



# SO<sub>2</sub> Awareness

VNL Labrador Operations – Mandatory Courses

# Agenda

- Properties of SO<sub>2</sub>
- Health Effects of SO<sub>2</sub> Exposure
- How You Can be Exposed
- Respiratory Protection
- Hot Work Procedure and SO<sub>2</sub>
- Minimizing Risk

# Properties of SO<sub>2</sub>

- SO<sub>2</sub> has good early warning properties.
- *(most people can smell or taste SO<sub>2</sub> at levels of 0.3 to 2 ppm)*
- It is a colourless, suffocating and irritating gas with a strong familiar sulphurous odour at low concentrations.
- At high concentrations, SO<sub>2</sub> is a poisonous gas, but because of its irritating effect on the eyes and respiratory tract it is intolerable to breathe at low concentrations.

# Properties of SO<sub>2</sub>

- SO<sub>2</sub> is heavier than air with a specific gravity of 2.26 (air is 1)
- Non-flammable
- A liquid when under pressure
- Dissolves in water very easily

# Health Effects of SO<sub>2</sub> Exposure

The major effects of sulphur dioxide (SO<sub>2</sub>) are on the upper respiratory tract.

## **Short Term (*without respiratory protection*)**

- Upper respiratory irritant – lungs, nose and eyes
- Causes coughing, mucus secretion (swelling of the lungs)
- Aggravates conditions such as asthma and chronic bronchitis
- 6-12 ppm: nose and throat irritation occur
- 20 ppm: chronic respiratory symptoms occur with repeat short term exposures
- 100 ppm: coughing, irritation to the eyes, nose and throat; maximum concentration (IDLH)

# Health Effects Long Term (without respiratory protection)

## Respiratory Effects:

Long-term exposure to persistent levels of sulphur dioxide can affect your health. Lung function changes were seen in some workers exposed to low levels (1-5 ppm) of sulfur dioxide for 20 years or more.

**Reference:** Agency for Toxic Substances and Disease Registry

# How Can I Be Exposed to SO<sub>2</sub>?

**Inhalation** - Breathing air that contains SO<sub>2</sub> (applicable at Voisey's Bay operations)

**Absorption** - Skin contact with SO<sub>2</sub> can occur when handling compressed gas (not applicable at Voisey's Bay operations)

# Where Does SO<sub>2</sub> Come From?

- Under ideal conditions, the ore and concentrate here at Voisey's Bay may begin to oxidize (rust) when exposed to moisture and oxygen.
- Oxidation is a chemical reaction which results in the self-heating of the concentrate or ore.
- If the temperature reaches or exceeds 100° C sulphur dioxide is produced.
- An early sign of concentrate / ore that is starting to oxidize and self-heat is the generation of steam vapour.



# Where Am I Most At Risk of Being Exposed to SO<sub>2</sub>?

At the Voisey's Bay site, the risk of exposure to SO<sub>2</sub> is greatest at the following locations:

- Concentrate Load Out (including filter floor)
- Concentrate Storage Building at the Port
- Crusher (pocket floor and levels below)
- (SO<sub>2</sub> has been detected in areas of the grinding circuit on occasions)

# ACGIH Exposure Guidelines

## TLV – STEL (or simply STEL)

### **Threshold Limit Value-Short Term Exposure Limit**

#### **(without respiratory protection)**

...“the concentration to which it is believed that workers can be exposed continuously for a short period of time (15 minutes) without suffering from:  
Irritation  
Chronic or irreversible tissue damage or  
Enough drowsiness to increase the chance of accidental injury

**STEL = 0.25 ppm**

This exposure level should not be exceeded more than 4 times during a workday. There should be at least 60 minutes between successive exposures in this range.

**Note: In 2009 the TLV (Threshold Limit Value) of 2.0 ppm was revoked**

# Respiratory Protection for SO<sub>2</sub> in Air

**For concentrations up to 2.5 ppm**

Any air-purifying half-mask respirator equipped with appropriate gas / vapour cartridges



# Respiratory Protection for SO<sub>2</sub> in Air (up to 12.5 ppm)

**For concentrations up to 12.5 ppm**

Any air-purifying full-faced respirator equipped with appropriate gas / vapour cartridges



# Respiratory Protection for SO<sub>2</sub> in Air

## Filters supplied for Full-Faced or Half-Mask Respirators

Warehouse inventory item multi-purpose cartridge for removal of SO<sub>2</sub> and particulate

**When should I change my filters?**



# Respiratory Protection

## Cartridge change out schedule

### Work Areas

- Concentrate Load Out (including filter floor)
- Concentrate Storage Building at the Port
- Crusher (pocket floor and levels below)

**If SO<sub>2</sub> in alarm** – cartridge to be changed at the end of that shift

**If NO SO<sub>2</sub> alarm** – cartridge to be changed once every three months or sooner if breathing becomes difficult the cartridge/filter becomes soiled or damaged

**\*\*Calculations based on NORTH SAFETY EZ Guide Software – Cartridge Service Life Estimator**

# Respiratory Protection for SO<sub>2</sub> in Air



## Over 12.5 ppm

In situations where SO<sub>2</sub> levels are in excess of 12.5 ppm, self-contained breathing apparatus offers the necessary protection against SO<sub>2</sub> exposure.

Over 12.5 ppm ERT is called in to control the situation.

# Hot Work Procedure and SO<sub>2</sub>

When working near dry sulphides be aware that this material has the potential to emit SO<sub>2</sub> when heated as a result of grinding, welding etc. and should be considered as a combustible material and treated as such in our HOT WORK procedure.

To effectively eliminate the potential for SO<sub>2</sub> the affected area must be: washed down with water and if this is not possible, fire blankets should be used to prevent sparks from coming in contact with the dry sulphides.



# Minimizing Risk

While it is evident that SO<sub>2</sub> can be generated from our ore and concentrate, it is important to realize that it can be prevented.

Prevention of the production of SO<sub>2</sub> can be achieved by:

- Management of ore and concentrate (i.e. compaction, timely removal, etc.)
- Effective early detection procedures (timely reaction to steam generation)

The early warning sign for SO<sub>2</sub> production is the generation of steam. If this is observed, notify your supervisor immediately.

## **Managing Our Ore and Concentrate**

# SO<sub>2</sub> in the Workplace - If in Doubt, Ask

Protect your health. Wear your respirator when and where required.

Take care of your respirator.

If you are not sure about any of the potential risks that you might be exposed to ask your supervisor and/or SH&E.

Know what risks you might be exposed to.

Know how to control the exposure.