

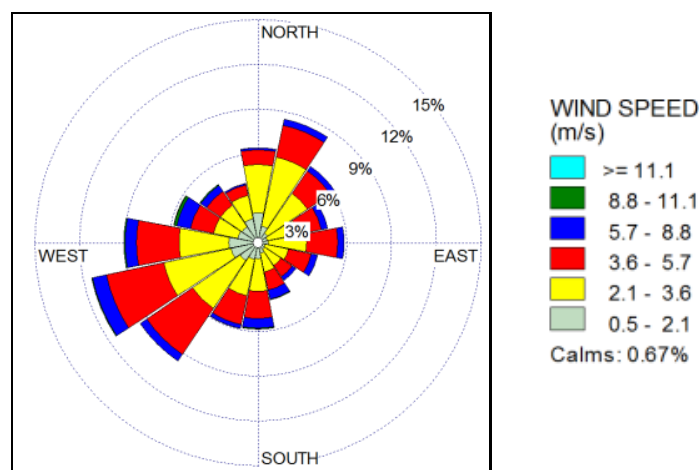
# GA EPD Dispersion Modeling for the 2010 1-Hour SO<sub>2</sub> NAAQS: Georgia-Pacific Savannah River Mill and Georgia Power Plant McIntosh December 13, 2016

Georgia-Pacific Savannah River Mill (SRM) and Georgia Power Plant McIntosh are affected sources under EPA's Data Requirements Rule (DRR) because Savannah River Mill and Plant McIntosh each emitted greater than 2,000 tons of SO<sub>2</sub> in 2014. To satisfy the requirements of the DRR, Georgia-Pacific and Georgia Power notified Georgia EPD that they will characterize air quality through the modeling option and submitted a dispersion modeling report and related modeling files (prepared by Georgia Pacific) on November 11, 2016. Georgia EPD reviewed the modeling report and files to ensure that the dispersion modeling was conducted in accordance with the final Data Requirements Rule and Modeling Technical Assistance Document (TAD).

This report discusses the procedures used to review the supporting dispersion modeling and the modeling results.

## INPUT DATA

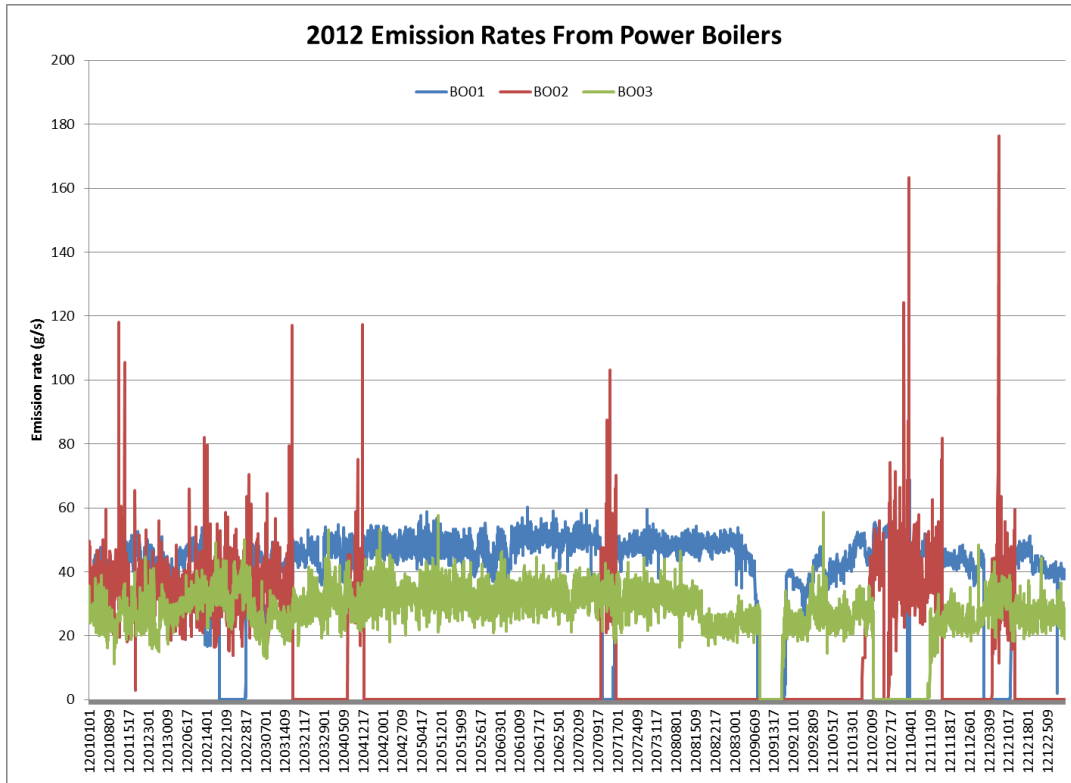
**Meteorological Data** – Since no on-site meteorological data was available, the hourly meteorological data of surface and upper air observations from the Savannah/Hilton Head International Airport located in Savannah, GA (surface) and the Charleston International Airport, SC (upper) NWS stations for the period of 2012-2014 were used in this modeling. The data were compiled and provided by GA EPD. The AERMET processor (15181) was used to convert the NWS data into AERMOD model-ready meteorological data files using the AERSURFACE surface characteristics evaluation utility (13016). Values of the surface characteristics (albedo, Bowen ratio, and surface roughness) surrounding the Savannah Airport, GA NWS surface station and the project site were derived for each of twelve 30-degree sectors over four seasons in accordance with the AERMOD Implementation Guide (09078). GA EPD compared the above AERSURFACE generated surface characteristics and found no significant differences in the albedo, Bowen ratio, and surface roughness for the two sites. Therefore, a meteorological dataset with the Savannah airport NWS surface characteristics was used in the modeling. According to the 3-year wind rose for the Savannah International Airport (Figure 1), the winds are predominantly from the southwest.



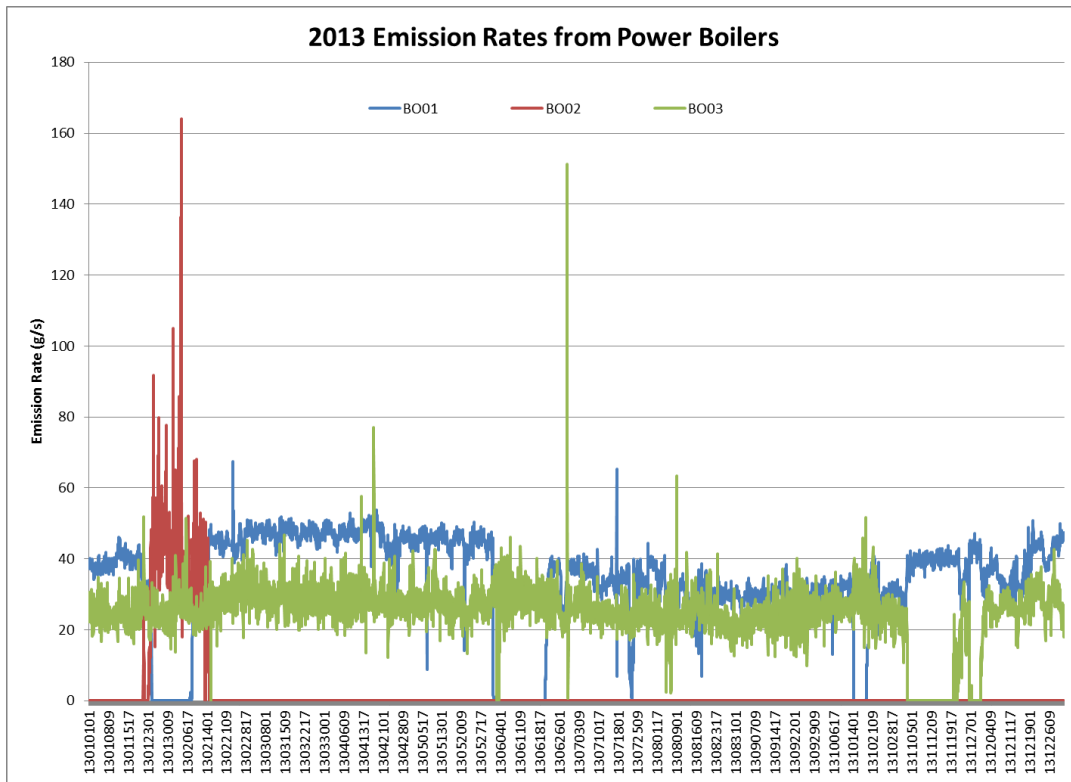
**Figure 1.** Three-year Wind Rose (2012-2014) for the Savannah International Airport.

**Source Data** – Georgia-Pacific’s Savannah River Mill operates a recycle and deinking paper mill. The primary operations at the Savannah River Mill are pulping and bleaching operations, paper machines, converting and printing operations, and additional equipment necessary to support these operations including three boilers (BO01-Boiler No.3, BO02-Boiler No.4, and BO03-Boiler No.5). Each boiler is equipped with a baghouse to control particulate matter (PM) emissions and a limestone injection system to control SO<sub>2</sub> emissions. Each boiler (BO01-BO03) exhausts to a dedicated 381-ft stack with an inner diameter of 7.25 ft. Actual hourly emissions, temperatures, and flow rates for the most recent three calendar years (2012-2014) were modeled. Hourly emission rates, temperatures, and flow rates were reported to EPA’s Clean Air Markets Division (CAMD) under the Acid Rain Program using continuous emission monitoring systems (CEMS) certified according to 40 CFR Part 75. Figures 2-4 show the hourly SO<sub>2</sub> emission rates (g/s) that were modeled through each stack for BO01-BO03 in 2012, 2013, and 2014.

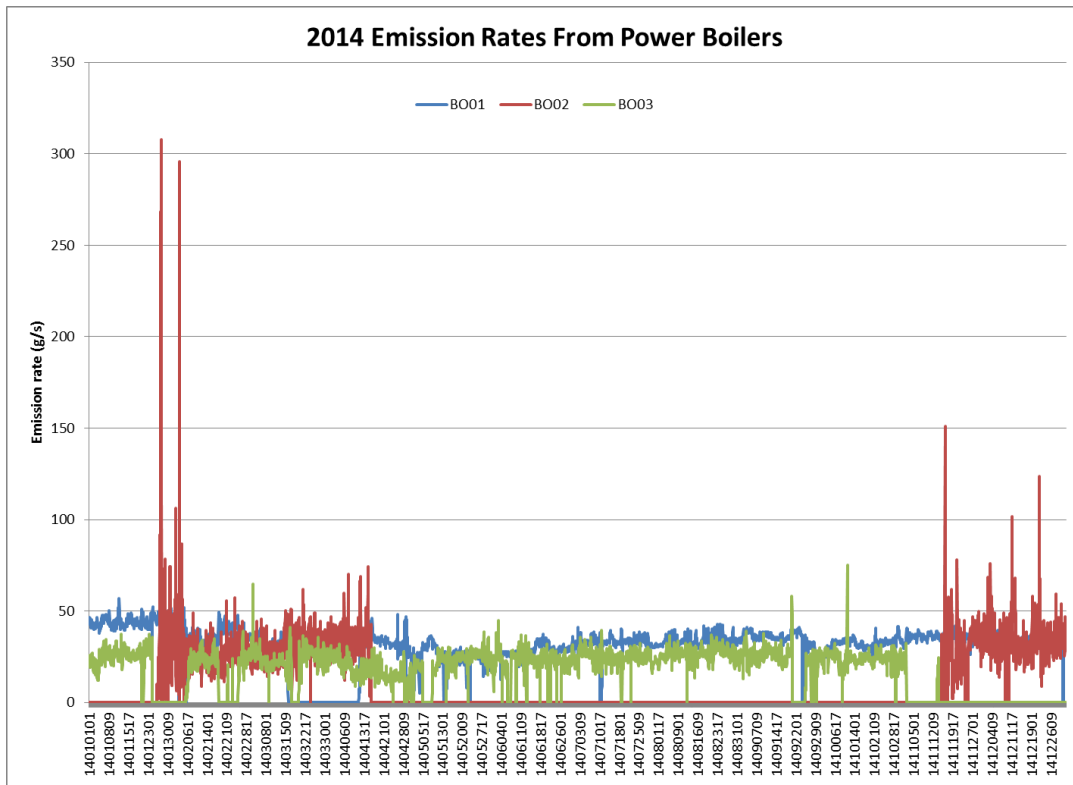
Plant McIntosh is located adjacent to Savannah River Mill, and is an electric power generation plant including one steam electric generating unit (SG01) that primarily burns coal and eight simple cycle combustion turbines (CT1-CT8) that primarily burn natural gas. The McIntosh Combined-Cycle facility is also located nearby and includes two combined-cycle power blocks. Each combined-cycle power block includes two combustion turbines (10A-B & 11A-B) with a supplementally fired heat recovery steam generator (dust burner). Each dust burner fires natural gas exclusively. The steam generating unit SG01 exhausts through one 400-ft stack, and each simple cycle combustion turbine has its own 64-ft stack. The emissions from each combined cycle combustion turbines exhausts through a 160-ft stack. The actual hourly emissions, temperatures, and flow rates for steam electric generating unit (SG01) were modeled. Hourly emission and flow rates were reported to EPA’s Clean Air Markets Division (CAMD) under the Acid Rain Program using CEMS certified according to 40 CFR Part 75. Figure 5 shows the hourly SO<sub>2</sub> emissions rates for SG01 that were modeled in 2012, 2013, and 2014. The SO<sub>2</sub> emissions for the simple cycle combustion turbines (CT1-CT8) were based on 15 ppm ULSD combustion (1.93 lb/hr) and the combined cycle combustion turbines (10A-B and 11A-B) were based on an emission rate of 0.0006 lb/MMBtu, including the heat input from the duct burners (1.47 lb/hr).



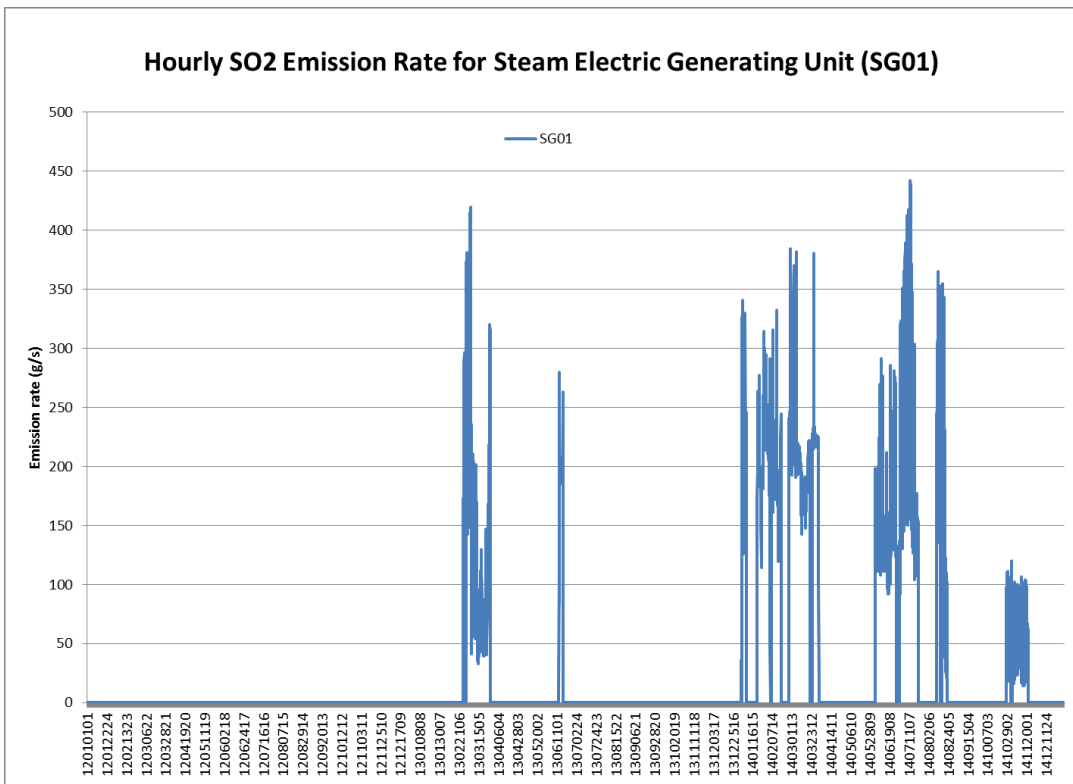
**Figure 2.** Hourly (2012) SO<sub>2</sub> emission rates (g/s) modeled through each stack for Georgia-Pacific Savannah River Mill.



**Figure 3.** Hourly (2013) SO<sub>2</sub> emission rates (g/s) modeled through each stack for Georgia-Pacific Savannah River Mill.



**Figure 4.** Hourly (2014) SO<sub>2</sub> emission rates (g/s) modeled through each stack for Georgia-Pacific Savannah River Mill.



**Figure 5.** Hourly (2012-2014) SO<sub>2</sub> emission rates (g/s) that were modeled for SG01 for Plant McIntosh.

**Receptor Locations** – A comprehensive Cartesian receptor grid extending to approximately 20 km from the Savannah River Mill was used in the AERMOD modeling analysis to assess ground-level SO<sub>2</sub> concentrations. The Cartesian receptors were placed according to the following configuration based on the center of the Savannah River Mill:

- 0 km – 5km → 100 meters apart
- 5 km – 10 km → 500 meters apart
- 10 km – 20 km → 1,000 meters apart

This domain is sufficient to capture the maximum impact which was located at a receptor spaced at 100 meters. Receptors were also placed at 100-m intervals within Savannah River Mill, Plant McIntosh, Effingham County Power, LLC, and Jasper Generating facility ambient air boundary. Although the SO<sub>2</sub> Modeling TAD specifies that receptors need not be placed at locations where it is not feasible to place a monitor (e.g., water bodies and within facility property lines), the receptor grid conservatively simulates all areas including within each facility's ambient air boundary that is not generally accessible to the public. This receptor grid represents a very conservative approach to the modeling analysis. **Since the maximum SO<sub>2</sub> impacts are nearby the Savannah River Mill, we decided to focus our analysis on a 10 km modeling sub-domain extending to 10 km from the Savannah River Mill (includes all receptors at 100 meters and 500 meters spacing).** All receptor locations are represented in the Universal Transverse Mercator projections, Zone 17, North American Datum 1983.

**Terrain Elevation** – Terrain data from USGS 1-sec National Elevation Dataset (NED) CONUS were extracted to obtain the elevations of all sources and receptors by AERMAP terrain processor (version 11103). The resulting elevation data were verified by comparing contoured receptor elevations with USGS 7.5-minute topographic map contours.

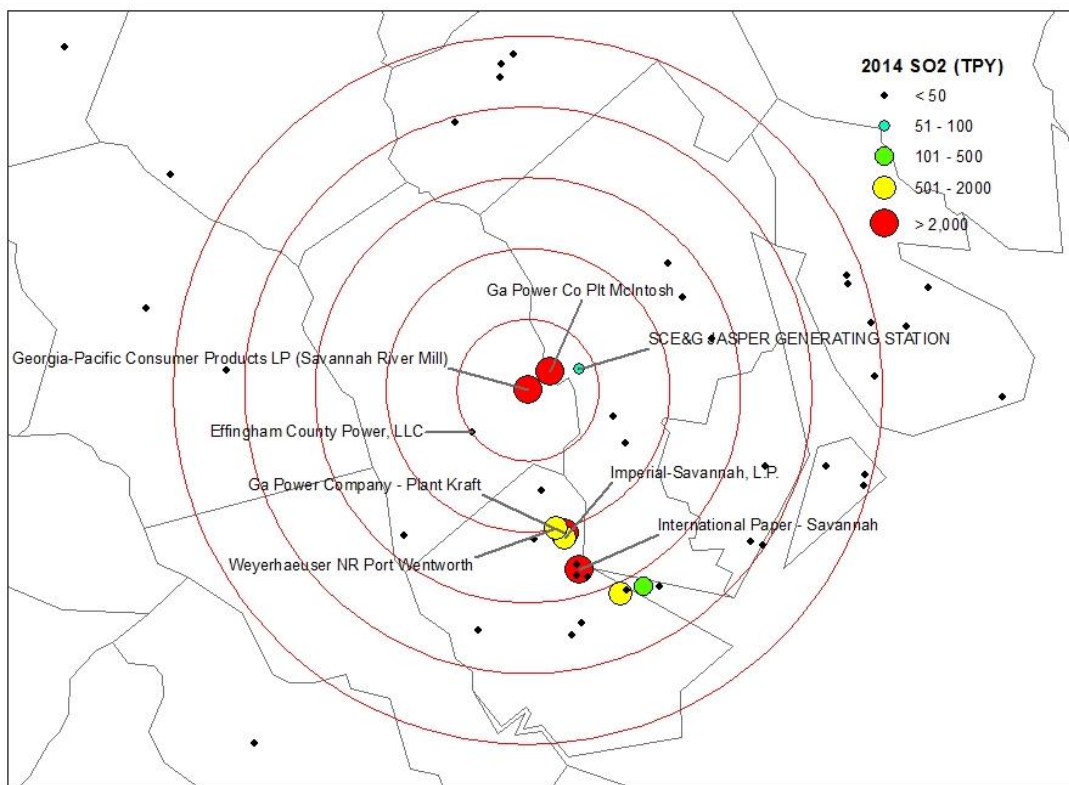
**Building Downwash** – The effects of building downwash were incorporated into the AERMOD analysis. Direction-specific building parameters required by AERMOD were developed using the BPIP PRIME utility (version 04274). Actual stack heights for Savannah River Mill and Plant McIntosh were used in the modeling together with actual emissions.

**Offsite Emission Inventory** – Figure 6 contains a spatial map of annual 2014 SO<sub>2</sub> emissions (TPY) from offsite sources near Savannah River Mill. Table 1 contains a detailed list of facilities within 50 km from Savannah River Mill and the emission (TPY), distance (km), and Q/d. Two electric generating power plants (Effingham County Power, LLC in Georgia and Jasper Generating Station in South Carolina) are within 10 km of Savannah River Mill and Plant McIntosh. These facilities were modeled with their potential hourly SO<sub>2</sub> emission rates.

International Paper - Savannah (IP-Savannah) is over 25 km away and was modeled separately as part of the DRR requirements. This modeling was submitted to EPA on August 30, 2016. The impact from IP-Savannah is accounted for using the maximum modeled SO<sub>2</sub> concentration of 50.3 µg/m<sup>3</sup> (19.2 ppb) due to IP-Savannah (without background concentration added) along the northern and upper western modeling domain boundaries. This is a very conservative assumption since the SO<sub>2</sub> concentrations will continue to decrease at further distances. Detailed information can be found in the Appendix A.

The impacts from Georgia Power Plant Kraft, Weyerhaeuser NR Port Wentworth, and Imperial-Savannah, L.P. with Q/d values greater than 20 were included in the seasonal background concentration. These facilities are located approximately 7 km away from the Augusta & Lathrop SO<sub>2</sub> monitor, but are located approximately 20 km away from the Savannah River Mill and Plant McIntosh. These same facilities are approximately 10 km away from the edge of the 10 km modeling sub-domain used for our modeling analysis. Therefore, the use of the 2012-2014 seasonal hour of day background SO<sub>2</sub> concentrations will be a conservative estimate of the background (not including IP-Savannah) since the Plant McIntosh and Georgia Pacific Savannah River Mill modeling domain is further away from Weyerhaeuser NR Port Wentworth, Imperial-Savannah, L.P., and Georgia Power Plant Kraft than the Augusta & Lathrop SO<sub>2</sub> monitor.

All the remaining facilities have Q/d values less than 20 and were not explicitly modeled.



**Figure 6.** Map of actual annual 2014 SO<sub>2</sub> emissions (TPY) from offsite sources near the Georgia-Pacific Savannah River Mill facility. Red circles are placed in 10 km increments out to 50 km.

**Table 1.** List of facilities within 50 km from the Georgia-Pacific Savannah River Mill facility and the emission (TPY)/distance (km), or Q/d.

FACILITY ID	FACILITY NAME	SO <sub>2</sub> Emissions (TPY)	distance (km)	Q/d
10300003	Ga Power Co Plant McIntosh	2267.8	4.1	549
5100007	International Paper - Savannah	8122.7	26.3	309
5100006	Ga Power Company - Plant Kraft	5140.1	20.9	245
5100010	Weyerhaeuser NR Port Wentworth	570.3	19.9	29
5100110	Imperial-Savannah, L.P.	582.0	21.5	27
5100077	Southern States Phosphate & Fertilizer	597.1	31.6	19
13005611	SCE&G JASPER GENERATING STATION	98.6	7.9	12
10300014	Ga Power Company - McIntosh Combined Cycle Facility	15.9	2.5	6
5100008	Savannah Acid Plant LLC	125.2	32.2	4
5100148	Arizona Chemical Corporation	34.7	27.1	1
5100205	Superior Landfill & Recycling Center	42.6	34.6	1
10300012	Effingham County Power, LLC	3.2	9.8	0
5100037	EMD Millipore Corporation	4.5	14.4	0
8306411	SANTEE COOPER HILTON HEAD	14.4	49.3	0
5100076	Colonial Terminals, Inc.	6.4	27.7	0
4781011	USMC RECRUIT DEPOT	9.9	49.0	0
4802311	ELLIOTT SAWMILLING	7.4	44.3	0
10300004	Simpson Lumber Company, LLC	2.0	26.9	0
3100028	Claude Howard Lumber Company, Inc.	3.6	55.1	0
3100005	W. M. Sheppard Lumber Co Inc,	2.4	42.6	0
4508411	HICKORY HILL LANDFILL/RECYCLING	1.5	27.0	0
9186311	Hilton Head Airport	1.3	49.0	0
5100149	Hunter Army Airfield	0.4	35.1	0
9159411	Ridgeland	0.2	26.6	0
5100019	Georgia-Pacific Gypsum Llc - Savannah Plant	0.1	31.5	0
17012111	HAIG POINT CLUB	0.1	39.8	0
5100046	Gulfstream Aerospace Corporation	0.1	21.1	0
5100012	Axeon Specialty Products	0.1	25.6	0
5100003	Southern LNG Company, L.L.C. -Elba Island LNG	0.0	33.4	0
4834011	US MARINE CORPS AIR STATION	0.0	47.5	0
5100017	Ga Power Company - Plant Boulevard	0.0	33.7	0
16906311	COASTAL DEBRIS	0.0	25.5	0
4508311	SCE&G HARDEEVILLE	0.0	12.6	0
12084911	BEAUFORT COUNTY MEMORIAL HOSPITAL	0.0	49.3	0
11099511	MELROSE LANDING	0.0	38.0	0
16083011	SALTY FARE LANDNG	0.0	43.5	0
4760611	VALMONT COMPOSITE STRUCTURES ESTILL	0.0	46.1	0
9159511	ATHENA CORPORATION	0.0	15.7	0
11426511	DAVIS	0.0	39.1	0
10942511	HARPERS	0.0	47.4	0
12486811	BEAUFORT MCAS /MERRITT FIELD/	0.0	47.8	0

## 1-HOUR SO<sub>2</sub> NAAQS ASSESSMENT

The total SO<sub>2</sub> concentrations were calculated as the sum of the modeled concentrations due to emissions from Savannah River Mill, Plant McIntosh, Effingham County Power, and Jasper Generating Station; the 2012-2014 seasonal hour of day background SO<sub>2</sub> concentration; and the modeled impact from IP-Savannah (50.3 µg/m<sup>3</sup>, 19.2 ppb). AERMOD (version 15181) was used to model the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> highest three-year average of maximum 1-hour SO<sub>2</sub> concentrations due to emissions from those four facilities (Table 2). Detailed information on the 2012-2014 seasonal hour of day background SO<sub>2</sub> concentrations and modeled impact from IP-Savannah is included in Appendix A. Figure 7 shows a google earth map for the Savannah River Mill, Plant McIntosh, Effingham County Power, and Jasper Generating Station. As seen in Figure 8, the 4<sup>th</sup> high daily maximum 1-hour SO<sub>2</sub> concentration averaged over 3-years was located at approximately 0.86 kilometers south east of the center of the Savannah River Mill.

The 4<sup>th</sup> highest 1-hour SO<sub>2</sub> concentration averaged over three years including the 2012-2014 seasonal hour of day background SO<sub>2</sub> concentration and the modeled impact from IP-Savannah is 187.5 µg/m<sup>3</sup> (72 ppb). As shown in Table 3, this value is below the NAAQS level of 196 µg/m<sup>3</sup> (75 ppb).

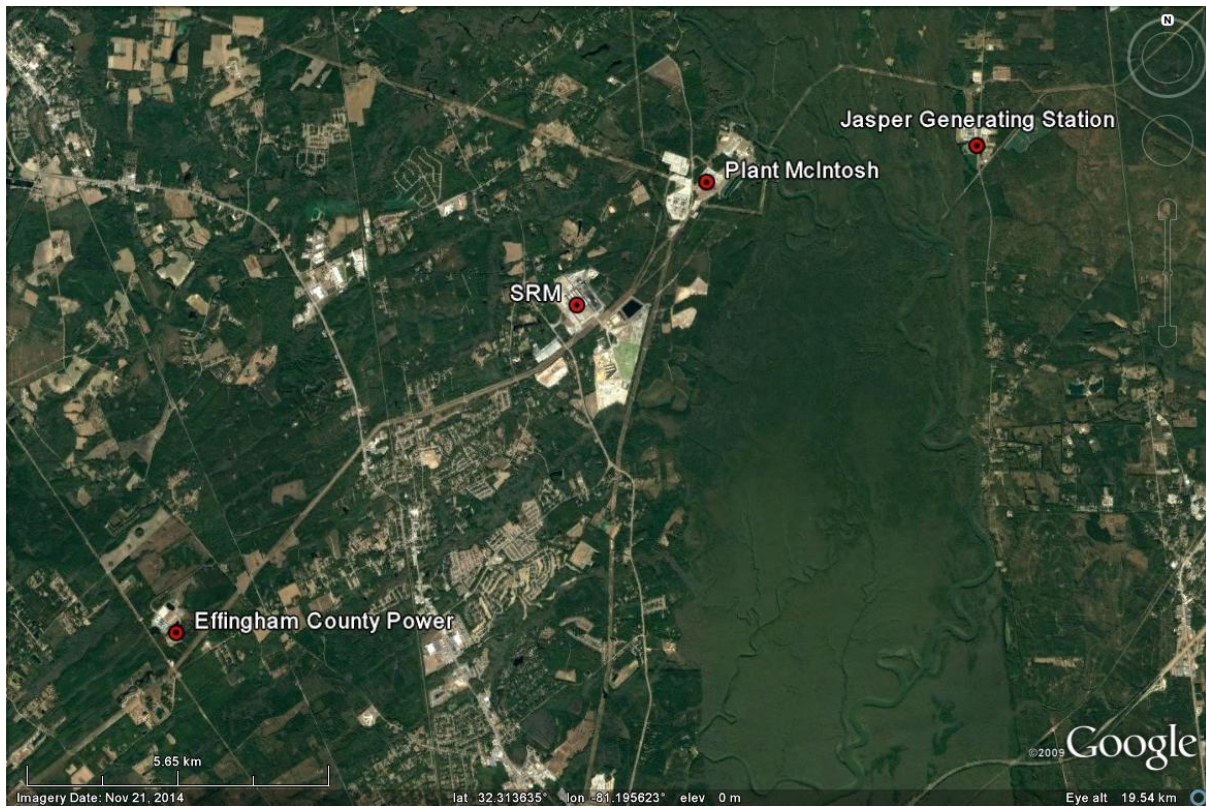
**Table 2.** Summary of highest 1-hour SO<sub>2</sub> modeled impacts averaged over 3 model years.

Rank	3-year Average (ppb)	2012 (ppb)	2013 (ppb)	2014 (ppb)	Receptor (lat, log)	Distance from center of SRM (km)
1 <sup>st</sup> High	<b>77</b>	86	56	88	32.3352, -81.1915	1.04
2 <sup>nd</sup> High	<b>58</b>	45	59	70	32.3271, -81.1915	1.04
3 <sup>rd</sup> High	<b>54</b>	46	54	62	32.3280, -81.1915	0.99
4 <sup>th</sup> High	<b>52</b>	47	54	56	32.3271, -81.1936	0.86

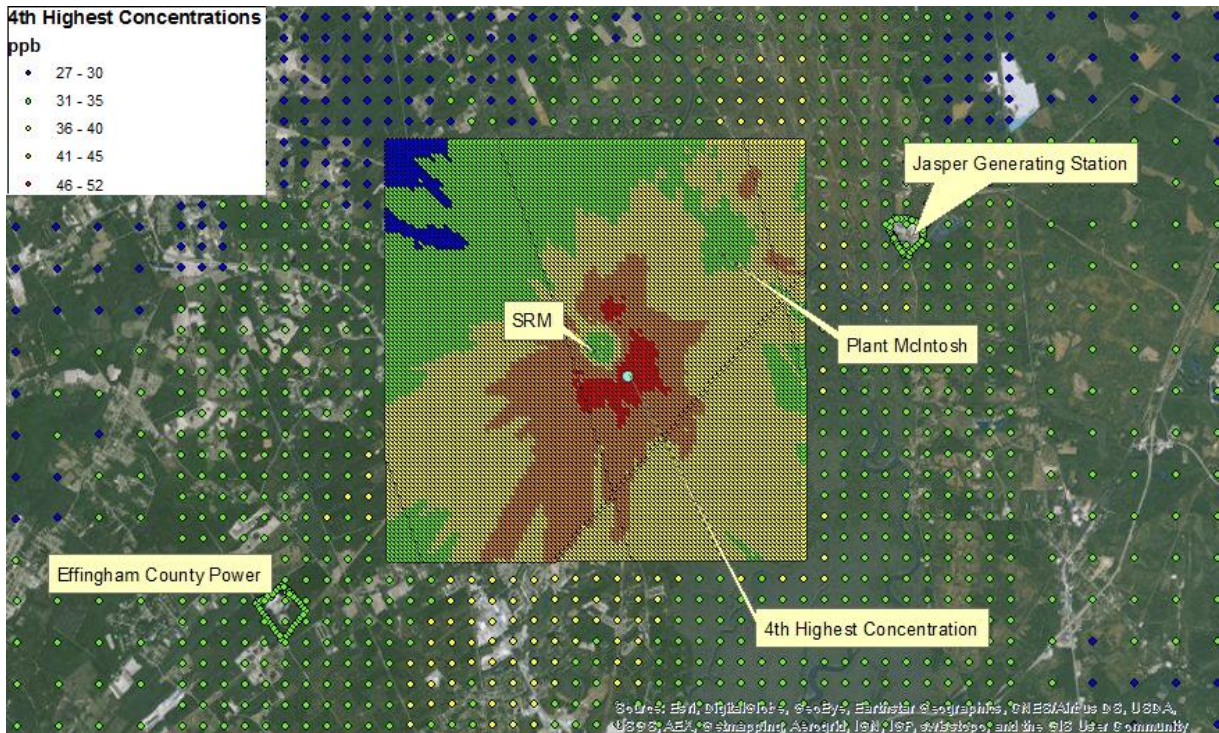
**Table 3.** Summary of 1-hour SO<sub>2</sub> NAAQS (µg/m<sup>3</sup>) analysis

Pollutant	Averaged Period	Model Design Concentration including seasonal background (µg/m <sup>3</sup> )	IP Savannah Background Concentration (µg/m <sup>3</sup> )	Total Concentration (µg/m <sup>3</sup> )	NAAQS (µg/m <sup>3</sup> )	Below NAAQS (Y/N)
SO <sub>2</sub>	1-hour	137.2	50.3	187.5	196	Y





**Figure 7.** Google Earth Map for Savannah River Mill, Plant McIntosh, Effingham County Power, and Jasper Generating Station.



**Figure 8.** Spatial plot of the 4<sup>th</sup> highest daily maximum 1-hour SO<sub>2</sub> concentration averaged over 3 years.

## **CONCLUSIONS**

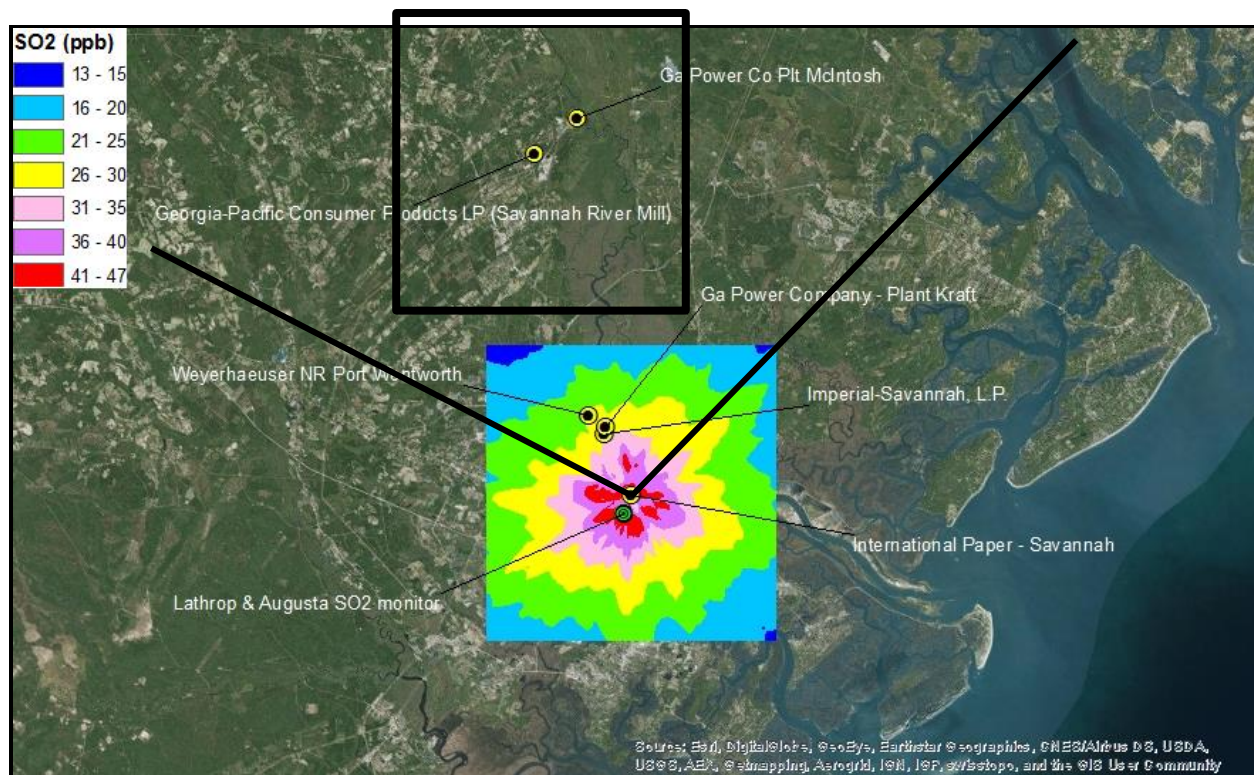
The Savannah River Mill and Plant McIntosh dispersion modeling for the 1-hour SO<sub>2</sub> NAAQS designations was conducted in accordance with the final Data Requirements Rule (DRR) and Modeling Technical Assistance Document (TAD) using the most recently available information. As seen in Table 3, SO<sub>2</sub> emissions from Savannah River Mill and Plant McIntosh do not cause or contribute to any violations of the 1-hour SO<sub>2</sub> NAAQS. This result demonstrates attainment of the 1-hour SO<sub>2</sub> NAAQS in the area surrounding the Savannah River Mill and Plant McIntosh.

# Appendix A

## Background to Account for Offsite Emission Sources Near Georgia Pacific Savannah River Mill and Georgia Power Plant McIntosh

EPA requested that International Paper Savannah (IP-Savannah), Weyerhaeuser NR Port Wentworth, Imperial-Savannah, L.P., and Georgia Power Plant Kraft be included in the modeling. Since IP-Savannah modeling has already been submitted to EPA to fulfill DRR modeling requirements, we proposed to use this existing modeling to help develop background concentrations for the requested sources.

To account for the impacts from IP-Savannah, we are proposing to use the maximum modeled SO<sub>2</sub> concentration from IP-Savannah (without background added) along the northern and upper western modeling domain boundary (see Figure A-1 and attached Excel file). Based on this analysis, the maximum SO<sub>2</sub> concentration along the northern and upper western modeling domain boundary is 19.2 ppb. Using this value to represent the impacts from IP-Savannah in the Plant McIntosh/Georgia Pacific Savannah River Mill 10 km modeling sub-domain will be a very conservative assumption since the SO<sub>2</sub> concentrations will continue to decrease at further distances.



**Figure A-1.** Modeling domain for IP-Savannah and 10 km modeling sub-domain for Plant McIntosh and Georgia Pacific Savannah River Mill.

As part of the IP-Savannah modeling, Georgia EPD developed seasonal hour of day background SO<sub>2</sub> concentrations. These background values are meant to include impacts from all large sources in Savannah except IP-Savannah (e.g., Weyerhaeuser NR Port Wentworth, Imperial-Savannah, L.P., and Georgia Power Plant Kraft, plus other nearby sources) surrounding the Lathrop & Augusta SO<sub>2</sub> monitor (13-051-1002). The seasonal hour of day background concentrations were calculated for each of the four seasons using the following steps:

1. For each of the three years of data, SO<sub>2</sub> data was sorted by wind direction.
2. All SO<sub>2</sub> values corresponding to a wind direction between 10° and 45° were ignored since those impacts were directly attributable to IP-Savannah.
3. For each year, the remaining SO<sub>2</sub> data was sorted by season; spring (March-May), summer (June-August), fall (September- November), and winter (December-February).
4. For each season, SO<sub>2</sub> data was sorted by hour of day.
5. For each year and season, the second highest SO<sub>2</sub> value was selected for each hour of the day.
6. The average over the three years of the second highest SO<sub>2</sub> value was calculated for each hour of the day for each season.

For the IP-Savannah DRR modeling, 2011-2013 SO<sub>2</sub> data was used to develop the seasonal hour of day SO<sub>2</sub> background concentrations. However, for this modeling we are proposing to use 2012-2014 SO<sub>2</sub> data to develop the seasonal hour of day SO<sub>2</sub> background concentrations to be consistent with the actual emissions and meteorology used in the Plant McIntosh/Georgia Pacific Savannah River Mill modeling. Table A-1 and Figure A-2 show the seasonal hour of day SO<sub>2</sub> background concentrations that we propose to use in this modeling. The detailed calculations are included in the attached Excel file.

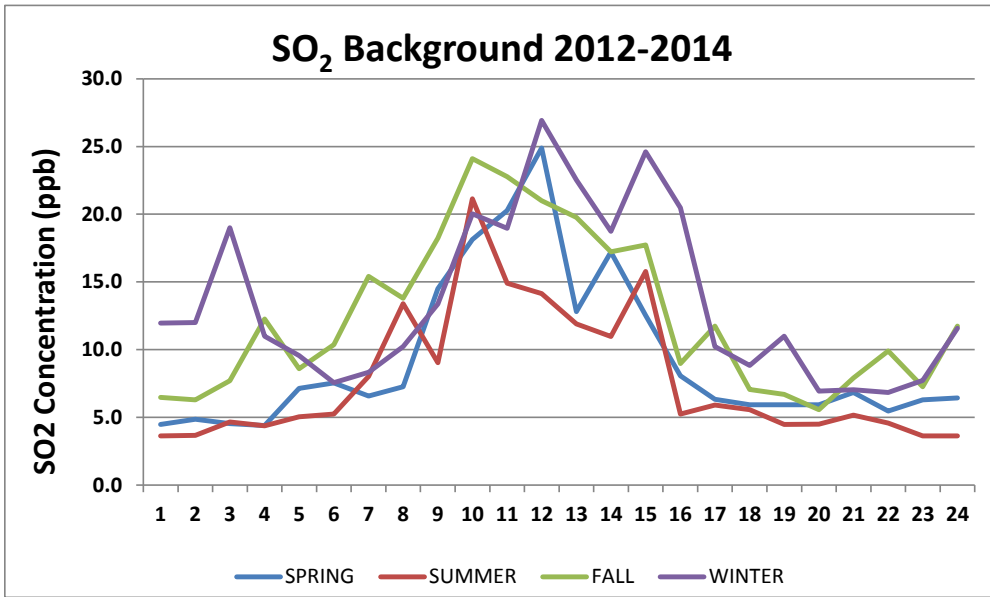
Weyerhaeuser NR Port Wentworth, Imperial-Savannah, L.P., and Georgia Power Plant Kraft are located approximately 7 km away from the Augusta & Lathrop SO<sub>2</sub> monitor. These same facilities are located approximately 20 km away from Plant McIntosh and Georgia Pacific Savannah River Mill and approximately 10 km away from the edge of the Plant McIntosh and Georgia Pacific Savannah River Mill 10 km modeling sub-domain. Therefore, the use of the 2012-2014 seasonal hour of day background SO<sub>2</sub> concentrations will be a conservative estimate of the background (not including IP-Savannah) since the Plant McIntosh and Georgia Pacific Savannah River Mill 10 km modeling sub-domain it is further away from Weyerhaeuser NR Port Wentworth, Imperial-Savannah, L.P., and Georgia Power Plant Kraft than the Augusta & Lathrop SO<sub>2</sub> monitor.

By adding 19.2 ppb from IP-Savannah to the 2012-2014 seasonal hour of day background SO<sub>2</sub> concentrations described above, the impacts from IP-Savannah, Weyerhaeuser NR Port Wentworth, Imperial-Savannah, L.P., and Georgia Power Plant Kraft will be conservatively accounted for in the combined seasonal hour of day SO<sub>2</sub> background concentration. This combined seasonal hour of day SO<sub>2</sub> background concentration will be added to the modeled

design concentration for the sources that were explicitly modeled in the Plant McIntosh/Georgia Pacific Savannah River Mill modeling domain and compared to the NAAQS.

**Table A-1.** Seasonal hour of day background SO<sub>2</sub> concentration in Savannah (not including IP-Savannah) for 2012-2014.

Hour of Day	Winter	Spring	Summer	Fall
1	12.0	4.5	3.6	6.5
2	12.0	4.9	3.7	6.3
3	19.0	4.5	4.7	7.7
4	11.0	4.4	4.4	12.3
5	9.6	7.1	5.0	8.6
6	7.6	7.5	5.2	10.4
7	8.3	6.6	8.0	15.4
8	10.2	7.3	13.4	13.8
9	13.4	14.5	9.0	18.2
10	20.0	18.1	21.1	24.1
11	19.0	20.3	14.9	22.8
12	26.9	24.9	14.1	21.0
13	22.5	12.8	11.9	19.8
14	18.7	17.2	11.0	17.2
15	24.6	12.5	15.8	17.7
16	20.5	8.1	5.2	9.0
17	10.2	6.3	5.9	11.7
18	8.8	5.9	5.6	7.1
19	11.0	5.9	4.5	6.7
20	6.9	5.9	4.5	5.6
21	7.0	6.8	5.2	7.9
22	6.8	5.5	4.6	9.9
23	7.7	6.3	3.6	7.3
24	11.6	6.4	3.6	11.7



**Figure A-2.** Seasonal hour of day SO<sub>2</sub> background concentration in Savannah (not including IP-Savannah) for 2012-2014.