

Appendix T

Voluntary Reduction of Emissions from Railyards in Metro Atlanta Region

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Introduction: The Georgia EPD has spent a significant amount of time analyzing the source and impact of emissions of ozone and fine particulate matter precursors from railyards in the metro Atlanta area. Table 1 lists railyards located in the metro Atlanta area as of April 22, 2005. While the use of railroads for shipping has a lower overall impact on air quality when compared with moving equivalent tons of cargo by trucks, railroad-related emissions of NO_x are an important contributor to ozone concentrations in many of Georgia's nonattainment counties. Cost-effective options are available to significantly reduce NO_x from locomotive engines, however federal regulations do not currently require nor allow states to require their use. In addition, recently proposed federal regulations for these engines would not significantly reduce their emissions to the level possible for many years.

Table 1 Metro Atlanta Railyards

County	Operator	Railyard Name
Cobb	Georgia Northeastern Railroad	GNRR Yard
	CSX Railroad	Bolton Yard
	Norfolk Southern Railroad	Whitaker Yard
Fulton	CSX Railroad	Howells Yard
	CSX Railroad	Tilford Yard
	CSX Railroad	Hulsey Yard
	CSX Railroad	Fairburn Yard
	CSX Railroad	Bellwood Yard
	Norfolk Southern Railroad	Inman Yard
	Norfolk Southern Railroad	Armour Yard
	Norfolk Southern Railroad	South Yard
Clayton	Norfolk Southern Railroad	Industry Yard
Clayton	Norfolk Southern Railroad	Forest Park Yard
DeKalb	CSX Railroad	Portion of Hulsey Yard

While estimates of emissions from locomotives have a high level of uncertainty, the likely levels of NO_x emissions from locomotives in the Georgia nonattainment counties is significant. For example, while stationary facilities emitting 25 or more tons of NO_x per year in the ozone nonattainment counties are regulated under the Title V requirements of the Clean Air Act, eleven of the twenty-three nonattainment counties in 2002 had

estimates of greater than 50 tons of NO_x per county emitted from yard locomotives¹ alone. One county (Fulton) had emissions greater than 380 tons of NO_x per year from yard locomotives alone. Statewide, line-haul locomotives were estimated to emit 23,671 tons of NO_x per year and railyard locomotives were estimated to emit 3,062 tons, levels comparable with emissions from 32 million Tier 2 automobiles².

The Georgia EPD has undertaken a number of activities to better understand and reduce railroad-related emissions, including submitting three proposals for funding assistance from the Georgia Department of Transportation under the Congestion Mitigation for Air Quality improvement program (CMAQ) to retrofit railyard locomotives with much lower emitting engines and to analyze emissions contributions to very high monitored ambient ozone and PM_{2.5} concentrations near large, active railyards, and working with a group of 23 states to prepare better railroad-related emissions inventories. To initiate these activities, a Technical Working Group Meeting titled “Air Quality and Railroads in Georgia” was held in Atlanta by the Georgia EPD on March 21, 2007. The meeting brought together Georgia Class I and Shortline Railroad representatives with members of the EPD and other Georgia agencies to discuss issues related to air quality and emissions from railroad-related activities. The meeting was well attended and participants have continued to be cooperative and interested in our air quality management efforts.

In particular, representatives from Georgia’s two Class I railroads (Norfolk-Southern and CSXT) have subsequently shared some engine and operations data and have discussed the possibility of collaborative emissions reduction projects. Representatives from the two Shortlines operating in nonattainment counties, the Chattooga & Chickamauga Railway and the Georgia Northeastern Railroad, attended the meeting have completed a questionnaire designed to collect engine and operations data needed for estimating emissions and have provided feedback on the design of the questionnaire. Shortline railroads, which account for approximately 27% of track route mileage in Georgia, are not required to submit equipment or operations data and their emissions are therefore not currently included in the emissions inventories. More details of this meeting and a general plan related to improvement of the railroad-related emissions inventory and air quality modeling analysis can be found on a website at <http://www.georgiaair.org/>, under “Hot Topics”, “Railroad-Related Activities”.

The EPD has been awarded funding based on three submitted railroad-related proposals submitted to the Georgia Department of Transportation 2007 CMAQ solicitation. All three of the projects proposed to retrofit switchyard locomotives (a.k.a. switchers), which generally utilize one powerful, old, high-emitting engine, with a set of 2 or 3 current-model nonroad diesel engines (e.g., those used in new construction and farm equipment) per locomotive. Most switcher locomotives are believed to operate 24 hours per day 365

¹ Locomotives are divided into three categories, (1) yard locomotives (“switchers”) which are used to assemble and disassemble trains in railyards, (2) line-haul locomotives which are used to pull freight over long, generally intercity or interstate distances, and (3) road locomotives which are used both as switchers and for local hauling generally by Class III (“Shortline”) railroads. These categories of locomotives have different engine types, operation patterns, and normal speed ranges.

² Calculations based on the Tier 2 NO_x emissions standard (0.07gNO_x/mile) for highway vehicles and assuming 12,000 vehicle miles traveled per year.

days per year, mostly within a designated railyard. This newly available ‘Genset’ technology guarantees significant emission reductions. Each project proposal submitted covered a different nonattainment metropolitan statistical area containing at least one switchyard operation: Atlanta, Macon, and Rome. The Atlanta proposal also contained a study, which was fully funded, to characterize emission sources in and near two major railyards in Atlanta located near monitors recording some of the worst ozone and PM2.5 levels in the city.

Table 2 provides information on the amount of funding awarded through CMAQ per fiscal year for each of the projects (note that FY 2009 contains the funding for the emissions study, which does not require a match and will not be awarded to a private entity):

Table 2. CMAQ Awarded Funding for Genset Retrofits and Ambient Monitoring and Analysis in Georgia Nonattainment Areas.

Project	Fiscal Year	Federal Funding	Minimum Match Required	Total Project
EPD Railroad Project - Atlanta	2009*	\$200,000	\$0	\$200,000
	2010	\$12,000,000	\$3,000,000	\$15,000,000
	2011	\$12,000,000	\$3,000,000	\$15,000,000
	2012	\$12,000,000	\$3,000,000	\$15,000,000
EPD Railroad Project – Macon	2010	\$1,800,000	\$450,000	\$2,250,000
	2011	\$900,000	\$225,000	\$1,125,000
	2012	\$900,000	\$225,000	\$1,125,000
	2013	\$900,000	\$225,000	\$1,125,000
EPD Railroad Project – Rome	2010	\$900,000	\$225,000	\$1,125,000

*The 2009 project is the ambient monitoring and analysis, all others are genset retrofits.

These CMAQ funding awards will allow us to provide incentive and support for railroads to purchase and use this new engine technology in railyards located in the GA nonattainment areas. The railroads must also provide training, updated testing and maintenance procedures, and to assume other costs and risks which are not quantified in the cost of retrofitting the switcher locomotives. These Gensets would not be built or designated to these areas without this significant financial incentive.

After receiving internal administrative clearance to provide funding to private entities, the EPD plans to release a request for proposals (RFP) specifying project selection criteria and weighting. Any railroad operating in each nonattainment area will be eligible to participate and will be able to propose various retrofit options. For Atlanta, the EPD will select proposals for funding based on criteria including, but not limited to, their total emissions reduction potential and its subsequent impact on ambient pollutant concentrations, retrofit cost, available match, previous technology and conversion performance, and cooperation with data collection and emissions reporting efforts. The selected railroads will be responsible for conducting or subcontracting the locomotive

retrofits. The EPD will participate in negotiations to optimize air quality benefits with any combination of the two Class I and/or the Shortline Railroads operating in the nonattainment areas specified. .

If a voluntary program is pursued in addition to the Genset locomotive retrofits, the Georgia EPD will advise the railroads on which potential actions would be most effective in improving air quality. There are a few potential emission reduction options, which are described below. The most likely for implementation include ensuring the use of the lower emitting locomotives in sensitive areas, accelerating the use of low-sulfur diesel fuel, and implementing anti-idling technologies or procedures.

Additional Emissions Reduction Options

➤ Ensuring the use of the lower emitting locomotives in sensitive airsheds.

A potentially effective emissions reduction strategy is ensuring the use of the lower emitting locomotives in sensitive airsheds. A program based on this principle was implemented in the South Coast Air Basin (SCAB) of California through a 1998 Memorandum of Understanding between CARB, the two California Class I railroads operating in the SCAB (Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad Company) and the U.S. EPA. The MOU includes provisions for early introduction of clean units, with requirements for a fleet average in the SCAB equivalent to U.S. EPA's Tier 2 locomotive standard by 2010.

A reduction in fleet-average locomotive emissions can be achieved by either assigning lower-emitting engines to use in and around the nonattainment counties, upgrading the Tier-level certification during re-manufacturing, a process undergone approximately every 5 years of the 40+ average years of service provided by a locomotive, or purchasing as clean-running engines as possible when expanding the fleet or replacing locomotives.

A promising new locomotive design has recently become available which utilizes multiple (generally 2 or 3) diesel engines such as EPA Tier III off-road certified engines. This allows the locomotive, called a ‘genset’, to run on only one engine when additional power is not needed, resulting in both lower emissions and lower fuel consumption. According to the EPA, much of the operating time of locomotives, particularly switchers, is spent in the range that would only require the use of one of the engines. Additionally, ‘stop-start’ functionality is built in to reduce unnecessary idling. Comparative emission factors between traditional and genset locomotives are specified in Table 3.

Table 3. Engine Emission Factors

	Gaseous and Particulate Emissions (g/bhp-hr)							
	Switch				Line Haul			
	HC	CO	NOx	PM	HC	CO	NOx	PM
Tier 0	2.1	8	14	0.72	1	5	9.5	0.6

Tier 1	1.2	2.5	11	0.54	0.55	2.2	7.4	0.45
Tier 2	0.6	2.4	8.1	0.24	0.3	1.5	5.5	0.2
Genset (NREC)	0.04	1.51	3.37	0.05	0.02	0.93	2.88	0.02

National Railway Equipment Co. <http://www.northeastdiesel.org/pdf/low-emissions-switcher-012206.pdf>

As can be seen, the use of a genset rather than the more common Tier 1 switcher can result in a 70% reduction in NO_x. As an ideal example of potential emissions reductions from the use of these locomotives, if genset switchers replaced all yard switchers in the five heavily populated ‘urban core’ counties of Atlanta³ (assumed to be Tier 1), NO_x would be reduced by 0.83 TPD from 2.72 TPD (based on 2002 EPD inventory data). A number of states, including California, Texas, and New York, have provided funding to assist Class I railroads in the purchase of switcher gensets, each of which costs approximately \$1.5M. Assuming 23.54 tons NO_x/year per yard locomotive (based on EPA national average estimates for 2002), there would have been 42.2 yard locomotives operating in the urban core counties. The cost of replacing this number of yard locomotives with genset switchers is \$50.6M.

As a result of the Workshop described above, one of Georgia’s Class 1 railroads, Norfolk-Southern, has indicated their intention to locate at least one new genset in their largest railyard in Fulton county (Inman Yard). They recently purchased other gensets, and if we receive funding assistance, we hope to negotiate the placement of other gensets at Inman or another rail yard(s), with the possibility of also accelerating the use of low-sulfur diesel fuel, as described below. In addition, or alternatively, funds may be used to assist a Shortline(s) with Tier level upgrades or the purchase of a genset if an improved emissions inventory combined with air quality modeling sensitivity analysis indicates that this approach would reduce peak ozone more effectively.

➤ Accelerating the use of low-sulfur diesel fuel.

Currently, most diesel fuel in the state of Georgia contains 15 ppm of sulfur (ppmS), while locomotives and marine engines are allowed to use diesel with 500 and greater ppmS. The use of 15 ppmS by locomotives will be phased in between 2012 to 2014. According to a study by the Southwest Research Institute for the CA Air Resources Board (CARB), the use of a CARB specified fuel with 50 ppmS rather than 320 ppmS EPA diesel fuel reduced NO_x emissions from line-haul locomotives by approximately 3.5%.

Using the results of this study, a conservative estimate⁴ of potential emission reductions from accelerating the use of lower sulfur fuel by railroads in the five urban core counties

³ Clayton, Cobb, DeKalb, Fulton, and Gwinnett.

⁴ Using 330 to 50 ppmS rather than 500+ to 15 ppmS sulfur reduction and using the 2002 emissions inventory estimates of locomotive emissions in Georgia (excludes Shortline activity). Additionally, ARB staff believes that, for a number of reasons, these tests underestimate emissions benefits gained from the use of the CARB fuel.

is 0.34 TPD NO_x. The use of this fuel throughout Georgia (excluding Shortlines) would result in a reduction of 2.57 TPD NO_x (based on 2002 emissions data).

CARB estimates that the use of CARB diesel fuel over on-highway EPA diesel fuel would result in a net cost increase of 3 cents per gallon. Considering an estimate of 123,026,000 gallons of diesel fuel used by the railroad industry in Georgia in 2005 (by the Dept. of Energy⁵), the increased cost for the amount of diesel fuel used in Georgia in 2005 would have been \$3.7M, or approximately \$487k for only in the urban core counties.

➤ Reducing engine idling time.

The use of idle-reduction technology (eg. Automatic Engine Stop-Start (AESS), Auxiliary Power Units (APUs.) with controls, etc.) is becoming increasingly common due to its significant reduction in fuel requirements. Switchers are estimated to idle 60% of the time, and line-haul locomotives 40% of the time⁶. Accounting for general levels of emissions under idling conditions, NO_x is estimated to be reducible by 3-5% for line-hauls, and 16-20% for switchers⁷. This would result in a 0.49 TPD reduction in NO_x from switchers in the urban core, and a 0.28 TPD reduction from line-haul locomotives in the urban core (assuming average idle time even when operating in the urban core and in and around rail yards).

The EPD will assist railroad in identifying where idle-reduction technology could be best implemented, and possibly assisting in its purchase and installation (which is estimated to cost approximately \$30-35k per engine.) An alternative approach to reducing idle-related emissions is to encourage more stringent shutdown procedures. Technology selection or operation guidelines would be established in cooperation with the participating railroad to ensure optimal emissions control and compatibility with equipment and general operating needs.

Other potential projects/activities include:

1. Performing a comprehensive analysis of railroad-related emissions at yards, such as from loading/unloading equipment, testing/maintenance, and truck patterns at Intermodal facilities to identify possible measures to reduce emissions.
2. Encouraging/accelerating the use in Georgia of techniques and equipment under testing and development by the railroads, such as LEADER (use of “Golden Run” guidance) and the optimization of wheel-rail interfaces.

⁵ http://tonto.eia.doe.gov/dnav/pet/pet_cons_821dst_dcu_nus_a.htm

⁶ Locomotive Emission Standards, Regulatory Support Document. United States Environmental Protection Agency, Office of Mobile Sources, April 1998.

⁷ Locomotive Idling Reduction, Presented to National Idling Reduction Planning Conference, Albany, NY, May 17-19, 2004 by D. E. Brann, Emissions Compliance, Electro-Motive Division, General Motors Corporation. http://www1.eere.energy.gov/vehiclesandfuels/pdfs/idling_2004/brann.pdf

3. Exploring options for expanding the use of railroads for moving freight, which would reduce the per ton emissions compared with the use of trucks.
4. Exploring options for moving some railroad operations outside of highly populated areas that are out of attainment with the NAAQS.

This wide range of emission reduction options for locomotives, the high levels of railroad-related emissions, and the currently cooperative stance of the Georgia Railroads offers a unique opportunity to produce significant emission reductions and subsequent air quality benefits in the nonattainment counties of Atlanta. An additional initiative in the GA EPD rail program is a eastern US (or possibly nationwide) collaboration to increase our understanding of rail-related emissions.

Improved Understanding of Railroad-Related Emissions

The GA EPD is co-leading the Eastern Regional Technical Advisory Committee (ERTAC) Rail Subcommittee, which is made up of representatives from state and regional air quality protection agencies that convened to improve our understanding and estimates of railroad-related atmospheric emissions. A regional or national approach to building a railroad emissions inventory, rather than a state-by-state approach, will benefit both the railroad community and the respective air agencies by requiring less effort and resources than if acting independently. In addition, a collaboration between the air and railroad organizations is being pursued because cooperation will produce much more meaningful results due to an understanding of the uses of the emissions inventories by the agencies and of operations and data availability from the railroads. The ERTAC Rail Subcommittee, the Association of American Railroads, and representatives from all eight Class I railroads that operate in the US have begun communicating about the approaches and data needs to support this effort. The following information was provided to the railroad community as an overview of the Subcommittee and its objectives before our first web-based meeting:

The Eastern Regional Technical Advisory Committee (ERTAC)

State air pollution control agencies must estimate emissions from sources to develop a state-wide air pollutant emissions inventory that is used for planning purposes. ERTAC was convened by a group of state agencies to identify and address significant gaps in our representation of air pollutant emissions. We believe that collaboration will greatly improve our chances of addressing what we consider to be critical requirements for effective air quality planning. You can learn more about ERTAC at www.ertac.us.

The ERTAC Rail Subcommittee

Railroad-related sources were identified as a very high-priority early in ERTAC's planning activities due to the extent and level of emissions throughout the US, the high level of uncertainty associated with their representation in current emission inventories, and their rapid projected growth due to increased shipping demand, better fuel-efficiency, and generally lower emissions compared with alternative modes of transporting freight. The ERTAC Rail Subcommittee was formed to improve emissions estimates from this

sector. The subcommittee is comprised of active representatives from air quality protection agencies in 13 different states, as well as three regional air quality management groups representing additional states as shown in Table 1.

The Importance of Rail Emissions

Railroad activity releases a variety of emissions and occurs throughout the United States, often concentrated in densely populated, polluted urban areas. In particular, emissions of NO_x and primary PM_{2.5} from diesel combustion contribute to ambient concentrations of ozone and PM_{2.5}, pollutants for which many states have counties out of attainment of the National Ambient Air Quality Standards. Ozone and some components of PM_{2.5} are 'secondary' pollutants, meaning they are formed in the atmosphere rather than directly emitted, making them difficult to manage. Some control strategies can be inefficient or even counter productive if pursued in areas with a poorly characterized chemical composition (i.e. a poor understanding the mix of compounds in the ambient air). Maps of the ozone and PM_{2.5} nonattainment areas in the United States are attached (Figure 1) and clearly illustrate why these pollutants are of interest to air quality management agencies.

Current Status of Rail-related Emissions Inventories

Historically, each state has either requested voluntary data submissions individually or has estimated emissions using surrogates for the calculation of emissions from railroad activities. When additional effort is undertaken, these estimates are often found to be inaccurate. For example, a recent study of locomotive activity in the state of New York found, for the year 2002, NO_x emissions to be underestimated from Class I line-haul locomotives by 70%, by 11522% from Class II and III locomotives, and by 4671% from line-haul commuter rail. Yard locomotive (switcher) NO_x emissions were overestimated by 97%. This study estimated a total of 25,000 tons/year of NO_x to be emitted by these railroad sources in New York State, a significant contribution to the airshed. This level of error can impact the effectiveness of controls applied by other sources in the airshed, the efficiency of selected control strategies, and can obscure valuable opportunities for reducing emissions.

Previous efforts by individual states to improve their characterization of railroad emissions have often proven to be costly and ineffective. There are no consolidated, reliable sources of information regarding the location and activity of these sources. We hope that by unifying our efforts we can both build a more accurate, comprehensive inventory while reducing the burden on railroads of responding to individual state data requests, which often are developed with differing approaches and formats (see Appendix A for example questionnaires).

Objectives and Approach

Our primary goal is to build a link-level, consolidated emissions inventory of railroad related sources for the year 2008, focusing on Class I, II, and III line-haul emissions, railyard locomotive and possibly other uncharacterized yard source emissions, and commuter and passenger locomotive emissions. We plan to spatially and temporally allocate these emissions as accurately as possible. Our current efforts are largely aimed

at evaluating potential calculation methodologies based on the best available data we can obtain for the 2008 inventory; however, we also hope to develop a future methodology in cooperation with the railroad community so that future inventories will require less effort and will be more accurate. We intend to inform stakeholders of our activities at all stages of development, clearly record our efforts and techniques, and to invite collaboration so that we prepare an efficient mode of data collection that will not compromise confidentiality requirements or impose significant administrative burdens. We feel that this activity is critical to our respective agencies' responsibility of protecting and improving air quality and hope that you will support us in these efforts.

The following sections of the report described our current understanding/plans for emissions inventory calculations and potential sources of data related to the Class I railroad community.