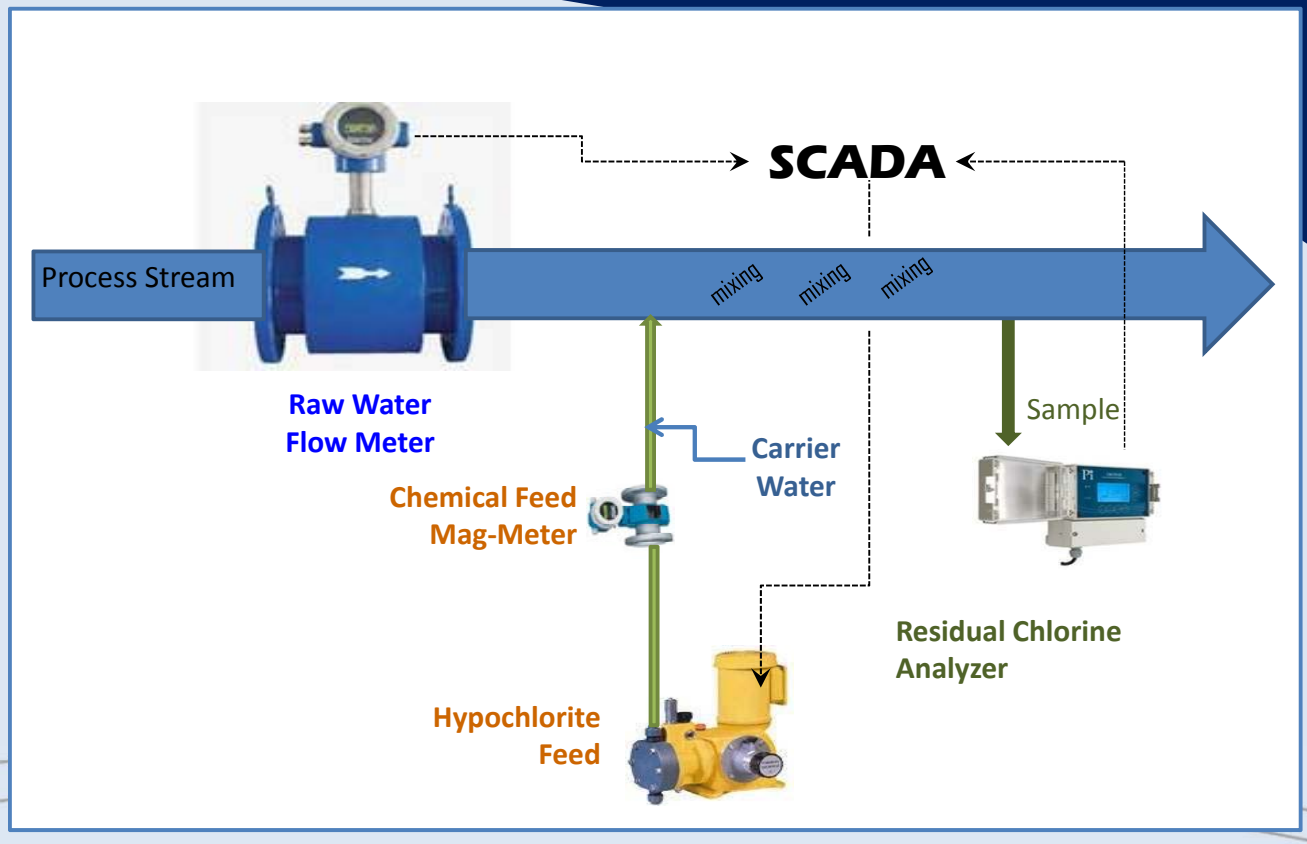
What are some other tools to optimize chemical use?

Inventory Measurement

- Bulk tank level tracking
  - Sight glass Vs Reverse Float Level
  - Ultrasonic, radar, pressure
- Chemical Flow metering
  - Mini-mag flow metering
  - Thermal dispersion switch

Chemical Feed Control Strategies

- Controlling Feedback Loops
  - Minimize lag time
  - Position analyzer element close to sample source
- Flow metering / monitoring
  - Flow pacing Vs. Manual dose control
  - Streaming current



Inventory & Dose Control

- Inventory monitoring
- Dose Calibration
- Performance Monitoring
- Performance Optimization

Last Impressions

- Chemical Systems are the Heart of the Treatment Process
- There are lots of important things to consider in Chemical System Design, including:
  - Safety
  - Reliability
  - Operability
- No one size fits all

What are the most important components of a chemical system?

Thanks.

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