Submission to Transport Canada, Environmental Policy

Response to the Public Consultation for the Development of Federal Locomotive Emissions Regulations

Railway Association of Canada

February 14, 2011

Executive Summary

The purpose of the Railway Association of Canada (RAC) submission is to present the views of federally regulated RAC member railways regarding the Government of Canada's approach in developing railway emissions regulations for criteria air contaminants under the *Railway Safety Act*.

The RAC and its Class I member railways (CN, CP and VIA Rail), which consume approximately 94 per cent of all locomotive diesel fuel in Canada, support Transport Canada's approach in developing emissions regulations for federally regulated railways—to align regulations with the U.S. Environmental Protection Agency (EPA) regulations on locomotive emissions. Transport Canada clearly recognizes the integrated nature of the North American rail industry and the need to limit the regulatory burden on the railways while meeting the public policy objectives of reducing man-made criteria air contaminants (CACs) and greenhouse gas emissions (GHGs).

Canadian railways have voluntarily managed locomotive emissions since 1995, through two Memoranda of Understanding (MOU). The initial MOU, which covered the period of 1995-2005, committed the railways to cap the criteria air contaminant (CAC) emissions of nitrogen oxides (NOx) for the rail industry to 115 kilo-tonnes annually. The subsequent MOU was for the period of 2006-2010. Under this agreement, the rail industry committed to greenhouse gas (GHG) reduction targets, on an intensity basis, for Class 1 freight railways, short line freight railways, intercity passenger rail, and commuter rail as well as efforts to reduce CAC emissions.

From 2005 to the end of 2009, the railways have added (purchased) 317 new U.S. EPA compliant Tier 2 locomotives to the Canadian fleet[1]. Finally, since year 2000 the Class I freight railways have upgrade, to the applicable U.S. EPA standards, virtually all eligible locomotives. This clearly demonstrates that Canadian railways are committed to following the U.S. EPA locomotive emissions standards.

The submission will outline key questions, raise concerns, and put forth recommendations related to the development of federal locomotive emissions regulations.

[1] Railway Association of Canada "2005 Locomotive Emissions Monitoring Program, Appendix B" and "draft 2009 Locomotive Emissions Monitoring Program", pg 1.

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1. The Railway Association of Canada

The Railway Association of Canada (RAC) has some 50 railway members and represents virtually all freight, tourist, commuter, and intercity passenger railways operating in Canada. The RAC membership also includes the U.S. Class I railways operating in Canada. CN and CP (members of RAC) also own and operate extensive railway operations in the United States. RAC members play a key role in promoting the safety, security, viability, and growth of the railway industry within Canada.

The RAC conducts the research, policy development and the advocacy necessary to promote the efficiency of rail. Further, the association informs all levels of government and transportation-related businesses about the advantages of rail. The RAC endeavours to ensure fair treatment among other modes.

The RAC headquarters are located in Ottawa, with technical field staff located across Canada, in Vancouver, Edmonton, Toronto and Montreal.

2. Introduction

The RAC wishes to provide comments and input on Transport Canada's public consultation for the Development of Canadian Locomotive Emissions Regulations, which was initiated in December 2010. Overall, the RAC and its Class I member railways (CN, CP and VIA Rail) support Transport Canada's approach in developing emissions regulations for federally regulated railways—to align regulations with the U.S. Environmental Protection Agency (EPA) regulations on locomotive emissions. Transport Canada clearly recognizes the integrated nature of the North American rail industry and the need to limit the regulatory burden on the railways while meeting the public policy objectives of reducing man-made criteria air contaminants (CACs) and greenhouse gas emissions (GHGs).

As noted in Transport Canada's Issue Brief entitled "Rolling Towards a Cleaner Future: The Development of Canadian Locomotive Emissions Regulations", Canadian railways have voluntarily managed locomotive emissions since 1995, under two Memoranda of Understanding (MOU). The initial MOU, which covered the period of 1995-2005, committed the railways to

cap the criteria air contaminant (CAC) emissions of nitrogen oxides (NOx) for the rail industry to 115 kilo-tonnes annually. NOx is a smog forming agent for which Canadian society and governments have taken extensive efforts to reduce NOx across major industrial sectors within the Canadian economy. The rail industry successfully maintained an average of NOx emissions below the 115 kilo-tonne target throughout the life of the 1995-2005 MOU. As further commitment under the MOU, the rail industry produced a series of annual reports which presented data of all major CAC emissions emitted, including NOx, by each class of railway. In addition, the reports outlined activities the railways undertook to reduce emissions associated with their operations, including operational changes and investments in upgrading locomotives to the applicable U.S. Environmental Protection Agency (EPA) standard.

CN and CP committed to purchase any future new locomotives acquired to EPA standards when they became available. This commitment was made years before EPA actually issued their regulations. As additional information, following the RAC-CN-CP participation in the 1989-90 NOx/VOC initiative of Environment Canada with stakeholders from all industries, the Class 1 members of RAC informally adopted a voluntary NOx cap and undertook fuel conservation measures from 1990-95 in anticipation of the completion of the 1995-2005 MOU. RAC submits that serious commitment to emissions controls by the rail industry in Canada has been in place for 20 years, notwithstanding the absence of specific and detailed regulations. RAC is pleased that this cooperation will continue in the future using a regulatory framework that harmonizes North American requirements.

The subsequent MOU was for the period of 2006-2010. Under this agreement, the rail industry committed to greenhouse gas (GHG) reduction targets, on an intensity basis, for Class 1 freight railways, short line freight railways, intercity passenger rail, and commuter rail as well as efforts to reduce CAC emissions.[2] Specifically, under the MOU Class 1 freight and passenger railways committed to upgrading locomotives, upon remanufacture, to the applicable U.S. EPA standard and only purchasing U.S. EPA compliant locomotives. Further, the railways committed to retiring from service 130 medium horsepower locomotives built between 1973 and 1999. Further, the railways committed to retiring from service 130 medium horsepower locomotives built between 1973 and 1999. From 2005 to the end of 2009, the railways have added

[2] The intensity targets for each Class of railway are as follows: Class 1 freight-16.98 kg/1,000 revenue tonne-kilometer (RTK); Regional and Short Line Railway-15.38 kg/1,000 RTK; Intercity Passenger Railway-0.12 kg/passenger km; Commuter Rail-1.46 kg/passenger

(purchased) 317 new U.S. EPA compliant Tier 2 locomotives to the Canadian fleet[3]. Finally, since year 2000 the Class I freight railways have upgrade, to the applicable U.S. EPA standards, virtually all eligible locomotives. This clearly demonstrates that Canadian railways are committed to following the U.S. EPA locomotive emissions standards.

In addition, the rail industry has published an annual report, for each year under the MOUs, which outlines the emissions levels of each class of railway as compared to the emissions intensity targets outlined in the MOU, total CAC emission level by type of CAC emission, as well as other efforts undertaken by the rail industry to reduce GHG and CAC emissions levels. Going forward the rail industry wishes to be a constructive partner is assisting the federal government achieve their clean air and climate change objectives.

The RAC would like to take the opportunity to outline key questions, raise concerns, and put forth recommendations related to the development of federal locomotive emissions regulations. Of primary concern to the RAC and its member railways is the intention of the federal government to apply the same regulatory approach to Class I, Class II and Class III federally regulated railways. The ability and the benefits realized in complying with federal locomotives emissions regulations greatly differ among each class of railway.

3. Regulatory Approach for Class I Freight and Passenger Railways

As stated, the Class I freight and passenger railways (CN, CP and VIA Rail) agree with the approach Transport Canada is taking in developing federal locomotive emissions regulations. CN and CP, Class I freight railways, presently comply with U.S. EPA regulations when purchasing new locomotives and upgrading locomotives within their Canadian fleet. VIA Rail Canada, Canada's intercity passenger railway, is currently undertaking a rebuild program of 54 F-40 diesel electric locomotives. The rebuild program is expected to be completed by the end of 2012. The technologies applied to the rebuilt locomotives are expected to reduce VIA's locomotive fleet GHG emissions by 12 percent. However, the overhaul locomotives will not meet the 1033 EPA standards despite significant fuel efficiency improvements.

[3] Railway Association of Canada "2005 Locomotive Emissions Monitoring Program, Appendix B" and "draft 2009 Locomotive Emissions Monitoring Program", pg 1.

3.1 Canadian Locomotive Emissions Regulation versus the U.S. EPA Locomotive Emissions Regulation

As stated by Transport Canada, during the public consultation for the development of Canadian locomotive emissions regulations, it is the intention of the federal government to develop locomotive emissions regulations that are aligned with the existing U.S. EPA locomotive emissions regulations. The RAC and its member railways agree with this approach as it reduces the regulatory burden of complying with the Canadian federal regulation. Upon the publication of the proposed federal locomotive regulation, in *Canada Gazette Part I*, the RAC requests that Transport Canada develop and provide a detailed description including specific reference to sections of the regulatory differences between the proposed federal locomotive emissions regulation and the existing U.S. EPA regulation. Outlining the regulatory differences will provide transparency to the regulatory development process.

Certificate Holders

Transport Canada should ensure uniformity with EPA regulations concerning "Certificate Holders" for the locomotive and engine Tier level. Currently, the OEM's (GE and EMD) hold most of the certifications and make all required tests in conformity with EPA regulations. In some cases, engine rebuild kit suppliers also hold certificates. Railways do not chose to be the certificate holders -- they buy and use certified kits from certified suppliers. Given the regulatory regime difference in Canada with the Railway Safety Act, Transport Canada Emissions regulations should be framed to continue the responsibility of the OEMs and suppliers to test and certify their products. RAC members cannot assume this responsibility and do not possess the expertise nor the facilities to assume this role.

In this respect, Transport Canada must not hold the railways responsible for certifying every new and overhauled locomotive before entering service. The railways are responsible for seeing to it that they purchase and use certified locomotives and kits, but Transport Canada must enforce the verification that the locomotives and the kits conform to regulations with the certificate holders, the OEM's and vendors.

3.2 Locomotive Testing

As discussed during the public consultation, the locomotive emissions regulations will require the testing of locomotives to ensure the locomotive emissions comply with the applicable emissions standard by class of locomotive. The RAC is seeking clarity, from Transport Canada, on the following issues related to EPA Compliance testing.

As information, each year from 2005 to date, CN and CP have participated with the AAR and the other Class 1 rail road's (BNSF, CSXT, KCS, NS, and UP) to have in-service locomotives tested at specialized and approved testing facilities. In 2008, 2009 and 2010, AAR has tested 68 locomotives in compliance with EPA regulations and submitted detailed reports on the findings to the EPA. Each year, CN contributes 2 locomotives and CP 1 locomotive. These quantities are in general proportion to CN and CP ownership on a North American fleet basis. These tests are designed to ensure emissions compliance by testing at or near the end of the "useful" life of the diesel engine and encompass representative samples of all major models of locomotives and engine families. The locomotive builders (EMD and GE) do further tests of samples of their continuing new production, also in compliance with EPA requirements. This industry cooperative program, with complete results available to all the participants is an excellent way to assure EPA that the fleet meets EPA's expectations throughout the service life. CN, CP and Transport Canada will jointly benefit from this industry testing program that provides collective results well beyond the capability of any one party. In this respect, RAC recommends that TC issue regulations in complete harmony with the existing CN-CP-AAR-EPA program and become part of the existing process that already provides assurance that locomotives maintain their emissions settings over their service life.

Further, the RAC recommends that the number of CN and CP locomotives tested in the existing AAR-EPA program be maintained and that TC receive the industry results as substantiating information which meets TC's needs to ensure compliance.

Finally, the RAC recommends that the federal locomotive testing program not result in undue burden or inhibit railways operations while providing reasonable assurance that locomotives are meeting regulated emissions standards.

3.3 Locomotive Fleet Reporting

It is anticipated that the proposed locomotive emissions regulations will require reporting, on an annual or more frequent basis, of the Canadian locomotive fleet. For many federally regulated railways, in particular CN and CP, the locomotive fleet continually changes as new locomotives are brought into service, used locomotives are purchased, locomotives are retired, locomotives are taken into or out of storage, and locomotives are sold. In addition, for CN and CP, virtually all line-haul locomotives are used in both Canada and the U.S. and other types of locomotives (e.g. yard and road switcher locomotives) are also used within both jurisdictions. Simply put, the Canadian locomotive fleet is not static.

The process of how to report the Canadian locomotive has been extensively discussed and debated during the course of the current Locomotive Emissions Monitoring (LEM) MOU. For the purposes of the LEM MOU reporting, a decision was made to report the Canadian locomotive fleet as of December 31st of the calendar year. The RAC assembles, on an annual basis, the Canadian locomotive fleet as part of RAC *Rail Trends* data collection process. The RAC collects data on the locomotive fleet as of December 31st of each year.

For reporting purposes under the federal locomotive emissions regulations the following issues will need to be clarified and defined:

- Defining the "Canadian locomotive fleet"
    - RAC recommends the Canadian Locomotive Fleet be defined by RAC providing periodic "snapshots" (say quarterly) of the actual geographic location by Canada vs U.S. of each locomotive in the CN and CP fleets, and then averaging for the year and then adding the other Canadian Class 2/3 fleet as needed. The fleet will be segregated by locomotive HP and general Model type.

- The frequency of locomotive fleet reporting
    - RAC recommends the Fleet Reporting be on an annual basis using the above quarterly snapshots to create an average annual value.

- The definition of a “retired locomotive”
    - RAC recommends that the quarterly snapshots will show the fleet changes resulting from retirements and hence be reflected in an average annual value. Retirement will be defined as the removal from the capital “books” of the railway.

- The definition of a “locomotive in storage”
    - RAC recommends that the above quarterly snapshots include the operating status of all locomotives, such as In-Service, Stored Serviceable, Stored Awaiting Overhaul, Stored Awaiting Retirement, Leased to Third Parties, etc., be used to create an average annual inventory of actual working locomotives.

- The classification of locomotives used in both Canada and the U.S.
    - RAC recommends the above quarterly snapshots showing physical location in Canada or U.S. will properly account for the usage in each country

3.4 Federal Jurisdiction over Federally Regulated Railway Locomotive Emissions

The federal government has jurisdiction to apply regulation on federally regulated railways. Currently, federally regulated railways are obligated to comply with regulations that fall under federal statutes such as the *Railway Safety Act, Canadian Labour Code, Canada Environmental Protection Act*, etc. Provincial and/or municipal regulations, which pertain to railway operations, are not recognized by federally regulated railways. However, provincial and municipal governments have and are continuing to develop regulations that can potentially impact the operations of federally regulated railways, for example, the non-road diesel regulations in Metro Vancouver. Metro Vancouver claims that they have been delegated management of the Metro Vancouver air shed from the Province of British Columbia. The RAC is anticipating further regulatory initiatives by provincial and municipal governments.

The RAC recommends federal pre-emption over locomotive emissions regulations and related requirements for federally regulated railways. The U.S. EPA states federal pre-emption in their regulations. Without federal pre-emption over locomotive emissions regulations and related

requirements, federally regulated railways could be placed in regulatory conflict with the locomotive emissions regulations from multiple provincial and/or municipal jurisdictions.

3.5 Role of Transport Canada Enforcement Officers in Enforcing Locomotive Emissions Regulations under the Railway Safety Act

During public consultation on locomotive emissions regulations, hosted by Transport Canada on December 14, 2010, in Ottawa, Transport Canada gave a presentation entitled "Locomotive Emissions Regulations: Proposed Elements". The presentation gave a comprehensive overview of the proposed regulations, including the expected regulatory compliance and assessment provisions. Specifically, with regard to regulatory compliance, the presentation stated "Compliance would be assessed by program compliance officers and inspections will be undertaken by railway inspectors as appropriate".

RAC recommends that appropriate on-site inspections will include seeing that locomotives are properly marked as to their Emissions Tier level. Additional compliance inspections at the "Headquarters " level should include assuring that Emissions status level records are available, Overhaul dates available, and that purchase records of compliant engines and major emissions related component parts are available.

The process for on-site locomotive compliance inspection must be defined, in writing, and commonly understood by the inspector and the regulated railways. This will result in improved assurance that each party is aware on the regulations and how they are applied. It is essential that everyone understands and follows the same set of regulations.

During on-site compliance inspections, isolated incidents of suspected non-compliance should not result in a locomotive being taken out of service for testing and/or service. For example if a specific locomotive is clearly visually in distress with improper combustion, the compliance inspector should inform railway senior management of this occurrence. If repeated observations of visual problems should occur, this issue should be addressed by Transport Canada and the railway on a senior management level.

3.6 Locomotive Emissions Modeling and Related Assumptions

Annex C, "Locomotive Emissions Modeling and Related Assumptions", contained in Transport Canada's *Issue Brief*, states that Transport Canada will forecast locomotive emissions for the period lasting 2011-2020. This exercise will be done to determine the benefits of the proposed regulations.

If it is the intention of Transport Canada to develop projections of the Canadian locomotive fleet composition and freight and passenger volumes for federally regulated railways, the RAC recommends that the rail industry, through the RAC, provide the projections directly to Transport Canada. The RAC has the ability to gather the required confidential data, which are absolutely vital to making an accurate assessment. These include:

- Projected annual locomotive purchases by RAC member railways
- Projected annual locomotive retirements by RAC member railways
- Changes in annual fleet usage by locomotive HP and Model, vis-à-vis, type of service (i.e. mainline (Bulk, Intermodal, Manifest, etc), branchline, local, road-switching, yard, etc)
- Estimates of future traffic growth by type of service and geographic area.
- Projection of annual fleet productivity improvements (i.e. more GTM's per unit)
- Projected annual mileage and fuel consumption by model of locomotive
- Changes in Emissions Tier level as overhauls are made and emissions kits are added
- Projection of overall annual improvement in fuel productivity (GTM's per Gallon)
- Projections of new locomotive technologies and operating practices that change the operation with improved productivity.

The above complex matrix of internal and confidential locomotive fleet planning, traffic, and operating data is not readily available to parties outside the RAC Class 1 railways. RAC development of the Transport Canada requested fleet projections allows the aggregated data to be validated by the industry. The benefit of this approach is that the Canadian rail industry will be confident with the locomotive fleet data and freight and passenger volume projections that Transport Canada uses for its projections of locomotive emissions.

With respect to the Transport Canada request for two sets of emissions scenario calculations: "Business-as-usual" and "harmonized regulations". The two major Class 1 freight railways

account for over 90 per cent of locomotives and annual locomotive fuel consumption in Canada. The locomotive fleets are increasingly mobile throughout our international networks in order to promote productivity and high utilization. As currently planned, many older low horse power (HP) locomotives, not subject to EPA or proposed Transport Canada emissions regulations, will disappear over the next planning period. The remaining fleets will primarily be locomotives already subject to EPA requirements and needed for operation anywhere. RAC sees that the "business-as-usual" scenario will in fact be the continuation of already existing programs to adopt applicable EPA tier levels as locomotives reach their overhaul point. Much of the high HP mainline fleet is already done and the remaining mid-horsepower fleets will be done as overhauls come due. RAC believe that there will not be any substantial difference between the "business-as-usual scenario" and the "regulated scenario". RAC can undertake to make the calculations as indicated above.

3.7 Interpretation of Locomotive Emissions Monitoring MOU in the Consultation Document entitled "Rolling Towards a Cleaner Future: The Development of Canadian Locomotive Emissions Regulations-Issues Brief"

In support of the consultation process for the development of locomotive emissions regulations, Transport Canada developed an Issues Brief entitled "Rolling Towards a Cleaner Future: The Development of Canadian Locomotive Emissions Regulations". The document provides a useful overview of the Canadian railway industry, a profile of locomotive emissions, past and current initiatives to manage locomotive emissions, and the regulatory approach for developing locomotive emissions regulations in Canada.

The RAC is concerned with Transport Canada's interpretation of the commitments, as stated in the Issue Brief, by the railways under the 2006-2010 MOU. The MOU commitment states the railways will "Acquire only new and freshly manufactured locomotives that meet all applicable U.S. Environmental Protection Agency emissions standards, during the life of the Memorandum of Understanding".[4] However, Transport Canada's Issue Brief states "This means that any addition to their locomotive fleets will at least meet the U.S. Environmental Protection Agency Tier 2 emissions standards".[5] The RAC does not agree with Transport Canada's interpretation. The intent of the MOU, according to the RAC and its member railways, is railways will purchase

[4] Transport Canada, "Rolling Towards a Cleaner Future: The Development of Canadian Locomotive Emissions Regulations", December 2010, pg 13.

U.S. EPA compliant locomotives when they are purchasing new locomotives. The MOU does not preclude the railways from purchasing used locomotives, if they choose to do so.

4. Regulatory Approach for Class II and Class III Freight and Passenger Railways

As stated, the RAC and its member railways agree with the proposed regulatory approach for the development of federal locomotive emissions regulations. We believe aligning the federal locomotive emissions regulation with the U.S. EPA regulation is appropriate given the integrated nature of the North American railway industry. However, the RAC is concerned with the applicability of the federal locomotive emissions regulation to Class II and Class III freight and passenger railways.

It is the understanding of the RAC that Transport Canada intends to apply the same regulatory approach to Class I, Class II and Class III freight and passenger railways in Canada[6]. The Canadian federally regulated Class II and Class III railways, listed in Appendix B of Transport Canada's Issue Brief, represent a very small portion of the Canadian locomotive fleet, annual fuel consumption and locomotive emissions. Specifically, with in the overall rail sector, federally regulated Class II and Class III railways transport 3.30 percent of freight traffic, on a tonne-km, basis, consume 2.70 percent of the diesel fuel and emit 2.70 percent of GHGs, and emit 3.66 percent of the principal criteria air contaminant NOx.[7] In 2009, total criteria air contaminants (CAC) emitted from the Canadian railway industry was (in kilotonnes): 83.70 NOx; 8.42 CO; 3.08 HC; 2.58 PM; and 0.33 SOx[8]. In comparison, the total CACs emitted in 2009 by federally regulated Class II and Class III railways was(in kilotonnes): 3.059 NOx; 0.319 CO; 0.124 HC;

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[5] Ibid.

[6] Class I rail carrier - a railway company that realized gross revenues of at least $250 million annually (in 1991 dollars) for the provision of Canadian railway services.
Class II rail carrier - a railway company that realized gross revenues of less than $250 million annually (in 1991 dollars) for the provision of Canadian railway services. Class II railways include regional and shortline carriers.
Class III rail carrier - a railway company, other than a Class I rail carrier or a Class II rail carrier, which is engaged in the operation of bridges, tunnels and stations. (Source: Department of Justice, Department of Justice, http://laws.justice.gc.ca/eng/SOR-96-334/page-2.html)

[7] Dunn, Robert and Eggleton, Peter, "Emissions Generated by Federally-regulated Regional and Short Line Railways in Canada-Database prepared for the Railway Association of Canada", January 12, 2011, pg i. Data for the report is from the Railway Association of Canada, Rail Trends Statistics.

[8] Dunn, Robert and Eggleton, Peter, "Emissions Generated by Federally-regulated Regional and Short Line Railways in Canada-Database prepared for the Railway Association of Canada", January 12, 2011, pg ii. Data for the report is from the Railway Association of Canada, Rail Trends Statistics.

0.089 PM; and 0.009 SOx[9]. The percentage of CACs emitted from federally regulated Class II and Class III railways of the total CACs emitted by all railways in Canada is as follows (in percent): 3.66 NOx; 3.78 CO; 4.35 HC; 3.36 PM; 2.70 SOx[10]. *(See Appendix A for further details)* As such, the criteria air contaminant profile of federally regulated railways is minimal.

Further, an analysis of the 2009 locomotive fleet of Class II and Class III railways indicates that these railways had a total of 185 locomotives in service, of which 110 were manufactured after 1972 and thus are candidates for being upgraded upon remanufacture to the U.S. EPA Tier 0+ emissions limits.[11] If the 110 locomotives, that are candidates to be upgraded upon remanufacture to U.S. EPA Tier 0+ standards, were upgraded the calculated CAC emissions profile[12] for federally regulated Class II and Class III railways would be as follows (kilo-tonnes): 1.880 NOx; 0.322 CO; 0.120 HC; 0.061 PM; and 0.009 SOx.[13] The resulting percentage of criteria air contaminant emitted from federally regulated Class II and Class III railways of the total criteria air contaminants emitted by all railways in Canada is as follows (percent): 2.24 NOx; 3.83 CO; 3.91 HC; 2.35 PM; and 2.70 SOx. From an emissions standpoint, the benefit of requiring Class II and Class III railways to comply with regulatory requirements to remanufacture to U.S. EPA Tier 0+ is negligible.

The cost to put in place the required technology which would allow for the 110 locomotives to meet the applicable U.S. EPA emissions standard, and without incurring a fuel penalty, is $5M CDN. The benefit of criteria air contaminant emissions reduction does not outweigh the costs for federally regulated Class II and Class III railways. Further, a majority of the Class II and Class III carriers operate on extremely thin margins, as compared to Class I railways and lack access to the lower cost public financial markets. As a result they purchase older, second hand equipment to meet their operational obligations. Requiring costly retrofitting of locomotives that small railways operate will negatively impact the financial viability of certain short line and regional railways as well as tourist operations. Freight and passenger rail service will disappear, just as it

[9] Ibid.
[10] Dunn, Robert and Eggleton, Peter, "Emissions Generated by Federally-regulated Regional and Short Line Railways in Canada-Database prepared for the Railway Association of Canada", January 12, 2011, pg iii. Data for the report is from the Railway Association of Canada, Rail Trends Statistics.
[11] Ibid.
[12] Note: The calculations are based on 2009 fuel consumption data and using U.S. EPA Tier 0+ emissions factors for locomotives manufactured after 1972 and Canadian duty cycle.
[13] Dunn, Robert and Eggleton, Peter, "Emissions Generated by Federally-regulated Regional and Short Line Railways in Canada-Database prepared for the Railway Association of Canada", January 12, 2011, pg iii. Data for the report is from the Railway Association of Canada, Rail Trends Statistics.

has in the past, when market conditions could not sustain it. In addition, the cost implications of Class II and Class III railways of meeting U.S. EPA emissions standards may act as a disincentive for these railways to remanufacture locomotives.

The RAC recommends that federal government exclude federally regulated Class II and Class III railways from regulatory requirements to upgrade upon remanufacture to Tier 0, Tier 1 or Tier 2 the locomotives in their existing fleets; and participation in the locomotive in-use emissions compliance testing programs. The RAC understands the concerns raised by Transport Canada in developing locomotive emissions regulations that are only fully applicable to Class I railways as theClass I railwaysrepresent such a small proportion of the total federally regulated railways in Canada. However, from an emissions stand point, the Class I federally regulated railways (CN, CP and VIA) account for over 94 percent of the fuel consumed and related GHG and CAC. As such, it is the opinion of the RAC that Transport Canada should be focused on developing regulations that are applicable to federally regulated Class I railways as they account for almost all of the emissions from railway operations in Canada and not be concerned with the number of railways that locomotive emissions regulations will be fully applicable to.

5. Concluding Remarks

The RAC wishes to thank Transport Canada for the opportunity to provide input on public consultation for the development of federal locomotive emissions regulations. The comments provided by the RAC, on behalf our members, are intended to be constructive as it is the goal of the industry to assist in efforts to improve the environmental performance of Canadian rail industry.

Appendix A

Emissions Generated by Federally-regulated Regional and Short Line Railways in Canada

Database Prepared for the

Railway Association of Canada

by

Peter Eggleton and Robert Dunn

Consultants on Railway Locomotive Emissions

12 January 2011

Executive Summary

The portion of the railway-generated emissions attributable to federally-regulated Regional and Short Lines in Canada has been calculated. The results provide a database for cost-benefit analyses and policy considerations pertaining to the imposition of regulations on emissions from Regional and Short Lines.

The motivation for the study stems from the Government of Canada publishing a Notice of Intent to develop emissions regulations under the Railway Safety Act applicable to federally-regulated railways, i.e., those that traverse provincial borders or cross into the U.S.A. Within the category of federally-regulated railways, there are three Canadian Class 1 railways (CN, CP and VIA Rail Canada), four U.S. Class 1s (Amtrak, BNSF, CSX and UP), one urban light rail (Capital Railway), one Regional (QNS&L) and twenty freight and three passenger Short Lines. The intent of the proposed regulations is to harmonize the Canadian standards for locomotive emissions with those of the U.S. Environmental Protection Agency (EPA) – one requirement of which is that locomotives manufactured after 1972 be, upon remanufacture, brought up to the EPA Tier 0+ or Tier 1+ emission standards. The 2009 locomotive fleet of federally-regulated Regional and Short Lines totalled 185, of which 110 were manufactured after 1972 and, hence, candidates for being upgraded upon remanufacture to the EPA Tier 0+ emissions limits.

The calculations delineated the emissions profile of twenty freight and three passenger federally-regulated (FR) Regional and Short Lines for the status quo and the case if, upon remanufacture, those locomotives originally manufactured after 1972 were to be to be upgraded to U.S. EPA Tier 0+ emissions standards. As displayed below, the impact of the latter on the CAC portions of the emissions profile is to reduce overall Canadian railway fleet NOx by 1.179 kilotonnes (kt), or 1.41 percent of the total emitted, while increasing CO by 0.05 percent. HC is reduced by 0.45 percent and PM by 1.01 percent.

	NOx	**CO**	**HC**	**PM**	**SOx**
Total Canadian Railway CAC Emissions (kilotonnes)	83.70	8.42	3.08	2.58	0.33
Impact of FR Locomotives Upgrading to EPA Tier 0+ Emissions Limits					
Freight – Line-haul and Yard (kt)	- 1.100	+0.004	- 0.014	- 0.026	0.000
Passenger - Tourist / Excursion (kt)	- 0.079	0.000	0.000	0.000	0.000
Totals: FR Regional / Short Lines (kt)	**- 1.179**	**+0.004**	**- 0.014**	**- 0.026**	**0.000**
Percent Change in Canadian Railway CAC Emissions due to Upgrading FR Regional and Short Line Locomotives to EPA Tier 0+ Limits	**- 1.41**	**+0.05**	**- 0.44**	**- 1.01**	**0.00**

Within the overall Canadian railway sector, the FR Regional and Short Lines transport 3.3 percent of the freight, consume 2.70 percent of the diesel fuel and emit 2.70 percent of the Greenhouse Gases and 3.66 percent of the principal criteria air contaminant, NOx. If the locomotives applicable were upgraded to U.S. EPA Tier 0+ standards, the NOx level attributable to them would drop from 3.66 percent to 2.24 percent of total NOx emitted.

The following data displays exhibit the portion that federally-regulated Regional and Short Lines contribute to the total Canadian railway activity.

Portion of Total Railway Freight Traffic Transported in 2009	**Gross Tonne-kilometres** (billion)	**Revenue Tonne-kilometres** (billion)	**Portion of Total RTK Traffic** (percent)
Total Canadian Railway Freight Traffic	579.99	307.88	100
Freight – FR Regional and Short Lines	**15.82**	**10.19**	**3.3**

Portion of Total Railway Sector Diesel Fuel Consumed in 2009	**Litres** (million)	**Percent**
Total Canadian Railway Fuel Consumption	1,871.394	100
Freight – FR Regional and Short Lines	47.887	2.56
Passenger – FR Tourist and Excursion Lines	2.726	0.14
Portion	**50.613**	**2.70**

Portion of Total Rail Sector GHG Emitted in 2009	**Kilotonnes**	**Percent**
Total Canadian Railway GHG Emissions	5,647.00	100
Freight – FR Regional and Short Lines	144.00	2.56
Passenger – FR Tourist and Excursion Lines	8.20	0.14
Portion	**152.20**	**2.70**

Mass of Criteria Air Contaminants Emitted from FR Regional and Short Lines
(using Emissions Factors based on Test Data and Canadian Duty Cycles)

Mass Emitted in 2009 (kilotonnes)	**NOx**	**CO**	**HC**	**PM**	**SOx**
Total Canadian Railway CAC Emissions	83.70	8.42	3.08	2.58	0.33
Freight – FR Regional and Short Lines	2.910	0.311	0.131	0.085	0.009
Passenger – FR Tourist and Excursion Lines	0.149	0.008	0.003	0.002	0.000
FR CAC Total (kilotonnes)	**3.059**	**0.319**	**0.134**	**0.089**	**0.009**

Portion of Criteria Air Contaminant Emitted from FR Regional and Short Lines
(using Emissions Factors based on Test Data and Canadian Duty Cycles)
(Percent)

Portion of Total Rail Sector CACs Emitted in 2009 (Percent)	**NOx**	**CO**	**HC**	**PM**	**SOx**
Freight – FR Regional and Short Lines	3.48	3.69	4.26	3.27	2.68
Passenger – FR Tourist and Excursion Lines	0.18	0.09	0.09	0.09	0.02
Portion (Percent)	**3.66**	**3.78**	**4.35**	**3.36**	**2.70**

Mass of Criteria Air Contaminants Emitted from FR Regional and Short Lines
(using U.S. EPA Tier 0+ Emissions Factors for Locomotives Manufactured after 1972 and Canadian Duty Cycles)
(kilotonnes)

Mass Emitted in 2009 using EPA Tier 0+ Limit (kilotonnes)	**NOx**	**CO**	**HC**	**PM**	**SOx**
Total Canadian Railway CAC Emissions	83.70	8.42	3.08	2.58	0.33
Freight – FR Regional and Short Lines	1.810	0.315	0.118	0.059	0.009
Passenger – FR Tourist and Excursion Lines	0.070	0.008	0.003	0.002	0.000
FR CAC Total (kilotonnes)	**1.880**	**0.322**	**0.120**	**0.061**	**0.009**

Portion of Criteria Air Contaminant Emitted from FR Regional and Short Lines
(using U.S. EPA Tier 0+ Emissions Factors for Locomotives Manufactured after 1972 and Canadian Duty Cycles)
(percent)

	NOx	**CO**	**HC**	**PM**	**SOx**
Freight – FR Regional and Short Lines	2.16	3.74	3.82	2.28	2.68
Passenger – FR Tourist and Excursion Lines	0.08	0.09	0.09	0.07	0.02
Portion (Percent)	**2.24**	**3.83**	**3.91**	**2.35**	**2.70**

Table of Contents

1 Introduction

This report contains databases to support the Railway Association of Canada's intervention regarding the proposed regulation of emissions from diesel locomotives operating on federally-regulated (FR) railways in Canada. The databases include:

1. the fuel consumed by federally-regulated Short Line railways (including Regional railways) using data from the 2009 Locomotive Emissions Monitoring report;
2. the CAC and GHG emissions profile of federally-regulated Short Line railways;
3. the projected CAC and GHG emissions profile if all Short Lines used Tier 0+ locomotives, and
4. the number of anti-idling equipped locomotives on Short Lines during 2009.

2 List of Federally-regulated Short Lines in Canada

The federally-regulated Regional and Short Line railways providing, respectively, freight and passenger (including tourist and excursion) services are listed below. Railways denoted by * were not members of the RAC in 2009 – hence no data were available for them, but as their operations are small or limited to terminal activity their emissions were considered minimal. Railways denoted by ** operated on a portion of another railway's line, hence, pro-rated fuel data were used to do the emissions calculations.

Federally-regulated Regional and Short Line Freight Railways
** 6970184 Canada Ltd
Arnaud Railway Company
* Eastern Maine Railway Company
Essex Terminal Railway Company
Goderich-Exeter Railway Company Ltd.
Hudson Bay Railway
* International Bridge and Terminal Company, The
Kelowna Pacific Railway Ltd.
Kettle Falls International Railway, LLC
* Maine Central Railroad Company and Springfield Terminal Railway Company
* Minnesota, Dakota and Western Railway Company
Montréal, Maine & Atlantic Railway, Ltd.
** Nipissing Central Railway Company
Okanagan Valley Railway Company
Québec North Shore and Labrador Railway Company Inc.
** RaiLink Canada Ltd. (operates on a portion of the Ottawa Valley Railway)
St. Lawrence & Atlantic Railroad (Quebec) Inc.
Sydney Coal Railway
Toronto Terminals Railway Company Limited, The
Wabush Lake Railway Company, Limited

Federally-regulated Tourist and Excursion Railways
Great Canadian Railtour Company Ltd.
Tshiuetin Rail Transportation Inc. (Also transports freight)
White Pass & Yukon Route

3 Emissions Calculations Methodology and Assumptions

The methodology followed in this study to calculate CAC, SOx and GHG emissions from locomotive operations on federally-regulated Regional and Short Lines in Canada used as its base the data contained in the *2009 Locomotive Emissions Monitoring* report of the Railway Association of Canada. The principal input data are the volume of diesel fuel consumed, the annual freight tonnage or passengers transported and locomotive fleet profile. Thus, knowing the annual fuel consumption, the locomotive fleet make-up and the respective utilization rates plus the duty cycle and emissions factors for each locomotive type in the fleet, the mass of a specific CAC emitted can be calculated. As SOx and GHG emissions are a direct function of the volume of fuel consumed, the mass of SOx or of a specific GHG emitted is calculated by multiplying the volume of diesel fuel by the respective emission factor.

Certain assumptions and judgments were required in order to quantify variables used in the calculations. They included:

i. **Selection of railways examined:** Of the 32 federally-regulated railways in Canada, the emissions calculated were restricted to the Regional and Short Line railways having significant trackage and operational activity. These were twenty freight and three passenger railways. Those railways excluded were the Canadian Class 1s (CN, CP, VIA Rail Canada), the U.S. Class 1s having spur services into Canada (Amtrak, BNSF, CSX and UP), an urban light rail (Capital Railway) and the terminal railways.

ii. **Handling 'track only' railways:** Some railways are track-only subsidiaries of provincially-regulated railways covering operations in an adjoining province (e.g., Nipissing Railway and 6970184 Canada Ltd.) or into the U.S.A. As emissions are generated by trains traversing these railways, the emissions apportioned to them were calculated in proportion of their track length versus that of the provincially-regulated owning railway – plus allocating the locomotive types of the owning railway. Also, data for RailLink Canada's operations over the Ottawa Valley Railway were proportioned similarly.

iii. **Application of U.S. EPA limit values:** Applicability particulars selected reflected those in the U.S. EPA regulations to which the Canadian standards will be harmonized. For example, for calculations pertaining to upgrading locomotives to Tier-level emissions standards, only locomotives manufactured after 1972 were selected with Tier 0+ applied for those manufactured between 1973 – 1992 and Tier 1+ for those 1993-2004. The EPA Tier-level limits were applied accordingly to the respective number of line-haul and switching locomotives in each Regional and Short Line railway fleet.

iv. **Fuel consumption implications of Tier-level upgrading kits:** It was assumed that the type of kits installed, upon remanufacture, to upgrade power assemblies to Tier-level standards would be those having zero fuel penalty.

v. **Reference case emission factors and duty cycles:** The reference case for the calculated emissions generated from the federally-regulated Regional and Short Lines utilized the emissions factors developed by applying the least square curve-drawing technique to measured test data points. The Canadian duty cycle was used for both the least-square derived and the U.S. EPA Tier 0+ factors.

4 Locomotive Inventory including Units having Anti-Idling Devices

The federally-regulated Regional and Short Line fleet locomotive inventory as of 2009 totalled 185, which is 6.8 percent of the 2,727 diesel powered locomotives and DMUs in service. Of the 185, those in freight service totalled 155, of which 24 are equipped with anti-idling devices. The passenger railway fleet totalled 30 locomotives, of which 9 are equipped with anti-idling devices. The number of locomotives originally manufactured in 1973 and afterwards and, hence, candidate to be upgraded upon remanufacture to U.S. EPA Tier-level emissions standards totals 110.

5 Fuel Consumption in 2009

Portion of Total Railway Sector Diesel Fuel Consumed in 2009	**Litres** (x 1,000)	**Percent**
Total Canadian Railway Fuel Consumption	1,871,394	100.00
Freight – FR Regional and Short Lines	47,888	2.56
Passenger – FR Tourist and Excursion Lines	2,726	0.14
Portion	**50,613**	**2.70**

6 Emissions Factors and Duty Cycles Applied

6.1 Greenhouse Gases (GHG) Factor

The emission factor to calculate, as $CO_{2\ equivalent}$, the mass of GHG emitted was 3.00715 kilograms per litre of diesel fuel consumed. This is the value used by Environment Canada in its annual reporting to the United Nations Framework Convention on Climate Change. The expressions, $CO_{2\ equivalent}$, encompasses the three GHG emitted from diesel engines, which are CO_2, CH_4 and N_2O.

6.2 Criteria Air Contaminants (CAC) Factors based on Test Measurements

The emissions factors for the CAC gases, that is, NOx, CO, HC, PM and SOx, are established, except for SOx which is a function of the fuel sulphur content, based on test measurements of emissions from different diesel engines across the throttle notch power settings. The results are applied to the duty cycles of locomotive types operating in the different Regional and Short Line services.

6.3 Criteria Air Contaminants (CAC) Factors based on U.S. EPA Standards

The CAC emissions standards set by the U.S. EPA (with which the proposed Canadian locomotive emissions regulations will be harmonized) have Tier-level limits that must not be exceeded. For those locomotives originally manufactured between 1973 and 1992 (which is the case for almost all Canadian Short Line locomotives), the EPA requires on or after 2010 that these locomotives upon remanufacture meet the upgraded Tier 0+ standards. Similarly, locomotives

originally manufactured from 1993 to 2004 must be upgraded to Tier 1+ standards, as displayed below:

EPA Line-Haul Locomotive Emission Standards
(g/bhp·hr)

Tier Level	Year of Original Manufacture	Date Effective	NOx	CO	HC	PM
Tier 0+	1973-1992	2010	8.0	5.0	1.0	0.22
Tier 1+	1993-2004	2010	7.4	2.2	0.55	0.22

6.4 Duty Cycles

Duty cycles are determined by evaluating the time spent at each power notch level for a statistically significant sample of locomotives in a particular type of service. The duty cycles for Regional and Short Line locomotives used in the calculations are those used in the *2009 Locomotive Emissions Monitoring* report. The values (in percentages) were extracted for each notch from the list below.

	Idle	N1	N2	N3	N4	N5	N6	N7	N8	DB
2007 - 2008 Updates										
2007 Class 1 Mainline Freight	51.3	4.7	5.7	4.7	3.8	3.2	3.0	1.6	14.0	8.0
2007 Class 1 Road Switch	77.6	4.3	4.4	2.8	2.2	1.4	1.1	0.6	3.2	2.4
2008 Regional Mainline Freight	67.4	8.3	4.9	4.1	3.5	2.0	2.0	1.6	6.2	0.0
2007 Short Line (Assumed equivalent to Road Switch)	77.6	4.3	4.4	2.8	2.2	1.4	1.1	0.6	3.2	2.4
2007 Yard Switching	84.9	5.4	4.2	2.2	1.4	0.6	0.3	0.2	0.6	0.2

7 Emissions Profiles Calculated

Displayed in this section are the calculated emissions profiles using, firstly, emissions factors based on the least-square curve drawing through measured test data points (as used for the status quo case in the 2009 LEM report) and then, secondly, emissions profiles calculated assuming that all locomotives originally manufactured after 1972 be upgraded to the equivalent of the U.S. EPA Tier 0+ emissions standards

7.1 Using Emissions Factors from 2009 LEM Report for Status Quo Case

7.1.1 GHG Emissions Values

Portion of Total Rail Sector GHG Emitted by Short Lines in 2009	Kilotonnes (kt)	Percent
Total Canadian Railway GHG Emissions	5,647.00	100
Freight – FR Regional and Short Lines	144.01	2.56
Passenger – FR Tourist and Excursion Lines	8.20	0.14
Totals	**152.21**	**2.70**

7.1.2 CAC Emissions Values

	NOx	CO	HC	PM	SOx
Total Canadian Railway CAC Emissions (kilotonnes)	**83.70**	**8.42**	**3.08**	**2.58**	**0.33**
Freight – FR Regional and Short Lines	2.910	0.311	0.131	0.085	0.009
Passenger – FR Tourist and Excursion Lines	0.149	0.008	0.003	0.002	0.000
FR CAC Mass (kilotonnes)	**3.059**	**0.319**	**0.134**	**0.089**	**0.009**
FR Regional and Short Line Portions of Total Canadian Railway CAC Emissions (Percent)					
Freight – FR Regional and Short Lines	3.48	3.69	4.26	3.27	2.68
Passenger – FR Tourist and Excursion Lines	0.18	0.09	0.09	0.09	0.02
Portions (Percent)	**3.66**	**3.78**	**4.35**	**3.36**	**2.70**

7.2 Using U.S. EPA Tier 0+ Emissions Factors

7.2.1 GHG Emissions Values

As it was assumed that the Tier-level upgrade kits installed would have zero fuel penalty, the fuel consumption and, hence, GHG emissions for both cases are the same.

7.2.2 CAC Emissions Values

	NOx	CO	HC	PM	SOx
Total Canadian Railway CAC Emissions Mass (kt)	**83.70**	**8.42**	**3.08**	**2.58**	**0.33**
Freight – FR Regional and Short Lines	1.810	0.315	0.118	0.059	0.009
Passenger – FR Tourist and Excursion Lines	0.070	0.008	0.003	0.002	0.000
FR CAC Mass (kilotonnes)	**1.880**	**0.322**	**0.120**	**0.061**	**0.009**
FR Regional and Short Line Portions of Total Canadian Railway CAC Emissions (Percent					
Freight – FR Regional and Short Lines	2.16	3.74	3.82	2.28	2.68
Passenger – FR Tourist and Excursion Lines	0.08	0.09	0.09	0.07	0.02

Portions (Percent)	**2.24**	**3.83**	**3.91**	**2.35**	**2.70**

8 Conclusions

The calculations delineated the emissions profile of the federally-regulated Regional and Short Lines for both the status quo and the case if, upon remanufacture, those locomotives originally manufactured after 1972 were to be to be upgraded to U.S. EPA Tier 0+ emissions standards. As displayed below, the impact of the latter on the CAC portions of the emissions profile is to reduce overall Canadian railway fleet NOx by 1.179 kilotonnes (kt), or 1.41 percent, while increasing CO by 0.05 percent. HC is reduced by 0.45 percent and PM by 1.01 percent.

	NOx	**CO**	**HC**	**PM**	**SOx**
Total Canadian Railway CAC Emissions (kilotonnes)	83.70	8.42	3.08	2.58	0.33
Impact of FR Locomotives Upgrading to EPA Tier 0+ Emissions Limits					
Freight – FR Line-haul and Yard (kt)	- 1.100	+0.004	- 0.014	- 0.026	0.000
Passenger – FR Tourist / Excursion (kt)	- 0.079	0.000	0.000	0.000	0.000
Totals: FR Regional / Short Lines (kt)	**- 1.179**	**+0.004**	**- 0.014**	**- 0.026**	**0.000**
Percent Change in Canadian Railway CAC Emissions due to EPA Tier 0+	**- 1.41**	**+0.05**	**- 0.45**	**- 1.01**	**0.00**