Chemical Safety in Water and Wastewater Treatment Facilities

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• Review and discuss participant knowledge of common chemical use in treatment facilities.
• Test current participant knowledge on regulatory requirements.
• Provide participants with recommendations on conducting safety planning and Hazard Communication activities.
• Allow participants to share solutions for chemical use in various operations.
  • In the laboratory
  • Bulk storage operations
  • Chemical feed systems

A brief quiz will follow each section.

Course Objectives
Section 1
• Chemicals play an important role in many aspects of water treatment.

• Treatment operations fall under many specific regulations that apply to all site personnel.

• Developing written facility safety guidelines that are specific to the worksite is critical for compliance.

• Training and enforcing the safety procedures and processes are critical to employee safety.

Chemical Safety in W/WW Treatment Facilities
Common Chemicals used in Water Treatment

- Chlorine (gas)
- Sodium hypochlorite
- Calcium hypochlorite
- Aluminum sulfate
- Soda ash
- Sodium bicarbonate
- Ferric chloride
- Sodium bisulfite
- Hydrofluoric acid
- Sodium hydroxide
- Various polymer solutions for coagulation and flocculation
Knowing the Hazards in Chemical Situations

• Being aware of the type of chemical
  • Its physical state, whether it be liquid, solid or gas
  • Physiological effects, whether they be caused by toxins, carcinogens, asphyxiation or corrosives
Typical Operator Job Duties Involving Chemicals

- Laboratory analysis
- Set-up and maintenance of chemical feed systems
- Transfer of bulk storage chemicals
Causes of Most Operator Injuries

• Failure to follow established safety practices
• Lack of a safety policy
Important Workplace Safety Plans

- Safety Data Sheet (SDS) notebook
- Emergency Response Plan
- Spill Prevention Plan
- Operations and Maintenance Plan
- Standard Operations Procedures (SOPs)
Permissible Exposure Levels (PEL)

- OSHA requires that employers provide a healthy workplace.
- Permissible Exposure Levels (PELs) are used to provide a level of exposure that is not harmful to employees.
  - Employers frequently control exposures to \( \frac{1}{2} \) PEL or to the “lowest achievable level.”
  - Engineering controls are the primary method for hazard control.
  - Work procedures are the secondary method for hazard control.
  - Personal protective equipment is used when other controls are not feasible or are inadequate.
Employee Training

The most important component of safe chemical management

• Training must be thorough, frequent and focused on specific work tasks.
• Management must support training by providing adequate time and funding.
• Supervisors must lead by example.
Emergency Management

- Prepare for and prevent emergencies
  - Fires
  - Spills/releases
  - Injuries
- Emergency response must be part of basic work procedures and employees must be trained.
  - Evacuation
  - Fire brigade
  - Spill response
  - Medical response
Incident Investigations

• All incidents, regardless of severity, must be investigated and *lessons learned* used for prevention
• Formal investigation of serious incidents
• Accountability at all levels, from staff to management
Safety is everyone’s responsibility

• Proper and safe chemical management
  - Part of the facility culture
  - Part of every employee’s activity
  - Recognition of safety improvement
Four Elements of a Workplace Safety Program

1. Management, leadership and employee involvement
2. Worksite analysis
3. Hazard prevention and control
4. Safety and Health training and education
Management – Leadership - Employee Involvement

- Employer and employee involvement and communication on workplace-safety and health issues are essential.
- Post the company’s written safety and health policy for all to see.
- Involve all employees in policy making on safety and health issues.
- Everyone must take an active part in safety activities.

ELEMENT #1: Involvement
Basic Principles of Good Safety Management

- Management commitment
- Documented safety philosophy
- Safety goals and objectives
- Committee organization for safety
- Line responsibility for safety
- Supportive safety staff
- Rules and procedures
- Audits
- Safety communications
- Safety training
- Accident investigations
- Motivation

ELEMENT #1: Involvement
Basic Safety Philosophy

• Every incident can be avoided.
• No job is worth getting hurt for.
• Every job will be done safely.
• Incidents can be managed.
• “Safety is everyone’s responsibility”.
• Safety/best manufacturing practices
• Safety standards, procedures and practices must be developed.
• Training
  • Everyone must understand AND meet the requirements.
• Working Safely is a condition of employment.

ELEMENT #1: Involvement
Benefits of a Zero Incident Safety Policy

- Safety standards are communicated to all employees.
- Responsibilities for implementing standards are understood and accepted.
- Records document how standards and Best Management Practices (BMPs) are met.
- Internal management control.
- Cost avoidance.
- Improved quality.
- Better productivity.
- Team building.
- Unsafe behavior stands out.
- Unsafe behavior is unacceptable.
- Safe work is influenced through peer pressure.
- Consistent planning and task execution.

ELEMENT #1: Involvement
Key Safety Principles

• Working safely is a condition of employment.

• Each employee is expected to give consideration to the prevention of injury to self and co-workers.

• Involvement and thinking of all people in the safety process is valued and expected.

• Continual improvement is the goal.

• Individuals and teams must be recognized for their adherence to and advancement of safety.

ELEMENT #1: Involvement
Four Elements of a Workplace Safety Program

1. Management, Leadership and Employee Involvement
2. Worksite Analysis
3. Hazard Prevention and Control
4. Safety and Health Training and Education
Analyze all workplace conditions.

- Identify and eliminate existing or potential hazards.
- Outline the procedure for reporting hazards.
- Perform analysis on a regular and timely basis.
- Ensure employee understanding.
  
  - Current hazard analysis for all jobs and processes.
  - Emergency Response Plans and procedures.

Element #2: Worksite Analysis
Focus workplace design on all physical aspects of the work environment.

- Size and arrangement of work space.
- Physical demands of the tasks to be performed.
- Design of tools and other devices people use.
- The fundamental goal of a workplace design is to improve people’s ability to be productive, without error or accident, for extended time periods.
  - Proper workplace design improves both safety and productivity.

Element #2: Worksite Analysis
Review incident causes

- Inspection results to help identify trends.
- Practice
  - Employee participation in drills
Four Elements of a Workplace Safety Program

1. Management, Leadership and Employee Involvement
2. Worksite Analysis
3. Hazard Prevention and Control
4. Safety and Health Training and Education
Regularly and thoroughly maintain equipment

- Ensure that employees know how to use and maintain personal protective equipment (PPE)
- Train employees in proper procedures for handling specific situations
- Emergency Action Plans and procedures - fire, life safety and first aid issues
Standard Operating Procedures

- Drug-free workplace
- Recognition and awards
- Audits and surveillances
- Incident reporting & investigation
- Lessons learned
- General safety SOPs – Let’s discuss
Personal Protective Equipment (PPE)

- Use
- Maintain

KEEP SAFE AND WEAR PPE

ELEMENT #3 - Hazard Prevention & Control
Protect Employees from Workplace Hazards

- Employers must protect employees from hazards that can cause injury.
  - Falling objects
  - Harmful substances
  - Noise exposures

- Employers must:
  - Use all feasible engineering and work practice controls to eliminate and reduce hazards.
  - Use personal protective equipment (PPE) if the controls don’t eliminate the hazards.
  - PPE is the last level of control.

ELEMENT #3 - Hazard Prevention & Control
Select the right PPE for the job.

ELEMENfT #3 - Hazard Prevention & Control
### Examples of PPE

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Safety Glasses, Goggles</td>
</tr>
<tr>
<td>Face</td>
<td>Face Shields</td>
</tr>
<tr>
<td>Head</td>
<td>Hard Hats</td>
</tr>
<tr>
<td>Feet</td>
<td>Safety Shoes</td>
</tr>
<tr>
<td>Hands and Arms</td>
<td>Gloves</td>
</tr>
<tr>
<td>Bodies</td>
<td>Vests</td>
</tr>
<tr>
<td>Hearing</td>
<td>Earplugs, Earmuffs</td>
</tr>
</tbody>
</table>
PPE Compliance

• Employer
  • Assess workplace for hazards.
  • Determine when to use PPE.
  • Provide PPE.
  • Provide PPE training.

• Employee
  • Use PPE in accordance with training received and other instructions.
  • Inspect daily.
  • Maintain in a clean and reliable condition.

ELEMENT #3 - Hazard Prevention & Control
**PPE Summary:** Employers must implement a PPE program

- Assess the workplace for hazards.
- Use engineering and work practice controls to eliminate or reduce hazards before using PPE.
- Select appropriate PPE to protect employees from hazards that cannot be eliminated.
- Inform employees why the PPE is necessary, how and when it must be worn.
- Train employees how to use and care for their PPE, including how to recognize deterioration and failure.
- Require employees to wear selected PPE.

**Element #3 – Hazard Prevention & Control**
Four Elements of a Workplace Safety Program

1. Management, Leadership and Employee Involvement
2. Worksite Analysis
3. Hazard Prevention and Control
4. Safety and Health Training and Education
Activity Hazard Analysis

Activity hazard analysis requires everyone to be proactive in **aggressively identifying hazards** that can be anticipated and **controlling** them rather than looking back with 20/20 hindsight.

**ELEMENT #4 – Training and Education**
Activity
Workers in their first year with their employer account for more than 50% of accidents.

*Why?*
(list three possible explanations)

**ELEMENT #4 – Training and Education**
Activity Hazard Analysis - Key Terms

• What’s the Job or Activity?
• What are the Hazards?
• What’s an Exposure?
• What is Analysis?

ELEMENT #4 – Training and Education
Chemical Reactions

- Can be violent.
- Can cause explosions.
- Dispersion of materials and emission of heat, or acute bodily injuries through direct contact.
Section 1 Quiz
Section 2
• The following slides are credited to the PA Department of Labor and Industry for the explanation of Chemical Hazard Communication Requirements.

• The slides are excerpts from a larger presentation on the subject.
Hazard Communication

- OSHA
- 29 CFR 1910.1200
- (HCS-2012) & United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS, Rev 3)
Hazard Communication Standard (1910.1200)

- Intent - To provide employees with information to help them make knowledgeable decisions about chemical hazards in their workplace
Standard Requirements

• Written program for each location to cover issues of chemical safety and hazard communication (HAZCOMM)
• Labels to identify each chemical
• Material Safety Data Sheets (MSDSs) (now SDSs under the Globally Harmonized System: GHS)
• Safe work procedures/practices
• Employee training on SDS information and safe chemical procedures and practices
Training

• Upon initial employment
• When a new hazardous product/chemical is introduced into the workplace
• Change in process
• As deemed necessary by supervision/management
“Right to Know” Law

- Ensures all employees’ right to know the hazards of chemicals they work with at their job
- Mandates that employees must be provided with information about chemicals they work with through:
  - Information on chemical labels
  - Safety Data Sheets (SDSs)
  - Training on hazard communication
  - Written HAZCOMM plan
Why is a Standard Necessary?

• To evaluate the hazards of all chemicals imported into, produced, or used in workplaces in the United States
• To prevent or minimize employee exposure to chemicals
• Because chemical exposure can contribute to serious health effects:
  - Heart ailments
  - Burns/rashes
  - Kidney/lung damage
  - Sterility
  - Cancer
  - Central nervous system damage
Globally Harmonized System

GHS

• Created by United Nations
• A system for standardizing chemical classification and labeling for world-wide implementation

Labels

• Signal words
  • Danger/Warning
• Hazard statements
• Precautionary statements
• Pictograms (9)
  • SDS-16 categories
  • Training
GHS

- Rationale:
  - “To provide a single, harmonized system to classify chemicals, labels and SDS with the primary benefit of increasing the quality and consistency of information provided to workers, employers and chemical users”*
- Effective, in part, on June 26, 2012, with a built-in transition period and a fully effective date of June 1, 2016

Updating GHS/HCS

• The adoption of this will affect the OSHA 29 CFR 1910.1200 Hazard Communication Standard with changes
• GHS is updated every two years
• Hazard Communication Standard, (HCS), to remain current, can be updated by:
  - Technical updates (minor terminology changes),
  - Direct final rules (for text clarification), and
  - Notice and comment rulemaking (for more substantive updates or changes)
OSHA HazComm Modifications due to GHS

- Hazard classification of chemical hazards
  - Revised labeling provisions that include requirements for:
    - Standardized signal words
    - Pictograms
    - Hazard statements
    - Precautionary statements
  - Specified format for safety data sheets in 16 section format and
    Revisions to definitions of terms used in the standard and
    requirements for employee training on labels and Safety Data Sheets
    (SDS)
Other OSHA Label Elements for:

- **Pyrophoric Gases:**
  - **Signal Word:** Danger
  - **Hazard Statement:** “Catches fire spontaneously if exposed to air”

- **Simple Asphyxiates:**
  - **Signal Word:** Warning
  - **Hazard Statement:** "May displace oxygen and cause rapid suffocation”

- **Combustible Dusts:**
  - **Signal Word:** Warning
  - **Hazard Statement:** “May form combustible dust concentrations in the air”
Hazard Communication & Chemical Safety

• Chemicals are all around us every day
• Chemicals can be:
  - Corrosive
  - Reactive
  - Flammable
  - Explosive
  - Oxidizing
  - Inert
Chemical Safety

• In many cases, the chemicals you may deal with at work are no more dangerous than those you use at home.
• But in the workplace exposure may be greater, concentrations higher, exposure time longer: potential danger could be greater on the job.
Routes of Occupational Exposure

- Inhalation
  - Nearly all materials that are airborne can be inhaled
- Skin Absorption
  - Skin contact with a substance can result in a possible reaction
- Ingestion
  - Most workers do not deliberately swallow materials they handle
- Injection
  - Normally associated with bloodborne pathogens
- Ocular
  - Absorbed through the eyes
Hazards

- A chemical can pose a “physical hazard” or a “health hazard”
- The hazard communication standard applies to both types of hazards
- GHS looks at:
  - Class-nature of hazard
  - Category-degree of severity
Physical Hazards

• Physical hazards are exhibited by certain chemicals because of their physical properties (e.g. flammability, reactivity, etc.)
• These chemicals fall into the following classes
  - Flammable liquids or solids
  - Combustible liquids
  - Compressed gases
  - Explosives
Physical Hazards

• Organic peroxide
  - May react explosively to temperature/pressure changes.

• Oxidizers
  - Chemicals that initiate or promote combustion in other materials.

• Pyrophoric materials
  - May ignite spontaneously in air temperatures of 130°F or below

• Unstable materials

• Water reactive materials
Health Hazard

• Occurs when a chemical produces an acute or chronic health effect on exposed employees
Acute Health Effects

• Happen quickly
• High, brief exposure
• Examples:
  - Carbon monoxide poisoning
  - Cyanide inhalation
  - Hydrogen sulfide inhalation
Chronic Health Effects

• May be caused by chemical exposures that do not cause immediate, obvious harm or make you feel sick right away
• May not see, feel, or smell the danger
• Effects are long, continuous and follow repeated long-term exposure
  - Lung cancer from cigarette smoking
  - Black lung from coal mine dust
Keeping It Safe

- Corrosives, solvents and other chemical substances can be potentially dangerous
- Safe handling procedures
  - Read container labels
  - Check SDS(s)
- Never sniff a chemical for identification
- Use appropriate personal protective equipment
Labeling

- Example of one type of labeling system used
Chemical Labels

• Each container must be labeled, tagged or marked.
• Warning can be a message, words, pictures or symbols.
• Labels must be written in English and prominently displayed.
Reading Chemical Labels

• Warning labels provide important information about the chemical:
  - DANGER
  - WARNING

• Always read the label before you begin a job using a potentially hazardous chemical
GHS Comparison

- GHS classification ratings order of severity differ from NFPA and HMIS:
  - HMIS/NFPA
    - 0 = Least Hazardous
    - 4 = Most Hazardous
  - GHS
    - 5 = Least Hazardous
    - 1 = Most Hazardous
Health Hazard

- Used to describe:
  - Carcinogen
  - Mutagenicity
  - Reproductive toxicity
  - Respiratory sensitizer
  - Target organ toxicity
  - Aspiration toxicity
  - Germ cell mutagens
Flame

• Describes:
  - Flammables
  - Pyrophorics
  - Self-heating
  - Emits flammable gas
  - Self-reactives
  - Organic peroxides
Exclamation Mark

- Irritant (skin and eye)
- Skin sensitizer
- Acute toxicity (harmful)
- Narcotic effects
- Respiratory tract irritant
- Hazardous to ozone layer (non-mandatory)
Gas Cylinder

• Describes:
  - Gases under pressure
Corrosion

- Skin corrosion/burns
- Eye damage
- Corrosive to metals
Exploding Bomb

- Describes:
  - Explosives
  - Self-reactives
  - Organic peroxide
Flame Over Circle

- Describes:
  - Oxidizers
Flame Over Circle

- Describes:
  - Oxidizers

Anything wrong with this picture?
Flame Over Circle

- Describes:
  - Oxidizers

Anything wrong with this picture? YES!
Unsafe storage. Cylinders falling over.
Skull and Crossbones

- Describes:
  - Acute toxicity (fatal or toxic)
Signal Word

- A single word indicating relative hazard severity
- “Danger” for more severe hazards
- “Warning” for less severe hazards

Product J
(abc chemical)

Danger
Fatal if swallowed
Causes skin irritation

Precautions:
Wear protective gloves.
Take off contaminated clothing and wash before reuse.
Wash hands thoroughly after handling.
Do not eat, drink or smoke when using this product.

Store locked up
Dispose of contents/containers in accordance with local regulations

IF ON SKIN: Rinse skin with water/shower.
IF IN EYES: Rinse cautiously with water.
IF SWALLOWED: Immediately call a Poison Center or doctor/physician. Do not induce vomiting.

ABC Chemical Co., 123 Anywhere St., (123) 456-7890
See the SDS for more information
Labels

- Information required on a GHS label:
  1. Product identifier
  2. Pictograms
  3. Signal word
  4. Hazard statement
  5. Precautionary statement
  6. Supplier information
SDS

- Under the GHS, MSDSs (material safety data sheets) become SDS (safety data sheets)
- Categories (16) to be listed in a specific order
- Adheres to ANSI standard Z400.1
- GHS requires new SDSs be in uniform format by June 1, 2015
- Information for mixtures not individual chemicals in a mixture
SDS

• Safety Data Sheet
• Developed by chemical manufacturers and importers
• An SDS must be on hand for each hazardous chemical used
Information on a SDS

• Chemical names
• Manufacturer info (name, address and telephone numbers)
• List of chemical ingredients
• Permissible exposure limits (PELs) and threshold limit values (TLVs)
Information on a SDS

Any other exposure limit used or recommended by chemical manufacturer, importer or employer preparing the SDSs now are required on the SDS
Information on a SDS

• Reactions with other chemicals
• Physical appearance
• Date of preparation
• Plus:
  - How to put out a fire caused by a chemical
  - How to handle spills
  - How to prevent dangerous exposures
Where are your SDSs?

- SDSs:
  - Must be readily accessible to employees during their work shift
  - Are typically kept in a centralized location
  - Must be updated as new information becomes available
SDS Categories

• Section 1: Identification
• Section 2: Hazard identification
• Section 3: Ingredients
• Section 4: First-aid measures
• Section 5: Fire fighting measure
• Section 6: Accidental release measures
• Section 7: Handling and storage
SDS Categories

- Section 8: Exposure controls and personal protection
- Section 9: Physical and chemical properties
- Section 10: Stability and reactivity
- Section 11: Toxicological information
- Section 12: Ecological information*
- Section 13: Disposal considerations*
- Section 14: Transport information*
- Section 15: Regulatory information*
- Section 16: Other information

*OSHA indicated that since other agencies regulate sections 12-15, OSHA will not be enforcing them
Written Hazard Communication Plan

• The standard requires industry:
  - To develop and implement a written hazard communication program
  - To provide hazard communication training for employees:
    • Initially (to newly hired personnel)
    • Whenever a new hazard is introduced into the workplace
Special Hazards

• Management of process spills or leaks:
  - Implement the facility’s emergency control program
  - Secure the area
Summary

- All facilities should have a hazard communication plan in a location that is accessible to all employees.
- All hazardous products should be labeled and all employees should be aware of what and where they are.
- SDSs should be available and accessible for all hazardous products.
Do you see any problems here?
Do you see any problems here?

Large containers balanced on edge of shelf - not safe

If chemical, coffee can is not proper type of storage container

Maybe improperly labeled container - what’s in the coffee can? Coffee not allowed with chemicals; if chemical, not labeled properly.
Laboratory Safety
Acquisition Recommendations

- Order the smallest quantity possible for each chemical
  - No discounts, but final cost is less
- Never accept “left-over” or “donated” chemicals
  - There’s no guarantee of its purity
  - If you don’t normally use it, you probably don’t need it
Safe Storage & Handling

VS.

SSM
Recommended Practices
Examine your currently available storage space
Avoid floor clutter
Avoid shelf clutter
Avoid desk clutter
Use storage containers for small or loose items
Arrange containers based on compatibility
Keep your containers in good condition
Use edging to prevent containers from falling off.

Sturdy shelving units
Store acids in an Acid Cabinet
Store flammables in a Flammables Cabinet
Avoid overhead storage
An eye wash unit and/or emergency shower nearby (but not in the storage room)

**Additional Safety Measures**
Ensure adequate ventilation for:

- Chemical storage areas
- Chemical preparation areas
- For volatile compounds use a fume hood!
- Chemical use areas
• Emergency gas shut-off valve
• Retractable electrical outlets

Additional Safety Measures
• “Frequently used chemicals should be ordered in bulk.”
• “Ordering in bulk is the best deal for the money.”
• “Accept any donated chemicals...”
• “I’ll remember what I put in that jar.”

Remember these costly phrases:
Label everything clearly
Appropriate containers in good condition
Be neat and orderly
Store only what you will use
Always wear protective clothing
Food allowed in eating areas only
Everything in its place on a shelf
Time to inventory & organize
Your safety is important

LAB SAFETY
Section 2 Quiz
Section 3
Examples of Chemical Feed Systems
**Sodium Hypochlorite**

- The liquid form of chlorine
- Clear and has a slight yellow color
- Ordinary household bleach (~5% chlorine by solution) is the most common form
- Industrial strength: 12% and 15% solutions
- Can lose up to 4% of its available chlorine content per month; should not be stored for more than 60 to 90 days
- Very corrosive; should be stored and mixed away from equipment that can be damaged by corrosion
Diaphragm Pump/Tank for Chlorine
On-site generated sodium hypochlorite

- 0.8% sodium hypochlorite is produced on demand by combining salt, water & electricity
- Electrolysis of brine solution produces sodium hydroxide and chlorine gas, which then mix to form sodium hypochlorite
- Hydrogen gas byproduct; vented to atmosphere
- Alleviates safety concerns associated w/ hauling and storing bulk chlorine
- Higher initial cost, high power cost
- Mixed oxidants (proprietary)
Electrodes for onsite chlorine generation
Calcium Hypochlorite

- The solid form of chlorine
- Usually tablet or powder form
- Contains ~65% chlorine by weight
- White or yellowish-white granular material and is fairly soluble in water
- Important to keep in a dry, cool place
- More stable than liquid
- Used by small systems with low flows or no power
Calcium hypochlorite erosion feeder
Calcium hypochlorite hopper interior
Chlorine Gas (Cl2)

- 99.5% pure chlorine
- Yellow-green color 2.5x heavier than air
- Liquefied at room temperature at ~107 psi – hence the pressurized cylinders actually contain liquefied chlorine gas
- Liquefied Cl2 is released from tanks as chlorine gas, which is then injected into the water stream
- Usually used only by large water systems
- Smaller systems may find initial cost of operation prohibitive
1-ton chlorine gas cylinders
1-ton chlorine gas cylinders

Note: scales used to weigh cylinders (to tell when they are empty)
150-lbs chlorine gas cylinders

Chain to secure tank in place
Spare tank on hand
Tanks clearly marked
Chloramines

- Chlorine + ammonia = chloramination
- Two advantages to regular chlorination:
  - Produces a longer lasting chlorine residual (helpful to systems with extensive distribution systems)
  - May produce fewer by-products depending on the application
- Disadvantage:
  - Needs a lot of contact time to achieve CTs compared to free chlorine (300 times more) which is why not used for primary disinfection
  - Requires specific ratio of chlorine to ammonia or else potential water quality problems
Ammonia for making chloramines
Ozone

- Colorless gas ($O_3$)
- Strongest of the common disinfecting agents
- Also used for control of taste and odor
- Extremely unstable; Must be generated on-site
- Manufactured by passing air or oxygen through two electrodes with high, alternating potential difference
Large water system ozone
Large water system ozone
Ozone Contactors
Ozone & Liquid Oxygen

- Ozone is too reactive to store, so liquid oxygen is used for making ozone.
Storage Tanks and Containment

Example Storage Tanks (Containers)

- Single-wall Aboveground Storage Tank (AST)
  - Has one wall to contain the contents of the tank, typically older fuel and oil tanks were single-wall construction. Some form of containment is required when storing oil.
  - Typically admixture tanks are single-wall polyethylene tanks.
  - Industrial Bulk Containers (IBC) totes and drums are typically single-wall.

- Double-wall AST
  - The primary tank is wrapped by an exterior tank that may be in contact with the primary tank (a tank within a tank). The outer tank has the capacity to capture the inner tank contents should a leak develop. This interstitial space between the tanks can be checked for signs of leakage during regular inspections.
Storage Tanks and Containment

Example: storage tanks (containers)

• Industrial Bulk Containers (IBC) Totes
  - Typically these totes are single-wall and range in size from 275 to 330 gallons. Many chemicals such as admixtures and form oils are shipped in totes. Containment would also be required if storing oil.

• Drums
  - 55 gallon drums are an industry favorite for a variety of chemicals. They come in a multitude of materials and sizes ranging from 10 gallons all the way to 95 gallons. Some form of containment is required when storing oil.
Storage Tank Examples

- Single-Wall Steel AST in Plastic Containment
- Steel Oil ASTs not in Containment
- 10,000 Gallon Diesel Double-Wall Steel AST
- 55 Gallon “Oil” or Larger Drums
- Plastic Admix Tanks in Containment
- Industrial Bulk Containers (IBC Totes)
What is a Storage Tank?

• Variety of shapes and sizes
• EPA uses the term "bulk storage container".
  • 55 gallons or larger
  • Everything from a drum to the 10,000 gallon or larger diesel Aboveground Storage Tank (AST) at your facility is a bulk storage container.
• Chemicals stored in bulk should be provided with secondary containment.
• With multiple tanks, the secondary containment should cover the tank with the largest volume.
Section 3 Quiz
Wrap Up/Evaluation