

Tier 3: Nickel Refinery Orientation

1. Copper Cliff Nickel Refinery

1.1 Copper Cliff Nickel Refinery



Copper Cliff Nickel Refinery

Tier Three – Site Specific Access



Start

1.2 Course Objectives

Course Objectives

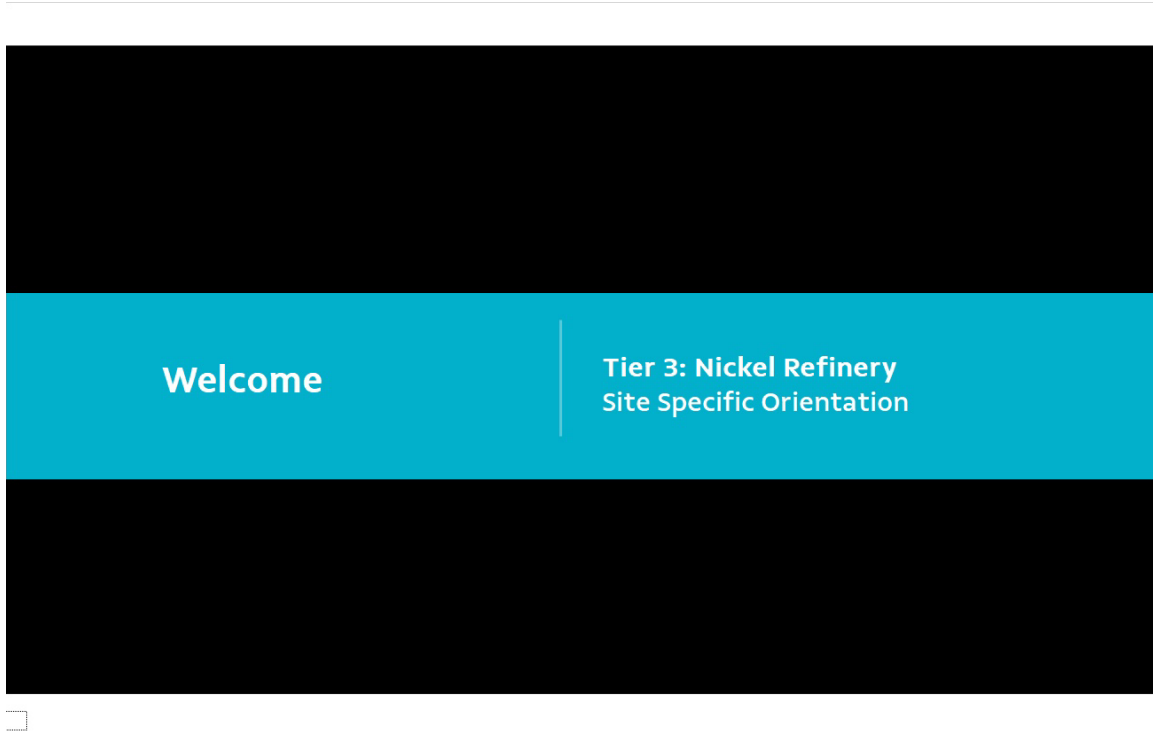


Upon completion of this module as a worker you will be able to:

- Follow Plant Entry Procedure
- Identify Site Specific Hazards and Controls for the Copper Cliff Nickel Refinery
- Follow Procedures in the event of:
 - ⌋ Equipment Damage
 - ⌋ Personal Injury
 - ⌋ Process Upset (Emergency Preparedness)
- Complete Plant Exit Procedure Checklist

2. Introduction

2.1 Introduction



2.2 Quality Assurance

NOTICE TO ALL PERSONNEL COMING ONSITE at CCNR

As a result of potential hazards encountered onsite at CCNR (specifically Nickel Carbonyl), robust emergency management protocols are in place. In the event of an emergency involving nickel carbonyl, all those onsite will be triaged accordingly to determine required response protocols. These protocols may include the submission of periodic urine samples for nickel analysis and based on urine nickel concentrations, the administration of an antidote to treat the exposure. There may be instances where urine samples need to be submitted after hours and are collected via taxi services.

As such, it is imperative that the security systems in place (site access security) contain the most up to date information pertaining to the contact numbers and addresses of all those onsite. This information will not be used for any purpose other than as part of emergency management protocols.

By completing this Tier 3 training, you are agreeing to periodically provide the above noted information upon request or at the time of an event.

2.3 CCNR Overview

CCNR Overview

The Copper Cliff Nickel Refinery is a quality assured, world-class facility which annually produces over 130 million pounds of high-quality, pure nickel pellets and powders for the world marketplace.

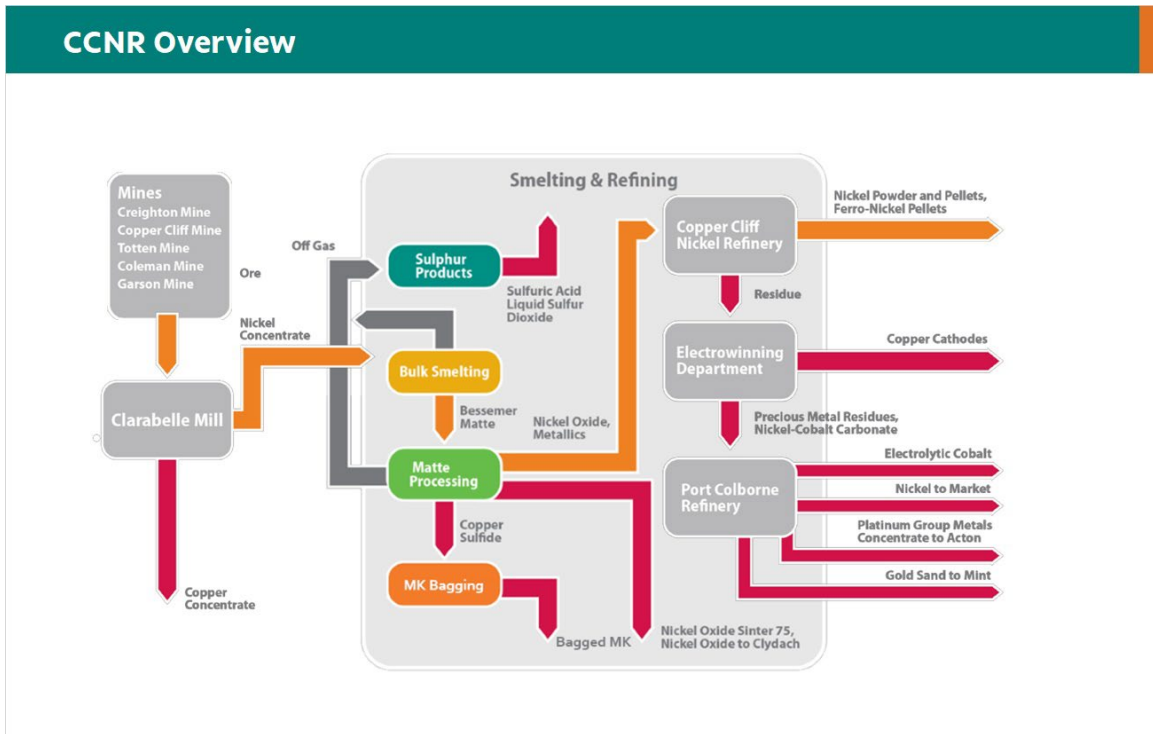
The C.C.N.R. has been in operation since 1973 and has enjoyed a safe, productive history.



Vale Operations group are the only ones authorized to actuate/manipulate valves or equipment and special authorization is required for exceptions to this.



2.4 CCNR Overview



2.5 CCNR Overview

CCNR Overview

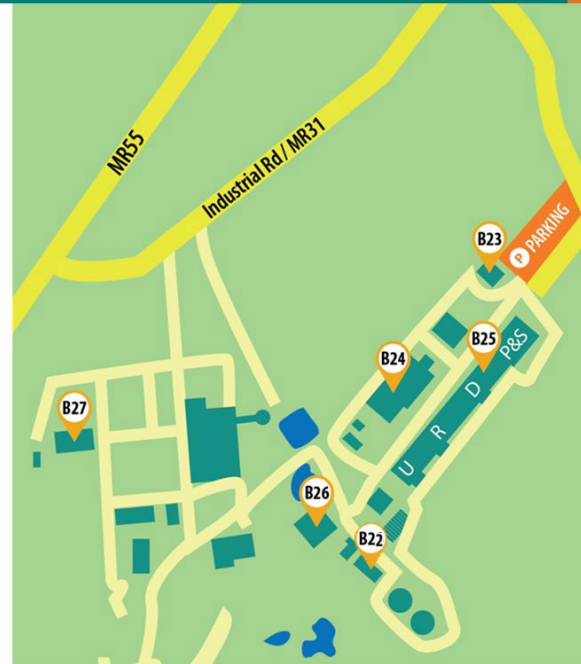
The CCNR Process involves the two major process buildings;

- NRC (Nickel Refinery Converter) Building (B24)
- IPC (Inco Pressure Carbonyl) Building (B55)

There are also several other buildings that provide various functions to support the process which include the;

- MYN Building (B56)
- TBRC Off Gas Baghouse Building
- CO Storage (22)

* Security Gatehouse (B23)



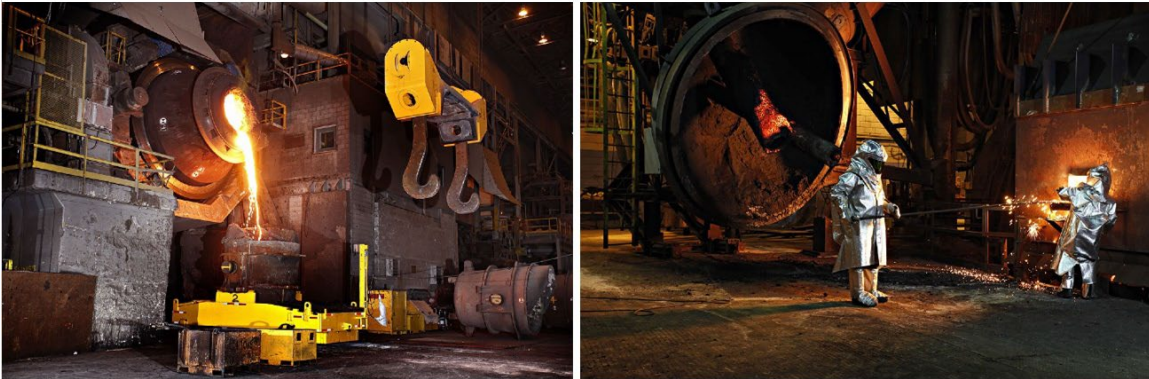
2.6 CCNR Overview

CCNR Overview

The NRC receives various nickel-bearing Raw Feed Materials from the Smelter Complex.

These materials are blended, then charged to one of two TBRCs (Top Blown Rotary Converters), converting them into molten metal.

The molten metal is then conveyed by Ladles to Granulation, where high pressure water sprays blast and freeze the molten metal into Dry Metallic Granules.



2.7 CCNR Overview

CCNR Overview

In the IPC, the Dry Metallic Granules are charged to High Pressure Reactors, where the Nickel is chemically removed using high pressure Carbon Monoxide (CO) to form Nickel Carbonyl Gas $\text{Ni}(\text{CO})_4$.

The Nickel Carbonyl Gas is then broken down, or "decomposed," into Metallic Nickel and Carbon Monoxide gas.

This process allows us to produce a variety of pure, quality assured Nickel Products that are packaged and shipped to markets around the world.



3. Quality Assurance

3.1 *Quality Assurance*



Quality Assurance

ISO 9001:2015

3.2 Quality Assurance

Quality Assurance

The Copper Cliff Nickel Refinery is an ISO registered facility. Whether you are a Vale employee or a contract worker, you have an important role to play in the C.C.N.R. quality system.

ISO 9001:2015

International Organization for Standardization is a set of Quality Standards that have become a world-wide minimum which Companies must meet to become preferred suppliers in the global market.

These standards cover every aspect of how each of us manages our day-to-day activities.



3.3 Why Focus Upon Quality?

Quality Assurance

Why Focus Upon Quality?

- Quality is leading the way organizations around the world do business.
- Maintaining a strict focus on quality will help us compete on a global scale.
- Customer satisfaction must continually be both our focus and driving force.
- Together we must strive to be a dependable provider of quality products, thus securing our position and reputation as a preferred supplier in the world nickel market.



3.4 What Is Quality?

Quality Assurance

What Is Quality?

- Quality has a direct impact upon all aspects affecting the products and services provided to our customers.

Our continual goal and focus must be:

- Consistent and on-spec products,
- Reliability of supply,
- Meeting or exceeding customer needs and expectations.

Essentially:

Getting the *right product*, in the *right package*,
at the *right time* – *all the time!*



3.5 Quality Doesn't Just Happen.

Quality Assurance

Quality Doesn't Just Happen.

Everyone must pursue quality daily:

- By conscientiously, thoughtfully and continually improving the work we do.
- By continual awareness to product quality and packaging.

Registration to the **ISO 9001:2015** standard shows the seriousness of our commitment to quality.



The Basic ISO Theory:
SAY what you do
DO what you say
PROVE it
IMPROVE it



3.6 Quality Begins With You!

Quality Assurance

Quality Begins With You!

The work you do is important for the success of the quality system.

Personal involvement is critical in our efforts towards continuous improvement.

By continually performing your work safely, conscientiously and thoroughly, you contribute ultimately to the quality of the products we produce, contributing to both our longevity and the job security for Vale employees and contractors alike.



CCNR Quality Policy

All products and packages will meet or exceed customers, expectations.

The quality of our products is recognized as the end result of the efforts of everyone in the complex.



3.7 Question 1

(Multiple Response, 10 points, 1 attempt permitted)

4. Plant Entry

4.1 *Quality Assurance*



Plant Entry

Driving in, Walking in

4.2 Approaching The Plant

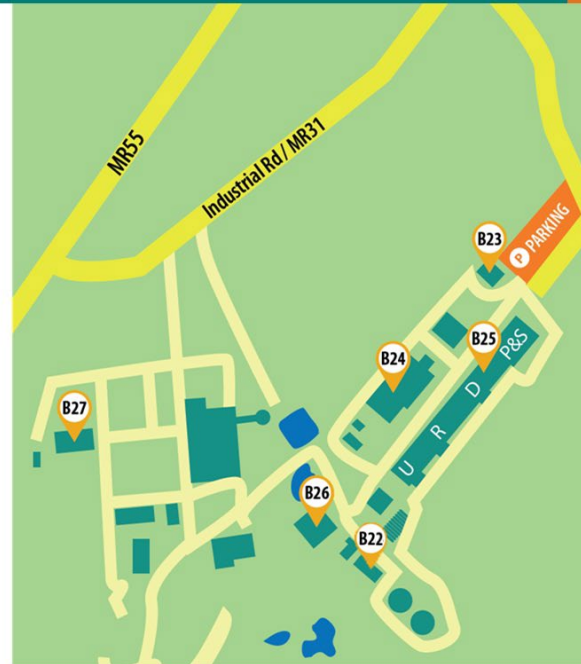
Approaching the plant

There is one access point into the CCNR Complex:

- Industrial Road off of Municipal Road 55.
- Single laned roadway with strict restrictions from passing any vehicles.
- Video monitored.



Be aware of large trucks hauling various products to and from the CCNR on roadway



4.3 Approaching The Plant

Approaching the Plant

Perimeter Warning Lights

While approaching the CCNR Complex, take notice of the Pre-Entry Warning Sign located on the right hand side of the access road.

The Red Light on top of the sign is activated during a CCNR Emergency, to warn and stop incoming traffic.



4.4 Parking

Parking

There are various areas designated for parking.

Personal vehicles must be parked at the northeast end of the main parking lot.

1. Contractor Parking Lot
2. Vale Employee Day Shift
3. Vale Employee Night Shift
4. Admin Staff Parking



4.5 Approaching Sign-in Location

Approaching Sign-in Location

The area approaching the sign in location is a high activity area.

There is large tractor trailer truck traffic, there are train tracks parallel to the roadway, vehicles pulling over to the side either signing in or out, and a major pedestrian crossover is in the area.

Be aware and be vigilant to the activity.



If Plant Security Personnel (PSP) is not at the Gatehouse, phone first aid 7220

4.6 Approaching Sign-in Location

Approaching Sign-in Location

All individuals, including contractors and visitors, who enter the CCNR Complex are required to possess a valid Vale Swipe Access Card, which *must be kept on their person at all times* and used to swipe in and out at the turnstile check-in/out point.



Be Aware
If required, Personal CO
monitors are available at the
Gatehouse.



4.7 Approaching Sign-in Location

Approaching Sign-in Location

SCENT POLICY:

Employees, Contractors and Visitors must adhere to the CCNR's scent reduced workplace policy in order to safeguard the comfort of everyone by banning personal care products the use of propellants or heavily scented products to protect individuals with fragrance sensitivities or medical conditions.

4.8 Approaching Sign-in Location

Approaching Sign-in Location

Because the hazards associated with carbon monoxide are present both in the IPC and NRC areas, the CCNR has implemented the following controls to mitigate the risk of exposure to workers.

- Persons working in or around the IPC building **must have or at all times be with someone** who has a CO detector. Personal CO detectors are required in all IPC areas (shops and offices included).
- **Everyone** entering the NRC; whether for work or tours, is required to carry a functioning personal CO detector and keep it on themselves at all times.
- CO Detectors are signed out at the start of the Contractors shift and must be returned before leaving the property.
- CO monitors can be acquired from the CCNR Instrumentation department.



The procedure for operating along with other information regarding CO Monitors will be discussed later in this module.

4.9 Approaching Sign-in Location

Approaching Sign-in Location

Depending on where you're working within the complex, there may be other items required beyond simply "signing in" such as;

Certain areas require you to be issued a personal air monitor (IPC).

Most areas within the complex require additional sign-ins once you pass the gate (e.g. IPC/NRC DCS Control Rooms, MYN Building, CO Storage)

Entry will not be permitted without the direct knowledge and permission of your Vale Contact Person or designate.



If Plant Security Personnel (PSP) is not at the Gatehouse, phone first aid 7220

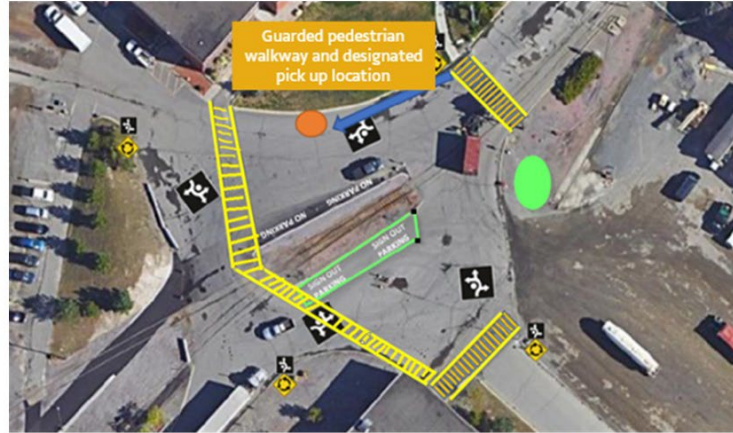
4.10 Traffic Management

Traffic Management

The purpose of the traffic management plan at CCNR is to ensure the safe and efficient movement of all vehicles and pedestrians within the facility.



All traffic rules apply as per Tier 1: General Orientation, Tier 2: Surface Entry Requirements, and the Vale Base Metals' Awareness Module on Critical Activity Requirements.



The flow of traffic at the entrance at the main gate is to be adhered to, the railway track median in the centre of the entrance way is to remain on the left side of the vehicle at all times.

Be Aware that rial traffic has the right of way.

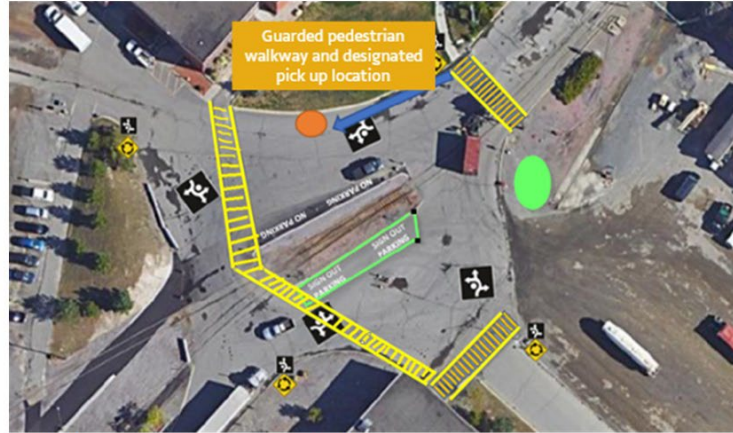
4.11 Traffic Management

Traffic Management

The purpose of the traffic management plan at CCNR is to ensure the safe and efficient movement of all vehicles and pedestrians within the facility.



All traffic rules apply as per Tier 1: General Orientation, Tier 2: Surface Entry Requirements, and Critical Activity Requirement (CAR) 2: Light Motor Vehicles.



Traffic Management routes when rail traffic is occurring onsite.

Entry points to the traffic circle are marked with traffic flow/direction signs. The parking for sign out of the plant is located on the south side of the railway track median, marked in green, as shown here.

4.12 Traffic Management

Traffic Management

The purpose of the traffic management plan at CCNR is to ensure the safe and efficient movement of all vehicles and pedestrians within the facility.



All traffic rules apply as per Tier 1: General Orientation, Tier 2: Surface Entry Requirements, and Critical Activity Requirement (CAR) 2: Light Motor Vehicles.



Shown here are the Truck Traffic routes when a Rail car is being moved in and out of CCNR. Always follow the green arrows while entering or exiting the main gate.

4.13 Question 4

(Multiple Choice, 10 points, 1 attempt permitted)

5. Working with Nickel

5.1 Quality Assurance



Working with Nickel

Introduction to Nickel Species

Exposure to Nickel: Types of Exposure

Controls for Working with Nickel

5.2 Working with Nickel: Hazards

Working with Nickel: Hazards

Due to the diverse make up of the CCNR Complex, the plant wide hazards are summarized in the table to the right before the individual areas are introduced.

As you can see from the table, nickel is an extensive part of this complex, therefore this section of the orientation will provide you with a detailed segment on Working with Nickel.



Area	NRC	IPC	P&S	MYN	TBRC Baghouse
Mobile Equipment	✓	✓	✓	✓	
Crane Activity	✓				
Arsenic	✓	✓			
Lead	✓				
Silica	✓				
Sulphur Dioxide	✓				
Oxygen	✓				
Natural Gas	✓				
Process Dust	✓	✓	✓	✓	✓
Nickel Insoluble	✓	✓	✓	✓	✓
Nickel Soluble	✓				
Nickel Metallic		✓	✓		
Iron Carbonyl		✓			
Carbon Monoxide		✓			
Inert Gas		✓			
Anhydrous Ammonia		✓			
Cobalt	✓	✓			

5.3 Nickel Species

Nickel Species

Nickel can be found extensively throughout the entire complex.

The dust you may encounter, even outside of the main operating areas, cannot be compared to the household dusts you may sweep or vacuum at home.

Nickel is the 24th most abundant element. It is non-essential to your body, consequently it is not absorbed or used.

There are three types of nickel species at CCNR:




- Insoluble nickel
- Soluble nickel
- Metallic nickel



5.4 Nickel Species

Nickel Species

The majority species of nickel found at CCNR are present in industrial dusts and carbonyl which are part of CCNR's operational process. It's important to remember that the properties of the various nickel species are different.

 Nickel Insoluble	 Nickel Soluble	 Nickel Metallic
<ul style="list-style-type: none">• Nickel Oxide,• Nickel Sulphide,• Nickel Subsulphide (found in sintering operations)	<ul style="list-style-type: none">• Nickel Chloride,• Nickel Sulphate,• Nickel Carbonate,• Nickel Hydroxide.	<ul style="list-style-type: none">• Powders,• Pellets,• Electrolytic nickel.• Nickel Carbonyl: (found as a liquid and gas.)

Among the different species, the potential for toxicity and how you can be exposed varies as well. By far, Carbonyl (both nickel and iron) present the highest occupational health risk to workers at the CCNR.

5.5 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

What is Nickel Carbonyl?

Nickel carbonyl is different from other species of nickel. It can be found as a colourless liquid or vapor. It is volatile, flammable and toxic with a slight musty odor.

Nickel and iron carbonyl are created chemically during CCNR's reacting process by carbon monoxide (CO) passing over reduced, impure nickel and iron bearing granules.

Nickel and iron combine with CO, forming nickel and iron carbonyl with the iron impurity being removed later in the process through distillation columns where it's decomposed at 180°C.



High Pressure Reactors

5.6 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

What is Nickel Carbonyl?

Carbon Monoxide (CO) although understood in our day to day living with CO monitors in our houses, it is important to understand that the hazard of CO is associated to Carbonyl.

Properties of Carbon Monoxide (CO)

- Volatile
- Flammable Limits: 12.4 – 74.2% in Air
- Toxic
- TLV: 25 PPM
- Colourless, Odourless Gas



High Pressure Reactors

5.7 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

Carbonyl Properties

The "half-life" of carbonyl in air is approximately 1 minute.

This means that within approximately 1 minute, half of the nickel carbonyl gas in the air will have decomposed into metallic nickel and carbon monoxide.

The "half-life" of carbonyl in the body is less than 4 hours, depending on the person and the severity of exposure.

Carbonyl Properties	
Nickel Carbonyl; Ni(CO)₄	Iron Carbonyl; Fe(CO)₅
Boiling Point: 42.2°C	Boiling Point: 103°C
Specific Gravity: 1.31	Specific Gravity: 1.46
Liquid Heavier Than Water	Liquid Heavier Than Water
Gas Heavier Than Air	Gas Heavier Than Air
Liquid: Colourless	Liquid: Yellowish
Decomposition Yields: Ni + 4 CO	Decomposition Yields: Fe + 5 CO
TLV: 50 Parts per Billion (PPB)	
IDLH: 2000 PPB	
LEL: 2%	
Volatile	
Flammable	Flammable
Toxic	Toxic

5.8 Nickel Exposure

Nickel Exposure

Introduction

We interact with Nickel Species on a day to day basis and while working at the CCNR you can be exposed through Non-Industrial or Industrial Means.

Non - Industrial

Products containing nickel;

- food
- (cocoa, chocolate)
- vitamins
- cigarettes

Industrial

Dusts & Particles

Nickel and Iron
Carbonyl Gases
and Liquids

5.9 Nickel Exposure

Nickel Exposure

Introduction

Whether at work, or at home, our day to day activities have the potential to expose ourselves to small amounts of nickel through products such as foods and water or by smoking.

Ingested nickel does not accumulate in the body. Food slowly absorbs and binds up nickel, resulting in excretion via "solid wastes" This is non-toxic.

On an empty stomach, stomach acids quickly dissolve nickel. It is then absorbed into the bloodstream and excreted by the kidneys.

Non - Industrial

Products containing nickel;

- food
- (cocoa, chocolate)
- vitamins
- cigarettes

Industrial

Dusts & Particles

Nickel and Iron Carbonyl Gases and Liquids

5.10 Nickel Exposure

Nickel Exposure

Introduction

The hazards associated with industrial exposure have the most potential for harm.

This section will identify the properties of these hazards and how they're controlled at the CCNR. It will be broken into two sections:

- Dusts and Particles
- Nickel and Iron Carbonyl Gases and Liquids.

Non - Industrial

Products containing nickel;

- food
- (cocoa, chocolate)
- vitamins
- cigarettes

Industrial

Dusts & Particles

Nickel and Iron Carbonyl Gases and Liquids

5.11 Nickel Exposure

Nickel Exposure

Introduction

Each section will address:

- Routes of entry (How it enters my body)
- Elimination (How it exits the body)
- Hazards (Health Effects) and
- Controls

Non - Industrial

Products containing nickel;

- food
- (cocoa, chocolate)
- vitamins
- cigarettes

Industrial

Dusts
&
Particles

Nickel and Iron
Carbonyl Gases
and Liquids

5.12 Nickel Dusts & Exposure

Nickel Dusts & Exposure

Introduction

There are three ways you can be exposed to hazards associated with nickel dusts and particles in an industrial setting.

The primary routes of entry are inhalation and ingestion, although you may experience limited exposure through skin contact/absorption.

Although it's important to know how nickel dusts and particles enter the body, it is equally important to understand the effects on the body from these routes of entry.



Inhalation



Ingestion



Skin Contact / Absorption

5.13 Nickel Dusts & Exposure

Nickel Dusts & Exposure

Inhalation

As stated, the primary exposure route for nickel dusts and particles is inhalation.

Variables affecting intake and its distribution through the body include:

- Concentration of particles in the air
- The lungs inhale many different particle sizes.

Larger Particles (greater than 100 microns μm): get trapped in the nasal passages (nasopharyngeal tract) and are expelled.

Smaller Inhalable Particles: (less than 100 microns μm): enter the respiratory tract and upper lung and are filtered out by cilia.



Cilia are found in the lungs and respiratory tract. They have a rhythmic waving or beating motion to keep the airways clear of mucus and dirt, allowing us to breathe.

CAUTION: Smoking damages cilia, rendering them virtually ineffective!

5.14 Nickel Dusts & Exposure

Nickel Dusts & Exposure

Inhalation

In addition to cilia, sputum is the lung's other defense to help trap dust and particles.

Sputum is constantly regurgitated from the lungs. If swallowed, dust contained in this sputum may increase the nickel level in urine.



Dusts repeatedly inhaled can cause eventual lung damage

5.15 Nickel Dusts & Exposure

Nickel Dusts & Exposure

Inhalation

How Can Nickel Harm Me?

Even though the body has defenses, exposure to dusts and particles are potentially hazardous to workers.

Care must be taken to protect yourself against:

- Short term "Acute" Health Effects, and
- Long term "Chronic" Health Effects.
- Although rare because of the use of PPE, any large or repeated dust exposure may harm the lungs and may lead to pneumonia.

Nickel Species	TWAEV Insoluble Dust
Insoluble:	
Nickel Oxide	
Nickel Sulphide	0.2mg/M3
Soluble:	
Nickel Sulphate	
Nickel Chloride	0.1mg/M3
Nickel Subsulphide	0.1mg/M3
Metallic Nickel	1mg/M3
Nickel Carbonyl	50ppb (Ceiling)



DO NOT Inhale Nickel Dust!
By avoiding it, you will reduce the possibility of future health problems such as chronic toxicity or poisoning.

5.16 Nickel Dusts & Exposure

Nickel Dusts & Exposure

Inhalation

How Can Nickel Harm Me?

There are certain species of nickel that when inhaled at higher doses for long periods have been linked to increased risk of cancers:

- Lung
- Nasal
- Sinus

These are:

- Insoluble nickel subsulphide
- High-temperature form of nickel oxide
- Possible copper-nickel oxides

Cancer Potency

Nickel Subsulphide

Nickel Oxide

Soluble Nickel
Compounds (salts)

Nickel Metal Powders

Nickel Metal Pellets



Soluble nickel compounds
add to the risks.
Reducing exposure potential
is your best protection.

5.17 Nickel Dusts & Exposure

Nickel Dusts & Exposure

Ingestion

Nickel dusts and particles are harmful when they are taken into our body through ingestion.

In the workplace the primary source of ingestion are dusts collected on hands, cigarettes and food when good hygiene and work practices are not followed.

Swallowed Sputum is the second source of ingestion.

- Some nickel will be absorbed by your Gastro-Intestinal Tract and excreted by the kidneys.
- There is no evidence of long term health effects from this (i.e. stomach cancers).

Deliberate poisoning with soluble nickel salts may cause abdominal cramps and general malaise.



5.18 Nickel Dusts & Exposure

Nickel Dusts & Exposure

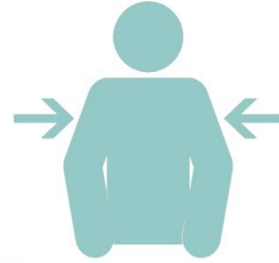
Skin Contact/Absorption

Although the risk is very minimal, nickel dusts and particles may be harmful when they come into contact with the skin or when they are absorbed through the skin.

An allergic reaction (dermatitis or "nickel itch") can result from prolonged contact with nickel metal and soluble forms of nickel.

Exercise caution if you are allergic to nickel from jewelry, watches, etc. Even the slightest contact may trigger a reaction.

If allergic, report to First Aid and avoid all nickel exposure. Skin sensitivity may lead to nickel bearing food allergies.



5.19 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

The primary route of entry for Carbonyl is inhalation.

Although there is a risk of being exposed to contact with liquid, the likelihood is minor and there is a greater risk of catching fire than of skin contact/absorption as it is highly volatile and flammable.



WARNING:

When there is the possibility of exposure to nickel carbonyl gas, there is also the possibility of immediate carbon monoxide poisoning!



5.20 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

Nickel Carbonyl can cause immediate harm. Severe exposure can prove FATAL within 4 to 10 days if untreated!

Absorbed carbonyl goes deep in the lungs, into the alveoli and there enters the bloodstream.

- The breakdown of nickel and CO causes inflammation to develop,
- Resulting in chemical pneumonitis,
- Characterized by redness, fluid and swelling of the lungs.

Do not hesitate to submit a urine sample at any time!



5.21 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

Carbonyl poisoning is a two stage illness.

Stage 1:

Initial symptoms occur 12 to 36 hours after exposure and are due mainly to carbon monoxide (CO) poisoning and may include flu-like symptoms:

- Headache,
- Dizziness and
- Nausea.



5.22 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

As of January 1, 2018, the OEL for Nickel Carbonyl has changed from:
50 ppb TWA (an 8 hour average) to 50 ppb Ceiling (a value not to be exceeded).



The Ceiling Exposure Value, referred to as CEV or simply C, cannot be exceeded at any time.

The Ceiling Exposure Value is most commonly applied to chemicals which, having an acute toxicity, are extremely harmful.



5.23 Nickel & Iron Carbonyl

Nickel & Iron Carbonyl

Carbonyl poisoning is a two stage illness.

Stage 2:

Delayed symptoms occur 3 to 5 days after exposure and are due to chemical pneumonitis. Symptoms may include:

- Chest pain,
- Shortness of breath,
- Cyanosis (bluish colour of lips),
- Dry cough,
- Weakness.

Severe exposures can be fatal within 4 to 10 days if untreated.
(i.e. kidney failure, heart and lung failure)

5.24 Elimination of Nickel

Elimination of Nickel

How does my body dispose of nickel?

If you are exposed to Nickel, your body will dispose of it depending on what species entered your body:



Insoluble Dust

Insoluble dusts are absorbed slowly, as the particles lodge in the lungs.

They are released slowly into the blood and are excreted by the kidneys over several days or weeks, again, depending on the severity of exposure.



Soluble Dust

Soluble nickel dust that settles in the lungs is absorbed into the bloodstream, then excreted in urine by the kidneys within hours or days, depending on the severity of exposure.



Carbonyl

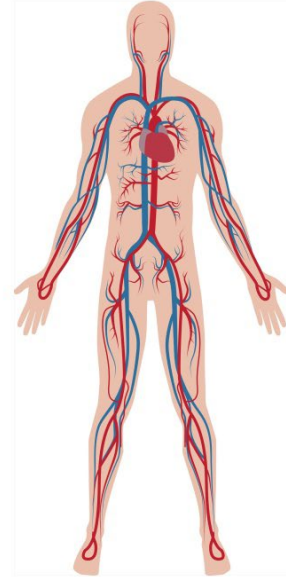
Carbonyl is absorbed quickly into the blood and excreted quickly in the urine by the kidneys.

5.25 Elimination of Nickel

Elimination of Nickel

The nickel in your blood is cleaned out by the kidneys. It takes up to 4 days for your system to remove nickel after a moderate exposure.

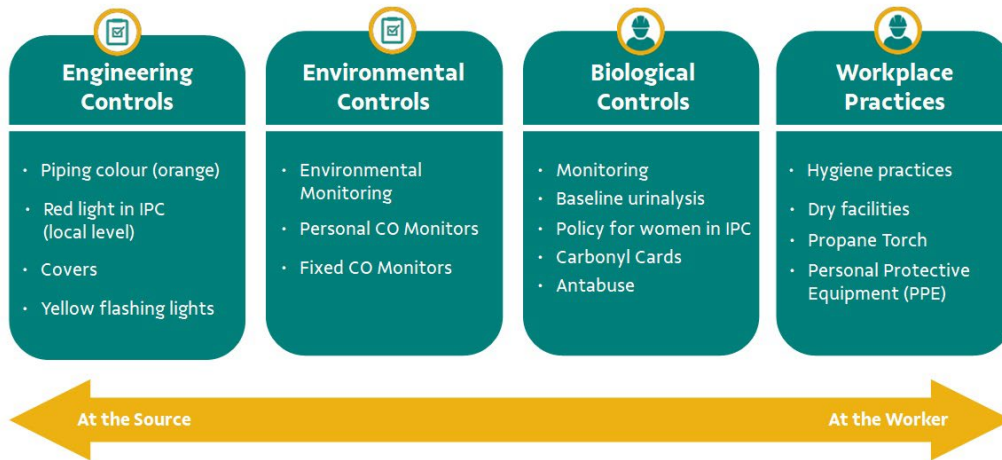
The half-life of nickel carbonyl in the body is less than 4 hours. The half-life of nickel dust in the body can be anywhere from 17- 39 hours, depending on the dust species and the severity of exposure.



5.26 Controls: Working with Nickel

Controls: Working with Nickel

Having now covered the hazards associated to working with nickel in an industrial setting, the remaining section of this working with nickel module is a summary of all of the controls that the CCNR has implemented.



5.27 Engineered Controls

Engineered Controls

Nickel Exposure

The hierarchy of controls is used to control hazards. The IPC process produces carbonyl and carbon monoxide that are essential to the final product and therefore, cannot be eliminated or substituted.

The next level of controls are Engineering or Facility Controls:

- To identify these hazardous gases, the piping associated to its collection are colour coded orange.
- Any work on orange piping is restricted to qualified and authorized workers.



For piping colours used at CCNR,
Please contact your Vale contact
person.



5.28 Nickel Exposure

Engineered Controls

Nickel Exposure

As stated, carbonyl and carbon monoxide are products of production in the IPC and process upsets, such as leaks, do occur. During such events, affected areas would be evacuated.

During an evacuation, the IPC Control room Operator will:

- Sound the IPC Tone Alert
- Make a PA announcement
- Activate IPC Area Evacuation Horns in the affected area until all people are evacuated from the building
- Activate Flashing Red Lights(both inside and at all entrances to the affected IPC area)



5.29 Nickel Exposure

Engineered Controls

Nickel Exposure

CAUTION:

Before entering the IPC Building or passing from one area into another, always check the red lights at entrances.

Be aware that although there may not be a horn being sounded, if the red lights are on, it is still a restricted area.



5.30 Nickel Exposure

Engineered Controls

Nickel Exposure

Another light associated to carbonyl is the yellow flashing lights that IPC personnel use when working on carbonyl equipment.

Warning lights shall be placed at/near a job site whenever there is a potential to release hazardous substances due to the work being performed.

The warning light(s) location(s) shall be chosen to ensure that there is a warning light visible at all approaches to the job site. In areas that have grated floors, lights shall be positioned on the floors above and below to ensure all personnel maintain a 50' radius away from the potential hazard.

Note: All personnel are to maintain a 50' distance from the active warning light.



A yellow flashing light does not mean that you need to report to the IPC Control Room. It does however mean to avoid the area because of potential carbonyl exposure

5.31 Nickel Exposure

Environmental Controls

Environmental Monitoring

Air Sampling is done by a Senior Environmental Analyst. Personal Sampling (wearing a dust monitor) determines personal dust exposure.

Environmental Sampling determines dust levels in the work place.

Results assist in identifying problem areas and implementing adequate controls.



Worker Wearing a Dust Monitor

5.32 Personal CO detectors

Environmental Controls

Personal CO Detectors

Personal CO detectors are essential personal protective equipment in the IPC and are required in all IPC areas (shops and offices included).

Persons working in or around the IPC building must have or at all times be with someone who has a CO detector.

CO Detectors are signed out at the start of the Contractors shift and must be returned before leaving the property.

Decomposing Carbonyl releases CO. If your Detector detects CO, Carbonyl may be present.



Carbonyl is carried by Carbon Monoxide (CO). If a CO Monitor alarms, you are to respond as though you are being exposed to Carbonyl.

5.33 Personal CO detectors

Environmental Controls

Personal CO Detectors

Here are some basic things to remember when using your personal CO monitor in the IPC area.

- Other gases, in addition to CO, may activate the detector (e.g.: Hydrogen from forklift truck batteries, methane from natural sources etc).
- Do not allow dirt and grease to clog the sensors. Keep the unit clean and dry.
- The unit has two alarm set points; an a1 low alarm and an a2 high alarm.
- The personal CO detector detects CO from 0 – 500 ppm.
- Upon obtaining your CO detector, take a few minutes to familiarize yourself with it. Direct any questions to your supervisor or contact person.



Carbonyl is carried by Carbon Monoxide (CO). If a CO Monitor alarms, you are to respond as though you are being exposed to Carbonyl.

Basic Operation Instruction

Environmental Controls (Slide Layer)

Environmental Controls



1. Push the "OK" button to turn the Instrument "ON" and hold during countdown.
2. To turn the Instrument "OFF", push both buttons at the same time and hold for > 3 seconds.
3. If there is an alarm, read the display for information icons and gas values.
4. Take the appropriate safety precautions.

Return

5.34 Personal CO detectors

Environmental Controls

Personal CO Detectors

In the event that your CO monitor alarms, respond according to the following procedure:

- If your CO Detector alarms, and you suspect that it is not due to CO and/or Carbonyl: report the event to your Supervisor (or the Operations Shift Supervisor) immediately.
- Upon verification that it is not CO and/or Carbonyl related, no action or follow-up is required.



5.35 Personal CO detectors

Environmental Controls

Personal CO Detectors

In the event that your CO monitor alarms, respond according to the following procedure:

- If your CO Detector alarms while you are not under Supplied Air protection, and CO and/or Carbonyl is suspected: retreat to a safe location immediately and notify your Supervisor and the IPC Control Room @ 7241 or 7242. The Control Room will notify the Field Operator, who will then investigate.
- During such occasions you must submit a urine sample for nickel analysis.



5.36 Personal CO detectors

Environmental Controls

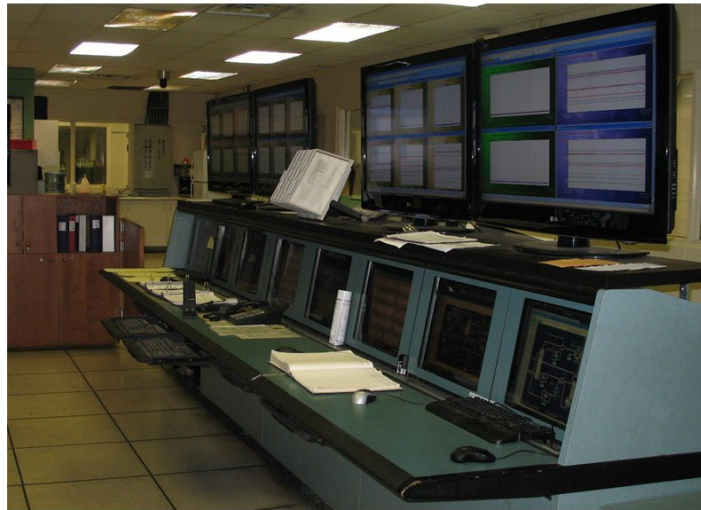
Fixed CO Monitors

Fixed CO monitors detect Carbon Monoxide in a range from 2 – 100 parts per billion (ppb).

They are monitored by the IPC Control room, will alarm in both the control room as well as in the field, and are located throughout the IPC:

- Ceiling exhaust fans
- Strategic inside locations
- Strategic outside locations
- CO Storage Area
- the Complex boundaries

Exhaust air is continuously monitored. There are 10 to 12 air changes per hour in all operating areas.



5.37 Biological Controls

Biological Controls

To monitor the worker's health and well being, a **Health Surveillance Program** is active at the Nickel Refinery.

Included in this monitoring program are the following biological controls:

- Baseline urine samples
- Suspected nickel carbonyl exposure
- Worker illness / absenteeism
- Non-event
- Policy for women in IPC
- Carbonyl Cards
- Antabuse



5.38 Biological Controls

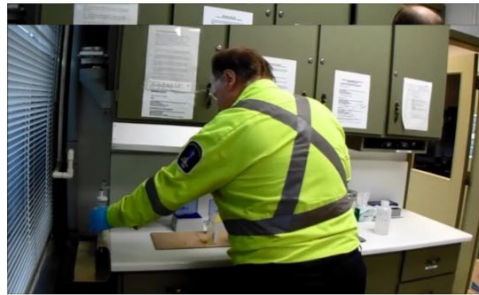
Biological Controls

CCNR Health Surveillance Program

All nickel species from all exposure sources that enter the bloodstream pass through the kidneys and are excreted with the urine.

The CCNR Health Surveillance Program assesses exposure to Nickel Dust and Nickel Carbonyl by measuring the nickel levels in urine.

Urine nickel levels reflect recent exposure to all forms of nickel, by all routes of entry into the body.



Health surveillance monitoring (the urine sample) determines the nickel exposure from all sources of exposure.

5.39 Biological Controls

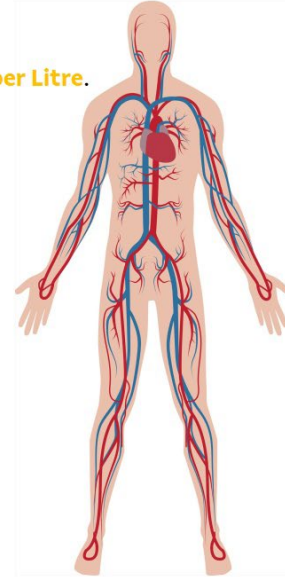
Biological Controls

CCNR Health Surveillance Program

Initial sample results can vary from: **0 to 10 micro grams (ug) of Nickel per Litre.**

These background values are due to non-work related contributors such as food, water and air.

The small amount of Nickel you normally have in your body is called your **Baseline Urine Nickel Level.**



Health surveillance monitoring (the urine sample) determines the nickel exposure from all sources of exposure.

5.40 Baseline (Biannual) Samples

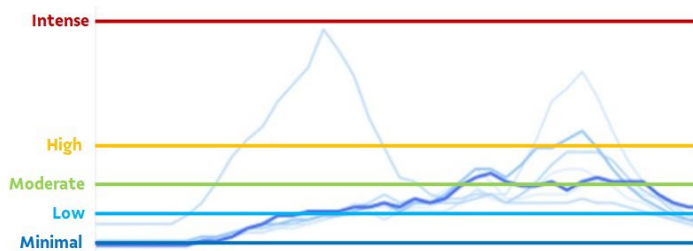
Biological Controls

Baseline Biannual Samples:

Biannual urine samples establish a baseline for nickel carbonyl and exposure to nickel powder.

Workers at risk are encouraged to submit a urine sample every **6 months**.

“At risk” includes workers and contractors that work in the IPC for a continuous period of 6 months or more. *(including Packaging and Shipping)*.



5.41 Suspected Exposure

Biological Controls

Suspected Exposure

If CCNR Management suspects or has reason to believe that an employee has been exposed to Nickel Carbonyl, that employee must:

- Notify their supervisor
- Submit a urine sample at First Aid within one hour of the event
 - † Complete an incident form
 - † First Aid will monitor vitals and symptoms
 - † First Aid will determine if additional medical attention is required
- Decision to return to work is based on the event (liquid vs. gas) and your symptoms
- Continue to monitor symptoms
- Repeat another urine sample eight hours post exposure.

5.42 Suspected Exposure

Biological Controls

In the event of a Level I evacuation due to carbonyl activity, all personnel who were present in the IPC must submit a nickel urine sample.

A Mandatory nickel urine sample is required when:

- If you are working *Without Supplied Air*;
- Worker(s) are known to be in the vicinity of a leak that caused an area evacuation.
- Worker(s) smelled carbonyl.
- Worker(s) personal CO monitors alarmed in the work area and an interfering source cannot be identified.
- Worker(s) are working near B Liquid, B Vaporizer or #9 Pellet Decomposer and a leak occurs.



5.43 Suspected Exposure

Biological Controls

In the event of a Level I evacuation due to carbonyl activity, all personnel who were present in the IPC must submit a nickel urine sample.

A Mandatory nickel urine sample is required when:

- If you are working *With Supplied Air*;

In order to work under Supplied Air in the IPC worker(s) need to be trained and authorized by way of the following:

- Working With Carbonyl training package delivered by CCNR L&D.
- Qualified in MSA Breathing Air and provide documentation.
- Work Permits signed by Vale Contact Person verifying qualifications and authorizing work.



5.44 Suspected Exposure

Biological Controls

It's important that workers don't delay or hesitate to submit a urine sample. All personal results are confidential.

For suspected exposures, a urine sample should be provided as soon as reasonably possible, with the expectation being that they be provided approximately one hour after the event.

To provide a sample:

- Do not smoke prior to testing. Cigarette smoke will contain CO, leading to a faulty reading.
- A clean urine sample will be analyzed for "urine nickel" only.

For samples required due to high risk activity, the sample may be submitted at the end of shift. Other than this an 8 hour sample is not required.



Health effects cannot be prevented unless the employee takes the initiative to acknowledge the possibility of an exposure.



5.45 Suspected Exposure

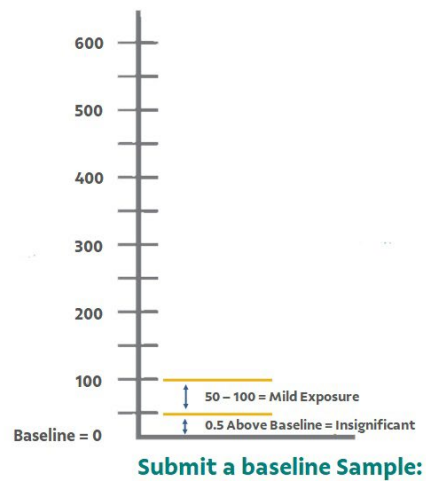
Biological Controls

Once the test has been completed, an analysis of the level of Nickel will be evaluated and the level of exposure diagnosed.

Once the level is determined:

- A reading of 50 micrograms/litre above the Baseline is **"Insignificant"**.
- 50-100 micrograms/litre above baseline is regarded as **"Mild"**.

The worker is removed from the workplace and monitored until deemed symptom free and/or the urinary nickel has fallen to or below the baseline + 50ug/l for two consecutive samples 8 hours apart.



5.46 Biological Controls

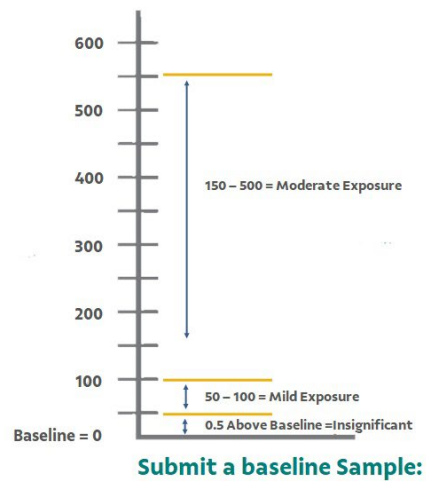
Biological Controls

Once the test has been completed, an analysis of the level of Nickel will be evaluated and the level of exposure diagnosed.

Once the level is determined:

- **"Medium (or Moderate)"** exposures are in the range of 100 - 500 micrograms/litre above the Baseline.

The worker is sent to the hospital for assessment by the Doctor, Antabuse may be indicated. You will be interviewed by the Plant Nurse to discuss hygiene and work practices.

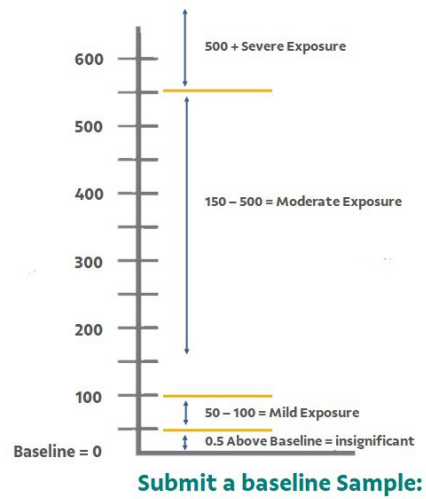


5.47 Biological Controls

Biological Controls

- **“High (or Severe)”** exposures are 500 micrograms/litre above the Baseline and up.

Same as moderate exposure. Antabuse is indicated. Intensive medical treatment may be indicated as well.



5.48 Confirmation

Biological Controls

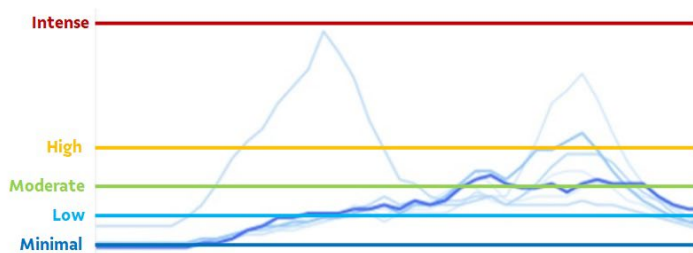
Confirmation

Urinary Nickel Levels provide Complementary Information to Exposure History.

The immediate urine sample is important!

The 8-hour "post-exposure" urine sample is CRITICAL because it will confirm the exposure, plus the pattern of the elevation will determine if Dust or Carbonyl is the cause.

The "urine level" will be compared to the worker's baseline.



5.49 Prior to providing a sample:

Biological Controls

Prior to providing a sample:

Do not smoke. Cigarette smoke is laced with CO. This will give a faulty reading.

You will then submit a clean urine sample, which will be analyzed for nickel.

If you have a Nickel Carbonyl exposure in an Iron Carbonyl area, you may have been exposed to Iron Carbonyl as well. This will be determined by: the location of the leak, equipment worked on, etc.



5.50 Diagnosis

Biological Controls

Diagnosis

While on site, if you suspect you've been exposed to Nickel Carbonyl, or experience any exposure symptoms:

- You will then submit a clean urine sample, which will be analyzed for nickel.
- Inform your Supervisor and/or Contact Person, then go directly to First Aid,
- Relate information to the PSP regarding the work area, job function, Carbonyl detection, etc,
- Advise the PSP of any symptoms,
- The PSP will test your exhaled breath for CO. If CO is detected, Oxygen will be administered as a therapeutic measure.



5.51 Illness/absentee protocol:

Biological Controls

Illness/Absentee Protocol:

For employees that work in the IPC

If there is a possibility that symptoms may be due to carbonyl, a urine sample will be requested if:

- Employee is feeling unwell.
- Employee is sent to the hospital with the following symptoms: chest pain, headache, weakness, shortness of breath and cough.



5.52 Illness/absentee protocol:

Biological Controls

Illness/Absentee Protocol:

For employees that work in the IPC

If the IPC employee calls in sick for two consecutive days or is sick on the last day of the work week;

- Accountable supervisor (or designate) is responsible for notifying the plant nurse (dayshift, weekdays) or first aid attendant (nightshift, weekends).



5.53 Carbonyl Information Card

Biological Controls

Carbonyl Information Card

It's important to realize that the symptoms for illness related to Carbonyl exposure may not always occur at work.

Therefore you need to carry the provided yellow information card when seeking medical attention outside of work hours.

The yellow cards contain critical information and contact phone numbers, make sure that family and friends also know about this card and provide them with a copy.

Carbonyl Information Card Vale Copper Cliff Nickel Refinery, Sudbury, Ontario

The Vale Pressure Carbonyl Process at the Copper Cliff Nickel Refinery in Sudbury produces nickel/iron carbonyl vapor as an intermediate compound in the production of nickel powder. During the process, there may be inadvertent inhalation of these gases with resultant chemical pneumonitis.

Signs and Symptoms of Exposure

Two (2) stage (biphasic) illness (the 2 stages may merge)

First stage: Immediate to 12 to 36 hours. No symptoms; Or headache, dizziness, abdominal pain, nausea/vomiting

Second stage: Delayed phase 3 to 5 days. Chest pain (pneumonia like), dyspnea (shortness of breath), cyanosis (bluish colour of lips), dry cough, profound weakness

Diagnosis:

1. History of potential or actual exposure
2. Signs and symptoms
3. Level of nickel in urine / Level of iron in blood (serum ferritin)
4. CO levels in expired air

Urine nickel determinations are done at the Copper Cliff Nickel Refinery First Aid, with results available within hours.

Serum ferritin levels can be obtained at most hospital labs.

Vale's Medical Director or his designate is on call to help the treating physician interpret the urine nickel/serum ferritin levels and advise on treatment.

Flip Over

Back (Slide Layer)

Biological Controls

Carbonyl Information Card

It's important to realize that the symptoms for illness related to Carbonyl exposure may not always occur at work.

Therefore you need to carry the provided yellow information card when seeking medical attention outside of work hours.

The yellow cards contain critical information and contact phone numbers, make sure that family and friends also know about this card and provide them with a copy.

Treatment (for the physician)

The chelating agent for nickel carbonyl is Antabuse. This medication has been provided to the Health Sciences North Emergency Department. Antabuse is also available at the Vale's Copper Cliff Nickel Refinery first aid.

The chelating agent for iron carbonyl is Deferoxamine, a standard iron chelating agent readily available at poison control centers.

In addition to the above chelating agents, provide standard treatment for chemical pneumonitis if required. Dosage of the use of Antabuse can be provided by Vale's Medical Director or his designate. Dosages for Deferoxamine can be obtained from Poison Control Ontario (1-800-268-9017).

Note: All medications have the potential for drug interaction with other medications. Antabuse and Deferoxamine are no different. Patients must not drink any alcohol or take any medicine containing alcohol while taking Antabuse and for 1 week after stopping the medication.

For a detailed Treatment Protocol and to contact Vale's Medical Director or his designate, call:

Vale's Copper Cliff Nickel Refinery First Aid	705-682-7220
Vale #1 First Aid (24 hours / 7 days per week)	705-682-6622
Vale's Medical Director	705-682-7220 / or / 705-682-6622

(Revised May 2012)

Flip Back

front (Slide Layer)

Biological Controls

Carbonyl Information Card

It's important to realize that the symptoms for illness related to Carbonyl exposure may not always occur at work.

Therefore you need to carry the provided yellow information card when seeking medical attention outside of work hours.

The yellow cards contain critical information and contact phone numbers, make sure that family and friends also know about this card and provide them with a copy.

Carbonyl Information Card

Vale Copper Cliff Nickel Refinery, Sudbury, Ontario

The Vale Pressure Carbonyl Process at the Copper Cliff Nickel Refinery in Sudbury produces nickel/iron carbonyl vapor as an intermediate compound in the production of nickel powder. During the process, there may be inadvertent inhalation of these gases with resultant chemical pneumonitis.

Signs and Symptoms of Exposure

Two (2) stage (biphasic) illness (the 2 stages may merge)

First stage: Immediate to 12 to 36 hours. No symptoms; Or headache, dizziness, abdominal pain, nausea/vomiting

Second stage: Delayed phase 3 to 5 days. Chest pain (pneumonia like), dyspnea (shortness of breath), cyanosis (bluish colour of lips), dry cough, profound weakness

Diagnosis:

1. History of potential or actual exposure
2. Signs and symptoms
3. Level of nickel in urine / Level of iron in blood (serum ferritin)
4. CO levels in expired air

Urine nickel determinations are done at the Copper Cliff Nickel Refinery First Aid, with results available within hours.

Serum ferritin levels can be obtained at most hospital labs.

Vale's Medical Director or his designate is on call to help the treating physician interpret the urine nickel/serum ferritin levels and advise on treatment.

Flip Over

5.54 Policy: Working or Visiting the CCNR/EW

Biological Controls

Policy for All Personnel Working at/Visiting the IPC/CCNR/EW

The purpose of this policy is to Inform all personnel working at or visiting CCNR, specifically in the Inco Pressure Carbonyl (IPC) building, Utilities and in the Electrowinning (EW) Instrumentation Lab about the hazards of nickel carbonyl and the associated health surveillance protocols.

As part of Vale's commitment to maintaining a safe and healthy workplace, we require all employees who will be Working or Visiting the CCNR/EW to review and acknowledge their understanding of this policy.



POLICY: All Personnel Working at or Visiting CCNR/EW

Carbonyl Health Surveillance Program



ONTARIO OPERATIONS CCNR-CBS-APP-21 Rev: 2-2023/11/97 INTERNAL USE

Purpose: Inform all personnel working at or visiting CCNR, specifically in the Inco Pressure Carbonyl (IPC) building, Utilities and in the Electrowinning (EW) Instrumentation Lab about the hazards of nickel carbonyl and the associated health surveillance protocols.

Nickel Carbonyl is highly toxic and poses serious health risks if inhaled. It has an airborne exposure limit (ceiling) of 0.001 (parts per billion) (ppb) (as a ceiling - level to not be exceeded). As there is a risk of exposure at the CCNR/EW, all employees, contractors and visitors must be aware of the hazards and adhere to the Carbonyl Health Surveillance Protocols outlined in the CCNR-CBS-PROGRAM document.

Exposure to carbonyl can occur if:

- you are in the vicinity of a leak
- you are performing a task on or near equipment that contains carbonyl
- you come in contact with A or B liquid
- you smell carbonyl
- your personal CO monitor or a personal CO monitor in the vicinity alarms and an interfering source cannot be identified.

Nickel carbonyl exposure may result in pulmonary absorption of nickel, which will be reflected in urinary nickel samples. It has been shown that the 8-hour post exposure urinary nickel not only correlates with exposure but also with the severity of delayed health effects – chemical pneumonitis and/or systemic illness. In the event of a suspected exposure, urine nickel levels are critical factors in assessing nickel carbonyl exposure severity and determining the best medical treatment. Depending on the urine nickel exposure classification, treatment with the chelating agent **Antabuse may be required.**

Special note around Pregnancy:

The acute dose of nickel carbonyl in humans that may cause fetotoxicity is not known. As with the chelating agent (Antabuse) administered in exposure cases to speed the elimination of nickel from the body, it is not recommended during pregnancy. Therefore, females who are pregnant shall obtain from working in the IPC, Utilities and the EW Instrumentation Lab.

Additional information on carbonyl exposure can be found in the Tac 3 Plant Instruction and the Annual Carbonyl Awareness presentation.

Vale Copper CCR Nickel Refinery

Release form for personnel working in or visiting the IPC, Utilities or Electrowinning Instrumentation Lab

Name _____ Employee ID Number _____

Address _____ Postal Code _____

Reason for release form completion: Employee/Contractor working at CCNR

CCNR Visitor

I have received the information concerning the potential health hazards of exposure to Nickel Carbonyl.

Signature _____ Date _____

Witness _____ Date _____

[Click Here to Review Policy](#)

Sorry (Slide Layer)

Biological Controls

Policy for All Personnel Working at/Visiting the IPC/CCNR/EW

The purpose of this policy is to Inform all personnel working at or visiting CCNR, specifically in the Inco Pressure Carbonyl (IPC) building, Utilities and in the Electrowinning (EW) Instrumentation Lab about the hazards of nickel carbonyl and the associated health surveillance protocols.

As part of Vale's commitment to maintaining a safe and healthy workplace, we require all employees who will be Working or Visiting the CCNR/EW to review and acknowledge their understanding of this policy.



Sorry, You must review the policy for All Personnel Working/Visiting The IPC at or Visiting CCNR/EW before proceeding.

POLICY: All Personnel Working at or Visiting CCNR/EW

CCNR/Health Surveillance Program



ONTARIO OPERATIONS CCNR/CHS-APP-21 Rev: 2.20211107 INTERNAL USE

Purpose: Inform all personnel working at or visiting CCNR, specifically in the Inco Pressure Carbonyl (IPC) building, Utilities and in the Electrowinning (EW) Instrumentation Lab about the hazards of nickel carbonyl and the associated health surveillance protocols.

Nickel Carbonyl is highly toxic and poses serious health risks if inhaled. It has an airborne exposure limit (inhalation) of 50 ppb (parts per billion) (as a ceiling level to not be exceeded). As there is a risk of exposure at the CCNR/EW all employees, contractors and visitors must be aware of the hazards and adhere to the Carbonyl Health Surveillance Protocols outlined in the CCNR-CHS-PROGRAM document.

Exposure to carbonyl can occur if:

- you are in the vicinity of a leak
- you are performing a task on or near equipment that contains carbonyl
- you come in contact with it or its liquid
- you smell carbonyl
- your personal CO monitor or a personal CO monitor in the vicinity alarms and an interfering source cannot be identified.

Nickel carbonyl exposure may result in pulmonary absorption of nickel, which will be reflected in urinary nickel samples. It has been shown that the 8-hour peak exposure urinary nickel test only correlates with exposure but also with the severity of delayed health effects - chemical pneumonitis and/or systemic illness. In the event of a suspected exposure, urine nickel levels are critical factors in assessing nickel carbonyl exposure severity and determining the best medical treatment. Depending on the urine nickel exposure classification, treatment with the chelating agent **Acetate** may be required.

Special note around Pregnancy:
The acute dose of nickel carbonyl in humans that may cause fetotoxicity is not known. As well, the chelating agent (Acetate) administered in exposure cases to speed the elimination of nickel from the body, is not recommended during pregnancy. Therefore, females who are pregnant shall abstain from working in the IPC, Utilities and the EW Instrumentation Lab.

Additional information on carbonyl exposure can be found in the Tier 3 Plant Instruction and the Annual Carbonyl Awareness presentation.

Vale Copper Cliff Nickel Refinery
Release form for personnel working in or visiting the IPC, Utilities or Electrowinning Instrumentation Lab

Name: _____ Employee ID Number: _____
Address: _____ Postal Code: _____

Reason for release form completion: Employee/Contractor working at CCNR
 CCNR Visitor

I have received the information concerning the potential health hazards of exposure to Nickel Carbonyl.

Signature: _____ Date: _____
Witness: _____ Date: _____

[Click Here to Review Policy](#)

Scrolling Panel (Slide Layer)

Biological Controls

Policy for All Personnel Working at/Visiting the IPC/CCNR/EW

Nickel carbonyl exposure may result in pulmonary absorption of nickel, which will be reflected in urinary nickel samples. It has been shown that the 8-hour post exposure urinary nickel not only correlates with exposure but also with the severity of delayed health effects – chemical pneumonitis and/or systemic illness. In the event of a suspected exposure, urine nickel levels are critical factors in assessing nickel carbonyl exposure severity and determining the best medical treatment. Depending on the urine nickel exposure classification, **treatment with the chelating agent Antabuse may be required.**

Special note around Pregnancy:

The acute dose of nickel carbonyl in humans that may cause fetotoxicity is not known. As well, the chelating agent (Antabuse) administered in exposure cases to speed the elimination of nickel from the body, is not recommended during pregnancy. Therefore, females who are pregnant shall abstain from working in the IPC, Utilities and the EW Instrumentation Lab.

Additional information on carbonyl exposure can be found in the Tier 3 Plant Indoctrination and the Annual Carbonyl Awareness presentation.

Vale Copper Cliff Nickel Refinery	
Release form for personnel working in or visiting the IPC, Utilities or Electrowinning Instrumentation Lab	
Name _____	Employee ID Number _____
Address _____	Postal Code _____
Reason for release form completion:	<input type="checkbox"/> Employee/Contractor working at CCNR
	<input type="checkbox"/> CCNR Visitor
I have received the information concerning the potential health hazards of exposure to Nickel Carbonyl.	

[Click Here to Continue](#)

5.55 Biological Controls

(Pick One, 10 points, 1 attempt permitted)

Biological Controls

Policy for All Personnel Working/Visiting the IPC/CCNR/EW

Acknowledgement statement:

I hereby confirm that I have, read and understand the Policy for All Personnel Working at or Visiting the IPC, CCNR and EW. I further understand that it is my responsibility to comply with the controls contained within this policy as a condition of entry to the CCNR/EW areas.



POLICY: All Personnel Working at or Visiting CCNR/EW
Carbonyl Health Surveillance Program



ONTARIO OPERATIONS CCNR/CCS-APP-21 Rev: 2-2021/11/07 INTERNAL USE

Purpose: Inform all personnel working at or visiting CCNR, specifically in the Inco Pressure Carbonyl (IPC) building, Utilities and in the Electroplating (EW) Instrumentation Lab about the hazards of nickel carbonyl and the associated health surveillance protocols.

Nickel Carbonyl is highly toxic and poses serious health risks if inhaled. It has an airborne exposure limit (ceiling) of 50 ppb (parts per billion) (as a ceiling level to not be exceeded). As there is a risk of exposure at the CCNR/EW all employees, contractors and visitors must be aware of the hazards and adhere to the Carbonyl Health Surveillance Protocols outlined in the CCNR-CHS-PROGRAM document.

Exposure to carbonyl can occur if:

- you are in the vicinity of a leak
- you are performing a task on or near equipment that contains carbonyl
- you come in contact with it or its liquid
- you smell carbonyl
- your personal CO monitor or a personal CO monitor in the vicinity alarms and an interfering source control has been identified.

Nickel carbonyl exposure may result in pulmonary absorption of nickel, which will be reflected in urinary nickel samples. It has been shown that the 2-hour post exposure urinary nickel test only correlates with exposure but also with the severity of delayed health effects - chemical pneumonitis and/or systemic illness. In the event of a suspected exposure, urine nickel levels are critical factors in assessing nickel carbonyl exposure severity and determining the best medical treatment. Depending on the urine nickel exposure classification, treatment with the chelating agent **Ambixone may be required.**

Special note around Pregnancy:
The acute dose of nickel carbonyl in humans that may cause fetotoxicity is not known. As well, the chelating agent (Ambixone) administered in exposure cases to speed the elimination of nickel from the body, is not recommended during pregnancy. Therefore, females who are pregnant shall abstain from working in the IPC, Utilities and the EW Instrumentation Lab.

Additional information on carbonyl exposure can be found in the Tier 3 Plant Introduction and the Annual Carbonyl Awareness presentation.

Vale Copper Cliff Nickel Refinery
Release form for personnel working in or visiting the IPC, Utilities or Electroplating Instrumentation Lab

Name: _____ Employee ID Number: _____
Address: _____ Postal Code: _____

Reason for release form completion: Employee/Contractor working at CCNR
 CCNR Visitor

I have received the information concerning the potential health hazards of exposure to Nickel Carbonyl.

Signature: _____ Date: _____
Witness: _____ Date: _____

[Click Here to Acknowledge You Have Completed Your Review of this Policy](#)

Correct Choice

X [Click Here to Acknowledge You Have Completed Your Review of this Policy](#)

Feedback when incorrect:

You are required to Acknowledge You have Completed your Review of this Policy to Continue.

Correct (Slide Layer)

Biological Controls

Policy for All Personnel Working/Visiting the IPC/CCNR/EW

Acknowledgement statement:

I hereby confirm that I have, read and understand the Policy for All Personnel Working at or Visiting the IPC, CCNR and EW. I further understand that it is my responsibility to comply with the controls contained within this policy as a condition of entry to the CCNR/EW areas.



Thank you for your confirmation!

[Click Here to Continue](#)

POLICY: All Personnel Working at or Visiting CCNR/EW

Carbonyl Health Surveillance Program



ONTARIO OPERATIONS CCNR/CHS-APP-21 Rev: 2-2021/1/07 INTERNAL USE

Purpose: Inform all personnel working at or visiting CCNR, specifically in the Iron Pressure Carbonyl (IPC) building, Utilities and in the Electroplating (EW) Instrumentation Lab about the hazards of nickel carbonyl and the associated health surveillance protocols.

Nickel Carbonyl is highly toxic and poses serious health risks if inhaled. It has an airborne exposure limit (ceiling) of 50 ppb (parts per billion) (as a ceiling level to not be exceeded). As there is a risk of exposure at the CCNR/EW all employees, contractors and visitors must be aware of the hazards and adhere to the Carbonyl Health Surveillance Protocols outlined in the CCNR-CHS-PROGRAM document.

Exposure to carbonyl can occur if:

- you are in the vicinity of a leak
- you are performing a task on or near equipment that contains carbonyl
- you come in contact with it or its liquid
- you smell carbonyl
- your personal CO monitor or a personal CO monitor in the vicinity alarms and an interfering source cannot be identified

Nickel carbonyl exposure may result in pulmonary absorption of nickel, which will be reflected in urinary nickel samples. It has been shown that the 8-hour peak exposure urinary nickel test only correlates with exposure but also with the severity of delayed health effects - chemical pneumonitis and/or systemic illness. In the event of a suspected exposure, urine nickel levels are critical factors in assessing nickel carbonyl exposure severity and determining the best medical treatment. Depending on the urine nickel exposure classification, treatment with the chelating agent **Acetate** may be required.

Special note around Pregnancy:
The acute dose of nickel carbonyl in humans that may cause fetotoxicity is not known. As well, the chelating agent (Acetate) administered in exposure cases to speed the elimination of nickel from the body, is not recommended during pregnancy. Therefore, females who are pregnant shall abstain from working in the IPC, Utilities and the EW Instrumentation Lab.

Additional information on carbonyl exposure can be found in the Tier 3 Plant Introduction and the Annual Carbonyl Awareness presentation.

Vale Copper Cliff Nickel Refinery
Release form for personnel working in or visiting the IPC, Utilities or Electroplating Instrumentation Lab

Name: _____ Employee ID Number: _____
Address: _____ Postal Code: _____

Reason for release form completion: Employee/Contractor working at CCNR
 CCNR Visitor

I have received the information concerning the potential health hazards of exposure to Nickel Carbonyl.

Signature: _____ Date: _____
Witness: _____ Date: _____

Incorrect (Slide Layer)

Biological Controls

Policy for All Personnel Working/Visiting the IPC/CCNR/EW

Acknowledgement statement:

I hereby confirm
Policy for All Pe
CCNR and EW. I
responsibility to
within this polic
the CCNR/EW a



You are required to Acknowledge You
have Completed your Review of this
Policy to Continue.

POLICY: All Personnel Working at or Visiting CCNR/EW
Carbonyl Health Surveillance Program



ONTARIO OPERATIONS CCNR/CCS-APP-21 Rev: 2.20221107 INTERNAL USE

CCNR, specifically in the Iron Pressure Carbonyl (IPC)
(W) Instrumentation Lab about the hazards of nickel
protocole

I advised it has an airborne exposure limit (ceiling) of
10. As there is a risk of exposure at the CCNR/EW all
site and adhere to the Carbonyl Health Surveillance

I contains carbonyl

filter in the vicinity alarms and an interfering source

is of nickel, which will be reflected in urinary nickel
every nickel test only correlates with exposure but also
in and/or systemic illness. In the event of a suspected
inhal carbonyl exposure severity and determining the
to classification, treatment with the chelating agent

toxicity is not known. As well, the chelating agent
injection of nickel from the body, is not recommended
accoun from working in the IPC, Utilities and the EW

As Tar 3 Plant Introduction and the Annual Carbonyl

Acknowledgement statement:

Vale Copper Cliff Nickel Refinery
Release form for personnel working in or visiting the IPC, Utilities or Electrowinning Instrumentation Lab

Name: _____ Employee ID Number: _____
Address: _____ Postal Code: _____

Reason for release form completion: Employee/Contractor working at CCNR
 CCNR Visitor

I have received the information concerning the potential health hazards of exposure to Nickel Carbonyl.

Signature: _____ Date: _____
Witness: _____ Date: _____

[Click Here to Acknowledge You Have Completed Your Review of this Policy](#)

5.56 Response to Suspected Exposure to Carbonyl

Biological Controls

Response to Suspected Exposure to Carbonyl



At Work

- Proceed to First Aid
- Provide urine sample
- Continue to follow Working with Carbonyl Protocol



Outside of Work

- Proceed to nearest Hospital
- Present yellow card to Emergency Physician

5.57 Work Practices

Biological Controls

Carbonyl Exposure - Treatment

If exposure has evolved to *stage III*, you will need to be treated in order to reverse the effects. The treatment for Carbonyl exposure is **Antabuse®** and it is the only substance available to speed the removal of nickel from the lungs.

Antabuse binds to the nickel in the blood and increases the rate of excretion in the kidneys.

Antabuse was developed for treating recovering alcoholics therefore interaction of this drug with alcohol is severe.

The product is generally very safe, except during pregnancy.



5.58 Personal Hygiene and Best Work Practices:

Work Practices

In addition to controls already mentioned, there are things that you as a worker can do to mitigate the risk associated to working with Nickel.

- Always use common sense
- Set and maintain high safety standards
- Protect yourself
- Remember that you are the last line of defense against nickel exposure and related illness
- Your safety and long term health depend directly upon the choices you make each day
- Follow good personal hygiene practices



5.59 Work Practices

Work Practices

Personal Hygiene and Best Work Practices:

In order to provide for the health and hygiene of all personnel and visitors who work at the CCNR complex, several “**Day Use Lockers**” have been identified throughout the dry.



5.60 Personal Hygiene and Best Work Practices:

Work Practices

Personal Hygiene and Best Work Practices

Guidelines for the use of "Day Use Lockers:"

- Off site personnel may use one or two lockers as required. More than two lockers for a single user is not permitted.
- Lockers are to be used for a single day (duration of the shift) only.
- Locks are not to be left on the lockers when the user is not on site.
- Locks left on lockers for more than 1 day will result in the locks being cut, and the contents of the locker bagged. Any items left in an unlocked locker will be bagged.
- Personal locks must be provided by the user. Red lock-out locks are not permitted and will be removed immediately. Included with the use of a day use locker is the use of the shower and washing facilities in the dry.
- Day use lockers are available in both the Men's and Women's dry in the CCNR administration building.

5.61 Question 7

(Multiple Response, 10 points, 1 attempt permitted)

6. Plant Hazards

6.1 *Quality Assurance*



Plant Hazards and Controls

6.2 Plant Hazards & Controls

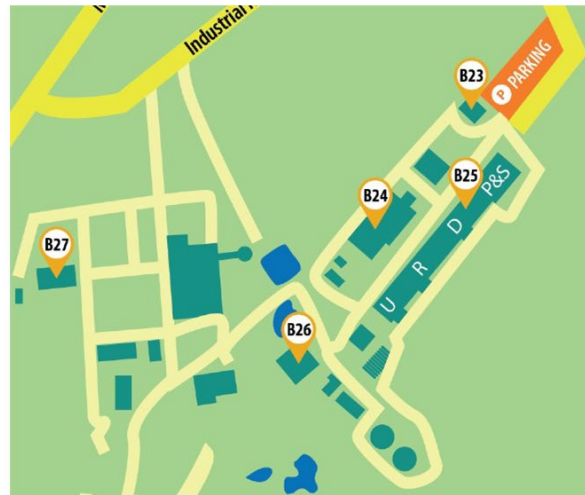
Plant Hazards & Controls

At the Nickel Refinery, contractors and visitors sign in at the main gatehouse when arriving at the complex.

Each building within the complex has its own individual sign in process as well as its own set of hazards and controls.

This section will review the sign in processes, hazards and controls, for the following areas.

- NRC
 - MYN Storage Building
 - TBRC Off Gas Baghouse
- IPC



7. NRC

7.1 NRC Hazards & Controls



NRC

Hazards & Controls

7.2 Sign-in Procedure

Sign-in Procedure

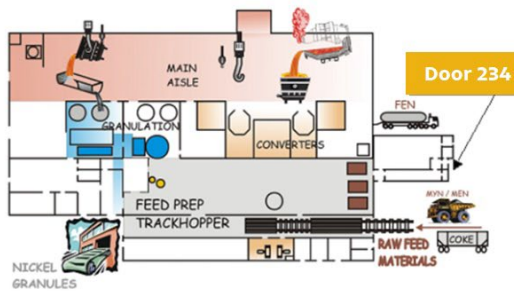
To work in the NRC Building, or any outside associated area, you must first proceed directly from the Gatehouse to the NRC Sign-In Station.

To Get to the NRC Sign-In Station, enter the NRC Building at Door 234 (east end of NRC Administration Building).

The NRC sign-in station is located just inside Door 234 on the main floor.

From the sign-in station, page the NRC Operator or your Contact Person as per the directions posted at the station.

To access the Converter Platform or enter the NRC Control Room, you must get permission from the NRC Control Room at 705-682-7232.



Inform your Vale contact person when you are on site so that you may start your job.

7.3 Site Specific Hazards

Site Specific Hazards

Using the tools that you learned in Tier 1 Orientation, ensure to use operation controls to mitigate risk associated to the identified hazards within the NRC Building.



Be Aware

Be aware of my surroundings and the risks around me.



Follow Policies & Procedures

Our internal policies and procedures guide us in doing our work in a manner that reduces risk.

The following section lists identified hazards that may be encountered in the work you're doing. Knowing if these hazards apply to your work can be found through:

- Vale Contact Person
- PHA/PHR (or other Risk Assessment Tools)
- SLAM

7.4 Site Specific Hazards

Site Specific Hazards

The NRC Area has workplace specific hazards that have been identified and need to be controlled.

These include but are not limited to:

- Molten Metal
- Sulphur Dioxide (SO₂)
- Oxygen (O₂)
- Carbon Monoxide (CO)
- Production crane activity



7.5 Molten Metal - Hazard

Molten Metal – Hazard

Molten Metal at 3000 3000 °F (1650 °F) is created in the NRC Top Blown Rotary Converters (TBRCs).

It is poured into Transfer Ladles and conveyed to Granulation by a 75 Ton Crane.

It is then passed through high-pressure water sprays and transformed into Dry Metallic Granules.



7.6 Molten Metal Hazard

Molten Metal Hazard

Hazards associated with hot metal include:

Hot metal burns – Splashes associated with hot metal processes

Explosions – molten metal coming in contact with water

SO₂ Gas – a by-product of the refining process

Hot Ladle Movement – Movement of ladles through the plant aisle

Radiant Heat Exposure – surfaces absorbing temperatures of the process (furnace walls, launders, flues, pots and ladles, etc.)

Radiation – ultraviolet rays emanating from hot metal flows

Heat Stress/Environment – atmospheric conditions combined with process heat exposure



7.7 Molten Metal Control

Molten Metal Control

Flashing Signs

When the **"DO NOT ENTER"** sign, located on the Blast Door accessing the Converter floor and the NRC Control Room is flashing, no person shall open the door.

The NRC Control Room and the platforms around the Converters are Restricted Areas. Permission is required from the NRC Control Room to gain access.



Molten metal, dust and gas can emit from the mouth of the Converter at any time.



7.8 Molten Metal Control

Molten Metal Control

Yellow Flashing Lights

Yellow flashing lights are located at all entrances to the Converter Area to indicate molten metal is being processed in the TBRCs.

A warning horn will also sound before the converter hood opens.



CAUTION:

Never walk behind a TBRC without permission from the NRC control room



7.9 Molten Metal Control

Molten Metal Control

Red Flashing Lights

Red Flashing Lights are located at all entrances to the main aisle to indicate that molten metal is about to be poured from a Converter and transferred to Granulation via the 75 Ton Crane.

Inform an operator and contact person if water is found spilled or leaking.

Because molten slag may still be cooling, do not walk through the slag pit area.



Water and molten metal are an explosive combination. Do not enter the area when the red light is flashing

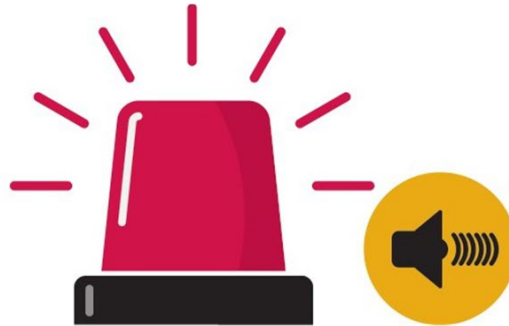
7.10 Molten Metal Control

Molten Metal Control

Red Flashing Lights Accompanied with a Warning Horn

Red flashing lights and a warning horn indicates molten metal is about to be granulated.

These lights are located at all entrances leading to the granulation area. When the red light is flashing, stop and do not enter the area.



7.11 Sulfur Dioxide (SO₂) - Hazard

Sulfur Dioxide (SO₂) – Hazard

When a TBRC (Top Blown Rotary Converter) hood is opened, low concentration Sulphur Dioxide (SO₂) gas may rise to the 3rd and 4th floor Feed Prep Area.

As a result of this process, workers can be exposed to Sulphur Dioxide, a colourless, gas with a sharp, pungent, suffocating or choking odor.

- SO₂ is soluble in water. In water, Sulphur Dioxide is converted to sulfurous acid; this acid is what causes irritation of the nose and throat, rhinorrhea, choking, cough and in some instances reflex bronchoconstriction with increased pulmonary resistance.
- For concentrations between 10–20ppm the following symptoms typically occur:
 - Inhaled SO₂ is only slowly removed from the respiratory tract. After absorption in the blood stream, the sulfurous acid is widely distributed throughout the body, quickly converted to sulfite and bisulfite, which in turn is oxidized to sulfate and excreted in the urine.



7.12 Sulfur Dioxide (SO₂) - Hazard

Sulfur Dioxide (SO₂) – Hazard

Individuals with asthma can be much more susceptible to the respiratory effects of sulfur dioxide (SO₂).

The TWA or “time-weighted average limit” for SO₂ to which a worker may be exposed in a work day or work week is:

TWA (8 hour shift) = 2 ppm

TWA (10 hour shift) = 1.6 ppm

TWA (12 hour shift) = 1.33 ppm

STEL” or “short-term exposure limit” means the maximum airborne concentration of SO₂ to which a worker may be exposed in any 15-minute period. STEL (15 min) = 5 ppm



7.13 Sulfur Dioxide (SO₂) - Hazard

Sulfur Dioxide (SO₂) – Hazard

Long Term Health effects

- NIOSH has recognized the phenomenon that adaptation to irritating concentrations of SO₂ occurs in experienced workers. Other studies have shown that acclimatization to the subjective effects of SO₂ does occur. This will result in detection and recognition in the upper concentration ranges outlined previously.
- Long-term occupational exposure to sulfur dioxide has been associated with respiratory effects such as decreased pulmonary function and increased incidents of chronic bronchitis. However, the information located is not sufficient to draw firm conclusions (CCOHS).
- **Sulfur dioxide is not known as a respiratory sensitizer. However, in some cases workers have developed asthma following short or long-term exposure to sulfur dioxide. This effect is most likely due to airways hypersensitivity caused by severe irritation of the respiratory tract, which occurs following "gasing".**



7.14 Sulfur Dioxide (SO₂) - Hazard

Sulfur Dioxide (SO₂) – Hazard

Long Term Health effects

- **Sulfur dioxide is not known to be a human carcinogen. Several human population studies have examined the possibility that sulfur dioxide may cause cancers such as lung cancer, stomach cancer or brain tumours. In all of the studies, there were uncontrolled confounding factors, such as concurrent exposure to other chemicals.**
- The International Agency for Cancer (IARC) has reviewed these studies and concluded there is inadequate evidence for carcinogenicity in humans. There is limited evidence of carcinogenicity in animals.

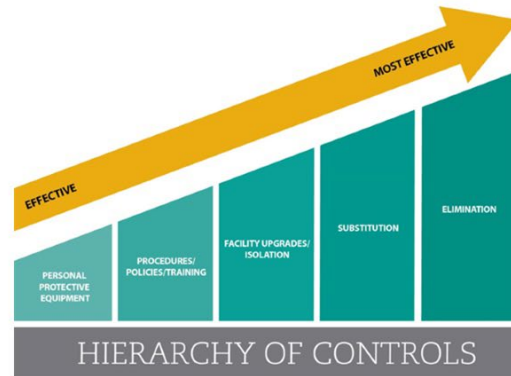


7.15 Sulfur Dioxide (SO₂) - Control

Sulfur Dioxide (SO₂) – Control

To maintain the health of workers and contractors within the NRC, controls have been put in place to reduce the risks associated with elevated exposure concentrations of sulfur dioxide (SO₂).

The following covers the details of the NRC SO₂ Policy.



7.16 Sulfur Dioxide (SO₂) - Control

Sulfur Dioxide (SO₂) – Control

NRC SO₂ Policy

A minimum half face air purifying respirator (NIOSH-approved) with a combination particulate and chemical cartridge(s) (ie: P-100/OV/Acid Gas) appropriate for sulfur dioxide must be carried on each worker accessing the NRC.

User Shall;

- Wear the appropriate respirator when required.
- Use the respirator in accordance with instructions and training received.
- Check that the respirator is in good operating condition.
- Fit-check the face to facepiece seal immediately after donning.



7.17 Sulfur Dioxide (SO₂) - Control

Sulfur Dioxide (SO₂) – Control

NRC SO₂ Policy

A minimum half face air purifying respirator (NIOSH-approved) with a combination particulate and chemical cartridge(s) (ie: P-100/OV/Acid Gas) appropriate for sulfur dioxide must be carried on each worker accessing the NRC.

User Shall;

- Take all precautions to prevent damage to the respirator and report any malfunction or damage to your supervisor.
- Clean the respirator after each use.
- Be clean-shaven where the facepiece seals to the skin.



7.18 Sulfur Dioxide (SO₂) - Control

Sulfur Dioxide (SO₂) – Control

NRC SO₂ Policy

The SO₂ levels in Area 4 (972') and Area 3 (1002') are monitored using (PI Coresight). Lights and horns are used to alert workers to the presence of SO₂ in the workplace.

SO₂ ALARM 1 = 2ppm or above, less than 20 ppm

- SO₂ gas detected by the area monitors.
- SO₂ gas level reaches 2 ppm – 20 ppm, Intermittent red lights and buzzers (2 buzzes with red lights, then a pause) repeats until gas level is below 2 ppm.
- Don ½ face, perform SLAM and egress to fresh air or continue working only if SLAM indicates it would be safe to do so.



7.19 Sulfur Dioxide (SO₂) - Control

Sulfur Dioxide (SO₂) – Control

NRC SO₂ Policy

The SO₂ levels in Area 4 (972') and Area 3 (1002') are monitored using (PI Coresight). Lights and horns are used to alert workers to the presence of SO₂ in the workplace.

SO₂ ALARM 2 = 20 ppm or above

- SO₂ gas level reaches 20 ppm and above, red lights and buzzers turn on/off repeatedly until SO₂ level is below 20 ppm, then intermittently until below 2 ppm.
- Egress to fresh air unless wearing a higher level of PPE protection and using a portable monitor.



Continuous (Slide Layer)

Sulfur Dioxide (SO₂) – Control

NRC SO₂ Policy

The SO₂ levels in Area 4 (972') and Area 3 (1002') are monitored using (PI Coresight). Lights and horns are used to alert workers to the presence of SO₂ in the workplace.

SO₂ ALARM 2 = 20 ppm or above

- SO₂ gas level reaches 20 ppm and above, red lights and buzzers turn on/off repeatedly until SO₂ level is below 20 ppm, then intermittently until below 2 ppm.
- Egress to fresh air unless wearing a higher level of PPE protection and using a portable monitor.



7.20 Sulfur Dioxide (SO₂) - Control

Sulfur Dioxide (SO₂) – Control

NRC SO₂ Policy

At **2 ppm SO₂**, workers don their ½ face respirator and egress to fresh air or continue working only after evaluating the risk.

At **20 ppm** the ½ face respirator is no longer effective and the workers must egress to fresh air.

If employees are going to be working in a restricted location (e.g. MEWP, scaffold at heights, confined spaces, etc) a portable SO₂ monitor is to be worn.

Higher levels of PPE protection can be used after completing formal risk assessment.



7.21 Sulfur Dioxide (SO₂) - Control

Sulfur Dioxide (SO₂) – Control

NRC SO₂ Policy

As part of the process the TBRC's are opened.

There is an announcement over the P.A. system within the NRC indicating the hood(s) will be opening.

There are rare occasions that the hood will open (WITHOUT an announcement) due to a safety issue within the process.

EXPECT SO₂ to be present and follow the controls to work safely in the NRC.



7.22 Oxygen - Hazard

Oxygen - Hazard

Fire is the primary hazard associated with gaseous oxygen and highly concentrated sources of oxygen promote rapid combustion.

Oxygen is used in the TBRCs (with Natural Gas) to melt raw materials into molten metal.

In general, the area surrounding any oxygen equipment shall be treated as a hazardous location.



7.23 Oxygen - Hazard

Oxygen - Hazard

Fire and explosion hazards exist when concentrated oxygen and fuels are brought into close proximity. Oxygen is the oxidant, not the fuel, but nevertheless the source of most of the chemical energy released in combustion.

Concentrated Oxygen will allow combustion to proceed rapidly and energetically. Steel pipes and storage vessels used to store and transmit both gaseous and liquid oxygen will act as a fuel; and therefore the design and manufacture of oxygen systems requires special training to ensure that ignition sources are minimized.

Explosions may occur in locations where a mixture of fuel gas and oxygen can accumulate.

Materials easily ignited in air not only become more susceptible to ignition, but also burn with added violence.



7.24 Oxygen - Control

Oxygen - Control

When maintenance work is performed on oxygen equipment, precautions need be taken similar to those employed in other hazardous locations:

- Use non-sparking tools. A burning permit is required to govern the use of electric drills and impact wrenches.
- All pipes and fittings must be installed free of flammable oil and grease.
- Where threaded joints are necessary, no grease or pipe fitting compounds containing oil are to be used.
- Purge oxygen cylinder valves before connecting regulators.



7.25 PPE - Clothing Precautions

Oxygen - Control

PPE – Clothing Precautions

- For your own protection, you must not wear oily or greasy clothing or wear oil stained gloves when working on or near oxygen equipment. These are easily ignited and greatly increase the possibility of injury.
- Rags, which may have been used for wiping up oil spillage, must be kept away from the work areas with exposed oxygen lines and not carried in your pockets.
- Clothing worn in areas subject to possible oxygen rich air should be carefully selected for minimum combustibility. Clothing should be well fitted, yet easy to remove. It must be free from oil and grease.
- If clothing should accidentally become saturated with an oxygen-enriched atmosphere, the clothing must either be changed or the person remain for a period of at least thirty (30) minutes in a well-ventilated area avoiding smoking and all other sources of ignition during this period.

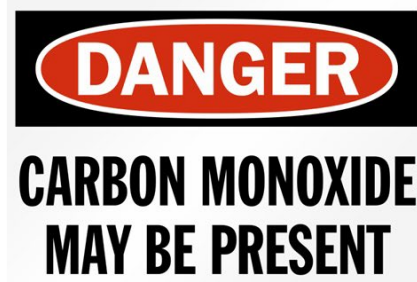


7.26 Carbon Monoxide- Hazard

Carbon Monoxide- Hazard

The NRC has many TSSA appliances that are used throughout the NRC in process and building/workroom maintenance.

A byproduct with these appliances are products of combustion (CO), which can create an unsafe condition of high levels of CO that you could be exposed to during work activities such as, performing crane inspections.



7.27 Production Crane - Hazard

Production Crane – Hazard

Cranes are used to facilitate the movement of materials throughout the plant. Some of the hazards associated to crane movement:

- Suspended Loads.
- Contact with stationary equipment.
- Hot Metal Splashes from ladles while in transport.
- Hot spots and subsequent cut-outs which can lead to uncontrolled flows of metal on ladles being hoisted.



7.28 Production Crane - Control

Production Crane – Control

To maintain the safety of employees working around cranes the following controls are in place:

- Flashing red lights indicate that an overhead crane is being used; look up before entering areas.
- The cranes also have sirens to warn you that they are in use.
- Do not walk under a suspended load.
- Listen and watch for crane travel before crossing any part of the NRC Aisle.



In the NRC, whenever granulating, the entire building is restricted, identified by red flashing lights.

7.29 Question 17

(Multiple Choice, 10 points, 1 attempt permitted)

8. MYN Storage

8.1 Quality Assurance



8.2 Sign-in Procedure

Sign-in Procedure

To work in the MYN Building, you must first proceed directly from the Gatehouse to the NRC Sign-In Station.

At this sign-in location, all workers must account for themselves in the logbook, specifying 'MYN Building', under the location tab.

Next, workers must contact the NRC Dayshift Yard Supervisor or their designate. If your work is after hours, contact the NRC Control Room at 705-682-7232.



All workers entering the MYN building require a radio. If you do not have one, radios can be signed out at the CCNR Gatehouse.



8.3 Dust & Gas - Hazard

Dust & Gas - Hazard

Dust and Gas generated from the movement and storage of MYN, along with atmospheric contaminants from heavy industrial mobile equipment may contain various elements (e.g.: lead, NO_x gas, arsenic, silica, nickel) that could cause health problems without proper controls.

Due to the nature of the process in this building, these hazards are generated and are present in the work environment.



8.4 Dust & Gas - Hazard

Dust & Gas - Hazard

How can dust and gases enter my body?

- The Primary routes of entry are inhalation, ingestion and skin absorption (although very little is absorbed through skin and into bloodstream)

How can it affect me?

- Continuous exposure to dust and gases increases the risk of long term lung conditions and diseases and in the past, has been associated with increased respiratory cancers.
- Allergic contact dermatitis or “nickel itch” can result after prolonged and direct contact.
- The Nervous system can be affected (i.e. weakness, tremors, behavioural changes, impaired vision or hearing impairment).
- Damage to the Kidneys.
- Reproductive toxicity (may harm developing fetus, affect male fertility by lowering sperm count).



8.5 Dust & Gas – Control

Dust & Gas – Control

To mitigate the health hazards of dust and gases, controls have been put in place in the MYN Building to reduce the risks associated with acute and chronic exposure.

Work and hygiene practices:

- Wash your face and hands, scrub your nails before eating, drinking and/or smoking.
- Shower, wash, change before going home.
- Eat and drink only in designated areas.
- Keep your work area clean by performing daily housekeeping and
- Report any illness or injuries right away (even if thought to be minor).



8.6 Dust & Gas - Control

Dust & Gas - Control

To mitigate the health hazards of dust and gases, controls have been put in place in the MYN Building to reduce the risks associated with acute and chronic exposure.

Engineering Controls

- Stationary CO monitors are installed in the building and will alarm at 25ppm for workers to exit the building.
- Stationary NOx monitors are installed in the building and will alarm at 3PPM for workers to exit the building.
- A yellow light and horn indicate that monitors have tripped. If this occurs, leave the building immediately and contact 7232 (NRC Control Room).



8.7 Dust & Gas - Control

Dust & Gas - Control

To mitigate the health hazards of dust and gases, controls have been put in place in the MYN Building to reduce the risks associated with acute and chronic exposure.

Work Practices

- Half mask respirators must be worn at all times within the MYN Building.
- When entering or exiting the building always use door 304 when possible and it is safe to do so.
- Be aware of additional mobile equipment hazards in this area.



8.8 Dust & Gas - Control

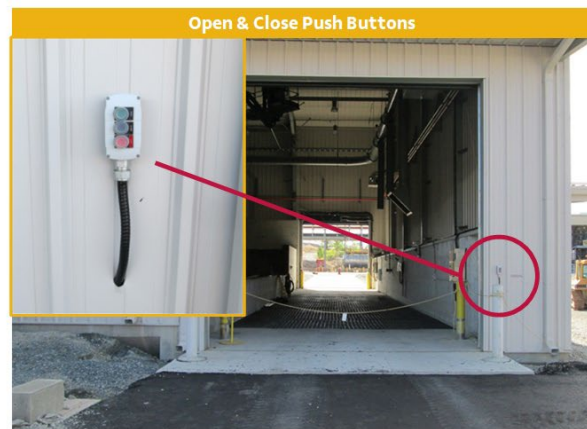
Dust & Gas - Control

To mitigate the health hazards of dust and gases, controls have been put in place in the MYN Building to reduce the risks associated with acute and chronic exposure.

Work Practices

Prior to entering the building, turn on the bag house and MAU (Make-up air unit):

- Hit the "door open" button located at any of the roll up doors.
- Ensure the green light turns on and the bag house is running.
- Wait approximately 1 minute – ensure MAU turns on.
- If the green light stays lit, the work crew may enter the building.



8.9 Question 20

(Multiple Choice, 10 points, 1 attempt permitted)

9. IPC

9.1 *Quality Assurance*



IPC Area

Hazards & Controls

9.2 Sign-in Procedure

Sign-in Procedure

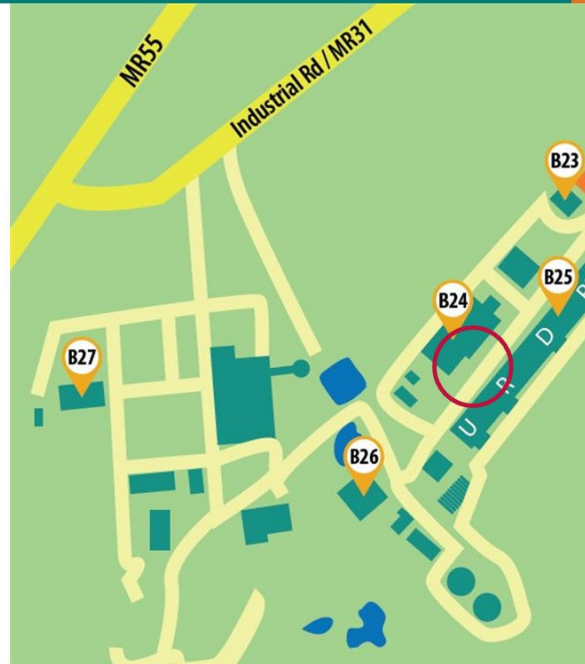
To work in the IPC Building, or any outside associated area you will first proceed directly from the Gatehouse to the IPC Main Control Room (3rd Floor).

To get to the IPC control room: enter door 351 (on south side of building),

- Take the elevator or stairs to the 3rd floor,
- The IPC control room is on the left.



Inform your Vale contact person when you are on site so that you may start your job.



9.3 Sign-in Procedure

Sign-in Procedure

Because of the high risk hazards associated to this area, one of the controls to mitigate risk is a vigorous work management system which includes forms to be completed jointly by the contact person and the contractor:

Safety Checklist	Contractor Safety Card	IPC Building Work Permit	Area Work Permit	Safe Work Permit (SWP)	Flange Management Program
Is completed by the Contact Person with the Contractor.	Is completed by the Contact Person with the Contractor Representative for each crew member	Is completed by the CCNR Operating Authority and the Contractor Representative.	Is completed and signed by the Area operator before any work can begin.	Maintenance worker arrives with a work order/PTS checklist and signs into the respective area.	The Flange Management Program is intended to: clearly identify the status of flanged connections in the field.
Is only valid for the job indicated.	Is only valid for the duration of the indicated.	Is only valid for the shift issued.	Is valid for the Operators shift.	Operator and Maintenance worker go into the field with the completed SWP.	Ensures all flanged connections are maintained in accordance with its respective specifications.
The questions on the checklist pertain to the Contractor Representative and each crew member working on the job.	The safety card indicates the employees name, start and finish date, job description, location and the name and number of the Plant Contact person and Alternate.	The IPC work Permit is vital to the accounting process, keeping track of off-site employees working throughout the IPC Building and associated areas.	The Area Work Permit verifies the equipment to be ready and safe by the Operator. A new Permit must be issued if work continues into the next shift.	Operator and worker verify that the hazards and controls are in place as indicated on the permit.	Flange tags will be applied in the field to the applicable flanged connections during maintenance activities.
The Safety Checklist must be signed and dated by the CCNR Contact Person and the Contractor Representative.	First Aid and Fire emergency phone numbers are listed for quick reference.	Special safety precautions and instructions are also listed.	The Contractor Representative and the Area Operator must sign the permit together before any work can begin.	Operator and worker sign the permit.	Tags to be given to the Operations Supervisor.
One copy stays in the sign-in area, the other is given to the Contractor Representative.	You may be asked to show your safety card.	When the work is complete, the permit must be signed off by the Contractor representative and the Operating Authority.	Prior to leaving the area, the Contractor Representative must first relate the work status, then sign off the permit with the Area Operator.	A copy of the permit is retained by the worker and the other copy is placed in the appropriate slot on the SWP Board.	

9.4 Sign-in Procedure

Sign-in Procedure

Once signed into the IPC Control Room, there are areas that have additional sign-in requirements. Additional sign-in station locations are as follows:

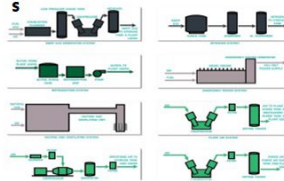
Utilities sign-in station is on the 2nd floor by the main gas compressors.

The **Reactor and Decomposer area** sign-in stations are located on the 3rd floor between the lunch room and the control room.

Packaging and Shipping sign-in station is on the main floor between packaging lines.

Page the operator as per the directions posted at the station. If there is no response, call the IPC control room at 705-682-7241 or 705-682-7242.

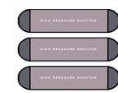
Utilities



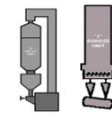
CO P&R



Reactor Area



Decomposer Area



Packaging & Shipping



9.5 Site Specific Hazards

Site Specific Hazards

Using the tools that you learned in Tier 1 Orientation, ensure to use operation controls to mitigate risk associated to the identified hazards within the IPC Area.



Be Aware
Be aware of my surroundings
and the risks around me.



Follow Policies & Procedures
Our internal policies and procedures
guide us in doing our work in a
manner that reduces risk.

The following section lists identified hazards that may be encountered in the work you're doing. Knowing if these hazards apply to your work can be found through:

- Vale Contact Person
- PHA/PHR (or other Risk Assessment Tools)
- SLAM

9.6 Site Specific Hazards

Site Specific Hazards

The IPC has workplace specific hazards that have been identified and need to be controlled.

These include but are not limited to:

- Asbestos
- Carbonyl
- Carbon Monoxide
- IPC residue (will burn in air)
 - Includes Cobalt, Lead and Arsenic
- Pressure vessels
- Inert gas

Communicate with your Vale contact person concerning the procedures pertaining to designated substances, product locations, and process hazards in your work area.

Separate training is required for handling and or working with designated substances.



9.7 Asbestos - Hazard

Asbestos - Hazard

Exposure to asbestos fibers can lead to serious health problems, it is important to take proper precautions to prevent exposure in the workplace.

Asbestos fiber bundles can split and small fine fibers can break away.

If inhaled the body is able to resist most of the large particles, *but fine fibers*, too small to see, can lodge deep in the lungs.

This can cause these diseases such as:

- Asbestosis
- Lung cancer
- Mesothelioma



9.8 Asbestos - Control

Asbestos - Control

To minimize the risks associated with asbestos, workers are encouraged to do the following:

Do not work on or disturb any materials until you have confirmed that the material does not contain asbestos.

To confirm the absence or presence of asbestos, contact your Vale Contact Person if suspected.

If the material is found to contain asbestos, the site contact will work with the Area Planner to have the material rendered safe by having it stabilized, encapsulated, repaired or removed in accordance with our protocols.

Once this is completed, the site will be released.



9.9 Carbonyl - Hazard

Carbonyl - Hazard

As mentioned in the working with Nickel section, carbonyl is a hazard of the IPC process. In particular, it can be generated in the High Pressure Reactors.

It has the potential to affect not only people in the immediate area but also outside of the plant and even in the community.



9.10 Carbonyl - Hazard

Carbonyl - Hazard

The hazards associated with Carbonyl are:

- Nickel Carbonyl, if inhaled will irritate the lungs, nose and throat causing shortness of breath and/or coughing.
- Exposure can cause headaches, dizziness, nausea, and confusion.
- Repeated exposure, or exposure to high levels can cause liver, kidney, and lung damage.
- Nickel Carbonyl is flammable and explosive, along with being a reactive chemical.
- Nickel Carbonyl is carcinogenic, and can irritate the eyes and burn the skin if contacted.



9.11 Carbonyl - Control

Carbonyl - Control

The working with nickel section eluded to several controls to mitigate the risks associated with Carbonyl.

These include but are not limited to:

- Portable (Monitors)
- Fixed (Monitors)
- Piping (Orange)
- Yellow flashing lights
(Carbonyl service, gasket change-outs)
- Propane Torches
- Emergency Protocol (Red Flashing Lights)

If your task requires you to work on carbonyl equipment, you require additional training (Working with Carbonyl) that can be scheduled through the Learning & Development Group at the Nickel Refinery.

Call: 705-682-7395 to book Working With Carbonyl Training



Untitled Layer 1 (Slide Layer)

Carbonyl - Control

The working with nickel section eluded to several controls to mitigate the risks associated with Carbonyl.

These include:

- Portable
- Fixed (
- Piping
- Yellow
- (Carbo
- Prepar
- Emerg

Potable Water	Inert Gas
Cooling Water	Nitrogen
Plant Water	Caustic
Closed Loop Water	Ammonia (Gas/Liquid)
Glycol	Ammonia (Aqueous)
Closed Loop Glycol	Natural Gas
Plant Air	Hydrogen
Purge Air	Acetate Solution
Instrument Air	Lub, Hydraulics/Fuel Oil
Breathing Air	CO and Carbonyl
Inert Gas Vent (IGV)	Residue
Dry Air Vent (DAV)	Flue Gas
Air Steam Vent (ASV)	Steam
Minor Leak Protection	Dry Handling
Process Vent Header	Fire Water
Relief Header Drain	Oxygen

If your task requires you to work on carbonyl equipment, you require additional training (Working with Carbonyl) that can be scheduled through the Learning & Development Group at the Nickel Refinery.

Call: 705-682-7395 to book Working With Carbonyl Training

9.12 Carbon Monoxide - Hazard

Carbon Monoxide – Hazard

Carbon Monoxide (CO) is the IPC Plant "Process" Gas. It is produced by CO Generators in the IPC Utilities. CO is volatile, flammable and toxic. Refer to the SDS sheet for further information.

It is introduced into the High Pressure Reactors and "reacts" with the nickel in the granules, becoming Nickel Carbonyl Ni (CO)₄.

As the "vehicle", it conveys the nickel, in gaseous and liquid form, through the process, eventually depositing the nickel "passenger" in a Pellet or Powder Decomposer Unit.



Carbon Monoxide (CO):

Volatile
Flammable Limits:
12.4 – 74.2% in Air.
Toxic
TLV: 25 PPM
Colourless, Odourless Gas



9.13 Carbon Monoxide - Control

Carbon Monoxide – Control

Because the hazards with carbon monoxide and carbonyl are closely related, the CCNR has implemented the following controls to mitigate the risk of exposure to workers.

The colour code for CO piping and vessels is orange.

Personal CO detectors are required in all IPC areas (shops and offices included). Persons working in or around the IPC building must have or at all times be with someone who has a CO detector.

Decomposing Carbonyl releases CO. If your Detector detects CO, Carbonyl may be present.



NOTE: Other gases, in addition to CO, may activate the Detector (i.e.: Hydrogen from Forklift Truck Batteries, Methane from natural sources etc).

9.14 IPC Residue - Hazard

IPC Residue – Hazard

A by-product of the refining process is the creation of a residue.

This residue can contain various metals such as lead, arsenic, cobalt among others.

It's most often piped from the CCNR as a slurry to Electrowinning.

The main hazard associated with IPC Residues is that it is pyrophoric, which means it will ignite spontaneously on exposure to air.



9.15 IPC Residue - Control

IPC Residue – Control

To mitigate the risk of pyrophoric reaction, the IPC has introduced the following controls:

- Additional ventilation has been installed in areas receiving IPC residue.
- Respirators (Job specific, could require Breathing Air).



9.16 High Pressure Storage Vessel - Hazard

High Pressure Storage Vessel – Hazard

The CCNR uses vessels to store substances under pressure higher than atmospheric conditions and these are found in various locations within the CCNR area.

Pressure vessels store large amounts of energy; the higher the operating pressure and the bigger the vessel, the more energy released in the event of a rupture and consequently the higher the extent of damage or the danger it poses, hence there should be no complacency about the risks.

Liquid Ammonia, CO, NiCO₄, Nitrogen, Steam, Glycol, and H₂O can all be found in pressurized vessels.



9.17 High Pressure Storage Vessel - Control

High Pressure Storage Vessel – Control

To minimize the risks associated with high pressure storage vessels, the following controls have been implemented:

Maintenance performs Non Destructive Evaluation (NDE) and structural integrity tests on a recurring basis.



Areas with high pressure vessels are considered 'restricted' and no entry permitted.



9.18 Inert Gas – Hazard & Control

Inert Gas – Hazard & Control



Inert Gas (IG) is produced in the IPC Utilities area. This Gas is used extensively throughout the IPC as a purge agent for several operations and vessel integrity (leak tests).

The main hazard associated with Inert Gas is that it can displace air, resulting in asphyxiation.



To control this hazard the plant has implemented the following:

The colour code for inert gas piping is black.

Do not enter or extend yourself into a process vessel or unit without following Vale's Confined Space Program. Confined Space includes several different topics:

- Training
- Purging
- Permits
- Authorization

9.19 Anhydrous Ammonia - Hazard

Anhydrous Ammonia – Hazard

Anhydrous ammonia is used to purify and recover CO process gas. It is delivered by truck and stored in the anhydrous ammonia storage tank near the incinerator building

From the tank, it is piped to the Carbon Monoxide Purification and Recovery area.

- Ammonia is lighter than air. Ammonia has a very pungent and suffocating odour.
- Ammonia is a poisonous and infectious material causing immediate and serious toxic effects.



9.20 Anhydrous Ammonia - Control

Anhydrous Ammonia – Control

To minimize the risks associated with Anhydrous Ammonia, the following controls have been implemented:

- There are several barriers installed in the storage tank area to prevent entry.
- Upon coming in contact with liquid Ammonia or high concentration vapour, flush the effected area for at least 15 minutes with copious amounts of water, then seek medical aid.
- If you have detected an Ammonia leak, back away to a safe location and contact the IPC Control Room @ 7241 or 7242.



9.21 Equipment Damage

Risk Management

As mentioned, there are controls to manage risk. Actions or inactions in response to controls may result in one of three conditions; an **Unsafe Condition**, a **Near Miss**, or an **Incident**. Any of the three must be reported immediately to a Supervisor or Contact Person.



Be aware.

Be aware of my surroundings and the risks around me.



Follow Policies & Procedures.

Our internal policies and procedures guide us in doing our work in a manner that reduces risk.

In the case of incidents, there may be additional steps required if the resulting action includes:

- Equipment Damage
- Personal Injury
- Process Upset

9.22 Question 23

(Multiple Choice, 10 points, 1 attempt permitted)

10. Accident/Incident Reporting

10.1 Accident/Incident Reporting



Accident/Incident Reporting

10.2 Accident/Incident Reporting

Accident/Incident Reporting

An incident is an event that results in loss or harm to personnel in the form of (injury/illness), environment, asset, or equipment.



Iris

Even with "near misses", all workers, including Offsite Personnel are encouraged to initiate and/or participate.

The Intent is to prevent recurrences and reduce or eliminate any further injuries.

Iris is our platform for reporting of problems and events related to health and safety, environment, communities and operational occurrences.

10.3 Personal Injury

Accident/Incident Reporting

Personal Injury/Equipment Damage

All incidents, accidents or injuries must be immediately reported by contacting the supervisor to register the event.

In the case of personal injury, generally, contact your Supervisor and report immediately to First Aid.

In the event you cannot physically report to First Aid, contact first aid for emergency response.

Copper Cliff Nickel Refinery CCNR - Emergency Numbers

First Aid.....705-682-7220

IPC Control Room.....705-682-7241

Plant Security...705-682-7214

NRC Control Room.....705-682-7232



Who can report problems and events?

Events can be reported by any employee or contractor who has access to the Vale network.



Reporting Deadline

All events must be registered within 48 hours.

11. Safe Work Permit/Flange Management

11.1 Safe Work Permit (SWP) / Flange Management



Safe Work Permit (SWP) / Flange Management

11.2 Safe Work Permit (SWP)

Safe Work Permit (SWP)

Safe Work Permit (SWP) is a process to control potentially hazardous work. It is applied when equipment or a work area is changing hands between the facility owners and the executors of the work, e.g. maintenance or project work.

The process is designed to ensure:

- Consideration is given to the risks of a particular job or simultaneous activities;
- Verification of controls in the field prior to the work beginning;
- Communication between Operations and those who carry out the work; and
- Agreement on what work is to be done and how the hazards are to be controlled.



11.3 Activities Requiring Permits

Safe Work Permit (SWP)

Activities Requiring Permits

Safe Work Permit applies to:

- Maintenance activities in an operational area, infrastructure or remote site (there is a handover of equipment or space).
- Maintenance of maintenance areas e.g. contractor repairing a crane in a welding shop.
- Project activities (capital or sustaining).



11.4 Activities Requiring Permits

Safe Work Permit (SWP)

Activities Requiring Permits

The following activities triggers the need for a SWP:

- Equipment isolations and lockboxes
- Hot work
- Confined space
- Excavation
- Critical lifts
- Line breaking
- Opening of process equipment
- High Pressure Washing



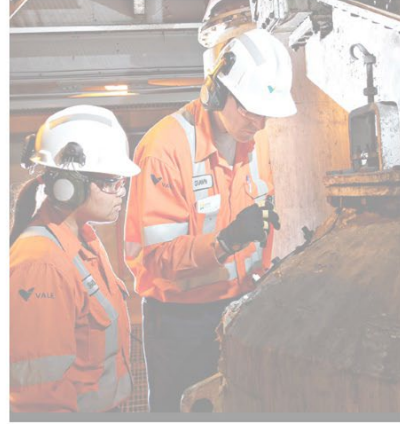
11.5 Activities Requiring Permits

Safe Work Permit (SWP)

Activities Requiring Permits

Exemptions:

- Non-intrusive maintenance work, e.g. visual inspections.
- Maintenance activity in a designated area e.g. normal work being performed in a maintenance shop.



11.6 SWP Form & Contents

Safe Work Permit (SWP)

SWP Form & Contents

Section A – Scope of Work & Permit Conditions

- Work area, activity description & equipment
- Activity trigger for permit
- Hazards & controls
- Reference documents (JHA, PHR, Procedure, SDS)

Section B – Issuer Sign-Off

- Operations Supervisor (Issuer)
- Authorize work to occur

Section C – Field Verification Sign-Off

- Operator (Verifier) & work execution team (Executors)
- Controls understood, present and verified

Section D – Permit Closure

- Equipment or area in safe state



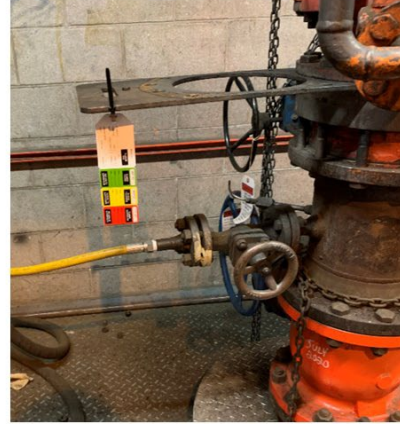
SECTION A - to be completed by Permit/Supervisor		Scheduled Date
W/O #	Description	
Operation #	Description	
Area/Location	Prepared by	Date
Work Activity covered in this permit (Separate Hot Work and Confined Space permits are still required)	<input type="checkbox"/> RAC 00-Moving at heights <input type="checkbox"/> RAC 00-Light motor vehicles <input type="checkbox"/> RAC 00-Mobile equipment operation <input type="checkbox"/> RAC 00-Lockout, tagout and zero energy <input type="checkbox"/> RAC 00-Lifting of loads <input type="checkbox"/> RAC 00-Confined spaces	<input type="checkbox"/> RAC 00-Machine guarding (i.e. removal) <input type="checkbox"/> RAC 00-Ground stability <input type="checkbox"/> RAC 00-Explosives <input type="checkbox"/> RAC 20-Work with electricity <input type="checkbox"/> RAC 11- Hot Metal <input type="checkbox"/> Other: _____
List equipment to be locked and tagged or isolated		
Task Hazards	Hazard	Control
<input type="checkbox"/> Confined Space		Permit # _____
<input type="checkbox"/> Hot Work		Permit # _____
<input type="checkbox"/> Open Hole		Permit # _____
<input type="checkbox"/> Excavation		Permit # _____
<input type="checkbox"/> Fall from height		
<input type="checkbox"/> Tipping hazards		
<input type="checkbox"/> Overhead hazards		
<input type="checkbox"/> Chemical hazards		
<input type="checkbox"/> Hot metal		
<input type="checkbox"/> Residual energy		
<input type="checkbox"/> Ergonomic hazards		
<input type="checkbox"/> Pressurized lines		
<input type="checkbox"/> Fire/Explosion		
<input type="checkbox"/> Heat/Cold Stress		
<input type="checkbox"/> Noise/Dust		
<input type="checkbox"/> Material in bins/dumps		
<input type="checkbox"/> Mobil Equip.		
<input type="checkbox"/> Line of fire hazards		
<input type="checkbox"/> Others		
Documents	<input type="checkbox"/> JHA <input type="checkbox"/> PHR <input type="checkbox"/> Procedure <input type="checkbox"/> Rescue Plan <input type="checkbox"/> Other	
SECTION B - to be completed by work authorize/area supervisor (Permit Issuer)		
I acknowledge that I have authority over the work area and process. I authorize the work described on this permit to occur. Name & Signature: _____ Date and Time: _____		
SECTION C - to be completed by verifier and authorized personnel (Field Verification)		
The controls listed in Section A are understood, present and verified mitigating against the hazards that I am aware of.		
Operations	Maintenance/Worker	
Name: _____	Name: _____	
Signature: _____	Signature: _____	
Signature: _____	Signature: _____	
Proceed with work execution. If new hazards are identified during execution, stop work until additional controls are applied.		
SECTION D - to be completed by work authorizer/area supervisor & the supervisor on end of job		
Equipment tested	<input type="checkbox"/> Guards reinstalled <input type="checkbox"/> Tools Removed <input type="checkbox"/> Equipment Deactivated <input type="checkbox"/> Other	
Equipment Status Notes: _____		
I acknowledge that the equipment and work area referred to in this permit has been returned in a safe state and that the permit is deemed closed. Permit Issuer Sign off: _____ Date and Time: _____		

11.7 Flange Management Program

Flange Management Program

The Flange Management Program is intended to:

- Clearly identify the status of flanged connections in the field.
- Ensure all flanged connections are maintained in accordance with its respective specifications.



11.8 Flange Management Program

Flange Management Program

The status of flanges will be tracked in the field by the application of Flange Tags to the applicable flanged connections during maintenance activities.

There are four status stages in the Flange management program, these are:

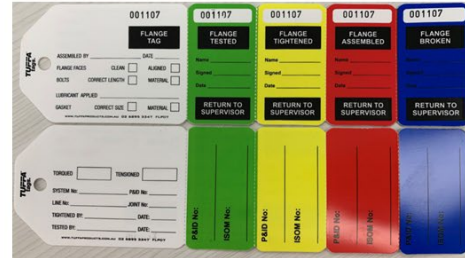
Flange Broken:

Flange connection has been disturbed. This includes isolation, loosened and flanges requiring a re-gasket.

Flange Assembled: Flange connection has been properly re-assembled and ready for a final torque check. This includes de-isolated and re-gasketed flanges.

Flange Tightened: Final torque has been completed on the connection as it is ready to be tested.

Flange Tested: Final pressure check has been completed and the flange is ready to be put back in service.



[Click to zoom](#)

During each stage of the process to disturb and reassemble a flange, one of the associated color tags will be removed.

If you are required to work on any of the flanges covered by this program, ensure to review:

Procedure - 11_0_2 Flange Assembly and Flange Tag Procedure prior to commencing work.

Zoom view (Slide Layer)

Flange Management Program

001107

FLANGE TAG

ASSEMBLED BY _____ DATE _____

FLANGE FACES CLEAN ALIGNED

BOLTS CORRECT LENGTH MATERIAL

LUBRICANT APPLIED _____

GASKET CORRECT SIZE MATERIAL

WWW.TUFFAPRODUCTS.COM.AU 02 8895 3347 FLPG7

001107

FLANGE TESTED

Name _____

Signed _____

Date _____

RETURN TO SUPERVISOR

001107

FLANGE TIGHTENED

Name _____

Signed _____

Date _____

RETURN TO SUPERVISOR

001107

FLANGE ASSEMBLED

Name _____

Signed _____

Date _____

RETURN TO SUPERVISOR

001107

FLANGE BROKEN

Name _____

Signed _____

Date _____

RETURN TO SUPERVISOR

TORQUED TENSIONED

SYSTEM No: _____ P&ID No: _____

LINE No: _____ JOINT No: _____

TIGHTENED BY: _____ DATE: _____

TESTED BY: _____ DATE: _____

WWW.TUFFAPRODUCTS.COM.AU 02 8895 3347 FLPG7

Click to Hide

11.9 Question 1

(Multiple Choice, 10 points, 1 attempt permitted)

12. Emergency Preparedness

12.1 *Emergency Preparedness*



Emergency Preparedness

12.2 Emergency Preparedness

Emergency Preparedness

The Surface Tier 2 Orientation provided guidance on the application of Emergency Preparedness including activating an emergency and how to classify one.

The following is how to respond to an emergency at the Copper Cliff Nickel Refinery.



12.3 Emergency Tone Alert

Notification

Emergency Tone Alert and Announcement

A level emergency at CCNR is communicated by an emergency tone alert and a PA announcement.

The purpose of the tone alert is to draw attention to a PA announcement which will provide the necessary details regarding the type of emergency and its location.



If you are working in an outlying area where emergency announcements cannot be heard, the CCNR has radios that are equipped with an emergency channel.



[Click here for audio sample](#)

Tone Alert (Slide Layer)

Notification

Emergency Tone Alert and Announcement

A level emergency at CCNR is communicated by an emergency tone alert and a PA announcement.

The purpose of the tone alert is to draw attention to a PA announcement which will provide the necessary details regarding the type of emergency and its location.



If you are working in an outlying area where emergency announcements cannot be heard, the CCNR has radios that are equipped with an emergency channel.



[Click here for audio sample](#)

[Return](#)

12.4 Emergency Air Horn

Notification

Emergency Air Horn

The Emergency Air Horn is activated during a LEVEL III Emergency only.

It does not stop until the level is reduced.



If you are working in an outlying area where emergency announcements cannot be heard, the CCNR has radios that are equipped with an emergency channel.



[Click here for audio sample](#)



Emergency Siren (Slide Layer)

Notification

Emergency Air Horn

The Emergency Air Horn is activated during a LEVEL III Emergency only.

It does not stop until the level is reduced.



If you are working in an outlying area where emergency announcements cannot be heard, the CCNR has radios that are equipped with an emergency channel.



[Click here for audio sample](#)

[Return](#)



12.5 Local Evacuation

Notification

Local Evacuation

The IPC has its own unique notification referred to as a “Local Evacuation” if the emergency is confined to one area within the IPC.

The local evacuation notification effects no other areas within the IPC or the CCNR complex.

All departments in affected plant are notified. Notification to personnel is communicated by a steady tone alert followed by an emergency announcement.



Remember: At the IPC a steady tone is a “local evacuation” and an intermittent tone is a “level emergency” and you need to evacuate



[Click here for audio sample](#)

Emergency Siren (Slide Layer)

Notification

Local Evacuation

The IPC has its own unique notification referred to as a “Local Evacuation” if the emergency is confined to one area within the IPC.

The local evacuation notification effects no other areas within the IPC or the CCNR complex.

All departments in affected plant are notified. Notification to personnel is communicated by a steady tone alert followed by an emergency announcement.



Remember: At the IPC a steady tone is a “local evacuation” and an intermittent tone is a “level emergency” and you need to evacuate



[Click here for audio sample](#)

[Return](#)

12.6 Local Evacuation

Notification

Local Evacuation

Alert Centre (#1 First Aid) is not notified.

May be called at the discretion of an area Operator, Supervisor, Control Room Supervisor and/or Superintendent.

A local evacuation is automatically called when:

Nickel Carbonyl is detected and the monitor sample point reaches 5 ppb (7ppb, given 2 ppb floating zero), or two consecutive readings on the same sample point exceeds 2 ppb (4ppb, given 2 ppb floating zero). or,

Carbon Monoxide is detected and the monitor sample point reaches 25 ppm.



Remember: At the IPC a steady tone is a "local evacuation" and an intermittent tone is a "level emergency" and you need to evacuate



[Click here for audio sample](#)

Local Evacuation (Slide Layer)

Notification

Local Evacuation

Alert Centre (#1 First Aid) is not notified.

May be called at the discretion of an area Operator, Supervisor, Control Room Supervisor and/or Superintendent.

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Carbon Monoxide is detected and the monitor sample point reaches 25 ppm.



Remember: At the IPC a steady tone is a "local evacuation" and an intermittent tone is a "level emergency" and you need to evacuate



[Click here for audio sample](#)

[Return](#)

12.7 NRC Emergency Siren

Notification

NRC Emergency Siren

The NRC Emergency Siren (located inside the NRC) warns everyone within the NRC Building of a major emergency.



[Click here for audio sample](#)

NRC Siren (Slide Layer)

Notification

NRC Emergency Siren

The NRC Emergency Siren (located inside the NRC) warns everyone within the NRC Building of a major emergency.



[Click here for audio sample](#)

[Return](#)

12.8 Responding in an Emergency

Responding in an Emergency

The main CCNR Safe Assembly area is located in the Administration Building and you must report to the area within the complex as follows:

Admin Building South Dry

- Male Contractors

Admin Building North Dry

- Vale Production & Maintenance Personnel

Admin Building 2nd Floor Conference Room

- Administration building personnel
- Vale Staff
- Female Contractors



In addition, the Kelly Lake Pumphouse Assembly Trailer is available.

12.9 Responding in an Emergency

Responding in an Emergency

Signs with map illustrations are posted at strategic locations throughout the Nickel Refinery.

These maps include “you are here” markers to assist in finding surface safe assembly areas.



Prior to beginning work, orient yourself with respect to the Assembly Area, and plan your exit strategy.



12.10 Responding to a Carbonyl Notification

Responding to a Carbonyl Notification

Unlike other areas of Sudbury Operations, at the CCNR, depending on the level associated to a notification, different actions may be required due to the hazards that are in the area.

How to Respond to an Emergency at CCNR		
IPC Local Area Isolation	Evacuate carbonyl active area. Contact supervisor or Plant Contact.	<ul style="list-style-type: none">• If signed into an area, IPC must be informed that work has been discontinued.• Can work in unaffected areas if sample indicates no exposure.
Level I	Go to Assembly Area.	<ul style="list-style-type: none">• All personnel on property accounted for.• Employees are to submit urine sample based on triage.• Can work in unaffected areas if sample indicates no exposure.
Level II	Go to Assembly Area	<ul style="list-style-type: none">• All personnel on property accounted for.• Employees will submit urine sample based on triage.• Remain in Assembly Area until "All Clear".
Level III	Go to Assembly Area.	<ul style="list-style-type: none">• All personnel on property accounted for.• All personnel submit urine sample.• Remain in Assembly Area until "All Clear".

12.11 Responding to Warnings

Responding to Warnings

In addition to notifications related to possible exposures to hazards, the following are two examples of how the CCNR alerts workers by way of “warnings”:

Major Power Failure Warning:

In the event of a Major Power Failure lasting more than 5 minutes. Safely stop what you are doing. Operations personnel are to report to their control rooms. All non operating personnel report to their respective lunchrooms/trailers.

Storm Warning:

In the event of severe weather, an announcement will come over the PA indicating action that may include restricting certain work activities.



12.12 CCNR – Module Quiz

(Drag and Drop, 10 points, 1 attempt permitted)

13. Plant Exit

13.1 *Quality Assurance*



13.2 Plant Exit

Plant Exit

Good work practices dictate that you close the loop on work you were doing to avoid creating risks or hazards for other work groups, cross shifts, or other work in the area. Here are some tasks to consider when getting ready to exit the plant to ensure your safety and that of those around you:

- ✓ **Housekeeping** – Is your worksite cleaned up after your job?
- ✓ **Personal Lock and Tag** – Has your personal protection been removed at the end of the shift?
- ✓ **Status Tagging** – Is there ongoing work that needs a status tag placed or is there equipment in Bad Order that needs to be identified?
- ✓ **End States** – Have you left the process in the proper state?
- ✓ **Waste Segregation** – Have you disposed of materials in the appropriate waste receptacles/bin/area?
- ✓ **Control room** – Do I need to let the control room know that I'm clear of an area?
- ✓ **Vale Contact Person** – do they need an end of shift report from me?
- ✓ **Permits** – do I need to close or hand in any permits?
- ✓ **Sign out** at the gate or other designated areas.

14. Conclusion

14.1 *Quality Assurance*



14.2 Conclusion

Conclusion

This concludes the material for the Nickel Refinery Tier 3 Orientation. You should now have a working knowledge and understanding of:

- Plant Entry
- Site Specific Hazards and Controls for the Nickel Refinery
- Procedures in the event of:
 - Equipment Damage
 - Personal Injury
 - Process Upset (Emergency Preparedness)
- Plant Exit Procedure

This Orientation provided information to access the Nickel Refinery. In order to feel comfortable with the area, you may arrange a field visit with your Vale Contact Person to specifically identify procedures provided in the Orientation.

Additionally, depending on the site or work you're doing, you may require task-specific information through either the local Learning & Development Group or your Vale Contact Person.