University Transportation Research Center - Region 2

Final Report

Mobile Source Air Toxics Mitigation Measures

Performing Organization: New York University

October 2013

Sponsors:
New York State Department of Transportation (NYSDOT)
Research and Innovative Technology Administration (USDOT/RITA)

University Transportation Research Center - Region 2

The Region 2 University Transportation Research Center (UTRC) is one of ten original University Transportation Centers established in 1987 by the U.S. Congress. These Centers were established with the recognition that transportation plays a key role in the nation's economy and the quality of life of its citizens. University faculty members provide a critical link in resolving our national and regional transportation problems while training the professionals who address our transportation systems and their customers on a daily basis.

The UTRC was established in order to support research, education and the transfer of technology in the field of transportation. The theme of the Center is "Planning and Managing Regional Transportation Systems in a Changing World." Presently, under the direction of Dr. Camille Kamga, the UTRC represents USDOT Region II, including New York, New Jersey, Puerto Rico and the U.S. Virgin Islands. Functioning as a consortium of twelve major Universities throughout the region, UTRC is located at the CUNY Institute for Transportation Systems at The City College of New York, the lead institution of the consortium. The Center, through its consortium, an Agency-Industry Council and its Director and Staff, supports research, education, and technology transfer under its theme. UTRC's three main goals are:

Research

The research program objectives are (1) to develop a theme based transportation research program that is responsive to the needs of regional transportation organizations and stakeholders, and (2) to conduct that program in cooperation with the partners. The program includes both studies that are identified with research partners of projects targeted to the theme, and targeted, short-term projects. The program develops competitive proposals, which are evaluated to insure the mostresponsive UTRC team conducts the work. The research program is responsive to the UTRC theme: "Planning and Managing Regional Transportation Systems in a Changing World." The complex transportation system of transit and infrastructure, and the rapidly changing environment impacts the nation's largest city and metropolitan area. The New York/New Jersey Metropolitan has over 19 million people, 600,000 businesses and 9 million workers. The Region's intermodal and multimodal systems must serve all customers and stakeholders within the region and globally.Under the current grant, the new research projects and the ongoing research projects concentrate the program efforts on the categories of Transportation Systems Performance and Information Infrastructure to provide needed services to the New Jersey Department of Transportation, New York City Department of Transportation, New York Metropolitan Transportation Council , New York State Department of Transportation, and the New York State Energy and Research Development Authorityand others, all while enhancing the center's theme.

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The modern professional must combine the technical skills of engineering and planning with knowledge of economics, environmental science, management, finance, and law as well as negotiation skills, psychology and sociology. And, she/he must be computer literate, wired to the web, and knowledgeable about advances in information technology. UTRC's education and training efforts provide a multidisciplinary program of course work and experiential learning to train students and provide advanced training or retraining of practitioners to plan and manage regional transportation systems. UTRC must meet the need to educate the undergraduate and graduate student with a foundation of transportation fundamentals that allows for solving complex problems in a world much more dynamic than even a decade ago. Simultaneously, the demand for continuing education is growing – either because of professional license requirements or because the workplace demands it – and provides the opportunity to combine State of Practice education with tailored ways of delivering content.

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UTRC's Technology Transfer Program goes beyond what might be considered "traditional" technology transfer activities. Its main objectives are (1) to increase the awareness and level of information concerning transportation issues facing Region 2; (2) to improve the knowledge base and approach to problem solving of the region's transportation workforce, from those operating the systems to those at the most senior level of managing the system; and by doing so, to improve the overall professional capability of the transportation workforce; (3) to stimulate discussion and debate concerning the integration of new technologies into our culture, our work and our transportation systems; (4) to provide the more traditional but extremely important job of disseminating research and project reports, studies, analysis and use of tools to the education, research and practicing community both nationally and internationally; and (5) to provide unbiased information and testimony to decision-makers concerning regional transportation issues consistent with the UTRC theme.

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Project Date: October 2013

Project Title: Mobile Source Air Toxics Mitigation Measures

Principal Investigator(s):

Dr. Rae Zimmerman
Professor of Planning and Public Administration
New York University
Email: rae.zimmerman@nyu.edu

Dr. Marta Panero
Adjunct Professor and Director for Strategic Partnerships at NYIT
Email: mpanero@nyit.edu

Co-author(s):
- Carlos E. Restrepo, Research Scientist
- Andrew Mondschein, Research Scientist
Robert F. Wagner Graduate School of Public Service

Performing Organization(s): New York University

Sponsor(s):

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Research and Innovative Technology Administration / USDOT (RITA)

To request a hard copy of our final reports, please send us an email at utrc@utrc2.org

Mailing Address:

University Transportation Reserch Center
The City College of New York
Marshak Hall, Suite 910
160 Convent Avenue
New York, NY 10031
Tel: 212-650-8051
Fax: 212-650-8374
Web: www.utrc2.org

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Assistant Professor of Civil Engineering, CCNY

Dr. Robert E. Paaswell: *Director Emeritus of UTRC and Distin*guished Professor of Civil Engineering, The City College of New York

Herbert Levinson: *UTRC Icon Mentor, Transportation Consultant and Professor Emeritus of Transportation*

Dr. Ellen Thorson: *Senior Research Fellow, University Transportation Research Center*

Penny Eickemeyer: *Associate Director for Research, UTRC*

Dr. Alison Conway: *Associate Director for New Initiatives and Assistant Professor of Civil Engineerin*g

Nadia Aslam: *Assistant Director for Technology Transfer*

Dr. Anil Yazici: *Post-doc/ Senior Researcher*

Nathalie Martinez: *Research Associate/Budget Analyst*

NYUWagner rudin center for transportation policy & management

NYU • Robert F. Wagner Graduate School of Public Service
295 Lafayette Street, 2nd Floor • New York, NY 10012
phone: (212) 992-9865 • fax: (212) 995-4166
www.wagner.nyu.edu/rudincenter

Mitchell Moss, Ph.D, *Director*

New York State Department of Transportation (NYSDOT)
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Rae Zimmerman, Principal Investigator (PI)
Marta Panero, Initial Principal Investigator (PI)
Carlos E. Restrepo, Research Scientist
Andrew Mondschein, Research Scientist
Robert F. Wagner Graduate School of Public Service
New York University
295 Lafayette Street, 2nd Floor, New York, NY 10012

George D. Thurston, Faculty
Kevin Cromar, Faculty
New York University School of Medicine
Institute of Environmental Medicine
57 Old Forge Road, Tuxedo, New York 10987

Tom Carlson, Consultant
Bob Dulla, Consultant
Sierra Research
1801 J Street, Sacramento, CA 95811

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DISCLAIMER

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New York University
Wagner Graduate School of Public Service
295 Lafayette Street – 2nd floor
New York, NY 10012

NYU School of Medicine
Nelson Institute of Environmental Medicine
57 Old Forge Rd.
Tuxedo, NY 10987-5007

Sierra Research, Inc.
1801 J Street
Sacramento, CA 95811</td><td>10. Work Unit No.</td></tr>
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16. Abstract

In accordance with the Federal Highway Administration (FHWA) *"Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents (September 30, 2009),"* transportation projects subject to the National Environmental Policy Act (NEPA) must include an analysis of mobile source air toxics (MSATs). MSATs are air pollutants emitted by mobile sources that can cause serious health effects. Of a group of 93 MSAT compounds, the U.S. Environmental Protection Agency (USEPA) has identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA). These seven compounds consist of acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. FHWA classifies these seven compounds as the "priority MSATs," recognizing that this list is subject to change.

The objectives of this project are to: (1) propose a "screening" protocol that will facilitate the decision making process regarding which projects warrant MSAT assessment; (2) develop procedures (in consultation with regulatory agencies) for conducting qualitative and quantitative analyses of the seven priority MSATs in NYSDOT NEPA and SEQRA environmental documents; and (3) identify feasible MSAT mitigation measures for NYSDOT capital improvement projects and facilities. The work involves 10 separate tasks, including a guidance document for conducting MSAT assessments for projects that fall within NEPA/SEQRA.

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Executive Summary

In accordance with the Federal Highway Administration (FHWA) "Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents (September 30, 2009)," transportation projects subject to the National Environmental Policy Act (NEPA) must include an analysis of mobile source air toxics (MSATs). MSATs are air pollutants emitted by mobile sources that can cause serious health effects. Of a group of 93 MSAT compounds, the U.S. Environmental Protection Agency (USEPA) has identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA). These seven compounds consist of acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. FHWA classifies these seven compounds as the "priority MSATs," recognizing that this list is subject to change.

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Introduction

The overall goal of the Mobile Source Air Toxics (MSATs) Mitigation Measures project is to develop procedures for analyzing the seven priority MSATs in New York State Department of Transportation (NYSDOT) National Environmental Policy Act (NEPA) and State Environmental Quality Review Act (SEQRA) documents and identify feasible MSAT mitigation measures. The seven priority MSATs are acrolein, benzene, 1,3-butadiene, diesel particulate matter (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. Table 1 summarizes the project participants at the conclusion of the project. The project is divided into ten tasks. These are listed in Table 2.

Table 1. Project Members

Institution	Project Member	Role
New York University	Rae Zimmerman	Principal Investigator; Faculty
	Marta Panero	Initial Principal Investigator
	George Thurston	Faculty
	Carlos Restrepo	Research Scientist
	Kevin Cromar	Faculty (this position had also once included graduate assistants)
	Andrew Mondschein	Research Scientist
	Marilyn Lopez	Staff Support
Sierra Research	Tom Carlson Bob Dulla	Research/Consultant Research/Consultant
New York State Department of Transportation (DOT)	Jonathan Bass Catherine Leslie	Project Manager Initial Project Manager

New York State DOT, Main Office and Region 10; Federal Highway Administration (New York Division)	Technical Working Group	Support/Review
New York State Department of Environmental Conservation; New York State Department of Health	Technical Advisory Group	Support/Review

Table 2. Project Tasks

Project Tasks	Current Status
Task 1. Kick-Off Meeting	Completed
Task 2. Benchmarking of State DOTs' Best Practices	Completed and approved
Task 3. Literature Review – MSAT Health Effects	Completed and approved on May 23, 2012
Task 4. Consultation Process • Sub-Task 4.1: Consultation Plan, Organization of Technical Advisory Group and First Meeting • Sub-Task 4.2: Second and Final Meetings and Consultation Process Summary Report	Sub-Task 4.1 was completed and approved Sub-Task 4.2 was completed and approved on September, 2013.
Task 5. Use MOVES & NONROAD Models to Generate MSAT Emission Rates	Completed and approved on February 27, 2012
Task 6. Establish the Screening Criteria	Completed and approved on August 30, 2012

Task 7. Identify and Assess MSAT Monitoring Data	Completed and approved on August 27, 2012
Task 8. Develop Procedures for Performing MSATs Analyses • Sub-Task 8.1: MSAT Analysis Procedures Outline • Sub-Task 8.2: MSAT Analysis Procedures Guidebook	Sub-Task 8.1 was approved on September 7, 2012 Sub-Task 8.2 is currently completed and under review on October, 2013.
Task 9. Characterization of Mitigation Measures	Completed and approved in September, 2013.
Task 10. Final Report	Completed; under review in March, 2013.

This Final Report provides a summary of the research methods, key findings and conclusions of each of the project tasks. The final reports for Sub-Task 8.2 (MSAT Analysis Procedures Guidebook), Task 9 (Characterization of Mitigation Measures) and Sub-Task 4.2 (Final Meetings and Consultation Process Summary Report) are included as appendices at the end of the document.

Task 1. Kick-Off Meeting

Task 1 consisted of a kick-off meeting after the contract was executed. The researchers, project sponsors and the members of the Technical Working Group (TWG) discussed the goals of each project task and expected deliverables via teleconference on November 15th, 2010. The participants also reviewed the scope of work and discussed how best to structure the work in order to attain the goals of the project. This task did not include any research.

Task 2. Benchmarking of State DOT Best Practices

As part of Task 2 of the project, New York University conducted a benchmark study of State DOT state-of-the-practice for addressing MSATs analyses in NEPA documents and mitigating related impacts. The purpose of Task 2 was to identify best practices for MSAT analyses used by selected state transportation agencies for NEPA documents in order to obtain insights for NYSDOT. The final deliverable for this task was a benchmarking report that includes a summary of the mobile source air toxics (MSATs) analysis procedures established or under development by several State Departments of Transportation (DOTs), specifically those State DOTs that are considered leaders in MSAT analysis. The report also includes MSAT practices in states neighboring New York, which have been included to provide regional context.

Research Methodology

In order to conduct the benchmarking study, the Rudin Center contacted representatives from eight State DOTs: (1) California, (2) Colorado, (3) Connecticut, (4) Maryland, (5) Minnesota, (6) Pennsylvania, (7) Virginia, and (8) Washington. In addition, Texas DOT was approached but declined to participate and New Jersey DOT did not respond. Most of these states were selected for study because of their participation in the MSAT Study by the AASHTO Air Quality Community of Practice (COP), thus being considered national leaders in MSAT analysis and mitigation. Connecticut and Pennsylvania (now Air Quality COP Members), while not participants in the MSAT study, were selected to provide regional context for MSAT best practices.

The Rudin Center developed a standard questionnaire for state representatives. The questionnaire was divided into six topic areas that cover the breadth of MSAT practices at State DOTs. Those areas are:

1. Status of MSAT practices and policies
2. Role of FHWA guidance
3. Consultation in development of MSAT practices
4. Science
5. Implementation
6. Mitigation

Each state representative was sent the questionnaire. Within each topic the questionnaire included multiple, open-ended questions designed to allow them to provide information about their practices and their assessment of those practices. The information was gathered with follow-up exchanges, via email in order to address any questions the researchers had on the material provided.

Key Findings

Table 3 includes a comparison of State DOT's approaches to MSAT analysis for NEPA documents and provides the main highlights in the six categories explored during the research.

Table 3. Summary comparison of State DOT's approaches to MSAT analysis for NEPA documents

	Overall	Consultation	Science	Implementation	Mitigation
California	Uses FHWA guidance language in NEPA documents, follows lower CARB guidance on thresholds & analysis	California Air Resources Board (CARB), CA Department of Public Health	Emissions (MOVES), AERMOD (dispersion), and health risk assessment	Multiple projects conducted by state and local agencies	New windows & HVAC installation for buildings next to bridge replacement project
Colorado	Uses FHWA guidance in NEPA documents, mitigates with Air Quality Action Plan efforts	Wide-ranging, local MPOs, other state agencies	Transitioning to MOVES	Part of statewide Greenhouse Gas and MSAT policy initiative	Many programmatic mitigation measures, not on the project by project basis
Connecticut	Uses FHWA guidance, no local policy	Limited	MOBILE6.2, will transition to MOVES when required by EPA	Mostly qualitative analysis and only one quantitative analysis	Only one voluntary mitigation effort for construction phase (retrofit construction vehicles)
Maryland	Uses FHWA guidance but with PM 2.5 as pre-screening indicator for MSATs	Limited	Transitioning to MOVES	Little quantitative analysis	Improved MSAT monitoring and school bus retrofitting
Minnesota	Uses FHWA guidance	Limited	Transitioning to MOVES	Little quantitative analysis	None
Pennsylvania	Uses FHWA guidance, may consider using lower thresholds	Limited: PA Dept. of Environmental Protection	May use MOVES if quantitative analysis is necessary	Multiple qualitative assessments, no quantitative analysis	Requires exhaust systems and dust control for construction impacts (not specific to MSATs)
Virginia	Uses FHWA guidance	Limited	Transitioning to MOVES Wants "intermediate" analysis protocol	Comprehensive Environmental Data and Reporting (CEDAR) system	None
Washington	Uses FHWA guidance	Limited	EMIT and MOBILE6.2		None

Conclusions

Experience with MSAT analyses varies widely from state to state, with some states having conducted few analyses of any sort, some having only conducted qualitative reviews, and other states routinely conducting full quantitative analysis, including health impact assessments as in the case of California. Some DOTs have largely forged ahead without partnering with other state and local agencies, while others have been assiduously collaborative in their approach to MSATs. Experience with mitigation runs the gamut, from none, to project specific, to regional and programmatic measures.

The following are practices that would be potentially helpful in the development of NYSDOT's analysis procedures since they seem to be the most promising strategies developed by other states:

- Intermediate Level of Analysis – Development of an analysis procedure intermediate between qualitative and quantitative analyses (i.e., a quantitative MSATs screening) – The FHWA guidance provides little guidance in between conducting a qualitative review of MSATs and a full quantitative analysis. However, some kind of screening as described by Virginia could help streamline the MSAT analysis burden.
- PM2.5 – PM2.5 could be used as a surrogate for certain particulate MSATs, or as an indicator of the need for more extensive analysis, as in Maryland.
- Facility Locations – As in Colorado, a more holistic approach to MSATs could include planning to locate high-emission facilities away from sensitive receptors.
- Outreach – Focus on early and comprehensive public outreach, to educate the public and demonstrate agency awareness of the most up-to-date information on MSATs.
- Policy Integration – Promote multi-pollutant, integrated mitigation strategies, involving MSATs, greenhouse gases, and criteria pollutants. Colorado has integrated the MSAT policies into a broader context of regional policies for improving air quality. While this approach does not change the NEPA analysis requirements directly, it does potentially offer a basis for findings of "no impact," or readily implementable mitigations when impacts are found.
- Mitigation – Mitigation measures for MSATs during the construction phase are fairly common, but those for the project as a whole are still rare. While some mitigation measures that directly address local MSAT emissions have been developed (e.g., installing HVAC in nearby homes), many states appear to be approaching MSAT mitigation from a regional or programmatic approach, such as with school bus retrofits.

In addition to these potential policies, the wide variety of experiences among other states points towards other potential considerations when conducting MSAT analyses in New York:

- Inter-agency Consultation – The State DOTs that have the most developed MSAT analysis policies also tend to have devoted significant effort to coordination and collaboration with other state agencies
- Monitoring – Many states pointed out the lack of fundamental data on MSAT pollution in various settings along transportation facilities. Better monitoring would help address that uncertainty, with potential long term benefits in terms of impact analysis and community acceptance.
- Health Impacts – Currently, only California goes beyond the FHWA guidance to look at health impacts from MSATs emissions at the project level. However, even in California, there is a desire for more information on health impacts, along with future levels of MSAT emissions, to do a better job with understanding impacts.

Task 3. Literature Review – MSAT Health Effects: Goals

Task 3 consisted of a literature review of MSAT Health Effects. The goals of this task were to:

(1) Survey and assess the extent of available studies and published literature on MSATs health effects and analyses.

(2) Evaluate whether the tools and techniques for evaluating the health effects of the seven priority MSATs have progressed beyond the 2009 FHWA Interim Guidance Update.

(3) Assess the implications of the available new literature for the development of procedures to qualitatively and quantitatively analyze priority MSAT impacts in NEPA and State Environmental Quality Review Act (SEQRA) documents for transportation projects in New York State.

(4) Provide information that can be used to inform the development of procedures for performing MSATs analyses for transportation projects.

Research Methodology

The goals of this task were accomplished by surveying and analyzing the available literature on MSAT health effects in general terms and, when available, for New York State specifically. Among the documents analyzed were the Federal Highway Administration (FHWA) Interim Guidance Update and the FHWA MSAT Near Road Study; the American Association of State Highway and Transportation Officials (AASHTO) National Cooperative Highway Research Program (NCHRP) 25-25 Report, Tasks 18 (Recommended Approaches to Communicating Air

Toxics Issues and Transportation Project-Related Analyses in NEPA Documents) and 70 (Assessment of Quantitative Mobile Source Air Toxics in Environmental Documents) (AASHTO, 2007); several U.S. EPA documents including the PM Hot-spot Guidance, the National-Scale Air Toxics Assessment (NATA); the Integrated Risk Information System (IRIS)and the 2007 “MSAT Rule”; the New York State Department of Environmental Conservation (NYSDEC) DAR-1 Air Guide; the California EPA Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments; the South Coast Air Quality District, California, MATES III Final Report; several reports by the Health Effects Institute; and other peer-reviewed scientific and medical literature and government published reports that are particularly relevant to transportation projects.

In addition, the authors of the Task 3 report consulted with representatives from key organizations relevant to the application and understanding of MSAT methods. As part of this review, the following individuals were contacted:

Mr. Tom Gentile, NYS Department of Environmental Conservation
(518) 402-8402; tjgentil@gw.dec.state.ny.us
Mr. Gregg Recer, NYS Department of Health,
(518) 402-7820; gmr05@health.state.ny.us
Mr. Michael Brady, California Department of Transportation
(916) 653-0158; mike_brady@dot.ca.gov

Key Findings

Since the publication of the FHWA Interim Guidance Update in 2009, a number of improvements and refinements to the tools and techniques for assessing MSAT impacts have emerged. Diesel particulate matter (DPM), one of the priority MSATs, plays an important role in the cumulative health impacts of MSAT exposures. The findings of the Task 3 review have important implications for qualitative MSAT analyses as part of the NEPA and SEQRA processes; however, challenges remain in performing quantitative MSAT risk assessments given limitations of our understanding of the dispersion of these chemicals in the environmental and their health effects.

Conclusions

The inclusion of human health risk assessment as part of the quantitative analysis of MSAT impacts is potentially possible for non-cancer endpoints. However, important challenges remain in determining lifetime exposures to MSAT concentrations and this continues to pose difficulties for conducting human health risk assessment for cancer endpoints.

Diesel Particulate Matter (DPM) could potentially be used in the future as an MSAT index for risk assessments for both cancer and non-cancer outcomes, in cases where vehicles powered by diesel (e.g., trucks) are expected to be an important contributor to vehicle miles travelled. The adoption of an Annual Guideline Concentration (AGC) for DPM may be of value.

Task 4. Consultation Process

The Mobile Source Air Toxics Mitigation Measures project required extensive consultation with other New York State agencies to ensure that other parties were able to review and provide feedback on the various task deliverables. A Technical Advisory Group (TAG) was formed in order to structure this consultation process and it included representatives from the NYS Department of Environmental Conservation (NYSDEC) and the NYS Department of Health (NYSDOH).

The first TAG meeting was held on February 15, 2011. The goal of this meeting was twofold: 1) to ensure that all TAG members understood the project's objectives, background and scope of work and, 2) to ask TAG members to provide feedback at various stages during the research, as well as information that the researchers needed in order to complete the various tasks.

The final consultation process took place on July 22, 2013. New York State DOT organized a conference call for the TAG members and the research team. The goal of the conference call was to discuss the Sub-task 8.2 report and the Task 9 report. Valuable feedback was provided to the researchers who then incorporated the comments into the final version of these task reports. The final consultation report is included in Appendix C.

Task 5. Use MOVES & NONROAD Models to Generate MSAT Emission Rates

The goals of Task 5 were to establish MSAT emission sensitivities in EPA Motor Vehicle Emission Simulator (MOVES) and NONROAD models over various ambient, vehicle fleet, and operating conditions in order to better inform the development of Task 8 guidance procedures; to provide inputs for selecting the modeling scales (e.g., MOVES execution modes) that end-users should be directed to utilize in the written guidance; to provide emission factor "range checks" for incorporation into the guidance to ensure that the end-user modeling outputs are reasonable; and to support updating of AADT traffic thresholds triggering quantitative project-level analysis using MOVES-based emission rates and New York-specific fleet characteristics in Task 6 of the project.

Research Methodology

The sensitivity of emissions to model inputs was conducted in two parts. The U.S. EPA's MOVES2010a model was used for On-Road Sensitivity and the EPA NONROADS2008 emissions model was used for Non-Road sensitivity. For the On-Road Sensitivity analysis three sets of model runs were used. First, runs were performed for the base year of 2007 for the entire 62 county area using inputs from NYSDEC and generated monthly totals. These outputs were then used to calculate emission rates in grams per mile for MSAT specie, emission process, vehicle/fuel type, and road type. The purpose of this first set of runs was to examine MSAT sensitivity statewide geographically at the county level and seasonally using fleet characteristics. Second, in order to examine how emission rates vary by speed and temperature, a single county (New York County) was selected. For that county, output tables for rate per distance, vehicle and process were generated. Third, in order to examine how MSAT emission rates vary over time due to technology/fuel changes and fleet turnover, model runs were conducted for four counties (Albany, Erie, New York, and Westchester). For the Non-Road sensitivity analysis, variations in MSAT emission rates were examined for 32 general equipment types for construction projects, focusing on diesel as the main fuel source. EPA modeling protocols were followed in this analysis.

This task produced a set of emission rate tables for incorporation into the MSAT Analysis Procedures Guidebook.

Key Findings

The sensitivity analyses conducted under this task identified several variables that more highly affect MSAT emissions. For on-road vehicles in MOVES, these inputs include the following:

Fleet mix (distribution of vehicles by source type and fuel type);

Vehicle age distributions (when different from countywide fleet);

Speed distributions and operating patterns;

Calendar year range of analysis (to account for technology/fleet turnover); and

Seasonal variations (largely ambient temperature).

In modeling non-road MSAT emissions during a project's construction phase, the key inputs (with greatest sensitivities) include the following:

Equipment types and population distributions;

Engine size ranges by equipment type;

Age distributions;

Use of engine retrofits; and

Operating characteristics (activity/load factor data).

EPA has designed the Project Scale execution mode within MOVES to generate highly localized emission estimates associated with sub-county or project-specific travel, but this mode requires additional input data that are difficult to estimate or collect for a project.

These additional project-level data inputs include:

Links – Road type, volume, link length, road grade if applicable

Link Source Types – Traffic volume fractions by link driven by each source type

Link Driving Schedules – Optional input of second-by-second driving patterns

Operating Mode Distributions – Input for supplying parked vehicle soak time distributions when modeling "start" activity, or engine-on operating mode distributions for modeling running emissions as an alternative to average speed or link driving schedule inputs

Off-Network Activity – Input for supplying hourly distributions of start and engine-off "parked" fractions by vehicle source type.

Conclusions

Although EPA has designed the Project Scale mode to utilize the capabilities within MOVES to precisely resolve emission impacts of highly disaggregated travel activity data, many of these data are difficult to collect or reliably estimate at the individual project level. In addition, since the Project Scale mode has been designed to produce more accurate short-term localized emission estimates, it operates for only a single hour and month at a time. In order to generate integrated annual average MSAT emission estimates for NEPA applications, MOVES will have to be repeatedly invoked in Project Scale mode across each hour and an acceptable range of months.

As a policy matter, EPA's recent PM Conformity Hot Spot modeling guidance mandates the use of Project Scale MOVES analysis to support development of project-level and link-specific emission estimates used to support dispersion modeling of localized ambient air quality impacts. In that context (i.e., when supporting localized dispersion modeling), Project Scale MOVES analysis is more appropriate. Since FHWA's existing NEPA MSAT analysis requirements stop short of performing project-level dispersion modeling and MSAT risk assessment, the need to produce highly resolved emission estimates at the link level does not currently exist.

Task 6. Establish the Screening Criteria

The overall objective of this task consisted of developing a relevant set of questions for use in streamlining the decision-making process regarding which projects require MSAT analysis and the level of analysis required (i.e., qualitative vs. quantitative analysis). The task also utilizes the Task 3 review of existing studies that investigate and compare dispersion model performance and risk assessment uncertainties to provide "context" for the screening thresholds.

FHWA has established a three-tiered approach for analyzing MSATs in NEPA documents in its interim guidance, depending on specific project circumstances and activity. The three analysis levels are as follows:

1. No analysis for projects with no potential for meaningful MSAT effects;
2. Qualitative analysis for projects with low potential MSAT effects; or
3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

In addition to the final report, another deliverable of Task 6 consisted of eight files named Summary*.xlsx which included MOVES2010b outputs and tabulations of emission factors for each calendar year and geographic area considered.

Research Methodology

Screening thresholds are used to refer to established traffic activity levels above which potentially significant MSAT health risks may result from a planned transportation project and for which a quantitative analysis should be performed. In order to assess appropriate screening thresholds for New York State, FHWA and NCHRP 25-25 Task 18 reports were first reviewed since thresholds have been determined in these documents. New modeling inputs were developed in MOVES-ready structures that represented New York specific fleet and fuel characteristics and operating conditions. As a result of the findings of Task 5 which included significant variations in fleet emission factors across the state, Task 6 was expanded to develop area-specific, rather than average statewide, MSAT screening thresholds. For this analysis, the state was divided into two geographic areas: (1) Downstate; and (2) Upstate. These geographic divisions reasonably account for variations in parameters that affect vehicle emission rates across the state such as urban/rural travel splits, congestion levels, and fuel properties from different regulatory programs.

On April 23, 2012, EPA released a long-anticipated “maintenance” update to MOVES called MOVES2010b. As a result of this update and with approval from NYSDOT the workflow was converted from MOVES2010a to MOVES2010b. EPA released a further revision to MOVES2010b on June 18. All work presented in the Task 6 final report is based on the June 18 MOVES2010b release. Calendar year 2012 was selected as the primary year upon which New York screening thresholds were based.

Key Findings

Extrapolating the assumptions and methods employed under the TRB project NCHRP 25-25, but using updated benzene emission factors based on EPA’s latest MOVES2010b model (instead of MOBILE6.2), no level of roadway project activity would be sufficient to trigger a significant long-term health risk (no quantitative analysis would be considered necessary). However, when accounting for what have become greater, and now significant relative risk contributions from other MSATs (1,3-butadiene and formaldehyde), calculated AADT thresholds based on combined risk across all three species are markedly lower than those based only on benzene risk alone.

These expanded risk AADT thresholds range from 270,000 – 350,000 for freeway projects, 170,000 – 280,000 for arterial projects and 50,000 – 80,000 for intersection projects depending on region and speed.

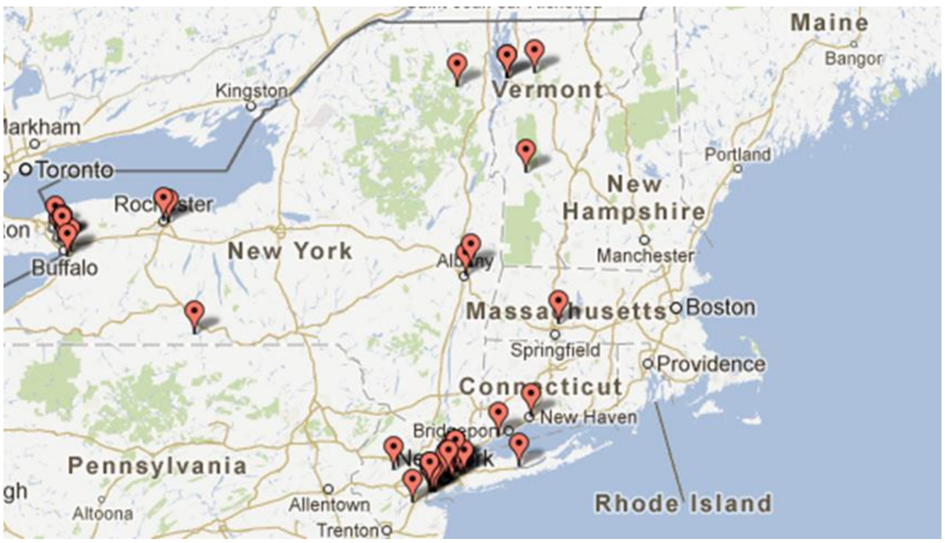
Conclusions

Based on the expanded MSAT risk analysis summarized in the previous section, the Task 6 final report concludes with a recommendation that AADT thresholds be set based on the combined risk of the three species examined: benzene, 1,3-butadiene, and formaldehyde. This accounts for changes in fleet emission factors for each MSAT that, based on MOVES2010b, indicate benzene is no longer the sole driver of vehicular cancer risk (when DPM is not considered).

Task 7. Identify and Assess MSAT Monitoring Data

The goals of Task 7 were to first identify and assess existing MSAT concentration data availability for New York State and relevant bordering areas, including regulatory monitoring (e.g., NYSDEC), research monitoring, and governmental air toxics modeling results (e.g., U.S. EPA's National-Scale Air Toxics Assessment results); second, to compare EPA air toxics modeling results for New York State counties with available monitoring data; and third, to provide an assessment of current monitoring gaps. Figure 1 shows the location of monitoring stations that collect data relevant to this project and which the team members used for their analysis.

Figure 1. All MSAT monitor locations in and near New York including Western Vermont, Western Massachusetts, Western Connecticut and Northern New Jersey



Source: USEPA AIRS Monitoring Database

Research Methodology

Monitoring data from New York State and adjacent states was used to evaluate the spatial distribution of all recent HAPs and Speciation monitoring sites. The temporal and spatial coverage of each priority MSAT included in this project was also assessed. In addition, a correlation analysis of MSAT concentrations as a function of distance between monitor locations was performed for each MSAT. In order to assess the spatial representativeness of the current monitoring network, inverse-distance weighting was applied to the monitoring network to compare the spatial averaged vs. observed concentration at each monitoring location for each MSAT, as computed from all the other available surrounding monitors for the five MSAT with sufficient data to conduct this analysis. Once weights were calculated based on distance, estimates of MSAT concentrations at monitor locations were computed by summing together all of the monitored values multiplied by the calculated, distance-based weight. The process assumes the nearest monitors to be more correlated as compared to monitors further away. The process was carried out for each of the monitoring locations and the resulting estimates were compared to the reported monitored values.

As part of Task 7, EPA air toxics modeling results for New York State were also compared to available monitoring data for the four MSATs for which sufficient monitoring data for comparison were available. Additionally, an assessment of the usefulness of these estimates for population exposures for these MSATs in New York State was provided.

Key Findings

The availability of data from the routine air quality stationary monitoring sites varies over time, and from MSAT to MSAT. Polycyclic Organic Matter (POM), one of the priority MSATs included in this study is not currently being measured at all in New York State. There are also variations in monitoring density between the NYC area and Upstate New York, with the density of monitoring being much higher in the NYC area than in Upstate New York.

In general there is variability across sites, especially in the distribution around the median annual concentration values, but concentrations do not differ dramatically between upstate and New York City, except for Elemental Carbon (EC) and formaldehyde, where upstate concentrations are lower than NYC area concentrations.

The comparison of spatial averaged and observed concentrations suggest that the distance-weighted spatial averages tend to overestimate actual concentrations, especially in Upstate New York, while the estimates in NYC are both more accurate and precise than outside NYC.

EPA National-Scale Air Toxics Assessment (NATA) exposure estimates are not consistently in agreement with measured data. Modeled 1,3-butadiene appears to be consistent with monitoring values, but the benzene NATA estimates are nearly double the observed concentrations in some monitored locations. Modeled estimates of formaldehyde and acetaldehyde concentrations are not consistently in agreement with monitored values. NATA exposure estimates may have limitations in estimating long-term ambient MSAT concentrations at individual locations.

Conclusions

When estimating MSAT exposures in locations where there is no monitoring it is preferable to use direct monitoring or computer dispersion modeling than to use the existing monitoring network to extrapolate concentrations, especially in upstate New York. A greater density of MSAT monitoring may be needed in upstate New York to make it more useful for exposure assessment.

There may be opportunities to expand the current MSAT monitoring network by co-locating new MSAT monitoring with newly federally required roadside monitors for nitrogen dioxide (NO_2).

Task 8. Develop Procedures for Performing MSATs Analyses

Sub-Task 8.1 - MSAT Analysis Procedures Outline

The Task 8 outline for this Sub-Task was completed and approved on September 7, 2012. It consists of seven parts: a roadmap that provides a means for readers to navigate through the document, background material on the MSAT analysis, the relationship of the MSAT analysis to environmental impact assessment procedures, procedures for determining whether the project will have a significant MSAT impact (future build scenarios), examples of prototype language for qualitative and quantitative project-level MSAT analysis, and mitigation measures.

Sub-Task 8.2 – MSAT Analysis Procedures Guidebook

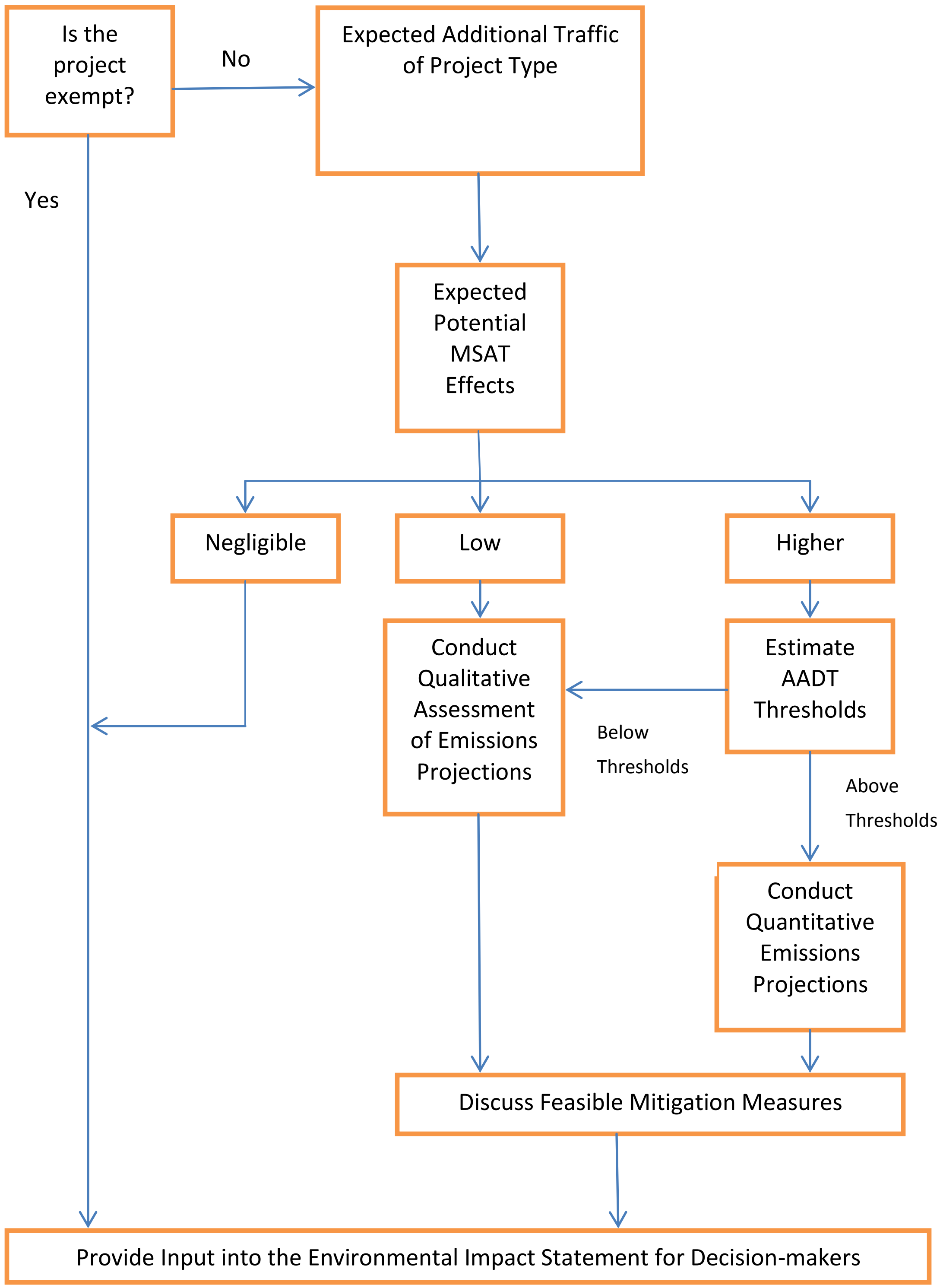
The MSAT Analysis Procedures Guidebook is based on the work carried out as part of all the other tasks of this project and provides guidance for analyzing priority mobile source air toxics (MSATs) as part of the environmental impact assessment (EIA) process associated with New York State Department of Transportation (NYSDOT) responsibilities under the National Environmental Policy Act (NEPA) and State Environmental Quality Review Act (SEQRA). The document also identifies selected MSAT mitigation measures for the proposed projects and includes a discussion about how to incorporate mitigation measures into the process. The EIA process related specifically to MSAT analysis required for a project applicant is summarized in Figure 2 and the steps outlined included in the figure are discussed throughout the guidance document. Some categories of projects may be exempt from conducting MSAT analyses as part of their air analysis if NYSDOT has determined that those projects are not associated with MSAT emissions. Projects that are not exempt from the EIA process should provide an assessment of the impact of the project on traffic and discuss the expected potential impact of the project on MSAT emissions. Projects with negligible impacts on traffic and MSAT emissions are not required to conduct any additional analyses (Section 4.2 of the guidance document). Projects with expected low levels of impact on MSAT emissions are required to conduct a qualitative assessment of emissions projections (Section 4.3 of the guidance document) and to discuss feasible mitigation measures (Section 7 of the guidance document) in their EIA. Examples of prototype language for qualitative project-level MSAT Analysis are provided in Section 5 of the guidance document. Projects with expected higher impacts on MSAT emissions are required to conduct quantitative emissions projections (Section 4.4 of the guidance document) and discuss feasible mitigation measures (Section 7 of the guidance document). Examples of prototype language for quantitative project-level MSAT analysis are provided in Section 6 of the guidance document.

In addition, the Guidebook also covers transportation conformity hot-spot modeling requirements to enable applicants to compare them with quantitative MSAT guidance, where relevant to the user, and enable users to use the same data for both types of analyses.

The specific technical guidance provided within the guidebook (depending on project activity levels) requires familiarity with the U.S. Environmental Protection Agency's (EPAs) MOVES vehicle emissions model. The guidebook was developed with the assumption that analysts using it are experienced with MOVES.

The MSAT Analysis Procedures Guidebook is included in Appendix A.

Figure 2. Summary of the Processes Included in the Guidance Document



Task 9. Characterization of Mitigation Measures

The purpose of this task is to provide summary guidance for the feasibility, financial implications and benefits of different types of mitigation measures.

Research Methodology

A review of mitigation measures that have the potential for being suitable to New York State are evaluated, covering existing literature and using criteria based on cost-effectiveness and financial implications. MSAT emission benefits are also identified.

Key Findings

Options for reducing MSAT effects for projects expected to have a higher potential of MSAT emissions include: construction mitigation through both operational improvements and technology retrofits and post construction mitigation through operational, travel demand management strategies and consideration of buffer zones between new or expanded highway alignments and populated areas. Table 4 summarizes a review of the literature (e.g., description, benefits, costs, etc.) of representative measures for each mitigation category.

Table 4 **EPA Estimates of Typical Diesel Retrofit Technologies and Costs**[*]					
	Typical Emission Reductions (%)				
Technology	PM	NOx	HC	CO	Typical Costs ($)
Diesel Oxidation Catalyst (DOC)	20-40		40-70	40-60	Material: $600-$4,000 Installation: 1-3 hours
Diesel Particulate Filter (DPF) Active or Passive	85-95		85-95	50-90	Material: $8,000-$50,000 Installation: 6-8 hours
Partial Diesel Particulate Filter (PDPF) Partial or Flow-through	up to 60		40-75	10-60	Material: $4,000-$6,000 Installation: 6-8 hours
Selective Catalytic Reduction (SCR)*		up to 75			$10,000-$20,000 Urea $0.80/gal
Closed Crankcase Ventilation (CCV)*	varies				
Exhaust Gas Re circulation (EGR)*		25-40			
Lean NOx Catalyst (LNC)*		5-40			$6,500-$10,000

* May be combined with DOC or DPF systems to reduce PM, HC and CO emissions.

The Task 9 report also includes a description of existing transportation control measures (TCMs) and travel demand management (TDMs) targeting commuter work trips that are currently available for implementation on a state and local basis. A summary of potential MSAT reductions and related estimates of cost and cost-effectiveness are presented for 15 measures. In addition, numerous measures targeting diesel vehicle activity have also been developed and they are also discussed. The establishment of buffer zones is also recommended by FHWA and is included in the report.

Conclusions

Given the cost of diesel retrofit systems and their durability, it is doubtful that investments in these systems can be recouped during the lifespan of a single construction project, nor is it likely they will provide cost-effective emissions reductions, relative to other measures on a project specific basis. Nevertheless, external requirements to implement these systems may be

[*] http://epa.gov/cleandiesel/technologies/retrofits.htm

mandated in local SIP commitments. Therefore, it is important to review applicable SIPs and related local air pollution control regulations.

Overall, a number of mitigation measures exist that can address some of the concerns decision-makers may have with regard to MSAT emissions for projects which are expected to have higher potential for impacts.

Statement on Implementation

The NYS DOT will upon further discussion and consultation with other New York State agencies conduct the feasibility of implementation.

Appendix A: Sub-Task 8.2 Report

MSAT Analysis Procedures Guidebook

Appendix B: Task 9 Report

Characterization of Mitigation Measures

Appendix C: Sub-Task 4.2

Final Consultation Process Summary Report

University Transportation Research Center - Region 2
Funded by the U.S. Department of Transportation

Region 2 - University Transportation
Research Center
The City College of New York
Marshak Hall, Suite 910
160 Convent Avenue
New York, NY 10031
Tel: (212) 650-8050
Fax: (212) 650-8374
Website: www.utrc2.org