

**Appendix C - Macon PM_{2.5} Nonattainment Area
Redesignation Request and Maintenance Plan**

Emissions inventory development for the Macon area

Emissions inventories for the Macon area were developed for attainment year 2007 and future years 2017 and 2023. Direct PM_{2.5} emissions and PM_{2.5} precursor emissions (SO₂ and NO_x), as defined in the Clean Air Fine Particle Implementation Rule (72 FR 20586), were included in the inventories. The majority of the 2007 attainment year emissions inventory was prepared as part of SESARM's contracted Southeastern Modeling, Analysis, and Planning (SEMAP) project. The majority of the projected emissions inventories was prepared by Georgia EPD. The attainment year and future year emissions were prepared for four source categories using different methods. The four source categories are:

- Point sources (EGU and Non-EGU)
- Nonpoint sources (including fire)
- Nonroad mobile sources (including marine, aircraft and railroad)
- Onroad mobile sources

The Macon PM_{2.5} nonattainment area includes Bibb County and part of Monroe County. All point sources located in Bibb County and the partial Monroe nonattainment area are included in the emission inventories for the Macon nonattainment area. Emissions from area, fires, nonroad and onroad mobile source are calculated first for the whole counties, as documented below. Then, the emissions in Monroe County were multiplied by the human population fraction in the nonattainment part of Monroe County to get the emissions in Monroe's partial nonattainment area.

1.0 Base Year Point Sources

Emissions estimates for point sources in 2007 were obtained from SEMAP point source inventory v1.8. This inventory includes emissions estimates for 74 very large sources in 2007, 109 additional facilities in 2008, and 66 additional facilities in 2005, which were all submitted to EPA by the state of Georgia. This inventory also includes 19 facilities in CAMD database which were not included in the state submittal. For facilities with 2005 and 2008 emissions (but no 2007 emissions), 2007 emissions were estimated based on a linear interpolation between facility level 2005 and 2008 emissions on a pollutant-by-pollutant basis to calculate facility level 2007 emissions. For facilities with only 2008 data (no 2007 or 2005 data available), the SIC growth factors from the VISTAS Best&Final inventory were used to backcast 2008 reported emissions to 2007. For facilities with only 2005 data (no 2007 or 2008 data available), the SIC growth factors from the VISTAS Best&Final inventory were used to project 2005 reported emissions to 2007. After the above backcasting and projecting was performed, additional adjustments were made for facilities where only 2005 data were available and the facility did not operate in 2007 or operated for only part of 2007. Facilities that did not operate in 2007 were removed from the NIF files. For facilities that operated for part of 2007, the 2005 emissions were approximated for 2007 by multiply the 2005 emissions by a scaling factor of the number of days the facility operated in 2007 divided 365 days of full year operation. Also, the end date in the NIF EM and PE tables were changed to reflect the actual date that the facility ceased operation. In addition, PM augmentation was performed to generate missing emissions estimates for filterable and primary PM_{2.5}, filterable and primary PM₁₀, and condensable PM.

The SEMAP inventory went through review using EPA's Basic Format and Content Checker tool (EPA 2004); which was used to verify the data was in the correct format, to check for referential integrity and duplicate record issues, and to check certain fields for proper valid codes and ranges. This inventory also went through several rounds of quality assurance (QA) reviews by State and local (S/L) agencies, as well as a review by SEMAP stakeholders. For more information regarding the SEMAP point inventory, please refer to Appendix C-1.

1.1 EGU Point Sources

Emissions estimates for EGU point sources in 2007 were obtained from SEMAP point source inventory v1.8. The only EGU point source in Macon PM_{2.5} nonattainment area is Plant Scherer (Units SG01 – SG04). Georgia Power

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provided updated PM and NH₃ emissions data for all Georgia Power facilities. The revised PM emission values include condensable emissions which were previously missing from the inventory.

Emissions in 2017 and 2023 were estimated using growth factors and control factors. Growth factors were calculated based on coal consumption for the Southeastern region in AEO2010. The SO₂ control factor due to Flue Gas Desulfurization (FGD) was assumed to be 95% according to VISTAS 2012 Projection Emissions Inventory. The NO_x control factor due to Selective Catalytic Reduction (SCR) was assumed to be 82.5% according to VISTAS 2012 Projection Emissions Inventory. The PM_{2.5} control factor due to FGD was assumed to be 50% according to Table 5.4-1 on page 5.4-24 of the EPA document "Stationary Source Control Techniques Document for Fine Particulate Matter" (EC/R Incorporated, 1998). Table 1 contains control dates for Plant Scherer. Tables 2, 3, and 4 contain a list of unit-specific SO₂, NO_x, and PM emissions for 2007, 2017, and 2023 and the associated growth and control factors for Plant Scherer.

Table 1. EGU Control Dates for Plant Scherer (AIRS 11500003)

UnitID	NO _x Control		SO ₂ Control		Other Controls
	Actual Operation	Required Operation rule (sss)	Actual Operation	Required Operation rule (sss)	
SG01	NO	12/31/14*	NO	12/31/14	Electrostatic precipitator (ESP) Sorbent Injection and Baghouse (12/31/09)
SG02	NO	12/31/13*	NO	12/31/13	Electrostatic precipitator (ESP) Sorbent Injection and Baghouse (6/1/09)
SG03	NO	7/1/11*	NO	12/31/11	Electrostatic precipitator (ESP) Sorbent Injection and Baghouse (6/1/09)
SG04	NO	12/31/12*	NO	12/31/12	Electrostatic precipitator (ESP) Sorbent Injection and Baghouse (4/30/10)

* SCR operation is required only during months of May through September
NO = not operating as of December 2010

Table 2. SO₂ emissions projection calculations for EGU point sources

POINTID	2007 Emissions (tons)	2017			2023		
		Growth Factor	Control Factor	Emissions (tons)	Growth Factor	Control Factor	Emissions (tons)
SG01	18450.800	1.013	95%	934.894	1.050	95%	968.232
SG02	18446.400	1.013	95%	934.671	1.050	95%	968.001
SG03	20149.700	1.013	95%	1020.976	1.050	95%	1057.384
SG04	19409.400	1.013	95%	983.465	1.050	95%	1018.535

Table 3. NO_x emissions projection calculations for EGU point sources

POINTID	Emissions Fractions in May through Sep*	2007 Emissions (tons)	2017			2023		
			Growth Factor	Control Factor	Emissions (tons)	Growth Factor	Control Factor	Emissions (tons)
SG01	43%	5032.500	1.013	82.5%	3286.143	1.050	82.5%	3403.326
SG02	42%	4653.480	1.013	82.5%	3099.703	1.050	82.5%	3210.238
SG03	43%	4473.180	1.013	82.5%	2916.451	1.050	82.5%	3020.451
SG04	41%	4689.480	1.013	82.5%	3145.361	1.050	82.5%	3257.523

* These controls will only operate during the period from May through September. Therefore, the fraction of NO_x emissions during the ozone season in 2007 was calculated using CEM data, and the control factors due to SCR operations were only applied to emissions during the ozone season.

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Table 4. PM_{2.5} emissions projection calculations for EGU point sources

POINTID	2007 Emissions (tons)	2017			2023		
		Growth Factor	Control Factor	Emissions (tons)	Growth Factor	Control Factor	Emissions (tons)
SG01	238.033	1.013	50.0%	120.610	1.050	50.0%	124.911
SG02	346.458	1.013	50.0%	175.549	1.050	50.0%	181.809
SG03	297.269	1.013	50.0%	150.625	1.050	50.0%	155.996
SG04	284.100	1.013	50.0%	143.952	1.050	50.0%	149.085

1.2 Non-EGU Point Sources

Emissions estimates for non-EGU point sources in 2007 were obtained from SEMAP point source inventory v1.8, as described in the section for base year point sources. Emissions in future years 2017 and 2023 were estimated using SCC- and county-specific growth factors generated with the USEPA's Economic Growth Analysis System version 5.0 (EGAS 5.0). Appendix C-7 contains a summary of the SCC-specific growth factors for Macon nonattainment area. Tables 5, 6, and 7 contain a list of specific non-EGU point sources in Macon nonattainment area and facility-specific SO₂, NO_x, and PM emissions for 2007, 2017, and 2023. These emissions are not subject to additional controls in the future years 2017 and 2023.

Table 5. SO₂ emissions projection for non-EGU point sources, tons

County	FIPs	PLANT ID	FACILITY NAME	2007	2017	2023
Bibb	13021	02100001	Graphic Packaging International	242.872	251.113	263.064
Bibb	13021	02100021	Southern Natural Gas Co., Ocmulgee	0.078	0.087	0.095
Bibb	13021	02100030	Armstrong World Industries Inc	0.000	0.000	0.000
Bibb	13021	02100167	Cherokee Brick & Tile Company	203.968	254.132	287.631

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Table 6. NO_x emissions projection for non-EGU point sources, tons

County	FIPs	PLANT ID	FACILITY NAME	2007	2017	2023
Bibb	13021	02100001	Graphic Packaging International	1259.400	1372.247	1493.333
Bibb	13021	02100021	Southern Natural Gas Co., Ocmulgee	366.856	408.797	445.414
Bibb	13021	02100030	Armstrong World Industries Inc	54.662	63.088	70.713
Bibb	13021	02100167	Cherokee Brick & Tile Company	56.224	70.052	79.286

Table 7. PM_{2.5} emissions projection , tons

County	FIPs	PLANT ID	FACILITY NAME	2007	2017	2023
Bibb	13021	02100001	Graphic Packaging International	271.746	312.683	343.302
Bibb	13021	02100021	Southern Natural Gas Co., Ocmulgee	9.938	11.074	12.066
Bibb	13021	02100030	Armstrong World Industries Inc	46.847	67.042	80.123
Bibb	13021	02100167	Cherokee Brick & Tile Company	44.395	55.314	62.605

2.0 Area Sources

Emissions from area sources in 2007 were obtained from the SEMAP area source inventory v1.1 which was developed by Pechan. Pechan created a default 2007 area source inventory that includes all of the source categories covered by the 2008 nonpoint source NEI. For all source categories except industrial and commercial/institutional (ICI) fuel combustion, Pechan either directly incorporated emissions data from the 2008 nonpoint source NEI (when the NEI represented use of 2007 emissions activity data), or recalculated the NEI emission estimates to reflect 2007 activity levels (when the NEI reflected 2006 or 2008 activity levels) and/or to remove emissions associated with activity reflected in the point source inventory. For ICI fuel combustion, the 2008 nonpoint source NEI only developed emissions activity estimates, not emission estimates. Because of the potential importance of these source categories and the availability of methodological improvements, Pechan utilized an emissions estimation method for ICI fuel combustion incorporates a few refinements to the NEI method. These emissions were supplemented with carry-forward categories from 2005 GA CERR submission grown using EGAS. For more information regarding the SEMAP area inventory, please refer to Appendix C-2.

Emissions in future years 2017 and 2023 were estimated using SCC- and county-specific growth factors generated with the USEPA's Economic Growth Analysis System version 5.0 (EGAS 5.0). Appendix C-7 contains a summary of the SCC-specific growth factors for Macon nonattainment area. These emissions are not subject to additional controls in the future years 2017 and 2023.

Emissions from fires in 2007 were obtained from the SEMAP final "actual" fire emissions inventory. This inventory was developed using 2007 burned area data submitted by states, as well as updated fuel consumption and emissions factors (Appendix C-8). Emissions in future years 2017 and 2023 were assumed to be the same as base year 2007.

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3.0 Nonroad Mobile Sources

The nonroad sector is comprised of nonroad engines included in EPA's NONROAD model, such as recreational marine and land-based vehicles, farm, construction and industrial machinery, and lawn and garden equipment. This sector also includes engines not modeled in NONROAD, specifically aircraft, commercial marine vessels, and locomotives.

3.1 Nonroad Mobile Sources – NONROAD Model Category

Emissions from NONROAD model source categories in 2007 were obtained from the SEMAP final nonroad mobile sources emissions inventory. These emissions were calculated using NMIM2008, which incorporates EPA's latest NONROAD model (NONROAD2008) released in April 2009, and reflects all of EPA's final nonroad standards to date. The county/monthly gasoline profile assignments in the CountyYearMonth table and the gasoline fuel profiles in the Gasoline table of the 2007 NMIM county-level database (NCD) were updated with data provided by the State of Georgia. For more information regarding the SEMAP nonroad inventory, please refer to Appendix C-2.

Emissions in future years 2017 and 2023 were also calculated using NMIM2008, using the same meteorological inputs as for 2007. Defaults in NMIM 2008 were used for other inputs in future years.

3.1 Nonroad Mobile Sources – Marine, Aircraft, and Locomotives

Emissions from commercial marine vessels (CMV), aircraft, and locomotives in 2007 were obtained from the SEMAP final nonroad mobile sources emissions inventory. For more information regarding the SEMAP marine, aircraft, and locomotive inventory, please refer to Appendix C-2. Growth and control factors that were used to develop future year emissions were provided by Pechan. For more information regarding the SEMAP marine, aircraft, and locomotive growth and control factors, please refer to Appendix C-5.

2007 CMV emissions in the SEMAP inventory were based largely on EPA's 2008 NEI, and then were adjusted to represent 2007. Growth factors for residual CMVs were developed using average annual growth rates in USEPA regulatory impact analysis (RIA) to support their category 3 engine rulemaking. Growth factors for diesel engine CMV emissions were based on fuel consumption forecasts published by EIA. Control factors were developed using information from USEPA's RIA. There were no CMV emissions in the Macon nonattainment area.

2007 aircraft emissions in the SEMAP inventory were primarily based on EPA's 2008 NEI, which were back-cast to 2007 using approach operations by airport and aircraft type compiled from the FAA's Air Traffic Activity Data System (ATADS) (FAA, 2010). Growth factors for all aircraft engine and airport-related SCCs were based on landing and take-off operation (LTO) projections available from the Federal Aviation Administration's Terminal Area Forecasts (TAF) (FAA, 2010). Growth rates for military aircraft were held constant at 2007 levels. No control factors have been applied to aircraft for criteria pollutant forecasts. Appendix C-5 contains a list of specific aircraft sources in the Macon nonattainment area and SCC-specific SO₂, NO_x, and PM_{2.5} emissions for 2007, 2017, and 2023 and the associated growth factors.

2007 locomotive emissions in the SEMAP inventory were obtained from the Eastern Regional Technical Advisory Committee for Class I and Class II/III line haul locomotives and railyards. Passenger and commuter rail line emissions were grown from EPA's 2002 NEI to 2007. For Class I and Class II/III line haul and diesel switchyard operations, Pechan calculated growth factors based on freight rail sector fuel consumption forecasts. For passenger and commuter rail, growth factors were developed from national forecasts of intercity rail diesel consumption, and commuter rail diesel consumption. Control factors were based on US EPA's locomotive engine RIA and associated emission factor guidance. Tables 11, 12, and 13 contain a list of specific locomotive sources in the Macon nonattainment area and SCC-specific SO₂, NO_x, and PM_{2.5} emissions for 2007, 2017, and 2023 and the associated growth and control factors.

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Table 11. SO₂ emissions projection for Locomotives

		SCC	Description	2007 Emissions (tons)	2017			2023		
					Growth Factor	Control Factor	Emissions (tons)	Growth Factor	Control Factor	Emissions (tons)
Bibb	13021	2285002006	Class I	4.20	1.02	95.80%	0.18	1.08	95.87%	0.19
Bibb	13021	2285002007	Class II/III	0.28	1.02	95.80%	0.01	1.08	95.87%	0.01
Bibb	13021	2285002010	Yard	2.89	1.02	95.80%	0.12	1.08	95.87%	0.13
Monroe	13207	2285002006	Class I	3.00	1.02	95.80%	0.13	1.08	95.87%	0.13
Monroe	13207	2285002007	Class II/III	0.18	1.02	95.80%	0.01	1.08	95.87%	0.01

Table 12. NO_x emissions projection for Locomotives

		SCC	Description	2007 Emissions (tons)	2017			2023		
					Growth Factor	Control Factor	Emissions (tons)	Growth Factor	Control Factor	Emissions (tons)
Bibb	13021	2285002006	Class I	368.85	1.02	34.86%	244.02	1.08	52.00%	190.46
Bibb	13021	2285002007	Class II/III	40.66	1.02	2.07%	40.44	1.08	7.85%	40.30
Bibb	13021	2285002010	Yard	327.56	1.02	17.27%	275.21	1.08	30.92%	243.40
Monroe	13207	2285002006	Class I	263.14	1.02	34.86%	174.09	1.08	52.00%	135.87
Monroe	13207	2285002007	Class II/III	26.19	1.02	2.07%	26.05	1.08	7.85%	25.96

Table 13. PM_{2.5} emissions projection for Locomotives

		SCC	Description	2007 Emissions (tons)	2017			2023		
					Growth Factor	Control Factor	Emissions (tons)	Growth Factor	Control Factor	Emissions (tons)
Bibb	13021	2285002006	Class I	12.92	1.02	53.97	6.04	1.08	69.84	4.19
Bibb	13021	2285002007	Class II/III	0.92	1.02	16.92	0.78	1.08	20.00	0.79
Bibb	13021	2285002010	Yard	9.98	1.02	30.77	7.01	1.08	43.08	6.11
Monroe	13207	2285002006	Class I	9.21	1.02	53.97	4.31	1.08	69.84	2.99
Monroe	13207	2285002007	Class II/III	0.59	1.02	16.92	0.50	1.08	20.00	0.51

4.0 Mobile – Onroad

SO₂, NO_x, and PM_{2.5} emissions from onroad mobile sources in 2007 and 2023 were developed by Georgia Department of Transportation contractor using MOVES2010a. MOVES was run at county level for Bibb in inventory mode for a July day in Year 2007 and 2023. Average 2007 annual daily meteorological inputs were used in both runs. Best available local data were used for MOVES inputs such as vehicle population, vehicle miles traveled (VMT) by source types, road type distribution, speed distributions, ramp fractions, hourly VMT fractions and age distribution.

SO₂, NO_x, and PM_{2.5} emissions from onroad mobile sources in the nonattainment part of Monroe County were calculated using a combined method. For running emissions, MOVES was run in rate mode. The emission rate outputs were combined with activity data derived using Georgia DOT historical traffic counts to calculate running emissions. For non-running emissions, MOVES was run in inventory mode, and the emissions in the nonattainment part of Monroe County were calculated using the percent of the human population in the nonattainment area. Local data such as vehicle population, VMT, and age distribution were used, and MOVES defaults were used for other MOVES inputs. Please refer to Appendix C-3 for more detailed information.

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5.0 Partial County Fractions

The partial county fraction was calculated as the ratio of human population in the nonattainment part to the total population of Monroe County. The human population in the nonattainment part of Monroe County was estimated as the total of human population in census blocks whose geographical centroids fall inside of the nonattainment area boundary. According to 2010 Census data, the human population in the nonattainment part of Monroe County is 241, and the total population in Monroe County is 26,424. Therefore, the partial county fraction is $241/26424 = 0.91\%$.

6.0 QA/QC

Detailed QA/QC efforts for point and fire sources were documented in the MACTEC 2009 Quality Assurance Project Plan (QAPP, MACTEC, 2009), and QA/QC efforts for nonroad and area sources can be found in E.H. Pechan's 2009 QAPP. Onroad mobile source emissions were provided by a Georgia Department of Transportation contractor, and were verified by running MOVES independently at Georgia EPD. All MOVES input files have been carefully checked.

References

MACTEC, 2009. Quality Assurance Project Plan for Point Source, On-Road, and Fire Base Year, Future Year, and Control Strategy Emissions Inventories.

MACTEC, 2011, Development of the Point Source Emission Inventory for 2007 in the SESARM Region (Version 1.8)

E.H. Pechan & Associates, Inc. 2009. Quality Assurance Project Plan for Non-Road and Area Source Base Year and Future Year Emissions Inventories.

EC/R Incorporated, 1998, Stationary Source Control Techniques Document for Fine Particulate Matter, obtained from <http://www.epa.gov/ttnecat1/dir1/finepmtech.pdf> , accessed on 1/19/2011.

E.H. Pechan & Associates, Inc. 2010. Area and Nonroad 2007 Base Year Inventories Final Report.

E.H. Pechan & Associates, Inc. 2011. Growth and Control Factor Development for Aircraft, Commercial Marine Vessels, and Locomotives

EPA, 2010. U.S. Environmental Protection Agency, EGAS Version 5.0, available for download from <http://www.epa.gov/tneacas1/egas5.htm>, accessed March 2010.