



Li-Cycle[®]

LI-CYCLE HUB PROJECT

August 6, 2021

CHEMICALS & REAGENTS – REVISED FOR SEQR



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Use of Reagents

Inorganic Reagents

- 93% Sulfuric Acid
- 50% Sodium Hydroxide
- 50% Hydrogen Peroxide
- Sodium Hydrosulfide Hydrate
- Calcium Oxide (Quicklime)
- Sodium Carbonate (Soda Ash)
- Chemical Compatibility Review

Organic Reagents

- Solvent Extraction Overview
- Solvent Extraction Organics



USE OF REAGENTS



The purpose of this presentation is to provide an overview of the reagents that will be used at Li-Cycle's North America Hub #1

- Li-Cycle's Hub will use various reagents to extract and recover nickel sulfate, cobalt sulfate, lithium carbonate, manganese carbonate, and other metal products from black mass concentrate.
- Black mass concentrate will be shipped to the Hub from other facilities for processing and is derived from the recycling of lithium-ion batteries.
- As part of this presentation, Li-Cycle have identified the risks associated with reagents that will be used at the Hub and the measures that will be implemented to eliminate and/or abate those risks.



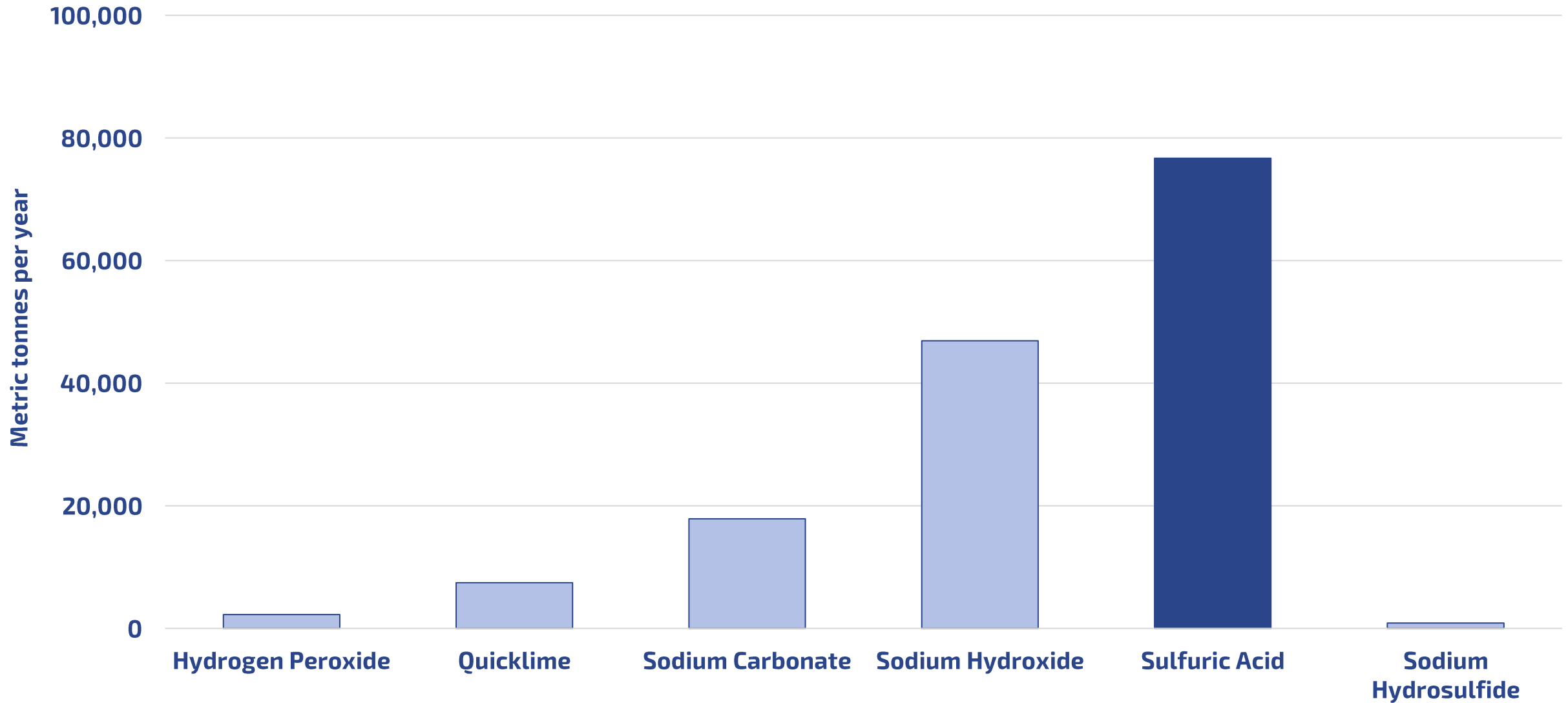


INORGANIC REAGENTS



93% SULFURIC ACID

REAGENT USAGE (Average)





Physical Properties

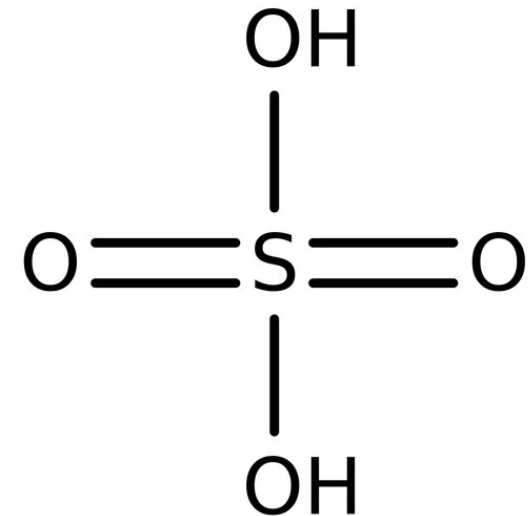
- Molecular form: H_2SO_4
- Colorless, odorless, oily liquid
- Denser than water (SG = 1.83)
- Highly corrosive
- Oxidant and strongly acidic

Incompatible Chemicals

- Strong bases
- Strong acids
- Hydration reaction releases heat

Industrial Uses

- Fertilizer production (ammonium sulfate/phosphate)
- Chemical industry (detergents, pharma)
- Water treatment
- Paints, coatings





General Hazards

Flammable Properties:	Does not burn
Extinguishing Media:	Not combustible. Use extinguishing agent suitable for surrounding fire. Only use water to keep non-leaking, fire-exposed containers cool. Do not use water or water-based extinguishing agents.
Specific Hazards:	Contact with water causes frothing and spattering. Reacts with some metals to produce flammable gas. In a fire, the following hazardous materials may be generated: sulfur oxides.
Chemical Stability:	Normally stable
Incompatible Materials:	Reacts with many chemicals, including, water. Corrosive to aluminum alloys, carbon steel, and other metals.
Hazardous Decomposition Products:	None known
Possibility of Hazardous Reactions:	None known



Specific Hazards

- *Contact with water causes frothing and spattering*
- *Reacts with some metals to produce flammable gas*
- *In a fire, the following hazardous materials may be generated: sulfur oxides*

Li-Cycle Mitigations for Specific Hazards

- Controlled injection of sulfuric acid into process tanks
- Instrumentation (i.e., pH, temperature), monitoring, and control systems (i.e., cooling water coils for select process tanks)
- Low temperature aqueous operation (<175°F)
- ~12 months of pilot plant operation using sulfuric acid



Health Hazards



Corrosive



Health Hazard

Skin:	Corrosive
Eyes:	Corrosive
Inhalation:	not expected to be a hazard unless heated or misted. Toxic / fatal if inhaled.
Ingestion:	Corrosive
Carcinogenicity	Mists are carcinogenic to humans.
Teratogenicity / Embryotoxicity	Not known to harm the unborn child
Reproductive Toxicity:	Not known to be a reproductive hazard
Mutagenicity:	Not known to be a mutagen

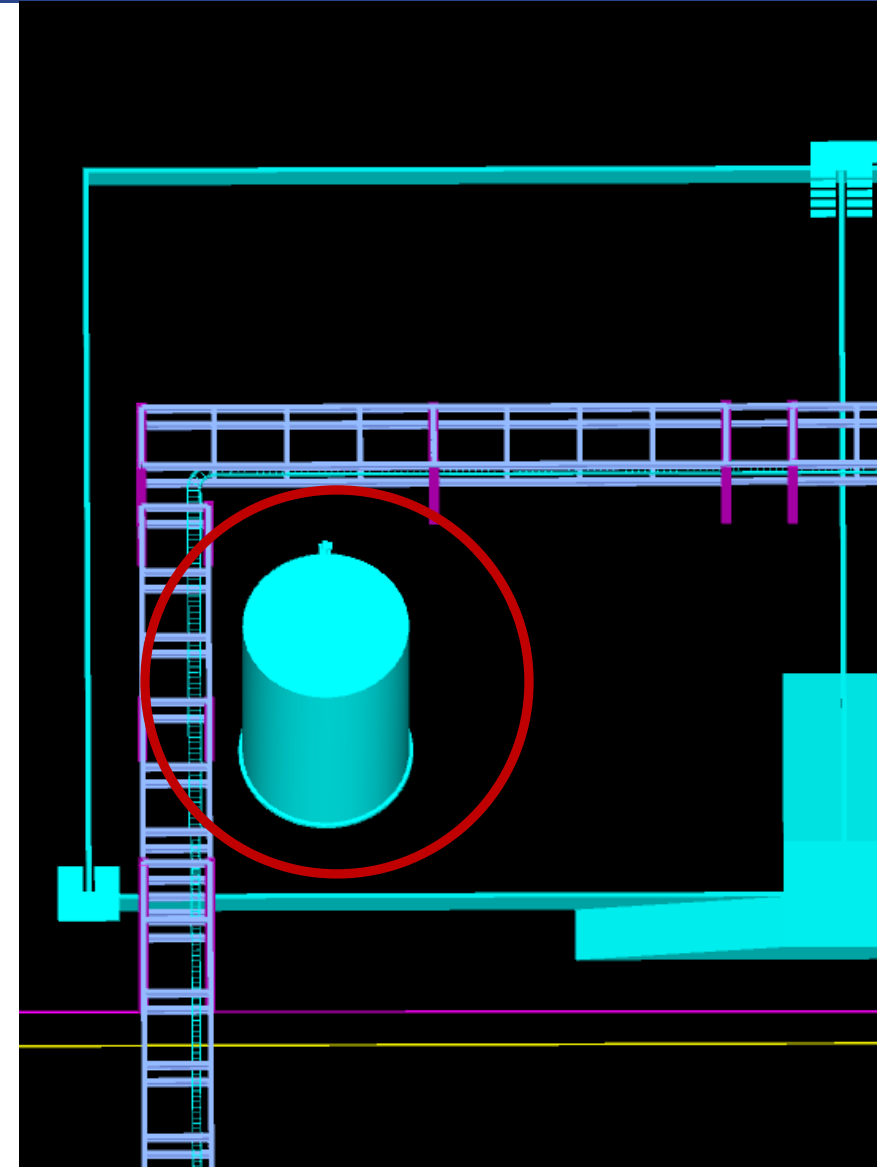


Bulk Delivery

- Rail delivery: 85 tons each car
- Three (3) tank cars per day
- Roughly 22 tank cars per week
- Unloaded by dedicated pumping system from rail cars

Bulk Storage

- One (1) bulk storage tank installed
- ~2.5 days of storage
- Space left for installation of 2nd tank, if needed
- Separate spill containment area with 3 ft walls

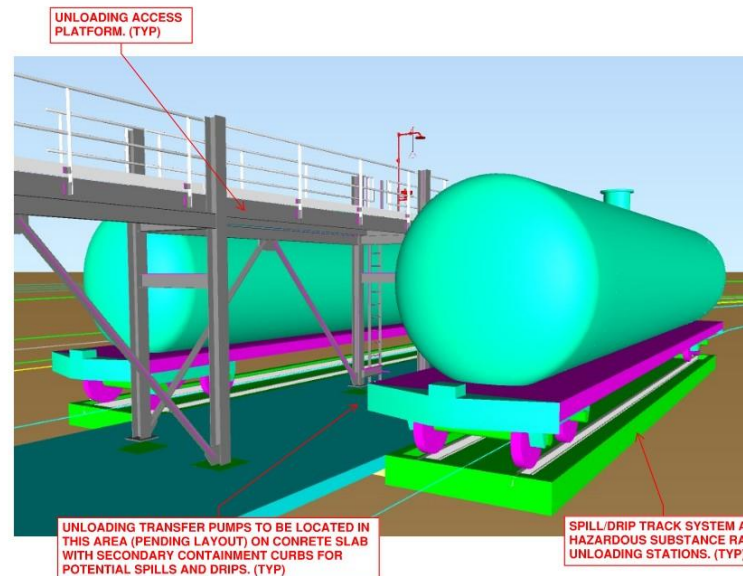


93% SULFURIC ACID



Rail Unloading

- Separate spill containment under sulfuric acid rail cars & pumping systems
- Overhead unloading arms
- Spill containment system will be coated to resist sulfuric acid corrosion. Coating to be discussed with supplier.





Sulfuric Acid Production Plant

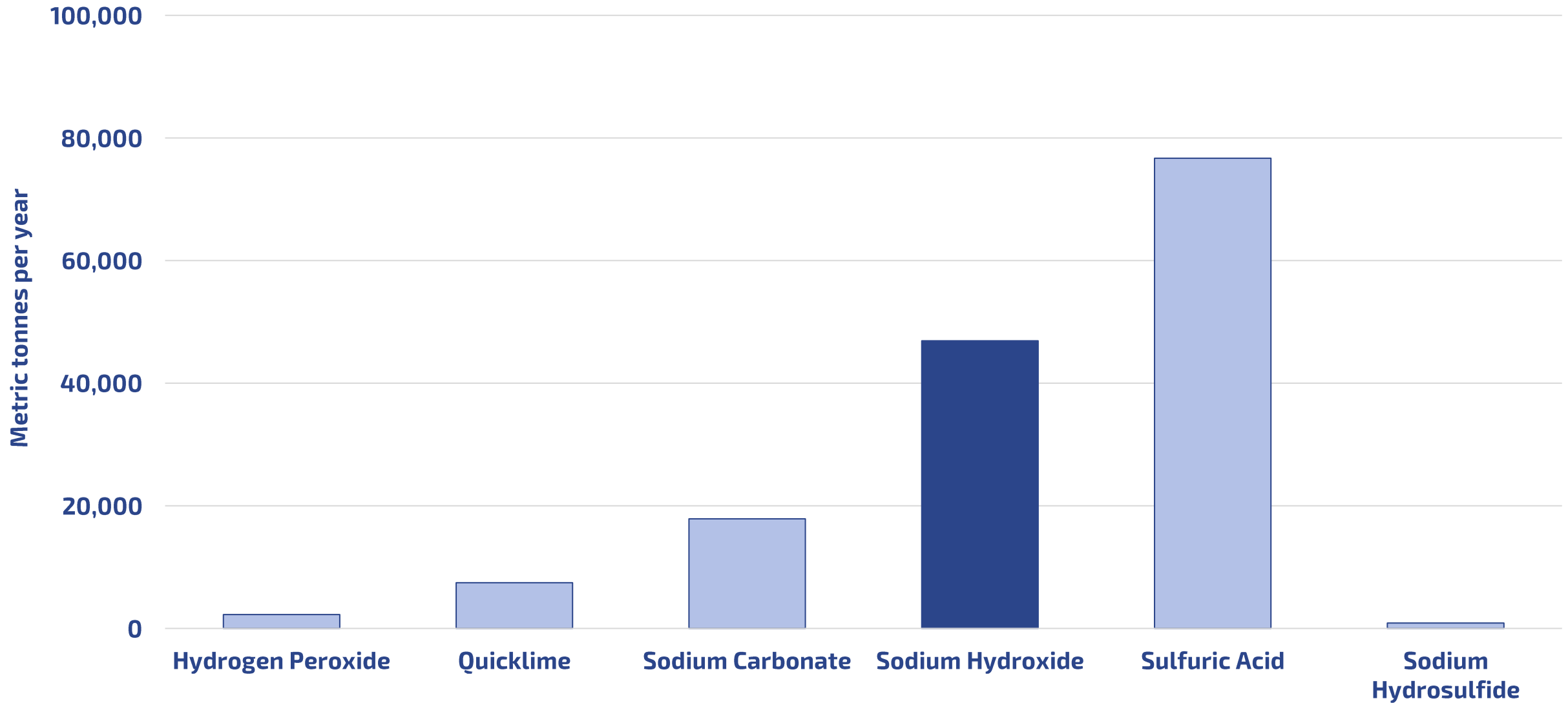
- 330 tons per day of sulfuric acid production
- Built: 1989
- Bulk storage of H_2SO_4

Al Conte
& A



**50% SODIUM
HYDROXIDE**

REAGENT USAGE (Average)





Physical Properties

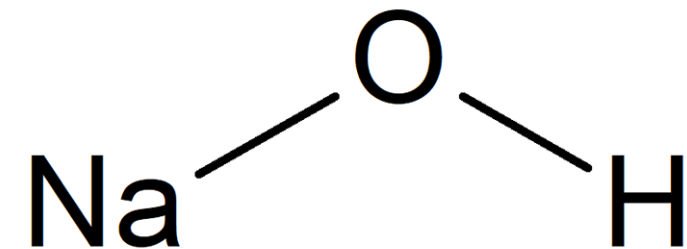
- Molecular form: NaOH
- Known as 'caustic soda'
- Colorless, odorless,
- Denser than water (SG = 1.50)
- Highly corrosive
- Strongly basic

Incompatible Chemicals

- Strong bases
- Strong acids
- Hydration reaction releases heat

Industrial Uses

- Chemical industry (detergents, sodium salts)
- Water treatment
- Pulp & paper
- Cleaning agents





General Hazards

Flammable Properties:	Does not burn
Extinguishing Media:	Not combustible. Use extinguishing agent suitable for surrounding fire. Do not use carbon dioxide
Specific Hazards:	Contact with water causes frothing and spattering. Reacts with metals to produce flammable gas. Toxic sodium oxide fumes can be generated at high temperatures.
Chemical Stability:	Normally stable
Incompatible Materials:	Highly reactive. Reacts with many chemicals, including, water, organic acids, inorganic acids, oxidizing agents, metals. Corrosive to aluminum alloys, carbon steel, and other metals.
Hazardous Decomposition Products:	None known
Possibility of Hazardous Reactions:	None known



Specific Hazards

- *Contact with water causes frothing and spattering*
- *Reacts with metals to produce flammable gas*
- *Toxic sodium oxide fumes can be generated at high temperatures*

Li-Cycle Mitigations for Specific Hazards

- Controlled injection of sodium hydroxide into our process tanks
- Instrumentation and monitoring (i.e., pH, temperature)
- Low temperature aqueous operation (<175°F)
- ~12 months of pilot plant operation using sodium hydroxide



Health Hazards



Corrosive



Health Hazard

Skin:	Corrosive
Eyes:	Corrosive
Inhalation:	Not expected to be an inhalation hazard unless it becomes an airborne dust or mist. Can cause severe irritation of the nose and throat.
Ingestion:	Corrosive
Carcinogenicity	Not known to cause cancer
Embryotoxicity	Not known to harm the unborn child
Reproductive Toxicity:	Not known to be a reproductive hazard
Mutagenicity:	Not known to be a mutagen

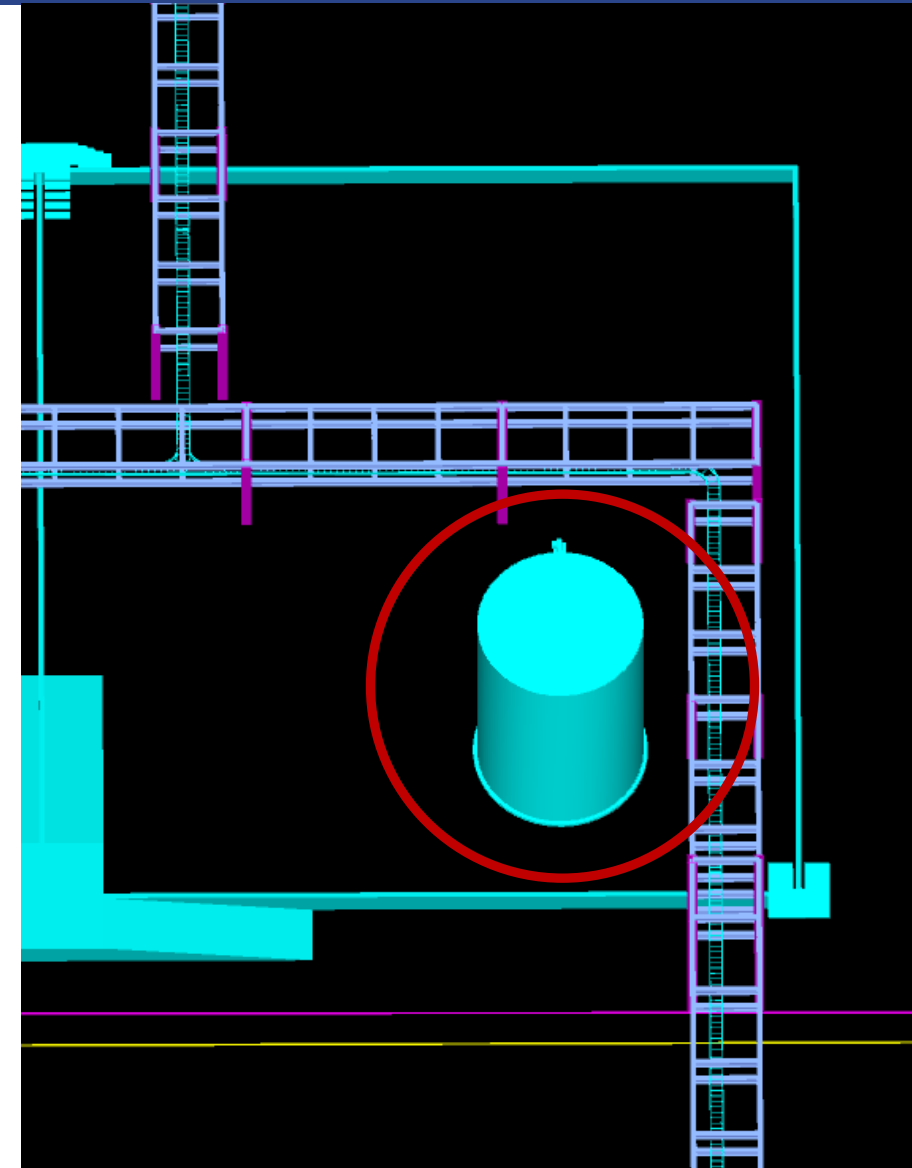


Bulk Delivery

- Rail delivery: 85 tons each car
- 2 tank cars per day
- Roughly 14 tank cars per week
- Unloaded by dedicated pumping system from rail cars

Bulk Storage

- One (1) bulk storage tank installed
- ~3.5 days of storage
- Space left for installation of 2nd tank, if needed
- Separate spill containment area with 3 ft walls

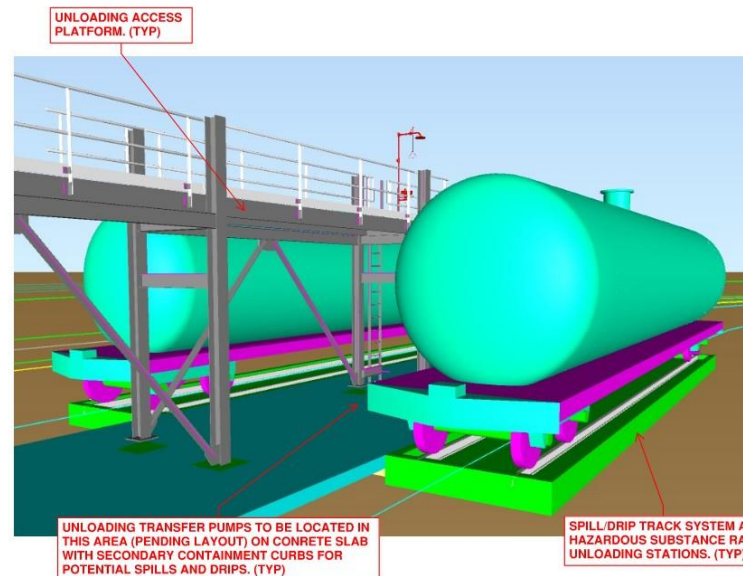


50% SODIUM HYDROXIDE



Rail Unloading

- Separate spill containment under sodium hydroxide rail cars & pumping systems
- Overhead unloading arms
- Spill containment system will be coated to resist sodium hydroxide corrosion. Coating to be discussed with supplier.



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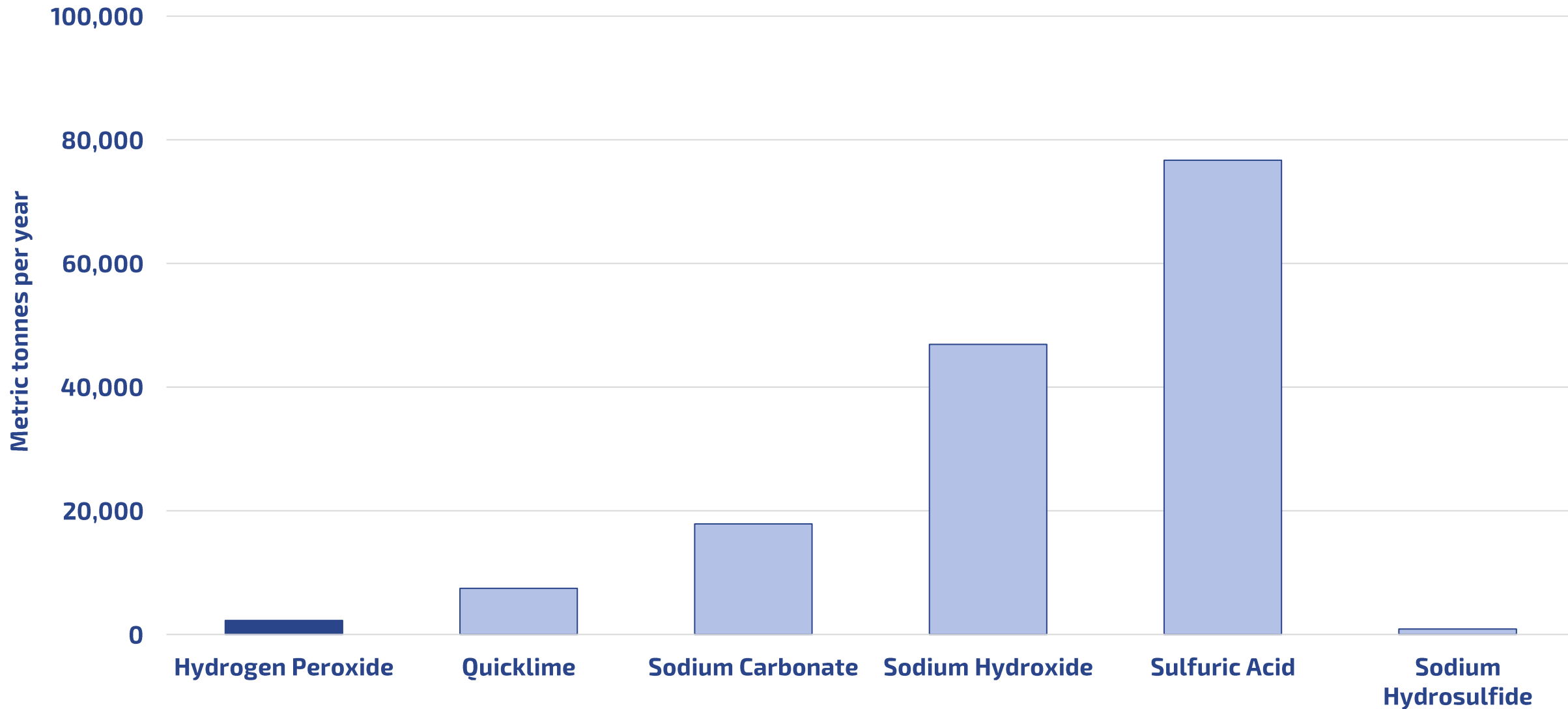




50% HYDROGEN PEROXIDE



REAGENT USAGE (Average)





Physical Properties

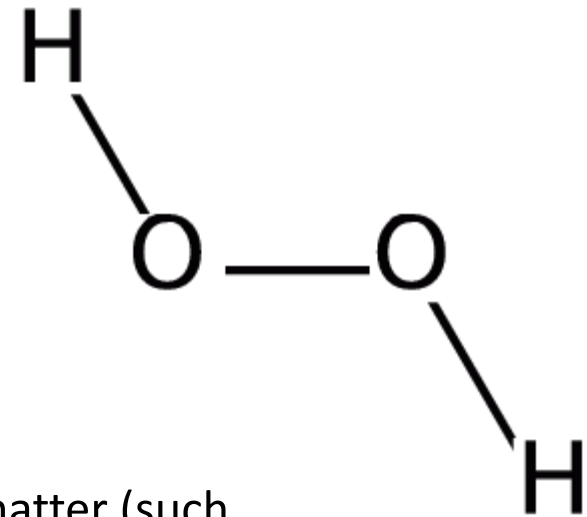
- Molecular form: H_2O_2
- Colorless, odorless, liquid
- Denser than water (SG = 1.20)
- Reactive and oxidizing agent
- Acidic

Incompatible Chemicals

- Strong bases (unless in a controlled process)
- Strong acids
- Combustible materials
- Contact with metals, metallic ions, alkalis, reducing agents and organic matter (such as alcohols or terpenes) may produce self-accelerated thermal decomposition.

Industrial Uses

- Bleaching
- Disinfection
- Propellant (at concentrations > 70%)





General Hazards

Flammable Properties:	Non flammable
Extinguishing Media:	Water. Do not use any other substance.
Specific Hazards:	In closed unventilated containers, risk of rupture due to the increased pressure from decomposition. Contact with combustible material may cause fire.
Chemical Stability:	Stable under normal conditions. Decomposes on heating. Stable under recommended storage conditions.
Incompatible Materials:	Combustible materials. Contact with metals, metallic ions, alkalis, reducing agents and organic matter (such as alcohols or terpenes) may produce self-accelerated thermal decomposition.
Hazardous Decomposition Products:	On decomposition product releases oxygen which may intensify fire.
Possibility of Hazardous Reactions:	Contact with organic substances may cause fire or explosion. Avoid excessive heat, contamination, exposure to UV-rays, pH variations.



Incompatible Materials

- *Contact with metals, metallic ions, alkalis, reducing agents and organic matter (such as alcohols or terpenes) may produce self-accelerated thermal decomposition.*
- *Strong acids and/or strong bases*
- *Combustible materials*

Li-Cycle Mitigations for Specific Hazards

- No combustible materials stored nearby
- Distance between hydrogen peroxide storage and solvent extraction area
- Pipelines will be self-draining to the extent feasible.
- Pipelines and tanks will be equipped with a pressure relief mechanism per industry best practices (hydrogen peroxide suppliers already engaged for design input)
- ~12 months of pilot plant operation using hydrogen peroxide



Health Hazards



Corrosive



Harmful



Oxidizer

Skin:	Corrosive
Eyes:	Corrosive
Inhalation:	Not expected to be an inhalation hazard unless it becomes an airborne mist. Can cause severe irritation of the nose and throat.
Ingestion:	Corrosive
Carcinogenicity	Not known to cause cancer in humans
Embryotoxicity	Not known to harm the unborn child
Reproductive Toxicity:	Not known to be a reproductive hazard
Mutagenicity:	Not known to be a mutagen

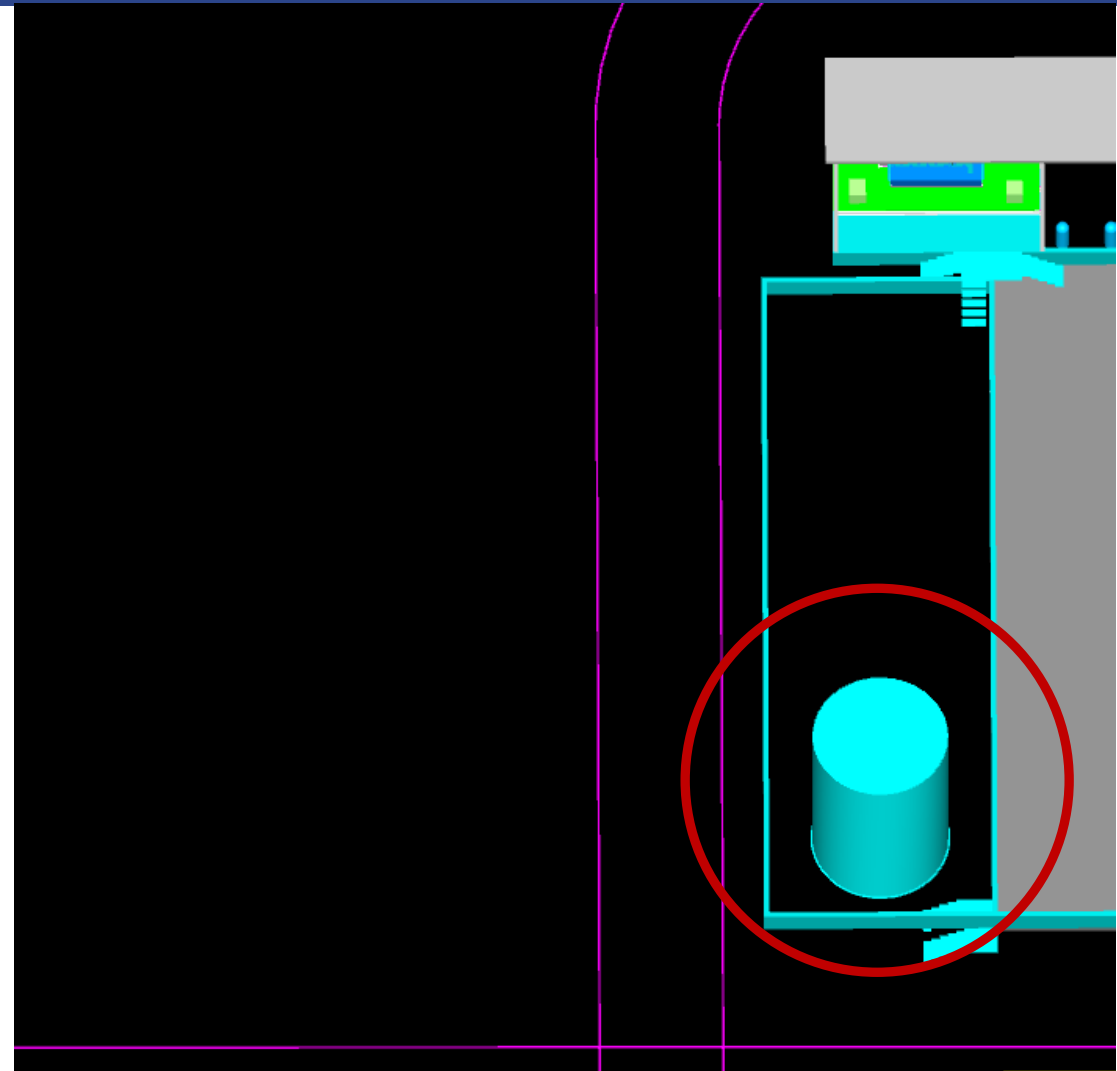


Bulk Delivery

- Rail delivery: 85 tons each car
- Roughly 1 tank car per week
- Unloaded by dedicated pumping system from rail cars

Bulk Storage

- One (1) bulk storage tanks
- ~12 days of storage
- Separate spill containment area with 3 ft walls

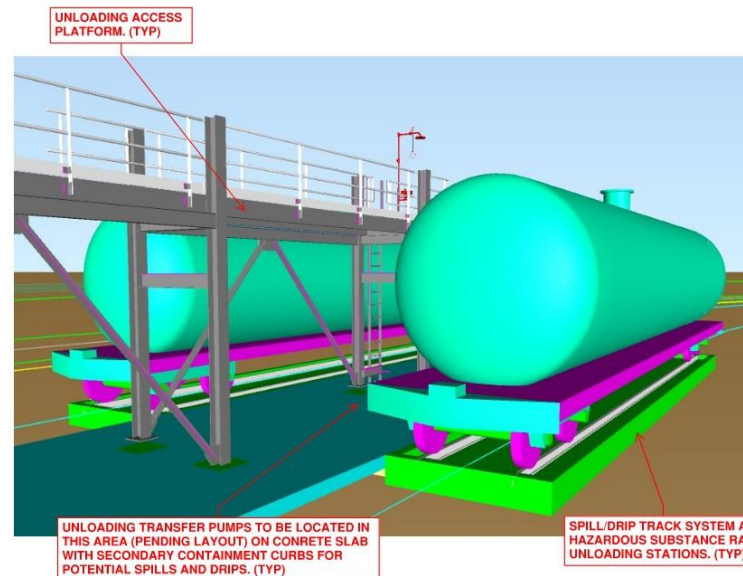


50% HYDROGEN PEROXIDE



Rail Unloading

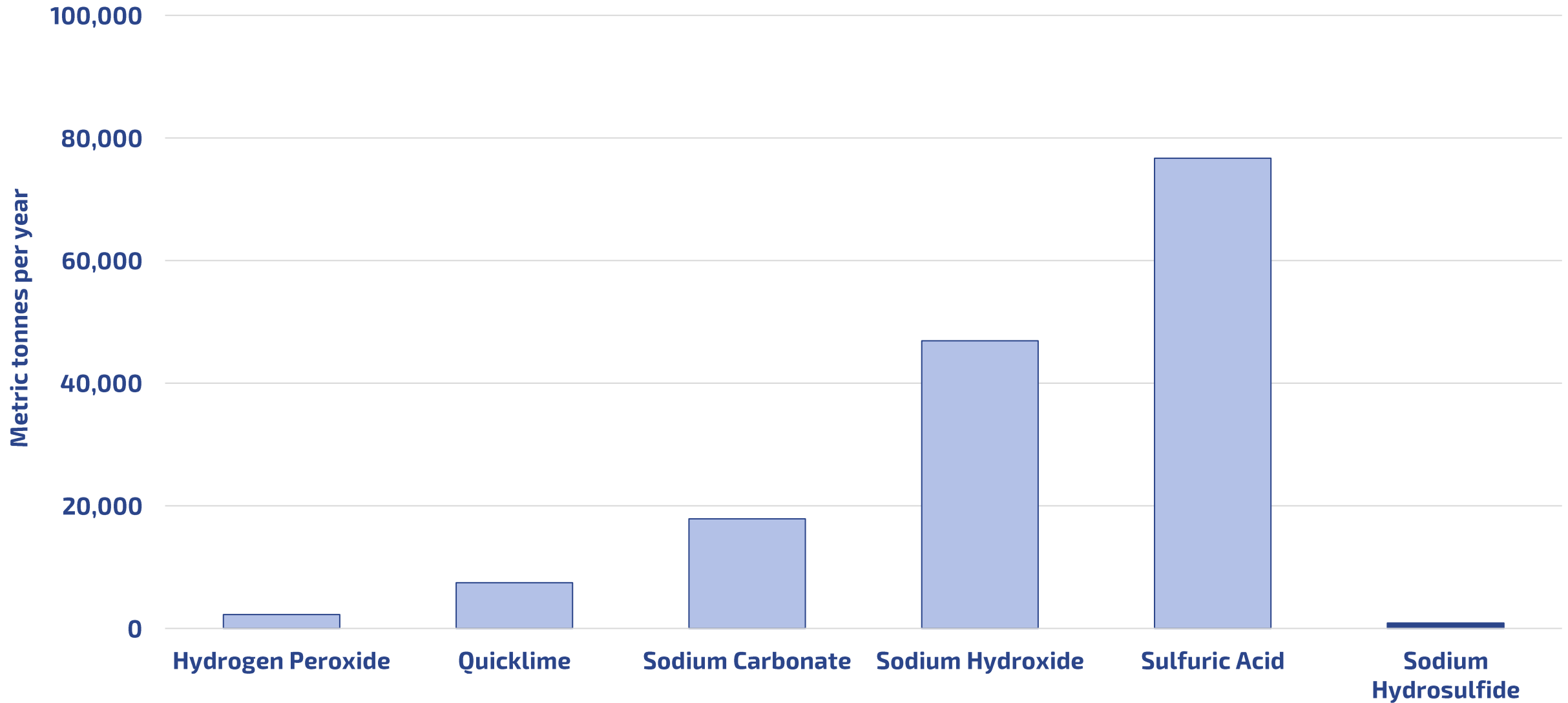
- Separate spill containment under hydrogen peroxide rail cars & pumping systems
- Overhead unloading arms
- Spill containment system will be coated to be compatible with hydrogen peroxide. Material/coating to be discussed with supplier.





SODIUM
HYDROSULFIDE
HYDRATE

REAGENT USAGE (Average)





Physical Properties

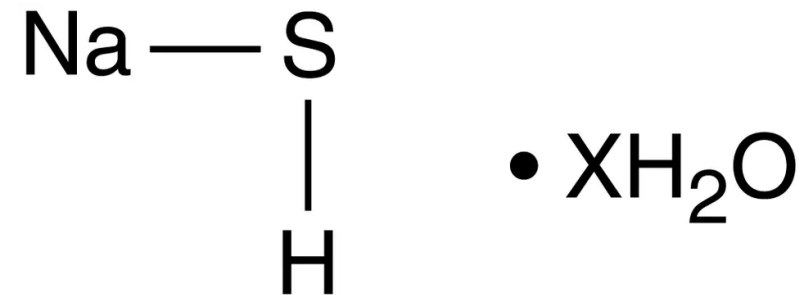
- Molecular form: $\text{NaHS}\cdot 2\text{H}_2\text{O}$
- Solid (flake) material, yellow

Incompatible Chemicals

- Strong acids (unless in a controlled process)
- Strong bases (unless in a controlled process)
- Strong oxidizers (unless in a controlled process)
- Heat & sources of ignition
- Do not store in contact with metals such as copper, zinc, or aluminum. Stainless steel is preferred. Carbon steel is acceptable.

Industrial Uses

- Flotation agent
- Metals precipitant
- Cloth & paper manufacturing





Fire Fighting Measures Hazards

Flammable Properties:	Non-combustible – sodium hydrosulfide does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.
Autoignition:	Not applicable.
Extinguishing Media:	Water. A heavy fog of water may be effective in knocking down vapors.

Li-Cycle Mitigations for Fire Hazards

- Dedicated storage area for sodium hydrosulfide hydrate bulk bags
- Low temperature aqueous operation (<175°F)
- Instrumentation and monitoring throughout the process area (i.e., gas monitors).
- Gas monitors will be for detecting very low levels of hydrogen sulfide gas (H₂S) and will have an audible siren and visual light alert.



Specific Hazards & Chemical Stability

Specific Hazards:	Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Poisonous sulfur dioxide gas will be generated if this product burns.
Chemical Stability:	Stable under normal conditions. Do not store near acids. Keep away from heat and sources of ignition.

Li-Cycle Mitigations for Specific Hazards & Chemical Compatibility

- No acid pipelines will be run through the area using sodium hydrosulfide.
- Instrumentation and monitoring throughout the process area (i.e., gas monitors). Gas monitors will have an audible siren and visual light alert in the event of low-level H₂S gas detection.
- No heat or sources of ignition in the areas storing or using sodium hydrosulfide.



Hazardous Reactions & Decomposition Products

Incompatible Materials:	Strong oxidizers, acids, bases, certain metals
Hazardous Decomposition Products:	Hydrogen sulfide (H ₂ S)
Possibility of Hazardous Reactions:	Toxic H ₂ S gas when mixed with an acid or exposed to high heat sources such as a fire.

Li-Cycle Mitigations for Specific Hazards & Chemical Compatibility

- No acid pipelines will be run through the areas storing or using sodium hydrosulfide.
- Instrumentation and monitoring throughout the process area (i.e., gas monitors). Gas monitors will have an audible siren and visual light alert in the event of low-level H₂S gas detection.
- All incompatible chemicals (sulfuric acid, hydrogen peroxide) are stored away from the area.
- All equipment will be closed and vented to a caustic scrubber for H₂S control. ***The scrubber will be connected to emergency/back-up power.***

SODIUM HYDROSULFIDE HYDRATE



Health Hazards



Corrosive



Acute Toxicity

Skin:	Corrosive
Eyes:	Corrosive
Inhalation:	Severe respiratory distress because of corrosivity.
Ingestion:	Headache, nausea, dizziness, confusion, and painful alkali burns to the esophagus.
Carcinogenicity	Not known to cause cancer in humans
Embryotoxicity	Not known to harm the unborn child
Reproductive Toxicity:	Not known to be a reproductive hazard
Mutagenicity:	Not known to be a mutagen

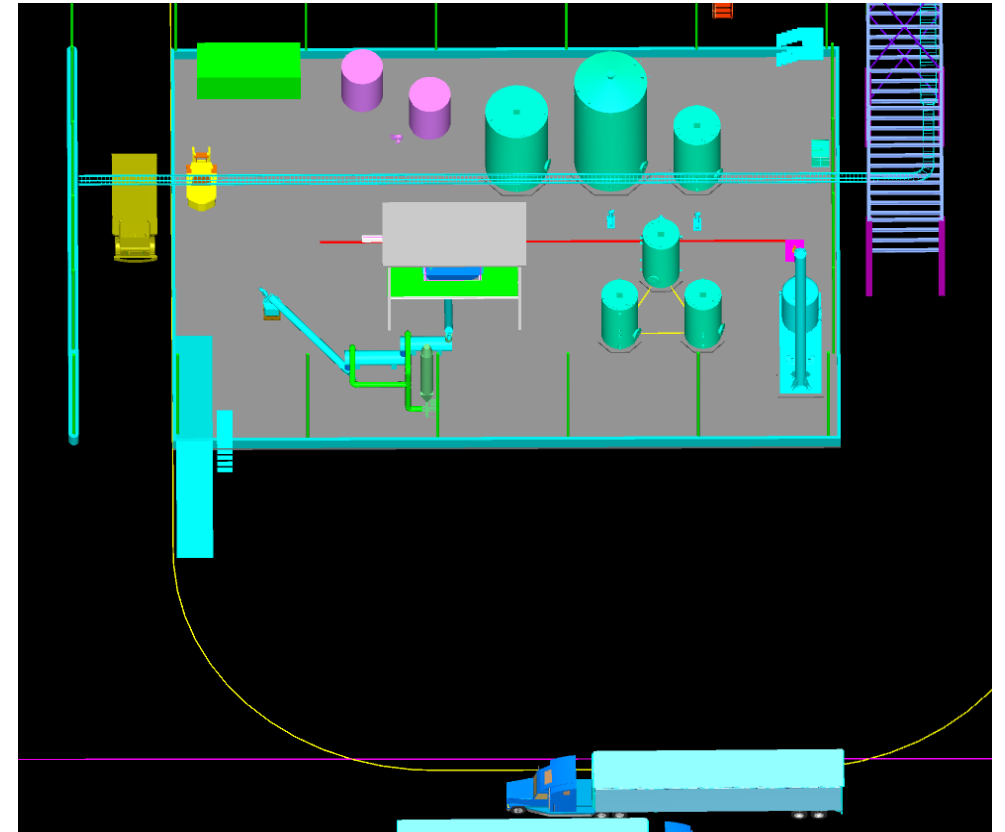


Bulk Delivery

- Truck delivery: 1 ton bags (~24 bags per ISO container)
- Roughly ½ truck per week
- Fully contained bag breaking system
- **All equipment connected to emissions control device (i.e., caustic scrubber)**

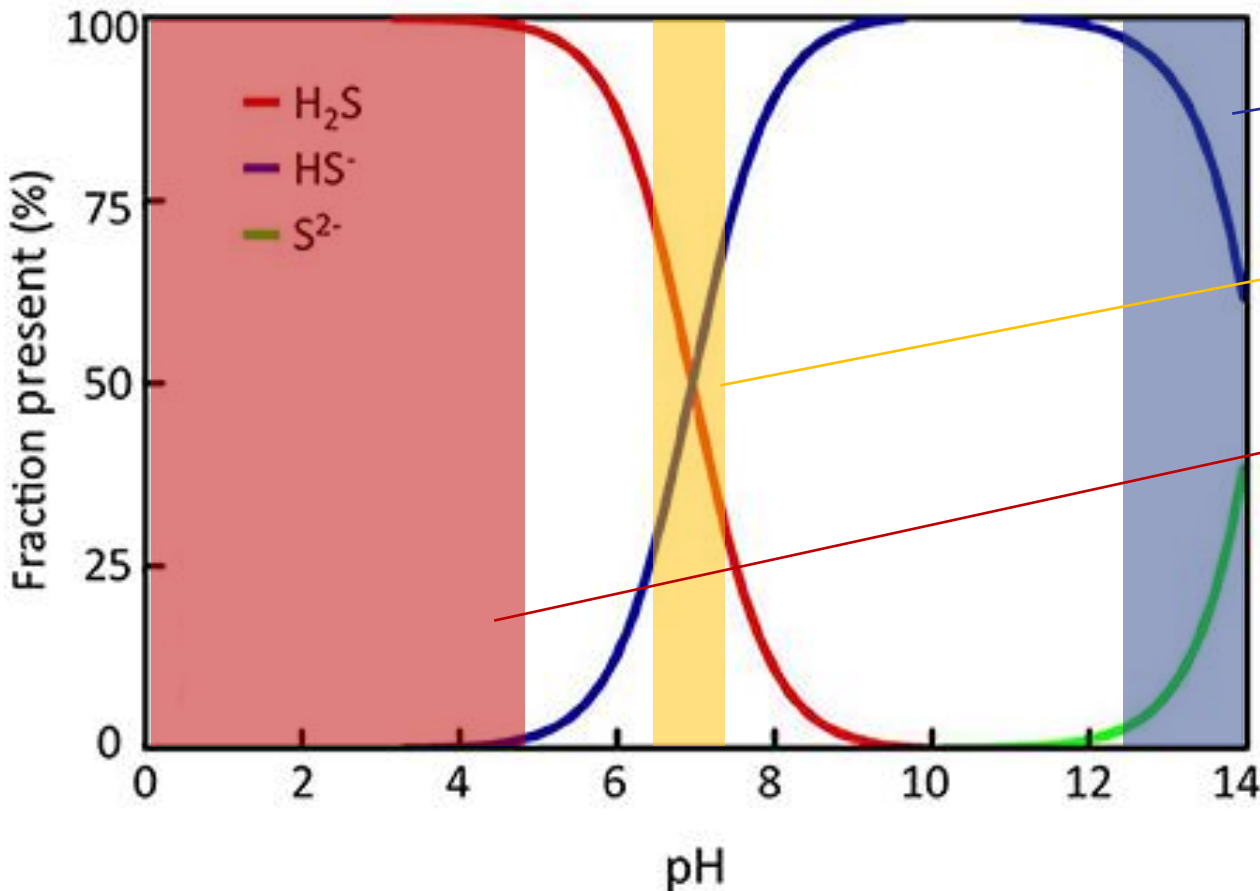
Bulk Storage

- Batch tank
- 30 hrs (maximum 3,500 gallons)
- No incompatible chemicals stored in, or passing through, sodium hydrosulfide area.
- Equipment will be constructed in secondary containment.





Sodium hydrosulfide is formed via the part neutralization of hydrogen sulfide (H_2S) with sodium hydroxide ($NaOH$)



This is the pH range of a sodium hydrosulfide solution (bulk storage tank). Note ~100% as HS^- anion.

This is the pH range at which the transition occurs to dissolved hydrogen sulfide gas in solution.

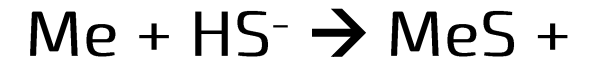
This is the pH range (acidic) all sulfide is in the form of hydrogen sulfide gas dissolved in solution.

Li-Cycle does not use hydrogen sulfide gas in the Hub process



The Hub process requires the injection of sodium hydrosulfide in to an acidic solution. Minimal H₂S generation is expected. Why does this work?

1. The acidic solution being processed has a high concentration of dissolved metals
2. Hydrosulfide prefers to precipitate metals rather than form H₂S in a metals-rich solution
3. Proper mixing and chemical injection helps to reduce H₂S formation
4. A scrubber will be used to capture H₂S gas that is produced



Li-Cycle piloted this process without issue by applying appropriate control devices and engineering controls



Physical Properties

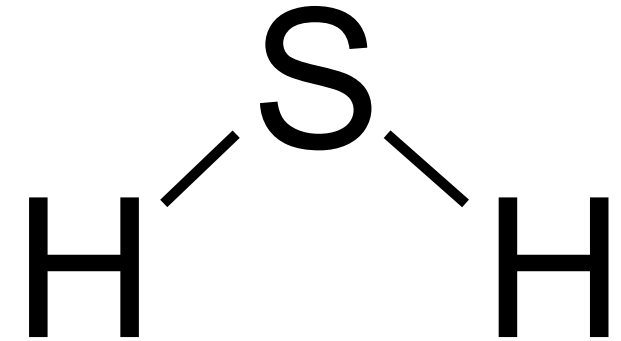
- Molecular form: H₂S
- Colourless gas
- Rotten eggs odor
- Denser than air (1.36 kg/m³)
- Highly corrosive
- Strongly basic

Incompatible Chemicals

- Highly reactive
- Increased risk of fire and explosion on contact with: metal oxides, oxidizing agents, strong bases
- In the presence of water, corrosive to: carbon steel
- Not corrosive to: aluminum alloys

Industrial Uses

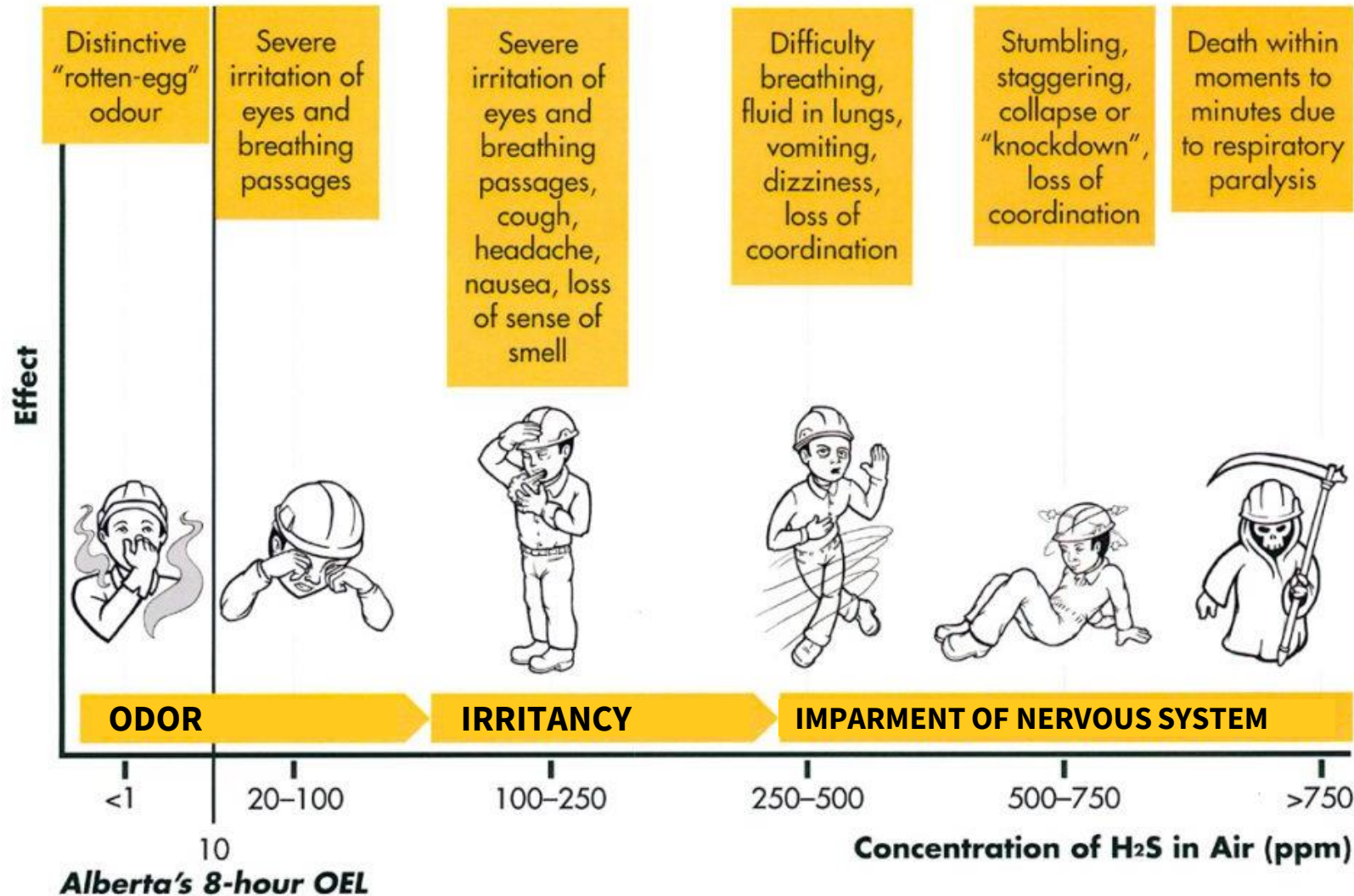
- Flotation agent
- Metals precipitant
- Cloth & paper manufacturing



EFFECTS OF EXPOSURE TO H₂S



EFFECTS OF H₂S EXPOSURE



Li-Cycle Hub Process

- Caustic scrubber inlet
 - 0.05 vol% = 50 ppm
- Caustic scrubber efficiency
 - >95% (conservative)
- Caustic scrubber outlet
 - 0.00025 vol% = 2.5 ppm
- Air dispersion modelling in-progress



Emissions Control Device

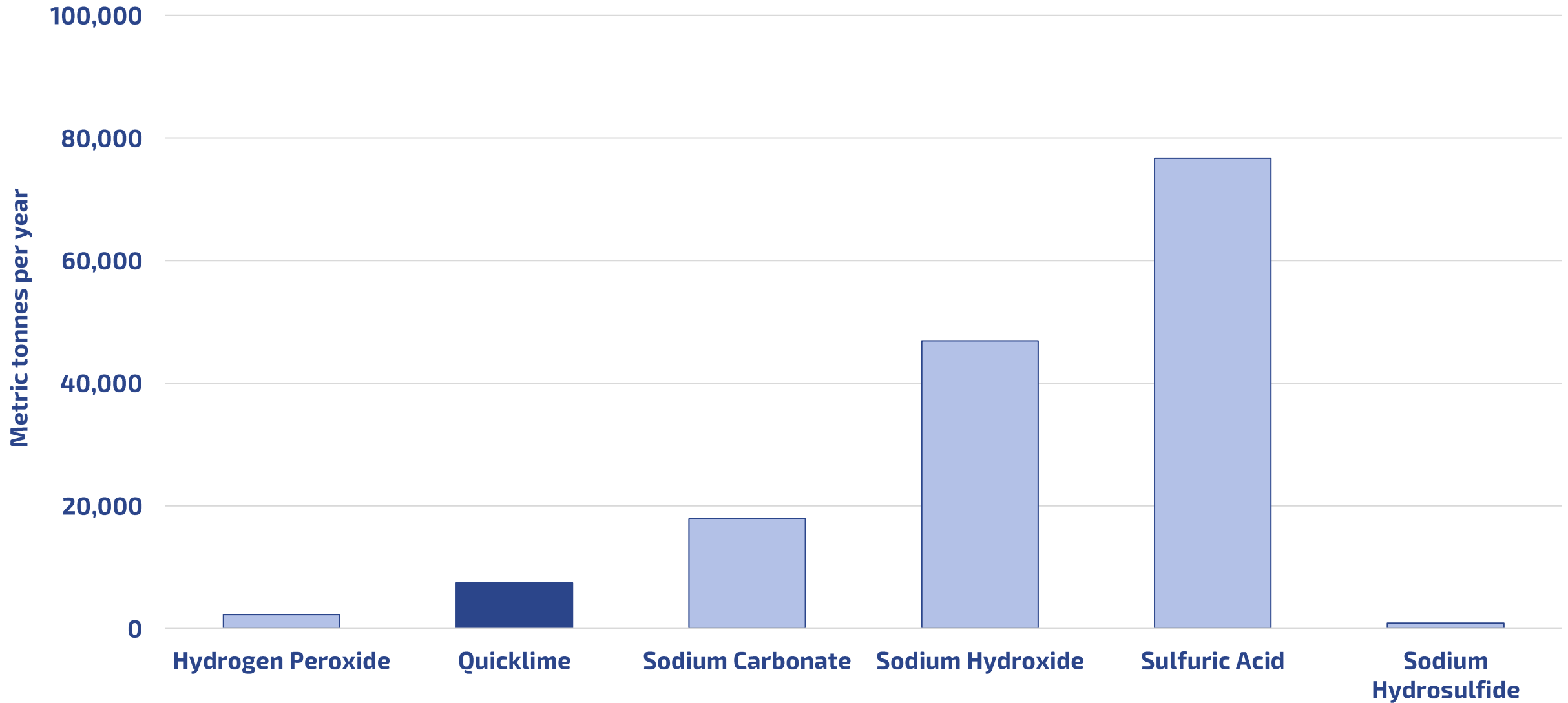
- Packed bed / venturi scrubber
- The scrubber will remove H₂S and sulfur odors from tank vents prior to venting air to atmosphere
- Water recirculated with pH control (sodium hydroxide injection)
- pH: 8 to 12
- Duty/standby fans
- Emergency/back-up power
- Scrubber sizing & arrangement in-progress





CALCIUM OXIDE (QUICKLIME)

REAGENT USAGE (Average)





Physical Properties

- Molecular form: CaO
- White solid powder or pebble
- Caustic, alkaline
- Odorless
- Specific gravity: 1.6 – 2.8

Incompatible Chemicals

- Water (unless in a controlled process)
- Acids (unless in a controlled process)
- Oxidizing materials (Hydrogen peroxide storage away from lime)
- Reactive fluorinated compounds (none @ Hub)
- Reactive brominated compounds (none @ Hub)
- Reactive powdered metals (none @ Hub)
- Reactive phosphorous compounds (none @ Hub)

Industrial Uses

- pH regulator
- Cement additive
- Pulp & paper
- Mining
- Plaster
- Chemical production





General Hazards

Flammable Properties:	Non flammable, non combustible
Extinguishing Media:	Use dry chemical or CO ₂ fire extinguisher to extinguish the surrounding fire. Do not use water, unless it is added in excess to flood the fire.
Specific Hazards:	Store in a cool, dry, and well-ventilated location. Do not store near acids or other incompatible materials. Keep away from moisture. Do not store or ship in aluminum containers.
Chemical Stability:	Chemically stable, but reacts with water to form calcium hydroxide, while generating heat. Quicklime also reacts with carbon dioxide to form calcium carbonate.
Incompatible Materials:	See previous slide.
Hazardous Decomposition Products:	Does not occur.
Possibility of Hazardous Reactions:	See previous slide – avoid incompatible materials.



Health Hazards



Corrosive



Harmful



Health Hazard

Skin:	Corrosive, skin irritation or burning
Eyes:	Corrosive, serious eye damage
Inhalation:	Respiratory irritation
Ingestion:	Severe irritation or burning of gastrointestinal tract if swallowed
Carcinogenicity	May cause cancer if inhaled. Risk of cancer depends on duration and level of exposure.
Embryotoxicity	No known significant effects or critical hazards.
Reproductive Toxicity:	No known significant effects or critical hazards.
Mutagenicity:	No known significant effects or critical hazards.

CALCIUM OXIDE (QUICKLIME)

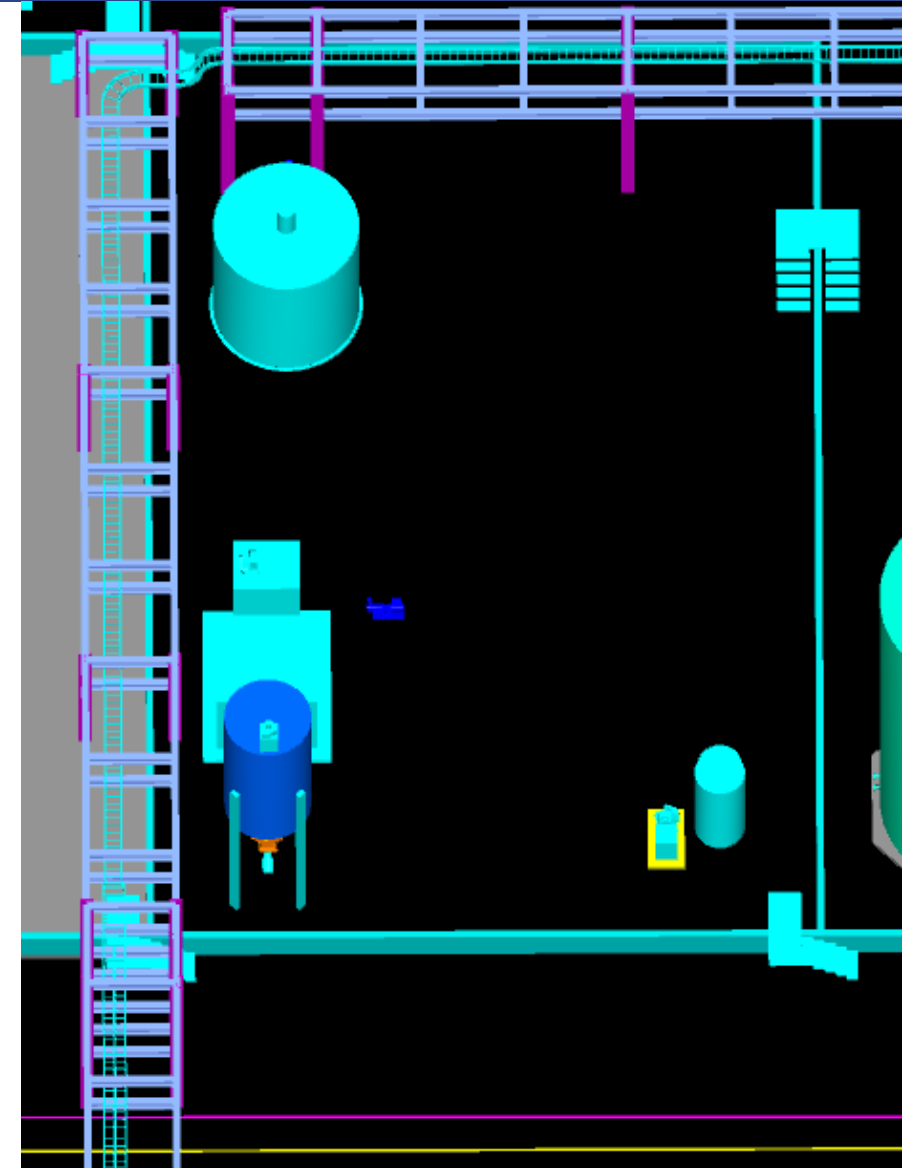


Bulk Delivery

- Rail delivery: 100 tons each car
- Hopper car
- Roughly 1.8 railcars per week
- Unloaded by a contained/enclosed pneumatic conveying system

Bulk Storage

- One (1) bulk storage silo
- Larger of 150 tonnes or 7 days
- Storage silo equipped with dust control





Rail Unloading

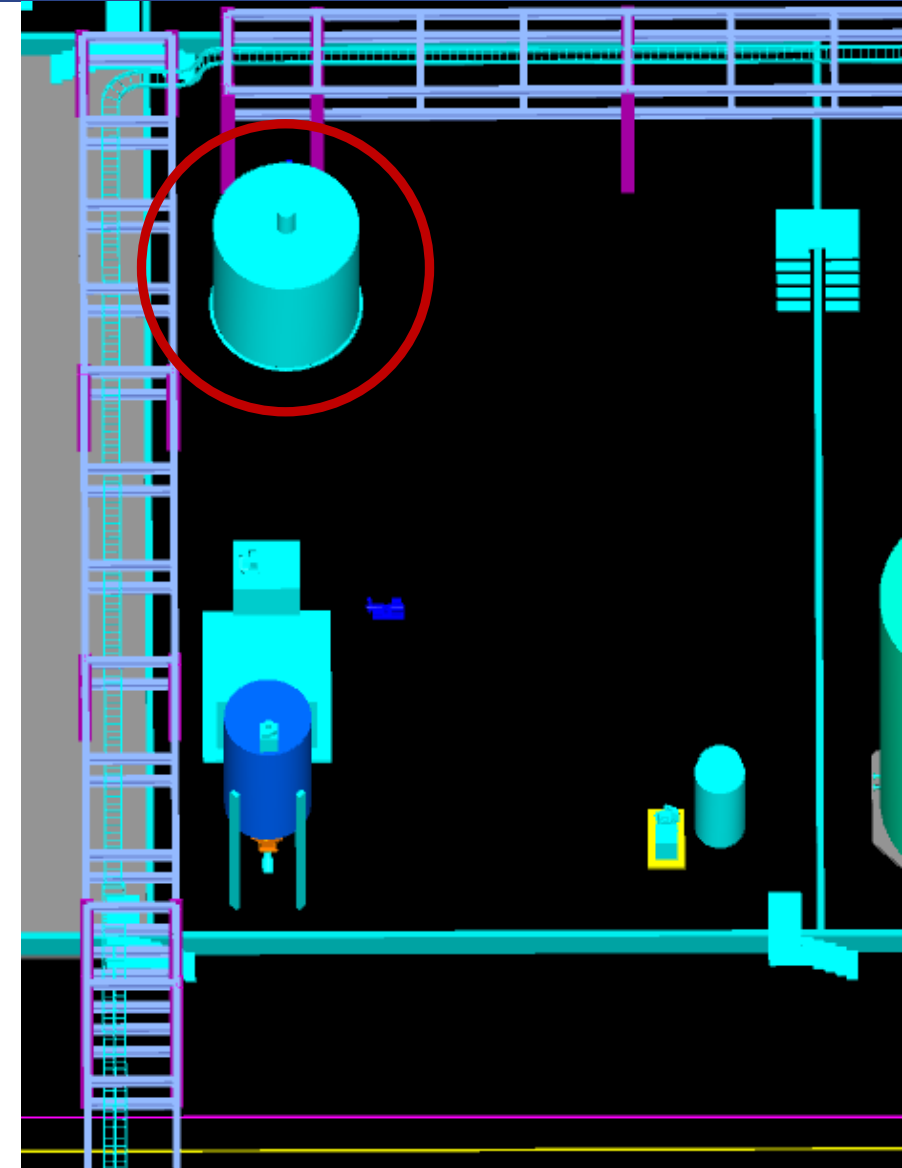
- Unloaded by pneumatic conveying system so that calcium oxide will not be exposed to precipitation
- Ground-mounted system similar to photo
- Control device on bulk silo to control dust during unloading





Hydrated Lime - Slurry Preparation

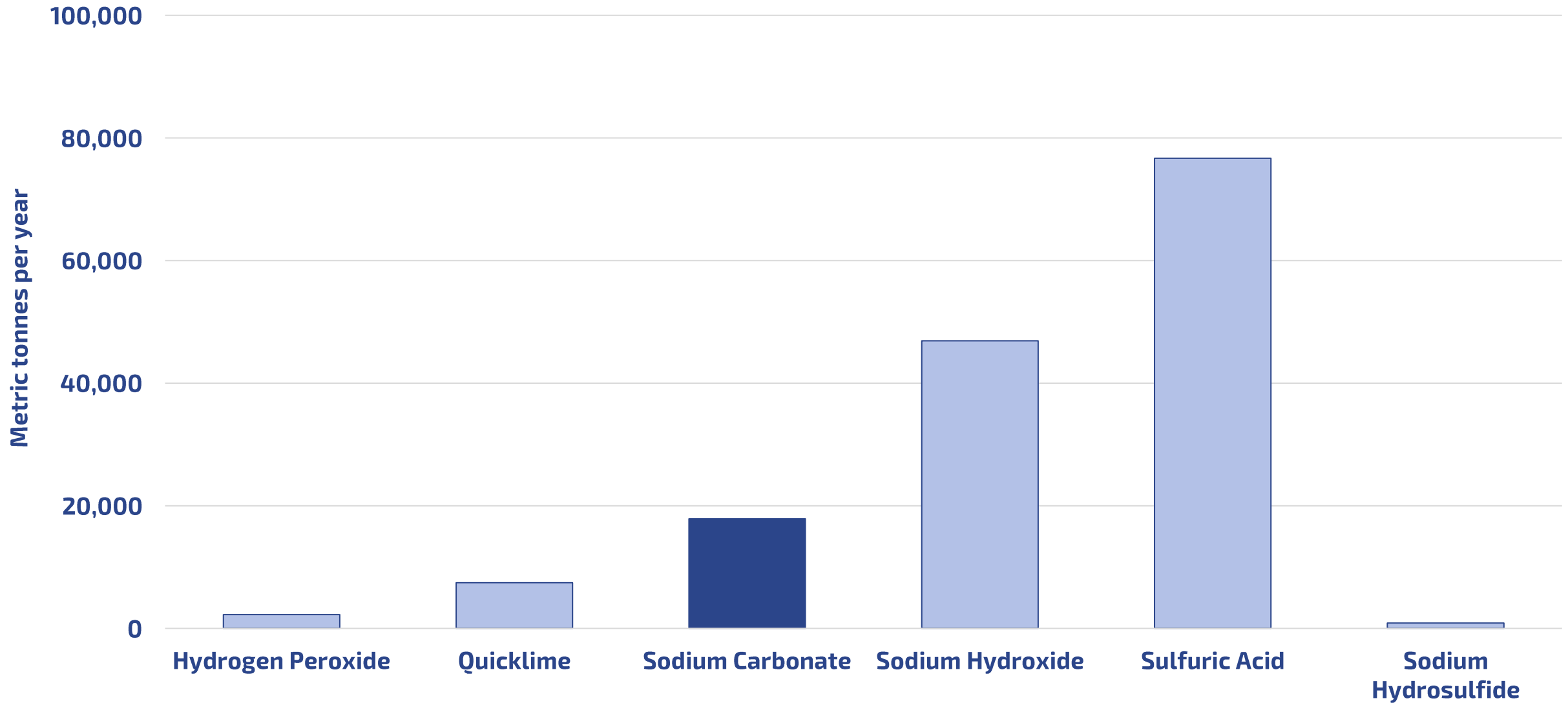
- Rail unloaded to bulk storage silo
- Quicklime conveyed (fully enclosed screw conveyor) to lime slaker
- Lime slaker allows controlled addition of water:
$$\text{Calcium oxide} + \text{water} \rightarrow \text{calcium hydroxide} + \text{heat}$$
- Temperature controlled process to optimizing lime slaking
- Slaked lime slurry (calcium hydroxide/hydrated lime) pumped to storage tank
- Ring main used for delivering hydrated lime to process users
- Hydrated lime will be distributed as a 10 to 20 wt% solution





SODIUM CARBONATE (SODA ASH)

REAGENT USAGE (Average)





Physical Properties

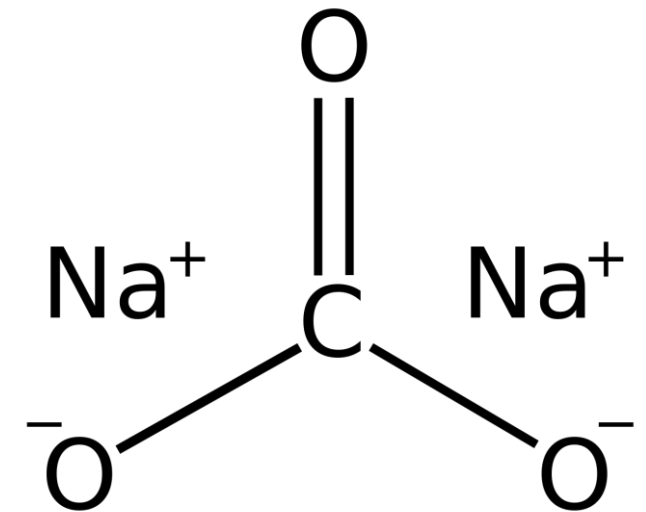
- Molecular form: Na_2CO_3
- White solid powder
- Alkaline when dissolved in water
- Odorless
- Specific gravity: 1.9 – 2.5

Incompatible Chemicals

- Acids (unless in a controlled process)
- Powdered aluminum
- CO_2 generation occurs when mixed with acidic materials

Industrial Uses

- Glass manufacturing
- Water softening
- Detergents
- Paper production
- Acidity regulator
- Carbonate source





General Hazards

Flammable Properties:	Non flammable, non combustible
Extinguishing Media:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Specific Hazards:	Reacts on exposure to water with some metals. CO ₂ generation occurs when mixed with acidic materials.
Chemical Stability:	Chemically stable. Decomposes by reaction with strong acid.
Incompatible Materials:	See previous slide.
Hazardous Decomposition Products:	Does not occur.
Possibility of Hazardous Reactions:	See previous slide – avoid incompatible materials.



Health Hazards



Irritant

Skin:	Not irritating
Eyes:	Inflammation/damage of the eye tissue. Corrosion of the eye tissue.
Inhalation:	Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.
Ingestion:	Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.
Carcinogenicity	No known significant effects or critical hazards.
Embryotoxicity	No known significant effects or critical hazards.
Reproductive Toxicity:	No known significant effects or critical hazards.
Mutagenicity:	No known significant effects or critical hazards.

SODIUM CARBONATE (SODA ASH)

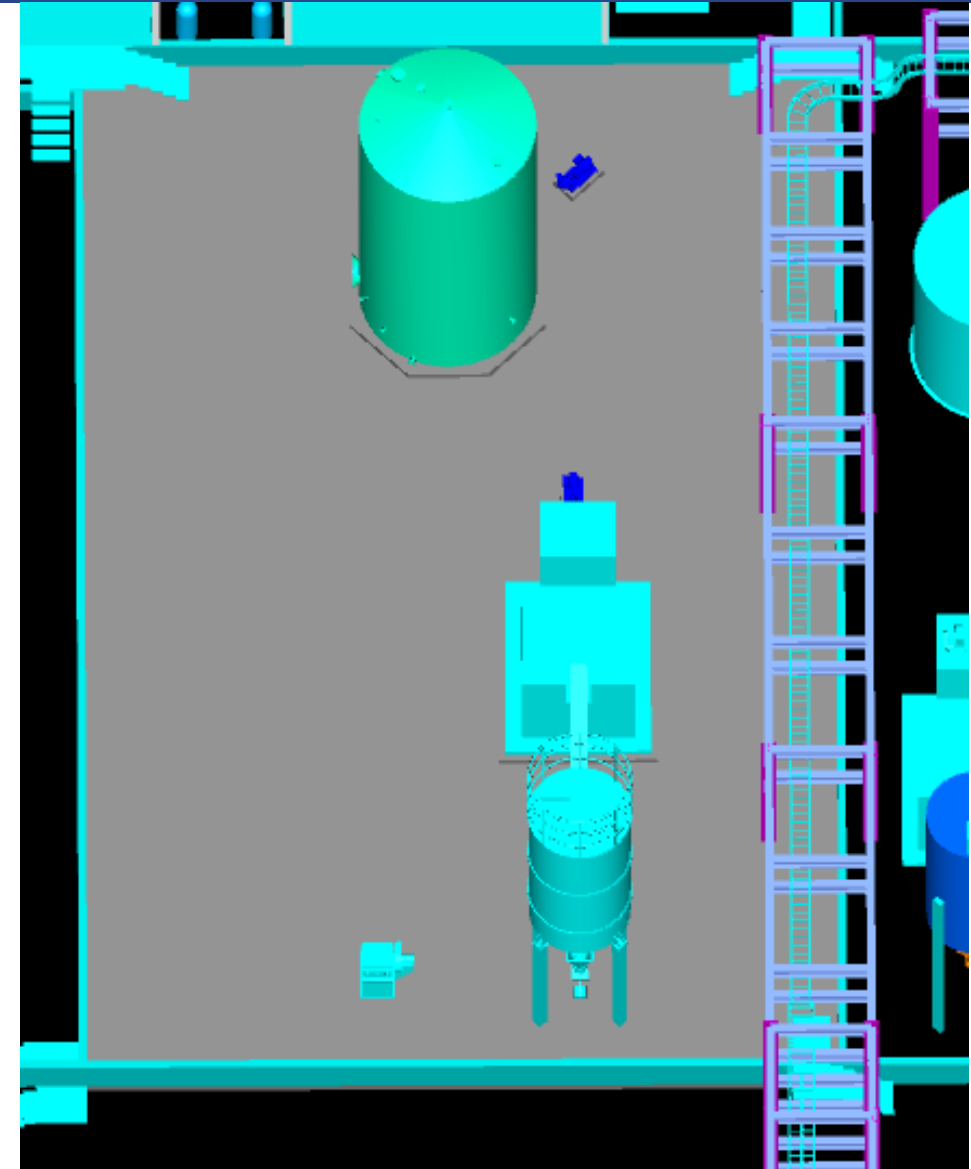


Bulk Delivery

- Rail delivery: 100 tons each car
- Hopper car
- Roughly 4.5 railcars per week
- Unloaded by enclosed pneumatic conveying system

Bulk Storage

- One (1) bulk storage silo
- Larger of 300 tonnes or 5 days





Rail Unloading

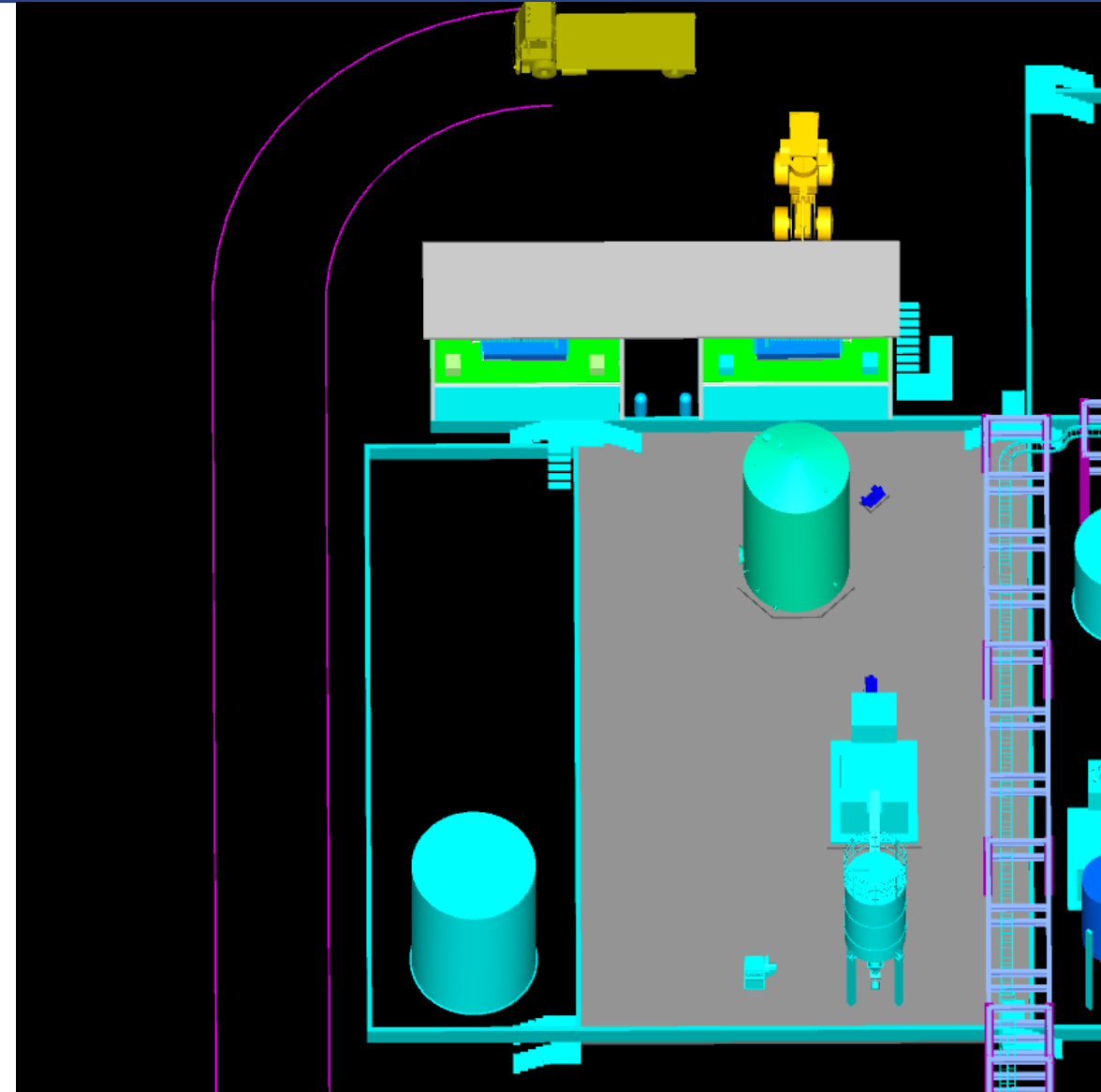
- Unloaded by pneumatic conveying system
- Ground-mounted system similar to photo
- Control device on bulk silo to control dust during unloading





Soda Ash – Solution Preparation

- Rail unloaded to bulk storage silo
- Soda ash conveyed (screw conveyor) to make-down tank and mixed with water
- Dissolved soda ash is filtered to remove grit / solid impurities
- Soda ash solution is pumped to storage tank and then on to process users
- Containment area for tanks, silo, etc





CHEMICAL COMPATIBILITY

BASIC COMPATIBILITY TABLE



	93% Sulfuric Acid	50% Sodium Hydroxide	50% Hydrogen Peroxide	Sodium Sulfide Hydrate	Quicklime	Soda Ash
93% Sulfuric acid	-	Heat Violent Rxn	Heat Explosion risk	Heat Toxic gas Flammable gas	Heat	Heat
50% Sodium hydroxide	Heat Violent Rxn	-	-	Heat	-	-
50% Hydrogen peroxide	Heat Explosion risk	-	-	Heat Fire Flammable gas	Gas (oxygen)	Gas (oxygen)
Sodium sulfide hydrate	Heat Toxic gas Flammable gas	-	Heat Fire Flammable gas	-	-	-
Calcium oxide (Quicklime)	Heat	-	-	-	-	-
Sodium carbonate (Soda Ash)	Heat	-	-	-	-	-



Chemical Bulk Storage

- Catastrophic rupture of a properly designed and fabricated bulk storage tank is very low.
- Multiple bulk storage tanks rupturing simultaneously is *extremely* unlikely.

Rail Unloading

- Unloading of rail cars is expected to be one of the highest risk chemical-related activities at the Hub.
- Written unloading Standard Operating Procedures (SOPs) and employee training
- HAZOP Study to identify additional safeguards to include in design.





Plans for ensuring safe rail unloading

- Instrumentation on all unloading lines with setpoints and interlock to unloading pumps
 - pH / density / conductivity
 - Visual Meter Displays at unloading stations
 - High level and High-High level alarms
- Security systems for full cars (e.g., perimeter fencing, CCTV, 24/7 site security)
- Each chemical has dedicated unloading system with different pipe sizes
- Separate spill containment systems with compatible liners (where applicable) for each reagent for the rail cars and unloading stations
- Spill prevention & Emergency Respond planning and procedures
- Checklists, procedures, and training (administrative controls)





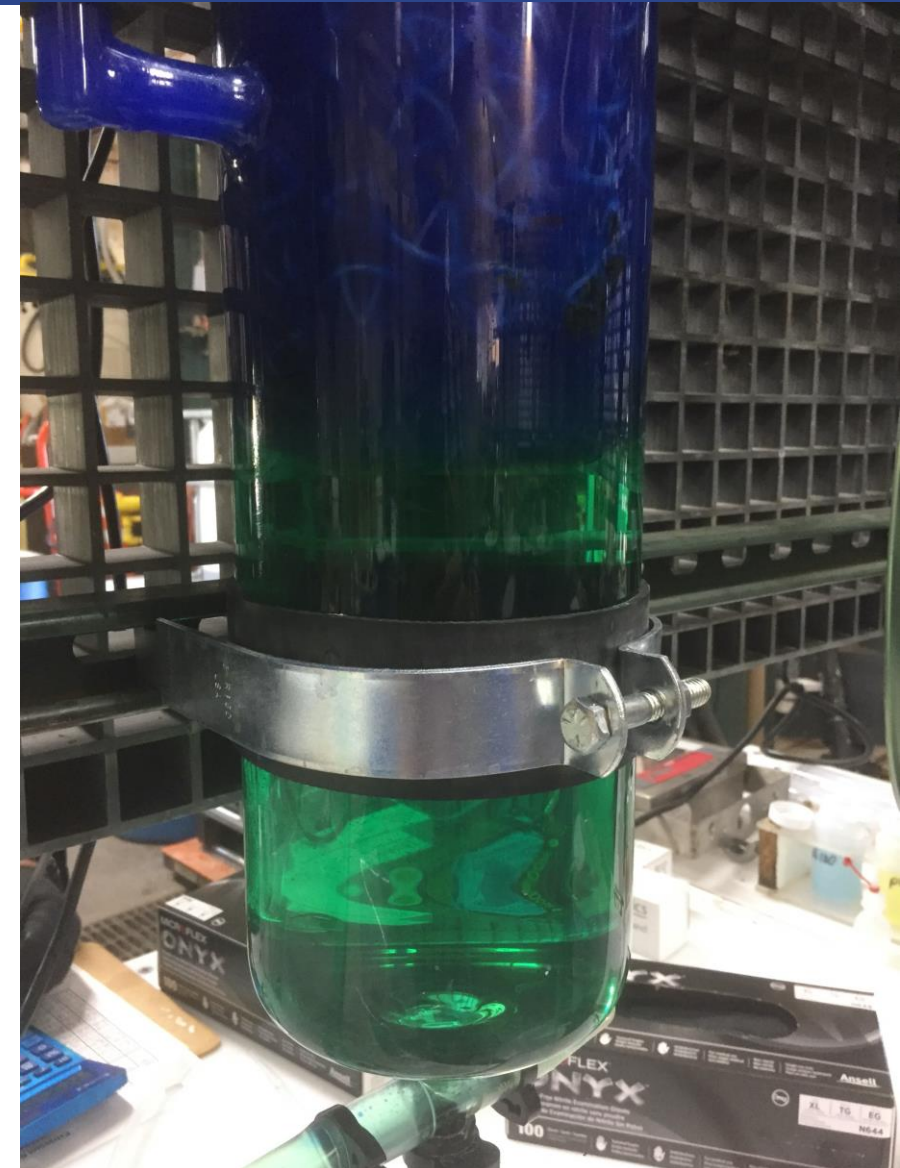
ORGANIC REAGENTS



SOLVENT EXTRACTION OVERVIEW



- The Li-Cycle process produces an aqueous solution that contains a mixture of concentrated dissolved metals. This aqueous solution is called 'PLS' or **P**regnant **L**each **S**olution.
- The first few process steps recover some of these metals and remove impurities from the PLS.
- **S**olvent **e**Xtraction (SX) is then used to recover key products from the PLS, mainly:
 - Cobalt sulfate, manganese sulfate, nickel sulfate

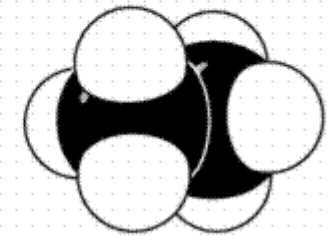
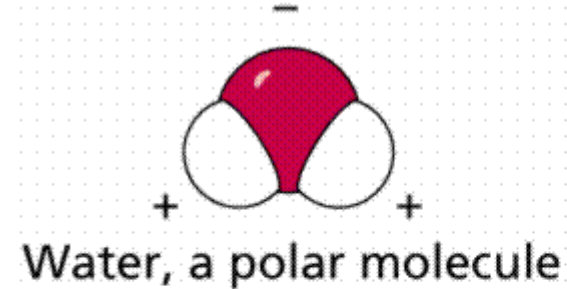


WHAT IS SOLVENT EXTRACTION?



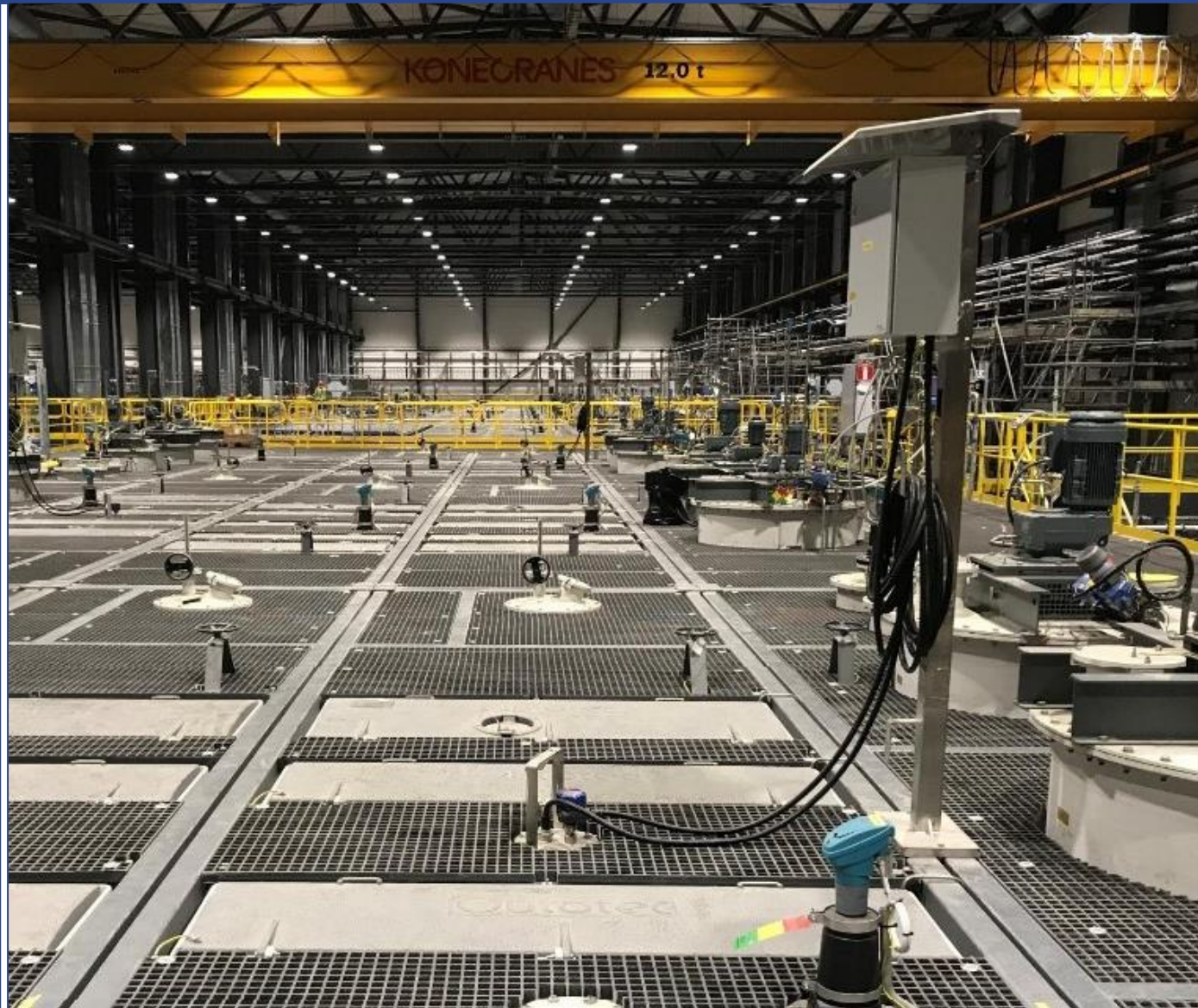
A liquid-liquid extraction method to separate metals based on their relative solubilities in two different immiscible liquids, usually water (polar) and an organic solvent (non-polar)

- Polar bonds form when two bonded atoms share electrons unequally.
- Non-polar bonds form between two atoms that share their electrons equally.

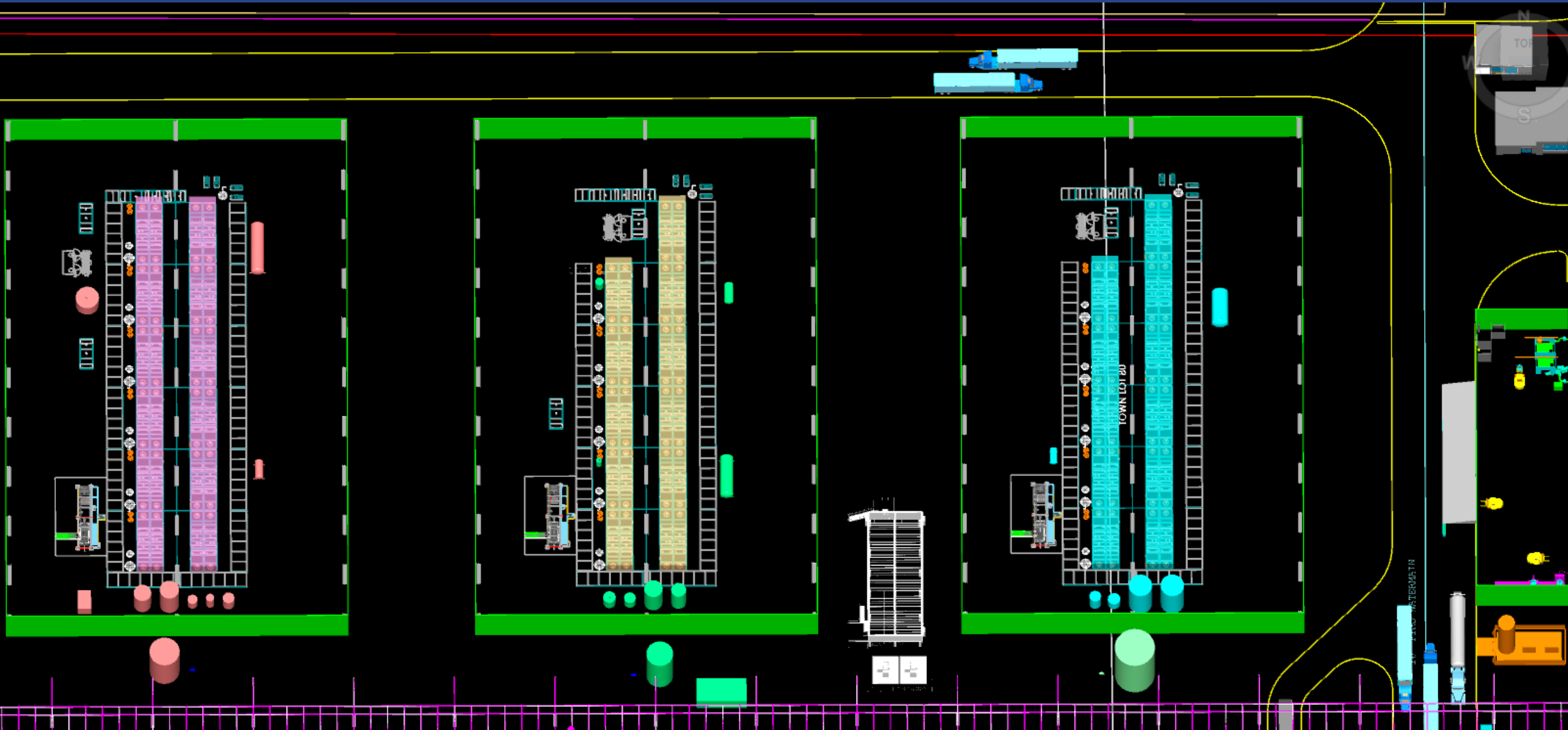


Ethane, a nonpolar molecule

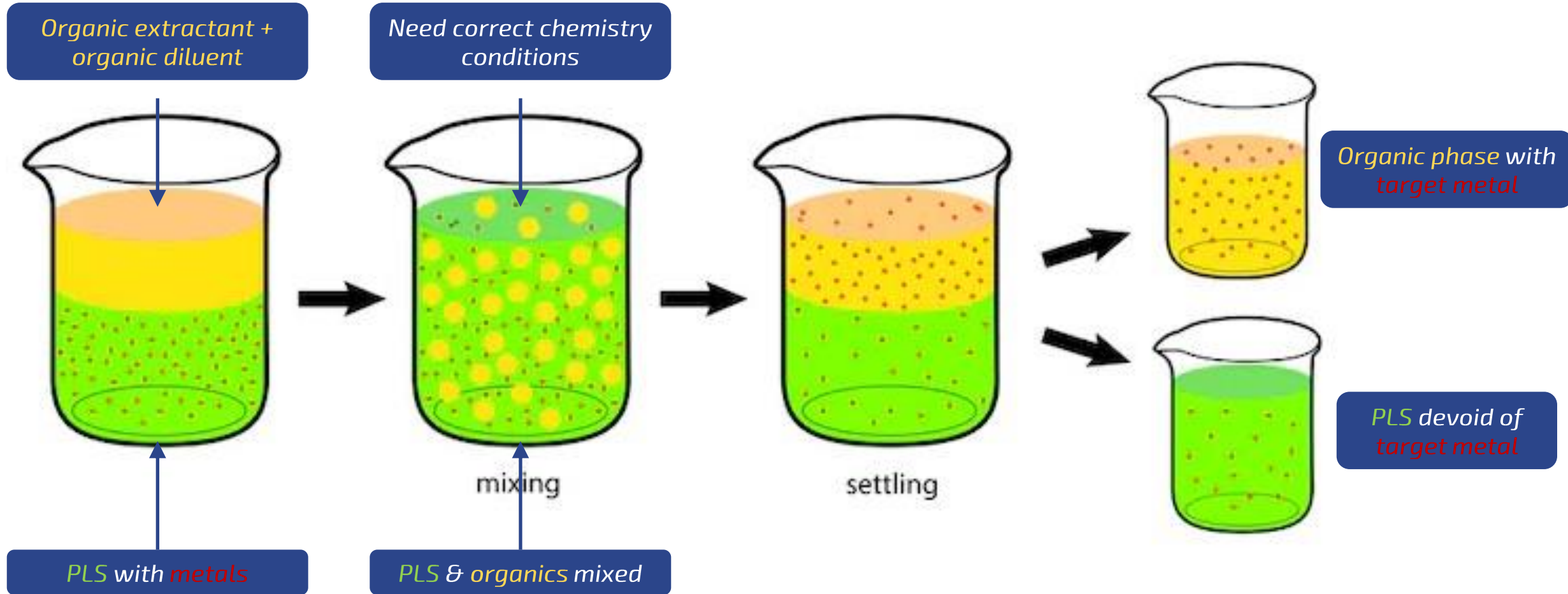
WHAT DOES THIS LOOK LIKE?



3 D M O D E L



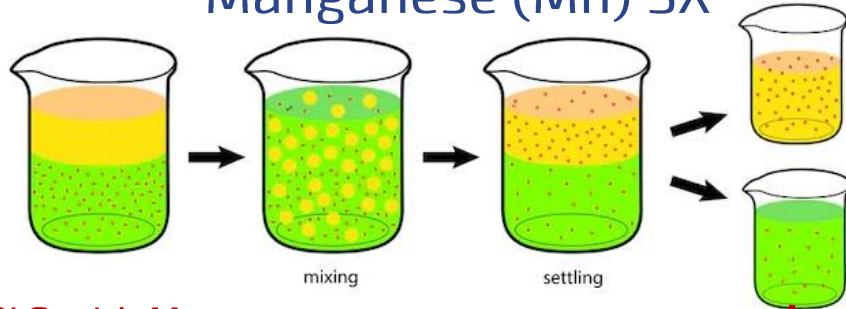
HOW DOES SX WORK?



HOW DOES SX WORK?



Manganese (Mn) SX

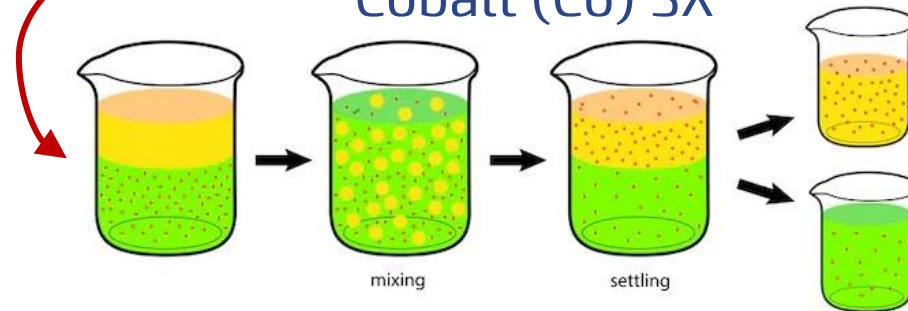


Organic with Mn

Mn raffinate (Co + Ni + Li)

PLS with Mn,
Co, Ni, Li

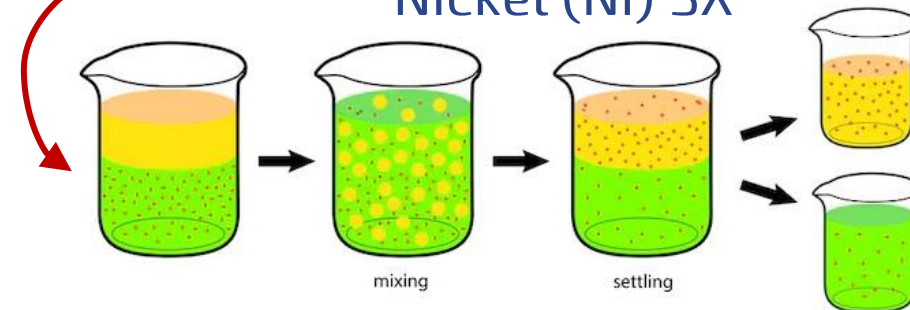
Cobalt (Co) SX



Organic with Co

Co raffinate (Ni + Li)

Nickel (Ni) SX



Organic with Ni

Ni raffinate (Li)

Not shown:

- In each SX circuit, the “loaded organic” is stripped using acid. Stripping removes the metal from the organic without chemically changing the organic.
- “Unloaded organic” is recycled in the process



Emissions Control Device

- Activated carbon air scrubber
- Remove volatile organic carbon vapors from tank vents prior to venting air to atmosphere
- Continuous differential pressure measurement
- Continuous organic compound monitoring in air outlet
- Emergency/back-up power
- Duty/standby fans
- Scrubber sizing & arrangement in-progress





Solvent Extraction Fire Protection Design

- Design currently in-progress.
- Petroleum hydrocarbon make-up (minor amounts) will be done via drums and/or totes on a 'just in time' basis.
- Fire fighting foam is typical for solvent extraction systems. Currently assumed to be the design basis.
- Grounded tanks & well ventilated building (through control device).
- No incompatible chemicals piped through the SX building (i.e., hydrogen peroxide).
- Area classification for SX building will be part of the design.
- Ignition sources will be mitigated or eliminated in SX buildings.
- Results of the Fire Protection Study will be a part of the design.





SOLVENT EXTRACTION ORGANICS



Combustible Liquid (per NFPA 30)

Class	Flashpoint	Examples
Class II	$\geq 100^{\circ}\text{F}$ and $\leq 140^{\circ}\text{F}$	Diesel fuel, kerosene
Class IIIA	$\geq 140^{\circ}\text{F}$ and $\leq 200^{\circ}\text{F}$	Linseed oil, mineral oil
Class IIIB	$\geq 200^{\circ}\text{F}$	Ethylene glycol (anti-freeze), glycerine

Flammable Liquid (per NFPA 30)

Class	Flashpoint	Boiling Point	Examples
Class IA	$< 73^{\circ}\text{F}$	$< 100^{\circ}\text{F}$	Ethyl ether, heptane, pentane
Class IB	$< 73^{\circ}\text{F}$	$\geq 100^{\circ}\text{F}$	Acetone, ethanol, IPA
Class IC	$\geq 73^{\circ}\text{F}$ and $< 100^{\circ}\text{F}$	All	Mineral spirits, isobutyl alcohol



Generally three types of organics in each solvent extraction circuit

	<i>Manganese Circuit</i>	<i>Cobalt Circuit</i>	<i>Nickel Circuit</i>
Diluent	Exxsol D80 / Shellsol D80	Exxsol D80 / Shellsol D80	Exxsol D80 / Shellsol D80
Extractant	Proprietary	Proprietary	Proprietary
Modifier	Proprietary	Proprietary	Proprietary

Diluent is a Class IIIA combustible, like linseed oil and mineral oil, and is not a flammable.

Total organics inventory in each solvent extraction circuit (*preliminary design*)

	<i>Manganese Circuit</i>	<i>Cobalt Circuit</i>	<i>Nickel Circuit</i>
Diluent & Extractant & Modifier	75,000 gallons	100,000 gallons	150,000 gallons
No. of tanks	12	12	12



Physical Properties

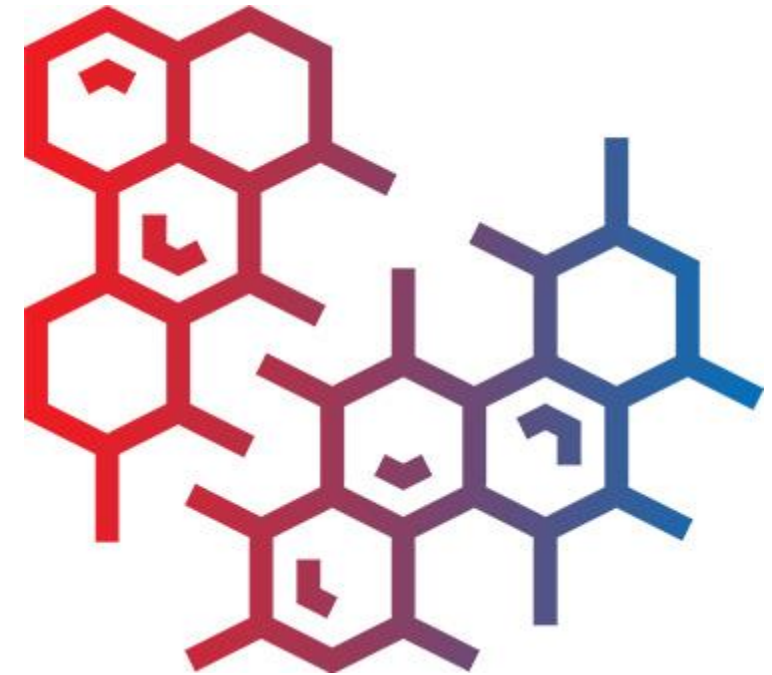
- Petroleum hydrocarbon solvent with aromatics removed
- Normal paraffins, isoparaffins and cycloparaffins
- Very low levels of aromatic hydrocarbons
- Colorless, mild solvent odor
- Less dense than water (SG = 0.798)

Incompatible Chemicals

- Fluid is combustible (Class IIIA)
- Relatively high vapor pressure / evaporation rate
- Handle with adequate ventilation and in areas where ignition sources have been removed
- The flash point is approximately 176°F / 80°C

Industrial Uses

- Paints, coatings
- Printing inks
- Mining – solvent extraction





General Hazards

Flammable Properties:	Material can accumulate static charges which may cause an ignition. Material can release vapors that readily form flammable mixtures. Vapor accumulation could flash and/or explode if ignited. Combustible.
Extinguishing Media:	Use water fog, foam, dry chemical or carbon dioxide (CO ₂) to extinguish flames. Do not use straight streams of water.
Specific Hazards:	Combustible (Class IIIA)
Chemical Stability:	Material is stable under normal conditions.
Incompatible Materials:	Avoid heat, sparks, open flames and other ignition sources. Strong oxidizers.
Hazardous Decomposition Products:	Material does not decompose at ambient temperatures.
Possibility of Hazardous Reactions:	Hazardous polymerization will not occur.



Physical Properties

- Petroleum hydrocarbon
- Clear to light yellow
- Odorless to faint odor
- Slightly less dense than water

Incompatible Chemicals

- Extractants are combustible (Class IIIB)
- Low vapor pressure / evaporation rate
- Avoid strong oxidizing agents and strong bases
- The flash points:
 - (1) 279°F / 137°C
 - (2) 226°F / 108°C
 - (3) 252°F / 122°C

Industrial Uses

- Mining – solvent extraction



General Hazards

Flammable Properties:	No data in SDS
Extinguishing Media:	Use water fog, foam, dry chemical or carbon dioxide (CO ₂) to extinguish flames. Do not use straight streams of water.
Specific Hazards:	Combustible (Class IIIB)
Chemical Stability:	Material is stable under normal conditions.
Incompatible Materials:	Avoid heat, sparks, open flames and other ignition sources. Strong oxidisers and strong bases.
Hazardous Decomposition Products:	Material does not decompose at ambient temperatures.
Possibility of Hazardous Reactions:	Oxides of carbon. Oxides of phosphorous.

Extractants are a Class IIIB combustible, like anti-freeze or glycerine, and are not flammable.



Physical Properties

- Petroleum hydrocarbon solvent
- Colorless
- Odorless
- Slightly less dense than water

Incompatible Chemicals

- Fluid is combustible (Class IIIB)
- Low vapor pressure / evaporation rate
- Avoid strong oxidizing agents and strong bases
- Flash point: 295°F / 146°C

Industrial Uses

- Solvent
- Plasticizer
- Adhesive additive
- Anti-foam for paints
- Mining – solvent extraction



General Hazards

Flammable Properties:	No data in SDS
Extinguishing Media:	Use water fog, foam, dry chemical or carbon dioxide (CO ₂) to extinguish flames. Do not use straight streams of water.
Specific Hazards:	Combustible (Class IIIB)
Chemical Stability:	Material is stable under normal conditions.
Incompatible Materials:	Avoid heat, sparks, open flames and other ignition sources. Strong oxidisers.
Hazardous Decomposition Products:	Material does not decompose at ambient temperatures.
Possibility of Hazardous Reactions:	Combustion products: Carbon monoxide (CO). Carbon dioxide (CO ₂). Oxides of phosphorus. Phosphorus trihydride (phosphine).

Modifier is a Class IIIB combustible, like anti-freeze or glycerine, and is not flammable.



Petroleum storage terminals in Finger Lakes Region

- 13 total terminals
- Total regional capacity: 2,379,000 bbl (99,918,000 gallons)
- Average: 7,686,000 gallons per terminal total

Li-Cycle Hub Petroleum Hydrocarbon Extraction Circuits

- 3 extraction circuits
- 36 tanks total
- Total organic inventory: ~350,000 gallons
- Average: ~6,950 gallons per tank



Source: ICF International

Li-Cycle Tank Information - Hazardous Material Storage Tanks

Tank Number	Tank Description	Vol. gal (Upper Limit)	Comments	Classification
120-TK-003	Stage 1 Leach Filter Feed Tank	52,800	Contains Li, Ni, Co Contains sulfuric acid - regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
120-TK-004	Pregnant Leach Solution Tank	18,700	Contains Li, Ni, Co Contains sulfuric acid - regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
120-TK-008	Graphite Residue Filter Feed Tank	25,300	Contains Li, Ni, Co Contains sulfuric acid - regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
210-TK-001	Cu Precipitation Feed Tank	151,800	Contains Li, Ni, Co Contains sulfuric acid - regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
210-TK-005	Cu Precipitation Filter Feed Tank	22,000	Contains Li, Ni, Co Contains sulfuric acid and sodium hydrosulfide - both of which are regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
210-TK-006	Sulfide Filtrate Tank	39,600	Contains Li, Ni, Co Contains sulfuric acid - which is regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
310-TK-005	Al-Fe Precipitation Filter Feed Liquor Tank	93,500	Contains Li, Ni, Co	Storage Tank - Process Solution, Hazardous Materials
310-TK-006	Gypsum Filtrate Tank	57,200	Contains Li, Ni, Co	Storage Tank - Process Solution, Hazardous Materials
310-TK-008	Gypsum Wash Filtrate Tank	12,100	Contains Li, Ni, Co	Storage Tank - Process Solution, Hazardous Materials
410-TK-001	Mn SX Feed Tank	174,900	Contains Li, Ni, Co	Storage Tank - Process Solution, Hazardous Materials
410-TK-050	Raffinate Filter Backwash Solution Tank	8,800	Contains Li, Ni, Co	Storage Tank - Process Solution, Hazardous Materials
510-TK-001	Co SX feed Tank	66,000	Contains Li, Ni, Co	Storage Tank - Process Solution, Hazardous Materials
510-TK-004	Co SX Spent Scrub Solution Tank	3,300	Contains Co	Storage Tank - Process Solution, Hazardous Materials
510-TK-064	Raffinate Filter Backwash Solution Tank	8,800	Contains Li, Ni	Storage Tank - Process Solution, Hazardous Materials
520-TK-001	Cobalt Sulfate Crystallizer Feed Tank	12,100	Contains Co	Storage Tank - Process Solution, Hazardous Materials
610-TK-001	Ni SX Feed Tank	74,800	Contain Li, Ni	Storage Tank - Process Solution, Hazardous Materials
610-TK-004	Ni SX Spent Scrub Solution Tank	6,600	Contain Li, Ni	Storage Tank - Process Solution, Hazardous Materials
610-TK-055	Ni SX Raffinate Filtrate Tank	29,700	Contain Li	Storage Tank - Process Solution, Hazardous Materials
610-TK-056	Raffinate Filter Backwash Solution Tank	8,800	Contain Li	Storage Tank - Process Solution, Hazardous Materials
620-TK-001	Nickel Sulfate Crystallizer Feed Tank	74,800	Contains sulfuric acid and nickel sulfate- regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
805-TK-006	Impurity Rejection Filtrate Tank	103,400	Contains Li Contains sodium hydroxide - regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
805-TK-007	Impurity Rejection Filter Feed Tank	47,300	Contains Li	Storage Tank - Process Solution, Hazardous Materials
810-TK-004	Glauber's Salt Crystallizer Centrate Tank	TBD	Contains Li	Storage Tank - Process Solution, Hazardous Materials
820-TK-001	SSA Crystallizer Centrate Tank	TBD	Contains Li	Storage Tank - Process Solution, Hazardous Materials
910-TK-005	Crude Lithium Carbonate Centrifuge Feed Tank	39,600	Contains Li	Storage Tank - Process Solution, Hazardous Materials
910-TK-006	Crude Lithium Carbonate Centrate Tank	18,700	Contain Li	Storage Tank - Process Solution, Hazardous Materials
915-TK-005	Fluoride Precipitation Filter Feed Tank	18,700	Contains sodium hydroxide - regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials

915-TK-006	Fluoride Precipitation Filtrate Tank	17,600	Contains sodium hydroxide - regulated by NYCRR part 597 as a hazardous substance.	Storage Tank - Process Solution, Hazardous Materials
920-TK-007	Lithium Bicarbonate Ion Exchange Feed Tank	26,400	Contains Li	Storage Tank - Process Solution, Hazardous Materials
920-TK-008	Purified Lithium Bicarbonate Storage Tank	26,400	Contains Li	Storage Tank - Process Solution, Hazardous Materials
930-TK-006A	Pure Lithium Carbonate Centrate Tank #1	27,500	Contains Li	Storage Tank - Process Solution, Hazardous Materials
930-TK-006B	Pure Lithium Carbonate Centrate Tank #2	27,500	Contains Li	Storage Tank - Process Solution, Hazardous Materials

Hazardous Substance Bulk Storage Application

Pursuant to the Hazardous Substance Bulk Storage Law, Article 40 of
ECL and 6 NYCRR 596-599

(See instructions and please be sure to complete Sections A, B & C)

Section A - Facility/Property Owner/Contact Information

Return Completed Form & Fees To:

**NYSDEC
Spill Prevention & Bulk Storage Section
625 Broadway, 11th Floor
Albany, NY 12233-7020**



CBS Number:

Expiration Date:

Transaction Type: <input type="checkbox"/> 1 1) Initial/New Facility 2) Change of Ownership 3) Tank Installation, Closing, or Repair 4) Information Correction 5) Renewal	F A C I L I T Y	Facility Name: Li-Cycle North America Hub #1	Tax Map Borough/Section	TYPE OF CHEMICAL STORAGE FACILITY (Check only one)	
		Facility Address (Physical Address, No P.O. Boxes): 50 & 205 McLaughlin Road Extension	Block:	<input type="checkbox"/> 01=Storage Terminal/Petrol. Distributor	<input type="checkbox"/> 02=Retail Gasoline Sales
		Facility Address (cont.):	Lot:	<input type="checkbox"/> 03=Other Retail Sales	<input type="checkbox"/> 04=Manufacturing(non-chemical)
		City: Rochester	State: NY	ZIP 14606	<input type="checkbox"/> 05=Utility
		County: Monroe	Township or	Facility Phone Number: 877-542-9253	<input type="checkbox"/> 06=Trucking/Transportation/Fleet
		Facility Operator: Li-Cycle North America Hub, Inc.			<input type="checkbox"/> 07=Apartment/Office Building
					<input type="checkbox"/> 08=School
					<input type="checkbox"/> 09=Farm
					<input type="checkbox"/> 10=Private Residence
					<input type="checkbox"/> 11=Airline/Air Taxi/Airport
					<input type="checkbox"/> 12=Chemical Distributor
					<input type="checkbox"/> 13=Municipality
					<input checked="" type="checkbox"/> 20=Chemical Manufacturing
					<input type="checkbox"/> 15=Railroad
					<input type="checkbox"/> 21=Swimming Pools (Other than Municipality)
					<input type="checkbox"/> 25=Auto Service/Repair (No Gasoline Sales)
					<input type="checkbox"/> 26=Religious (Church, Synagogue, Mosque, Temple, etc.)
					<input type="checkbox"/> 27=Hospital/Nursing Home/Health Care
					<input type="checkbox"/> 28=Cemetery/Memorial
					<input type="checkbox"/> 52=Marina
					<input type="checkbox"/> 99=Other (Specify):
				Emergency Contact Name: Jackie Jordan	Emergency Telephone Number:
Provide property owner information here and tank owner information in Section C.	O W N E R	Facility (Property) Owner (from Deed): Ridgeway Properties 1 LLC c/o Conductor Construction Management	I hereby certify, under penalty of law, that all of the information provided on this form is true and correct. False statements made herein may be punishable as a criminal offense and/or a civil violation in accordance with applicable state and federal law.		
Transaction type 1, 2 and 5: attach a copy of cover page, table of contents, and signature page from spill prevention report.		Facility Owner Address (Street and/or P.O. Boxes): 1010 Lee Road	City: Rochester	State: NY	ZIP Code: 14606
		Owner Telephone Number: 585 440 4900	Name of Property Owner or Authorized Representative:		
		Type of Owner (check only one):	Amount Enclosed: \$		
		3 <input type="checkbox"/> Local Government	Title:		
		1 <input type="checkbox"/> Private Resident	Signature:		
		4 <input type="checkbox"/> Federal Government	Date:		
		2 <input type="checkbox"/> State Government	(Please keep this information up to date.)		
		5 <input checked="" type="checkbox"/> Corporate/Commercial/Other	Facility Contact Person Name: Chris Biederman, Chief Technology Officer		
Official Use Only Date Received: ___/___/___ Date Processed: ___/___/___ Amount Received: \$_____ Reviewed By: _____ Rev. 6/14/2021	C O R R E S P O N D E N C E	Contact Person Company Name: Li-Cycle North America Hub, Inc.			
		Address: 2351 Royal Windsor Drive Unit 10			
		Address (cont.):			
		City/State/ZIP Code: Mississauga, Ontario Canada, L5J 4S7			
		Tel. Number: 674 660 2992	eMail Address: chris.biederman@li-cycle.com		

CBS Number:

Section B - Tank Information

(Please use the key located on the last page to complete each item/column)

Registration Expiration Date:

(1)	(2)	(3)	(4)	(5)	(6)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(16)	(17)	(18)	(19)	(20)				
Action	Tank Number	Tank Location	Status	Installation, Out-of-service Or Permanent Closure Date (mm/dd/yyyy) Application will be returned if blank	Capacity (Gallons)	Tank Type	Tank Internal Protection	Tank External Protection	Tank Secondary Containment	Tank Leak Detection	Tank Overfill Prevention	Tank Spill Prevention	Piping Location	Piping Type	Piping External Protection	Piping Secondary Containment	Piping Leak Detection	Hazardous Substance Name (List <u>all</u> Part 597 Substances, if more than 3 please list on separate sheet)	CAS Number	% of Haz Sub	Tank Fee \$
1	120-TK-003	02	01	Installation TBD	47,539	03	00	00	10	06	02 99	00	01	06	00	00	00	1) Please see attached Table 1 2) Table 1 3)	Table 1	Table 1	\$125
1	120-TK-004	02	01	Installation TBD	16,316	06	00	00	10	06	02 99	00	01	06	00	00	00	1) Please see attached Table 1 2) Table 1 3)	Table 1	Table 1	\$125
1	120-TK-008	02	01	Installation TBD	22,030	06	00	00	10	06	02 99	00	01	06	00	00	00	1) Please see attached Table 1 2) Table 1 3)	Table 1	Table 1	\$125
1	210-TK-001	02	01	Installation TBD	137,047	03	00	00	10	06	99	00	01	07	00	00	00	1) Please see attached Table 1 2) Table 1 3)	Table 1	Table 1	\$125
1	210-TK-005	02	01	Installation TBD	19,277	06	00	00	10	06	02 99	00	01	07	00	00	00	1) Please see attached Table 1 2) Table 1 3)	Table 1	Table 1	\$125
1	210-TK-006	02	01	Installation TBD	35,695	06	00	00	10	06	02 99	00	01	07	00	00	00	1) Please see attached Table 1 2) Table 1 3)	Table 1	Table 1	\$125
1	210-TK-009	02	01	Installation TBD	11,750	03	00	00	10	06	02	00	01	07	00	00	00	1) sodium hydrosulfide 2) 3)	16721-80-5	10	\$125

Note: If you need to add tanks to your registration, write them in using blank lines above. Attach additional sheets as needed.

Blank Section B is available at http://www.dec.ny.gov/docs/remediation_hudson_pdf/cbsregab.pdf

CBS Number:

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(1)	(2)	(3)	(4)	(5)	(6)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(16)	(17)	(18)	(19)	(20)					
Action	Tank Number	Tank Location	Status	Installation, Out-of-service Or Permanent Closure Date (mm/dd/yyyy) Application will be returned if blank	Capacity (Gallons)	Tank Type	Tank Internal Protection	Tank External Protection	Tank Secondary Containment	Tank Leak Detection	Tank Overfill Prevention	Tank Spill Prevention	Piping Location	Piping Type	Piping External Protection	Piping Secondary Containment	Piping Leak Detection	Hazardous Substance Name (List <u>all</u> Part 597 Substances, if more than 3 please list on separate sheet)	CAS Number	% of Haz Sub	Tank Fee \$	
1	310-TK-005	02	01	Installation TBD	93,500	03	00	00	10	06	02	99	00	01	07	00	00	00	1)nickel sulfate 2) 3)	7758-98-7	8.16	\$125
1	310-TK-006	02	01	Installation TBD	57,200	03	00	00	10	06	02	99	00	01	07	00	00	00	1) nickel sulfate 2) 3)	7758-98-7	8.73	\$125
1	310-TK-008	02	01	Installation TBD	10,868	06	00	00	10	06	02	99	00	01	06	00	00	00	1) sulfuric acid 2)nickel sulfate 3)	7664-93-9 7758-98-7	0.92 4.14	\$125
1	410-TK-050	02	01	Installation TBD	8,800	06	00	00	10	06	99	00	01	07	00	00	00	00	1) nickel sulfate 2) 3)	7758-98-7	8.09	\$125
1	510-TK-004	02	01	Installation TBD	3,300	06	00	00	10	06		00	01	07	00	00	00	00	1) nickel sulfate 2) 3)	7758-98-7	0.38	\$125
1	510-TK-064	02	01	Installation TBD	8,800	06	00	00	10	06	99	00	01	07	00	00	00	00	1) nickel sulfate 2) 3)	7758-98-7	8.25	\$125
1	610-TK-004	03	01	Installation TBD	5,453	06	00	00	10	06	99	00	01	07	00	00	00	00	1) sulfuric acid 2) nickel sulfate 3)	7664-93-9 7758-98-7	0.18 18.90	\$125

Note: If you need to add tanks to your registration, write them in using blank lines above. Attach additional sheets as needed.

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Action	Tank Number	Tank Location	Status	Installation, Out-of-service Or Permanent Closure Date (mm/dd/yyyy) Application will be returned if blank	Capacity (Gallons)	Tank Type	Tank Internal Protection	Tank External Protection	Tank Secondary Containment	Tank Leak Detection	Tank Overfill Prevention	Tank Spill Prevention	Piping Location	Piping Type	Piping External Protection	Piping Secondary Containment	Piping Leak Detection	Hazardous Substance Name (List <u>all</u> Part 597 Substances, if more than 3 please list on separate sheet)	CAS Number	% of Haz Sub	Tank Fee \$
1	620-TK-001	02	01	Installation TBD	67,866	06	00	00	10	06	99	00	01	07	00	00	00	1) sulfuric acid 2) nickel sulfate 3)	7664-93-9 7758-98-7	0.09 21.28	\$125
1	805-TK-006	02	01	Installation TBD	93,268	03	00	00	10	06	99	00	01	07	00	00	00	1) sodium hydroxide 2) 3)	1310-73-2	0.02	\$125
1	915-TK-005	02	01	Installation TBD	18,700	03	00	00	10	06	02 99	00	01	06	00	00	00	1) sodium hydroxide 2) 3)	1310-73-2		\$125
1	915-TK-006	02	01	Installation TBD	17,600	03	00	00	10	06	02 99	00	01	06	00	00	00	1) sodium hydroxide 2) 3)	1310-73-2	0.06	\$125
1	2110-TK-001A	02	01	Installation TBD	113,736	01	00	01	10	06	02 99	02	01	01	00	00	00	1) sulfuric acid 2) 3)	7664-93-9	>93	\$125
1	2120-TK-001	02	01	Installation TBD	31,377	03	00	00	10	06	02 99	02	01	07	00	00	00	1) hydrogen peroxide 2) 3)	7722-84-1	50.00	\$125
1	2150-TK-001A	02	01	Installation TBD	93,268	03	00	00	10	06	02 99	02	01	07	00	00	00	1) sodium hydroxide 2) 3)	1310-73-2	50.00	\$125

Note: If you need to add tanks to your registration, write them in using blank lines above. Attach additional sheets as needed.

Blank Section B is available at http://www.dec.ny.gov/docs/remediation_hudson_pdf/cbsregab.pdf

CBS Number:

Hazardous Substance Bulk Storage Application

Section C - Tank Ownership Information (for CBS tanks listed in Section B)

Tank Owner Information <input type="checkbox"/> Check box if same as Facility (Property) Owner. If tank owner is different from property owner, fill out information below:			Tank Owner Information <input type="checkbox"/> Check box if same as Facility (Property) Owner. If tank owner is different from property owner, fill out information below:		
Tank Owner Name (Company/Individual): Li-Cycle North America Hub #1			Tank Owner Name (Company/Individual):		
Contact Person: Chris Biederman, Chief Technology Officer			Contact Person:		
Tank Owner Address: 2351 Royal Windsor Drive Unit 10			Tank Owner Address:		
City: Mississauga	State: Ontario, Canada	ZIP: L5J 4S7	City:	State:	ZIP:
Contact Person Telephone Number: 674 660 2992	Contact Person email: chris.biederman@li-cycle.com		Contact Person Telephone Number:	Contact Person email:	
Specific Tanks Owned <input checked="" type="checkbox"/> Check box if this owner owns all tanks at this facility. If not, list tanks owned by this owner below:			Specific Tanks Owned <input type="checkbox"/> Check box if this owner owns all tanks at this facility. If not, list tanks owned by this owner below:		
Tank Number:			Tank Number:		
Name of Class B (Daily On-Site) Operator:		Authorization No:	Name of Class B (Daily On-Site) Operator:		Authorization No:
Name of Class A (Primary) Operator:		Authorization No:	Name of Class A (Primary) Operator:		Authorization No:

HAZARDOUS SUBSTANCE BULK STORAGE APPLICATION - SECTION B - TANK INFORMATION - CODE KEYS

Action (1)

- 1. Initial Listing
- 2. Add Tank
- 3. Close/Remove Tank
- 4. Information Correction
- 5. Repair/Reline Tank

Tank Location (3)

- 1. Aboveground-contact w/soil
- 2. Aboveground-contact w/impervious barrier
- 3. Aboveground on saddles, legs, stilts, rack or cradle
- 4. Partially buried tank /10% or more below ground.
- 5. Underground including vaulted with no access for inspection
- 6. Aboveground in Subterranean Vault w/access for inspections.

Status (4)

- 1. In-service
- 2. Out-of-service
- 3. Closed-Removed
- 4. Closed- In Place
- 5. Tank converted to Non-Regulated use

Tank Type (8)

- 01. Steel/Carbon Steel/Iron
- 02. Galvanized Steel Alloy
- 03. Stainless Steel Alloy
- 04. Fiberglass Coated Steel
- 05. Steel Tank in Concrete
- 06. Fiberglass Reinforced Plastic (FRP)
- 07. Plastic
- 08. Equivalent Technology
- 09. Concrete
- 10. Urethane Clad Steel

Internal Protection (9)

- 00. None
- 01 Epoxy Liner
- 02. Rubber Liner
- 03. Fiberglass Liner (FRP)
- 04. Glass Liner
- 99. Other-Please list:*

External Protection (10/18)

- 00. None
- 01. Painted/Asphalt Coating
- 02. Original Sacrificial Anode
- 03. Original Impressed Current
- 04. Fiberglass
- 05. Jacketed
- 06. Wrapped (Piping)
- 07 Retrofitted Sacrificial Anode
- 08. Retrofitted Impressed Current
- 09. Urethane
- 99. Other-Please list:*

Tank Secondary Containment (11)

- 00. None
- 01. Diking (AST Only)
- 02. Vault (w/access)
- 03. Vault (w/o access)
- 04. Double-Walled (UST Only)
- 05. Synthetic Liner
- 06. Remote Impounding Area
- 07. Excavation Liner
- 09. Modified Double-Walled (AST Only)
- 10. Impervious Underlayment (AST Only)**
- 11. Double Bottom (AST Only)**
- 12. Double-Walled (AST Only)
- 99. Other - Please list*

Tank Leak Detection (12)

- 00. None
- 01. Interstitial Electronic Monitoring
- 02. Interstitial Manual Monitoring
- 03. Vapor Well
- 04. Groundwater Well
- 05. In-Tank System (Auto Tank Gauge)
- 06. Impervious Barrier/Concrete Pad (AST Only)
- 99. Other-Please list: *

Overfill Protection (13)

- 00. None
- 01. Float Vent Valve
- 02. High Level Alarm
- 03. Automatic Shut-Off
- 04. Product Level Gauge (AST Only)
- 05. Vent Whistle
- 99. Other-Please list:*

Spill Prevention (14)

- 00. None
- 01. Catch Basin
- 02. Transfer Station Containment
- 99. Other-Please list:*

Piping Location (16)

- 00. No Piping
- 01. Aboveground
- 02. Underground/On-ground
- 03. Aboveground/Underground Combination

Piping Type (17)

- 00. None
- 01. Steel/Carbon Steel/Iron
- 02. Galvanized Steel
- 03. Stainless Steel Alloy
- 04. Fiberglass Coated Steel
- 05. Steel Encased in Concrete
- 06. Fiberglass Reinforced Plastic (FRP)
- 07. Plastic
- 08. Equivalent Technology
- 09. Concrete
- 10. Copper
- 11. Flexible Piping
- 99. Other-Please list:*

Piping Secondary Containment (19)

- 00. None
- 01. Diking (Aboveground Only)
- 02. Vault (w/access)
- 04. Double-Walled (Underground Only)
- 06. Remote Impounding Area
- 07. Trench Liner
- 12. Double-Walled (Aboveground Only)
- 99. Other-Please list: *

Pipe Leak Detection (20)

- 00. None
- 01. Interstitial Electronic Monitoring
- 02. Interstitial Manual Monitoring
- 03. Vapor Well
- 04. Groundwater Well
- 07. Pressurized Piping Leak Detector
- 09. Exempt Suction Piping
- 99. Other-Please list:*

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* If other, please list on a separate sheet including tank number.

** Each of these codes must be combined with code 01 or 06 to meet compliance requirements.