



March 22, 2017

**Action Plan Status Update: Copper Cliff Smelter
Site-Specific Standard Approvals for Sulphur Dioxide, # 503-12-rv0, 504-12-rv0**

Context

On December 24, 2012 the Ministry of Environment issued Vale Canada Limited two Site-Specific Standard Approvals for sulphur dioxide at its Copper Cliff Smelter. #503-12-rv0 is the 1-hr Site-Specific Standard Approval, #504-12-rv0 addresses the 24-hr standard. Vale submitted an action plan with its application and this became Appendix 1 in the Approvals; it is appended to this report. The reference numbers in the action item updates below are those in Appendix 1.

The update of each action item is detailed below:

Action Items

1. In January 2013 Vale's Ontario Operations announced it was moving to a single-furnace operation, which has resulted in a reshaping of the Clean AER Project plan. The single-furnace Clean AER project will deliver significantly improved environmental outcomes. Early calculations estimated an approximately 85% SO₂ emissions reduction from current levels along with a 70% reduction in nickel concentrations in the community.

The work in 2017 continues to be focused on executing the revised Clean AER project plan that was developed in 2014 on the basis of a future single furnace operation.

The Clean AER Project is approximately 70% complete to date. Engineering, procurement, fabrication and construction have continued as per the execution plan developed at the end of 2014. Detailed engineering is substantially complete and the Toronto engineering office is being demobilized. Procurement and fabrication is 93% complete. Construction is 41% complete and commissioning is 27% complete. Equipment fabrication and construction continue in the main areas as follows:

- The Converter 10 construction is complete; ramp-up is scheduled for August 2017.
- The Converter Wet Gas Cleaning Plant building and construction and equipment installation is currently underway. Construction will continue until late Q4 2017 to be followed by commissioning in Q1 2018.
- The Primary and Secondary Flue structural steel and ducting contract was awarded in Q4 2016. The contractor has mobilized to site and started erection of flue support steel. Completion is forecast for Q4 2017.
- Tie-ins for all completed flues is planned during the June Smelter shut-down (Planned Maintenance Period - PMP).
- The Secondary Baghouse and Fan Building construction contract was awarded late Q4 2016. Mobilization to site is planned for early Q2 2017.

- The acid plant and FBR gas cleaning modifications are well underway with much of the final work planned to take place during the June PMP.
 - M Floor conveyor modifications ramp-up is planned for Q3 2017.
 - Surface facility upgrades planned for 2017 include ramp up of Copper product (MK) filtration and loadout operations, and Matte Separation and Flash Furnace modifications.
2. The sulphur dioxide Emissions Reduction Program (ERP) has been in existence since the 1970's, originally voluntary, and later mandated through various legal instruments issued by the Ministry; it is currently mandated by the Smelter Environmental Compliance Approval, # 4414-92QPT8. The purpose of the ERP is to limit sulphur dioxide emissions to the atmosphere by curtailing production at the Smelter on days when dispersion conditions are such that unacceptable ground level concentrations of SO₂ are anticipated or experienced in the community. Details of the ERP, the daily control forecasts, and real-time and historical community SO₂ monitoring network data are available on Vale's website: <http://www.vale.com/canada/en/aboutvale/communities/sudbury/sudbury-environment/our-commitment-to-air-sudbury/pages/default.aspx>
This item is complete and ongoing, as reported March 18, 2013.
 3. A second Combined Analysis of Modelling and Monitoring study was conducted to better correlate measured to modelled sulphur dioxide results in the community. The report was submitted to the Ministry of Environment on June 14, 2012. This item is complete, as reported March 18, 2013.
 4. Vale annually reviews its sulphur dioxide Emission Reduction Program (ERP) and looks for opportunities to enhance the program. As work progresses on the Clean AER project and single furnace operation, and detailed engineering is completed on the scope elements, work to enhance ERP for the few remaining sources of sulphur dioxide will be undertaken. A consultant was retained to help out with the enhancements; work started in March 2017 and will continue throughout the year with further details to be provided in the September 2017 update. This work will continue to be ongoing until each stage of the AER project and 1-Furnace operation is complete.
 5. A new continuous sulphur dioxide monitor was installed on Union Street in the Little Italy area of Copper Cliff in consultation with the Ministry of Environment. It was commissioned in November, 2012. Real time data and historical data for the entire Sudbury air quality monitoring network are available on Vale's website, <http://www.vale.com/canada/en/aboutvale/communities/sudbury/sudbury-environment/our-commitment-to-air-sudbury/pages/default.aspx>
This item is complete, as reported March 18, 2013.
 6. Following completion of the Clean AER project, source testing will be performed and a Combined Analysis of Modelling and Monitoring study will be conducted to verify the emissions reduction accomplishments of the project and the enhancements made to the Emissions Reduction Program. This is planned to occur in 2020 when all components are complete.

Appendix 1: Summary of Action Plan Items

Table A: Measures to Reduce Sulphur Dioxide Emissions

Item Number	Reduction Measures	Description of Measure
1	Atmospheric Emissions Reduction (AER) Project - Process modifications and equipment installation	<p>Install 4 new nickel smelting converters with water cooled primary hoods and spray coolers</p> <p>Install a new dedicated Wet Gas Cleaning Plant that will clean gases from the nickel smelting converters before they are sent to the new acid plant.</p> <p>Build a second acid plant to convert SO₂ gas from the nickel converters to sulphuric acid products.</p> <p>Modifications to the existing acid plant to better control SO₂ gas strengths and allow for more efficient operation.</p> <p>Install a SO₂ scrubber at the existing Weak Acid Treatment Plant.</p> <p>Expand the Weak Acid Treatment Plant to allow for treatment of waste from the new Converter Wet Gas Cleaning Plant.</p> <p>Install secondary hoods on the nickel smelting converters and the copper smelting multi-purpose vessels (MPV) to capture fugitive SO₂ gases and install a secondary baghouse to remove particulate from the captured gases.</p> <p>Modify the copper smelting MPV #14 to capture and treat SO₂ containing process gas in the Reactor wet gas cleaning plant as feed for the acid plant –when it operates as a copper reactor.</p> <p>For low strength SO₂ sources not suitable for an acid plant:</p> <ul style="list-style-type: none"> • Implement changes in the Fluid Bed Roasting area to increase SO₂ gas strength by removing non-SO₂ gas streams from the acid plant. • Modify exhausts to allow for better dispersion of emissions from the furnace building roof. • Redirect emissions from the Flash-furnace uptake vents to the Copper stack for better dispersion.

Item Number	Reduction Measures	Description of Measure
2	Operate the Emissions Reduction Program (ERP)	Continue to operate the existing ERP, curtailing production as required to keep the ground level SO ₂ concentrations in the community below the levels in Tables 1 and 2 of this Approval.
3	Combined Analysis of Modelling and Monitoring study	Completion of the second Combined Analysis of Modelling and Monitoring study to try to better correlate measured to modelled results in the community.
4	Review and enhance ERP to control SO ₂ emissions post AER project.	Review and enhance ERP to control the few SO ₂ emissions sources remaining after finalizing the Clean AER project.
5	Installation of a new continuous SO ₂ monitor in Little Italy	Installation of a new continuous SO ₂ monitor in Little Italy
6	Following completion of Clean AER project perform source testing and conduct a Combined Analysis of Modelling and Monitoring study to verify the accomplishments of the AER and enhanced ERP	Following completion of Clean AER project perform source testing and conduct a Combined Analysis of Modelling and Monitoring study to verify the accomplishments of the AER and enhanced ERP.