FREEPORT
FOREMOST IN COPPER

Blackwell Zinc Company GWTF Site Specific/H2S Training

2020

fcx.com

FCX LISTED NYSE

A member of ICMM International Council on Mining & Metals

FREEPORT-McMoRan

Welcome to BZC GWTF

FREEPORT
FOREMOST IN COPPER

Goals and Reporting

FREEPORT
FOREMOST IN COPPER

- At BZC GWTF, our goal is to have Zero accidents, injuries or property damage. However should an incident occur, remain calm and ensure the following occurs:
  - If someone is injured and requires medical treatment, note your location and call 911 for an ambulance. Ensure all incidents are reported to your immediate supervisor.
  - BZC Management must be notified immediately. Call (520) 437-8678.

Visiting the BCZ GWTF

FREEPORT
FOREMOST IN COPPER

If you receive no response at the gate contact BZC personnel listed below.

Supervisor-Jordan Sisson
520-437-8678

Control Room- 580-718-1800

Visitor Policy

FREEPORT
FOREMOST IN COPPER

- All Visitors Must Sign in and out at BZC Office.
- Each person entering the site must sign themselves in. No signing in other people.
- Unless your duties require you to work daily at the site, you are required to sign in and out each time you visit.

Personal Protective Equipment

FREEPORT
FOREMOST IN COPPER

- Observe all posted signage. Minimum PPE requirements are:

- Leather Gloves (when working)
- Hard Hat (ANSI Z89.1 Compliant)
- Eye Protection (ANSI Z87+ Compliant)
- Personnel H2S Monitor
- Steel-toe work boots (ANSI Z41 or ASTM Compliant)

Obey All Posted Signs

FREEPORT
FOREMOST IN COPPER

Obey All Posted Signs

FREEPORT
FOREMOST IN COPPER

- Smoking is NOT permitted in vehicles, offices or shops
- Notice designated smoking areas
- Drugs, alcohol, and explosives are strictly prohibited
- Know evacuation routes and muster points
- Notice Exit Signs, Fire Extinguisher Locations and escape pack locations
- Watch for slippery surfaces, unleveled ground or floors, pinch points, doors and latches

Safety Policies

FREEPORT
FOREMOST IN COPPER

1. DRUG AND ALCOHOL POLICY
2. FIGHTING OR PHYSICAL ASSUALT RULE
3. LOCKOUT/TAGOUT/TRYOUT POLICY
4. BLUE STAKE PROCEDURES
5. RESTRICTED AREA ACCESS
6. CONFINED SPACE, FLAGGING, BARRICADES, HOT WORK (EITHER FAILURE TO BARRICADE OR FLAG, OR UNAUTHORIZED ENTRY INTO RESTRICTED AREA)

Emergency Muster Point

FREEPORT
FOREMOST IN COPPER

- If an emergency occurs, you will be notified by the following:

- Audible Alarm over the PA system

- Via radio phone, or verbal instructing you to proceed to the chosen muster point or shelter.

* Do not muster at any other time during an incident unless instructed to do so.

Hot Work

FREEPORT
FOREMOST IN COPPER

All areas of the GWTF property require a hot work permit

- Ensure the welder is properly trained
- Has the appropriate PPE and welding curtains in place
- Has completed and submitted Hot Work permits along with a JHA
- Maintains an appropriate fire watch after work ceases

Fall Protection

FREEPORT
FOREMOST IN COPPER

- Fall Protection/Prevention is required in all areas where a vertical fall distance of 4 feet or greater is present or when there is a reasonable expectation of injury from a fall at any height.

- Any personnel that is required to wear Fall Protection equipment must undergo **Documented** training prior to use.

- All equipment must undergo a **Documented** inspection prior to use

Required Training

FREEPORT
FOREMOST IN COPPER

All BZC employees are required to have the following training:

- HAZWOPER 40 Hour
- Task Training for any equipment used

You may be required to have additional training including, but not limited to:

- Fall Protection
- SPCC
- Blue Stake
- LOTOTO Authorized

Required Training

FREEPORT
FOREMOST IN COPPER

You must provide copies of your training certificates to your supervisor or Health and Safety representative.

For further questions regarding required training, contact:

- BZC GWTF Supervisor– (520) 437-8678

HAZCOM

FREEPORT
FOREMOST IN COPPER

BZC GWTF maintains a chemical inventory of all products on our site.

Prior to handling any chemical, ensure you have reviewed the SDS and understand its hazards.

Chemical SDS are located:

Contact your Supervisor for any additional PPE you require.

Product Approval Forms

- No chemicals may be brought onto site by any employee or Contractor without an approved Product Approval Form.
- This includes all fuels, oils, battery acids, grease, cleaning agents or any other chemical item. If you are not sure if you require an approval, ask your supervisor or Health and Safety professional for guidance.
- If you would like to submit a chemical for approval, contact:
  - Supervisor-Jordan Sisson- (520) 437-8678
  - Sr. Env Technician - (580) 718-1806

Environmental

FREEPORT
FOREMOST IN COPPER

- All leaks, spills or releases of any amount must be reported to BZC Environmental Department.

- This includes:

- Chemicals
- Reagents
- Zinc Sulfide
- and any other chemical….

Contact:

Sr. Env Technician- (580) 718-1806

Task Training

FREEPORT
FOREMOST IN COPPER

- You may have used this equipment at home or on previous jobs, but……
- **No** BZC employee is allowed to operate any equipment they have not been Task Trained on by BZC.
- If you are asked to use equipment that you have not been trained on….STOP. Notify your supervisor that you require training.

Slips, Trips and Falls

FREEPORT
FOREMOST IN COPPER

- MANY AREAS IN GWTF ARE TREACHEROUS AND DANGEROUS. THESE HAZARDS MAY CONSIST OF:

- SLIPS, TRIPS OR FALLS
- ELEVATED WALKWAYS

NEVER LEAVE DESIGNATED WORK

AREAS WITHOUT SUPERVISOR APPROVAL

Stay Alert, Stay Alive!

FREEPORT
FOREMOST IN COPPER

Wildlife

FREEPORT
FOREMOST IN COPPER

- Blackwell Zinc Company GWTF in close proximity to the Chikaskia River. You have the potential to encounter insects, reptiles and mammals. Leave all wildlife alone and report any potential hazardous wildlife.

Health and Safety Management System

FREEPORT
FOREMOST IN COPPER

Remember **P.I.C.K.**

- **P**…Prevention of all injuries, illnesses and fatalities is our goal!
- **I**…Improvement of our system is continuous and vital to our success!
- **C**…Compliance with HSMS and legal requirements is essential.
- **K**…Keys to our success.

Fatal Risk Management

FREEPORT
FOREMOST IN COPPER

Fatal Risk Management discussions will take place before work begins. Your site contact will explain icons that will apply to your work and surrounding areas.


Vehicle Impact on Person


Hazardous Substances Acute


Fire


Lifting Operations


Fall from Heights


Vehicle Collision or Rollover


Exposure to Electrical Hazards


Entanglement and Crushing


Hazardous Substances Chronic


Falling Objects

Always ask yourself “What can kill me now”?
and
“What critical controls will be added to prevent or reduce an occurrence of a fatal injury”?

Contacts

FREEPORT
FOREMOST IN COPPER

Contact Numbers

Jordan Sisson – Supervisor
(520) 437-8678

Mark McGlone-Environmental
(580) 718-1806

Amy McLain – Sr. Supervisor Health and Safety
(520) 345-0166

FREEPORT
FOREMOST IN COPPER

Blackwell Zinc Company GWTF Hydrogen Sulfide (H2S) Training

fcx.com

FCX LISTED NYSE

A member of ICMM International Council on Mining & Metals

FREEPORT-MCMORAN

What is Hydrogen Sulfide?

FREEPORT
FOREMOST IN COPPER

- Hydrogen sulfide (chemical abbreviation - H_2S) is a colorless, flammable, extremely toxic gas with a "rotten egg" smell
- Some common names for the gas include "sewer gas," "stink damp," "swamp gas" and "manure gas"

What is Hydrogen Sulfide?

FREEPORT
FOREMOST IN COPPER

- Concentrated hydrogen sulfide (H_2S) is heavier than air and may travel along the ground - It can collect in low-lying and enclosed, poorly-ventilated areas
- The primary route of exposure is inhalation and the gas is rapidly absorbed by the lungs - Absorption through the skin is minimal

What is Hydrogen Sulfide?

FREEPORT
FOREMOST IN COPPER

- People can smell the "rotten egg" odor of H_2S at very low concentrations in air - However, with continuous low-level exposure, or at high concentrations, a person loses his/her ability to smell the gas even though it is still present (olfactory fatigue)

- This can happen very rapidly and at high concentrations, the ability to smell the gas can be lost instantaneously – Therefore, **DO NOT rely on your sense of smell to indicate the continuing presence of H_2S or to warn of hazardous concentrations**

- In addition, H_2S is flammable and gas/air mixtures between 4 and 44% can be explosive

Where is Hydrogen Sulfide Found?

FREEPORT
FOREMOST IN COPPER

- It occurs naturally in crude petroleum, natural gas and hot springs - In addition, hydrogen sulfide (H_2S) is produced by bacterial break-down of organic materials and human and animal wastes (e.g., sewage)
- Industrial activities that can produce hydrogen sulfide (H_2S) include petroleum/natural gas drilling and refining, wastewater treatment, coke ovens, tanneries and Kraft paper mills
- Hydrogen sulfide (H_2S) can also exist as a liquefied, compressed gas

How is Hydrogen Sulfide Used in this Facility?

FREEPORT
FOREMOST IN COPPER

- Hydrogen sulfide (H_2S) is formed, within the water treatment process, when sodium hydrosulfide solution is mixed with the process water stream
- The H_2S is immediately consumed by the Zn/Cd metals ions present in the process water to form solid, metal sulfides
- **The ONLY time there is the potential to be exposed to H_2S is: during a plant upset; during a process confined space entry; when sodium hydrosulfide solution leaks out or is spilled, or when sodium hydrosulfide solution is mixed with water or acid outside of the process confines**

To understand how H_2S can be formed at the facility – you must understand some things about sodium hydrosulfide

What is Sodium Hydrosulfide Solution?

FREEPORT
FOREMOST IN COPPER

Sodium hydrosulfide solution (chemical abbreviation – NaHS, also known as "Nash") is a yellow to red, to dark green to black, corrosive, toxic liquid with a "rotten egg" smell, because it continuously and slowly evolves H_2S

DANGER

As long as the solution is kept strongly alkaline (pH > 10) there is very little release of H_2S

However - when exposed to heat or fire, when mixed with water, and especially when mixed with acid, NaHS can emit greater quantities of flammable, extremely toxic H_2S gas very rapidly!

Health Effects of H2S Exposure

FREEPORT
FOREMOST IN COPPER

- Hydrogen sulfide is both an irritant and a chemical asphyxiate with effects on both oxygen utilization and the central nervous system
- Its health effects can vary depending on the level and duration of exposure
- Repeated exposure can result in health effects occurring at levels that were previously tolerated without any effect

FRM ICONS

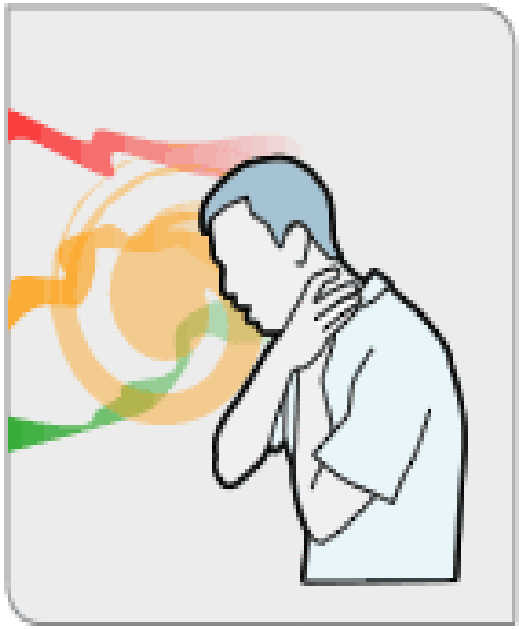
Hazardous Substances

Acute

Health Effects of H2S Exposure

FREEPORT
FOREMOST IN COPPER

- **LOW CONCENTRATIONS**
  - Irritate the eyes, nose, throat and respiratory system (e.g., burning, tearing of the eyes, cough, shortness of breath)
  - Asthmatics may experience breathing difficulties
  - Effects can be delayed for several hours, or sometimes several days, when working in low-level concentrations
  - Repeated or prolonged exposure may cause eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss



Health Effects and First Aid Measures for H2S Exposure

FREEPORT
FOREMOST IN COPPER

- **MODERATE CONCENTRATIONS**

  can cause more severe eye and respiratory irritation (including coughing, difficulty breathing, accumulation of fluid in the lungs), headache, dizziness, nausea, vomiting, staggering and excitability

- **HIGH CONCENTRATIONS**

  can cause shock, convulsions, inability to breathe, extremely rapid unconsciousness, coma and death

Hazardous Substances Acute

FIRST AID MEASURES

Inhalation – Move to fresh air - Promptly seek medical attention if symptoms develop or persist

Hydrogen Sulfide Exposure Limits

FREEPORT
FOREMOST IN COPPER

- FCX Occupational Exposure Limit (OEL) and OSHA Permissible Exposure Limit (PEL)
  - 20 ppm, as a Ceiling or “not-to-exceed” level
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)
  - 1 ppm, as averaged over an 8-hour workday
  - 5 ppm, as averaged over 15-minutes
- National Institute for Occupational Safety and Health (NIOSH) Immediately Dangerous to Life and Health (IDLH) level
  - 100 ppm

H2S Exposure/Health Effects Summary

FREEPORT
FOREMOST IN COPPER

Concentration (ppm)	Symptoms/Effects
0.00011-0.00033	Typical background concentrations
0.01-1.5	Odor threshold (when rotten egg smell is first noticeable to some). Odor becomes more offensive at 3-5 ppm. Above 30 ppm, odor described as sweet or sickeningly sweet.
2-5	Prolonged exposure may cause nausea, tearing of the eyes, headaches or loss of sleep. Airway problems (bronchial constriction) in some asthma patients.
20	Possible fatigue, loss of appetite, headache, irritability, poor memory, dizziness.
50-100	Slight conjunctivitis ("gas eye") and respiratory tract irritation after 1 hour. May cause digestive upset and loss of appetite.
100	Coughing, eye irritation, loss of smell after 2-15 minutes (olfactory fatigue). Altered breathing, drowsiness after 15-30 minutes. Throat irritation after 1 hour. Gradual increase in severity of symptoms over several hours. Death may occur after 48 hours.
100-150	Loss of smell (olfactory fatigue or paralysis).
200-300	Marked conjunctivitis and respiratory tract irritation after 1 hour. Pulmonary edema may occur from prolonged exposure.
500-700	Staggering, collapse in 5 minutes. Serious damage to the eyes in 30 minutes. Death after 30-60 minutes.
700-1000	Rapid unconsciousness, "knockdown" or immediate collapse within 1 to 2 breaths, breathing stops, death within minutes.
1000-2000	Nearly instant death

Hydrogen Sulfide Exposure Controls

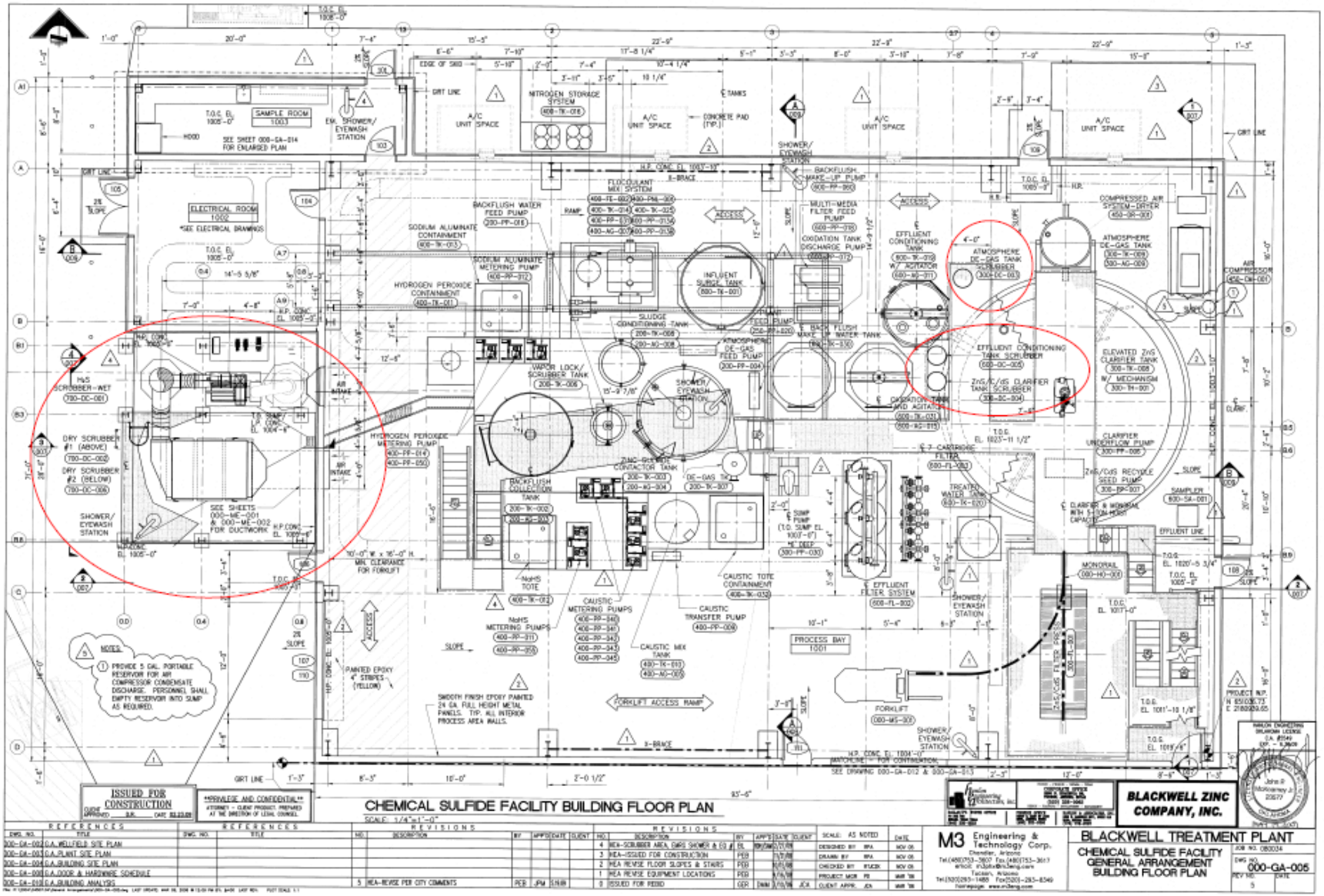
FREEPORT
FOREMOST IN COPPER

- **CLOSED CONTAINERS AND CLOSED SYSTEM (CRITICAL CONTROL: ENGINEERED)**
  - In the plant, sodium hydrosulfide solution is normally contained in closed containers or in the closed process system - Process vessels containing H_2S are under negative pressure and are vented to scrubber systems

- **H_2S SCRUBBERS (CRITICAL CONTROL: ENGINEERED)**
  - The plant uses both dry media and wet media (caustic) scrubbers that are located where H_2S could escape the closed process system or the plant (locations are shown on the plant drawing in the next slide)
  - These scrubbers work automatically in conjunction with the H_2S sensors (described in subsequent slides)

H2S Scrubber Locations (in red)

FREEPORT
FOREMOST IN COPPER



Hydrogen Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **H_2S DETECTION (CRITICAL CONTROLS: ENGINEERED / PPE)**
  - Various means of H_2S detection are used to give the earliest warning of hazardous H_2S concentrations
  - There are three types of H_2S monitors or sensors used in the plant:
    - Personal monitors (PPE)
    - Area or fixed sensors (Engineering)
    - Hand held monitors (Engineering)
  - All monitors and sensors will be calibrated according to the manufacturers' specifications (not to exceed monthly calibrations)

Hydrogen Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **PERSONAL MONITORS (CRITICAL CONTROL: PPE)**
  - Your personal H_2S monitor is an important part of your personal protective equipment and **MUST be worn at all times while in the plant**
  - It is important to evacuate the plant immediately if your monitor alarms

Hydrogen Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **AREA OR FIXED SENSORS (CRITICAL CONTROL: ENGINEERED)**
  - Fixed H_2S sensors are positioned throughout the plant and outside the plant (locations and functions are described on subsequent slides)
  - These monitors alarm the control room and give both visual and audible alarms to personnel in the plant

Hydrogen Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **HAND-HELD MONITORS (CRITICAL CONTROL: ENGINEERING)**
  - A hand-held H_2S monitor is also available to check vessels or other areas not covered by fixed area H_2S sensors
  - When using a hand-held monitor, the operator must also wear a personal monitor (PPE)

Outdoor H2S Sensors- Location and Function

FREEPORT
FOREMOST IN COPPER

Table 8.5.1. List of fixed hydrogen sulfide sensors at Blackwell Ground Water Treatment Facility

Sensor Listings						
Monitor ID	Drawing Reference	Function	Plant Location	Original or New	Sensor Model	Sensitivity Range, ppm H_2S
Outdoor H2S Sensors						
AIT-HS09-AIT-HS14		Monitor Environment Outside of Building	Perimeter monitors outside of building-**Use discontinued January 2019**	New	Jerome 651	0.003 - 50 ppm
AIT-DC006		Monitor Environment Outside of Building	Outlet of scrubbers 700-DC-006, 700-DC-002 and 700-DC-001. Main building vent discharge stack.		Jerome 651	0.003 - 50 ppm

Plant H2S Sensors- Location and Function

FREEPORT
FOREMOST IN COPPER

Sensor Listings				
Monitor ID	Function	Plant Location	Sensor Model	Sensitivity Range, ppm H_2S
Workplace Ambient Air Sensors				
AIT-HS01	Monitor In-door Work Place Environment	Above contactor tank near walkway, inside building	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-HS02	Monitor In-door Work Place Environment	Above clarifier near walkway, inside building	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-705A	Monitor In-door Work Place Environment	Inside building at lower levels to detect settled gas. Vicinity to contactor and in dead space determined by velocity profile during pre-operational testing	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-705B	Monitor In-door Work Place Environment	Inside building at lower levels to detect settled gas. Vicinity of clarifier and in dead space determined by velocity profile during pre-operational	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-705C	Monitor In-door Work Place Environment	Inside building just ahead of the grill that leads to the feed lines to the dry scrubbers.	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-705D	Monitor In-door Work Place Environment	Inside building in reagent room on east wall.	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-H705E	Monitor In-door Work Place Environment	East wall under clarifier	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-HS15	Monitor Environment Outside of Building	Suction side of scrubber 700-DC-006, wall of building.	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm

Dry Scrubber Influent H2S Sensors- Location and Function

FREEPORT
FOREMOST IN COPPER

Sensor Listings				
Monitor ID	Function	Plant Location	Sensor Model	Sensitivity Range, ppm H_2S
Dry Scrubber Influent Sensors				
AIT-HS03	Monitor Process Operation as it Relates to Generating H2S	Inlet to scrubber 300-DC-003, contactor tank scrubber. Gas detected in the inlet will be removed by scrubber. Performance of scrubber is monitored on discharge. This monitor is for purpose of evaluating contactor pressure system. If H2S is detected the conctactor has exceed 4 inches water pressure and has emitted H2S [illegible]	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-HS05	Monitor Process Operation as it Relates to Generating H2S	Inlet to scrubber 300-DC-004, clarifier vent scrubber. This monitor is for evaluating process upset. If large amount of gas enters from contactor to clarifier will have surge in H2S to scrubber	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-HS07	Monitor Process Operation as it Relates to Generating H2S	This monitor is for evaluating process upset. If large amount of gas enters from clarifier to effluent conditioning will have surge in	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm

Dry Scrubber Effluent H2S Sensors- Location and Function

FREEPORT
FOREMOST IN COPPER

Sensor Listings				
Monitor ID	Function	Plant Location	Sensor Model	Sensitivity Range, ppm H_2S
Dry Scrubber Effluent Sensors				
AIT-HS04	Monitor Scrubber performance and potential impact indoors	Outlet of scrubber 300-DC-003, contactor tank scrubber	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-HS06	Monitor Scrubber performance and potential impact indoors	Outlet from scrubber 300-DC-004, clarifier vent scrubber	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm
AIT-HS08	Monitor Scrubber performance and potential impact indoors	Outlet of scrubber 600-DC-006, effluent/oxidation tank vents	Honeywell Sensepoint XCD Electrochemical Sensor	0.1 - 50 ppm

Personal H2S Monitors- Location and Function

FREEPORT
FOREMOST IN COPPER

Sensor Listings				
Monitor ID	Function	Plant Location	Sensor Model	Sensitivity Range, ppm H_2S
Personal Monitors				
	Personal Monitor to be worn all times	On Operator	Altair Single-Gas Detector	

Hydrogen Sulfide Alarms

FREEPORT
FOREMOST IN COPPER

- H_2S alarms are both visual and audible
- Each employee or visitor will know the alarms and know how to evacuate the plant when there is an H_2S alarm (described in subsequent slides)

Hydrogen Sulfide Alarm Action Levels- Outdoor Sensors

FREEPORT
FOREMOST IN COPPER

Alarm and Action Levels					
Condition Level	H_2S ppm for Condition and Time Limits	Operator Response	Equipment Response	Alarm/ &Horn Warning Sequence	Notification Level
Action Levels for Outdoor H2S Sensors					
Normal	<0.2 ppm	Monitor for environmental protection	None	None	None
1	0.2 ppm	Evaluate process. Evaluate status of other sensors, wind direction and determine source.	Control panel alarm	Operator Control Panel	Operator
2	3 ppm	Commence operator shutdown after second reading above 3 ppm. After plant shutdown, review data on inlet monitor to scrubber. Evaluate scrubber and other monitors. Determine source of emission and review corrective action plan in manual.	Control panel alarm	Flashing light - outside of building, and at building exits. One inside building.	Notify per emergency response plan
3	5 ppm, immediate action	Check indoor monitors.	Plant groundwater and NaHS flows automatically stopped.	Flashing light (all) and horn	Notify per emergency response plan

Hydrogen Sulfide Alarm Action Levels - Plant Sensors

FREEPORT
FOREMOST IN COPPER

Alarm and Action Levels					
Condition Level	H_2S ppm for Condition and Time Limits	Operator Response	Equipment Response	Alarm/ &Horn Warning Sequence	Notification Level
Action Levels for Workplace Ambient Air Sensors					
1	1 ppm	Operator to evaluate process. Evaluate status of other sensors.	Control panel alarm	Operator Control Panel	Operator
2	5 ppm	Operator to evaluate process. Evaluate status of other sensors.	Wet scrubber for building ventilation is started automatically and runs in parallel with dry scrubbers 700-DC-002 and 700-DC-006. This is precaution provides that the wet scrubber is available should the H2S levels go higher.	Flashing light - indoors and at outside entrances to building.	Operator Supervisor
3	10 ppm	Evacuate building. Manually restart dry scrubbers when H2S levels drop to 5 ppm as means of improving conditions in a more rapid manner.	Plant groundwater and NaHS flows automatically stopped. Building evacuated. SCBA required in building. Wet scrubber only initially.	Flashing light and horn	Operator Supervisor

Hydrogen Sulfide Alarm Action Levels - Dry Scubber Influent Sensors

FREEPORT
FOREMOST IN COPPER

Alarm and Action Levels					
Condition Level	H_2S ppm for Condition and Time Limits	Operator Response	Equipment Response	Alarm/ &Horn Warning Sequence	Notification Level
Action Levels for Dry Scrubber Influent Sensors					
Normal	nil as this line is Nitrogen filled	None	None	None	None
1	1 ppm	Begin review of contact operation and check ORP in contactor.	Alarm to operator that contactor circuit has over-pressurized.	Operator Control Panel	Operator
2	>5 ppm and duration longer than 60 minutes	Check monitor on discharge of 300-DC-003, which has own action points. 300-DC-003 continuously discharges to dry scrubber 700-DC-002 as part of building ventilation and as back-up safety provision. Review contactor operation.		Flashing light - indoors and at outside entrances to building	Operator Supervisor
3	>15 ppm and duration longer than 60 minutes	Prior to restart after automatic shutdown, review plant operating mode.	Automatic shutdown of plant to evaluate cause of over-pressurization and gain control of circuit.	Flashing light - indoors and at outside entrances to building	Operator Supervisor
4	>40 ppm - immediate action	Check indoor air monitors	Plant groundwater and NaHS flows automatically stopped.	Flashing light (all) and horn	Operator Supervisor

Hydrogen Sulfide Alarm Action Levels - Dry Scrubber Effluent Sensors

FREEPORT
FOREMOST IN COPPER

Alarm and Action Levels					
Condition Level	H_2S ppm for Condition and Time Limits	Operator Response	Equipment Response	Alarm/ &Horn Warning Sequence	Notification Level
Action Levels for Dry Scrubber Effluent Sensors					
1	1 ppm	Operator to evaluate process. Evaluate status of other sensors. Determine if scrubber media is exhausted.	Control panel alarm	Operator Control Panel	Operator
2	5 ppm, max duration 5 Minutes	Commence operator shutdown after 5 minutes. After plant shutdown. Review data on inlet monitor to scrubber. Evaluate scrubber and other monitors. Determine source of emission and review corrective action plan in manual.	None	Flashing light - outside of building, and at building exits. One in building.	Operator Supervisor
3	10 ppm, immediate action	Check indoor air monitors.	Plant groundwater and NaHS flows automatically stopped.	Flashing light (all) and horn	Operator Supervisor

Hydrogen Sulfide Alarm Action Levels - Personal Monitors

FREEPORT
FOREMOST IN COPPER

Alarm and Action Levels					
Condition Level	H_2S ppm for Condition and Time Limits	Operator Response	Equipment Response	Alarm/ &Horn Warning Sequence	Notification Level
Action Levels for Personal Monitors					
1	5 ppm	Evacuate area of high H2S. Evaluate other sensors before re-entering area	Low level alarm	Low level audible and vibrating alarm	Operator
2	10 ppm	Evacuate building. Evaluate other sensors before re-entering	High level alarm	High level audible and vibrating alarm	Operator Supervisor

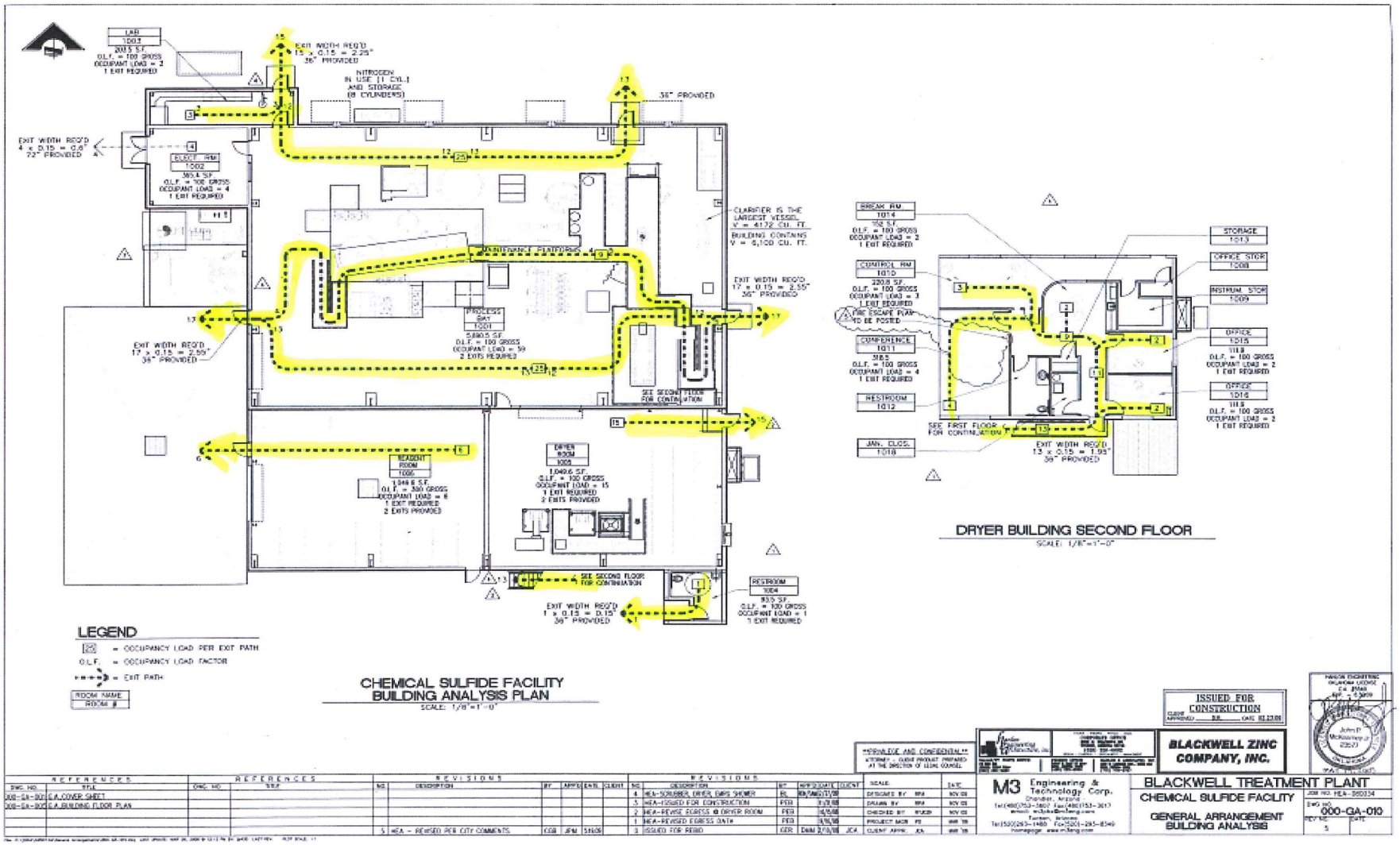
Evacuation

FREEPORT
FOREMOST IN COPPER

- IN AN ALARM CONDITION:
  - All employees and visitors will evacuate through the marked exits (see exit routes on next slide); follow any directions given during the emergency; observe wind direction via wind socks, and go up wind
  - Emergency respirators are available to escape and exit the facility in emergency high alarm H_2S (described in subsequent slides)
  - Everyone will be accounted for at the assembly area

Exits and Assembly Area (Highlighted Dashed Lines)

FREEPORT
FOREMOST IN COPPER



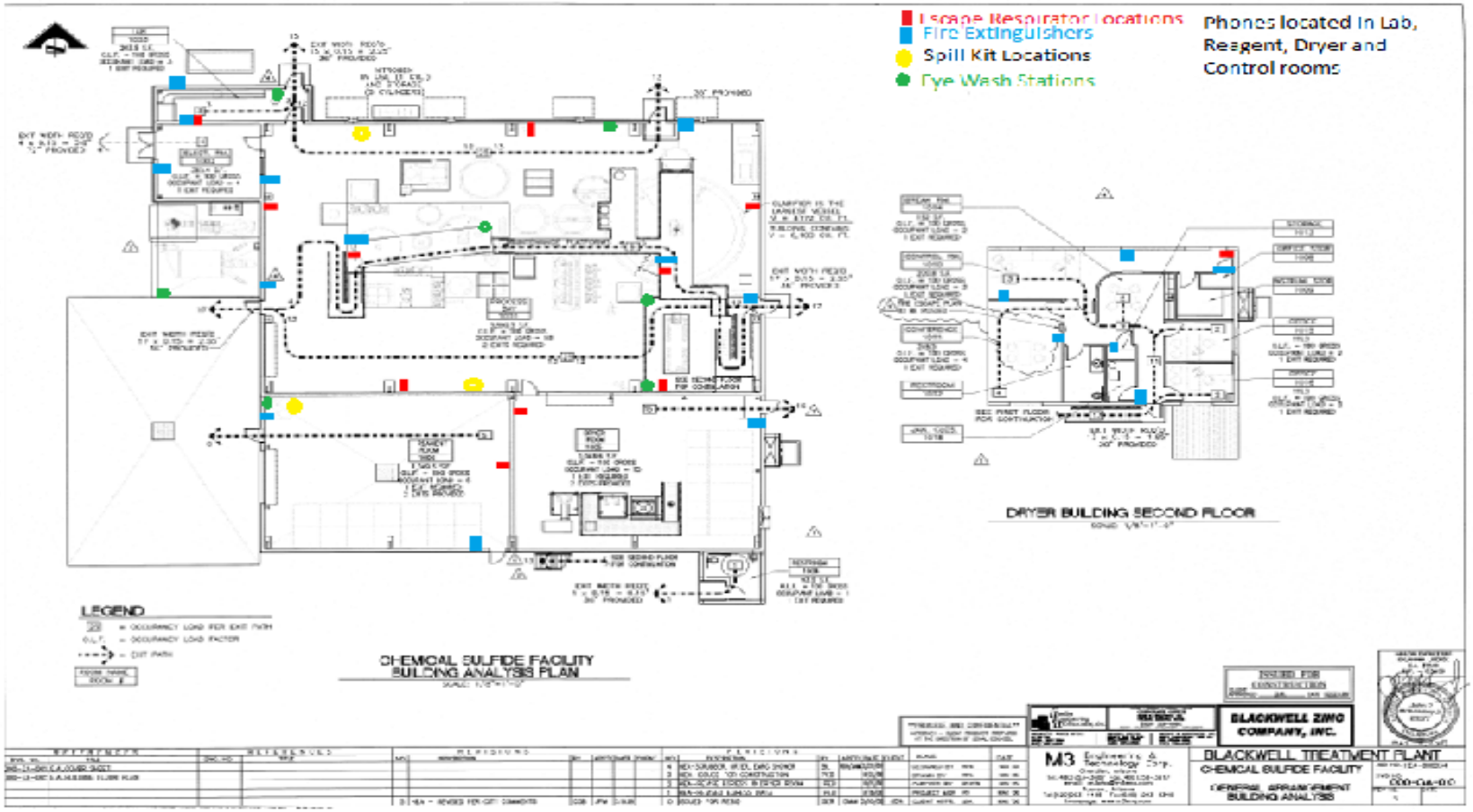
Emergency Respirators

FREEPORT
FOREMOST IN COPPER

- Escape air-supplying respirators are located in various areas of the plant (see subsequent slide) and are available to all employees and visitors
- Escape respirators **will only be used in emergency high alarm H_2S conditions to escape and exit the facility and NEVER to enter, or continue working in, a hazardous atmosphere**

Emergency Equipment Locations

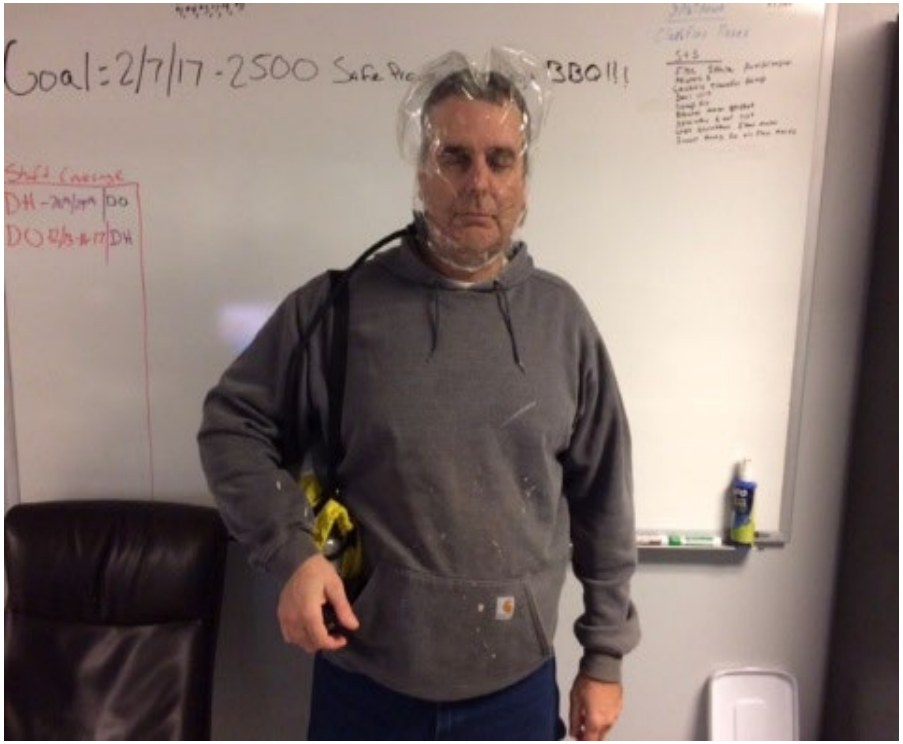
FREEPORT
FOREMOST IN COPPER



Emergency Respirators

FREEPORT
FOREMOST IN COPPER

- All personnel who enter the facility will be given instructions on when and how to use the emergency respirators



FREEPORT
FOREMOST IN COPPER

BZC Cadmium Sulfide (CdS) Awareness Training

fcx.com

FCX LISTED NYSE

A member of ICMM International Council on Mining & Metals

FREEPORT-MCMORAN

What is Cadmium Sulfide?

FREEPORT
FOREMOST IN COPPER

- Cadmium sulfide (chemical abbreviation – CdS,) is a yellow-orange, toxic solid
- It is found in zinc ores, and to a much lesser extent, in cadmium mineral greenockite

Health Effects of CdS Exposure

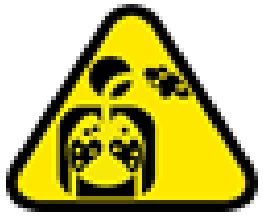
FREEPORT
FOREMOST IN COPPER

- Health hazard results principally from inhalation and to a smaller extent from ingestion

- Local skin or eye irritation

- Repeated or long-term exposure, even at relatively low concentrations, may result in kidney damage and increased risk of cancer of the lung and prostate

FRM ICON



Hazardous Substances Chronic

- Very harmful to aquatic life with long lasting effects

Health Effects of CdS Exposure

FREEPORT
FOREMOST IN COPPER

Cadmium stays in body a very long time and can build up from many years of exposure to low levels – 26 year biological half-life

FRM ICON

Hazardous Substances Chronic

Where is Cadmium Sulfide Found in this Facility?

FREEPORT
FOREMOST IN COPPER

- Present in the zinc sulfide concentrate at a typical cadmium concentration of approximately 4%

- Low level CdS is also likely to be present on surfaces in Plant production areas and to a much lesser extent in non-production areas – from zinc sulfide concentrate migration

Cadmium Airborne Exposure Limits

FREEPORT
FOREMOST IN COPPER

- OSHA Permissible Exposure Limit (PEL)
  - 5 µg/m3
- OSHA action limit (AL)
  - 2.5 µg/m3

Cadmium Surface Exposure Limits

FREEPORT
FOREMOST IN COPPER

- While there are no FCX or regulatory limits for metal wipe samples, the OSHA Cadmium standard (29 CFR 1910.1027) mandates that:
  - All surfaces shall be maintained as free as practicable of accumulations of cadmium
  - All spills and sudden releases of material containing cadmium shall be cleaned up as soon as possible
  - Surfaces contaminated with cadmium shall, wherever possible, be cleaned by vacuuming or other methods that minimize the likelihood of cadmium becoming airborne

Cadmium Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **WET MATERIAL HANDLING**
  - There is minimal exposure to airborne Cd - attributed to zinc sulfide concentrate remaining wet throughout process
  - Air monitoring has been discontinued until there is change in materials, equipment or work practices that may result in exposures above OSHA AL

- **PERSONAL PROTECTIVE EQUIPMENT (CRITICAL CONTROL: PPE)**
  - Replacement of dirty gloves frequently to minimize Cd transfer to other surfaces

Cadmium Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **CONTAMINATION CONTROL**
  - Promptly clean up of all zinc sulfide concentrate spills
  - Use **HEPA-filtered vacuum** and/or wet methods **(Critical Control: Engineering)** - no compressed air cleaning or dry sweeping

Cadmium Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **GOOD HOUSEKEEPING**
  - Clean eating and food preparation surfaces daily
  - Clean control room and conference room and office areas weekly, with special attention to surfaces having frequent hand contact
  - Periodic, thorough cleaning in plant with special attention to settled dust in areas with potential for hand contact or potential to be re-aerosolized by future activities
  - **Tacky Mat (Critical Control: Engineering)** on inside of plant entry to trap easily-removable dust from soles of shoes prior to leaving plant and entering control room - replace tacky mat regularly

Cadmium Sulfide Exposure Controls

FREEPORT
FOREMOST IN COPPER

- **GOOD HYGIENE PRACTICES**
  - Hand washing after removing gloves, before leaving plant and before eating, drinking, or smoking

- **ENVIRONMENTAL AND MEDICAL SURVEILLANCE**
  - Periodic industrial hygiene evaluations (including surface wipe sampling) and facility inspections to monitor Cd migration control practices
  - Annual medical surveillance including urine and blood cadmium and β-2 macroglobulin (a sensitive indicator of kidney damage)

Questions?

FREEPORT
FOREMOST IN COPPER

If you have any questions – talk to your supervisor or the plant manager

Please review and complete the recognition sheet in the white binder.

Thanks, BZC Staff

FREEPORT
FOREMOST IN COPPER