Michigan Department of Environmental Quality

Air Quality Division

Sulfur Dioxide
One-Hour National Ambient Air Quality Standard
Nonattainment State Implementation Plan
for Wayne County (partial)

Michigan Department of Environmental Quality
Air Quality Division
P.O. Box 30260
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Executive Summary

The United States Environmental Protection Agency (USEPA) revised the primary National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2) on June 2, 2010. The USEPA replaced the 24-hour and annual SO_2 standards, set in 1971, with a new short-term standard based on the 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum SO_2 concentrations. The new level was set at 75 parts per billion (ppb). In 2010, one air monitor located in Michigan's Wayne County at Southwestern High School (SWHS), with a monitored 3-year average of 96 ppb, violated the new NAAQS. The Michigan Department of Environmental Quality (MDEQ) subsequently recommended to the USEPA designating the area surrounding the monitor as nonattainment. The USEPA agreed with this recommendation, establishing the sub-county boundary in Wayne County as nonattainment and the remainder of Wayne County as unclassifiable. Michigan is required by the federal Clean Air Act (CAA) to submit a State Implementation Plan (SIP) that describes the method the state will use for bringing the nonattainment area into attainment with the NAAQS within five years of the nonattainment designation and contains the legally enforceable mechanisms to do so. This document serves as the SIP for the SO_2 1-hour nonattainment area described above.

Monitoring data and dispersion modeling data are both used in this analysis. Monitoring data reflects the impact of "actual" emissions from source operations when the monitor is sampling the air we breathe. The SIP must demonstrate through dispersion modeling that the NAAQS will be met at all locations in the nonattainment area while sources are operating up to their legally permissible rate; i.e., "allowable" emissions. The dispersion modeling also looks at multiple locations, known as receptors, while the monitor reflects concentrations at a single location.

In 2012, the MDEQ identified the largest SO_2 sources in the nonattainment area and, with allowable SO_2 emissions provided by the companies, used a dispersion model to analyze the sources' impacts in the nonattainment area. The following sources' individual modeled impacts exceeded the standard under this operating scenario: Carmeuse Lime, U.S. Steel, DTE River Rouge power plant, and DTE Trenton Channel power plant. EES Coke was included in the SIP analysis because of its large contribution to SO_2 in the area by way of the coke oven gas (COG) that the company sells to U.S. Steel for fuel.

The MDEQ undertook extensive dispersion modeling of the five large sources to determine how much and from which sources SO_2 should be reduced to reach the SO_2 NAAQS throughout the nonattainment area. The process included the development of an initial draft strategy that was included in a proposed SIP in August of 2015. The proposed SIP received public comment from August 20 through October 5, 2015, with a public hearing on September 23, 2015. Many comments were received stating that the proposed SIP strategy was not adequate to maintain attainment. The USEPA commented that the proposed SIP did not meet the requirement that compliance with the standard was to be achieved at all modeled receptors.

Based on these comments, the MDEQ undertook additional modeling analysis, applying additional controls and reductions to achieve compliance at all modeled receptors. The subsequent analysis also updated the meteorological data used and demonstrated the background SO_2 concentration should be reduced from 15 ppb to 12 ppb. The MDEQ worked with DTE and Carmeuse Lime to achieve additional SO_2 reductions and reduced SO_2 impacts, with the modeled results showing NAAQS attainment throughout the nonattainment area. Permits for the DTE power plants and Carmeuse Lime were revised to incorporate the changes. U.S. Steel remains subject to new Rule 430.

Based on the final SIP control strategy implemented through the revised permits and new rule, this SIP demonstrates attainment with the 1-hour SO_2 NAAQS.

Introduction

The USEPA revised the primary NAAQS for SO_2 on June 2, 2010. The USEPA replaced the 24-hour and annual SO_2 standards, set in 1971, with a new short-term standard based on the 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum SO_2 concentrations. The new level was set at 75 ppb. In accordance with Section 107 of the federal CAA, within one year of a new or revised NAAQS, states are to submit designation recommendations to the USEPA.

In 2010, one air monitor in Michigan, located at SWHS in the City of Detroit in Wayne County, showed SO_2 levels exceeding the new 1-hour NAAQS. On June 11, 2011, the MDEQ submitted its recommended designations to the USEPA for the new 1-hour SO_2 NAAQS. The MDEQ submitted a sub-county boundary in Wayne County as nonattainment and the remainder of Wayne County as unclassifiable. The USEPA accepted the recommendation and classified the area as nonattainment on October 4, 2013.

The federal CAA further requires the state to submit a SIP within 18 months after an area is designated nonattainment for a new NAAQS. The SIP describes the method the state will use for bringing the nonattainment area into attainment of the NAAQS within five years of the nonattainment designation, and contains the legally enforceable mechanisms to do so. The MDEQ is late in submittal of the SIP to the USEPA because of extra time needed to identify and make legally enforceable an approvable control plan. Michigan received a letter from the USEPA on March 18, 2016, finding that Michigan had failed to submit the SO_2 SIP by the due date of April 4, 2015. A number of other states also received similar letters.

The MDEQ released a proposed SIP strategy for public comment and hearing in August of 2015. The proposal achieved significant SO_2 reductions and reduced impacts, although the predicted impacts did not meet the standard at all receptors. The MDEQ addressed this through a discussion of current monitor compliance, future actual emissions decreases, trends analyses, and the allowables versus actuals emissions over-predictions. Many commenters, including the USEPA, stated that additional SO_2 reductions were needed.

The MDEQ revisited the control strategy needed to achieve compliance through both modeled receptors and monitor readings. This resulted in a number of changes, including agreements by DTE River Rouge, DTE Trenton Channel, and Carmeuse Lime to make additional SO_2 reductions / impact improvements. Several other revisions were made to the modeling process as well. These changes are described in the body of this document, which serves as the SIP for the SO_2 1-hour NAAQS nonattainment area.

This document describes how the 1-hour SO_2 nonattainment area boundaries were determined, the major sources of SO_2 emissions impacting the air monitor at SWHS and other areas, the dispersion modeling methods and results used to determine which sources should reduce emissions and by how much, the control strategies adopted by the affected companies, and how these controls are incorporated into the SIP.

Nonattainment Area Designation

In the process for recommending a nonattainment area, the MDEQ followed a USEPA guidance memorandum that was issued on March 24, 2012, directing states on the SO_2 designation process and timeline. The MDEQ developed a recommendation that took into consideration the air quality data, emissions data, meteorological data, and major SO_2 source locations in southeast Michigan. This data and subsequent dispersion modeling provided the information necessary for determining which sources of SO_2 emissions in the general vicinity of the SWHS monitor should be included in the nonattainment area boundaries.

The MDEQ recommended the nonattainment area shown in Figure 1, and the USEPA subsequently accepted this region as the 1-hour SO_2 nonattainment area for Michigan. The nonattainment area is bound by the Canadian border on the east, the Wayne County border on the south, follows Interstate 75 on the west to Southfield Road (M-39), Interstate 94 East (Detroit Industrial Expressway) and Michigan Avenue (US-12) on the northern boundary. Some key information the MDEQ used in the nonattainment recommendation is discussed below.

Figure 1. Nonattainment Area for Wayne County, Michigan

Air Quality Data

The Wayne County nonattainment designation for SO_2 was triggered by the SWHS monitor located at 50 Waterman Street, Detroit. The 99th percentiles of the daily 1-hour maximums and the resulting 3-year design values, since 2008, are shown in Table 1. The design values listed in the third column are the average of that yearly daily maximum listed in the second column and the two previous years' daily maximum. It should be noted that the design values have continued to drop since the USEPA designated the area as nonattainment for the 1-hour SO_2 standard in 2012. Table 1 shows that the SWHS monitor design value was just above the new 75 ppb NAAQS in 2013 and dropped below the standard with the 2014 design value, thereby meeting the 1-hour SO_2 standard for the first time since the SO_2 NAAQS was revised as a 1-hour standard.

Table 1. SWHS Annual & 3-year Design Value (ppb)

Year	99th Percentile, Daily Max.	Design Value
2008	101.0	
2009	79.0	
2010	107.0	96
2011	84.0	90
2012	80.2	90
2013	65.6	77
2014	71.5	72
2015	55.2	64

One other MDEQ SO_2 monitor, the Allen Park monitor, is located in the nonattainment area on the central/western edge, as shown in Figure 1. The Allen Park 99^{th} percentiles of the daily 1-hour maximums and resulting 3-year design values, since 2008, are shown in Table 2. The monitor's design values continue to attain the 1-hour SO_2 standard. The monitor location and lower SO_2 levels suggest that it be used in setting a background level of SO_2 for purposes of modeling SO_2 sources in and near the nonattainment area.

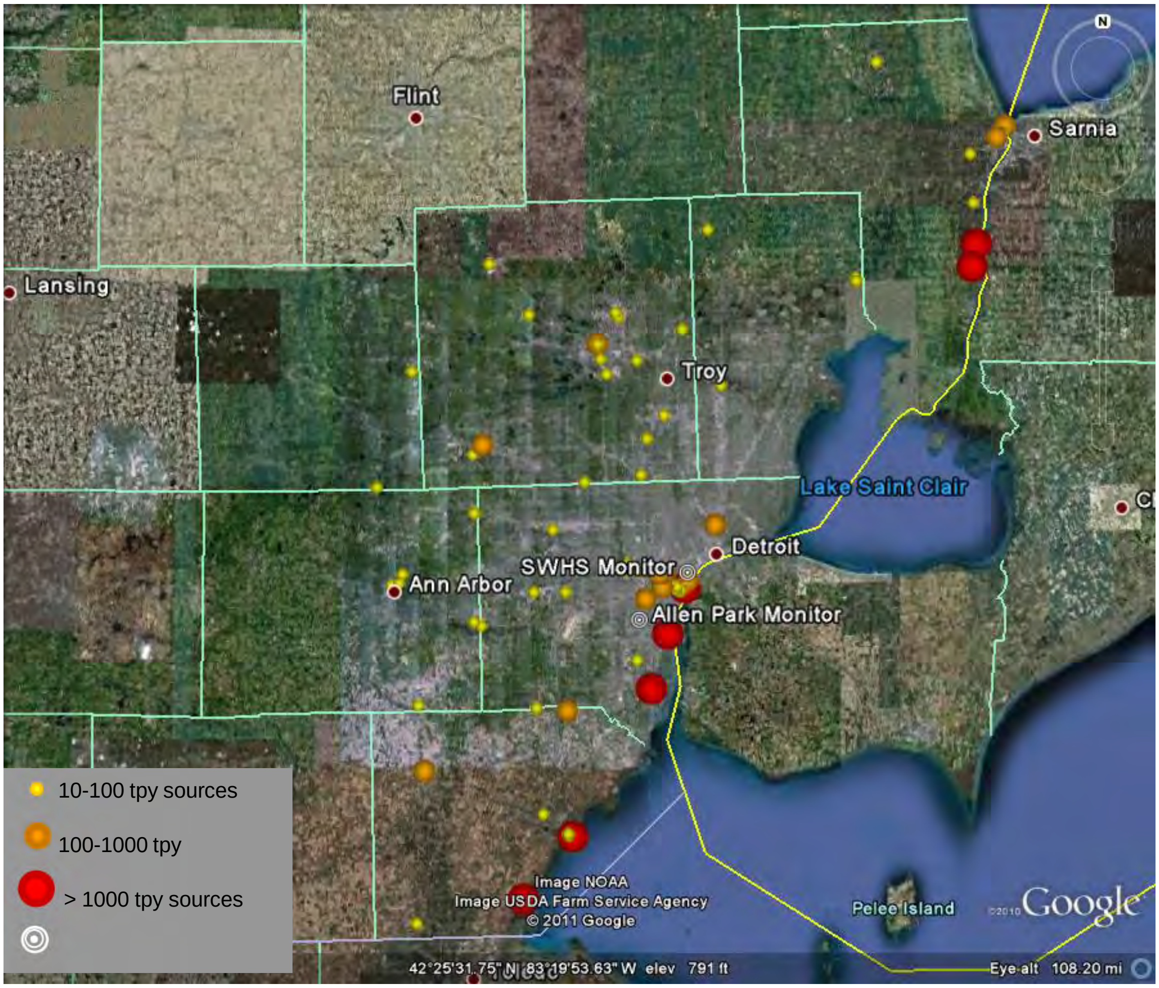
Table 2. Allen Park Annual and 3-year Design Value (ppb)

Year	99th Percentile, Daily Max.	Design Value
2008	70.0	
2009	41.9	
2010	57.2	56
2011	46.7	49
2012	48.9	51
2013	43.1	46
2014	55.6	49
2015	33.6	44

Emissions

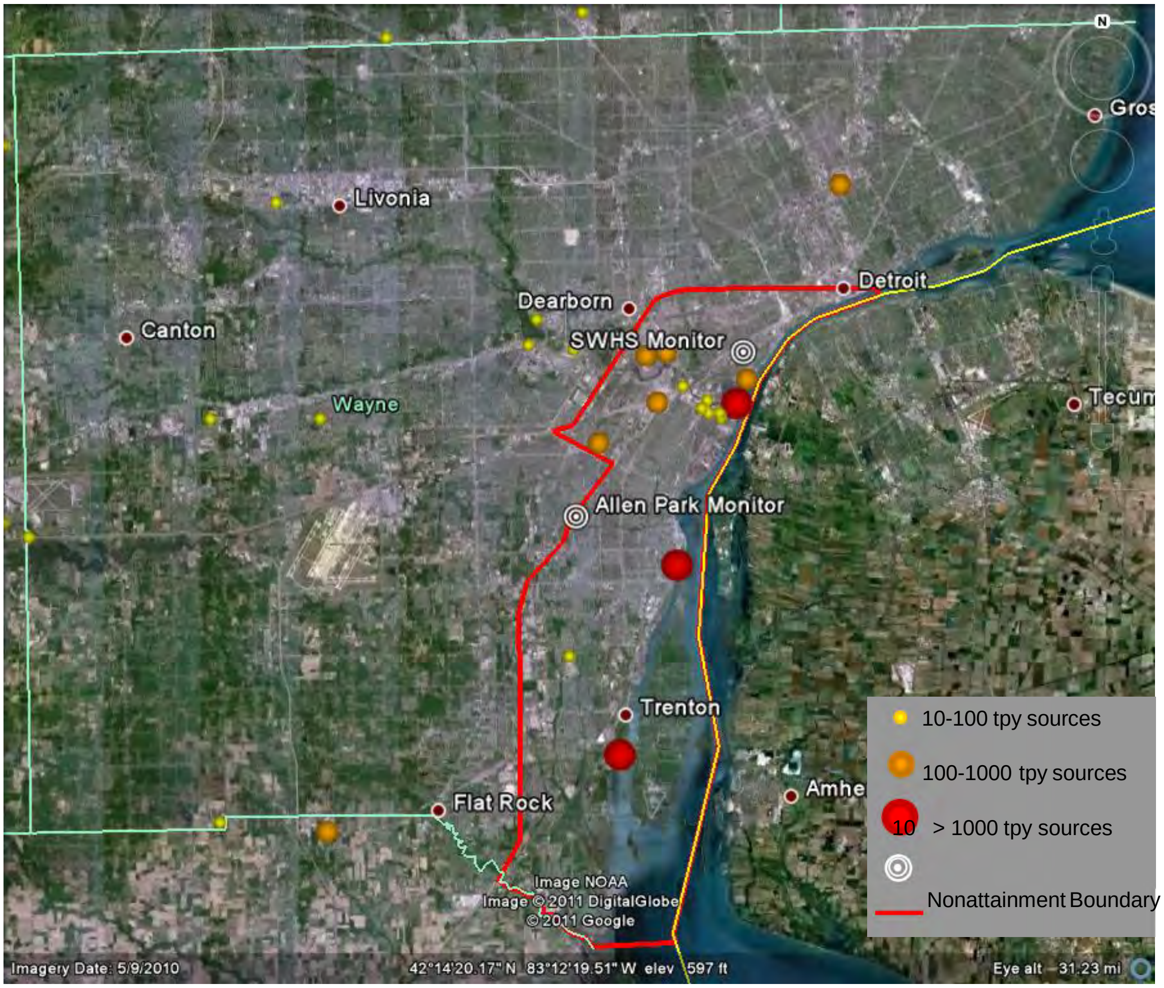
Large sources of SO_2 emissions that impact the SWHS monitor are key to determining the boundaries of the nonattainment area. Figure 2 shows the location of SO_2 sources in southeast Michigan with either actual or permitted emissions of 10 tons or more. Where permit data was available, allowable limits were used. If allowable limits were not available, reported emissions inventory data for 2009 was used (2009 was the most recent inventory available when the boundary analysis was completed). Figure 3 shows the sources in Wayne County in relationship to the SO_2 nonattainment area. The red dots indicate sources either emitting or permitted to emit more than 1,000 tons per year (tpy) of SO_2. The orange dots indicate sources between 100 and 1,000 tpy. The yellow dots indicate sources between 10 and 100 tpy of SO_2.

Figure 2. SO_2 Sources in Southeast Michigan



The nonattainment area contains most of the SO_2 sources emitting more than 100 tpy in Wayne County. Directly south of the SWHS monitor is Zug Island, located in the city of River Rouge. This small island contains the blast furnaces and boilers of U.S. Steel, one of the two steel mills in the Detroit area. The remaining U.S. Steel steelmaking operations (basic oxygen furnaces and other processing) are located further south in Ecorse, Michigan. The only operating coke battery in the state, owned by EES Coke, is also located on Zug Island. Just south of Zug Island is DTE River Rouge, one of two coal-burning power plants located in the nonattainment area. The other, DTE Trenton Channel, is located approximately 12 miles south-southwest of the SWHS monitor along the Detroit River. Other SO_2 sources located within three miles south and west of the SWHS monitor are the other Detroit area steel mill, a wastewater treatment plant, a petroleum refinery, and a lime processing plant. All of these sources are included in the nonattainment area (see Figure 3).

Figure 3. SO_2 Sources, Air Monitors, and the Nonattainment Area in Wayne County



Emissions and Meteorology

Meteorology, wind direction, and wind speed indicate movement of air around a particular point. This information, in combination with the location and operations of emission sources, is important for determining where the SO_2 impacts at the monitors are originating.

Wind roses are particularly useful in visualizing where winds are coming from (wind direction) and how fast winds are moving (wind speed). The size of the bar indicates the frequency, or how often the wind is at that particular speed and direction. Wind roses were created for SWHS and Allen Park using meteorological data from 2012-2014 collected at each of the two monitor locations. The wind roses for Allen Park and SWHS indicate winds from all directions, but most commonly from the south and west (see Figure 4).

Pollution roses indicate the wind direction during high concentration hours of a pollutant. They are similar to wind roses, except the wind speed is replaced by pollutant concentration. High pollutant concentrations in a particular wind direction indicate a source of that pollutant is located in that wind direction in relation to the monitor.

Pollution roses were also created for the SWHS and Allen Park monitors using 2015 data. To emphasize the high days, a threshold value of 5 ppb of SO_2 was used. Although the NAAQS is set at 75 ppb, using a 75 ppb threshold would not provide enough data to create pollution roses, thus 5 ppb was used.

The Allen Park monitoring data shows northeast to south wind directions during the hours when SO_2 concentrations are above 5 ppb. SWHS shows a distinct southerly wind direction when SO_2 concentrations are above 5 ppb (see Figure 5). There are many SO_2 sources in eastern Wayne County as shown in Figure 1, with several large sources of SO_2 south of SWHS and east of Allen Park along the Detroit River. Less than two miles directly south of the SWHS monitor is an ironmaking facility, a coke battery, a power plant, and the Detroit River, which together greatly increase SO_2 concentration at that monitor. These major sources of SO_2 are more than three miles away and downwind of the Allen Park monitor and thus have little influence on SO_2 concentrations at that monitor.

Figure 4. Wind Roses for the SWHS and Allen Park Monitors for 2012-2014

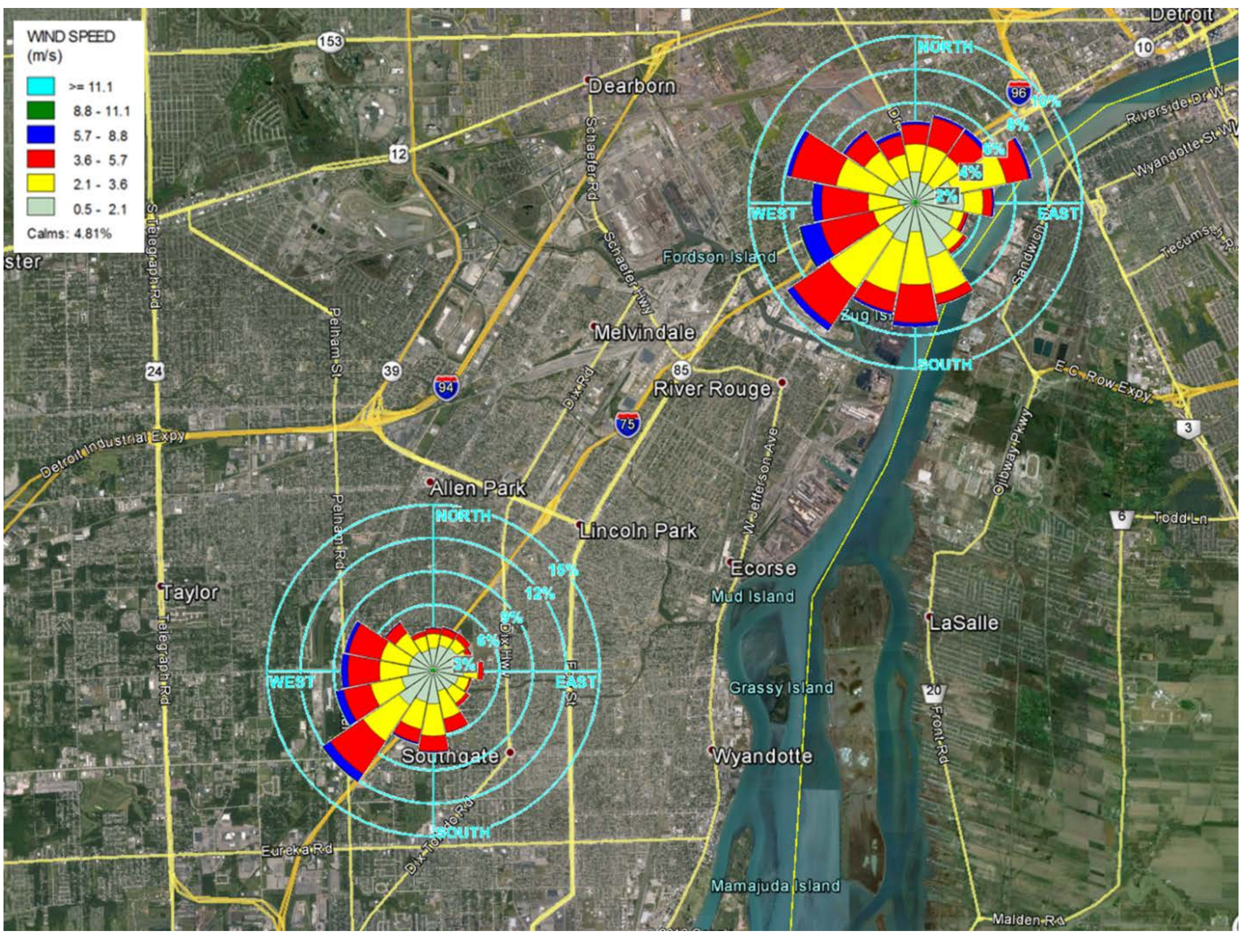
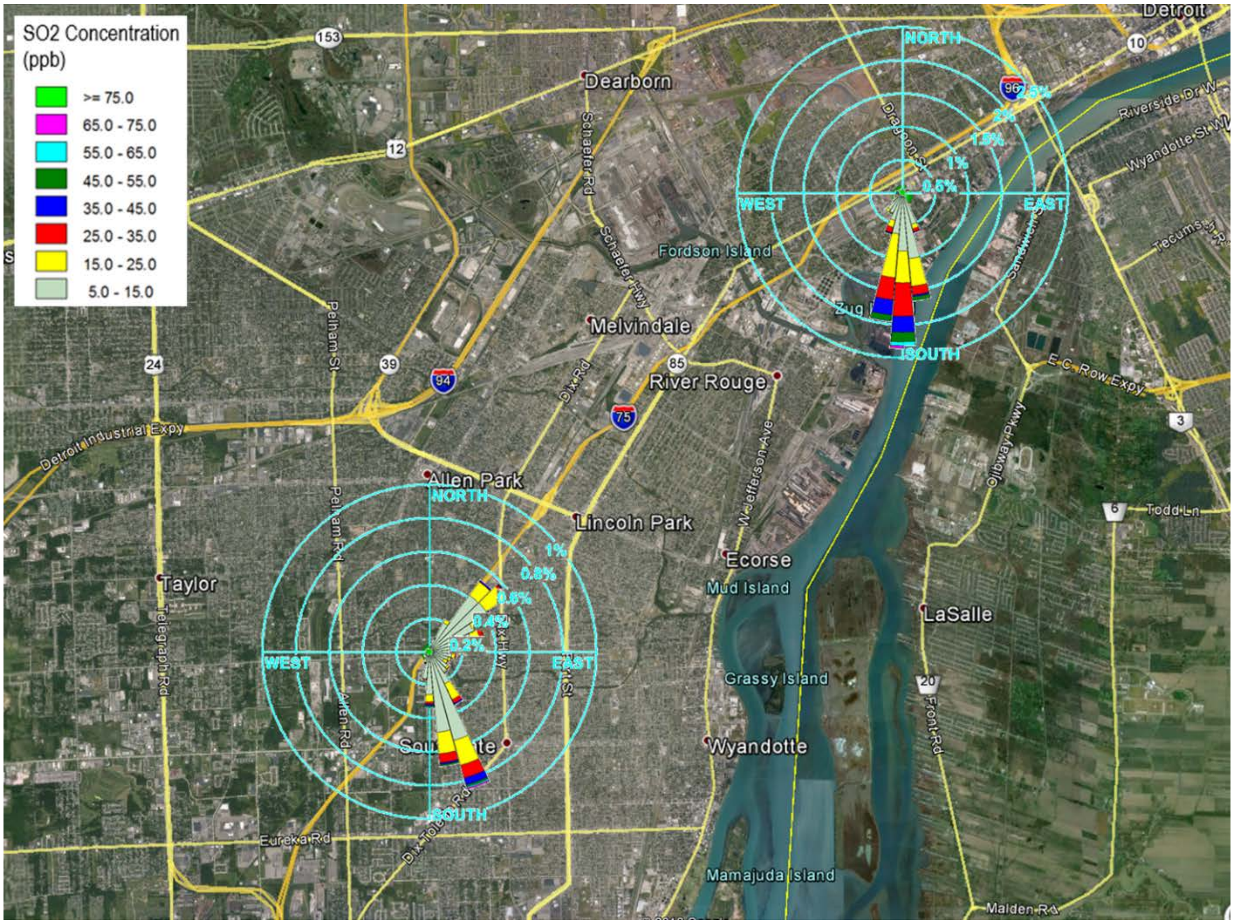


Figure 5. 2012-2014 SO_2 Pollution Roses showing Wind Direction during Hours with SO_2 Greater than 5 ppb



Large SO2-Emitting Facilities

The information obtained in the designation recommendation analysis covered in the previous section of this document led directly to the rest of the SIP planning process. A key part of the SIP process is identifying and characterizing impacts of the main sources of SO_2 contributing to the high SO_2 levels at the violating SWHS monitor and other areas in the nonattainment boundaries. Dispersion modeling of SO_2 emissions from the facilities shown to be most likely impacting the nonattaining SWHS monitor is necessary to fully accomplish this.

The USEPA specified 100 tpy SO_2 as the emission threshold for evaluating SO_2 sources for inclusion in nonattainment modeling. The 2012 Michigan Air Emissions Reporting System (MAERS), the most recent emission inventory of SO_2 at the start of the SIP process, was used as the starting point of the source review (Appendix A). The MDEQ visited all such facilities to verify which had actual emissions over the100 tpy threshold and to better understand operations. The following facilities are those with verified actual emissions over 100 tpy in 2012:

- U.S. Steel (Zug Island, River Rouge, and Ecorse) (2,874.3 tpy)
- EES Coke (1,900 tpy)
- DTE River Rouge Power Plant (8,202.5 tpy)
- DTE Trenton Channel Power Plant (22,426.1 tpy)
- Severstal Dearborn, LLC (677.1 tpy)
- Dearborn Industrial Generating (597.9 tpy)
- Carmeuse Lime, Inc. (699.7 tpy)
- Marathon (137.3 tpy)

All sources, with the exception of DTE Trenton Channel, are located in close proximity to each other in the northern portion of the nonattainment area, within approximately two miles of the SWHS monitor. DTE Trenton Channel is located approximately 12 miles south of the SWHS monitor.

The DTE Monroe power plant was also included in the modeling because of the historically large amount of SO_2 emitted from the facility, despite the fact that it is not within the nonattainment area boundaries. Since the beginning of the SIP process in 2012, all four units at Monroe have installed scrubbers. All scrubbers were installed and operating by the end of 2014.

The following are descriptions of the SO_2 sources that were modeled in this SO_2 SIP development process.

U.S. Steel

U.S. Steel Great Lakes Works (U.S. Steel) is a steelmaking facility located along the Detroit River in the communities of Ecorse and River Rouge. Products manufactured at the plant include hot-rolled, cold-rolled and coated sheet steels used primarily by customers in the automotive industry. U.S. Steel has an annual raw steelmaking capability of approximately 3.8 million net tons. Production facilities include three blast furnaces and associated equipment located at the primary iron producing facility on Zug Island in River Rouge, two boiler houses containing five boilers each also located on Zug Island, the 80" hot strip mill containing five reheat furnaces located south of Zug Island in River Rouge, and assorted other operations involved in the steelmaking and finishing process located in Ecorse.

The primary sources of SO_2 emissions at the steel mill are the five hot strip furnaces that burn COG and natural gas and 10 boilers located in boiler houses 1 and 2 that burn COG, blast furnace gas (BFG), and natural gas. COG is a high sulfur by-product of the coking process at EES Coke located on Zug Island. BFG is a by-product of the blast furnace operations.

Pre-control Strategy Emission Rate

The potential emission rates the MDEQ used in the modeling for U.S. Steel sources are listed in Table 5, and are in pounds per hour (lbs/hr) as required for use in the AERMOD model. The MDEQ was provided the emission rates by U.S. Steel, and the rates are based on the company's fuel throughput monitoring and other factors. As stated above, U.S. Steel typically burns multiple fuels in the modeled processes. In developing the emission rates used for modeling, U.S. Steel allocated the majority of the COG to the reheat furnaces to represent worst case impacts when modeled, as required by SO_2 SIP modeling guidance.

EES Coke

EES Coke Battery, LLC (EES Coke) is an existing coke battery facility located at 1400 Zug Island Road, River Rouge, Michigan. The EES Coke No. 5 coke battery produces coke from the heating of metallurgical coal, in the absence of oxygen, to vaporize volatile constituents and concentrate the carbon. The coke is used as a raw material in a blast furnace to produce iron. Volatile matter, water, and coal-tar in the coal mass are vaporized and driven off. This volatile matter leaves the battery oven as raw COG and is sent to the No. 3 By-products Plant for further processing. To minimize emissions, staged heating and recirculation flow technologies are utilized on the No. 5 Coke Battery.

Following the coking process, a pushing machine pushes the coke out of the oven into a quench car. Fugitive emissions from the quench car are collected and exhausted through the Pushing Emission Control System (PECS) Baghouse. The coke is quenched with water for cooling prior to screening and shipment.

The No. 3 By-products Plant refines the raw COG, separating out tars and light oils. The conditioned COG is then used as a fuel to heat the coke battery. In addition, a portion is sent to U.S. Steel for use in several processes and a portion is sold to offsite sources. Excess COG is flared in an open flare located adjacent to the battery.

SO_2 is emitted from underfire combustion of COG at the coke battery as a result of the thermal oxidation of the sulfur compounds in the fuel. EES Coke currently collects fuel samples to determine the hydrogen sulfide (H_2S) content of the COG and operates a continuous emissions monitoring system (CEMS) for SO_2 to demonstrate continuous compliance with the current permit emission limits. SO_2 is also emitted from combustion of excess COG in the COG flare and from the PECS stack. The COG flare is a control device used to combust any COG that is not used at the battery, used at other on-site sources, or sold offsite.

Pre-control Strategy Emission Rates

The emission rates used for the EES Coke operations came from existing permit PTI 51-08. The maximum allowed SO_2 emission rate for the battery combustion stack is 544.6 lb/hr. The maximum flare rate of 354 lb/hr occurs when the combustion stack is at its maximum of 544.6 lb/hr. The rate of 10 lb/hr for the PECS was derived from testing of the system.

DTE

River Rouge Power Plant

The River Rouge power plant is located in the city of River Rouge and operates under Renewable Operating Permit (ROP) No. MI-ROP-B2810-2012. When SIP development began, the River Rouge power plant had three electric-generating units. Unit 1 is a 2,400 million British thermal units (MMBtu) per hour natural gas-fired boiler that is not part of this analysis. Units 2 and 3 were solid fuel-fired boilers rated at 2,280 and 2,670 MMBtu per hour, respectively. Units 2 and 3 had nameplate electric-generating capacities of 292 and 358 Megawatt (MW), respectively. Both of these boilers were permitted to fire pulverized coal, natural gas, blast furnace gas, and COG and exhausted to separate stacks. The stack dimensions are included in Table 8 in this document.

The River Rouge power plant also has four distillate fuel oil-fired generators rated at 2.75 MW each. ROP No. MI-ROP-B2810-2012 limits SO_2 emissions to 120 parts per million (ppm) by volume at 50% excess air, equal to an SO_2 emission rate of 0.27 pounds per million British thermal units (lb/MMBtu). These generators are not part of this analysis.

Pre-control Strategy Emission Rates

The MDEQ used the permitted SO_2 daily limit for each unit, expressed in tons per day, and converted it to an hourly average, as shown in Table 3.

Table 3. Permitted Daily Limits, River Rouge Power Plant (2012)

Boiler	Daily Limit, tons/day	Hourly Rate, lbs/hour
2	43.2	3,600
3	50.5	4,208

Trenton Channel Power Plant

The Trenton Channel Power Plant is located in the City of Trenton, and operates under ROP No. 199600204. When SIP development began, the Trenton Channel Power Plant consisted of five coal and oil-fired boilers and five oil-fired Slocum peaker generating units. Boilers 16, 17, 18, and 19 were similar, tangentially fired coal-fired boilers with a combined heat input capacity of 3,023 MMBtu per hour for all four boilers. Boiler 9A is a coal-fired boiler with a rated heat input capacity of 4,530 MMBtu per hour serving an electric generator with a nameplate capacity of 520 MW. Boilers 16, 17, 18, and 19 were exhausted to a common stack and Boiler 9A is exhausted to a separate dedicated stack. The stack dimensions are included in Table 8 in this document.

Pre-control Strategy Emission Rates

In accordance with ROP No. 199600204, the sulfur content of the coal-fired in boilers 16, 17, 18, 19, and 9A shall not exceed 0.83 pounds per MMBtu of heat input (i.e., an emission limit of 1.67 lbs SO_2/MMBtu), based on a monthly average. The MDEQ modeled the emission rates calculated by applying the permitted rates of 1.67 lb/MMBtu to the boiler ratings (MMBtu/hr). This produced the lb/day value in Table 4 below.

Table 4. Potential SO_2 Emissions for the Trenton Channel Power Plant (2012)

Boiler No.	Boiler Rating (MMBtu/hour)	Allowable SO_2 Emission Rate		
		lb/MMBtu	lb/hour	ton/day
16, 17, 18 and 19	3,023	1.67	5,048	60.58
9A	4,530	1.67	7,567	90.78
TOTAL			**12,615**	**151.36**

Carmeuse

Carmeuse Lime & Stone owns and operates a lime manufacturing plant consisting of two straight rotary kilns and ancillary equipment at 25 Marion Avenue in River Rouge, Michigan. The kilns are controlled by baghouses that exhaust through monovents (not traditional stacks). The kilns have historically been fired using pulverized coal and natural gas. Emissions of SO_2 come primarily from the burning of coal and are emitted through the monovents. Carmeuse produces a variety of lime and limestone products used in steelmaking and other industries.

Pre-control Strategy Emission Rates

The MDEQ calculated the emission rates based on ROP No. MI-ROP-B2169-2013 and information in the stack test report, “Carmeuse Lime, Inc. Kilns 1 and 2 Compliance Test Report,” November 2011. The allowable rate is 300 parts per million by volume (ppmv) in exhaust gas corrected to 50% excess oxygen. The calculated emission rates are 126 lbs/hr for kiln 1 and 133 lb/hour for kiln 2.

Marathon Oil

Marathon Petroleum Company LLC, Detroit Refinery and Detroit Terminal are located at 1300 Fort Street, 301 Fort Street, and 12700 Toronto Street in the southwest part of Detroit, Michigan. The facilities are sited between Interstate I-75, Fort Street, Oakwood Avenue, Dix Avenue, and the Rouge River.

The refinery processes approximately 105,000 barrels per day (B/D) of crude oil, which is refined into a product mix of liquefied petroleum gases, gasoline, fuel oil, asphalt, and other products. The makeup of this production varies depending on the type of crude used as charge stocks. The refinery operates 24 hours per day, 7 days per week and 52 weeks per year. SO_2 is emitted from a variety of processes in the facility.

The refinery is organized into five complexes for operations and maintenance purposes. Complex I has the Crude and Vacuum Units; Complex II consists of the Unifiner, Alkylation, Sulfur Recovery Units; Complex III includes the Fluid Catalytic Cracking Unit (FCCU) and other Light Ends Units; Complex IV includes the Catalytic Reformers, Hydrotreaters, and Boilers; and Complex V contains the storage and blending facilities, as well as the Marine Loading Facilities. The refinery operations are controlled by a Distributed Control Computer System.

Pre-control Strategy Emission Rates

The MDEQ used emission rates supplied by the contractor doing permit modeling for Marathon. The multitude of equipment and emission rates is listed in Table 5 in this document.

AK Steel/Severstal

AK Steel purchased Severstal Dearborn, LLC recently, but the facility will continue to be referred to as Severstal throughout this document. Severstal operates an integrated steel mill at the Rouge Industrial Complex in Dearborn, Michigan. The Rouge Industrial Complex is located at 3001 and 4001 Miller Road in Dearborn, Michigan. Severstal operations include two blast furnaces with C Blast Furnace currently operating and B Blast Furnace undergoing repairs, a basic oxygen furnace shop, two continuous casters, a hot strip mill, and cold mill operations. The plant produces sheet steel that is used in a variety of manufacturing applications. Ford Motor Company operates the remainder of the complex.

Pre-control Strategy Emission Rates

The SO_2 emissions come from a variety of processes at Severstal. The MDEQ used emission rates for four processes for modeling the facility based on the SO_2 limits found in Permit 182-05C. The limits in the permit are in lbs/hr with a calendar day average and are listed in Table 5 in this document.

Dearborn Industrial Generation (DIG)

The DIG is a power-generating facility located at 2400 Miller Road in Dearborn, Michigan. The facility consists of three natural gas-fired turbines, three boilers capable of combusting natural gas or a combination of natural gas and BFG, two open flares, and two diesel fuel-fired emergency generators. The two flares combust any excess BFG which cannot be burned in the boilers. One of the turbines is a single cycle combustion peaking unit. The other two turbines are identical combined cycle combustion turbines. The three boilers are designed to fire a mixture of up to 95% BFG and 5% natural gas (by heat input) or 100% natural gas. The BFG is received from Severstal as a by-product of their iron and steel making operations. Steam generated by the combined cycle turbines and boilers is diverted to a steam turbine, which generates electricity sold to the electrical power grid.

Pre-control Strategy Emission Rates

The SO_2 emissions come from the combustion of BFG in the DIG boilers and flares. The MDEQ used emission rates for modeling the facility based on the SO_2 limits found in ROP MI-N6631-2012. The limits in the permit are in lb/hr with a calendar day average and are listed in Table 5.

DTE Monroe

The Monroe power plant consists of four similar-sized supercritical pulverized coal-fired Black & Wilcox cell burner boilers with a total electric-generating capacity of 3,280 MW (gross), associated coal and ash handling systems, auxiliary boilers, parts cleaners, and five diesel generators. The DTE Monroe power plant is currently operated under ROP No. MI-ROP-B2816-2009. The four pulverized coal-fired boilers are referred to as Units 1, 2, 3, and 4 and currently combust a blend of bituminous and subbituminous coals with startup using No. 2 fuel oil. They are capable of combusting up to 100% each of bituminous and subbituminous coals, a blend of bituminous and subbituminous coals, and up to 10 percent on a mass basis of petroleum coke.

Units 1, 2, 3, and 4 are equipped with wet flue gas desulfurization (FGD) systems for SO_2 control. The wet FGD began operation in 2009 for Units 3 and 4 and in 2014 for Units 1 and 2. Additional information on the modeled impacts of DTE Monroe in the nonattainment area is located in Appendix J.

Pre-control Strategy Emission Rates

The MDEQ used emission rates provided by DTE for SO_2 modeling. The SO_2 limits at Monroe are 24-hour rolling averages, updated each hour, for Monroe Units 1, 2, 3, and 4. The limits are contained in PTI No. 93-09B and are listed in Table 5.

Modeling Protocol

Modeling is a key component of the 1-hour SO_2 SIP and therefore must meet USEPA established criteria. This criterion is called the modeling protocol, which was developed by the MDEQ in conjunction with USEPA guidance. The information in the protocol is followed by the MDEQ in doing the modeling for this SIP. The various components are listed below.

Facility Description

General description of the facility with a description of sources (i.e., turbines, boilers, peakers), which will be explicitly included in the modeling demonstration plus justification for any on-site SO_2 sources that will be excluded.

Model Selection

As required by 40 CFR Part 51 Appendix W, use of the most recent AERMOD model (including AERMET and AERMAP); and inclusion of building profile data using BPIP-Prime.

Meteorology

Detroit Metro Airport (DTW) meteorological data was defined as the most representative. The SIP project began with the 2008-2012 data set but 2010-2014 data was used to evaluate the final control strategy impacts. One-minute data was used with default settings to minimize the number of calm hours (0.8%) and missing hours (1.1%).

Modeling Domain

The nonattainment area is bound by the Canadian border on the east to the Wayne County border on the south end, follows I-75 on the west side to Southfield Road (M-39) to I-94 East (Detroit Industrial Expressway) to Michigan Avenue (US-12) on the northern boundary. Receptor spacing was a uniform 100 meters (m) throughout the grid for a total of 27,455 receptors with nonambient air receptors being excluded.

Terrain heights and elevation data source (e.g., 30 m NED GEOTIFF) were included.

Off-site Emissions Inventory

Sources with a significant concentration gradient were explicitly modeled while remaining sources were considered part of the background concentration. This typically excludes emergency equipment, natural gas sources, and minor emissions equipment.

1. Emissions Characterization

Maximum hourly emission rates were needed for each modeled source. In determining these rates, it was important to define how the emission factor was derived (e.g., was it based on hourly data or 24-hour rolling averages). In those instances where it was based on something other than true maximum hourly rates, correlations were necessary to determine an equivalent maximum hourly rate.

2. Source Description

The model also required a complete listing of the source parameters associated with the worst-case emissions. This included stack height, stack diameter, exhaust temperature, and exit velocity.

3. Background concentration

To account for SO_2 from small and regional sources that weren't modeled explicitly, a representative background concentration was necessary. The Allen Park monitor was determined to be the most representative monitor. A wind speciation analysis was performed to exclude the hourly concentrations when winds were from areas having explicitly modeled sources.

Urban/Rural Source Selection

Stack dispersion characteristics considering population, land use, and terrain types. This issue is discussed in more detail under Modeling Details.

Modeling Details

A more detailed description of elements in the modeling protocol follow.

Facility Description

The large SO_2 emitting facilities listed in the previous section were requested to provide the MDEQ with the worst-case, allowable hourly emission rates. A summary of the worse-case hourly emissions at each large source by the individual stacks is contained in Table 5. All processes listed were modeled. Sources not included in the modeled emissions inventory typically were minor sources (less than 1,000 lbs/year), intermittent emergency equipment, and natural gas sources. Appendix A lists the reported 2012 actual SO_2 emissions at each facility and whether they were explicitly included in the model or not. Table 5 documents the emission rates used at the modeled facilities.

Table 5. Modeled Sources and Allowable SO_2 Emission Rates (2012)

	Modeled Emission Rate (lb/hr)
US STEEL (Ecorse)	
HSM Slab Reheat Furnace 1	173.84
HSM Slab Reheat Furnace 2	173.84
HSM Slab Reheat Furnace 3	173.84
HSM Slab Reheat Furnace 4	173.84
HSM Slab Reheat Furnace 5	173.84
No. 2 BOP - No. 2 Baghouse	3.30
Main Plant Boiler No. 9	0.07
Main Plant Boiler No. 8	0.07
US STEEL (Zug Island)	
Zug Island 1 Boiler House No. 1	12.90
Zug Island 1 Boiler House No. 2	12.90
Zug Island 1 Boiler House No. 3	33.32
Zug Island 1 Boiler House No. 4	33.32
Zug Island 1 Boiler House No. 5	33.32
Zug Island 2 Boiler House No. 1	16.84
Zug Island 2 Boiler House No. 2	16.84
Zug Island 2 Boiler House No. 3	16.84
Zug Island 2 Boiler House No. 4	16.84
Zug Island 2 Boiler House No. 5	16.84
Zug Island A1 Blast Furnace	40.18
Zug Island B2 Blast Furnace	40.18
Zug Island D4 Furnace	40.18
Zug Island A/B Blast Furnace Flares	60.19
Zug Island D Furnace Flare	60.19
EES COKE (Zug Island)	
EES Combustion (aka Underfire) Stack	544.60
EES COG Flare	354.00
EES PECS Stack	10.00
DTE RIVER ROUGE	
DTE River Rouge - Unit 2	3,599.92
DTE River Rouge - Unit 3	4,207.94
DTE TRENTON CHANNEL	
Trenton Channel Boilers	5,047.94
Trenton Channel Unit 9	7,566.90
CARMUESE LIME	
Carmeuse Kiln 1	126.00
Carmeuse Kiln 2	133.00
DTE MONROE	
DTE Monroe Unit 3	815.79
DTE Monroe Unit 4	815.79
DTE Monroe Unit 1	815.79
DTE Monroe Unit 2	815.79
SEVERSTAL STEEL	
Severstal Blast Furnace B Stove	38.75
Severstal Blast Furnace C Stove	193.58
Severstal B Furnace Casthouse Baghouse	71.87
Severstal C Furnace Casthouse Baghouse	179.66

Table 5 (continued)

	Modeled Emission Rate (lb/hr)
DEARBORN INDUSTRIAL GENERATION	
DIG Boiler 1	140.00
DIG Boiler 2	140.00
DIG Flare 1	126.59
DIG Flare 2	126.59
MARATHON REFINERY	
Marathon NEWCVHTR	1.01
Marathon FRPUMP1	0.00
Marathon FRPUMP2	0.00
Marathon HYDROHTR	9.98
Marathon COKERHTR	2.40
Marathon NEWSRUTO	17.47
Marathon DHTHTR	0.95
Marathon NEWBOILE	0.13
Marathon BWBOILER	3.15
Marathon VACHTR	1.86
Marathon SRUTO	15.37
Marathon NHTCHTR	0.67
Marathon NHTRHTR	0.48
Marathon KHTHTR	0.19
Marathon GOHTHTR	1.21
Marathon FOIL	0.08
Marathon FPRE	9.13
Marathon CRUDHTR	2.52
Marathon ESP	20.78
Marathon SRHTR	1.45
Marathon NSRHTR	1.45
Marathon MELASPH	0.09
Marathon NTHERM	0.04
Marathon STHERM	0.07
Marathon RGEHTR	0.03
Marathon ALKYHTR	0.95

Model Selection

The following models and supporting models were used in the modeling analysis:

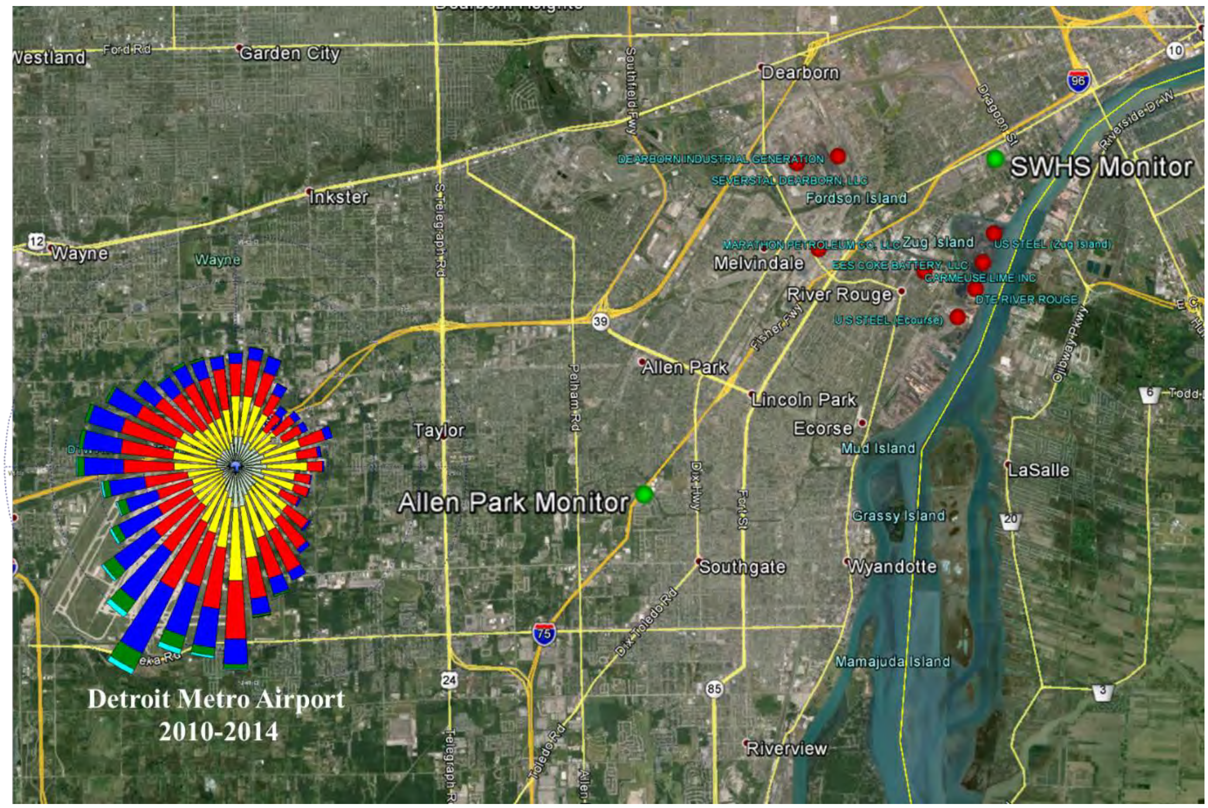
- AERMOD (version 15181)
- AERMAP (version 11103)
- AERMET (version 14134)
- AERMINUTE (version 15272)
- AERSURFACE (version 13016)
- BPIPPRM (version 04274)

The MDEQ used the Lakes Environmental program system to assemble, run, and provide graphical results of the modeling analysis.

Meteorology

Five years of meteorological data from DTW was selected as the most representative for this analysis. The DTW meteorological data is collected by the National Weather Service and is located in the prevailing upwind direction of the primary SO_2 emission sources (Figure 6). One-minute data is also available from this first order collection station. The data set from 2010–2014 is the MDEQ's most recent, vetted data. This 5-year data set is highly representative of the nonattainment area and has been used for multiple industrial permitting purposes. Valid 1-minute data capture was 99.9% and the percentage of calm hours was 0.7%.

Figure 6. DTW Meteorological Site Location



Area Receptor Grid

As described in previous sections, the SWHS monitored design value concentrations, the locations of large SO_2 sources, and other factors were used to establish the SO_2 nonattainment area, as shown in Figure 7.

The southeast Michigan nonattainment designation for SO_2 was triggered by the SWHS monitor located at 50 Waterman Street, Detroit. The 99th percentiles of the daily 1-hour maximums and resulting 3-year Design Values since 2010 are shown in Table 6.

Table 6. SWHS Annual and 3-year Design Value (ppb)
(99th percentile of the daily 1-hour maximums)

Year	99th Percentile, Daily Max.	Design Value
2008	101.0	
2009	79.0	
2010	107.0	96
2011	84.0	90
2012	80.2	90
2013	65.6	77
2014	71.5	72
2015	55.2	64

Figure 7. SWHS Nonattainment Area

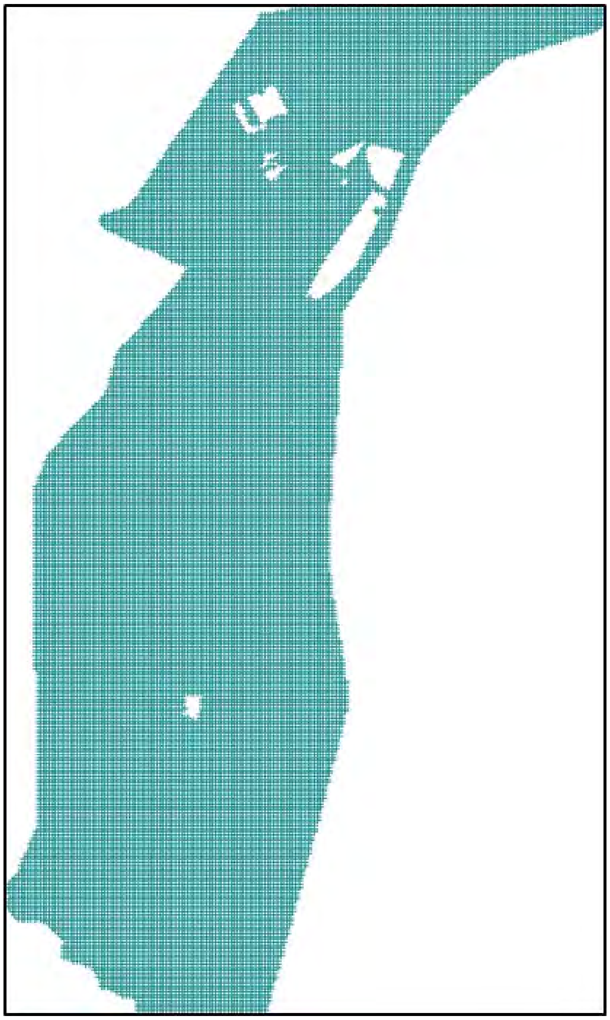
The Allen Park monitor, which is located on the central/western edge of the nonattainment area, shows design values that continue to attain the NAAQS. The monitor is considered the upwind monitor for purposes of determining the background concentration. The Allen Park 99th percentiles of the daily 1-hour maximums and resulting 3-year design values since 2010 are shown in Table 7.

Table 7. Allen Park Annual and 3-year Design Value (ppb)
(99th percentile of the daily 1-hour maximums)

Year	99th Percentile, Daily Max.	Design Value
2008	70.0	
2009	41.9	
2010	57.2	56
2011	46.7	49
2012	48.9	51
2013	43.1	46
2014	55.6	49
2015	33.6	44

The modeling receptor grid was generated with a uniform, 100-meter spacing throughout the domain. The resulting grid contains 27,455 discrete receptors. The topography in this area is generally flat with terrain relief generally ranging from only 10 to 15 feet throughout the grid. Receptor terrain heights were still included for modeling enhancement using AERMAP and 30 m NED GEOTIFF. The nonattainment receptor grid, with nonambient receptors removed, is shown in Figure 8.

Figure 8. Nonattainment Receptor Grid

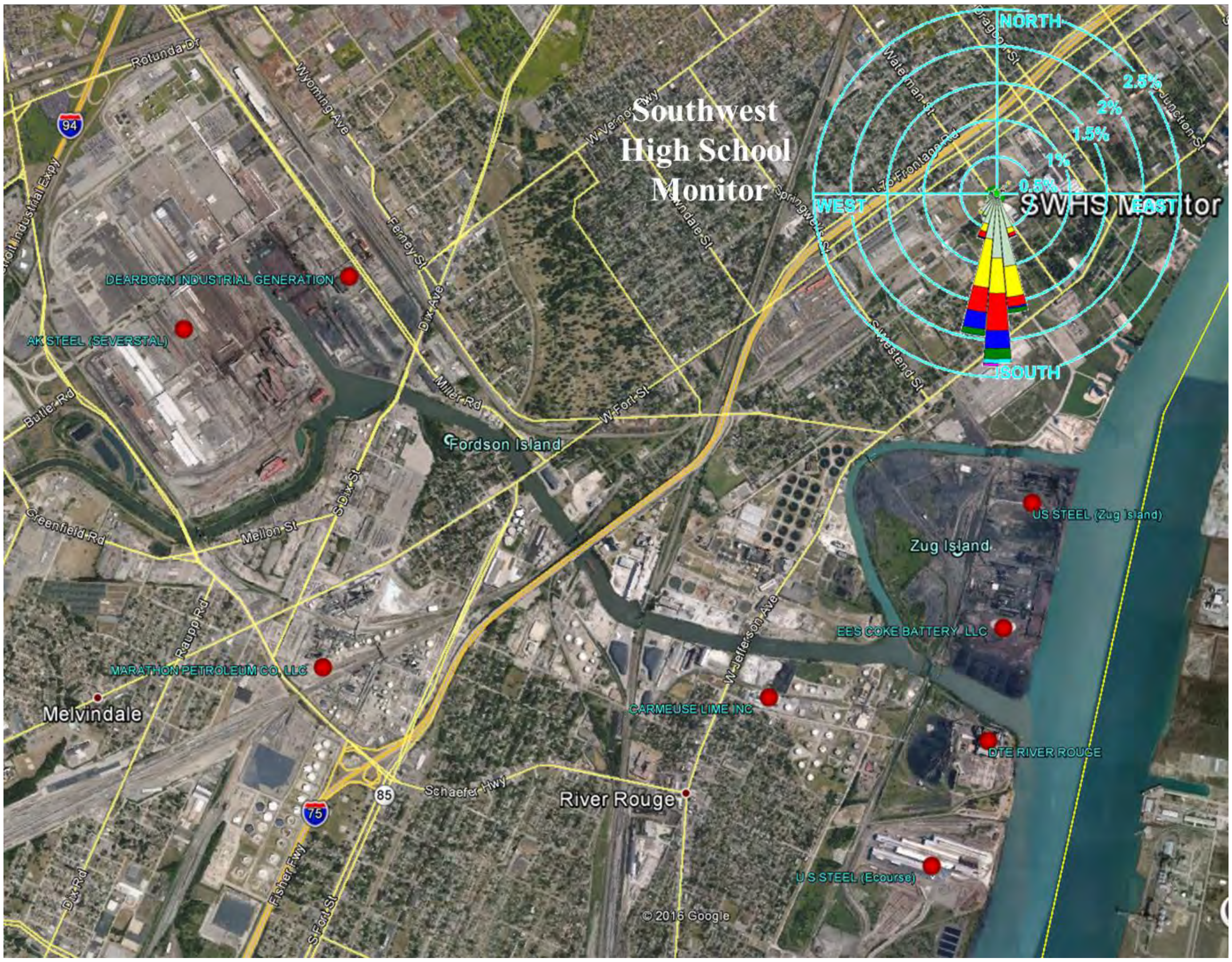


The sources most affecting the SWHS nonattainment monitor share common or near-common boundaries. With overlapping impacts from this cluster of closely grouped sources, the inclusion of additional discrete property boundary receptors between sources did not provide any added value to the overall impact analysis and were not included. Additionally, the MDEQ believes a uniform receptor density of 100 m is adequate to identify areas of modeled violations.

Emission Source Selection

The MDEQ identified the large SO_2 sources to be used in the modeling as described earlier. A key consideration is the SWHS monitoring data, which has shown that emissions having the greatest impact are from sources aligned along the Detroit River. Those aligned sources are U.S. Steel (Zug Island), EES Coke, DTE River Rouge, U.S. Steel (Ecorse), DTE Trenton Channel, and DTE Monroe. The remaining sources, which do not align together in a straight line (Carmeuse Lime, Marathon Oil, AK Steel [Severstal], and DIG), do not tend to significantly impact the SWHS monitor. Of these nonaligned sources, only Carmeuse Lime had a violating hotspot impact, which also needed to be addressed in this SO_2 SIP. A pollution rose based on only the hours when the monitored concentration is greater than 5 ppb indicates SO_2 emissions from the south are impacting the SWHS monitor, as shown in Figure 9.

Figure 9. Pollution Rose, SWHS Monitor, 2012-2014



<u>Background Concentration</u>

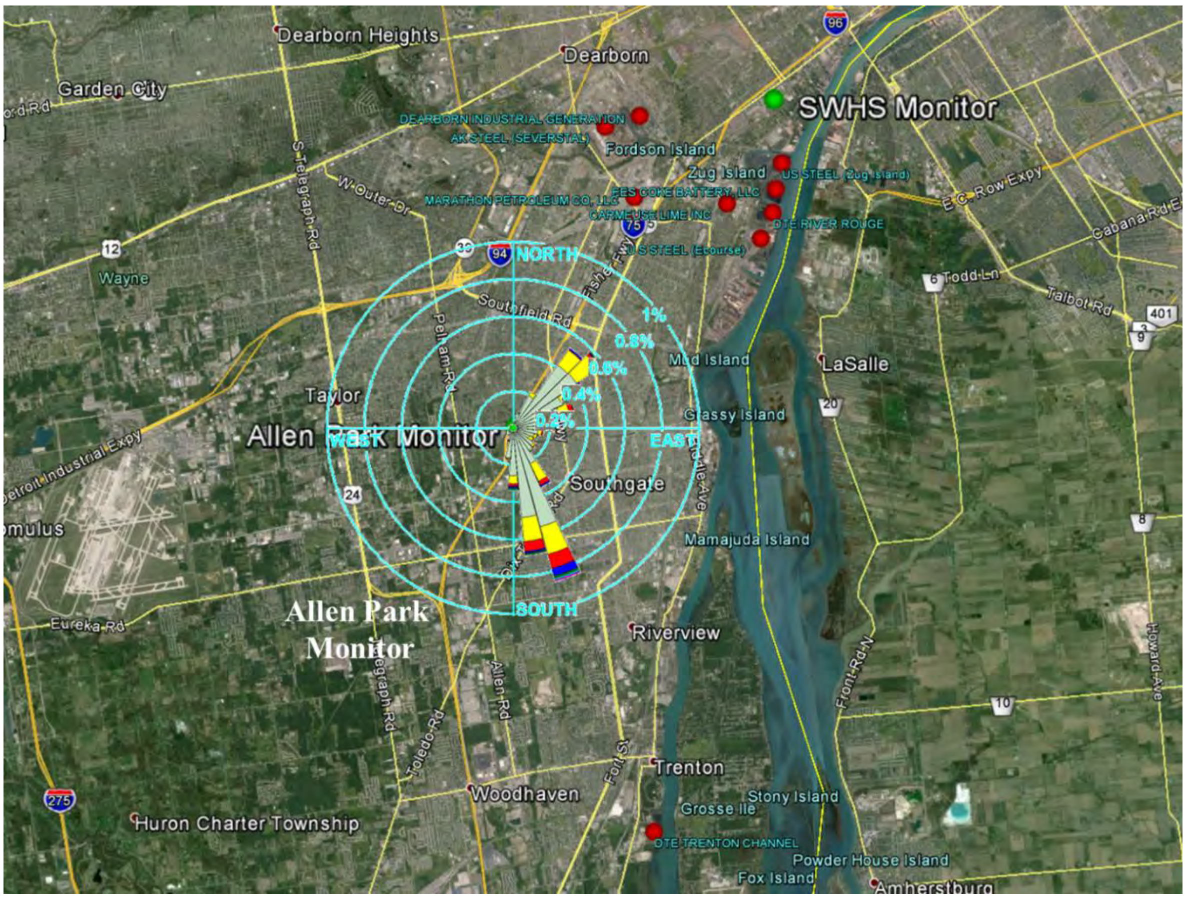
Determination of a background concentration is important in calculating the overall modeled impact. As depicted in previous figures, the Allen Park monitor is located on the west-central boundary of the nonattainment area. With the prevailing southwest wind, this monitor also serves as the upwind monitor for the sources addressed in this modeling analysis and is useful in determining a representative background concentration. A pollution rose based on hourly concentrations greater than 5 ppb shows the direction of primary SO_2 emissions affecting the Allen Park monitor.

The pollution rose in Figure 10 clearly shows elevated SO_2 emissions originating from the northeast (i.e., Zug Island, DTE River Rouge, U.S. Steel Ecorse, Carmeuse) in addition to a source of elevated SO_2 emissions from the south-southeast (DTE Trenton Channel and DTE Monroe). No sources of significant SO_2 appear from the regional upwind direction. To derive a regional background devoid of the sources explicitly modeled in the analysis, the MDEQ developed an SO_2 concentration spreadsheet to exclude hourly SO_2 concentrations when the wind is blowing from sources explicitly included in the modeling. Using this methodology, the spreadsheet ignores all hours (and associated preceding hour) when the wind direction is between 40 degrees and 205 degrees. This will exclude all modeled sources to the northeast

(U.S. Steel, DTE River Rouge, EES Coke, Carmeuse Lime, Marathon, AK Steel [Severstal] and DIG) and modeled sources to the south (DTE Trenton Channel and DTE Monroe).

On-site meteorological data from the Allen Park monitor was used to correlate with the hourly data. A valid day for determining a maximum hourly value was identified when eight or more hours of valid data were available for that day to eliminate isolated outlier concentrations. The spreadsheet determined design values for years 2010-2012 (10 ppb), 2011-2013 (11 ppb), and 2012-2014 (12 ppb). Based on these results, a uniform background value of 12 ppb was chosen. The original calculation spreadsheet and methodology documentation were provided to the USEPA for their review.

Figure 10. Pollution Rose, Allen Park Monitor, 2012-2014



Urban/Rural Source Selection

Based on the population and industrial demographics for the area, the MDEQ selected urban coefficients for all sources in the initial SIP model runs. The current population of Detroit is approximately 690,000 while the population of Wayne County is approximately 1.8 million. Since the grid covers only the southeastern portion of Wayne County, a population of 1,000,000 was chosen. The original accuracy check model run, which utilized AERMOD v14134, 2008-2012 DTW meteorological data, 2012 actual emissions, and urban coefficients for all sources, yielded a modeled design value impact of 127.3 ppb (including 12 ppb background) at the SWHS monitor receptor. This impact seemed unrealistic compared to 2012 monitored design value of 80.2 ppb. Upon research, USEPA guidance (e.g., AERMOD Implementation Guideline [AIG]) recommended using caution when choosing between urban or rural. Quoting the AIG:

> Another consideration that may need attention by the user and is discussed in section 5.1 of the AIG relates to tall stacks located within or adjacent to small to moderate size urban areas. In such cases, the stack height or effective plume height for very buoyant sources may extend above the urban boundary layer height. The application of the urban option in AERMOD for these types of sources may artificially limit the plume height. The use of the urban option may not be appropriate for these sources, since the actual plume is likely to be transported over the urban boundary layer.

This description applied to the southeast Michigan modeling analysis as the unrealistically high impacts were traced back to tall, buoyant stack emissions. The AIG provided a formula, based on population, to estimate a tall stack height cutoff to aid in determining urban or rural classification on a source-by-source basis. However, appropriate population density in this area is difficult to accurately determine due to the nearby large body of water (Detroit River) and the high level of resident population flight from this area. Therefore, the formula approach to determining "tall" stacks was deemed unreliable due to the uncertainty in population.

The MDEQ discussed this situation with the USEPA for possible solutions. Based on their recommendations, the MDEQ did an in-depth analysis of tall, buoyant stacks and determined that buoyant stacks taller than 100 feet (30 meters) were particularly susceptible to the artificial trapping and inflated impacts. As a result, the SIP model input was revised to classify taller, buoyant stacks (greater than 100 feet) as rural with all remaining stacks considered as urban with a population of 1,000,000. Those conclusions were documented in detail in the proposed SIP for public comment during August-October, 2015. That documentation included monitor/model comparison, which showed close correlation using the hybrid approach.

In part because of these conclusions, the USEPA applied a fix to the latest version of AERMOD (v15181) to address the issue. The MDEQ evaluated the model fix by comparing revised impacts, using both the old AERMOD version (14134) and new AERMOD version (v15181) and comparing results to monitored impacts.

The MDEQ concluded that the AERMOD v15181 model fix did seem to improve impacts for the tall, buoyant stacks, especially between 30 meters and 100 meters (USS Zug Island and EES Coke flares) but that the very tall, buoyant stacks (DTE River Rouge and EES Coke Combustion (Underfire)) still seemed susceptible to inflated impacts which drove up the overall impacts to unrealistic levels as compared to the monitor values. Affected stacks are listed below comparing old AERMOD and new AERMOD with rural and urban coefficients:

Tall, Buoyant Stacks	**AERMOD v14134 Coefficients**				**AERMOD v15181 Coefficients**			
ZUG_FLAR	2.35672	urban	0.42527	rural	0.74333	urban	0.42527	rural
EES_FLR	11.28989	urban	3.18409	rural	7.61049	urban	3.18409	rural
EES_UNDR	11.12941	urban	4.42177	rural	10.37444	urban	4.42177	rural
RIVERROU	67.30776	urban	18.72701	rural	41.82493	urban	18.72701	rural

Based on the MDEQ analysis, the shorter stacks (USS Zug Island and EES Coke flares) still showed inflated impacts with new AERMOD but much less severe. The two very tall, buoyant stack configurations (from DTE River Rouge and EES Coke Combustion) had improvements but still showed inflated impacts by a factor of 2-3 times over the rural mode, which caused the model to grossly over-predict monitor results. As such, the MDEQ determined that the DTE River Rouge and EES Coke Combustion stacks should remain as rural until the model fix has been further vetted and validated. The MDEQ shared this concern and conclusion with the USEPA, which will continue to examine this feature of the model.

The MDEQ used the most recent three years of emissions inventories and meteorological data (2013-2015) to ground-truth these conclusions. 2012 emissions were not used in this analysis because that year did not reflect current controls now employed at the DTE Monroe facility, which would result in higher impacts at the monitor than is currently expected. 2014 emissions were used as a surrogate for 2015 since the 2015 emissions data were not certified at the time this analysis was completed.

With the 2013-2015 data set, AERMOD v15181 was run with both stack configurations for DTE River Rouge and EES Coke Combustion to ground-truth the model performance with the downwind monitors and demonstrate the over-prediction with urban coefficients.

When using urban coefficients with DTE River Rouge and EES Coke Combustion, the modeled predictions at the downwind monitor receptors (SWHS and West Windsor) over-estimated the actual monitor design value by an average of 41.0%.

Receptor Location	2013-15 (All Urban Mode)	
	Monitored DV	Modeled DV
SWHS	64.4	100.5
West Windsor	46.0	80.0

When using rural coefficients with DTE River Rouge and EES Coke Combustion, the modeled predictions at the downwind monitor receptors (SWHS and West Windsor) slightly under-estimated the actual monitor design value by an average of 0.6%.

Receptor Location	2013-15 (Urban/Rural Mix)	
	Monitored DV	Modeled DV
SWHS	64.4	62.9
West Windsor	46.0	46.6

As a conclusion, the model provides nearly perfect 3-year design value prediction as compared to affected downwind monitors.

The final urban/rural stack designations and associated stack parameters are presented below.

Table 8. Stack Parameters Including Urban/Rural Designations

	Stack Height (feet)	Exit Temp (Deg F)	Exit Velocity (m/s)	Stack Diameter (feet)	Urban/ Rural
US STEEL (Ecorse)					
HSM Slab Reheat Furnace 1	102.0	400.0	6.08	14.01	Urban
HSM Slab Reheat Furnace 2	102.0	400.0	6.14	14.01	Urban
HSM Slab Reheat Furnace 3	102.0	400.0	6.14	14.01	Urban
HSM Slab Reheat Furnace 4	102.0	400.0	6.14	14.01	Urban
HSM Slab Reheat Furnace 5	102.0	400.0	6.31	14.01	Urban
No. 2 BOP - No. 2 Baghouse	90.0	250.0	20.78	9.51	Urban
Main Plant Boiler No. 9	70.0	550.0	11.16	5.51	Urban
Main Plant Boiler No. 8	70.0	550.0	11.16	5.51	Urban
US STEEL (Zug Island)					
Zug Island 1 Boiler House No. 1	68.0	550.0	18.41	5.51	Urban
Zug Island 1 Boiler House No. 2	68.0	550.0	18.41	5.51	Urban
Zug Island 1 Boiler House No. 3	68.0	550.0	18.41	5.51	Urban
Zug Island 1 Boiler House No. 4	81.0	550.0	19.12	5.51	Urban
Zug Island 1 Boiler House No. 5	81.0	550.0	19.12	5.51	Urban
Zug Island 2 Boiler House No. 1	88.0	550.0	7.36	9.74	Urban
Zug Island 2 Boiler House No. 2	88.0	550.0	7.36	9.74	Urban
Zug Island 2 Boiler House No. 3	88.0	550.0	7.36	9.74	Urban
Zug Island 2 Boiler House No. 4	88.0	550.0	7.36	9.74	Urban
Zug Island 2 Boiler House No. 5	88.0	550.0	7.36	9.74	Urban
Zug Island A1 Blast Furnace	230.0	230.0	24.88	9.32	Urban
Zug Island B2 Blast Furnace	200.0	230.0	24.83	9.32	Urban
Zug Island D4 Furnace	230.0	550.0	25.21	9.25	Urban
Zug Island A/B Blast Furnace Flares	109.0	2650.0	62.69	10.01	Urban
Zug Island D Furnace Flare	160.0	2650.0	62.69	10.01	Urban
EES COKE (Zug Island)					
EES Combustion Stack	315.0	502.9	6.44	16.50	Rural
EES COG Flare	200.1	1831.7	20.00	14.14	Urban
EES PECS Stack	115.0	100.0	11.22	10.01	Urban
DTE RIVER ROUGE					
DTE River Rouge - Unit 2	385.0	298.0	48.77	12.04	Rural
DTE River Rouge - Unit 3	425.0	320.0	48.77	12.83	Rural
DTE TRENTON CHANNEL					
Trenton Channel Boilers	559.0	310.0	42.67	14.50	Rural
Trenton Channel Unit 9	561.5	280.0	42.67	16.01	Rural
CARMEUSE LIME					
Carmeuse Kiln 1	70.9	550.0	1.46	23.82	Urban
Carmeuse Kiln 2	70.9	550.0	1.46	23.82	Urban

Table 8 (continued)

	Stack Height (feet)	Exit Temp (Deg F)	Exit Velocity (m/s)	Stack Diameter (feet)	Urban/ Rural
DTE MONROE					
DTE Monroe Unit 3	578.7	119.9	17.74	27.99	Rural
DTE Monroe Unit 4	578.7	119.9	17.74	27.99	Rural
DTE Monroe Unit 1	578.7	119.9	17.74	27.99	Rural
DTE Monroe Unit 2	578.7	119.9	17.74	27.99	Rural
SEVERSTAL STEEL					
Severstal Blast Furnace B Stove	190.0	750.0	10.94	8.20	Urban
Severstal Blast Furnace C Stove	210.0	750.0	17.38	10.01	Urban
Severstal B Furnace Casthouse Baghouse	200.0	130.0	20.00	10.20	Urban
Severstal C Furnace Casthouse Baghouse	200.0	130.0	22.65	12.80	Urban
DEARBORN INDUSTRIAL GENERATION					
DIG Boiler 1	185.0	261.8	13.87	10.50	Urban
DIG Boiler 2	185.0	276.9	15.42	10.50	Urban
DIG Flare 1	194.7	1832.0	79.31	9.38	Urban
DIG Flare 2	254.7	1832.0	11.52	9.38	Urban
MARATHON REFINERY					
Marathon NEWCVHTR	125.0	475.1	3.55	8.01	Urban
Marathon FRPUMP1	30.0	980.0	3.00	0.49	Urban
Marathon FRPUMP2	30.0	980.0	3.00	0.49	Urban
Marathon HYDROHTR	150.0	350.0	7.60	16.01	Urban
Marathon COKERHTR	150.0	350.0	7.21	8.99	Urban
Marathon NEWSRUTO	150.0	1300.0	6.67	8.01	Urban
Marathon DHTHTR	125.0	475.1	7.96	4.99	Urban
Marathon NEWBOILE	150.0	290.0	22.76	4.99	Urban
Marathon BWBOILER	150.0	350.0	20.61	5.25	Urban
Marathon VACHTR	199.0	385.1	3.62	9.84	Urban
Marathon SRUTO	199.5	1300.0	8.21	3.54	Urban
Marathon NHTCHTR	91.7	706.0	8.01	4.66	Urban
Marathon NHTRHTR	96.8	513.1	7.44	3.74	Urban
Marathon KHTHTR	85.7	436.0	3.57	3.25	Urban
Marathon GOHTHTR	160.0	436.0	8.88	5.22	Urban
Marathon FOIL	29.8	350.0	0.00	2.00	Urban
Marathon FPRE	150.0	549.1	5.45	7.51	Urban
Marathon CRUDHTR	199.0	385.1	4.90	9.84	Urban
Marathon ESP	195.0	550.0	39.60	4.99	Urban
Marathon SRHTR	195.0	350.0	8.64	5.51	Urban
Marathon NSRHTR	195.0	350.0	5.33	6.99	Urban
Marathon MELASPH	41.2	610.1	0.00	2.49	Urban
Marathon NTHERM	38.5	530.0	0.00	1.67	Urban
Marathon STHERM	40.0	610.1	0.00	2.00	Urban
Marathon RGEHTR	20.0	530.0	0.00	1.35	Urban
Marathon ALKYHTR	150.0	500.1	5.09	6.33	Urban

Modeling Scenarios

Modeling various emissions and dispersion scenarios is a key part of SO_2 SIP development. For SO_2 SIP modeling, USEPA guidance requires that allowable/potential SO_2 emissions be modeled as pounds of SO_2 per hour from the emission points of the affected sources to determine the ambient impact of the source. The modeling was conducted for each source as described in the previous sections. The modeling runs evaluated a baseline level of SO_2 impacts as well as a variety of scenarios representing different levels of emission reductions from the affected sources or representing changes in exhaust parameters that cause changes in ambient impacts of the SO_2 emissions. This kind of scenario modeling allowed the MDEQ to assess the level of ambient impacts for which each source is responsible. It also allowed for assessment of cumulative SO_2 impacts from all sources.

In addition to determining areas of high SO_2 ambient concentrations (often called "hotspots") from individual and cumulative sources, the MDEQ modeled the various scenarios to determine the impact at the SWHS monitor, thus assessing improvements at the only (formerly) violating SO_2 monitor in the nonattainment area.

2014 Actual Emissions Scenario

The first modeling scenario discussed here is modeling actual emissions using 2014 values contained in the MDEQ annual emissions database. While actual emission modeling is not allowed for purposes of determining SIP strategies or attainment, it serves a useful purpose in determining model performances.

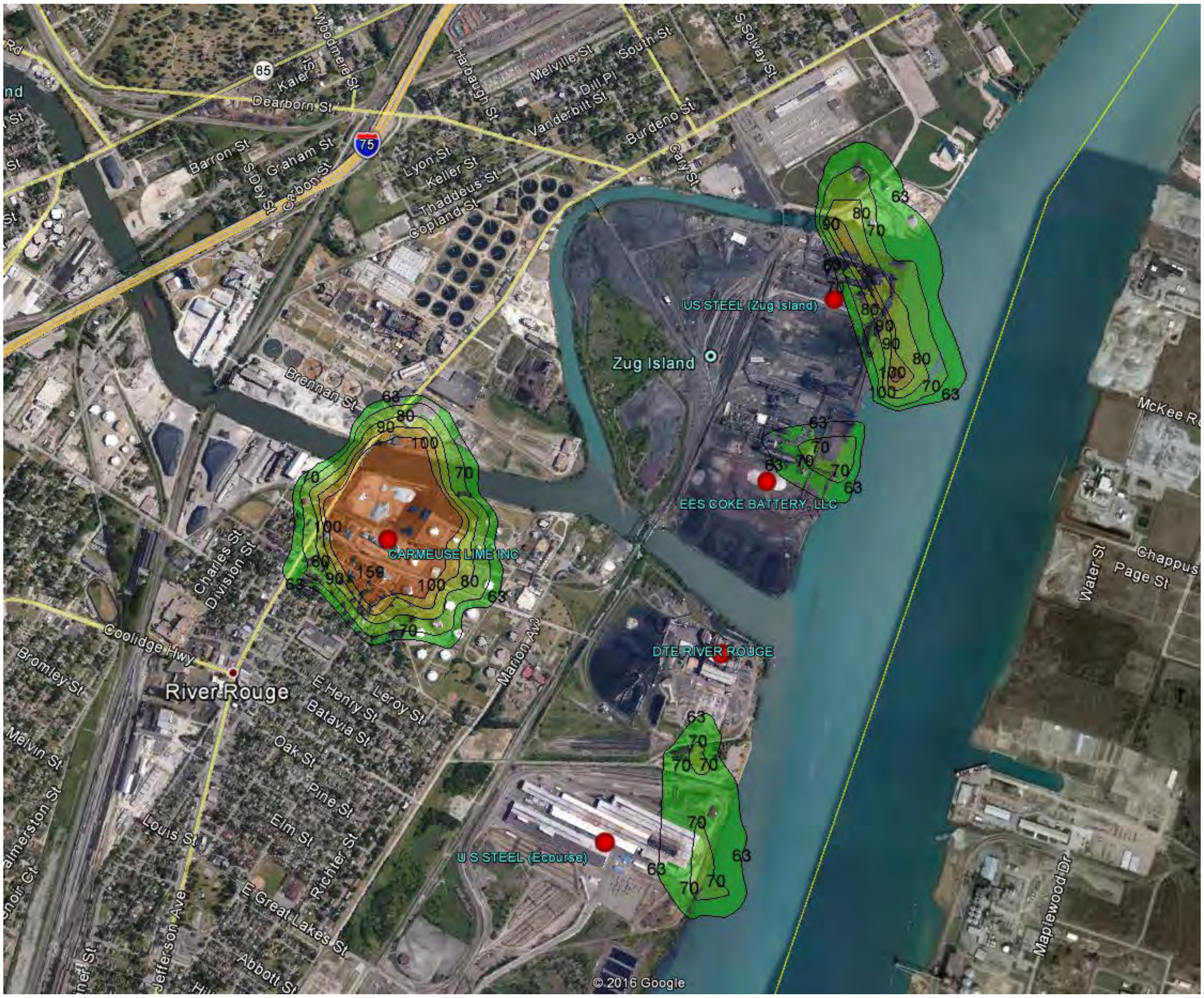
The urban/rural evaluation described in the previous section was ground tested for accuracy by using actual emissions and corresponding meteorological data (2013-2015) to model impacts at the SWHS monitor and West Windsor monitor locations and comparing modeled design value concentrations to monitored design value concentrations.

The reason for performing an actuals emission model run was to assess the "real" geographic extent of high SO_2 in the vicinity of the modeled sources instead of the worst case impacts that allowable/potential emissions modeling produces. Figure 11 depicts the high impact areas that would be expected to occur in the nonattainment area using 2014 actual emissions (most recent year of certified data at the time of this analysis). This type of figure, which is used for each of the modeling scenarios in this document, depicts the modeled "plume" of emissions coming from an SO_2 source. The lowest contour is 63 ppb to reflect the highest concentration allowed before the 12 ppb is added to meet the 75 ppb threshold.

One observation is that only a very small portion of the area around three of the four sources, consisting of several blocks of a residential area near the Carmeuse facility, is predicted to be impacted with actual levels of SO_2 above the standard of 75 ppb. Industrial and commercial properties receive the remainder of the impacts from these sources. However, U.S. Steel Zug Island sources significantly impact both residential and commercial areas in the northeast direction from Zug Island.

Figure 12 indicates hotspot impact zones exceeding 63 ppb (i.e., not including 12 ppb background). The primary hotspot zone is caused by Carmeuse's kilns. Secondary hotspot zones are caused by U.S. Steel's Zug Island boilers firing BFG and COG, and U.S. Steel Ecorse reheat furnaces.

Figure 11. 2014 Actual Emissions Hotspot Impact Zones (ppb)



A summary of the 2014 actuals modeling at both hotspot and the SWHS monitor (with 12 ppb background included with the combined impact in bold only) is shown in Table 9.

Table 9. Modeling of 2014 Actual Emissions

Emission Source	Hotspot (ppb)	SWHS (ppb)
U.S. Steel Zug Island	102.8	14.5
U.S. Steel Ecorse	69.0	5.7
EES Coke	11.9	8.0
DTE River Rouge	29.6	21.4
DTE Trenton Channel	39.6	16.7
Carmeuse Lime	158.7	9.0
Severstal/DIG	14.1	10.6
Marathon Petroleum Co.	5.4	1.8
DTE Monroe [1]	7.5	3.3
Overlapping Hotspot Impact [2]	**170.7**	**57.4**

[1] Maximum Monroe impact inside the nonattainment grid.
[2] Includes 12 ppb uniform background concentration.

Base Case Scenario

The model scenario called the base case uses company-supplied stack and allowable/potential emission parameters. As such, this scenario represents worst case impacts because the sources cannot operate at a higher emission rate due to permit restrictions (allowable emissions) or the equipment cannot physically emit more SO_2 (potential emissions). The remaining modeling scenarios will be modeled using the base case as a starting point, reducing emissions as each scenario dictates. Urban/rural parameters were set as urban unless deemed rural via tall, buoyant stacks as previously described.

Base case impacts were predicted at the SWHS monitor receptor, as well as at individual facility hotspots (maximum impact location for that facility only) for determining the relative individual source impacts. A summary of the base case modeling (with 12 ppb background included with the overlapping impacts) is shown in Table 10. This will allow overlapping impacts to be directly compared to the NAAQS.

Table 10. Base Case Modeling using Allowable/Potential Emissions (2010-2014)

Emission Source	Hotspot (ppb)	SWHS (ppb)
U.S. Steel Zug Island	142.4	19.0
U.S. Steel Ecorse	324.6	25.4
EES Coke	18.6	13.7
DTE River Rouge	87.4	77.2
DTE Trenton Channel	107.6	41.9
Carmeuse Lime	211.1	12.7
Severstal/DIG	55.3	25.9
Marathon Petroleum Co.	8.2	2.8
DTE Monroe [1]	14.1	6.0
Overlapping Hotspot Impact [2]	**336.9**	**141.8**

[1] Maximum Monroe impact inside the nonattainment grid (at southern boundary).
[2] Includes 12 ppb uniform background concentration.

Any ppb values above 63 reflect modeled impacts greater than the 1-hour SO_2 NAAQS of 75, because 12 ppb must be added to modeled values to account for the SO_2 background level for the nonattainment area. For the overlapping hotspot impact reflected in the bottom row of the table, the background value was already added to the modeled value, as noted in footnote 2 for Table 10.

It also should be noted that individual source impacts are not additive to reflect the overlapping value. Each of the modeled single source values in the table and the overlapping value reflect the highest impact over a 5-year period using meteorological data for that time period. The meteorological conditions that cause the highest impact at one source location will likely occur on a different day than the meteorological conditions causing the highest value at a different source location. The overlapping hotspot impact occurs at certain meteorological conditions that are likely to occur on a different day than for any of the individual sources. Thus adding high values from each source will not equal the overlapping highest impact value.

The individual hotspot impacts in Table 10 show that many of the listed sources are well above the acceptable level of 63 ppb and therefore have been evaluated to determine appropriate emission reduction strategies. EES Coke also was evaluated because of the high sulfur COG produced by the facility. The other sources, Severstal/DIG, Marathon, and DTE Monroe, do not exceed the 63 ppb value. The MDEQ therefore did not require further emission reduction analysis of these sources for SIP purposes.

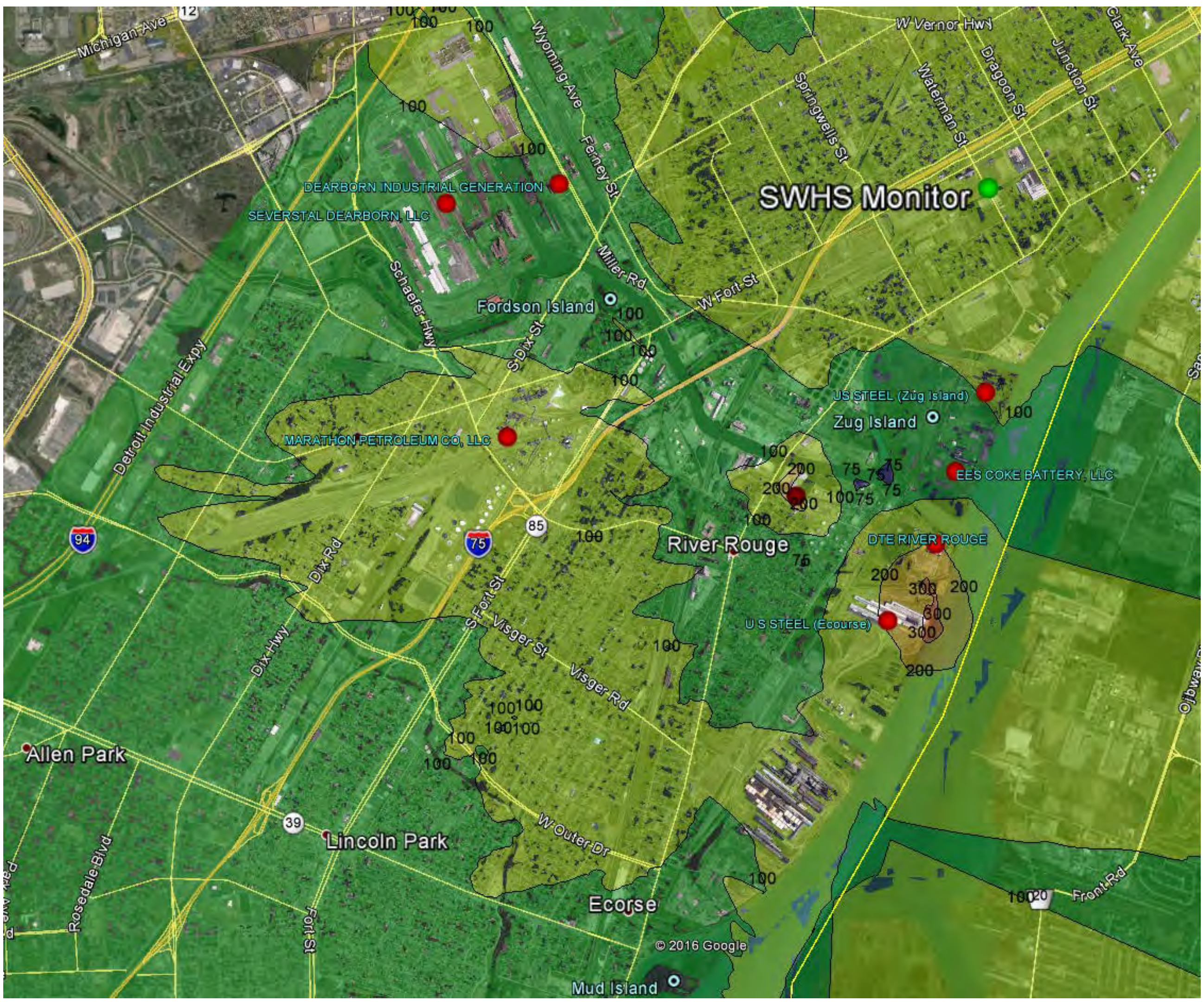
Table 10 also shows impacts at the SWHS monitor under the base case scenario. DTE River Rouge shows the highest impact at the SWHS monitor receptor, with DTE Trenton Channel having the second highest impact. The MDEQ used a modeled source apportionment procedure to determine each source’s contributions to the monitor during a predicted (modeled) violation. Table 11 provides the average contribution from each facility to the monitor during all violation hours during the base case analysis. DTE River Rouge power plant had the highest impact, followed by DTE Trenton Channel. The source apportionment tool was also useful in providing information on source contributions to overlapping hotspots.

Table 11. SWHS Monitor Violation Average - Source Contribution (Percentage) (2010-2014)

USS Zug Is.	USS Reheat	EES	River Rouge	Tr. Chan.	Carm. Lime	Severstal	DIG	Marathon	Monroe
6.1%	9.9%	10.5%	51.5%	19.9%	0.6%	0.1%	0.1%	0.0%	1.1%

A visual portrayal of the modeling for the overall hotspot is contained in Figure 12. It can be seen that the primary impact zone is caused by the U.S. Steel Ecorse reheat furnaces with impact levels over 300 ppb. This is the result of high SO_2 emissions from the burning of COG with emissions exhausted through relatively short stacks. Secondary hotspot zones at levels greater than 200 ppb are caused by the Carmeuse kilns.

Figure 12. Base Case Overlapping Hotspot Impact Zones (ppb) (2010-2014)



Original SIP Control Strategy Scenario

The original SIP strategy applied the amount of controls needed for each facility to meet its own hotspot level at or below the standard. Updated predicted impacts (using AERMOD v15181, a 12 ppb background, and 2010-2014 meteorological data) from each company's facility using the original SIP control strategy are provided in Table 12.

Table 12: Original SIP Control Strategy Scenario (2010-2014)

Emission Source	Hotspot (ppb)	SWHS (ppb)	Reduction Strategy
U.S. Steel Zug Island	20.6	9.4	Reduce Boiler House BFG impact by 75%, No COG
U.S. Steel – Ecorse	55.7	4.4	Reduce Reheat COG impact by 83%
EES Coke	18.6	13.7	No change
DTE River Rouge	51.1	45.2	New DTE permit plus 15% max 1-hour adjustment
DTE Trenton Channel	56.9	22.2	New DTE permit plus 15% max 1-hour adjustment
Carmeuse Lime	63.1	14.8	New permit to Install 100-foot stand-alone stack
Severstal/DIG	55.3	25.9	No change
Marathon Petroleum Co.	8.2	2.8	No change
DTE Monroe [1]	14.1	6.0	No change
Overlapping Hotspot Impact[2]	**91.0**	**87.5**	

[1] Maximum Monroe impact inside the nonattainment grid.
[2] Includes 12 ppb uniform background concentration.

Although each source group met the individual hotspot threshold at or below 63 ppb, the near proximity of the sources caused overlapping impacts to exceed the NAAQS. Figure 13 shows large areas that still exceeded 63 ppb and that the highest area is northeast of the Zug Island area. Although the overlapping monitor and hotspot impacts were above the standard once background was added, the MDEQ believed that in conjunction with the following factors, it demonstrated a control strategy acceptable for the following reasons:

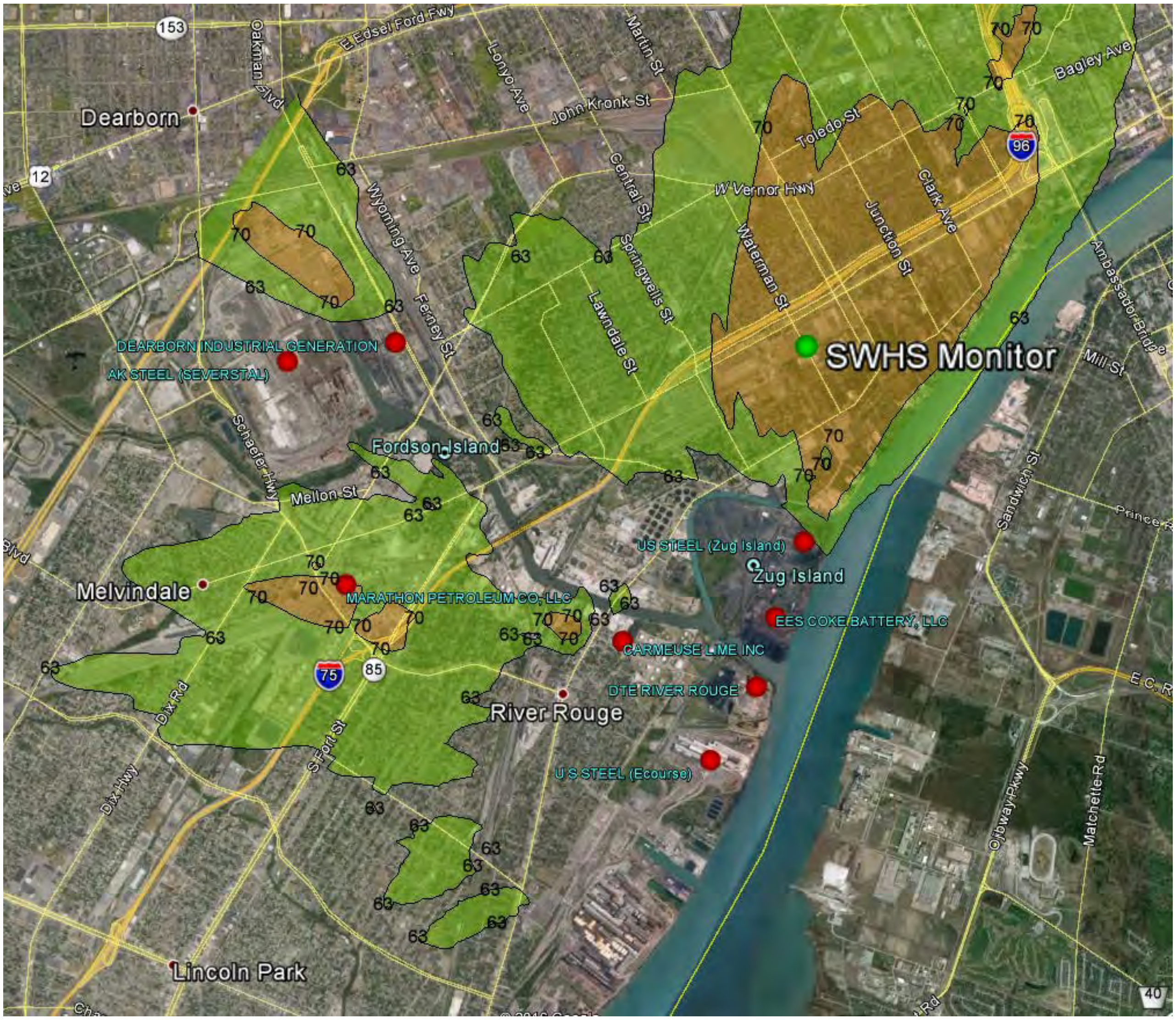
1. It is very unlikely all the modeled facilities will operate at their maximum capacity at the same time.

2. While the dispersion model used is judged to be reasonably accurate to predict SO_2 impacts, it is recognized to be conservative.

3. While the SWHS SO_2 monitor measured values averaging 96 ppb from 2008-2010 (used as the basis for the nonattainment designation), the most recent 3-year average of the data at the time of the original SIP development (2012-2014) was 72 ppb, below the NAAQS.

Public comment on this original SIP control strategy was taken during August-October 2015. Many commenters, including the USEPA, stated that more control was needed so that the modeling showed all areas in the nonattainment area meeting the NAAQS. The MDEQ responded with additional analysis and revised requirements for DTE and Carmeuse. This revised SIP strategy control strategy scenario is described below.

Figure 13. Remaining Overlapping Hotspot Impact Zones After Original SIP Strategy (ppb) (2010-2014)



Final SIP Control Strategy Scenario

After receiving comments through the public comment period and hearing, the MDEQ conducted more analyses to determine what additional controls would be required in order for the modeling to meet the NAAQS threshold at all receptors. The analyses showed that the standard could be met with the addition of the following controls:

1) Increase the Carmeuse Lime stand-alone stack from 100 feet to 120 feet; and
2) Remove Unit 2 from DTE River Rouge.

The revised SIP modeling scenario is based on the final control strategies for each facility. A summary of the control strategies is listed in Table 13.

Table 13. Final SIP Control Strategy Scenario

Facility	Modeled Final Control Strategy
U.S. Steel Zug Island	Reduce boiler house BFG impact by 75%; No COG
U.S. Steel - Ecorse	Reduce reheat COG impact by 83%
EES Coke	No Change
DTE River Rouge	DTE permit plus 15% 1-hour emission rate Unit 3, Remove Unit 2
DTE Trenton Channel	DTE permit plus 15% 1-hour emission rate, all emissions from Unit 9 only
Carmeuse Lime	Permit to Install 120-foot stand-alone stack

Table 14 provides the highest individual SO_2 impact for each source (without including the other sources in each modeling run) based upon the revised SIP control strategy. The values are in parts per billion as modeled, and to compare to the 75 ppb NAAQS, a value of 12 ppb must be added to account for the SO_2 present as background. Therefore a table value of 63 ppb or less attains the NAAQS. The bolded value at the bottom of the column is the highest SO_2 impact from overlapping source impacts but includes the background. The third column called SWHS contains the modeled impact of each source at the monitor, and the bolded value at the bottom is the overlapping impact at the monitor including the background. It is important to understand that the modeled impact at SWHS for each source does not occur simultaneously.

Table 14 demonstrates that the SO_2 impacts at all points of highest impact (hotspot) attain the NAAQS, which means all receptors in the nonattainment area comply with the NAAQS.

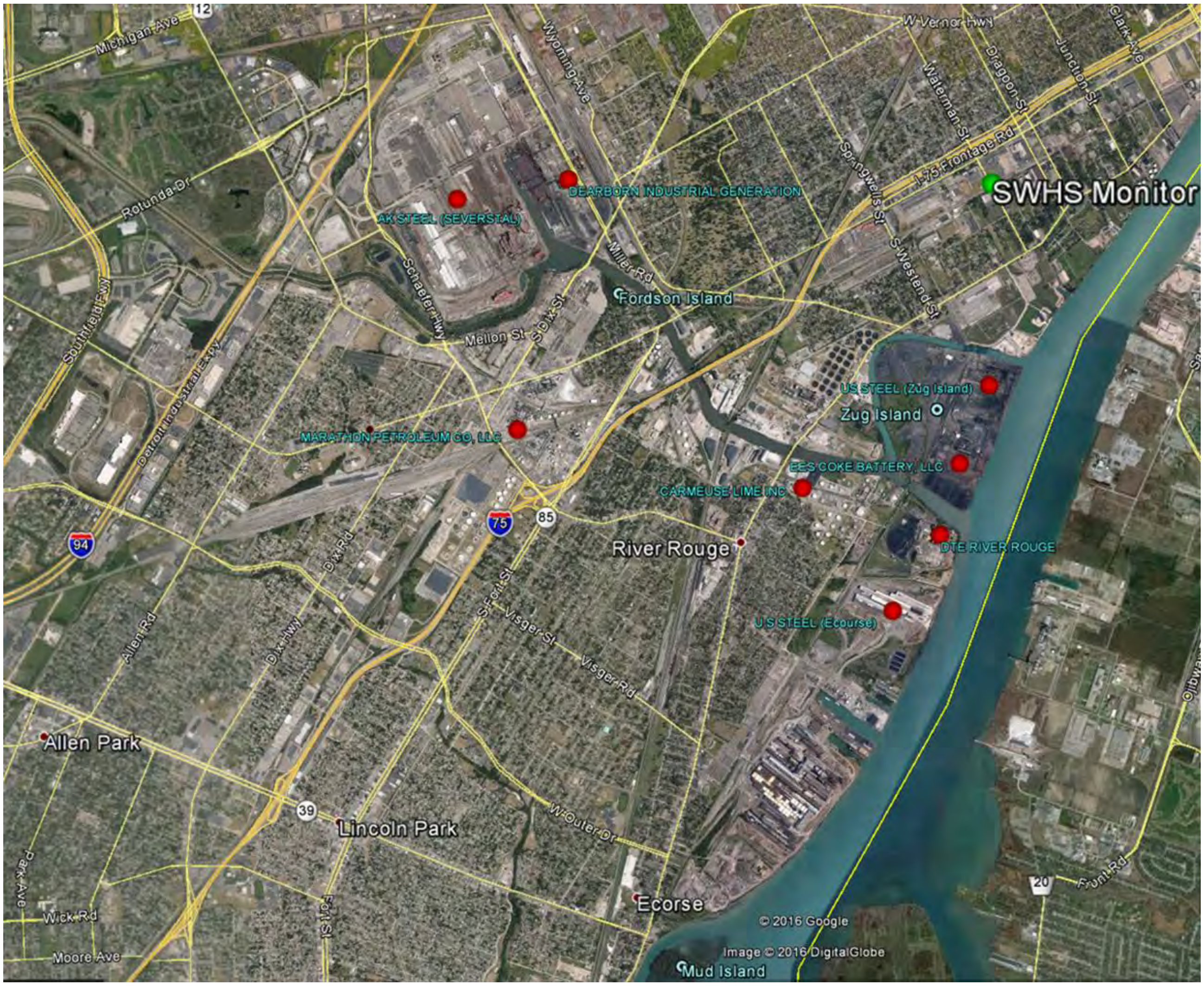
Table 14. Final SIP Control Strategy Impacts

Emission Source	Hotspot (ppb)	SWHS (ppb)
U.S. Steel Zug Island	20.6	9.4
U.S. Steel - Ecorse	55.7	4.4
EES Coke	18.6	13.7
DTE River Rouge	26.6	23.9
DTE Trenton Channel	56.9	22.2
Carmeuse Lime	49.4	14.8
Severstal/DIG	55.3	25.9
Marathon Petroleum Co.	8.2	2.8
DTE Monroe [1]	14.1	6.0
Overlapping Impact [2]	**73.7**	66.9

[1] Maximum Monroe impact inside the nonattainment grid.
[2] Includes 12 ppb uniform background concentration.

Figure 14 depicts no areas exceeding 63 ppb after applying the final SIP control strategies.

Figure 14. Final SIP Control Strategy; No Overlapping Hotspots Exceeding 63 ppb (2010-2014)



Control Strategy Analysis

As the MDEQ performed the modeling described in the previous section of this report, the MDEQ formally requested that each of the companies prepare a Reasonably Available Control Technology (RACT) analyses for their affected sources, as required in Section 172 of the Clean Air Act for sources in nonattainment areas. The RACT demonstrations would be used by both the company and the MDEQ as a source of information on what control options were available to the companies as they considered methods to reduce SO_2 emissions and impacts. A brief summary of the RACT determination for each of the companies is provided in the next section. Copies of the RACT documents are located in Appendix B of this document.

Throughout the development of the SIP control strategy, the MDEQ had contact with the affected companies including plant visits, face to face meetings, conference calls, and many emails and individual phone calls. Topics of discussion included the latest MDEQ modeling results, details of company RACT plans, the proposed rule as it was being developed, and possible emission reduction strategies the companies may be considering. The outcome of this effort was proposed Rule 430 and proposals from each of the companies. The following provides more in-depth information on the RACT analyses and the proposed rule. The companies' proposals follow in the section titled Company Original Proposals for Reducing SO_2 Emissions Impacts.

<u>RACT Analysis</u>

Section 172 of the federal CAA sets out basic planning requirements for areas that do not meet one or more NAAQS. One such plan requirement is the application of RACT controls to existing facilities in the nonattaining area. Subrule (c) (1) of Section 172 states: "Such plan provisions shall provide for the implementation of all reasonably available control measures as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology) and shall provide for attainment of the NAAQS." Further, the USEPA defines RACT as devices, systems, process modifications, or other apparatus or techniques that are reasonably available, taking into account the necessity of imposing such controls to attain and maintain the NAAQS and the social, environmental, and economic impact of such controls.

The MDEQ sent a formal request to each of the affected companies to submit a RACT analysis of their SO_2 emission sources. The companies were requested to include all emission reduction options that were technically feasible and do a cost analysis of each option. Each company's RACT analysis is contained in Appendix B. The following is a summary of each company's RACT determination.

The Carmeuse RACT document provides a determination that the least-cost option is to construct a stand-alone stack to vent the SO_2 emissions from their two kilns. Modeling demonstrates that a stack of 100 feet will provide adequate dispersion to reduce their contribution to the nearby hotspot impact to below the NAAQS threshold of 75 ppb when operating at maximum allowable levels. Modeling shows that their impact on the SWHS monitor remains small using this emission dispersion option.

The U.S. Steel RACT document contains an analysis of several control strategies and costs per ton reduced, including add-on controls, fuel switching and blending, and dispersion via new stacks. The RACT document identifies fuel blending, using various fuel blends to achieve an overall lower fuel sulfur level, as the most reasonable of the control options evaluated. The recommended blend for U.S. Steel would be at an emission rate of 0.40 lb/MMBtu on an annual average for the combined affected U.S. Steel sources. The report states that this emission rate is equivalent to the rate in 2013 with a 25% increase to account for variability.

The DTE RACT document addresses both the River Rouge and Trenton Channel power plants. The document proposes RACT to be an emission limit of 0.8 lb/MMBtu on a 12-month rolling average on units 2 and 3 at River Rouge and boilers 16-19 at Trenton Channel, and a rate of 1.2 lb/MMBtu on a 12-month rolling average on Trenton Channel unit 9. Also, a limit of 77.22 tons per day applies to River Rouge units 2 and 3 combined, and a limit of 117.83 tons per day applies to Trenton Channel boilers 16-19 and unit 9.

The EES Coke RACT document looked specifically at desulfurization of the COG they generate as a by-product of the coal coking process. The company burns a portion of the gas as fuel to heat the coke batteries, flares some, and sells the rest, primarily to U.S. Steel. COG is high in sulfur content and when burned as a fuel emits large amounts of SO_2. The RACT document acknowledges that COG desulfurization is technically feasible but that is a costly control option, at \$14,000 per ton of SO_2 removed. Further, the company makes the point in the document that their SO_2 emissions do not require reducing for the SIP because their SO_2 impacts are small.

The MDEQ believes that desulfurization of COG is a very viable option for reducing large amounts of SO_2 emissions in the area. EES Coke is one of only a few coke batteries in the country that does not desulfurize their COG. However, the coke battery and flare disperse the SO_2 emissions such that there is only a small modeled impact due to emissions from EES Coke in the area. For this reason, the MDEQ is not able to require EES Coke to desulfurize the COG. The primary purchaser of the excess COG is U.S. Steel, which significantly impacts the area with SO_2 emissions from combusting the COG as fuel in the five reheat furnaces and to a lesser extent in the boilers on Zug Island. The MDEQ encouraged EES Coke and U.S. Steel to work together to find a way to desulfurize the COG in a manner mutually beneficial to both companies. However, the MDEQ is not aware of any agreement having been reached.

Company Original Proposals for Reducing SO_2 Emissions/Impacts

The MDEQ worked with the affected companies for more than two years in an effort to reach an agreement on a strategy to reduce SO_2 emissions/impacts as necessary for meeting the SIP requirements. Carmeuse and DTE eventually provided proposals that the MDEQ accepted. U.S. Steel did not offer an acceptable control proposal, therefore, the MDEQ put forth Rule 430 as the control plan for U.S. Steel. A modeling run reflecting this scenario is contained in the Modeling section of this document, with Table 12 containing the modeled impact values.

Carmeuse

Carmeuse Lime and Stone is located in River Rouge and operates two straight rotary kilns controlled by baghouses that emit through monovents. The kilns are fired primarily with coal that is approximately 1% sulfur as received. Coal combustion is the source of SO_2 emissions. The environment in the kiln, containing lime, provides some inherent scrubbing of SO_2.

The company evaluated various control options and costs per ton reduced as described in their RACT document, located in Appendix B. The company determined their least cost option is to construct a stand-alone stack to vent the SO_2 emissions from the two kilns. Modeling demonstrated that a stack of 100 feet will provide adequate dispersion to reduce their contribution to the nearby hotspot impact to below the NAAQS threshold of 75 ppb when operating at maximum allowable levels. The company committed to raise the stack to a height of 100 feet to provide additional dispersion and to accommodate a higher SO_2 emission rate. This was incorporated in Permit to Install 193-14, which was approved in January 2015.

Table 12 in the Modeling section of this document provides the modeled impact values. The proposed control plan would decrease the hotspot impact from the base case (Table 10) from 211 ppb to 63.1 ppb, and the impact on the SWHS monitor is 14.8 ppb. Construction of a new stack would need to begin in the 2016/2017 time frame so that compliance with the NAAQS would be achieved by 2018. The MDEQ allowed this schedule for Carmeuse for two reasons. First, Carmeuse has little impact on the SWHS monitor, so requiring Carmeuse to control sooner to ensure at least two years of monitored attainment is not needed. Furthermore, the SWHS monitor is attaining the NAAQS now, independent of dispersion improvements from the forthcoming Carmeuse stack.

Although the 100-foot stack addressed Carmeuse's individual impact, when combined with the impact of U.S. Steel after implementation of proposed Rule 430, the combined impact exceeded the NAAQS (Figure 13). Further reductions were sought, as described in the Final Company Compliance Plans section.

U.S. Steel

U.S. Steel Great Lakes Works is an integrated steel manufacturer located in Ecorse and River Rouge. U.S. Steel emits SO_2 from a number of operations and locations in the general vicinity of the SWHS monitor. The largest impacting sources of SO_2 are the ten boilers located in boiler houses 1 and 2 on Zug Island in River Rouge and the five reheat furnaces located in Ecorse. The boilers burn primarily BFG and the reheat furnaces burn both COG and natural gas. The COG is purchased from EES Coke, which operates a coke battery on Zug Island.

U.S. Steel submitted a proposed compliance strategy that required the shutdown of boiler 4 in boiler house 1 along with a monitoring and recordkeeping requirement to monitor and record the monthly COG and BFG for each of the nine remaining boilers in boiler houses 1 and 2. The strategy also required a material usage limit on COG of 211,944 MMBtu per month and a monitoring and recordkeeping requirement to monitor and record the monthly COG usage at the five reheat furnaces.

Modeling for this U.S. Steel proposal demonstrates reductions in their SO_2 impacts, but this proposal fell far short of meeting the NAAQS at their individual hotspots. Specifically, 107 ppb from Zug Island and 159 ppb from the Ecorse facility.

The MDEQ met with the company after evaluating the proposal and explained that a more robust compliance strategy was needed which, at a minimum, showed attainment of the standard at their own hotspot for the reheat furnaces and more significant reductions at the boilers. U.S. Steel agreed to continue to explore strategies to accomplish this goal. The MDEQ's alternative control strategy for U.S. Steel, if an agreed-upon control strategy was not developed, would be Rule 430.

Implementation of proposed Rule 430 on boiler houses 1 and 2 on Zug Island would change from their base case individual hotspot contribution impact (See Table 10) of 142.4 ppb to 20.6 ppb and the reheat furnaces labeled as U.S. Steel Ecorse on the modeling tables change from the base case value of 324.6 ppb to 55.7 ppb. Impacts at the SWHS monitor change from 19.0 ppb to 9.4 ppb for the boilers on Zug Island and 25.5 to 4.4 ppb for the reheat furnaces. Proposed Rule 430 was included in the proposed SIP for the August-October 2015 comment period; the impacts are summarized in Table 12.

The proposed rule was included in the SIP document, submitted on May 31, 2016, in Appendix E as a placeholder. Rule 430 was subsequently promulgated with an effective date of June 14, 2016.

DTE River Rouge Power Plant

This power plant is located in the city of River Rouge and has a capacity of 651 megawatts of electricity generation. The plant was constructed in 1957 and 1958. The plant burns coal of varying sulfur content and has been increasing its use of western low sulfur coal over the last few years. This coal is lower in BTU value than eastern coal but is currently cheaper per BTU. The power plant primarily burns eastern coal on the days when electricity demand is the highest, typically during summer months. The SO_2 is emitted from the power plant's two 400-foot stacks.

DTE originally proposed an emission limit of 1,890 lbs/hr for Unit 2; 2,300 lbs/hr for Unit 3; and 3,980 lbs/hr total for both units. These limits are based on a 720-hour rolling average. The modeling for this DTE proposal is in Table 12 of this document. It shows their proposal reduces their SO_2 impacts to 51.1 ppb at their individual hotspot, meeting the NAAQS. Their impact at the SWHS monitor is reduced from 77.2 ppb in the base case run (see Table 10) to 45.2 ppb. The company submitted the proposed limits in a Permit to Install request, 40-08G. A public comment period was held with a public hearing in March 2015. The permit was approved by MDEQ in July 2015.

The MDEQ accepted the 720-hour rolling average averaging time based on a demonstration provided by DTE supporting this approach. The USEPA 1-hour SO_2 nonattainment area SIP guidance allows states to approve emission limits with up to 30-day averaging times if a demonstration is provided showing that the longer term average limits are as stringent as the associated 1-hour limits determined by modeling analysis. A description of this demonstration is contained in Appendix C.

Although the 100-foot stack addressed DTE River Rouge's individual impact, when combined with the impact of U.S. Steel after implementation of proposed Rule 430, the combined impact exceeded the NAAQS (Figure 13). Further reductions were sought, as described in the Final Company Compliance Plans section.

DTE Trenton Channel Power Plant

This power plant is located in the city of Trenton and has a capacity of 776 megawatts of electricity generation. The existing plant was constructed in 1950, with a newer section added in 1968. The plant burns coal of varying sulfur content and has been increasing its use of western low sulfur coal over the last few years The power plant primarily burns eastern coal on the days when electricity demand is the highest, typically during summer months. The SO_2 is emitted from the power plant's two 500-foot stacks.

DTE originally proposed an emission limit of 5,907 lbs/hr for unit 9 and boilers 16-19, based on a 720-hour rolling average. The modeling for this DTE proposal is in Table 12 of this document. It shows that their proposal reduces their SO_2 impacts significantly, meeting the NAAQS at their individual hotspot. Their impact at the SWHS monitor is reduced from 41.9 ppb in the base case run (see Table 10) to 22.2 ppb. The company submitted the proposed limits in a Permit to Install request, 125-11B, and a public comment period and hearing were held in March 2015. The permit was approved by the MDEQ in July 2015.

The 720-hour rolling average was accepted by the MDEQ as described the DTE River Rouge write-up, above.

EES Coke

EES Coke operates a 6-meter, 85-oven coke battery on Zug Island in River Rouge that was constructed in 1992. SO_2 is emitted from the combustion of COG, which is both a by-product of the coking process and fuel used to heat the coke battery. Sources of SO_2 emissions at EES Coke are primarily the combustion stack from the coke battery and a flare. Excess COG is either flared or sold to U.S. Steel for use in boilers in boiler house 1 and as a primary fuel for the reheat furnaces. Some COG is also sold to the DTE River Rouge power plant for combustion in a boiler. EES Coke is one of the few coke batteries in the country that does not desulfurize the COG prior to combusting and/or selling it.

The MDEQ is not requiring EES Coke to reduce their SO_2 emissions. SO_2 emission reductions are not required because modeling shows that impacts from EES Coke are below the 75 ppb standard and their impact at the SWHS monitor is relatively small. Table 10 shows their base case hotspot impact of 18.6 ppb and their impact on the SWHS monitor at 13.7 ppb. The company included revisions to a permit to install, 51-08C, which addressed the new 1-hour SO_2 standard. The permit was approved on November 21, 2014, and is located in Appendix I.

The main purpose of the permit revision 51-08C was to remove the daily and annual heat input restrictions on the combustion of COG in their coke oven battery and to increase the production limit on the battery. The battery was originally permitted to combust a mixture of COG and BFG as fuel to heat the battery. However, due to a structural failure in the battery, BFG could no longer be used in the battery and the restrictions on COG needed to be reevaluated. Some modifications to the coal and coke material handling systems were also made.

The 1-hour SO_2 standard was addressed in the permit revision by adding a new 1-hour limit to the existing permit for the coke oven battery underfire combustion stack. The new limit is 0.702 lb SO_2 /1,000 scf of COG, determined on a 1-hour average basis. The new limit is a conversion of the maximum H_2S content of 2.6 grains per dry standard cubic foot allowed in the fuel gases. This was an existing limit in Permit to Install 51-08.

Several related requirements were also added to the permit to track compliance with the new limit by means of the existing continuous emission monitoring system (CEMS) on the coke oven battery underfire combustion stack. These included a new SO_2 emission rate as well as exhaust gas flow rate monitoring, recording, and reporting requirements for the SO_2 CEMS data.

Final Company Compliance Plans

The original company proposed limits described in the preceding section were made part of proposed SO_2 SIP which received public comment in the August-October time frame with a public hearing on September 23, 2015 in the city of River Rouge. The majority of comments received, including those from the USEPA stated that additional SO_2 reductions were needed. Many commenters expressed concern that the SIP was insufficient because the modeling of the proposed control strategy continued to show areas in the nonattainment area exceeding the NAAQS for 1 hour SO_2.

The MDEQ responded to these comments by doing additional modeling to determine what further emission reductions were needed and from whom, such that the entire area attained the NAAQS. Next, the MDEQ held additional meetings with Carmeuse and DTE, seeking a solution to this need. From the meetings and modeling, the companies agreed to make additional changes as described in the following paragraphs. The final company compliance plans are listed in Table 13, and the resulting modeled impacts are listed in Table 14.

Carmeuse

To address the unacceptable combined hotspot value near the facility, Carmeuse agreed to construct a 120 foot stand-alone stack to vent the SO_2 emissions from their two lime kilns and preserve their SO_2 emission rate. The new stack will be completed and operational by October 2018. The company incorporated this and related conditions and emission rates in Permit to Install 193-14A. The permit was approved by the MDEQ on March 18, 2016, and is provided in Appendix D.

U.S. Steel

As described in the previous section of this document, the MDEQ did not accept the company proposal for reducing SO_2 emissions from the affected sources. The MDEQ therefore continues to follow the control program in Rule 430 as the SIP control strategy for U.S. Steel. The rule contains pound per hour SO_2 emission limits for each of the reheat furnaces. MDEQ modeling shows that emissions at this level result in the reheat furnaces meeting the NAAQS individually and adequately providing for attainment in conjunction with the other control strategies contained in the SIP. The same is true when modeling the 10 boilers in boiler houses 1 and 2 on Zug Island with the pound per hour SO_2 limits the rule applies to these boilers.

Rule 430 was not fully promulgated when the rest of the SIP package was sent to the USEPA on May 31, 2016. The rule is now fully promulgated with an effective date of June 14, 2016. The final rule is located in Appendix E. A document containing a summary of all comments received during the public comment period and hearing on proposed Rule 430, with corresponding MDEQ responses, is located in Appendix F, along with the Notice of Public Hearing.

DTE River Rouge Power Plant

To address the unacceptable combined hotspot impact northeast of the facility (Figure 13), DTE has agreed to permanently shut down Unit 2, achieving an additional 45% reduction in SO_2 emissions from the River Rouge power plant. This change is included in Permit to Install 40-08H which was approved on May 3, 2016. The permit retains the emission rate for Unit 3 of 2,300 pounds per hour of SO2 as contained in the original permit described in the previous section. Also retained from the original permit is a 720-hour rolling average for the emission limit for Unit 3. As described in the previous section, the MDEQ accepted the proposed averaging time based on a demonstration provided by DTE supporting this approach and following USEPA guidance for use of an averaging time greater than 1 hour. The permit is located in Appendix G.

DTE Trenton Channel Power Plant

DTE has agreed to permanently shut down Units 16-19 and to retain the emission limit for Unit 9 contained in the original Permit to Install 125-11B. The change is included in Permit to Install 125-11C which was approved on April 29, 2016. Also retained from the original permit is a 720-hour rolling average for the emission limit for Unit 9. As described in the previous section, the MDEQ accepted the proposed averaging time based on a demonstration provided by DTE supporting this approach and following USEPA guidance for use of an averaging time greater 1 hour. The permit is located in Appendix H.

EES Coke

No change from the previous permit description.

Conclusions, Contingency Measures, and Next Steps

This SIP provides enforceable allowable SO_2 emission reductions at U.S. Steel, DTE River Rouge and Trenton Channel power plants, and enforceable improved dispersion of Carmeuse SO_2 emissions. These permits and Rule 430 are included in Appendices D, E, G, and H.

The MDEQ requests that the USEPA make these permit requirements part of the Michigan SIP for SO_2. All terms and conditions of each permit will be incorporated into the Renewable Operating Permit (ROP) for each facility and a source-wide Permit to Install will be issued per Michigan Rule R 336.1214a requirements as part of the ROP (contained within the ROP document). DTE Permits 40-08H and 125-11C and Carmeuse Permit 193-14A will be voided upon their incorporation into the respective facility ROPs and source-wide Permits to Install. The source-wide Permits to Install for each facility will incorporate all federally enforceable requirements at the facility (R 336.1214a(1)). Also, Michigan Rule R 336.1214a(4), specifies that "...If the renewable operating permit expires or is voided the source-wide permit to install remains in effect, unless the criteria of R 336.1201(6)(a) or (6)(c) are met." Therefore, the MDEQ considers these source-wide Permits-to-Install as permanent and enforceable for purposes of the SO_2 SIP.

The plan for U.S. Steel is Rule 430, which has an effective date of June 14, 2016.

The MDEQ's modeling of these control strategies demonstrates substantial reductions in maximum SO_2 impacts in the nonattainment area, sufficient to bring the entire nonattainment area into attainment of the SO_2 1-hour NAAQS. Table 14 provides the modeled impacts of the emission reductions at DTE and U.S. Steel and the dispersion improvement from a new stack at Carmeuse. The table shows that the highest SO_2 impact from each of the sources; i.e., their individual hotspot, all are complying with the 1-hour standard. Similarly, each source individually is impacting the SWHS monitor at less than the NAAQS. As a result of the additional controls and reductions, all overlapping hotspots show impacts below the NAAQS threshold of 75 ppb. The dispersion modeling approach has been shown to give reasonable results and compared very favorably with monitor values in an actual emissions modeling scenario.

The Clean Air Act requires that the SIP demonstrate attainment of the 1-hour SO_2 NAAQS within five years of the nonattainment designation of the area. This sets the attainment date at October 2018. The violating monitor at SWHS must show attainment based on three years of monitoring data and MDEQ modeling must demonstrate attainment throughout the nonattainment area. Currently, the SWHS monitor has been attaining the NAAQS for the last two years based on 2012-2014 monitoring data and 2013-2015 data. Based on recent monitoring trends as well as MDEQ modeling, it is expected that the SWHS monitor will continue to attain the NAAQS.

The emission rates in the final compliance plans for DTE and U.S. Steel in this SIP are to be met by January 1, 2017, and December 31, 2016, respectively. From a modelling standpoint, these sources will be attaining the NAAQS individually as of those dates. In fact, the reductions in the DTE permits are already being substantially met because the #2 boiler at the River Rouge power plant has already discontinued operation, as have boilers 16-19 at the Trenton Channel power plant. An exception to this schedule is the new Carmeuse stack, which must be built and functioning by the October 2018 attainment date. This schedule ensures that Carmeuse has adequate time to install the new stack, and it ensures that all potential hotspot areas are attaining the NAAQS when modeled.

Contingency measures are normally included in a SIP, per Sect. 172(c)(9) of the CAA. The USEPA guidance document for SO_2 SIP development states on page 41 that “contingency measures” can mean that the air agency has a comprehensive program to identify sources of violations of the SO_2 NAAQS and to undertake an “aggressive” follow-up for compliance and enforcement. This is the approach taken by the MDEQ to address contingency measures in this SIP. Michigan has adequate enforcement authority to enter and inspect sources based on Section 5526 of Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, MCL 324.5526. This is further shown by the USEPA’s approval of the Michigan Title V program. All of the sources in the SIP strategy are major sources and in the Title V program. Michigan has a USEPA-acceptable Title V compliance monitoring program, including periodic inspections, review of company monitoring records, reporting, and issuance of violation notices for all violations shown from inspections or data. Michigan responds promptly to citizen complaints. Michigan reports all high priority violations to the USEPA, and puts all inspection reports and violation notices on our web site. Michigan pursues enforcement actions on all USEPA-defined high-priority violations, addressing the USEPA’s Timely and Appropriate Enforcement Policy. Therefore, this meets the requirements of CAA section 172(c)(9).

A final point should be made regarding the very conservative approach to this attainment determination that the USEPA requires and which the MDEQ followed. The SIP modeling reflects the very worst case possible in terms of SO_2 emissions from the sources by using allowable/potential emissions. This reflects a scenario of all sources emitting their maximum allowable emissions at the same time. The reality is that the sources are not likely to run at their allowable/potential emission rates, and if they do, it will not likely be at the same day and hour. This means that this SIP, by demonstrating attainment using these higher-than-normal emission rates, provides a large measure of confidence that the whole area meets and stays in attainment of the NAAQS.

APPENDIX A
LARGE SO_2-EMITTING FACILITY SOURCES; MODELING STATUS

The SO_2 emissions estimates included below are 2012 actual emissions reported to the Michigan Air Emissions Reporting System. The processes shown in bold were those included in the modeling, using allowable rates shown in Table 5.

DTE RIVER ROUGE				
EU03	**7,410,345**	**lbs/yr**	**Modeled**	**Unit No. 2**
EU04	**8,994,400**	**lbs/yr**	**Modeled**	**Unit No. 3**
EU05	3.62	lbs/yr	Not Included	Auxiliary Boiler
EU07-1	74.91	lbs/yr	Not Included	Peaking Unit DG 11-1
EU07-2	81.25	lbs/yr	Not Included	Peaking Unit DG 11-2
EU07-3	71.74	lbs/yr	Not Included	Peaking Unit DG 11-3
EU07-4	72.53	lbs/yr	Not Included	Peaking Unit DG 11-4
DTE TRENTON CHANNEL				
EU09	**33,998,790**	**lbs/yr**	**Modeled**	**Boiler No. 9A**
RGHighPressure	**10,853,290**	**lbs/yr**	**Modeled**	**TCHPP High Pressure Boilers**
EU08	32.90	lbs/yr	Not Included	Slocum Peaker Generating Units : DG 11-1
EU10	38.42	lbs/yr	Not Included	Slocum Peaker Generating Units : DG 11-2
EU11	14.35	lbs/yr	Not Included	Slocum Peaker Generating Units : DG 11-3
EU12	30.01	lbs/yr	Not Included	Slocum Peaker Generating Units : DG 11-4
EU13	38.50	lbs/yr	Not Included	Slocum Peaker Generating Units : DG 11-5
DTE MONROE				
EU01	**50,768,865**	**lbs/yr**	**Modeled**	**Unit No. 1**
EU02	**45,483,933**	**lbs/yr**	**Modeled**	**Unit No. 2**
EU03	**1,237,826**	**lbs/yr**	**Modeled**	**Unit No. 3**
EU04	**810,609**	**lbs/yr**	**Modeled**	**Unit No. 4**
EU06-1	0.21	lbs/yr	Not Included	North Auxiliary Boiler
EU09	2.15	lbs/yr	Not Included	Diesel Generator Peaking Units DG 11-1
EU10	0.43	lbs/yr	Not Included	Diesel Generator Peaking Units DG 11-2
EU11	2.18	lbs/yr	Not Included	Diesel Generator Peaking Units DG 11-3
EU12	2.24	lbs/yr	Not Included	Diesel Generator Peaking Units DG 11-4
EU13	0.82	lbs/yr	Not Included	Diesel Generator Peaking Units DG 11-5
EU06-2	3.60	lbs/yr	Not Included	South Auxiliary Boiler
EUWFGD-QP1	4.59	lbs/yr	Not Included	252 hp diesel fuel-fired FGD quench pump
EUWPGD-QP2	4.59	lbs/yr	Not Included	252 hp diesel fuel-fired FGD quench pump
CARMEUSE LIME				
RG-Kiln#1&#2	**1,399,373**	**lbs/yr**	**Modeled**	**Horizontal Lime Kilns #1 and #2**
SEVERSTAL STEEL				
EUCBFCASTHOUSE	**686,651**	**lbs/yr**	**Modeled**	**C Blast Furnace Casthouse Operation - ROOF & Baghouse emissions**
EUCFURNACESTOVES	**663,767**	**lbs/yr**	**Modeled**	**C Blast Furnace stoves**
EUHSMREHEATFCE1	1,082	lbs/yr	Not Included	Reheat Furnace No. 1 at Hot Strip Mill
EUHSMREHEATFCE3	1,030	lbs/yr	Not Included	Reheat Furnace No. 3 at Hot Strip Mill
EUHSMREHEATFCE2	770.0	lbs/yr	Not Included	Reheat Furnace No. 2 at Hot Strip Mill

EUBOFSHOP	303.0	lbs/yr	Not Included	Two Basic Oxygen Furnace vessels (including charging, blowing, tapping and slagging), electrostatic precipitator, baghouse and stacks. One Reladling Station for hot metal reladling.
RGEU_HDGLSCR	172.0	lbs/yr	Not Included	Reporting group for the HDGL annealing furnace and dryers controlled by an SCR
RGEU_PLHDGLHEAT	61.0	lbs/yr	Not Included	Reporting group for the PLTCM and HDGL building heaters
EUCOKEUNLOADEE	34.0	lbs/yr	Not Included	Coke Unloading EE Building
EUSTOCKHOUSE	32.0	lbs/yr	Not Included	Raw Material Handling Stockhouse and Baghouse
EUTREADWELL	5.0	lbs/yr	Not Included	Treadwell Car Dryout Operation
EUHANDSCARFING	1.0	lbs/yr	Not Included	Hand Scarfing Operation, Rule 201 exempt per Rule 285(r)(i)
DEARBORN INDUSTRIAL GENERATION (DIG)				
EUBOILER1	**422,444**	**lbs/yr**	**Modeled**	**Boiler is rated at an output of 500,000 lb of steam/hour and is capable of firing either natural gas (NG) or a mixture of NG and blast furnace gas (BFG). The NG heat input is 763 MM Btu/hour; NG/BFG heat input is 746 MM Btu/hour.**
EUBOILER2	**320,020**	**lbs/yr**	**Modeled**	**Boiler is rated at an output of 500,000 lb of steam/hour and is capable of firing either natural gas (NG) or a mixture of NG and blast furnace gas (BFG). The NG heat input is 763 MM Btu/hour; NG/BFG heat input is 746 MM Btu/hour.**
EUBOILER3	**290,424**	**lbs/yr**	**Modeled**	**Boiler is rated at an output of 500,000 lb of steam/hour and is capable of firing either natural gas (NG) or a mixture of NG and blast furnace gas (BFG). The NG heat input is 763 MM Btu/hour; NG/BFG heat input is 746 MM Btu/hour.**
EUBFGFLARE2	**98,289**	**lbs/yr**	**Modeled**	**BFG relief flare BFGFLARE #2. The flare is rated at an approximate heat input of 1,292 MM Btu/hour.**
EUCTG2	30,726	lbs/yr	Not Included	Natural gas fired combined-cycle combustion turbine rated at an output of 167 MW and a heat input of approximately 1,562 MM Btu per hour. The unit has been installed and has commenced commercial operation.
EUCTG3	27,582	lbs/yr	Not Included	Natural gas fired combined-cycle combustion turbine rated at an output of 167 MW and a heat input of approximately 1,562 MM Btu per hour. The unit has been installed and has commenced commercial operation.
EUCTG1	6,260	lbs/yr	Not Included	Natural gas fired simple-cycle combustion turbine rated at an output of 170 MW and a heat input of approximately 1,586 MM Btu per hour. The unit was initially installed and operated under permit 359-98.

EU3516GEN1	10	lbs/yr	Not Included	Diesel fired reciprocating internal combustion engine generator used for emergency electrical service. The engine generator is rated at a maximum heat input of 14.4 MM Btu/hr, and an output of 2,288 bhp or an electrical output of 1.7 megawatts.
EU3516GEN2	6	lbs/yr	Not Included	Diesel fired reciprocating internal combustion engine generator used for
				emergency electrical service. The engine generator is rated at a maximum heat input of 14.4 MM Btu/hr, and an output of 2,288 bhp or an electrical output of 1.7 megawatts.
MARATHON OIL REFINERY				
EU04-05-FLARE	8,385.4	lbs/yr	Not Included *	Crude/Vacuum Unit Flare
EU04VAC2HTR	**171.7**	**lbs/yr**	**Modeled**	**Vacuum Heater. Area 4. Fuel: Refinery fuel gas and natural gas.**
EU04-VACHTR	**2,302.6**	**lbs/yr**	**Modeled**	**Vacuum Heater. Area 4. Fuel: fuel oil, refinery fuel gas (non-NSPS), and natural gas.**
EU05-CRUDEHTR	**4,172.5**	**lbs/yr**	**Modeled**	**Crude Alcorn Heater. Area 5. Fuel: fuel oil, refinery fuel gas (non-NSPS), and natural gas.**
EU07-C1	17.2	lbs/yr	Not Included	GAS OIL UNIFINER HYDROGEN - GAS COMPRESSOR 1
EU07-C2	16.9	lbs/yr	Not Included	GAS OIL UNIFINER HYDROGEN - GAS COMPRESSOR 2
EU07-C3	17.2	lbs/yr	Not Included	GAS OIL UNIFINER HYDROGEN - GAS COMPRESSOR 3
EU07DHTCHARHTR	**731.8**	**lbs/yr**	**Modeled**	**DHT Charge Heater. Area 7. Capacity: 75 MMBTU/hr. Fuel: refinery fuel gas (NSPS), and natural gas. Permit: C-10393.**
EU07-FLARE	27,045.5	lbs/yr	Not Included *	Unifiner Flare. Area 7.
EU08-GOHTCHRGHTR	**1,461.3**	**lbs/yr**	**Modeled**	**GASOIL HYDROTREATER CHARGE HEATER. AREA 8. FUEL GAS**
EU09ALKDIBRBHTR2	**159.7**	**lbs/yr**	**Modeled**	**Alkylation deisobutanizer heater. Area 9: Fuel: refinery fuel gas and natural gas.**
EU09ALKDIBREBHTR	**752.2**	**lbs/yr**	**Modeled**	**Alkylation Deisobutanizer Reboiler Heater. Area 9. Fuel: Refinery fuel gas (NSPS) and natural gas.**
EU09-FLARE	205.6	lbs/yr	Not Included *	Alkylation Unit Flare. Area 9.
EU11-25CPFLARE	8,692.8	lbs/yr	Not Included *	Cracking Plant Flare
EU11-CATCHARHTR	**99,388.8**	**lbs/yr**	**Modeled**	**FCCU Catalyst Charge Heater. Area 11. Fuel: Refinery fuel gas (NSPS) and natural gas.**
EU11-FCCU	**30,983.7**	**lbs/yr**	**Modeled**	**Fluid Catalytic Cracking Unit. Area 11. The FCCU converts heavier hydrocarbons to lighter products in the presence of a catalyst.**
EU12-C6	0.0	lbs/yr	Not Included	#6 Gas Recovery Compressor - Gas Con Unit. Area 12. Natural gas-fired engine, 440 hp

EU14-CCRINTERHTR	**1,823.5**	**lbs/yr**	**Modeled**	**CCR Intermediate Platformer Charge Heater. Area 14. Fuel: refinery fuel gas (NSPS), and natural gas. Permit: C-9022.**
EU14-CCRPLCHRHTR	**2,066.7**	**lbs/yr**	**Modeled**	**CCR PLATFORMER CHARGE HEATER. AREA 14. REFINERY FUEL GAS AND NATURAL GAS**
EU16NHTCHARHTR	**862.7**	**lbs/yr**	**Modeled**	**Naphtha Hydrotreater Charge Heater. Area 16. Capacity: 40.30 MMBtu/hr. Fuel: refinery fuel gas (NSPS), No. 6 fuel oil, and**
				natural gas. Permit: C-11493.
EU16STRIPREBOIL	**424.0**	**lbs/yr**	**Modeled**	**Naphtha Hydrotreater Stripper Reboiler. Area 16. Capacity: 25 MMBtu/hr. Fuel: refinery fuel gas (NSPS), residual oil, and natural gas. Permit: C-11497.**
EU19KHTCHARHTR	**186.8**	**lbs/yr**	**Modeled**	**Kerosene Hydrotreater Charge Heater. Area 19. Capacity: 15 MMBtu/hr. Fuel: fuel oil, refinery fuel gas (NSPS), and natural gas. Permit: C-11496.**
EU22-FUELOILHTR	**1.3**	**lbs/yr**	**Modeled**	**Fuel Oil Heater. Area 22. A natural gas fired heater used to heat fuel oil tanks. Heater size is 7.5 MMBtu/Hr.**
EU27-B&WBoiler1	**2,035.6**	**lbs/yr**	**Modeled**	**Gas-fired boiler, capacity 190,000 pounds steam per hour at 600psig; design heat input not to exceed 249 MMBtu/hr.**
EU27-ZURNBOILER	**390.9**	**lbs/yr**	**Modeled**	**Zurn Boiler. Area 27. Capacity: 210 MMBtu/hr. Fuel: natural gas. Permit: C-9022**
EU38-THERMHTR-N	**12.5**	**lbs/yr**	**Modeled**	**North Therminol Heater - Rouge Terminal. Area 38. Permit C-2403 was issued for this natural gas-fired heater. There are no enforceable permit conditions.**
EU38-THERMHTR-S	**28.2**	**lbs/yr**	**Modeled**	**South Therminol Heater - Rouge Terminal. Area 38. Permit C-1173 was issued for this natural gas-fired heater. There are no enforceable permit conditions.**
EU42-43SULRECOV	**74,411.7**	**lbs/yr**	**Modeled**	**Sulfur Recovery Unit/Scot Tail Gas Treatment Unit. This unit converts hydrogen sulfide to elemental sulfur using the Claus process. Additional hydrogen sulfide is removed using the Scot Tail gas treating unit process a (TGTU). After the acid gas passes**
EU70-COKERHTR	**435.7**	**lbs/yr**	**Modeled**	**Coker Charge Heater. Area 70. Fuel:**
EU71-H2HTR	**1,112.3**	**lbs/yr**	**Modeled**	**Hydrogen Plant Heater. Area 71. Fuel: Refinery fuel gas, pressure swing absorption gas, Syngas, and natural gas.**
EU72 new SRU	**5,068.8**	**lbs/yr**	**Modeled**	**new SRU, SCOT tail gas Treating Unit Block 2**
EU76-UTILITIES	0.0	lbs/yr	Not Included *	Coker plant flare and flare gas recovery systems. Area 76. This source is intended to maintain consistency with the permit.
EU77 DHTHTR	**221.2**	**lbs/yr**	**Modeled**	**Distillate Hydrotreater Heater. Area 77. Fuel:**
EUCOKERFLARE	948.7	lbs/yr	Not Included *	Coker Plant Flare. Area 76.

EU-EG4WWTPGen	97.9	lbs/yr	Not Included	This an emergency generator for the WWTP. It is run once a month to ensure operation. Permitted in 195-00
EUHotOilHTR	**32.7**	**lbs/yr**	**Modeled**	**Heater used at the Asphalt Terminal. Data provided by Marathon TT&M**
EULOADING_RACKS	2.0	lbs/yr	Not Included	Five lane loading rack and associated vapor recovery unit. Includes use of backup vapor control device during extended malfunction/breakdown of primary device.
EUMELVASPHHTR	**20.8**	**lbs/yr**	**Modeled**	**MELVINDALE ASPHALT HEATER**
* Majority of flare emissions are upset conditions and not considered worse-case as compared to process emissions.				
U.S. STEEL				
EU80-MILL-FURNCS	**2,757,432**	**lbs/yr**	**Modeled**	**80 Hot Strip Mill including (5) natural or coke oven gas fired steel slab reheat ovens**
RG-ZI No2 BLRHSE	**1,155,440**	**lbs/yr**	**Modeled**	**Zug Island No 2Bolier House Boilers**
RG-ZI No1 BLRHSE	**630,710**	**lbs/yr**	**Modeled**	**Zug Island No 1Bolier House Boilers**
EUBLAST-FCE-D	**463,034**	**lbs/yr**	**Modeled**	**D Blast Furnace consisting of the following groups of devices**
EUBFG-FLARES	**431,529**	**lbs/yr**	**Modeled**	**BLAST FURNACE GAS FLARES includes**
EUBLAST-FCE-B	**270,240**	**lbs/yr**	**Modeled**	**B Blast Furnace consisting of the following groups of devices**
RG-BOP-OPERATION	**22,961**	**lbs/yr**	**Modeled**	**Basic Oxygen Process Operations include: - Furnace Vessel Operations (blowing) (BOF VESSELS) - Furnace Charging (BOF-CHARGING) - Furnace Tapping (BOF-TAPPING) - Process Desulfurization (BOP-DESULF-OPS) - Hot Metal Transfer (2BOP-HMT)**
RG-MP-No1 BLRHSE	**14,379**	**lbs/yr**	**Modeled**	**No 8 & No 9 Boilers, Main Plant**
EUHARSCO-SCREEN3	810.0	lbs/yr	Not Included	Portable iron ore pellet screening operation
EUHARSCO-SCREEN2	682.0	lbs/yr	Not Included	Portable iron ore pellet screening operation
EUINSGNIFCNT-NG	318.0	lbs/yr	Not Included	Natural Gas used for insignificant processes and space heaters. Unit is exempt from Rule 201 under Rule 282 (b)(i)
EU#1CGL	259.0	lbs/yr	Not Included	The Number One Continuous Galvanizing Line coats steel in zinc by dipping the steel in a pot of melted zinc.
EUANEAL-B-BLDG	249.0	lbs/yr	Not Included	B Annealing Building Furnaces (10 units) - Unit is exempt from Rule 201 under Rule 282 (a)
EULADLE-DRYOUT	153.0	lbs/yr	Not Included	Steel Ladle Maintenance Operations - Unit is grandfathered.
EUVDG-DGAS-BLR	149.0	lbs/yr	Not Included	Vacuum Degassing Process, Package Water Tube Steam Boiler - Main Plant. Natural gas fired boiler to produce 60,000 pounds per hour steam for process requirements. The exhaust stack for the vacuum degasser boiler as represented as MAPR AQ-24 stack
EUANEAL-F-BLDG	97.0	lbs/yr	Not Included	F Annealing Building Furnaces (6 units) - Unit is exempt from Rule 201 under Rule 282 (a)
EUSTEEL-OPS	74.0	lbs/yr	Not Included	STEEL OPERATIONS include

EUANEAL-H2-BLDG	63.0	lbs/yr	Not Included	H2 Annealing Process Furnaces (9 heating units 14 bases) - Unit is exempt from Rule 201 under Rule 282 (a)
RG-EGL-OPERATION	22.0	lbs/yr	Not Included	Electro Galvanizing Line Operations
EUVDG-FLARE	6.0	lbs/yr	Not Included	VACUUM DEGASSING FLARE includes flared gas from the VDG operation and natural gas
EUIMS-SCARFING	2.1	lbs/yr	Not Included	International Mill Service (IMS) operations include: natural gas process heat, steel slab scarfing operation within an enclosed negative
				pressure building, 4 fume-collection canopies, and one pulse-jet baghouse.
EUBLAST-FCE-A	0.0	lbs/yr	Not Included	A Blast Furnace consisting of the following groups of devices
EUBURNOUT-OVEN-1	0.0	lbs/yr	Not Included	Maintenance Burnout Oven No 1
EUBURNOUT-OVEN-2	0.0	lbs/yr	Not Included	Maintenance Burnout Oven No 2
EUGLRS-BRQUET	0.0	lbs/yr	Not Included	GLRS (Briquetting operations) is a third party located at the main plant that processes blast furnace dust and other metal by-products.
RG-ZI No3 BLRHSE	0.0	lbs/yr	Not Included	Zug Island No 3 Boiler House Boilers
EES COKE				
EUCOG-FLARE	**1,350,295**	**lbs/yr**	**Modeled**	**COKE OVEN GAS FLARE includes - Flare Coke Oven Gas Consumed**
EUCOKE-BATTERY	**2,450,941**	**lbs/yr**	**Modeled**	**No 5 Coke Battery includes: (1) Underfire Combustion Stack (1) Pushing Emissions Control System (PECS) Baghouse (1) Quench Tower (1) Coal Charging Larry Car**
EUCOKE-BY-PRODUCT	307.0	lbs/yr	Not Included	The No 3 By Products Plant includes (2) COG exhausters (18) Process Vessels (1) Gas Blanketing System (1) Tar Loadout (1) Light Oil Loadout

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