RTI INTERNATIONAL | Memorandum

To: Amy Vasu
From: Marvin Branscome and Sandra Burns
Date: February 7, 2006
Subject: Technical Recommendations for Emission Control Measures for $PM_{2.5}$ and Metals and for Additional Testing

Background

The purpose of this memorandum is to present draft recommendations for emission control measures for $PM_{2.5}$ and metals for two steel mills and a coke plant in Wayne County, Michigan. In assessing the two steel mills and coke plant, as well as from evaluating relevant data from other steel mills and coke plants, we have enough information to make some recommendations for control measures to reduce emissions. In addition, we have identified other potential control measures that may be applicable, but additional testing and evaluation are needed to assess their feasibility for $PM_{2.5}$ emission reductions. Consequently, recommendations are also included for additional testing and site-specific evaluations to assess these potential control options.

Cost estimates for testing are also presented because some of the major recommendations deal with filling data gaps on emissions. The costs for testing were developed from information supplied by the companies, testing contractors, and EPA estimates prepared for information collection requests.

Control Measures for the Coke Plant

The recommended control measures and site-specific evaluations for the coke plant relate to the combustion of coke oven gas. The control measure for SO_2 at the coke plant will also result in reductions at the U.S. Steel plant for the steel mill processes that burn coke oven gas.

1. EES Coke Battery should perform a feasibility analysis for coke oven gas desulfurization. Our information indicates that it may be cost effective for SO_2 control. Most U.S. coke plants and many foreign coke plants already desulfurize their gas, which suggests that it is affordable and cost effective. Desulfurizing the coke oven gas at the coke plant would reduce SO_2 emissions from several emission points (the battery's combustion stack, boilers at the steel mill, and flares).

2. EES Coke Battery should also conduct testing and investigate the level of condensible PM from the combustion stack. This study should focus on the potential for reducing condensible PM by reducing sulfates, improving combustion conditions, changing the mix of blast furnace and coke oven gas, and identifying other factors affecting emissions.

Control Measures for the Steel Mills

The recommended control measures for steel mills are described below. In some cases, a site-specific evaluation is recommended to evaluate and confirm the feasibility of the control measure.

1. Severstal should proceed with plans to install capture and control systems for the blast furnace casthouse that is currently operating and for charging and tapping at the BOF shop. They should also consider similar controls for the other casthouse if that blast furnace is expected to resume operation. These installations should result in significant reductions in emissions of PM and HAP metals (such as manganese) from the casthouses and BOF shop. According to Michigan DEQ, Severstal plans to enter into a consent order to install these controls.

2. Each of the two steel mills should perform a detailed engineering evaluation of their ESP performance and assess the potential for upgrading. Survey responses indicated that U.S. Steel already has an upgrade program underway. (The emissions from the BOF that escape control by the ESP are a significant contributor to process emissions of PM and HAP metals such as manganese.)

3. The two steel mills should evaluate the capture efficiency of hoods applied to casthouse fugitive emissions from tapping, hot metal transfer, desulfurization, BOF charging, BOF tapping, and ladle metallurgy. This will provide data for determining if there are cost effective ways of improving the capture efficiency, such as better hood design or increased evacuation rates. Improvements would reduce emissions of PM and HAP metals.

4. The two steel mills should evaluate the control efficiency of existing baghouses applied to casthouse fugitive emissions from tapping, hot metal transfer, desulfurization, BOF charging, BOF tapping, and ladle metallurgy. This will provide data for determining if there are cost effective ways of improving the baghouse control efficiency to reduce emissions of PM and HAP metals (including manganese).

5. The two steel mills should evaluate the feasibility of installing NO_x controls on the major combustion sources, including blast furnace stoves, reheat furnaces, and boilers. The study of best available retrofit technology (BART) concluded there are cost-effective options for reducing NO_x emissions (which can form $PM_{2.5}$ emissions). For example, Severstal plans to install low-NO_x burners on their blast furnace stoves. (Note: When the coke battery was reconstructed in 1992, the underfiring system was equipped with a state-of-the-art technology using both staged heating and recirculation flow to reduce NO_x emissions.)

6. For mercury emissions, the two steel plants should consider developing and implementing a scrap management plan that limits the amount of scrap from end-of-life vehicles or participate in a program with scrap suppliers and vehicle dismantlers that encourages the removal and proper disposal of mercury switches. For example, Severstal

plans to limit their use of shredded (fragmented) automobile scrap to 2 percent of the total scrap, and their scrap management plan commits the company to purchase scrap from suppliers who reduce or eliminate mercury switches from their scrap.

Testing and Ambient Monitoring

A comprehensive program of emission testing is needed to develop a more credible emissions inventory for steel mills and coke batteries (especially for $PM_{2.5}$ and HAP metals), to better establish the impact that the emissions from these plants have on ambient air concentrations, and to identify cost-effective opportunities to reduce emissions. The testing would likely be more cost effective if arranged and conducted by the companies at their expense because testing arranged by EPA would incur higher costs. Suggestions for testing and evaluation of ambient monitoring data include:

1. Perform sampling and analysis for all major emission points for condensible PM. In particular, additional testing is needed for the coke oven battery's combustion stack to determine the representativeness of a single previous test that found about 700 tons per year of condensible PM. The constituents of the condensible PM should be identified to the extent possible to provide insight into their origin and the potential for reduction through changes in operating conditions, fuel quality, and desulfurization of the coke oven gas.

2. Perform sampling and analysis for filterable $PM_{2.5}$ for baghouses applied to miscellaneous operations (casting, hot metal transfer, desulfurization, charging, tapping, ladle metallurgy). This information is needed to assess the current performance of the baghouses and the potential for upgrading.

3. Perform sampling and analysis for HAP metals for all processes involving molten iron and steel, but especially the basic oxygen furnace (BOF) electrostatic precipitator (ESP) stack, tapping emissions, and the ladle metallurgy facility (LMF). Emissions from tapping and the LMF are of particular interest because ferromanganese, ferrochrome, and other alloys are added to the tapping ladle or at the LMF. The analysis of dust from these operations shows that it is enriched with HAP metals (i.e., higher concentrations of manganese, lead, and chromium than from other collected dust).

4. Perform sampling and analysis for mercury species (particulate and vapor phase) for the BOF ESP stack using the Ontario Hydro method or a similar method. Keep records of the types and quantities of scrap melted during the tests. Our limited data indicate that mercury emissions are not expected from the coke battery combustion stack or the blast furnace stoves. However, we also recommend at least one test for mercury for these emission points because of the uncertainty and lack of data for mercury emissions.

5. Consider studies to better evaluate the contribution of emissions from these plants to ambient air concentrations. For example, analyze daily ambient monitoring data,

wind speed, wind direction, and PM constituents with respect to the plant location (i.e., when the emission plume from the plant is most likely influencing a monitor). Also consider PM species most associated with a plant. For example, a monitor near one of the steel mills showed 5 to 10 times more iron, manganese, and zinc than did other monitors in the county.

6. Also consider the analysis of fence line monitoring data similar to a study performed at the largest U.S. coke plant (Clairton Works in Allegheny County, PA). That study used "highly time-resolved fence line measurements" to develop a fine particle emissions profile for the plant.[1]

Testing Costs

Ranges of costs for testing are given below. These estimates generally assume that there are no access problems for testing and that sampling ports are available. They are based on a test comprised of three runs of one hour each for a single stack and do not include the economy of testing multiple locations or stacks by a single contractor.

1. Method 5 (filterables and condensibles): $3,000 to $5,000.

2. Methods 201/202 (PM_{10} filterables and condensibles, assume same for $PM_{2.5}$): $4,000 to $7,000.

3. Method 29 (multiple metals): $10,000 to $15,000.

4. Ontario Hydro Method[2] for mercury species: $8,500 to $15,000.

5. Total mercury (estimated from $67,500/year for monthly sampling): $5,600.

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[1] Weitkamp, Emily, Eric M. Lipsky, Patrick J. Pancras, John M. Ondov, Andrea Polidori, Barbara J. Turpin, and Allen L. Robinson. *Fine particle emission profile for a large coke production facility based on highly time-resolved fence line measurements.* Atmospheric Environment 39 (2005) 6719–6733.

[2] ASTM D6784. Standard test method for elemental, oxidized, particle-bound, and total mercury in flue gases generated from coal-fired stationary sources.