Environmental Management System & Community Engagement Report 2017

Environmental Compliance Approval #7530-93ZKPV
and Site Specific Standard Approvals:
  Sulphur Dioxide (1 hr.) #501-12-rv0
  Sulphur Dioxide (24 hr.) #502-12-rv0
  Cadmium (24 hr.) #501-13-rv0
  Nickel (annual) #501-15-rv0

Report Prepared by:
  Chris Ransom
  Environmental Coordinator

Submitted to Ministry of the Environment and Climate Change
March 31, 2018

Sudbury Integrated Nickel Operations, Sudbury Smelter
2 Longyear Drive, Falconbridge, Ontario, P0M 1S0
1. Introduction

This report provides the following information for the Sudbury Integrated Nickel Operation Smelter (Glencore Canada Corporation) for the 2017 calendar year as per Section 13 and Schedule D, Section 4 of the Amended Environmental Compliance Approval #7530-93ZKPV, dated February 6, 2013:

a) Documentation of all registered complaints and their resolutions;

b) Written summary of the action plan implementation as required by Site-Specific Standard approvals for sulphur dioxide and cadmium;

c) Summary of actions taken when there are two or more exceedences of measured levels of sulphur dioxide, cadmium, and nickel as required by Site-Specific Standard approvals, if applicable;

d) A report on the reduction of total annual sulphur dioxide emissions over time; and

e) A summary and analysis of the five-minute sulphur dioxide data as measured through the sulphur dioxide monitoring network.

2. Citizen Complaints

Citizens of Falconbridge are encouraged to contact the Smelter Central Control Room directly if they have any immediate concerns related to air quality or noise. The telephone numbers have been provided to residents in communication materials that were distributed door to door in 2011 and again in 2015. The Glencore Smelter’s contact information is also available to new residents through the local post office. There is also a selection on the main telephone answering system that will direct calls to the Central Control Room.

When a citizen complaint is received in the Central Control Room, the Supervisor documents the concern and works to resolve the issue immediately. All actions that are taken are recorded and the Supervisor follows up with the citizen after actions have been taken to ensure the air quality has improved. In some cases, longer-term programs and engineered mitigation measures are put in place to address issues that cannot be addressed immediately.
2.1 Citizen Complaints Related to Air Quality

Table 1 lists the citizen complaints related to air quality that were received at the Sudbury INO Smelter during the 2017 calendar year. Air quality complaints were received on seven days in 2017. Actions were taken immediately upon receipt of the complaints to decrease sulphur dioxide emissions.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Wind Direction</th>
<th>Address</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 20th</td>
<td>12:45 pm</td>
<td>83 deg.</td>
<td>Falconbridge Town-site</td>
<td>The converter aisle had been down since 8:30am. Shut down both roasters</td>
</tr>
<tr>
<td>May 24th</td>
<td>6:10 pm</td>
<td>90 deg.</td>
<td>3 Cobalt Street</td>
<td>Converter aisle was already shut down. Shut down furnace power</td>
</tr>
<tr>
<td>June 6th</td>
<td>3:15 pm</td>
<td>60 deg.</td>
<td>13 MacDonnell Street</td>
<td>Stopped all converter aisle activity</td>
</tr>
<tr>
<td>June 14th</td>
<td>12:15 pm</td>
<td>75 deg.</td>
<td>Franklin Street</td>
<td>Converter aisle activity stopped and furnace power shut down</td>
</tr>
<tr>
<td>July 7th</td>
<td>10:45 am</td>
<td>62 deg.</td>
<td>Hodge Street</td>
<td>Shut down furnace power and curtailed converter aisle activities</td>
</tr>
<tr>
<td>July 13th</td>
<td>10:00 am</td>
<td>58 deg.</td>
<td>MacDonnell Street</td>
<td>Curtailed all Smelter operations</td>
</tr>
<tr>
<td>July 23rd</td>
<td>3:25 pm</td>
<td>78 deg.</td>
<td>Rix Street</td>
<td>Turned down finishing vessels and sent a supervisor to check the area</td>
</tr>
</tbody>
</table>

2.2 Citizen Complaints Related to Noise

There was one noise complaints received during the 2017 calendar year. Noise complaints are more difficult to investigate and usually take longer to resolve as engineered solutions are often necessary.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Wind Direction</th>
<th>Address</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 28th</td>
<td>11:45 am</td>
<td>95 deg.</td>
<td>Lindsley St.</td>
<td>Investigate the source of the noise. Engineering project to improve noise suppression at matte granulation.</td>
</tr>
</tbody>
</table>

As part of our continuing efforts to reduce noise levels in the Town of Falconbridge, we continue to investigate improvements that are needed to ensure minimal impact on the
town. The 2017 noise assessment also shows that the only sources remaining to be
abated are the matte gran sources which are part of the Process Gas project plan.

Golder Associates, a 3rd Party Consultant completed a full noise assessment of the site
in 2017 to determine if sources are running normally or if there are any areas of concern
that may require noise mitigation. Glencore also had Golder review matte granulation
operations noise controls and make recommendation as to how we could improve noise
suppression in the matte granulation plant. These plans are in early stages as Glencore
just received the recommendation in late 2017.

In response to the noise complaint Glencore is investigating engineering solutions to
further suppress the noise from matte granulation. In October 2016, an administrative
control was implemented which informs the operator when they may be impacting the
town site due to elevated noise levels. This control has had a significant effect in
decreasing complaints since it was implemented.

As part the Site Specific Standards Action Plans there are several new pieces of
equipment that will be added to the Smelter site. The Smelter site noise model is used
as part of the design and engineering of future equipment and processes. This is to
assess the noise impacts and to ensure the proper mitigations are put in place in the
design phase.

In the fall of 2012 the Smelter installed a noise barrier between the plant and the
community. The barrier is positioned along the rear of the park on Hardy Street and
wraps around the corner of Lakeshore Drive. The noise barrier both absorbs and
deflects noise coming from the facility with the overall goal of reducing noise levels
experienced in the community. As per our discussions with the Falconbridge Citizens
Committee, and in keeping with Sudbury Integrated Nickel Operation's commitment to
protection and enhancement of the environment, we erected a “Living Wall”. This wall
is made of a solid column of soil wrapped in a geotextile fabric and interweaved on both
sides with willow trees. Although the wall was installed in 2012, it did not sprout until
the spring of 2013. The wall continues to fill in. As we trim the tops, the bottom of the
wall will grow thicker. As time passes the “living wall” will become a tall dense hedge.
This type of wall is constructed entirely of environmentally friendly, natural materials.
The uniqueness of the Living Wall is the soil core, which provides an excellent
absorptive sound barrier. The Living Wall exceeds the Ministry of the Environment
noise attenuation requirements for noise barrier construction and has been used with
great success in many other industrial and residential applications in Ontario, Quebec
and Europe.
3. Site Specific Standard Action Plan Implementation

The Sudbury Smelter has received four Site Specific Standard Approvals as follows:

- 1 hour sulphur dioxide (Approval #501-12-rv0)
- 24 hour sulphur dioxide (Approval #502-12-rv0)
- 24 hour cadmium (Approval #501-13-rv0)
- Annual nickel (Approval #501-15-rv0)

Tables 3, 4 and 5 summarize the Site Specific Standard Action Plans for Sulphur Dioxide, Cadmium, and Nickel respectively, as per Appendix 1 of the Site Specific Standard approvals. A final column has been added to the tables from the approvals to indicate the progress achieved on the action items to the end of 2017. Detailed engineering studies have been completed for the various projects associated with these action plans. In 2017 the focus was on engineering of the remaining components of the plan to be installed in the future. Although several actions have already been completed, there are remaining actions over the next several years.

Detailed Engineering and execution for the Sudbury Smelter Process Gas Project Phase II is ongoing to complete the action plan outlined below. Several items have already been completed. The most significant part of the action plan to be completed is Controlled Furnace atmosphere (CFA) technology. Several challenges were encountered with operating the furnace under CFA conditions. A team of several
engineers worked through the challenges in 2016 and 2017. The challenges that the commissioning team faced were as follows:

- Equipment reliability (analyzers, burners, make up air fans)
- Flow management and optimization for oxygen levels – including tuning of suction on the furnace to minimize air ingress and run closer to neutral
- Off-gas system blockages caused by high temperatures in the uptakes
- Smelting rate in the Electric Furnace

As with any new process, it takes several months and even years to commission and optimize related processes.
## Table 3  Progress on Action Plan for Sulphur Dioxide (1 hr and 24 hr)

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Reduction Measures</th>
<th>Description of Measure</th>
<th>Progress to 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Improve Operating Practices for Finishing Vessels in Converter Aisle</td>
<td>Develop Semtech converter monitoring system</td>
<td>The concept was tested and the technology was not reliable so testing was stopped. Other options are being investigated.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ensure reliability of stack analytical monitor</td>
<td>Installed in 2012.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement operator training program</td>
<td>Produced metallurgical training modules with roll out to operations. Completed in 2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement turn up/turn down blast air control</td>
<td>Completed</td>
</tr>
<tr>
<td>2</td>
<td>Implement High Roast (HR) for Roasters and Controlled Furnace Atmosphere (CFA) for Electric Furnace</td>
<td>Conduct pilot scale trial of DC electrical furnace</td>
<td>Pilot test and Scoping Study completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install furnace sealing systems</td>
<td>Project completed in 2015.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install new ductwork system to add Acid plant tail-gas (low oxygen air) to electric furnace. Control tail gas split between furnace and smelter stack if tail gas is chosen supply</td>
<td>Project executed in end of July 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop slag make converter slag cleaning hybrid vessel</td>
<td>Project completed. Still optimizing the process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upgrade acid plant</td>
<td>Drying tower, converter, absorbing acid cooler and converter heat exchangers replaced in 2012. New Tail Gas re-heater was installed in 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve feed blending systems to stabilize metallurgical control</td>
<td>Construction of 013 filter feed tank was completed in 2014. The conversion of two settle storage tanks to agitated tanks was completed in 2015.</td>
</tr>
<tr>
<td>Item Number</td>
<td>Reduction Measures</td>
<td>Description of Measure</td>
<td>Progress to 2017</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Implement Secondary Hooding for four converters in Converter Aisle and the use of 137m stack or a new stack</td>
<td>Conduct laser mapping of existing plant</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop a detailed flow model</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refurbish 137m stack or construction of a new stack</td>
<td>A detailed assessment of the 137m stack was completed as part of the Feasibility Study. A new plan was developed in late 2015 to install a new stack rather than refurbish the 137m stack.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install secondary fans and install secondary hoods for four converters</td>
<td>The secondary gas will be directed to a new stack. Project to be completed in late 2019</td>
</tr>
<tr>
<td>4</td>
<td>Implement continuous improvement projects</td>
<td>Conduct a furnace technology assessment to identify other opportunities for reductions</td>
<td>Completed as part of the Options Analysis study in 2011.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conduct an acid plant tail gas engineering study to compare double contact/double absorption acid plant design with Cansolv regenerative scrubbing</td>
<td>Evaluation completed including a pilot trial in 2009 and Cansolv/Double Absorption tradeoff study in 2011.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assess heat recovery options to generate energy for scrubbing systems</td>
<td>Completed as part of the Cansolv / Double Absorption study in 2011.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upgrade curtailment software</td>
<td>Several upgrades made to curtailment software including enhanced SO₂ concentration and meteorological real-time and predictive components. Further improvements to the model are planned for 2018</td>
</tr>
</tbody>
</table>
Process Gas Project
CONTROLLED FURNACE ATMOSPHERE

Furnace SO$_2$ emissions will be reduced by 50% by replacing ingress air in the furnace freeboard with low oxygen tail gas from the Acid Plant. This will create a Controlled Furnace Atmosphere (CFA), which will minimize SO$_2$ formation in the furnace.

A duct connected to the absorbing tower outlet will supply tail gas to eight inlet ports on each side wall of the furnace.

Please talk to your supervisor if you have any questions.

STARTING Q2 2014
EXPECTED COMPLETION Q3 2015

SUDBURY INTEGRATED NICKEL OPERATIONS
• GLCNORC COMPANY

HATCH

Figure 2 - Controlled Furnace Atmosphere installed in 2015

Figure 3 - New Tail Gas re-heater (2014)

Figure 4 - New 4-pass converter in the acid plant to increase sulphur capture. (2012)
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Reduction Measures</th>
<th>Description of Measure</th>
<th>Progress to 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Secondary Hooding in Converter Aisle, Matte Granulation Emission Collection to a new stack, and Baghouse for Furnace Slag Tapping Ventilation Exhaust</td>
<td>Installation of baghouse on slag tapping ventilation exhaust</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laser mapping of existing plant</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of detailed flow model</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation of a new primary hood on # 8 vessel</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refurbish 137m stack</td>
<td>A detailed assessment of the 137m stack was completed as part of the Feasibility Study. A new plan was developed in late 2015 to install a new stack rather than refurbish the 137m stack.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation of the secondary fans Installation of secondary hoods</td>
<td>The secondary gas will be directed to a new stack. Project to be completed in late 2019</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Redirection of gas streams from matte granulation to the 93m stack</td>
<td>Project to be completed in late 2019</td>
</tr>
</tbody>
</table>
Figure 5 – New Primary Hood on #8 Hybrid Vessel

Figure 6 – New Slag Hauler Access to #7 and #8 Hybrid Vessels
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description of Measure</th>
<th>Progress to 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Update Emissions</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual Emission Reduction</td>
<td>Updated in the ESDM annually</td>
</tr>
<tr>
<td></td>
<td>Converter aisle emissions</td>
<td>Updated in the ESDM model as step changes are made</td>
</tr>
<tr>
<td>2</td>
<td><strong>Secondary Hooding in Converter Aisle, Matte Granulation Emission Collection to a new stack, and Baghouse for Furnace Slag Tapping Ventilation Exhaust</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Installation of baghouse on slag tapping ventilation exhaust</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td>Laser mapping of existing plant</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td>Development of detailed flow model</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td>Installation of a new primary hood on # 8 vessel</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td>Refurbish 137m stack or construct a new stack.</td>
<td>A detailed assessment of the 137m stack was completed as part of the Feasibility Study. A new plan was developed in late 2015 to install a new stack rather than refurbish the 137m stack.</td>
</tr>
<tr>
<td></td>
<td>Installation of the secondary fans</td>
<td>The secondary gas will be directed to a new stack. Project to be completed in late 2019</td>
</tr>
<tr>
<td></td>
<td>Installation of secondary hoods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Redirection of gas streams from matte granulation to the 93m stack</td>
<td>To be completed in late 2019</td>
</tr>
<tr>
<td>3</td>
<td><strong>Investigate Emissions from Roaster Roof fans</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal Housekeeping dust control</td>
<td>To be completed by 2022</td>
</tr>
<tr>
<td></td>
<td>Evaluate technology options in Roaster Roof Fan area</td>
<td>To be completed by 2022</td>
</tr>
<tr>
<td></td>
<td>Engineering assessment of Roaster Roof Fan 3 m stacks</td>
<td>To be completed by 2022</td>
</tr>
</tbody>
</table>
4. Exceedences of Site Specific Standards and Other Regulatory Limits

The Site Specific Standard Approvals for sulphur dioxide came into effect on August 23, 2012. There was one measured exceedences of the 1 hour site specific standards for sulphur dioxide in the 2017 calendar year on October 12th, 2017 that occurred due to an unplanned shutdown of the roasters. No exceedences of the 24 hour provincial Air Quality Standard for sulphur dioxide occurred during 2017.

The Site Specific Standard Approvals for Cadmium and Nickel came into effect on January 30, 2013 and December 21st 2015 respectively. During 2017 there was one exceedences of the Site-specific standard for Cadmium which occurred when all the furnace off gas fans failed due to a faulty Process Logic Controller. (PLC)

In 2017, one exceedence of the provincial 24 hour Ambient Air Quality Objective for cobalt was measured on the community particulate monitors located in Falconbridge. The Cobalt exceedence occurred on the same day and for the same reason the Cadmium Site Specific Standard (SSS) was exceeded.

The Smelter has developed an early warning system that alerts operations when meteorological conditions are such that particulate from the Smelter is impacting the town of Falconbridge. On these occasions many activities around the Smelter are suspended until the meteorological conditions change. Glencore continues to refine these administrative controls to achieve our goal of zero Ambient Air Quality Standard exceedences.

Under our ISO 14001 certified Environmental Management System, we continue to enhance our Best Management Practices Plan (BMPP) to better manage particulate sources on-site. Over the long-term, we are also working towards further improvements to control particulate and metal emissions as part of our Site Specific Standard Actions Plan for cadmium and nickel. The Site Specific Standard Action Plans for cadmium and nickel will reduce the impact of all metals emitted from the Sudbury INO Smelter.

5. Sulphur Dioxide Emission Reduction

Each year, the Sudbury Smelter is required to report the total yearly emissions of sulphur dioxide, using a mass balance approach that is audited by a third party. All major inputs and outputs containing sulphur are evaluated and audited.

A total of 24,949 tonnes of sulphur dioxide were emitted from the Sudbury Smelter in 2017, which is in compliance with ON Reg. 194. The decrease in Sulphur emissions can be attributed to optimization of the Controlled Furnace Atmosphere (CFA) process and High Degree Roast operations. As with any new process there is always a commissioning phase that can take over a year to work out process issues. Throughout 2017 there was a team of engineers working on the challenges of operating the new process.
Going forward the process will continue to be optimized further and suppress SO$_2$ generation in the Electric Furnace. This coupled with high roast which sends more Sulphur to the acid plant to be fixed as sulphuric acid will reduce the total SO$_2$ emissions from the smelter.

Figure 6 below shows that nickel production has increased while the sulphur dioxide emissions have decreased.

![Figure 6 – Historical Sulphur Dioxide Emissions versus Nickel Production](image)

6. **Sulphur Dioxide Monitoring Station Network and Sulphur Dioxide Data Summary**

(a) Public Community Network Display

In 2008, Science North, Bestech, Vale and Sudbury Integrated Nickel Operations (formerly Xstrata Nickel) collaborated to create a public display of the sulphur dioxide monitoring network at Science North. In 2014 the software in the Science North site was updated to make the site more reliable. This display allows the public to view real-time sulphur dioxide concentrations at monitoring stations throughout Greater Sudbury. The display is also available for public access on the internet. A link to this website has been placed on the Sudbury Integrated Nickel Operations public website.
(b) Station Upgrades

A third party audit of the eight sulphur dioxide monitoring stations owned by Sudbury Integrated Nickel Operations as well as the Sudbury INO meteorological station was performed by Bestech in 2016. The eight monitoring stations are located in Coniston, Garson, Hanmer, Skead, Wahnapitae, on Sunderland Road, and on Parkinson and Edison streets in Falconbridge. A number of upgrades were made to the stations over the last three or four years as a result of this audit, including new buildings, some new analyzers, tree trimming, new fencing, Uninterrupted Power Supply (UPS) systems to maintain operation of the sulphur dioxide monitors during short-term power interruptions, and electrical upgrades to allow easy plug-in of a generator for longer term power outages. During 2017, there were several planned and unplanned power outages that affected one or more of the sulphur dioxide monitoring stations and these systems (UPS) were used effectively to keep the stations running and collecting data during these events. The monitoring stations were audited four times in 2017 by the Ministry of the Environment and the audit criteria were met.

(c) Summary and Analysis of Five-minute GLC Data

A summary of the total number of five-minute average ground level concentrations of sulphur dioxide concentrations at or above 0.1, 0.25 and 0.5 ppm, respectively, is presented in Appendix A for the following monitoring stations: Coniston, Garson, Hanmer, Skead, Wahnapitae, Sunderland, Edison and Parkinson. For reference purposes, the measured Site Specific Standard limit at the Community Ambient Air Quality Monitoring Stations was 0.25 ppm in 2017.
7. Comprehensive Supplementary Emission Control System

The Sudbury INO Smelter’s Environmental Compliance Approval for Air requires the operation of a Comprehensive Supplementary Emission Control System (COSEC) to control ground level concentrations of sulphur dioxide. The Smelter uses a software program, called CAPS, that displays both real-time data from the community monitoring stations and future predictions. The program performs continuous air dispersion modeling to project the most probable outcomes based on meteorology and various operating scenarios. This involves using forecast meteorological data, real-time meteorological data and real-time data from the monitoring stations as inputs to an air dispersion model that calculates the expected concentrations of a pollutant. The software is equipped with alarming features to alert production staff when there are changes in meteorology or real-time sulphur dioxide concentrations at the monitoring stations, so that they can take necessary steps to curtail production in order to maintain ground level concentrations less than the Site Specific Standards. The COSEC system operates 24 hours/day, 7 days/week in the Central Control Room at the Smelter.

Some significant upgrades were made to the CAPS software in 2017 and the Smelter is in the process of optimizing the new CAPs model. A second source for the meteorological forecast was added to the system as a back-up should the main source of meteorological forecast data fail. In the case of a failure the secondary source for the meteorological forecast is used so the CCR supervisor always has the most up to date meteorological forecast. Also an older LINEX server was replaced with a virtual server, which enables the CAPs model to be upgraded to a Windows based operating system. Another wind speed / wind direction sensor will be added at a lower elevation in 2018 to ensure the model has the best information available.

A redundant server system was installed at the NORCAT centre to provide a back-up server in the event of a disaster or outage at Bestech’s Lorne Street location. This also allows maintenance to occur without any interruption to SO₂ measurements. There are regular updates to the CAPS software that are part of a continual improvement program at the Smelter.

The Sudbury INO Smelter developed a Best Management Practices Plan for particulate emissions several years ago. This continual improvement program uses a risk-based approach to determine priorities for dust management activities on-site and then incorporates standard operating procedures and/or mitigative measures to minimize fugitive particulate and metal emissions.

The BMP Plan serves to:

- Identify the sources of the fugitive emissions associate with the facility;
- Describe how fugitive dust can be controlled from each significant source and describe the BMPs in place at the facility;
• Describe how fugitive dust sources are assessed and identified as high priority through a risk based approach;

• Describe methods of monitoring and record-keeping to verify and document ongoing compliance with the BMP Plan; and

• Summarize the Road Dust Sampling program results and the effectiveness of this plan. (Figure 9)

Figure 9 - Average Silt Loading from Smelter site Roadways since implementation of BMPP and Road Vacuuming in 2009/2010:

Although the road silt analysis from 2015 shows a slight upward trend the average silt loading, the 2016 and 2017 results show a decrease in silt loading. In 2018 Glencore will revisit the sweeping schedule to ensure that roads with higher silt loadings receive more attention.

During 2017, a number of actions were taken to minimize fugitive dust, including:

• Continued use of two dedicated road vacuum sweepers with sweepings recycled back into the process. A second shift was added during spring clean-up;
• Refining procedures for minimizing dust emissions from storage piles, including additional inside storage and increased use of tarps and covered roll-off bins for outside storage;

• When receiving custom feed more material is unloaded inside a building under specific wind conditions vs. previous years;

• Creating new procedures to minimize dust emissions from material handling activities;

• Developing an Online Particulate Monitor early warning system to provide early detection of elevated particulate emissions. Refined administrative controls were added to Smelter SOPs to minimize fugitive emissions when the wind is blowing towards the town site.

• Paving of additional sections of site roadways and crack-filling of existing roadways;

• Adding surface layers of coarse gravel to outside storage areas; and

• Use of off-site covered storage and “just-in-time” delivery to reduce on-site storage.

Dust Collector Management System improvements are on-going. As of 2017, we have completed the following:

• In 2015 Glencore created a position to improve dust collector management;

• Developed a dust collector management plan that outlines inspection, and maintenance schedules for all dust collectors on site;

• Completed training of maintenance and operations personnel to ensure the workers doing the inspections and maintenance understand the importance of the dust collectors operating properly;

• Implemented specific work instruction that state any time there is an issue with a baghouse an inspection is done, an inspection sheet is filled out and the problem is rectified;

• Developed a list of critical dust collectors that will get immediate attention if there is an issue identified;

• Developed a KPI (key performance indicators) for all the dust collectors that are reviewed twice a week at the operations KPI meeting; and

• The Raglan Receiving Baghouse redesign was started in 2017 in order to increase capacity and reduce emissions
9. Public Communication

Sudbury Integrated Nickel Operations continues to operate a public website for Sudbury INO at www.sudburyino.ca. This website contains links to the Science North public website for live views of sulphur dioxide concentrations and weather parameters throughout the monitoring network, as well as air dispersion forecast information. The website also provides links to the documentation required for Site Specific Standard Applications and the Toxic Reduction Act. A copy of this report will be available on the website, along with the minutes of the annual Environmental Monitoring Team meeting and any related follow-up actions.

Falconbridge Citizen Committee

The Falconbridge Citizens Committee meeting on a bi-monthly basis and acts as a forum for the citizens of Falconbridge to voice concerns with respect to Sudbury Integrated Nickel Operations. The Falconbridge Citizens Committee members act as a liaison with the company for communicating changes to the operations and how it will impact the community. The Terms of Reference are shown in Appendix B.

Wahnapitae First Nation/Glencore Environmental Working Group

A Participation Agreement (PA) was signed between the Wahnapitae First Nation and Glencore Sudbury INO in 2008. An Environmental Working Group was formed to ensure the environmental components of the PA are implemented. The environmental performance of the smelter and the projects related to Environmental Compliance and best practices are relayed at each meeting. These updates include the progress on the action plans under the Site Specific Standards.

For questions regarding this report, please contact Laura Mucklow (Laura.Mucklown@glencore.ca) or 705-693-2761 ext. 3388 or Chris Ransom at ext. 3303 (Chris.Ransom@glencore.ca).
Appendix A

Sulphur Dioxide Data Summary

### Edison

<table>
<thead>
<tr>
<th>Year</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>5000</td>
</tr>
<tr>
<td>2003</td>
<td>3000</td>
</tr>
<tr>
<td>2004</td>
<td>2000</td>
</tr>
<tr>
<td>2005</td>
<td>1000</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
</tr>
</tbody>
</table>

- No of Minutes >=0.1 and <0.25 ppm SO2
- No of Minutes >=0.25 and <0.5 ppm SO2
- No of Minutes >0.5 ppm SO2

### Parkinson

<table>
<thead>
<tr>
<th>Year</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>5000</td>
</tr>
<tr>
<td>2003</td>
<td>3000</td>
</tr>
<tr>
<td>2004</td>
<td>2000</td>
</tr>
<tr>
<td>2005</td>
<td>1000</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
</tr>
</tbody>
</table>

- No of Minutes >=0.1 and <0.25 ppm SO2
- No of Minutes >=0.25 and <0.5 ppm SO2
- No of Minutes >0.5 ppm SO2
Appendix B

Falconbridge Citizens Committee
(FCC)

Terms of Reference – 2017

1.0 Purpose
   a) To act as a forum for the citizens of Falconbridge to bring forward community concerns with Sudbury Integrated Nickel Operations Smelter. Community concerns refer to:
      i. matters of air quality
      ii. traffic congestion
      iii. noise
   b) This group will also act as liaison with the company for communicating changes to the operation and how it will impact the community.

2.0 Specific Objectives
   a) To disseminate concerns by the community and to bring them forward to the committee meetings;
   b) To ensure that concerns brought forth by this committee are addressed;
   c) To promote awareness on community air quality issues, emergency response (S03 alarm), provide public education, and initiate programs on how individual citizens can help do their part in improving the overall community;
   d) Ensure that a process for establishing priorities occurs on an annual basis (see Appendix A: 2016 Wish List).

3.0 Structure

Executive
   a) The Chair(s) will facilitate meetings and communicate on behalf of the committee when called upon.
   b) The Sudbury INO Smelter representative(s), under the direction of the Chair(s), will arrange committee meetings, develop meeting agendas and minutes and will provide them to members in a timely manner.

Members
   a) The committee includes representation from the community of Falconbridge and the Sudbury INO Smelter.
   b) The committee encourages membership from anyone in the community of Falconbridge who is interested in maintaining a working relationship with the company.


Falconbridge Citizens Committee list as of January 2017:

**Glencore**
- Marc Butler
- Chris Ransom
- Laura Mucklow
- Chad Pearson
- Iyo Grenon
- Moe Moreau

**Citizens**
- JoAnne McNamara (Chair)
- Erin McNamara
- Lorraine St.George
- Louise Mayer
- Don St. George
- Jim Brierley
- Fred LaPierre

4.0 Membership

Appointment of New Members

a) New members may be appointed to the committee on the recommendation of any member, but require the unanimous consent of all committee members before a Chair formally invites the individual to join.

Resignation of Members

a) Unless notification (written or verbal) is given to the Chair, a member is deemed to have resigned from the committee if they have missed three (3) consecutive meetings.

Appointment of Chair Member

a) A Chair is elected or nominated for a two year term.
   b) Each position may be served for a maximum of four years.
   c) Any other member can be nominated to chair an individual meeting if the chair is not able to attend.

5.0 Meetings

a) A minimum of the Chair must be in attendance before a meeting can proceed.
   b) If the Chair is unavailable to attend a meeting, a chair will be selected from the available members in attendance.
   c) Members should declare Conflicts of Interest at any time during the meeting in order to be excluded from a decision on a particular matter of conflict.
   d) Meetings may be called ad hoc by the Chair.
   e) Decisions are to be made by consensus first; if consensus cannot be reached the issue will be put to a vote whereby a simple majority (50%+1) will decide.
   f) In order to vote, there must be a quorum of committee members present 50%+1.
   g) The Chair shall have voting rights.
   h) Meetings will be held every second month on the third Wednesday of that month at 5:00pm, unless decided otherwise by members.
   i) The committee may from time to time appoint working groups that will undertake tasks as directed. These working groups will report directly to the committee by bringing forward recommendations on their work for final
approval by the committee. These working groups may include non-committee members.

6.0 **Review of Terms of Reference**

a) The committee’s Terms of Reference shall be reviewed at least annually.
Environmental Management System & Community Engagement Report 2017

Environmental Compliance Approval #7530-93ZKPV and Site Specific Standard Approvals:
Sulphur Dioxide (1 hr.) #501-12-rv0
Sulphur Dioxide (24 hr.) #502-12-rv0
Cadmium (24 hr.) #501-13-rv0
Nickel (annual) #501-15-rv0

Report Prepared by:
Chris Ransom
Environmental Coordinator

Submitted to Ministry of the Environment and Climate Change
March 31, 2018

Sudbury Integrated Nickel Operations, Sudbury Smelter
2 Longyear Drive, Falconbridge, Ontario, P0M 1S0
1. Introduction

This report provides the following information for the Sudbury Integrated Nickel Operation Smelter (Glencore Canada Corporation) for the 2017 calendar year as per Section 13 and Schedule D, Section 4 of the Amended Environmental Compliance Approval #7530-93ZKPV, dated February 6, 2013:

a) Documentation of all registered complaints and their resolutions;

b) Written summary of the action plan implementation as required by Site-Specific Standard approvals for sulphur dioxide and cadmium;

c) Summary of actions taken when there are two or more exceedences of measured levels of sulphur dioxide, cadmium, and nickel as required by Site-Specific Standard approvals, if applicable;

d) A report on the reduction of total annual sulphur dioxide emissions over time; and

e) A summary and analysis of the five-minute sulphur dioxide data as measured through the sulphur dioxide monitoring network.

2. Citizen Complaints

Citizens of Falconbridge are encouraged to contact the Smelter Central Control Room directly if they have any immediate concerns related to air quality or noise. The telephone numbers have been provided to residents in communication materials that were distributed door to door in 2011 and again in 2015. The Glencore Smelter’s contact information is also available to new residents through the local post office. There is also a selection on the main telephone answering system that will direct calls to the Central Control Room.

When a citizen complaint is received in the Central Control Room, the Supervisor documents the concern and works to resolve the issue immediately. All actions that are taken are recorded and the Supervisor follows up with the citizen after actions have been taken to ensure the air quality has improved. In some cases, longer-term programs and engineered mitigation measures are put in place to address issues that cannot be addressed immediately.
2.1 Citizen Complaints Related to Air Quality

Table 1 lists the citizen complaints related to air quality that were received at the Sudbury INO Smelter during the 2017 calendar year. Air quality complaints were received on seven days in 2017. Actions were taken immediately upon receipt of the complaints to decrease sulphur dioxide emissions.

Table 1  
2017 Citizen Complaints Related to Air Quality

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Wind Direction</th>
<th>Address</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 20th</td>
<td>12:45 pm</td>
<td>83 deg.</td>
<td>Falconbridge Town-site</td>
<td>The converter aisle had been down since 8:30am. Shut down both roasters</td>
</tr>
<tr>
<td>May 24th</td>
<td>6:10 pm</td>
<td>90 deg.</td>
<td>3 Cobalt Street</td>
<td>Converter aisle was already shut down. Shut down furnace power</td>
</tr>
<tr>
<td>June 6th</td>
<td>3:15 pm</td>
<td>60 deg.</td>
<td>13 MacDonnell Street</td>
<td>Stopped all converter aisle activity</td>
</tr>
<tr>
<td>June 14th</td>
<td>12:15 pm</td>
<td>75 deg.</td>
<td>Franklin Street</td>
<td>Converter aisle activity stopped and furnace power shut down</td>
</tr>
<tr>
<td>July 7th</td>
<td>10:45 am</td>
<td>62 deg.</td>
<td>Hodge Street</td>
<td>Shut down furnace power and curtailed converter aisle activities</td>
</tr>
<tr>
<td>July 13th</td>
<td>10:00 am</td>
<td>58 deg.</td>
<td>MacDonnell Street</td>
<td>Curtailed all Smelter operations</td>
</tr>
<tr>
<td>July 23rd</td>
<td>3:25 pm</td>
<td>78 deg.</td>
<td>Rix Street</td>
<td>Turned down finishing vessels and sent a supervisor to check the area</td>
</tr>
</tbody>
</table>

2.2 Citizen Complaints Related to Noise

There was one noise complaints received during the 2017 calendar year. Noise complaints are more difficult to investigate and usually take longer to resolve as engineered solutions are often necessary.

Table 2  
2016 Citizen Complaints Related to Noise

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Wind Direction</th>
<th>Address</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 28th</td>
<td>11:45 am</td>
<td>95 deg.</td>
<td>Lindsley St.</td>
<td>Investigate the source of the noise. Engineering project to improve noise suppression at matte granulation.</td>
</tr>
</tbody>
</table>
town. The 2017 noise assessment also shows that the only sources remaining to be abated are the matte gran sources which are part of the Process Gas project plan.

Golder Associates, a 3rd Party Consultant completed a full noise assessment of the site in 2017 to determine if sources are running normally or if there are any areas of concern that may require noise mitigation. Glencore also had Golder review matte granulation operations noise controls and make recommendations as to how we could improve noise suppression in the matte granulation plant. These plans are in early stages as Glencore just received the recommendation in late 2017.

In response to the noise complaint Glencore is investigating engineering solutions to further suppress the noise from matte granulation. In October 2016, an administrative control was implemented which informs the operator when they may be impacting the town site due to elevated noise levels. This control has had a significant effect in decreasing complaints since it was implemented.

As part the Site Specific Standards Action Plans there are several new pieces of equipment that will be added to the Smelter site. The Smelter site noise model is used as part of the design and engineering of future equipment and processes. This is to assess the noise impacts and to ensure the proper mitigations are put in place in the design phase.

In the fall of 2012 the Smelter installed a noise barrier between the plant and the community. The barrier is positioned along the rear of the park on Hardy Street and wraps around the corner of Lakeshore Drive. The noise barrier both absorbs and deflects noise coming from the facility with the overall goal of reducing noise levels experienced in the community. As per our discussions with the Falconbridge Citizens Committee, and in keeping with Sudbury Integrated Nickel Operation’s commitment to protection and enhancement of the environment, we erected a “Living Wall”. This wall is made of a solid column of soil wrapped in a geotextile fabric and interwoven on both sides with willow trees. Although the wall was installed in 2012, it did not sprout until the spring of 2013. The wall continues to fill in. As we trim the tops, the bottom of the wall will grow thicker. As time passes the “living wall” will become a tall dense hedge. This type of wall is constructed entirely of environmentally friendly, natural materials. The uniqueness of the Living Wall is the soil core, which provides an excellent absorptive sound barrier. The Living Wall exceeds the Ministry of the Environment noise attenuation requirements for noise barrier construction and has been used with great success in many other industrial and residential applications in Ontario, Quebec and Europe.
3. Site Specific Standard Action Plan Implementation

The Sudbury Smelter has received four Site Specific Standard Approvals as follows:

- 1 hour sulphur dioxide (Approval #501-12-rv0)
- 24 hour sulphur dioxide (Approval #502-12-rv0)
- 24 hour cadmium (Approval #501-13-rv0)
- Annual nickel (Approval #501-15-rv0)

Tables 3, 4 and 5 summarize the Site Specific Standard Action Plans for Sulphur Dioxide, Cadmium, and Nickel respectively, as per Appendix 1 of the Site Specific Standard approvals. A final column has been added to the tables from the approvals to indicate the progress achieved on the action items to the end of 2017. Detailed engineering studies have been completed for the various projects associated with these action plans. In 2017 the focus was on engineering of the remaining components of the plan to be installed in the future. Although several actions have already been completed, there are remaining actions over the next several years.

Detailed Engineering and execution for the Sudbury Smelter Process Gas Project Phase II is ongoing to complete the action plan outlined below. Several items have already been completed. The most significant part of the action plan to be completed is Controlled Furnace atmosphere (CFA) technology. Several challenges were encountered with operating the furnace under CFA conditions. A team of several
engineers worked through the challenges in 2016 and 2017. The challenges that the commissioning team faced were as follows:

- Equipment reliability (analyzers, burners, make up air fans)
- Flow management and optimization for oxygen levels – including tuning of suction on the furnace to minimize air ingress and run closer to neutral
- Off-gas system blockages caused by high temperatures in the uptakes
- Smelting rate in the Electric Furnace

As with any new process, it takes several months and even years to commission and optimize related processes.
### Table 3  Progress on Action Plan for Sulphur Dioxide (1 hr and 24 hr)

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Reduction Measures</th>
<th>Description of Measure</th>
<th>Progress to 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Improve Operating Practices for Finishing Vessels in Converter Aisle</td>
<td>Develop Semtech converter monitoring system</td>
<td>The concept was tested and the technology was not reliable so testing was stopped. Other options are being investigated.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ensure reliability of stack analytical monitor</td>
<td>Installed in 2012.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement operator training program</td>
<td>Produced metallurgical training modules with roll out to operations. Completed in 2016</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement turn up/ turn down blast air control</td>
<td>Completed</td>
</tr>
<tr>
<td>2</td>
<td>Implement High Roast (HR) for Roasters and Controlled Furnace Atmosphere (CFA) for Electric Furnace</td>
<td>Conduct pilot scale trial of DC electrical furnace</td>
<td>Pilot test and Scoping Study completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install furnace sealing systems</td>
<td>Project completed in 2015.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install new ductwork system to add Acid plant tail-gas (low oxygen air) to electric furnace. Control tail gas split between furnace and smelter stack if tail gas is chosen supply</td>
<td>Project executed in end of July 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop slag make converter slag cleaning hybrid vessel</td>
<td>Project completed. Still optimizing the process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upgrade acid plant</td>
<td>Drying tower, converter, absorbing acid cooler and converter heat exchangers replaced in 2012. New Tail Gas re-heater was installed in 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve feed blending systems to stabilize metallurgical control</td>
<td>Construction of 013 filter feed tank was completed in 2014. The conversion of two settle storage tanks to agitated tanks was completed in 2015.</td>
</tr>
<tr>
<td>Item Number</td>
<td>Reduction Measures</td>
<td>Description of Measure</td>
<td>Progress to 2017</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------</td>
<td>------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>3</td>
<td>Implement Secondary Hooding for four converters in Converter Aisle and the use of 137m stack or a new stack</td>
<td>Conduct laser mapping of existing plant</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop a detailed flow model</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refurbish 137m stack or construction of a new stack</td>
<td>A detailed assessment of the 137m stack was completed as part of the Feasibility Study. A new plan was developed in late 2015 to install a new stack rather than refurbish the 137m stack.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install secondary fans and install secondary hoods for four converters</td>
<td>The secondary gas will be directed to a new stack. Project to be completed in late 2019</td>
</tr>
<tr>
<td>4</td>
<td>Implement continuous improvement projects</td>
<td>Conduct a furnace technology assessment to identify other opportunities for reductions</td>
<td>Completed as part of the Options Analysis study in 2011.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conduct an acid plant tail gas engineering study to compare double contact/double absorption acid plant design with Cansolv regenerative scrubbing</td>
<td>Evaluation completed including a pilot trial in 2009 and Cansolv/Double Absorption tradeoff study in 2011.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assess heat recovery options to generate energy for scrubbing systems</td>
<td>Completed as part of the Cansolv / Double Absorption study in 2011.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upgrade curtailment software</td>
<td>Several upgrades made to curtailment software including enhanced SO₂ concentration and meteorological real-time and predictive components. Further improvements to the model are planned for 2018</td>
</tr>
</tbody>
</table>
Process Gas Project

Controlled Furnace Atmosphere

Furnace SO\textsubscript{2} emissions will be reduced by 50\% by replacing ingress air in the furnace freeboard with low oxygen tail gas from the Acid Plant. This will create a Controlled Furnace Atmosphere (CFA), which will minimize SO\textsubscript{2} formation in the furnace.

A duct connected to the absorbing tower outlet will supply tail gas to eight inlet ports on each side wall of the furnace.

Please talk to your supervisor if you have any questions.

STARTING Q2 2014
EXPECTED COMPLETION Q3 2015

SUDBURY INTEGRATED NICKEL OPERATIONS
GLENCORE CANADA
HATCH

Figure 2 - Controlled Furnace Atmosphere installed in 2015

Figure 3 - New Tail Gas re-heater (2014)

Figure 4 - New 4-pass converter in the acid plant to increase sulphur capture. (2012)

Sudbury Integrated Nickel Operations, Sudbury Smelter
2 Longyear Drive, Falconbridge, Ontario, P0M 1S0

Page 9 of 29
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Reduction Measures</th>
<th>Description of Measure</th>
<th>Progress to 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Secondary Hooding in Converter Aisle, Matte Granulation Emission Collection to a new stack, and Baghouse for Furnace Slag Tapping Ventilation Exhaust</td>
<td>Installation of baghouse on slag tapping ventilation exhaust</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laser mapping of existing plant</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of detailed flow model</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation of a new primary hood on # 8 vessel</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refurbish 137m stack</td>
<td>A detailed assessment of the 137m stack was completed as part of the Feasibility Study. A new plan was developed in late 2015 to install a new stack rather than refurbish the 137m stack.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation of the secondary fans Installation of secondary hoods</td>
<td>The secondary gas will be directed to a new stack. Project to be completed in late 2019</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Redirection of gas streams from matte granulation to the 93m stack</td>
<td>Project to be completed in late 2019</td>
</tr>
</tbody>
</table>
Figure 5 – New Primary Hood on #8 Hybrid Vessel

Figure 6 – New Slag Hauler Access to #7 and #8 Hybrid Vessels
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Reduction Measures</th>
<th>Description of Measure</th>
<th>Progress to 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Update Emissions</td>
<td>Annual Emission Reduction</td>
<td>Updated in the ESDM annually</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Converter aisle emissions</td>
<td>Updated in the ESDM model as step changes are made</td>
</tr>
<tr>
<td>2</td>
<td>Secondary Hooding in Converter Aisle, Matte Granulation Emission Collection to a new stack, and Baghouse for Furnace Slag Tapping Ventilation Exhaust</td>
<td>Installation of baghouse on slag tapping ventilation exhaust</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laser mapping of existing plant</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of detailed flow model</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation of a new primary hood on # 8 vessel</td>
<td>Completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refurbish 137m stack or construct a new stack.</td>
<td>A detailed assessment of the 137m stack was completed as part of the Feasibility Study. A new plan was developed in late 2015 to install a new stack rather than refurbish the 137m stack.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation of the secondary fans Installation of secondary hoods</td>
<td>The secondary gas will be directed to a new stack. Project to be completed in late 2019</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Redirection of gas streams from matte granulation to the 93m stack</td>
<td>To be completed in late 2019</td>
</tr>
<tr>
<td>3</td>
<td>Investigate Emissions from Roaster Roof fans</td>
<td>Internal Housekeeping dust control</td>
<td>To be completed by 2022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluate technology options in Roaster Roof Fan area</td>
<td>To be completed by 2022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering assessment of Roaster Roof Fan 3 m stacks</td>
<td>To be completed by 2022</td>
</tr>
</tbody>
</table>
4. Exceedences of Site Specific Standards and Other Regulatory Limits

The Site Specific Standard Approvals for sulphur dioxide came into effect on August 23, 2012. There was one measured exceedences of the 1 hour site specific standards for sulphur dioxide in the 2017 calendar year on October 12th, 2017 that occurred due to an unplanned shutdown of the roasters. No exceedences of the 24 hour provincial Air Quality Standard for sulphur dioxide occurred during 2017.

The Site Specific Standard Approvals for Cadmium and Nickel came into effect on January 30, 2013 and December 21st 2015 respectively. During 2017 there was one exceedences of the Site-specific standard for Cadmium which occurred when all the furnace off gas fans failed due to a faulty Process Logic Controller. (PLC)

In 2017, one exceedence of the provincial 24 hour Ambient Air Quality Objective for cobalt was measured on the community particulate monitors located in Falconbridge. The Cobalt exceedence occurred on the same day and for the same reason the Cadmium Site Specific Standard (SSS) was exceeded.

The Smelter has developed an early warning system that alerts operations when meteorological conditions are such that particulate from the Smelter is impacting the town of Falconbridge. On these occasions many activities around the Smelter are suspended until the meteorological conditions change. Glencore continues to refine these administrative controls to achieve our goal of zero Ambient Air Quality Standard exceedences.

Under our ISO 14001 certified Environmental Management System, we continue to enhance our Best Management Practices Plan (BMPP) to better manage particulate sources on-site. Over the long-term, we are also working towards further improvements to control particulate and metal emissions as part of our Site Specific Standard Actions Plan for cadmium and nickel. The Site Specific Standard Action Plans for cadmium and nickel will reduce the impact of all metals emitted from the Sudbury INO Smelter.

5. Sulphur Dioxide Emission Reduction

Each year, the Sudbury Smelter is required to report the total yearly emissions of sulphur dioxide, using a mass balance approach that is audited by a third party. All major inputs and outputs containing sulphur are evaluated and audited.

A total of 24,949 tonnes of sulphur dioxide were emitted from the Sudbury Smelter in 2017, which is in compliance with ON Reg. 194. The decrease in Sulphur emissions can be attributed to optimization of the Controlled Furnace Atmosphere (CFA) process and High Degree Roast operations. As with any new process there is always a commissioning phase that can take over a year to work out process issues. Throughout 2017 there was a team of engineers working on the challenges of operating the new process.
Going forward the process will continue to be optimized further and suppress SO\textsubscript{2} generation in the Electric Furnace. This coupled with high roast which sends more Sulphur to the acid plant to be fixed as sulphuric acid will reduce the total SO\textsubscript{2} emissions from the smelter.

Figure 6 below shows that nickel production has increased while the sulphur dioxide emissions have decreased.

**Figure 6 – Historical Sulphur Dioxide Emissions versus Nickel Production**

### 6. Sulphur Dioxide Monitoring Station Network and Sulphur Dioxide Data Summary

**(a) Public Community Network Display**

In 2008, Science North, Bestech, Vale and Sudbury Integrated Nickel Operations (formerly Xstrata Nickel) collaborated to create a public display of the sulphur dioxide monitoring network at Science North. In 2014 the software in the Science North site was updated to make the site more reliable. This display allows the public to view real-time sulphur dioxide concentrations at monitoring stations throughout Greater Sudbury. The display is also available for public access on the internet. A link to this website has been placed on the Sudbury Integrated Nickel Operations public website.
(b) Station Upgrades

A third party audit of the eight sulphur dioxide monitoring stations owned by Sudbury Integrated Nickel Operations as well as the Sudbury INO meteorological station was performed by Bestech in 2016. The eight monitoring stations are located in Coniston, Garson, Hanmer, Skead, Wahnapitae, on Sunderland Road, and on Parkinson and Edison streets in Falconbridge. A number of upgrades were made to the stations over the last three or four years as a result of this audit, including new buildings, some new analyzers, tree trimming, new fencing, Uninterrupted Power Supply (UPS) systems to maintain operation of the sulphur dioxide monitors during short-term power interruptions, and electrical upgrades to allow easy plug-in of a generator for longer term power outages. During 2017, there were several planned and unplanned power outages that affected one or more of the sulphur dioxide monitoring stations and these systems (UPS) were used effectively to keep the stations running and collecting data during these events. The monitoring stations were audited four times in 2017 by the Ministry of the Environment and the audit criteria were met.

(c) Summary and Analysis of Five-minute GLC Data

A summary of the total number of five-minute average ground level concentrations of sulphur dioxide concentrations at or above 0.1, 0.25 and 0.5 ppm, respectively, is presented in Appendix A for the following monitoring stations: Coniston, Garson, Hanmer, Skead, Wahnapitae, Sunderland, Edison and Parkinson. For reference purposes, the measured Site Specific Standard limit at the Community Ambient Air Quality Monitoring Stations was 0.25 ppm in 2017.
7. Comprehensive Supplementary Emission Control System

The Sudbury INO Smelter’s Environmental Compliance Approval for Air requires the operation of a Comprehensive Supplementary Emission Control System (COSEC) to control ground level concentrations of sulphur dioxide. The Smelter uses a software program, called CAPS, that displays both real-time data from the community monitoring stations and future predictions. The program performs continuous air dispersion modeling to project the most probable outcomes based on meteorology and various operating scenarios. This involves using forecast meteorological data, real-time meteorological data and real-time data from the monitoring stations as inputs to an air dispersion model that calculates the expected concentrations of a pollutant. The software is equipped with alarming features to alert production staff when there are changes in meteorology or real-time sulphur dioxide concentrations at the monitoring stations, so that they can take necessary steps to curtail production in order to maintain ground level concentrations less than the Site Specific Standards. The COSEC system operates 24 hours/day, 7 days/week in the Central Control Room at the Smelter.

Some significant upgrades were made to the CAPS software in 2017 and the Smelter is in the process of optimizing the new CAPs model. A second source for the meteorological forecast was added to the system as a back-up should the main source of meteorological forecast data fail. In the case of a failure the secondary source for the meteorological forecast is used so the CCR supervisor always has the most up to date meteorological forecast. Also an older LINEX server was replaced with a virtual server, which enables the CAPs model to be upgraded to a Windows based operating system. Another wind speed / wind direction sensor will be added at a lower elevation in 2018 to ensure the model has the best information available.

A redundant server system was installed at the NORCAT centre to provide a back-up server in the event of a disaster or outage at Bestech’s Lorne Street location. This also allows maintenance to occur without any interruption to SO₂ measurements. There are regular updates to the CAPS software that are part of a continual improvement program at the Smelter.

The Sudbury INO Smelter developed a Best Management Practices Plan for particulate emissions several years ago. This continual improvement program uses a risk-based approach to determine priorities for dust management activities on-site and then incorporates standard operating procedures and/or mitigative measures to minimize fugitive particulate and metal emissions.

The BMP Plan serves to:

- Identify the sources of the fugitive emissions associate with the facility;
- Describe how fugitive dust can be controlled from each significant source and describe the BMPs in place at the facility;
- Describe how fugitive dust sources are assessed and identified as high priority through a risk based approach;

- Describe methods of monitoring and record-keeping to verify and document ongoing compliance with the BMP Plan; and

- Summarize the Road Dust Sampling program results and the effectiveness of this plan. (Figure 9)

![Figure 9 - Average Silt Loading from Smelter site Roadways since implementation of BMPP and Road Vacuuming in 2009/2010:](image)

Although the road silt analysis from 2015 shows a slight upward trend the average silt loading, the 2016 and 2017 results show a decrease in silt loading. In 2018 Glencore will revisit the sweeping schedule to ensure that roads with higher silt loadings receive more attention.

During 2017, a number of actions were taken to minimize fugitive dust, including:

- Continued use of two dedicated road vacuum sweepers with sweepings recycled back into the process. A second shift was added during spring clean-up;
• Refining procedures for minimizing dust emissions from storage piles, including additional inside storage and increased use of tarps and covered roll-off bins for outside storage;
• When receiving custom feed more material is unloaded inside a building under specific wind conditions vs. previous years;
• Creating new procedures to minimize dust emissions from material handling activities;
• Developing an Online Particulate Monitor early warning system to provide early detection of elevated particulate emissions. Refined administrative controls were added to Smelter SOPs to minimize fugitive emissions when the wind is blowing towards the town site.
• Paving of additional sections of site roadways and crack-filling of existing roadways;
• Adding surface layers of coarse gravel to outside storage areas; and
• Use of off-site covered storage and “just-in-time” delivery to reduce on-site storage.

Dust Collector Management System improvements are on-going. As of 2017, we have completed the following:

• In 2015 Glencore created a position to improve dust collector management;
• Developed a dust collector management plan that outlines inspection, and maintenance schedules for all dust collectors on site;
• Completed training of maintenance and operations personnel to ensure the workers doing the inspections and maintenance understand the importance of the dust collectors operating properly;
• Implemented specific work instruction that state any time there is an issue with a baghouse an inspection is done, an inspection sheet is filled out and the problem is rectified;
• Developed a list of critical dust collectors that will get immediate attention if there is an issue identified;
• Developed a KPI (key performance indicators) for all the dust collectors that are reviewed twice a week at the operations KPI meeting; and
• The Raglan Receiving Baghouse redesign was started in 2017 in order to increase capacity and reduce emissions
9. Public Communication

Sudbury Integrated Nickel Operations continues to operate a public website for Sudbury INO at www.sudburyino.ca. This website contains links to the Science North public website for live views of sulphur dioxide concentrations and weather parameters throughout the monitoring network, as well as air dispersion forecast information. The website also provides links to the documentation required for Site Specific Standard Applications and the Toxic Reduction Act. A copy of this report will be available on the website, along with the minutes of the annual Environmental Monitoring Team meeting and any related follow-up actions.

Falconbridge Citizen Committee

The Falconbridge Citizens Committee meeting on a bi-monthly basis and acts as a forum for the citizens of Falconbridge to voice concerns with respect to Sudbury Integrated Nickel Operations. The Falconbridge Citizens Committee members act as a liaison with the company for communicating changes to the operations and how it will impact the community. The Terms of Reference are shown in Appendix B.

Wahnapitae First Nation/Glencore Environmental Working Group

A Participation Agreement (PA) was signed between the Wahnapitae First Nation and Glencore Sudbury INO in 2008. An Environmental Working Group was formed to ensure the environmental components of the PA are implemented. The environmental performance of the smelter and the projects related to Environmental Compliance and best practices are relayed at each meeting. These updates include the progress on the action plans under the Site Specific Standards.

For questions regarding this report, please contact Laura Mucklow (Laura.Mucklown@glencore.ca) or 705-693-2761 ext. 3388 or Chris Ransom at ext. 3303 (Chris.Ransom@glencore.ca).
Appendix A

Sulphur Dioxide Data Summary

Edison

- Red: No of Minutes >=0.1 and <0.25 ppm SO2
- Green: No of Minutes >=0.25 and <0.5 ppm SO2
- Purple: No of Minutes >0.5 ppm SO2

Parkinson

- Red: No of Minutes >=0.1 and <0.25 ppm SO2
- Green: No of Minutes >=0.25 and <0.5 ppm SO2
- Purple: No of Minutes >0.5 ppm SO2
Appendix B

Falconbridge Citizens Committee
(FCC)

Terms of Reference – 2017

1.0 Purpose
   a) To act as a forum for the citizens of Falconbridge to bring forward community concerns with Sudbury Integrated Nickel Operations Smelter. Community concerns refer to:
      i. matters of air quality
      ii. traffic congestion
      iii. noise
   b) This group will also act as liaison with the company for communicating changes to the operation and how it will impact the community.

2.0 Specific Objectives
   a) To disseminate concerns by the community and to bring them forward to the committee meetings;
   b) To ensure that concerns brought forth by this committee are addressed;
   c) To promote awareness on community air quality issues, emergency response (S0₃ alarm), provide public education, and initiate programs on how individual citizens can help do their part in improving the overall community;
   d) Ensure that a process for establishing priorities occurs on an annual basis (see Appendix A: 2016 Wish List).

3.0 Structure

Executive
   a) The Chair(s) will facilitate meetings and communicate on behalf of the committee when called upon.
   b) The Sudbury INO Smelter representative(s), under the direction of the Chair(s), will arrange committee meetings, develop meeting agendas and minutes and will provide them to members in a timely manner.

Members
   a) The committee includes representation from the community of Falconbridge and the Sudbury INO Smelter.
   b) The committee encourages membership from anyone in the community of Falconbridge who is interested in maintaining a working relationship with the company.
Falconbridge Citizens Committee list as of January 2017:

**Glencore**  **Citizens**
Marc Butler  JoAnne McNamara (Chair)  Don St. George
Chris Ransom  Erin McNamara  Jim Brierley
Laura Mucklow  Lorraine St.George  Fred LaPierre
Chad Pearson  Louise Mayer
Iyo Grenon  Moe Moreau

4.0 Membership

Appointment of New Members
a) New members may be appointed to the committee on the recommendation of any member, but require the unanimous consent of all committee members before a Chair formally invites the individual to join.

Resignation of Members
a) Unless notification (written or verbal) is given to the Chair, a member is deemed to have resigned from the committee if they have missed three (3) consecutive meetings.

Appointment of Chair Member
a) A Chair is elected or nominated for a two year term.
b) Each position may be served for a maximum of four years.
c) Any other member can be nominated to chair an individual meeting if the chair is not able to attend.

5.0 Meetings
a) A minimum of the Chair must be in attendance before a meeting can proceed.
b) If the Chair is unavailable to attend a meeting, a chair will be selected from the available members in attendance.
c) Members should declare Conflicts of Interest at any time during the meeting in order to be excluded from a decision on a particular matter of conflict.
d) Meetings may be called ad hoc by the Chair.
e) Decisions are to be made by consensus first; if consensus cannot be reached the issue will be put to a vote whereby a simple majority (50%+1) will decide.
f) In order to vote, there must be a quorum of committee members present 50%+1.
g) The Chair shall have voting rights.
h) Meetings will be held every second month on the third Wednesday of that month at 5:00pm, unless decided otherwise by members.
i) The committee may from time to time appoint working groups that will undertake tasks as directed. These working groups will report directly to the committee by bringing forward recommendations on their work for final
approval by the committee. These working groups may include non-committee members.

6.0 **Review of Terms of Reference**
   a) The committee’s Terms of Reference shall be reviewed at least annually.