Maine Air Toxics Advisory Committee

Recommended Air Toxics Strategy

As Presented to the
Department of Environmental Protection
on September 21, 2007

Revision of September 17, 2007

DEPAQ39 A2007

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Table of Contents

Table of Tables

Table of Figures

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Air Toxics Advisory Committee

Recommended Actions for the Maine State Air Toxics Strategy Presented to the Maine Department of Environmental Protection on September 21, 2007

Revision of September 17, 2007

1. INTRODUCTION

This document contains the Air Toxic Advisory Committee's (ATAC) consensus recommendations for Maine's Air Toxics Strategy. The Maine Department of Environmental Protection (MEDEP) has committed to considering this advice as it develops a strategic Air Toxic strategy for the state, aimed at reducing the most risk for the least cost. Section 2 describes the process used by ATAC to develop recommended strategies, while section 4 on page 8 covers two early actions that the ATAC has already undertaken. The ATAC's recommended long-term strategies, which focus on energy efficiency, are in section 5 beginning on page 8.

2. INITIAL DATA ASSESSMENT FOR THE MAINE AIR TOXICS INITIATIVE

Air toxics (ATs) are the many air pollutants for which the federal government has not established an ambient air standard but which could still cause health problems. The Maine Department of Environmental Protection (MEDEP) launched the Maine Air Toxics Initiative (MATI) in 2003 to identify any air toxics posing an unreasonable risk to Maine citizens and the source of those air toxics. The second phase of the project was to determine the best way to reduce potential health risks for the least cost. EPA awarded Maine DEP a Healthy Communities Grant to help fund the project. MATI was undertaken by a stakeholder group known as the Air Toxics Advisory Committee (ATAC), which is composed of some 33 interested community, government, industrial and environmental organizations, as shown in Table 1. A full list of the ATAC participants is included in Attachment 1. Jonathan Reitman is an independent facilitator who helped this diverse group reach agreement.

After evaluating emissions inventories, chemical toxicity databases, national air modeling, and ambient air monitoring programs[1] (see Figure 1 on page 3) in late 2005 the ATAC agreed on several major points[2]. Although data limitations introduced uncertainty into its findings, the ATAC agreed that air quality is better in Maine than in southern New England, but ATs in Maine could pose unacceptable health risks in hot-spot locations, primarily from combustion byproducts, as shown in

[1] Maine DEP, Maine Air Toxics Priority List & Basis Statement, (Bureau of Air Quality, MEDEP, 17 SHS, Augusta, ME 04333-0017, available at: http://www.maine.gov/dep/air/toxics/mati_docs/AT%20priority%20list%20Basis%20_D-48_.pdf), Draft Revision of October 7, 2005

[2] Consensus Report of the Maine Air Toxics Advisory Committee Regarding the Maine Air Toxics Priority List and Next Steps in the Maine Air Toxics Initiative As Agreed To At The ATAC's November 18, 2005 Meeting (Bureau of Air Quality, MEDEP, 17 SHS, Augusta, ME 04333-0017, available at: http://www.maine.gov/dep/air/toxics/mati_docs/MATI-11-18-05%20Consensus%20Report-v7.pdf), Revision of February 9, 2006

Figure 2 on page6. The ATAC agreed on an Air Toxics Priority List (ATPL)[3] and appointed subcommittees to begin phase II of the MATI; the evaluation of “low or no cost” AT reduction alternatives, while continuing to verify the underlying science behind the ATPL.

Table 1: Organizations Comprising the Maine Air Toxics Advisory Committee

Organization Type	Affiliation
Government -Federal	Acadia National Park
NGO-Health	American Lung Association of Maine
Government -Local	Androscoggin & Portland Regional Transportation Councils
Industry	Wood Power Electrical Generators & Independent Energy Producers of Maine
Gen-Citizen	General Citizens
Government -local	City of Biddeford
NGO-Health	Bucksport Bay, Coastal, & River Valley Healthy Communities Coalitions
Consultant-Industry	Environmental Engineering & Law Consultants
Non GO-Environmental	Environmental Health Strategy Center, Maine Branch of the Toxics Action Center, & Natural Resources Council of Maine
Industry	FPL Energy
Industry	General Dynamics - Armament Systems
Trade Org	Maine Automobile Dealers Assoc. Inc.
Trade Org	Maine Chamber of Commerce
Government -State	Maine Departments of Environmental Protection, Health and Human Services, and Transportation
Industry	Maine Energy Recovery Corporation and Penobscot Energy Recovery Co
Trade Org	Maine Pulp & Paper Association & Manufacturing facilities
Government -State	Maine Senate
Trade Org	Maine Snowmobile Assoc.
Trade Org	Massachusetts Petroleum Council & ExxonMobil Refining & Supply Co.
Government -Tribal	Passamaquoddy of Pleasant Point (Sipayik) & Penobscot Indian Nation
NGO-Health	Physicians for Social Responsibility, Maine Chapter
Educational	University of Maine at Orono
Government -Federal	USEPA - Region I

3. DATA VERIFICATION & ASSESSMENT OF AIR TOXIC REDUCTION ALTERNATIVES

In late 2005 the ATAC formed three subcommittees to undertake the Phase II work: the Science Advisory, Stationary Sources, and Mobile Sources Subcommittees.

3.1 Verification of the MATI phase I work by the Science Advisory Subcommittee

The ATAC charged the Science Advisory Subcommittee (SAS) with verifying the science used to build the ATPL and identifying AT hot-spots.

3.1.1 Hot-Spot Analysis

In an effort to locate potential air toxic hot-spots, SAS reviewed EPA’s 1999 National Air Toxics Assessment (NATA), traffic congestion, ambient air monitoring data and point source emissions. This data was useful for establishing potential hot-spots from Mobile Sources. The Maine Department of Transportation (DOT)

[3] The final ATPL is in Table 2 on page 4. The original ATPL ranking can be seen on page 122 in Table 9: Phase II Inventory Improvements for Select Pollutants.

Figure 1: Schematic of the Process Used to Develop the Maine Air Toxics Priority List

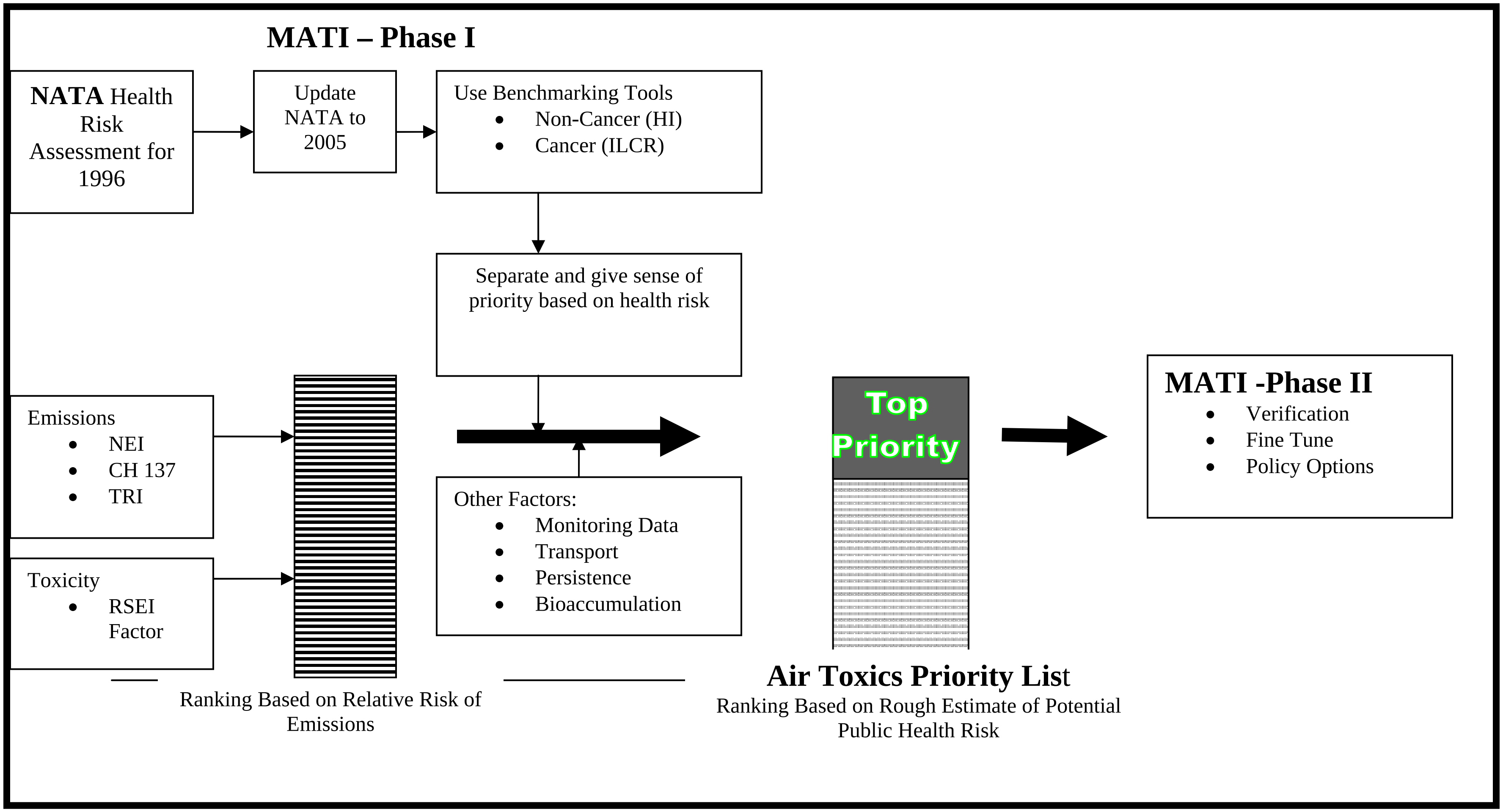


Table 2: Maine Air Toxics Priority List –July 2007

Revised Rank	MEDEP Pollutant CATEGORY NAME	ATPL-2 Basis
1	Polycyclic Organic Matter	Toxicity-Weighted Emissions and NATA risk
2	Naphthalene	Toxicity-Weighted Emissions and NATA risk
3	Acrolein	Toxicity-Weighted Emissions and NATA risk
4	Formaldehyde	Toxicity-Weighted Emissions and NATA risk
5	Benzene	Toxicity-Weighted Emissions and NATA risk
6	Chromium Compounds	Toxicity-Weighted Emissions and NATA risk
7	Cobalt Compounds	Toxicity-Weighted Emissions and NATA risk
8	1,3-Butadiene	Toxicity-Weighted Emissions and NATA risk
9	Sulfuric Acid	Toxicity-Weighted Emissions and NATA risk
10	Diesel Particulate Matter	Qualitative estimate of TW Emissions and risk
11	Nickel Compounds	Toxicity-Weighted Emissions and NATA risk
12	Arsenic Compounds	Toxicity-Weighted Emissions and NATA risk
13	Particulate Matter from Nanotechnology	Qualitative estimate of emerging risk
14	Brominated Flame Retardants	Persistence & bioaccumulation
15	Acetaldehyde	Toxicity-Weighted Emissions and NATA risk
16	Lead Compounds	Toxicity-Weighted Emissions and NATA risk
17	Cadmium Compounds	Toxicity-Weighted Emissions and NATA risk
18	Chloroform	Toxicity-Weighted Emissions and NATA risk
19	Manganese Compounds	Emerging risk update & persistence
20	Tetrachloroethylene (Perchloroethylene)	Monitoring exceeds ME Ambient Air Standard
21	Methyl Bromide (Bromomethane)	Persistence
22	Carbon Tetrachloride	Persistence
23	Dioxins and Furans	Persistence & bioaccumulation
24	H2S	Acute Risk incidents
25	Ethylene Dichloride (1,2-Dichloroethane)	Persistence
26	Ethylene Dibromide (Dibromethane)	Persistence
27	Mercury Compounds	Persistence & bioaccumulation
Removed from Priority List after MATI phase II verification process		
removed	Chlorine Compounds	Updated inventory & revised toxicity
removed	Hydrochloric Acid	Updated inventory & revised toxicity
removed	Cyanide Compounds	Updated inventory & revised toxicity
removed	2,4 Toluene Diisocyanate	Updated inventory & revised toxicity

provided SAS with interactive PDF maps of high traffic congestion areas[4] that should correlate with AT hot-spots. Unfortunately, there was insufficient data to identify hot spots from area and point sources emission sources, and the MEDEP will need to conduct further analysis to identify and prioritize these areas.

3.1.2 Toxicity Factor Adjustments

The AT inventory is "Toxicity-Weighted" to allow quick "apples – to – apples" comparisons between pollutants with widely varying potencies and health effects. MEDEP and the Maine Center for Disease Control revised the toxicity-factors used to weight the air toxics inventory. The revisions aligned the toxicity factors with the risk endpoints in Maine's Ambient Air Guidelines and captured the latest toxicity

[4] The mobile hot-spot screening analysis is available on the MATI website at: http://www.maine.gov/dep/air/toxics/mati-docs.htm#atpl_docs

data.[5] These revisions significantly altered the toxicity-weighted inventory, because the adjustments generally reduced the potency of non-carcinogens by a factor of 25, as compared to carcinogens. Persistence and bioaccumulation must still be accounted for in a qualitative manner.

3.1.3 Inventory Refinement

The MATI process was vital to MEDEP's continuous improvement in the accuracy, reproducibility, and transparency of its emissions inventory. Future inventory improvements will focus on reducing the high uncertainty with acrolein emission values, and with emissions from outdoor wood boilers, commercial marine vessels, trains and airplanes. The revised 2005 toxicity-weighted inventory is significantly different from the previous estimated 2005 inventory, as summarized in Table 9 in Attachment 5 on page 122.[6] Air toxics from combustion sources still dominate the toxicity-weighted emissions (Figure 2), and reduction of air toxics resulting from incomplete combustion is the target of both the Mobile and Stationary Sources recommended reduction strategies. Polycyclic Organic Matter (POM), which is a group of compounds that are formed by incomplete combustion processes[7], are now at the top of the ATPL, rather than acrolein, which is number 3. Additional inventory summaries are shown in Figure 3 on page 6 and in Figure 4 on page 8. Further details are included in Attachment 5 on page 121.

3.1.4 Acrolein uncertainty

EPA and MEDEP view acrolein as a significant state, regional, and national risk driver for air toxics, but acknowledge that the underlying science for this view is highly uncertain. During the refinement phase, MEDEP reduced the toxicity factor for acrolein by a factor of 25 as described in section 3.1.2 on page 4. Maine's largest industrial biomass burners are conducting stack tests for acrolein, and results to date indicate that emissions are significantly less than predicted by the AP-42 emission factor published by US EPA. (See SSS-Appendix I : Acrolein Stack Test Data from Large Maine Wood Boilers on page 23). MEDEP undertook a limited study to refine its approach to sampling and analyzing acrolein in ambient air. MEDEP also described the state of the science and future research needed to precisely quantify risks posed by acrolein.

[5] David W. Wright, Toxicity-Weighting: A Prioritization Tool for Quality Assurance of Air Toxics Inventories, Maine Department of Environmental Protection, 17 SHS, Augusta, ME 04333-0017 at: http://www.maine.gov/dep/air/toxics/mati-docs.htm#atpl_docs), Revision of April 19, 2007.

[6] MEDEP updated the 2005 emissions inventory for air toxics to support the MATI process and for submission to US EPA under State Implementation Plan requirements. On June 21, 2007 MEDEP published inventory summary charts for the ATAC. MEDEP is still compiling a complete narrative that describes the specific process and calculations used to develop the inventory.

[7] The one exception is Naphthalene, which can also be formed from other processes. To avoid confusion, Naphthalene was broken out of the POM category for the phase II MATI inventory.

Figure 2: Maine 2005 Air Toxics Inventory by Combustion and Non-Combustion Emission Sources (toxicity-weighted)

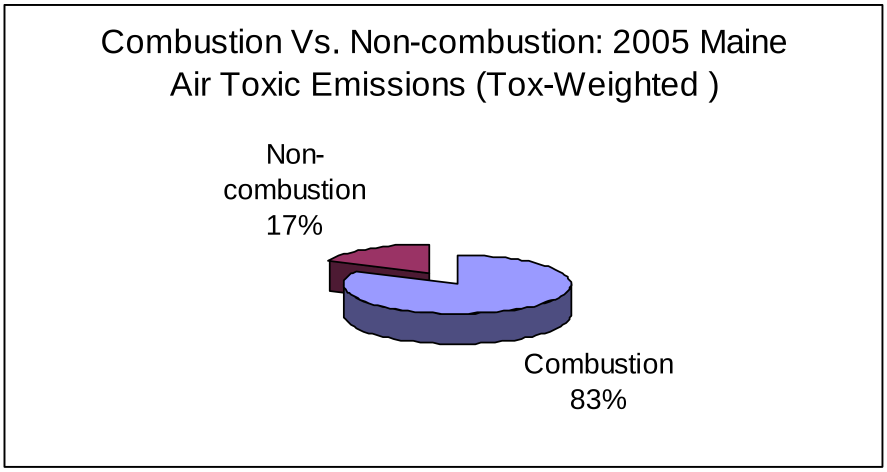
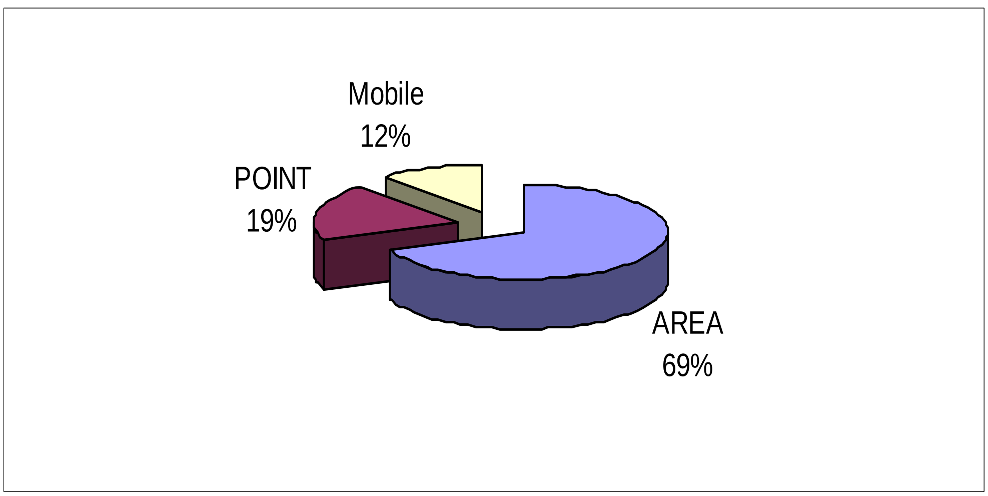


Figure 3: Maine 2005 Air Toxics Inventory by Major Sector (Toxicity-Weighted)



3.2 Development of Air Toxic Reduction Alternatives

Meanwhile, the Mobile Sources and Stationary Sources Subcommittees explored "low or no cost" strategies to reduce ATs in Maine. The subcommittees assessed available strategies, including co-benefits from strategies focused on reducing green house and criteria pollutants, economic incentives, targeted pollution prevention programs, new legislation at the state level, or partnering with regional agencies to resolve interstate issues.

The Stationary Sources Subcommittee completed a list of pending regulations on major and area point sources and anticipated AT reductions. The subcommittee also explored reductions afforded by energy conservation and low sulfur fuels. The stationary Sources Subcommittee report with recommendations is included as Attachment 2.

Concurrently, the Mobile Sources Subcommittee summarized the universe of pending on and off-road regulations and additional potential control options, and then screened them based on emission reduction potential and feasibility (including cost), to develop a list of preferred AT reduction strategies. The subcommittee then quantified costs and AT reduction benefits of each of the preferred alternatives. Based on this analysis, the ATAC adopted the Mobile Subcommittee final recommendations, which are included as Attachment 3.

4. EARLY AIR TOXIC REDUCTION ACTIONS

While reviewing the long-term air toxic reduction options, two early actions were undertaken, as follows:

4.1 Environmental Notebooks for Schools

The first early action was initiated by MEDEP prior to forming the ATAC, as part of the EPA Grant award. DEP developed and distributed a Maine School Environmental Guidebook[8] that specifically addresses school environmental, health, and safety concerns. The notebook explains in simple language all environmental statutes, regulations, and initiatives by state government and the U.S. EPA that reduce exposure to toxics in school settings.

4.2 Controls for Outdoor Wood Boilers

The second early action was initiated by the ATAC to control AT risks posed by the rapidly expanding use of outdoor wood boilers (OWBs) in Maine. Unlike indoor woodstoves, Outdoor Wood Boilers (OWBs) are not regulated by EPA, yet they emit 16 times more POM than EPA certified indoor stoves. The ATAC researched the available information on OWBs, including the positions of the American Lung Association, OWB manufacturers, along with state and federal authorities, before forwarding a recommended early action to the MEDEP on December 12, 2006. ATAC called for MEDEP to:

- Conduct Education & Outreach on best operating practices for wood burning devices, health effects of wood smoke, and the prohibition on burning solid waste;
- Immediately enact a moratorium on OWB sales until emission standards comparable to indoor stoves are established;
- By the 2007-08 heating season, establish state standards to control OWB emissions to at least the same level as indoor wood stoves, and to establish rules to reduce the risk from existing OWBs;
- Enforce the State's visible emission standards on existing OWBs; and
- Work with local authorities, OWB manufactures and suppliers to ensure that existing stoves meet recommended installation specifications.

Details of the ATAC's research and conclusions, including a model rule, are contained in Attachment 2SSS Appendix II: Position Paper on Outdoor Wood Boilers (OWBs), beginning on page 25.

Maine DEP introduced legislation in the late fall of 2006 seeking to clarify MEDEP's authority regarding OWB regulations. Subsequent emergency legislation, effective June 27, 2007, requires the MEDEP to phase in emission standards for OWBs such that by April 1,

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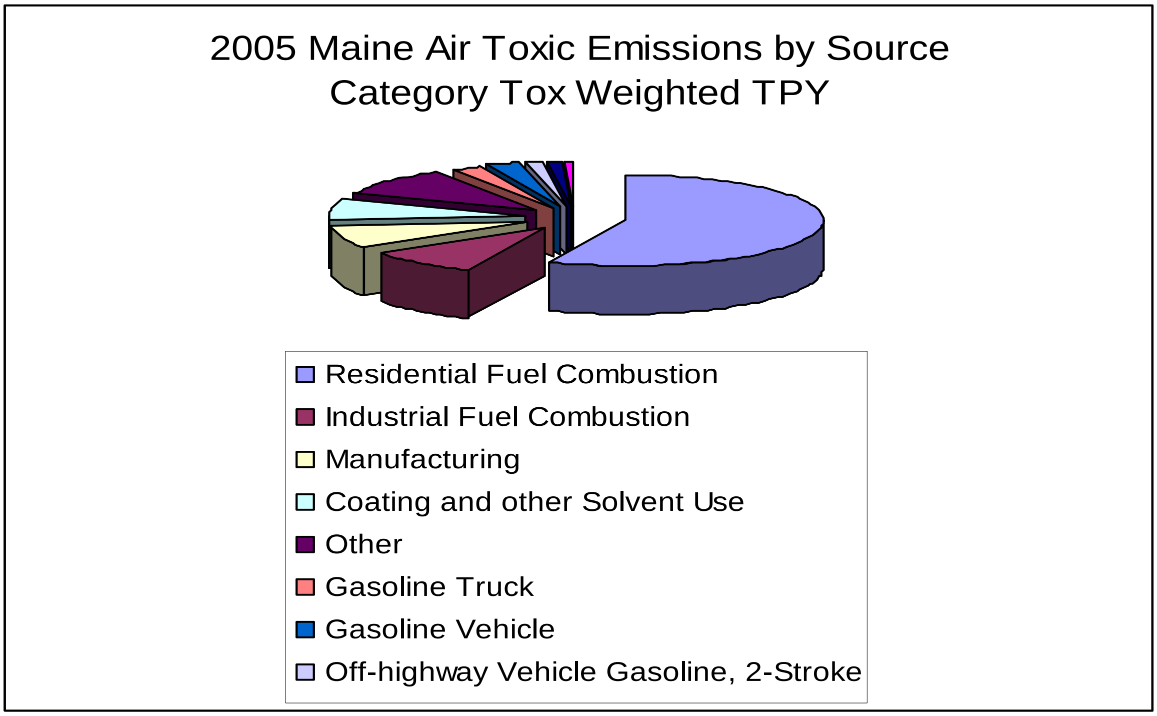
[8] Pistell, Ann, *Maine School Environmental Guide*, (Maine DEP, 17 SHS, Augusta, Maine, 04333-0017, http://www.maine.gov/dep/mercury/school.htm), May 2006.

2010 all OWBs sold in Maine must meet indoor stove standards. The new law also directs the Department to establish by rule a nuisance standard for the some 2000-3000 existing OWBs that do not meet indoor stove standards. The Board of Environmental Protection held a hearing on proposed OWB rules[9] on August 16, 2007, with the intention of promulgating a rule in October of 2007.

Figure 4: Maine 2005 Air Toxics Inventory by Source Category (Toxicity-Weighted)



5. ATAC'S RECOMMENDED "NO OR LOW COST" REDUCTION STRATEGIES FOR AIR TOXICS

On June 26, 2007 the three subcommittees presented their findings and recommendations for Maine's Strategic Air Toxics Strategy to the ATAC. The ATAC discussed the subcommittee findings and then developed the following consensus recommendations. The Commissioner of the Maine Department of Environmental Protection at the meeting committed to heavily weighting these consensus recommendations as the Department develops the State's Air Toxics Strategy. More details on the basis for the following recommendations can be found in the individual subcommittee reports, which are included in:

- Attachment 2: Stationary Sources Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007
- Attachment 3: Mobile Sources Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007;
- Attachment 4: Science Advisory Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007; and
- Attachment 6: Additional Science Advisory and Stationary Sources Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007.

[9] More details on the MEDEP's proposed OWB rules are available on the Air Bureau's Proposed Rules website at: http://www.maine.gov/dep/air/regulations/proposed.htm.

5.1 Stationary Source Reductions

The ATAC's recommendations for "low or no cost" air toxics reduction strategies from stationary sources are included in this section. Stationary sources as used in this section include both large point sources, as well as the smaller stationary sources, which are often called "area sources".

5.1.1 Energy Efficiency Programs

Most air toxic emissions in Maine are combustion by-products. Given the effectiveness of existing and pending emission control programs applicable to stationary sources in Maine, the ATAC finds that the only low or no cost air toxics reduction alternative addressing combustion by-products is to reduce the amount of fuel burned. Therefore, the ATAC recommends that MEDEP foster energy conservation programs for all stationary sources through a two-step approach:

1. MEDEP should promote energy conservation efforts for all stationary sources, where it is practical and has a low cost or results in a net savings; and

2. MEDEP should collaborate with EPA and others to help sources conserve energy. MEDEP should establish a forum of interested stakeholders to determine the information and support most needed by energy users to overcome barriers to energy conservation projects.

5.1.2 Reduce Pollutant Releases from Residential Wood Combustion

The Maine DEP and Science Advisory Subcommittee developed a revised air toxics inventory at the same time that the Stationary and Mobile Subcommittees were evaluating air toxic reduction options. MEDEP did not complete this revised inventory until June 21, 2007. The revised inventory included a significant increase in the estimated air toxic releases from residential wood combustion for the most recent inventory year, 2005. Since this information was not available until late in the process, the Stationary Sources Subcommittee did not conduct a detailed evaluation of reduction alternatives for this source category.

There is some uncertainty associated with the MEDEP's emissions inventory for residential wood combustion. However, due to the high potential risk from this source category, concurrent with refining the inventory, the ATAC recommends that the MEDEP explore low-cost or no-cost reduction alternatives for air toxics from Residential Wood Combustion. Since this source category is also a relatively large source of some criteria air pollutants, but can be low in terms of net green house gas emissions, this evaluation should be done on a multi-pollutant basis. DEP should consult stakeholders as it evaluates low-cost/no-cost alternatives, preferably through existing stakeholder groups working on green house gas reductions. Alternatives that MEDEP should consider include:

1. Education and outreach on proper stove use, maintenance, and the fuel savings achievable with the lower emitting stoves;

2. Woodstove change-out programs that promote use of cleaner existing home heating technologies, including how tax incentives could be used to foster change-outs;

3. Promotion of new home-heating technologies based on cleaner burning fuels that are derived from wood or other renewable resources.

4. Development of Outdoor Wood Boiler regulations, as discussed in section 4.2 on page 7.

5.2 Mobile Source Reductions:

The following ATAC recommendations for mobile sources air toxics reduction strategies in most cases will save money, in addition to reducing air toxic emissions.

5.2.1 Expand On-board Diagnostics Statewide

The state can achieve the greatest mobile source air toxics reductions for a low cost by expanding the Cumberland County On-board Diagnostics (OBD) program statewide. On-board Diagnostics refers to a computer-based system available in 1996 and newer light-duty vehicles that alerts owners to emission control problems. Prompt response to warning lights can prevent more costly repairs, save fuel, reduce wear and tear on the engine, and reduce pollution. The ATAC believes that the estimated cost of expanding OBD ($86/toxicity-weighted ton) is reasonable given the estimated reductions from this strategy (35,600 TW-Tons / year). Therefore, the ATAC is recommending that the Commissioner adopt this "low-cost" option.

5.2.2 Reduce VMT and Increase Vehicle Occupancy

The benefits predicted from the existing and pending mobile regulations diminish if Vehicle Miles Traveled (VMT) increases beyond predictions. Therefore, the ATAC explored several strategies aimed at reducing VMT, including changes to land use policy. A 10% reduction in commuter vehicle traffic would reduce air toxic emissions by some 17,800 toxicity-weighted tons per year (TW-Tons/yr), with a net fuel savings worth $681 million per year. Important strategies that reduce VMT and increase vehicle occupancy from the light-duty gas vehicle category include the following, in the order of the greatest potential for air toxics emissions reductions:

5.2.2.1 Promote Transit Oriented Development

Transit Oriented Development (TOD) is a strategy that promotes mixed use development around transportation stops which in turn reduces VMT and associated air pollution, promotes physical activity, and preserves open spaces. To ensure the highest benefit of TOD, Maine must make commensurate investments in new and improved transit infrastructure to serve and connect higher density, mixed use developments. Maine DOT will be undertaking a refined study of the possibility of implementing TOD in the state of Maine in cooperation with University of Southern Maine, MEDEP, State Planning Office, public transit operators, regional planning agencies and local governments. This study will give decision-makers concrete data about the benefits of implementing TOD in their cities, towns and regions.

5.2.2.2 Promote Targeted Infrastructure Funding

Targeted infrastructure funding is a strategy that encourages existing infrastructure funding programs to consider VMT reduction when awarding bids. The added VMT criterion often shifts resources towards repairing existing infrastructure rather than greenfield development.

5.2.2.3 Expand Public Transit

The ATAC recommends expanding public transit enough to reduce commuter vehicle miles traveled by 5%. While reducing air toxic emissions by 9,000 TW-tons/yr, this will result in a net savings of an estimated $220 million. Due to Maine's low population density, the state must carefully evaluate the locations where expanding public transit will be the most effective.

5.2.2.4 Promote Telecommuting

This option would evaluate and promote workplace policies allowing employees to work at home. It has been successful at some large corporations, and EPA has a model "Best Work Places for Commuters".

5.2.2.5 Increase Carpool Parking Lots

Doubling the number of spaces available in current carpool lots from 2000 to 4000 would achieve a reduction of at least 183 TW-Tons/yr of air toxics, at a net savings of $21 per TW-Ton. However, success is dependent on siting new carpool lots in the most congested areas of the state. Maine DOT should focus on leasing developed lots that have unused capacity during peak commuting hours, such as shopping malls.

5.2.3 Reduce Unnecessary Idling and Fuel Consumption

The ATAC estimates that reducing unnecessary idling by 50% would reduce AT emissions by about 3,000 TW-Tons/yr, while saving about $36 million worth of fuel. Coupling this with education on driving habits that save fuel could reduce emissions by about 11,700 TW-tons/yr, while increasing fuel savings to $108 million per year. The ATAC's first phase of a no-idling campaign in Maine should focus on education and outreach, followed by adoption of a no-idling regulation.

5.2.3.1 Phase I: Voluntary No-idling Campaign Coupled with Driver Education:

DEP should continue to support local community efforts with training and materials for a no idling campaign. Additionally MEDEP should promote supplemental driver education extolling the benefits of not idling and fuel savings techniques. Most of the education and outreach materials necessary for this option have already been developed and tested.

5.2.3.2 Phase II: Adopt Statewide No-idling Regulations

While being more costly to implement and enforce than a voluntary program, the ultimate air toxics reductions and fuel savings from a mandatory program could be more than three times greater. Maine should adopt a no-idling law consistent with the laws that are in place in all the other New England States, which target all transportation sectors and vehicle categories. MEDEP should take advantage of the opportunity for presenting a no-idling regulation to the legislature next session.

5.3 Continue Scientific Investigations into the Impacts of Air Toxics in Maine

The ATAC finds that additional collection and review of air toxics data is needed to effectively protect public health. Maine DEP's air toxic strategy should therefore include the following components.

5.3.1 Improve Residential Wood Combustion Emissions Inventory

Since residential wood combustion has emerged as such a large risk driver in the state, the ATAC recommends that the MEDEP continue to refine the emissions inventory of Residential Wood Combustion. To reduce uncertainty associated with activity data, MEDEP should undertake additional surveys to determine the amount of wood burned for residential heating in Maine. The survey should be similar to the survey MEDEP conducted for the 2005 heating season. Additionally, MEDEP should encourage EPA to develop a complete set of accurate emission factors for this important source category.

5.3.2 Conduct Further Hot-spot Analysis

MEDEP should first focus on identifying hot-spots stemming from emissions from point and area sources, with the primary focus on combustion by-products. MEDEP must first assess available emissions, modeling, and ambient air data, including information that might be available from green house gas and Criteria Air Pollutant programs. The MEDEP will then need to identify information gaps, and fill those gaps by gathering new information, which may include modeling and monitoring. Once MEDEP has identified the mobile and stationary hot-spot areas, it should evaluate the potential risk attributed to air toxics. In this evaluation, the MEDEP should consider cumulative exposure to multiple air toxics with an emphasis on combustion by-products, bioaccumulation, transport/background concentrations, and environmental persistence of air toxics.

5.3.3 Shift Risk Assessment Resources into Energy Efficiency Evaluations

While the protocols now exist for risk assessment, as spelled out in EPA's Air Toxics Risk Assessment Reference Library[10], conducting detailed risk assessment on the vast majority of stationary sources in the state is not a prudent use of resources. Rather, the ATAC recommends that risk assessments be focused on hot-spots (see section 5.3.2 above), and that the resource savings from not conducting risk assessments at all major stationary sources be channeled into energy efficiency evaluations and improvements (see section 5.1.1 on page 9).

5.3.4 Assess Adoption of Reformulated Gas (RFG)

Based on the current estimated cost of RFG (approx $1,800 per TW-ton), and the fact that EPA's recently promulgated Mobile Source Air Toxics phase 2 rule will achieve substantial air toxic reduction benefits in 2011, the ATAC is not recommending

[10] See EPA's Website at: http://www.epa.gov/ttn/fera/risk_atra_main.html

adoption of RFG at this time. However, benzene levels in Maine's fuel have increased within the past year and DEP should reconsider adoption of RFG if this trend continues. Additionally, given this option's high potential for air toxic reductions (some 14,000 TW-Tons/yr), this strategy should be reconsidered if additional air toxics emission reductions are necessary to reach Ambient Air Guidelines. Further, the economics of this alternative are likely to change as technology improves and if Maine begins producing ethanol. MEDEP should continue its analysis of the RFG option as part of its routine data collection and analysis programs.

5.3.5 Adjustments to the Air Toxics Priority List

The Air Toxics Priority List (Table 2 on page 4) will need to be continually evaluated as air toxic reductions are implemented and new information comes to light. For example, several changes were made to the list during the phase II MATI investigation. The toxicity-factor adjustments (section 3.1.2, beginning on page 4) changed the toxicity-weighted inventory significantly, necessitating changes to the order on the ATPL: the toxicity-weighted emissions of cobalt increased above those of other priority air toxics, so was added to the ATPL, while the toxicity factors for chlorine compounds, hydrochloric acid, and cyanide compounds were decreased, so these pollutants were removed from the ATPL. Also, while undertaking inventory revisions, 2, 4 toluene diisocyanate (2,4 TDI), was found to no longer be emitted in significant quantities from the graphic arts industry or the point source sector, so that virtually zero 2,4 TDI is emitted in the state. Therefore, this pollutant was also dropped from the Air Toxics Priority List (ATPL).

5.3.6 Other Ongoing Activities

There are several other ongoing activities at MEDEP that should continue. Specifically, Maine DEP should:

- continue to improve the transparency, accuracy and reproducibility of the air toxics emissions inventory; and
- continue to improve its air monitoring program for air toxics

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Attachment 1: Maine Air Toxics Advisory Committee Members

ATAC Role	Org Type	Name - First	Name - Last	Title	Affiliation
Primary Contact	Government - Fed	Bill	Gawley	Data Manager	Acadia National Park
Primary Contact	NGO-Health	Norm	Anderson	Environmental Health Scientist	American Lung Association of Maine
Primary Contact	Government - Local	Don	Craig	Director	Androscoggin Transportation Regional Council
Primary Contact	Industry	Bill	Parker	Environmental Manager	Boralex - Wood Power Electrical Generation
Primary Contact	Gen-Citizen	Myra	Karstadt	Toxicologist - EPA RTR	Citizen
Primary Contact	Gen-Citizen	Jenna	Shue	Citizen	Citizen
Primary Contact	Government - local	Brian	Phinney	Environmental Compliance Officer	City of Biddeford
Primary Contact	NGO-Health	Donna J.	Dion	Representative	Coastal Healthy Communities Coalition
Primary Contact	Consultant-Industry	David	Dixon	Consultant	Dirigo Environmental Consultants / Maine Chamber of Commerce
Primary Contact	NGO-Env	Michael	Belliveau	Executive Director	Environmental Health Strategy Center
Primary Contact	Industry	Al	Wiley	Director, Business & Regulatory Affairs NE Region	FPL Energy
Primary Contact	Industry	Scott	Belanger	Senior Principle Environmental, Health & Safety Specialist	General Dynamics - Armament Systems
Primary Contact	Facilitator	Jonathan	Reitman	Facilitator	Gosline & Reitman
Primary Contact	Government - Local	Steven	Linnell	Senior Transportation Planner	Greater Portland Council of Governments
Primary Contact	Trade Org	Dave	Wilby		Independent Energy Producers
Primary Contact	NGO-Energy	Pamela	Person	Representative	Bucksport Bay Healthy Community Coalition
Primary Contact	Trade Org	Tom	Brown	Executive Director	Maine Automobile Dealers Assoc. Inc.
Primary Contact	NGO-Env	Will	Everitt	Lead Contact	Maine Branch of the Toxics Action Center
Primary Contact	Trade Org	Kristine	Ossenfort	Senior Governmental Affairs Specialist	Maine Chamber of Commerce
Primary Contact	Government - State	David	Littell	Commissioner	Maine DEP
Primary Contact	Government - State	David	Wright	Air Toxics Coordinator	Maine DEP, Air Toxics Program, BAQ
Primary Contact	Government - State	James	Brooks	Bureau Director	Maine DEP, BAQ
Primary Contact	Government - State	Suzann	Watson	Program Director,	Maine DEP, Office of Innovation and Assistance, OC
Primary Contact	Government - State	Abel	Russ	Toxicologist	Maine DHHS - CDC

ATAC Role	Org Type	Name - First	Name - Last	Title	Affiliation
Primary Contact	Government - State	Andrew	Smith	Director of Environmental Health Unit	Maine DHHS - CDC
Primary Contact	Government - State	Nate	Howard	Transportation Planning Specialist	Maine DOT - Bureau of Planning
Primary Contact	Government - State	Anna	Price	Transportation Planning Specialist	Maine DOT – Office of Passenger Transportation
Primary Contact	Government - State	Steven	Greenlaw	Transportation Planning Analyst	Maine DOT – Office of Passenger Transportation
Primary Contact	Industry	Jim	Secunde	Environmental Manager	Maine Energy Recovery Corporation
Primary Contact	Trade Org	Michael	Barden	Director of Environmental Affairs	Maine Pulp & Paper Association
Primary Contact	Government - State	John	Martin	Senate Chair- Natural Resources Committee	Maine Senate
Primary Contact	Trade Org	Bob	Meyers	President	Maine Snowmobile Assoc.
Primary Contact	Educational	Jonathan	Rubin	Interim Director	Margaret Chase Smith Policy Center
Primary Contact	Consultant-Indust	Karen	Morrison	Co-President	Morrison Environmental Engineering
Primary Contact	NGO-Env	Matt	Prindiville	Toxics Project Director	Natural Resources Council of Maine
Primary Contact	Trade Org	John	Quinn	Executive Director	Massachusetts Petroleum Council
Primary Contact	Industry	Mike	Sinclair	Environmental Engineer	NewPage
Primary Contact	Government - Tribal	Marvin	Cling	Tribal Air Quality Program	Passamaquoddy of Pleasant Point (Sipayik)
Primary Contact	Industry	Carlo	White	Technical Manager	Penobscot Energy Recovery Co
Primary Contact	Government - Tribal	Eric	Nicolar	Asst. Air Quality Manager	Penobscot Indian Nation
Primary Contact	NGO-Health	Melissa	Boyd	Executive Director	Physicians for Social Responsibility, Maine Chapter
Primary Contact	Consultant-Indust	Dixon	Pike		Pierce-Atwood
Primary Contact	Consultant-Indust	Pattie	Aho		Pierce-Atwood consulting / American Petroleum Institute
Primary Contact	NGO-Health	Bill	Hine	Board of Directors	River Valley Healthy Communities Coalition
Primary Contact	Educational	Mary	Davis	Professor of Resource Economics and Policy	University of Maine at Orono
Primary Contact	Government - Fed	Bob	Judge	Mobile Sources Coordinator	USEPA - Region I
Primary Contact	Government - Fed	Susan	Lancey	Air Toxics Coordinator	USEPA - Region I
Primary Contact	Consultant-Indust	Samuel	Zaitlin	Environmental Consultant	
Technical Resource	Trade Org	Patrick	Gwinn	MPPA-Risk Assessment	AMEC c/o MPPA
Technical Resource	Industry	Dan	Horton	Advisor Downstream Health & Environment	ExxonMobil Refining & Supply Co.
Technical Resource	Government - State	Jeff	Emery	Air Monitoring Specialist	Maine DEP - Air Monitoring Prog

ATAC Role	Org Type	Name - First	Name - Last	Title	Affiliation
Technical Resource	Government - State	Andy	Johnson	Air Monitoring Specialist	Maine DEP - Air Monitoring Prog
Technical Resource	Government - State	Ron	Severance	Division Director Program Planning	Maine DEP- BAQ
Technical Resource	Government - State	Tammy	Gould	Emissions Inventory	Maine DEP, Air Inventory Program, BAQ
Technical Resource	Government - State	Rich	Greves	Environmental Specialist	Maine DEP, Air Toxics Program, BAQ
Technical Resource	Government - State	Lynne	Cayting	Mobile Sources Section Chief	Maine DEP, BAQ
Technical Resource	Government - State	Tom	Downs	Chief Meteorologist	Maine DEP, BAQ
Technical Resource	Government - State	Lisa	Higgins	Emission Engineer	Maine DEP, BAQ
Technical Resource	Government - State	Kevin	Ostrowski	Meteorologist	Maine DEP, BAQ
Technical Resource	Government - State	Mark	Roberts	Licensing Engineer	Maine DEP, BAQ
Technical Resource	Government - State	Jon	Voisine	Licensing Engineer	Maine DEP, BAQ
Technical Resource	Government - State	Ginger	Jordan-Hillier	Special Program	Maine DEP, Commissioner's Office
Technical Resource	Government - State	Julie	Churchill	Assistant Program Director,	Maine DEP, Office of Innovation and Assistance, OC
Technical Resource	Government - State	Ron	Dyer	Program Director	Maine DEP, Office of Innovation and Assistance, OC
Technical Resource	Government - State	Marc	Cone	Air Licensing Section Chief	Maine DEP-Air Licensing
Technical Resource	Government - State	Jeff	Crawford	Air Quality Planning Division	Maine DEP-Air Rules & outreach
Technical Resource	Government - State	Eric	Frohmberg	Toxicologist	Maine DHHS - CDC

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Attachment 2: Stationary Sources Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007

Recommendations for Air Toxic Reductions from Stationary Sources

Revision of June 19, 2007

The Stationary Source Subcommittee was convened in January 2006 with the purpose of exploring short- and long-term reduction strategies for Hazardous Air Pollutants (HAPs) from stationary sources, focusing on ways to reduce the most risk for the least cost. Additionally, the full ATAC directed the subcommittee to limit its recommendations to low-cost or no-cost alternatives. The strategies employed by the Subcommittee included evaluating the potential effects of new and pending federal and state regulations on HAPs, and the potential for HAP reduction through energy conservation programs at stationary sources. This subcommittee, in conjunction with the Science Advisory Committee, also explored the impacts of the rising number of Outdoor Wood Boilers (OWB) on air quality. As ATAC has identified Acrolein as an air toxic of some concern in Maine, this subcommittee has compiled stack testing results and projected dates of other stack testing being conducted on many large wood-fired boilers throughout the state (Appendix A). Combined with analysis from the other subcommittees and recent ambient air testing, this will allow ATAC to better understand the impact of Acrolein on Maine's air quality. The results of our approach are further outlined below.

<u>New and Pending Air Rules</u>

This subcommittee has evaluated the potential reduction in air toxics that could be expected from pending regulation of industrial coatings, household products, industrial boilers, plywood manufacturing, waste-to-energy facilities, electric generating units, and other stationary combustion and non-combustion sources.

New rules that will require the reformulation of household products and industrial coatings will reduce emissions of some hazardous volatile organic compounds, many of which are carcinogens. However, in order for some of these products to maintain their effectiveness, alternative chemicals containing other (albeit less toxic) HAPs may need to be used in the new formulations; negating the overall HAP reduction. The Industrial Boiler MACT (Maximum Achievable Control Technology) and the Clean Air Mercury rule will result in improved facility HAP emission estimates yielding a more accurate state HAP inventory. However, due to the level of control currently applied at facilities affected by these rules, neither will achieve much in the way of HAP reductions. The plywood MACT may result in HAP reductions since both major facilities in this sector are planning upgrades to their process equipment and boilers to meet the requirements of the plywood MACT. This past spring, EPA requested that the emissions standards and the compliance dates in the Industrial Boiler MACT and the Plywood MACT be vacated. This was based on the premise that the process used to develop these MACTs as used to develop the recently vacated Brick MACT. On June 8^{th}, the court issued an opinion to vacate the Industrial Boiler MACT rule <u>in its entirety</u>. The Boiler MACT will remain in effect until the court issues a mandate. In the meantime, the Plywood MACT has *not* been vacated and remains in place. EPA is still waiting to hear a decision from the court on this MACT and expects to hear back later this summer New federal waste-to-energy regulations have been put in place, but as Maine's regulations for these facilities were more stringent than the federal regulations, few changes need to be made.

As a result, the effect of new and pending regulation for these industrial sectors will provide some HAP reductions and better HAP emissions data due to increased monitoring and recordkeeping, but may have little impact on the overall HAP emission picture in the state.

Outdoor Wood Boilers

As sales of Outdoor Wood Boilers (OWBs) increased, so have the air quality complaints received by the DEP from Maine citizens. This subcommittee, in conjunction with the Science Advisory Subcommittee, researched the positions of other state and federal authorities as well as the American Lung Association and various manufacturers of OWBs. The subcommittees recommended an early action on OWBs, which the full ATAC subsequently approved. The position of the ATAC, that OWBs should be subject to immediate regulation to protect the heath and welfare of Maine citizens, was forwarded to the Commissioner in December of 2006. The results of this research and the opinion of this subcommittee have been outlined in the attached Position Paper (Hyperlink to Appendix B) which also includes recommendations that should be included in an OWB rule. The Joint Standing Committee on Natural Resources received a copy of the position paper on May 8. The committee reviewed various bills pertaining to OWBs (LD 128-5/16 dead, LD 1551-5/16 dead, & LD 1824- 5/8 voted OTP with amendments).

Low Sulfur Heating Oil

The Mobil Source Subcommittee forwarded to this subcommittee an option of using low sulfur heating oil to reduce HAP emissions, specifically sulfuric acid and other HAPs in particulate form. However, a new state regulation mandating the use of low sulfur fuel oil for both on and off-road mobile applications will be implemented by 2013. The subcommittee did not reach consensus on a recommendation for the use of low sulfur heating fuel as a short-term strategy at stationary sources due to short-term cost implications however this option remains a viable long-term HAP reduction strategy for this sector.

Energy Conservation

The subcommittee is exploring the HAP reduction potentials from energy conservation projects. A survey was conducted of several large industrial facilities in the state asking them to outline any energy conservation projects they have undertaken in recent years and the energy benefits (power, fuel, reduced waste) that they have seen as a result. Appendix C displays the results of this survey and the energy benefits the facilities have seen. The reduction in fuel and power usage has a direct and positive effect on the HAPs associated with fuel burning and power generation. In addition, the facilities have seen economic benefits from the reduced fuel and power consumption. The EPA has made this subcommittee aware of energy conservation seminars currently being conducted in other states. Similar seminars have been held in Maine for sources. Therefore, based on this information, the subcommittee makes the following recommendations.

1. The subcommittee recommends that the full ATAC's HAP reduction plan include the DEP promoting energy conservation efforts for all stationary sources, where it is practical and has a low cost or results in a net savings.
2. The subcommittee recommends that Maine DEP, EPA and others work together to help sources conserve energy by establishing a forum of interested stakeholders to determine the information and support most needed by the regulated community to get energy conservation projects implemented.

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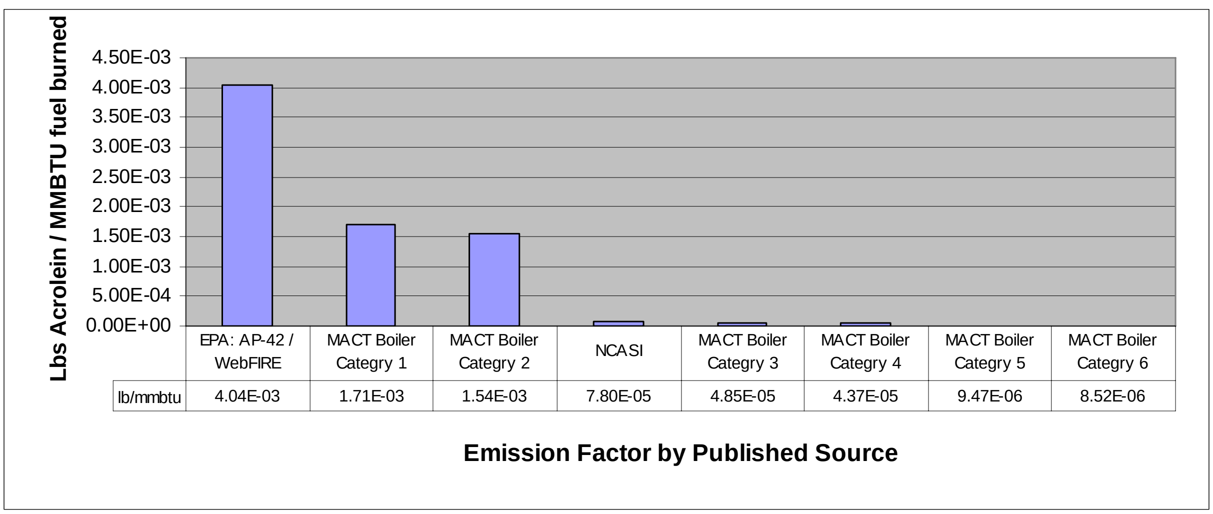
SSS-Appendix I : Acrolein Stack Test Data from Large Maine Wood Boilers
(Revised July 31, 2007)

Table 3: Acrolein Stack Testing Summary for Maine Facilities

Facility	Date Tested or Scheduled	Test Method	Results ppm @ 12% CO_2	Results lb/hr	Results lb/MMBtu
Domtar	Jun-06	CARB 430M	<2.07 E-2	<2.33 E-2	<1.45 E-4
Boralex Stratton	Jul-06	CARB 430M	<2.00E-4	<4.00 E-4	-<3.31E-07
Boralex Stratton	Nov-06	CARB 430M	<6.41 E-4	<1.03 E-3	<9.86 E-7
Boralex Livermore Falls	May-06	CARB 430M	<9.00E-04	<5.30E-03	<1.41E-06
Boralex Livermore Falls	Nov-06	CARB 430M	<2.46 E-7	<2.16 E-4	<2.46 E-7
MERC**	Aug-06	EPA-OO30	-	<1.61 E-3	-
Greenville Steam	Dec-06	-	-	1.36 E-2	6.02 E-5
SAPPI Somerset	May-07				
Lincoln P&T	Jul-07				
Boralex Ashland	Jun-07		<0.0003	<0.0003	<3.6 E-7
Huber	Jun-07		<0.0223	<0.004	
Indeck Jonesboro	Jun-07		<0.02	<0.01 lb/hr	
Indeck West Enfield			0.023	0.013	
PERC**	Sept-07				
** Note: Facility Burns Municipal Solid Waste rather than wood					

Figure 5: Chart of Published Emission Factors for Acrolein from Wood Fired Boilers
(From11)



[11] Derived from Maine DEP, **Acrolein: Air Quality Science and Policy Issues - Working Draft for Public Comment** (Document number DEPAQ35 A2007, DEP-Air Bureau, 17 SHS, Augusta, ME 04333-0017) December 4, 2006

Table 4: Acrolein Emission Factors for MACT Boiler Categories based on Control Equipment and Fuels
(From12)

	Material Burned		
Control Equipment	Wood	Wood/Other Biomass	Gas/Wood/Other Biomass
Cyclone/Venturi/Packed	1.54E-03	8.52E-06	4.37E-05
ESP/Wet Scrubber	1.54E-03	8.52E-06	4.37E-05
Fabric Filter (FF)	1.54E-03	8.52E-06	4.37E-05
FF/FSI		8.52E-06	
FF/Wet Scrubber		8.52E-06	4.37E-05
Wet Scrubber	1.54E-03	8.52E-06	4.37E-05
Cyclone	1.71E-03	9.47E-06	4.85E-05
Electro Static Precipitator (ESP)	1.71E-03	9.47E-06	4.85E-05
No Control	1.71E-03	9.47E-06	4.85E-05
Other	1.71E-03		

[12]The “Boiler MACT” is the term used to describe the "National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters”. This rule was promulgated by EPA on September 13, 2004 under Section 112 (c)(2) of the Clean Air Act. Data in the table is derived from: MEMORANDUM TO: Jim Eddinger, U.S. Environmental Protection Agency, OAQPS (C439-01) FROM: Christy Burlew and Roy Oommen, Eastern Research Group (ERG), Morrisville DATE: October, 2002 SUBJECT: Development of Average Emission Factors and Baseline Emission Estimates for the Industrial, Commercial, and Institutional Boilers and Process Heaters National Emission Standard for Hazardous Air Pollutants (http://www.epa.gov/ttn/atw/combust/boiler/baselineemissionfactor.pdf).

SSS Appendix II: Position Paper on Outdoor Wood Boilers (OWBs)
(Revised December 12, 2006)

Air Toxics Advisory Committee
Position Paper on Outdoor Wood Boilers (OWBs)

Position Summary

The Air Toxics Advisory Committee (ATAC) joins the American Lung Association and several states in a call for meaningful regulation of outdoor wood boilers (OWBs) or in the absence of regulation, a moratorium on the sale of these units until such time as emission standards are established that meet or exceed particulate matter standards established under 40 CFR 60 Subpart AAA-*Standards of Performance for New Residential Wood Heaters* or a manufacturer demonstrates to the satisfaction of the Maine Department of Environmental Protection, the ability to meet or exceed particulate matter standards established under 40 CFR 60 Subpart AAA.

OWBs emit significant levels of air toxic compounds, particulate matter, volatile organic compounds, and other pollutants. Many of these pollutants are emitted in excessive quantities compared to other forms of residential combustion. The growing popularity of these units may have a significant detrimental impact on Maine's air quality and more importantly, because of their location near homes and poor dispersion characteristics, the most sensitive members of Maine's population may be at greatest risk. The American Lung Association of Maine (2006) considers OWBs to be "an emerging health threat" and "strongly cautions against the use of outdoor wood boilers for residential heating purposes." ATAC has reached the same conclusions and urges the Maine Department of Environmental Protection to review and implement the recommendations presented. Furthermore, it is important to take action now to prevent air quality problems associated with OWBs from expanding as demand for OWBs increases.

Background

What is an outdoor wood boiler (OWB)?

A typical OWB is used as an alternative home or commercial heating source for such items as domestic hot water, forced hot water heating, and pool heaters. An OWB consists of a small metal shed within which is a firebox designed for the combustion of wood. The firebox is surrounded by a water jacket. The combustion of wood heats the water within the water jacket. A thermostat regulates the circulation of heated water through underground piping to the home, pool, or other source on a demand basis, meaning that damper cycles open and closed to modulate heat requirements. Smoke is typically directed through a short stack (chimney) extending a few feet above the roof of the shed. An owner generally loads the firebox once or twice a day. The OWB thermostat cycles the damper on and off throughout the day to maintain the desired water temperature.

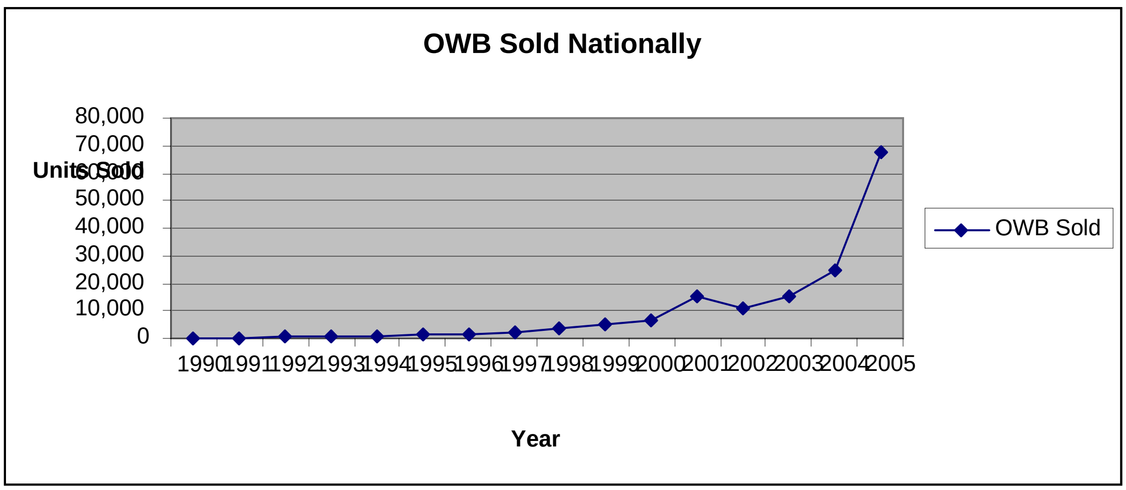
Why is ATAC involved with the review of OWBs?

ATAC is in the process of evaluating a number of source categories through subcommittees as part of Phase II of the Maine Air Toxics Initiative. This review includes the development of both short and long-term recommendations for assessing, evaluating, and if necessary reducing air toxics in Maine. Wood smoke contains particulate matter, volatile organic compounds, polycyclic organic matter (POM), polycyclic aromatic hydrocarbons (PAH), and other hazardous components. The health effects of these compounds are well documented and include cancer, respiratory illness, arteriosclerosis, and asthma to name a few.

The Stationary Source Subcommittee (SSS) found that OWBs represent a source category not specifically included in the Phase I MATI inventory because the national and state inventories relied upon to create the MATI Priority List did not include OWBs. However, the Phase II evaluation indicates that OWBs represent a significant concern because of their emission characteristics and the growing popularity of these units.

Figure 1 shows the national trend in sales of OWB since 1990 (NESCAUM, 2006a). It is estimated that the number of OWB sold in Maine since 1990 is 1,968 (NESCAUM, 2006b).

Figure 1. – OWB Sales Trends



If the growth rate remains constant at the 2004 – 2005 pace, the total number of OWBs in Maine in 2010 would be 6,228. However, if the growth rate continues to increase exponentially over the period the total number of OWBs would be as much as ten times higher.

Why are OWBs an emerging concern?

Simply put, OWBs release far more emissions than other forms of combustion used in residential heating. Moreover, due to their growing popularity among homeowners these units release emissions in residential areas where children, those with compromised immune systems, and the elderly live, potentially impacting the most sensitive members of Maine's population. The characteristically short stack contributes to the problem by limiting dispersion of pollutants.

Why do these units pose a greater threat than woodstoves or fireplaces?

The design of OWBs promotes low temperature/low oxygen smoldering combustion. The water jacket keeps the combustion chamber below 1,000 degrees (Woodheat.org, n.d.). This low temperature burn and reduced oxygen environment results in incomplete combustion. As the system cycles to maintain heat load requirements, the combustion gases and particulate matter are discharged to the atmosphere through a smoke stack. The pollutant load is considerably higher for OWBs than woodstoves or fireplaces due to these poor combustion design characteristics. The characteristically short stack reduces dispersion of the high pollutant load unlike an in-home fireplace or woodstove where the emissions are released above the height of the home. Most complaints from residents living adjacent to an OWB involve nuisance complaints about excessive smoke. Complaints filed with the Bureau of Air Quality have increased dramatically in 2005 and 2006. Table 1 provides a brief summary of officially logged and investigated complaints.

The complaints confirm the "smoky" nature of these units and while the majority of complaints address smoke, residents may not be aware of the significant health effects associated with wood smoke, seeing OWBs as simply a local nuisance. "Wood smoke contains many organic compounds known to cause cancer (such as benzopyrenes, dibenzoanthracines, and dibenzocarbazoles), and other toxic compounds (such as aldehydes, phenols, or cresols)" (Washington State Department of Ecology, 1997b).

This in itself is a significant concern. The Washington State Department of Ecology (1997a) reports that the size of particulate matter in wood smoke is "so small that it is not stopped by closed doors and windows, and often seeps into neighbors' houses."

This characteristic of wood smoke is a major concern for sensitive populations such as children, the elderly, and individuals with asthma and other health conditions. The Connecticut Department of Environmental Protection (2005a) compared particulate matter (PM) emissions from EPA certified woodstoves and OWBs with homes heated with natural gas and determined that an EPA certified woodstove produces the same amount of PM as 2,000 homes heated with natural gas. However, the study also found that a home heated with an OWB may produce as much PM as 3,000 to 8,000 homes heated with natural gas. It should be clear that a small increase in the number of OWBs could significantly undermine emission reduction efforts associated with residential wood combustion.

Table 1- Complaints Related to Outdoor Wood Boilers

Date	*Municipality*	*Nature of Complaint* - *Notes*
02/27/04	Gorham	Smoke-nuisance
01/03/05	Machias	Smoke/visible emissions
04/06/05	Searsmont	Multiple complaints (commercial installation)
04/12/05	Searsmont	Original complaint dates back to 3/13/02

Date	*Municipality*	*Nature of Complaint - Notes*
06/18/98 -06/17/05	West Rockport	Smoke-nuisance (commercial installation)
06/20/05	Rockport	Smoke – nuisance, multiple complaints
06/22/05	Mapleton	Smoke sets off smoke alarm in neighbors house
08/04/05	Bangor	Smoke – nuisance
09/15/05	Hampden	Smoke – nuisance
10/21/05	Kingfield	Multiple complaints
10/31/05	Kingfield	Multiple complaints
11/10/05	Whitefield	Burning trash in OWB; multiple complaints
11/29/05	Presque Isle	Multiple complaints; installing propane secondary burner
12/20/05	Wells	Smoke – nuisance
12/21/05	Wells	Smoke-nuisance (commercial installation)
2005	Eddington	Smoke-nuisance
Winter 05-06	Gorham	Smoke-nuisance
01/03/06	Benton	Smoke – nuisance
01/03/06	Machias	Smoke-nuisance
01/10/06	Benton	Smoke-nuisance
02/06/06	Sanford	Smoke-nuisance (commercial installation)
02/14/06	South Berwick	Smoke-nuisance
02/15/06	So. Berwick	Burning treated wood and other waste, town gets 3 calls/week
02/21/06	Saco	Smoke-nuisance
02/28/06	Presque Isle	Smoke – nuisance
02/28/06	Quimby	Smoke-nuisance
03/10/06	Eddington	Smoke – nuisance
03/13/06	Auburn	Numerous complaints; installing propane burner
03/20/06	Presque Isle	Smoke-nuisance
03/31/06	Searsmont	Multiple complaints (commercial installation)
04/10/06	Beals Island	Alleged aggravation of bronchitis
04/28/06	Greenville	Smoke sets off smoke alarm in neighbors house
05/01/06	South Portland	Smoke - nuisance
05/01/06	Greenville	Smoke-nuisance (commercial installation)
05/15/06	Eddington	Multiple complaints
05/15/06	Edgecomb	Smoke-nuisance
06/22/06	Mapleton	Smoke-nuisance
01/26/06	Saco	Smoke – Offensive odor
08/17/06	Bowdoinham	Smoke-nuisance (commercial installation)
09/07/06	Belmont	Smoke-nuisance
09/27/06	Jefferson	Smoke-nuisance

Emission Impacts and Health Impacts

Has testing been performed to support claims of excessive emissions from OWBs?

OWBs are a relatively new concern; documentation on emissions only extends back to the mid 90s. The type of air toxics emissions from OWBs is expected to be similar in composition to emissions from residential woodstoves, which have been more extensively studied. The MATI inventory identified the category of polycyclic organic matter (POM) as the class of hazardous air pollutants of greatest concern from residential woodstoves. In its evaluation of HAP emissions from OWBs, New York State compiled a summary of results of testing of OWBs and residential woodstoves both in terms of fine particulate matter ($PM_{2.5}$) and polycyclic aromatic hydrocarbons (PAH). PAH is considered a subcategory of POM as used in the MATI process. It is also important to note that the MATI process did not focus on $PM_{2.5}$. Table 2 provides a summary of the comparative emissions between OWBs and various residential woodstoves.

Table 2- Comparison of Emissions from Residential Wood Combustors (modified from Schreiber (2005a)[a])

Type of Wood Combustion Unit	PM2.5 (Average) *(grams/hr)*	PAH (Average) *(grams/hr)*
OWB[b]	71.6	0.96
EPA Phase –II Certified Woodstove		
Catalytic Woodstove	4.1[c]	0.165[d]
Non-Catalytic Woodstove	7.5[c]	0.149[d]

[a] Schreiber's original work incorrectly compared OWB emissions in grams/hr with data reported in grams/Kg for various residential combustion devices.
[b] Schreiber, J. *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State*. (p. 23). New York Office of Attorney General, Environmental Protection Bureau: Albany, NY. 2005. Retrieved on May 12, 2006 from http://www.oag.state.ny.us/press/2005/aug/August%202005.pdf.
[c] Subpart AAA-Standards of Performance for New Residential Wood Heaters, 40 CFR §§ 60.530-60.539b.
[d] Fisher, L.H., Houck, J.E., & Tiegs, P.E. *Long-Term Performance of EPA-Certified Phase 2 Woodstoves, Klamath Falls and Portland, Oregon: 1998/1999.* EPA/600/R-00-100. Table 3-15. U.S. EPA, National Risk Management Research Laboratory: Research Triangle Park, NC. 2000.

This summary indicates that OWBs emit PAH at a rate about 5.8 times greater than would be emitted form an EPA certified catalytic woodstove and about 6.4 times more than an EPA certified non-catalytic woodstove. These results are similar to conclusions by NESCAUM (2006c) that OWBs may emit 4.3 times to 18.8 times more PAH than non-catalytic woodstoves and 3.9 to 16.9 times more than catalytic woodstoves.

In terms of $PM_{2.5}$, one OWB emits as much as 2 heavy-duty diesel trucks, 45 passenger cars or 1000 oil furnaces (Schreiber, 2005b). In terms of POM, one OWB emits as much as 100,000 residential furnaces burning distillate oil (* 1999 NEI – ERG, 2003 and assumed capacity of 139,000 Btu/hr).

What are the health impacts from these pollutants?

Northeast States for Coordinated Air Use Management (NESCAUM), of which Maine is a member, conducted "in use" testing of a 250,000 Btu/hr OWB in June 2005, using a continuous monitor (using light scattering) and a modified EPA Method 17 sampling train. The average of all particulate filter samples was 93 g/hr with a range of 13 to 237 g/hr, while that from the continuous monitor was 161 g/hr. The higher emissions associated with the continuous monitor was believed to be the result of the inability of the filter methodology to capture condensable particulate matter (NESCAUM, 2006d). The NESCAUM testing confirmed the emission estimates used to compare OWBs with other residential heating options.

In March 2005, NESCAUM conducted a screening level evaluation of the ambient air impact associated with particulate emissions from an OWB in central New York State using a portable nephelometer (light scattering). The OWB burned a combination of seasoned hardwood (1 year) and split oak, which was seasoned for only 3-4 months. The monitor recorded frequent values greater than 400 ug/m^3 and periodic values greater than 1,000 ug/m^3 throughout the course of normal OWB operating conditions and at distances ranging from 50 feet to 150 feet from the OWB. The nephelometer readings indicate 15-second samples (NESCAUM 2006e). The reference background values recorded during the evaluation averaged <20 ug/m^3 (Johnson, 2006).

The NAAQS for $PM_{2.5}$ is 65 ug/m^3 for a 24-hour average (98th percentile) and 15 ug/m^3 on an annual basis, with a proposal to lower the 24-hour standard to 35 ug/m^3. While monitoring methods and sampling times do not allow direct comparison to the NAAQS for $PM_{2.5}$, the results show that the relatively high emissions combined with relatively low stack heights result in significant air quality impacts close to the OWBs relative to background concentrations.

Modeling of an OWB by the Michigan Department of Environmental Quality was conducted to predict the potential for ambient air impacts (NESCAUM 2006f). The results predicted 1-hour average ambient air impacts exceeding twice the NAAQS for $PM_{2.5}$ extending about 50 feet from the stack with concentrations at approximately 61% of NAAQS for $PM_{2.5}$ extending out approximately 200 feet from the stack. This illustrates the problem these units pose to the OWB owner and abutters.

The NESCAUM Report indicates that $PM_{2.5}$ is released in higher concentrations from OWBs than conventional wood stoves. $PM_{2.5}$ can cause asthma, other respiratory attacks, or heart trouble. An assessment of six-hour (acute) exposure to $PM_{2.5}$ that infiltrates houses within 1000 feet of the OWB has been conducted (Boissevain, Brown & Callahan, (in press)). The assessment indicates that persons could suffer respiratory or cardiac distress if they live within 500 to 1000 feet of an OWB emitting more than 100 grams of $PM_{2.5}$ per hour during periods of low wind speeds or inversions. An OWB emitting more than 250 grams of $PM_{2.5}$ per hour could cause impacts requiring hospitalization.

A Washington State Department of Ecology (1997b) publication on the health effects of wood smoke makes several correlations that effectively illustrate the concern and the gravity of allowing unregulated operation of OWBs.

- EPA, applying statistical methods and “using daily death records in London as well as U.S. cities where daily particulate measurements were available”, found a 6% increase in deaths for each 100 ug of total PM.
- EPA also found “for every 100 micrograms of total particulate matter per cubic meter of air, the risk of dying goes up 32% from emphysema, 19% from bronchitis and asthma, 12% from pneumonia, and 9% from cardiovascular disease…”

Recent studies on exposure times and health impacts establish a link between much shorter exposure times and doses than previously understood. Johnson (2006) evaluated health impacts in urban areas and found associations with exposure durations of as low as 1-12 hours and "acute cardiovascular and respiratory events, including myocardial infarction in older adults and asthma symptoms in children." The Johnson study also specifically assessed particulate matter emissions from OWBs finding peak 15-second values as high as 8,000 ug/m^3 $PM_{2.5}$, a 2.6 hr mean of 235 ug/m^3 $PM_{2.5}$ with the damper open and a 1.7 hr mean of 113 ug/m^3 $PM_{2.5}$ with the damper closed. Considering the potential for year-round operation and ability of wood smoke PM to penetrate buildings, homeowners and abutters may suffer significant exposures to wood smoke PM and other toxins.

The NESCAUM Report also indicates that the group of compounds called Polycyclic Organic Matter (POM), also known as Polycyclic Aromatic Hydrocarbons (PAHs), is released in higher concentrations from Outdoor Wood Boilers than conventional wood stoves. Likewise, $PM_{2.5}$ is released in higher concentrations, and much of the $PM_{2.5}$ is composed of POMs. Many POMs cause cancer. A screening assessment of potential carcinogenic risks from exposure to POM from OWBs found that the increased cancer risk to an individual living within 100 feet of an OWB is approximately 400 to 3,000 in a million (Held, 2006). A more formal risk assessment concluded that increased cancer risk from long-term exposure by persons living within 500 to 1000 feet of the OWB ranges from 76 to 2,700 in a million (Boissevain, Brown & Callahan, (in press)). Both risk assessments were done in accordance with standard EPA Risk Assessment Protocols for air toxics[13]. Due to lack of emissions data, neither assessment considered the added carcinogenic impacts of benzene, formaldehyde or dioxins, which are also emitted from OWBs and will increase the likelihood of increase cancer incidents for exposed individuals. None-the-less, both assessments indicate that OWB may increase cancer risks well above EPA's "acceptable" level of between 1 and 100 in a million.

Additionally, complaints from abutters and observations by Maine DEP staff suggest OWBs may be routinely used for combusting residential solid waste. HAP emissions from combusting solid waste in an OWB is considered comparable to other backyard burning options. Maine DEP banned the use of burn barrels as of September 21, 2001 recognizing the health impacts resulting from this practice.

Federal, State, and Local Regulation of OWBs

What regulations apply at the federal level?

OWBs are not regulated by the EPA at this time. Federal regulations limiting fireplace and woodstove emissions were promulgated in 1988 and revised in 1995. The regulations, 40 CFR Part 60 Subpart AAA, establishes a certification program for woodstoves and fireplace inserts and requires manufacturers to demonstrate compliance with particulate emission standards of 4.1g/hr for catalytic stoves and 7.5 g/hr for

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[13] The formal Boissevain, Brown & Callahan risk assessment was done using the protocols in NRC (National Research Council). 1983. Risk Assessment in the Federal Government Managing the Process. Committee on the Institutional Means for Assessment of Risks to Public Health. National Academy Press, Washington, DC, USA; and USEPA. 1989. Risk Assessment Guidance for Superfund. EPA/540/1-89/002. Office of Solid Waste, Washington, DC, USA. The screening Held risk assessment was done using the protocols in USEPA 2006, Air Toxics Risk Assessment Reference Library, Volumes 1-3, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, USA.

noncatalytic stoves. OWBs, being relatively new at the time the legislation was enacted, are not covered by this rule.

What regulations apply at the state level?

Initiated mainly by nuisance complaints and later by emissions and health data, several states have begun to regulate OWBs with varying results. Regulation ranges from outright bans on OWBs to public awareness/outreach.

Vermont, Connecticut, Michigan, Colorado, New Hampshire, and Washington State regulate OWBs. Connecticut Law PA05-227 establishes requirements for setbacks, stack height, fuel restrictions, and specifically provides for local control of OWB installations (Connecticut Department of Environmental Protection, 2005b). Vermont regulates OWBs in a manner similar to Connecticut with the addition of notification requirements by the vendor at the time of sale. These requirements explicitly discuss proper installation and terrain criteria and must be signed by both the vendor and buyer. Vermont also proposes a particulate emission standard of 0.2 grains/dscf. The State of Washington rules are more extensive than those adopted by the New England states. In addition to the general siting, stack height, and fuel-type restrictions, Washington requires a vendor certification prior to the sale of OWBs in Washington State confirming compliance with emission standards of 2.5 g/hr PM for catalytic devices and 4.5 g/hr PM for noncatalytic devices (WAC 173-433-100(3)). New York regulates OWBs indirectly through general nuisance rules (6 NYCCR§211.2) and opacity rules (6 NYCC § 200-1.3).

In Maine, there is no specific rule or law directed at OWBs however the units may be regulated as combustion devices in commercial applications depending on the Btu rating of the OWB. Maine Rule 06-096 Chapter 101 establishes a statewide visible emissions standard of 30% opacity on a six-minute block average not to exceed two six minute periods in any three-hour period. This requires units placed in service, whether commercial or residential, to meet existing opacity standards. All owners must comply with Maine’s prohibition on burning of solid waste (household trash and other residential waste).

What regulations apply at the local level?

According to New York Attorney General Elliot Spitzer, five NY counties regulate OWBs through fuel specifications, setback limitations, stack height requirements, and limits on seasonal operation while eleven other counties ban OWBs. The Wisconsin Department of Natural Resources (2004) developed a model ordinance on OWBs to offer consistency within the state recognizing that county and municipal governments were actively looking to regulate and or ban these units. The model ordinance provides guidance on several approaches to regulation such as an outright ban or in the absence of a ban, setback requirements, stack height requirements, annual permitting, and penalty provisions.

In Maine, the Town of Millinocket recently passed an OWB ordinance under Code Chapter 86. This ordinance establishes a local registration/permit program, fuel restrictions, setback requirements, stack height limitations, seasonal operating restrictions, and penalty provisions.

Committee Recommendations

ATAC believes that OWBs pose a significant health threat to citizens of Maine in areas where they have little ability to reduce exposure - their neighborhoods and homes. The relative emission loads produced by these units is excessive and is recognized by many of the Northeast states as a significant source of air pollution. Should the price of oil continue to climb, the sales of these units may expand exponentially creating a significant increase in emissions from wood burning with health impacts directly within residential areas. Until recently, improving the emission characteristics of these units and ensuring homeowners properly install OWBs in compliance with good operating practices did not appear to be a priority for most manufacturers. It should be noted however that a new manufacturer operating in Maine has designed an OWB capable of meeting or exceeding EPA's emission standard for residential wood heaters. Clean Woods Heat, LLC of East Millinocket, Maine has designed an advanced OWB and plans to have them available by late this year. Test results of the Clean Woods Heat, LLC "Black Bear" OWB using the ASTM test method demonstrated that the Black Bear could achieve an emission rate of 1.47 g/kg as a heating season weighted average compared with an emission rate of 18.5 g/kg from a conventional wood stove and 6 g/kg for an EPA certified non-catalytic stove (6.2 g/kg for EPA certified catalytic stove). Advanced boilers are also reportedly available through Maine Energyworks of Liberty, ME and New Horizon although there is no hard data to confirm emissions from these units. However, this clearly shows that OWB technology is capable of significant emission reductions and that EPA's residential wood heater standard is a reasonable and achievable emission target.

ATAC recommends that the Maine DEP and legislature take the following action concerning OWBs:

- Develop a PSA discussing best operating practices for wood burning devices, the health effects of wood smoke, and reiteration of the prohibition on backyard burning (residential solid waste combustion).
- Enact a moratorium on the sale of OWBs until these units are regulated at the same level as woodstoves and fireplaces under 40 CFR Part 60 Subpart AAA - *Standards of Performance for New Residential Wood Heaters* or a manufacturer demonstrates to the satisfaction of the Maine Department of Environmental Protection, the ability to meet or exceed particulate standards established under 40 CFR 60 Subpart AAA.
- In the absence of federal legislation or a moratorium, adopt state rules on an expedited basis to regulate outdoor wood boilers and apply current federal or more stringent state-level emission standards. See Attachment A for general regulatory provisions.
- Require OWB manufacturers/suppliers to create an Installation & Operation (I&O) document highlighting proper operating and installation requirements consistent with state OWB regulations. Require all vendors and buyers to sign the document at the time of sale. Require the vendor and buyer to provide a copy of the I&O document to the Department and require buyers to

retain a copy of the I&O agreement. Prohibit the sale of new or existing OWBs, regardless of retail or private sale, without an I&O agreement.

- Require OWB manufacturers or suppliers to demonstrate compliance with state visible emission and particulate standards for any new OWB sold in Maine for residential use within three months of the date of adoption.
- Require OWB manufacturers/suppliers to demonstrate compliance with state visible emission and particulate standards for any new OWB sold in Maine for commercial use within three months of the date of adoption.
- Coordinate with local and county governments/agencies to actively identify improper installations, i.e., those that do not conform to recommended installation criteria (setback, stack height, fuel restrictions) published by each manufacturer/vendor or applicable state rules for all existing OWBs in Maine.
- Adopt rules to address existing OWBs to include minimum requirement that units comply with all written installation and operating instructions available to the buyer at the time of sale or minimum state standards addressing setback, stack height, opacity, and fuel restrictions.
- Establish a date, not to exceed three (3) months from the date of adoption, by which all OWBs in Maine must comply with these standards.

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OWB Attachment A: Proposed General Rules Governing OWBs

1. **Purpose**. This chapter establishes emission standards, opacity standards, and fuel restrictions for outdoor wood-fired boilers.

2. **Applicability**. The provisions of this chapter apply to outdoor wood-fired boilers in all areas of the State of Maine. This chapter shall not apply to residential wood heaters regulated and certified under 40 CFR 60 Subpart AAA-Standards of Performance for New Residential Wood Heaters or other combustion devices regulated or licensed under 06-096 Chapters 101, 103, 115, or 140. To the extent future State and Federal regulations specifically address OWBs, the more stringent regulation shall apply.

3. **Definitions**. Unless a different meaning is clearly required by context, the following words and phrases as used in this chapter, shall have the following meanings:

   (A) "EPA" means Environmental Protection Agency.

   (B) "Existing outdoor wood-fired boiler or furnace" means an outdoor wood-fired boiler or furnace manufactured and sold, bartered, or given away, prior to the effective date of this chapter.

   (C) "Department" means Maine Department of Environmental Protection.

   (D) "New outdoor wood-fired boiler or furnace" means an outdoor wood-fired boiler or furnace manufactured after the effective date of this chapter. Any existing outdoor wood-fired boiler or furnace sold, bartered, or given away after the effective date of this chapter shall be a "new outdoor wood-fired boiler or furnace.

   (E) "Nuisance" means any odor, emission, or event that prevents the use and enjoyment of one's property. For purposes of this chapter, an OWB shall constitute a nuisance following three or more verified complaints within any one-month period.

   (F) "Outdoor wood-fired boiler (OWB)" (same as outdoor wood-fired furnace) means an accessory structure or appliance capable of being installed out of doors and designed to transfer or provide heat, via liquid or other means, through the burning of wood or any other nongaseous or non-liquid fuels for heating spaces other than where such structure or appliance is located, any other structure or appliance on the premises, or for heating domestic, swimming pool, hot tub or Jacuzzi water. "Outdoor wood-burning boiler or furnace" does not include a fire pit, wood-fired barbecue, or chiminea.

   (G) "Seasoned wood" means wood of any species that has been sufficiently dried so as to contain twenty percent or less moisture by weight.

   (H) "Treated wood" means wood of any species that has been chemically impregnated, painted, or similarly modified to prevent weathering or deterioration.

4. **Prohibition**. No person shall, from the effective date of this chapter to the effective date of regulations promulgated by the United States Environmental Protection Agency to regulate OWBs, if more stringent, construct, install, establish, modify, operate or use an existing or new outdoor wood-fired boiler or furnace, without meeting the applicable requirements of this chapter.

5. **Emission and Performance Standards**.

(A) Existing OWBs. No person may sell, bargain, give away, operate, modify, or use an existing OWB unless the OWB complies with the following:

(i) Installation of the OWB is not less than two hundred feet from the nearest residence not serviced by the OWB, however in no event shall an existing OWB be located within 1,000 feet of a state licensed school, daycare, or healthcare facility; and

(ii) Installation of the chimney of the OWB is at a height that is five feet more than the height of the highest roof peak of any occupied building that is located within 500 feet of the OWB, provided the chimney height is not more than fifty-five feet or is otherwise limited by local ordinances or fire codes adopted prior to the effective date of this chapter; or

(iii) Installation and operation of the OWB is in full compliance with the manufacturer's written installation and operating instructions (instructions), provided such instructions were available at the time of sale/distribution, the issue date of the instructions coincides with the manufacture date or earlier and specifically address setback distances and chimney height. The provisions of this subsection (5(A)(iii)) do not apply for instructions that are revised or otherwise amended after the date of manufacture and before the effective date of this chapter to the extent such revisions are less stringent than the provisions of subsections 5(A)(i-ii).

(iv) No other materials are burned in the OWB other than seasoned wood that is not treated wood.

(v) An existing OWB sold, bartered for, or given away after the effective date of this chapter shall constitute a new OWB.

(vi) Any existing outdoor wood-fired boiler or furnace installed prior to the effective date of this chapter shall meet the stack height, and setback requirements established by this chapter within one year. Any existing OWB that does not meet the requirements of section 5(A)(i-iii) during this period may not operate between April 15 and September 15 and must permanently discontinue operation if compliance is not achieved within the one year period .

(B) New OWBs. No person may advertise, operate, sell, bargain for, give away, modify, install, or use a new OWB unless the new OWB complies with the following emission limits and has received a certificate from the Department:

(i) Particulate emission limits;

(a) for catalytic units 4.1 g/hr

(b) for noncatalytic units 7.5 g/hr

(c) Emission Test Methods and Procedures. Particulate emission limits shall be determined as follows:

(1) In order to obtain certification of an outdoor wood-fired boiler under subsection 5(B) of this section, the manufacturer of any such boiler shall have an emission test(s) conducted to determine compliance with the particulate matter emission limit under subsection 5(B)(i) of this section and furnish the Department with a written report of the results of such tests, including a detailed description of the operating conditions of the boiler during the tests. Said written report shall contain such documentation and other information and follow such format as may be specified by the Department. At the discretion of the Department, a manufacturer of an OWB subject to this section may have emission testing conducted on a representative boiler within a model line of OWBs and may use those tests to demonstrate compliance of all units manufactured in that model line to the extent units are mechanically and operationally equivalent as demonstrated by the manufacturer and approved by the Department.

(2) An independent testing consultant, who has no conflict of interest and receives no financial benefit from the outcome of the testing, other than for services rendered, shall conduct all emission testing required under this section. Manufacturers of outdoor wood-fired boilers shall not involve themselves in the conduct of any emission testing under this section nor in the operation of the unit being tested, once actual sampling has begun.

(3) Emission tests shall be conducted and data reduced in accordance with 40 CFR Part 60, Appendix A, Test Methods 1 through 5, and 40 CFR Part 51, Appendix M, Test Method 202, or alternative methods approved by the Department. All tests shall be conducted in accordance with Maine's Emission Testing Guidelines, as amended and under a test protocol, which has received the prior approval of the Department. Emission tests shall be conducted under such conditions as the Department may specify, based on representative performance of the OWB under actual field operating conditions.

(4) The manufacturer of the OWB shall provide the Department with at least 30 days prior notice of any emission test to afford the Department the opportunity to have an observer present. The manufacturer of an OWB(s) being tested as required by this section shall reimburse the State of Maine or its designated representative for reasonable expenses incurred by any such Agency observer for out-of-state travel to observe such testing, including among other items the costs of transportation, lodging and meals.

(C) Opacity limits;

(i) No person shall cause or allow emission of a smoke plume from any new OWB to exceed thirty (30) percent opacity on a six minute block average except for no more than two (2) six minute block averages in any three (3) hour period.

(ii) Test method and procedures. Methods and procedures specified by the EPA in "40 CFR 60 Appendix A reference method 9 – *Visual Determination of the Opacity of Emissions from Stationary Sources*" as amended through July 1, 1990, shall be used to determine compliance with subsection 5(C)(i) of this section.

(iii) Enforcement. Smoke visible from a chimney, flue, or exhaust duct in excess of the opacity standard shall constitute prima facie evidence of unlawful operation of an applicable OWB. This presumption may be refuted by demonstration that smoke was not caused by an applicable OWB. The provisions of this requirement shall:

(1) Be enforceable on a complaint basis.

(2) Not apply during the starting of a new fire for a period not to exceed ten minutes in any eight-hour period.

(D) Notification by Manufacturers

(1) By March 1st of each year and prior to the sale of any new OWB as necessary when an OWB is certified, whichever is sooner, each OWB manufacturer shall provide the following information in writing to any person requesting such information or any person to whom the manufacturer has distributed or sold, intends to distribute or sell, or actually distributes or sells OWBs in Maine or for installation in Maine:

(a) A list of all the models of OWBs it manufactures; and

(b) An identification of which, if any, of said models or boilers has received a certification of compliance under subsection 5(B) of this section and thus may be distributed or sold in Maine or for installation in Maine.

(2) By March 15th of each year, a copy of all written information provided to comply with paragraph (1) of this subsection and a list of persons to whom it was provided shall be submitted to the Department.

6. **Siting Standards**.

(A) Installation of any new OWB may not be less than 200 hundred feet from the nearest property line, however in no event shall a new OWB be located within 1,000 feet of a state licensed school, daycare, or healthcare facility; and

(B) Installation of the chimney of any new OWB is at a height that is five feet more than the height of the highest roof peak of any occupied building that is located within 500 hundred feet of the OWB. Chimney height shall be limited to the lesser of fifty-five feet or a height otherwise limited by local ordinances or fire codes adopted prior to the effective date of this chapter; and,

(C) The installation complies with all manufactures' written installation and operating instructions to the extent instructions are more stringent than the provisions of this subsection 6(A&B).

(D) Existing OWB Low-income Exemption. Existing OWBs installed and operated at a single-family low-income residence may petition the Department for an exemption from the requirements of section 5(A)(i-iii). The Department may grant an exemption based upon evaluation of specific homeowner circumstances. Such exemption, if granted, shall be valid until such time as the OWB becomes a new OWB or funding assistance becomes available to bring the unit into compliance with these provisions.

7. **Notice to Buyers**. Each manufacturer and distributor shall be jointly and severally responsible for obtaining a written agreement signed by the distributor and buyer at the point of sale acknowledging the installation and operation requirements of this Chapter for all new OWBs.

(A) Each [manufacture / distributor] prior to offering an OWB for sale, shall provide certification as issued by the Department, that each model offered for sale in the State of Maine complies with the emission and opacity limits of this chapter.

(B) Any transaction for sale, barter, or donation of an existing OWB shall be accompanied by installation and operating documentation containing information listed in section 5(B) & 5(C).

8. **Delegation of Authority**. The provisions of this chapter shall be enforced by the Department and may be enforced by any municipality affected by the operation or potential operation of an OWB, however the Department shall retain the following sections.

(A) Section 5(B)(i)(c)

(B) Section 5(D)

(C) Section 7

9. **Violations**.

(A) Any person who operates an OWB in violation of this chapter shall be deemed to have committed a violation. Each day of operation of such OWB in violation of this chapter shall be a separate violation. Violations are enforceable in accordance with the Department's general enforcement authority found at 38 MRSA §347, and subject to fines as set forth in 38 MRSA §349.

(B) No person shall cause or permit the emission of any air contaminant from an identifiable OWB, including any air contaminant whose emission is not otherwise prohibited by this chapter, if the air contaminant emission causes detriment to the health, safety, or welfare of a person, plant, or animal, or causes damage to property or business, or constitutes a nuisance.

(C) Failure to correct any violation or mitigate a nuisance within thirty days, incurring three or more violations within any six-month period, or an OWB deemed a nuisance more than three times in any consecutive six-month period, may result in an order to permanently discontinue operation of any new or existing OWB.

10. **Enforceability**. Nothing contained herein shall authorize or allow burning which is prohibited by codes, laws, rules or regulations promulgated by the United States Environmental Protection Agency, Maine Department of Environmental Protection, or any other federal, state, county, local agency, or municipality. OWBs, and any electrical, plumbing or other apparatus or device used in connection with an OWB, shall be installed, operated, and maintained in conformity with the manufacturer's specifications and any and all local, State and Federal codes, laws, rules and regulations. In case of a

conflict between any provision of this chapter and any Federal, State or local ordinances, codes, laws, rules or regulations, the more restrictive or stringent provision or requirement shall prevail.

11. **Severability**. The invalidity of any clause, sentence, paragraph or provision of this rule shall not invalidate any other clause, sentence, paragraph, or part thereof.

SSS Appendix III: Energy Conservation Survey

Table 7: Effects of Energy Conservation Projects at Various Maine Industrial Facilities

PROJECT	ENERGY SAVINGS	HAP REDUCTION
Installing raw water pump variable frequency drive and replacing 300 HP motors with 150 HP	Reduce electric usage by 1.6 million KWH/yr	See Below
Optimization of recausticizing efficiency in recovery boiler	Reduction in steam usage and resulting savings of 207,000 gallons/yr residual oil	1.9 Tons
Replacing pumps in digesters to waterless packing	Reduces water use, and reduces residual oil use by 560,000 gallons/yr	5.15 Tons
Optimize energy recovery system in digesters by replacing flash liquor cooler	Reduces water use and reduced residual oil use by 686,000 gallons/yr	6.31 Tons
Upgrade boiler soot blower nozzles	Reduces steam usage resulting in savings of 441,000 gallons/yr residual oil	4.06 Tons
Decrease run times on refiner motors and install timers on agitators	Reduces electric usage saving 2.1 million KWH/yr	See Below
Refiner upgrade to paper machine	Decreased electric usage by 0.9 million KWH/yr	See Below
Upgrade pulp condensate recovery system	Reduces steam usage resulting in savings of 231,000 gallons/yr residual oil	2.13 Tons
Upgrade D2 Medium Consistency Pump	Reduces electric usage by 0.65 million KWH/yr and reduced steam use saves 319,200 gallons/yr residual oil	3.0 Tons, See Below

- A total HAP reduction of 26.2 tons was achieved through reduced residual oil combustion.
- A total of 5.25 Million kWh/yr were saved from these energy conservation projects. The HAP reductions as a result of these savings will vary with boiler type, generator type, and fuel combusted.

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Attachment 3: Mobile Sources Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007

Recommendations for Air Toxics Reductions from Mobile Sources

Revision of June 7, 2007

I. Summary

The Mobile Sources Subcommittee (MoSS) recommends that the full Air Toxics Advisory Committee (ATAC) promote the following air toxics reduction options for the mobile sources sector. These options are "no cost or low cost" strategies, and are listed in the order of the greatest potential reductions of air toxics:

1. Expand to statewide the **On-board Diagnostics** testing as part of the vehicle safety inspection program.

2. Reduce vehicle miles traveled from light-duty-gas vehicles, increase vehicle occupancy and improve opportunities for walking, biking and using public transit by implementing, among other things, **Transit Oriented Development, Expanding Public Transit**, **Telecommuting,** and **Increasing Carpool Lots**.

3. Adopt a **No-idling Regulation** in combination with an education and outreach campaign on the benefits to public health and the environment from not idling vehicles.

MoSS bases these recommendations on semi-quantitative calculations of air toxics reductions and associated implementation costs from forty identified control options. The subcommittee targeted emissions from light-duty gas vehicles and heavy-duty diesel engines and vehicles.

II. Purpose

The Mobile Sources Subcommittee explored cost-effective strategies for air toxic reductions from mobile sources in both the on-road and non-road sector. Also, the subcommittee considered the impact from land use development on transportation and resultant air toxics emissions. Specifically, the ATAC charged the subcommittee with the following:

1. Work with the Science Advisory Subcommittee to quantify a timeline of emission reductions, and corresponding theoretical risk reductions expected to be achieved by existing programs within the next ten years. Programs explored should include new diesel engine performance standards, new diesel fuel specifications and changing composition of the motor vehicle fleet that could affect emissions of air toxic compounds.

2. Review the list of priority toxics and identify common sources and potential no-cost options for control. Then identify no-cost, low cost and co-benefit solutions to reduce emissions from the highest risk air toxics. The cost and effectiveness in reducing actual risks must be considered in the evaluations of costly risk reduction strategies.

III. Mobile Source Air Toxics Inventory

Information provided to the Mobile Sources Subcommittee from the Science Advisory Subcommittee on May 15, 2006 indicated that Mobile Sources comprise 35% of the toxicity-weighted air toxic emissions in Maine. The following air toxics are from mobile sources and are a priority for evaluating reduction strategies:

Table 8: Mobile Source Air Toxics

Pollutant Category Name	Toxicity-Weighted Tons Emitted in 2005	Percentage of Toxicity-weighted Inventory
Polycyclic Organic Matter	135,306	36%
Acrolein	84,463	23%
Benzene	68,809	18%
Formaldehyde	39,658	11%
1,3-Butadiene	29,684	8%
Chromium Compounds	4,315	1%
Arsenic Compounds	3,810	1%
Acetaldehyde	2,325	1%

The subcommittee requested better information as to the source of pollutants that made up the mobile sources inventory based on toxicity-weighting. This information would direct the subcommittee on which source categories to focus on for emission reduction strategies.

Based on the 2005 Mobile Sources Inventory, light-duty gas vehicles and trucks make up 75% of the air toxics emissions from the on-road sector. Passenger cars and light-duty gas trucks comprise 92% of the volatile organic compound emissions which are precursors to harmful ground level ozone. Therefore, we focused our efforts in identifying strategies that would reduce vehicle emissions from gasoline powered light-duty vehicles and trucks.

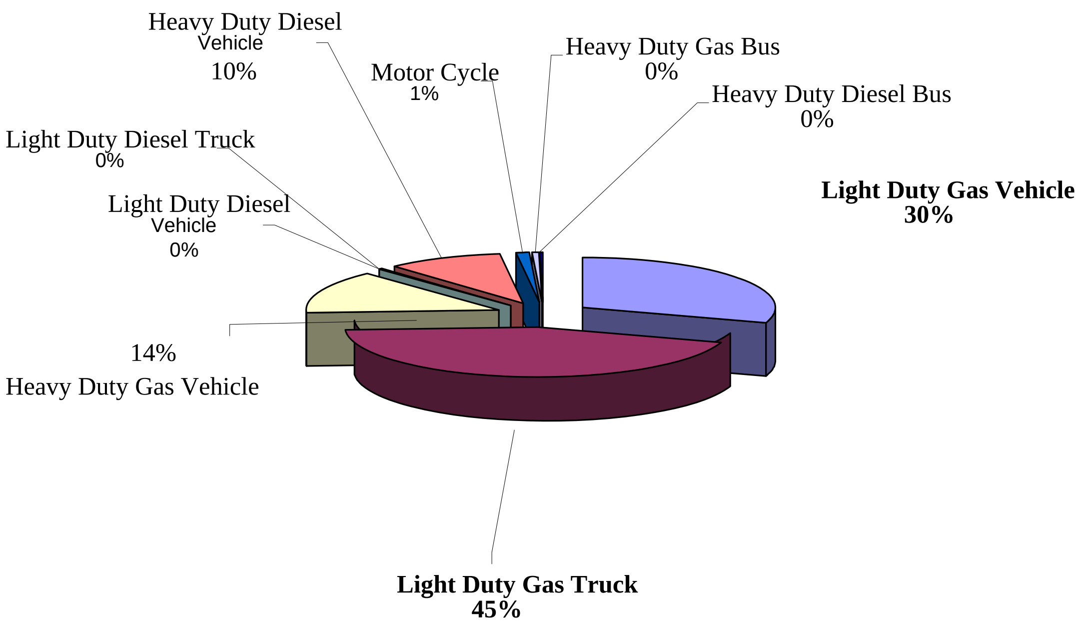

Figure 7: 2005 Air Toxic Emissions from On-Road Mobile Sources (Tox-Weighted)

Diesel exhaust contributes to ozone formation (smog), acid rain, and global climate change.

According to U.S. EPA, diesel exhaust is likely to cause cancer in humans. Diesel exhaust contains significant levels of small particles known as fine particle matter. Fine particles pose a significant health risk because they can pass through the nose and throat and lodge themselves in the lungs. These fine particles aggravate respiratory conditions such as asthma and bronchitis and can cause lung damage, even premature death. Nationwide, particulate matter is responsible for more than 15,000 premature deaths each year.[14]

The pie chart below demonstrates heavy-duty diesel trucks are responsible for 74% of Maine's PM 2.5 emissions. Therefore, in addition to the light-duty gas sector, the subcommittee also focused on diesel emission reduction strategies.

[14] U.S. EPA publication, *Diesel Exhaust in New England*, March 2002 pamphlet.

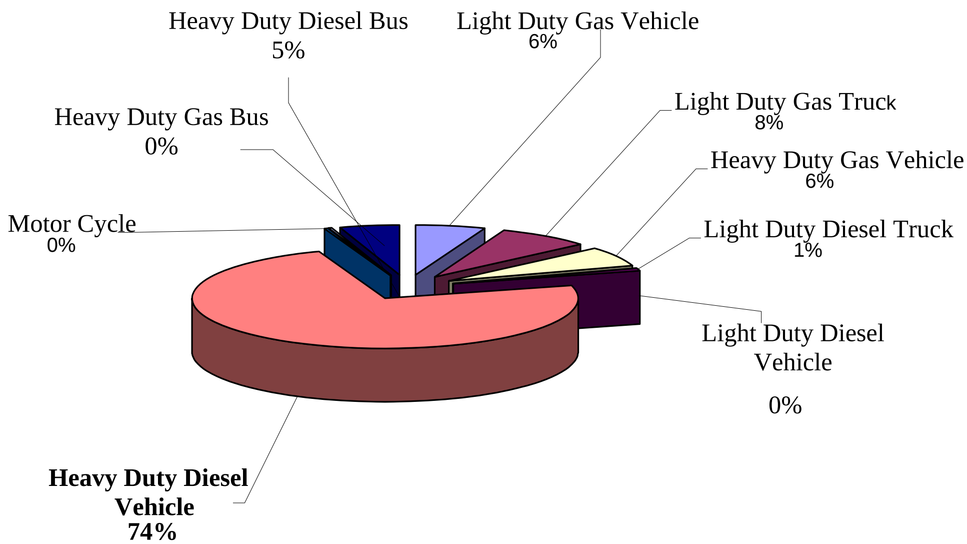

Figure 8: 2005 PM 2.5 Emissions from On-Road Mobile Sources

The subcommittee also recognized that hot spots caused by vehicle congestion in urban areas, would also require additional analysis (see Science Advisory Subcommittee Report).

IV. Existing and Pending Regulations

The first step for the subcommittee was to identify the existing and pending state and federal programs that reduce air toxics emissions. Please see MoSS Appendix IV beginning on page 59 for a compilation of existing and pending state and federal regulations. As examples:

1. In 2007, significant reductions (90%) in diesel particulate emissions will be achieved with the phase-in of ultra low sulfur diesel of 15 ppm in combination with advanced pollution control technologies used for meeting the 2007 heavy-duty diesel engine standards.

2. The federal Tier 2 standard for gasoline was phased-in on January 2006 requiring the average national standard for sulfur be reduced to 30 ppm, achieving a 90% reduction in sulfur levels in gasoline. This should result in reduced Polycyclic Organic Matter (POM) and metal emissions from mobile sources.

3. Despite the impressive progress made in developing and introducing clean vehicles and fuels, motor vehicles still contribute a significant portion of the emission inventory for ozone, fine particulate matter and air toxics. Therefore, Maine adopted the California LEV program in 1993 to reduce emissions from the on-road motor vehicle sector. California's LEV II standards for evaporative and tailpipe VOC emissions are more stringent than those of the federal Tier 2 program. In particular, risks associated with exposure to air toxics such as benzene, formaldehyde, and 1, 3-butadiene will be significantly reduced by the California LEV II program. Additional reductions in toxic vehicle emissions under LEV II are

estimated at approximately 12 percent in 2020, compared to the federal program.[15] NESCAUM modeling of the LEV II program using the MOBILE6.2 model indicates that nearly 50 tons of NOx+VOC per day will be reduced in the seven Northeast LEV II states in 2025.

The subcommittee found that these existing and pending regulations will significantly reduce air toxic emissions. Below is a table showing Maine Department of Environmental Protection (MEDEP)'s expected trend of air toxics reductions from the on-road sector due to existing and pending regulations.

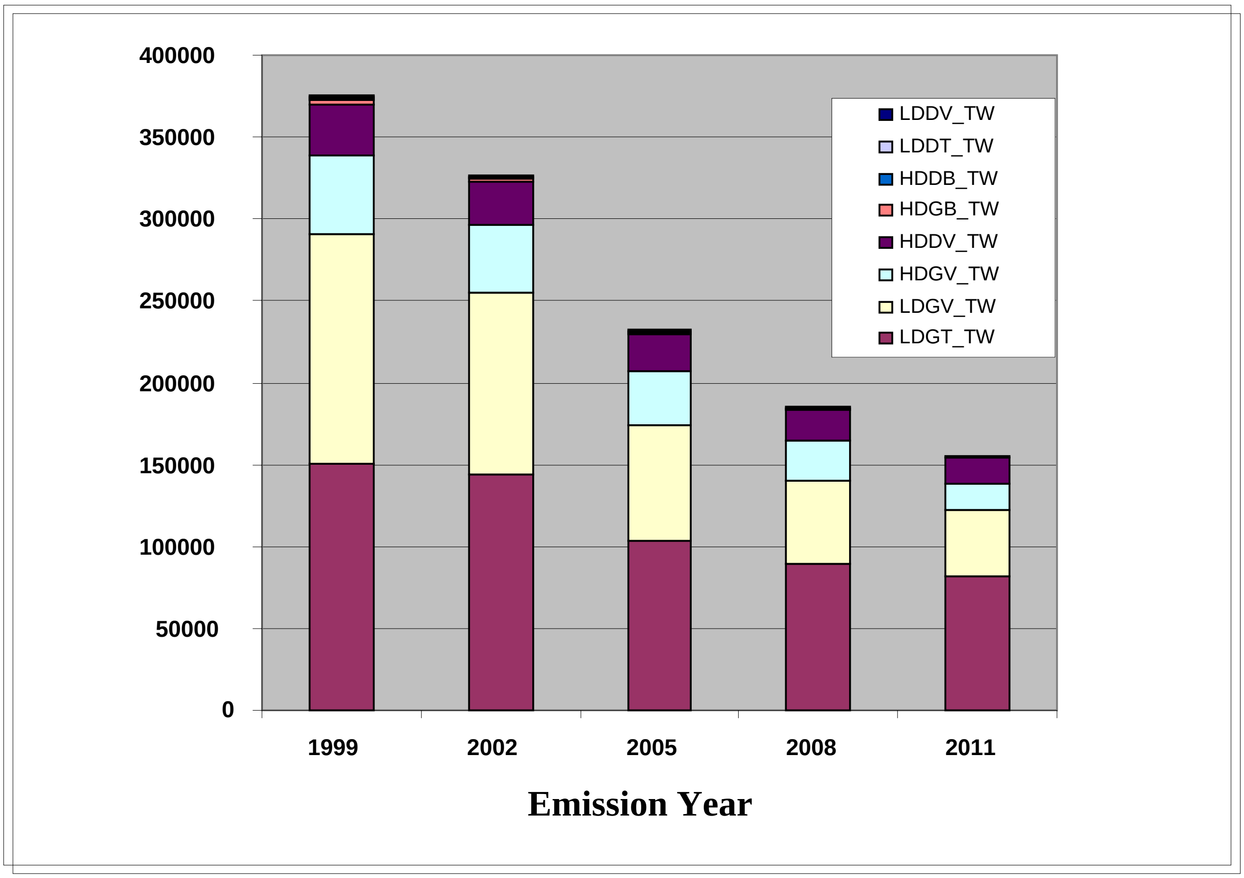

Figure 9: Toxicity-Weighted Emissions (TPY) Trends for the On-Road Mobile Sector

V. Screening of Additional Reduction Alternatives

Next, the Mobil Sources Subcommittee developed a comprehensive matrix that identified the sector and vehicle category impacted and the estimated costs and benefits for approximately forty mobile sources emissions reduction strategies. The sectors identified were:

1. Non-road, including marine, locomotives and construction equipment, or

[15] Summary of NESCAUM Analysis Evaluating NOx, HC and CO Emission Reduction Potential from Adoption of the California Low Emission Vehicle (LEV II) Standards, June 2005, page 6.

2. On-road, including passenger vehicles, transit, heavy-duty diesel, and school buses.

The subcommittee qualitatively ranked emission reduction potential and the technical and financial feasibility of each scenario as high, medium or low (H, M, L). The subcommittee qualitatively considered cost, feasibility of the option, and the technological development stage of the alternative.

This matrix was used as the initial screening tool to select certain strategies for further analysis. It was decided that some of the strategies listed were actually funding mechanisms and should be evaluated separately from the control options. Some examples for options to fund air toxics emissions reduction controls included establishing a Clean Diesel Fund, assessing fees on new car sales or vehicle registrations, and funding from the MEDEP Surface Water Fund. The funding alternatives are shown in MoSS Appendix V on page 71.

Each subcommittee member ranked each mobile sources reduction strategy on a scale of 0-5, five being the best. Multiple subcommittee members from one organization such as the MEDEP and Maine DOT combined their scores for ranking each strategy. After tallying all the scores, the subcommittee agreed to consider the highest ranked control options that received twenty points or more, for an in-depth review of potential emission reductions and costs associated to implement. In addition, the subcommittee tabled further evaluation of funding mechanisms, since the subcommittee was focusing on no or low-cost options and any necessary funding mechanism might vary based on the control options employed.

Following the initial qualitative screening analysis of the Mobile Sources Control Options, the subcommittee undertook a semi-quantitative analysis of the air toxics reduction potential and costs to implement of the top ranking strategies, as shown in MoSS Appendix VI on page 73. The Mobile Sources Control Options selected for a semi-quantitative assessment by the subcommittee are as follows:

Education and Outreach Efforts

- Develop a driver education module to include no-idling and fuel saving techniques
- Develop community outreach materials for a no-idling campaign
- Expand voluntary programs to reduce VMT and single occupancy vehicles
- Promote diesel retrofit technologies and programs, such as EPA's SmartWay

Voluntary Programs

- Establish workplace policies to allow employees to work at home i.e. telecommuting
- Expand public transit
- Increase carpool parking lots
- Provide incentives to retrofit older heavy-duty diesel engines
- Promote land-use development strategies that support alternative modes of transportation

Regulatory Programs

- Adopt statewide On-board Diagnostics program
- Adopt statewide a no-idling regulation

Fuels

- Purchase alternative fuels for transit buses
- Adopt statewide use of reformulated gas

VI. Costs and Benefits Analysis

The MEDEP inventory staff calculated potential emission benefits for those identified control options which were predicted to result in significant air toxics risk reductions and appeared economically feasible. The subcommittee agreed on the assumptions used to conduct the cost and benefits analysis. The subcommittee predicted the potential percentage of emission reductions from the hazardous air pollutant (HAPs) mobile sources inventory for that category which the strategy targeted (i.e. 20% reduction of air toxics for light-duty gas vehicles). Based on those assumptions MEDEP staff was able to calculate the potential toxicity-weighted tons per year reductions.

A matrix was developed of the identified alternatives for final evaluation. The matrix included:

(a) Identified targeted category, i.e. light-duty gas vehicles;
(b) An estimation % risk reductions by the alternatives in that sector, and the mobile sources sector as a whole;
(c) Tons per year reduction of air toxics;
(d) Annual cost and normalized annual cost (cost per toxicity-weighted ton reduced);
(e) Identification of whether the strategy is also a hot-spot strategy, or will also result in reductions in Greenhouse Gases.

The subcommittee gave the highest ranking to those Mobile Sources Control Options that could achieve the greatest air toxics emission reductions and which were also no cost or low cost strategies. Some options actually resulted in a net cost savings to Maine citizens. Those alternatives included education and outreach, voluntary programs with incentives, and a no-idling regulation. Consideration was also given to technical feasibility and ease of implementation in the short term.

Below are listed the top ranking control options in the order of the greatest potential for air toxics emissions reductions. The Mobile Sources Subcommittee's recommendations for mobile sources air toxics reduction strategies are as follows.

1. Expand On-board Diagnostics statewide

The greatest air toxics reductions of 35,660 toxicity-weighted tons per year were projected for expanding the Cumberland County On-board Diagnostics (OBD) program statewide. On-board Diagnostics refers to a computer-based system that monitors the performance of the vehicle engine and emissions control system. All model year 1996 and newer light-duty cars and trucks have a "check engine" light that alerts vehicle owners when there is a possible problem with the engine or emissions control system. By paying attention to this early warning and repairing the vehicle right away can often avoid more costly repairs, save fuel, reduce wear and tear on the engine, and reduce pollution. Depending on the age and mileage of the vehicle, these repairs may be covered under warranty.

Using the assumption that an additional 509,431 light-duty gas vehicles would pay the additional $6.00 inspection fee for an OBD test, the annual cost was $86 per toxicity-weighted ton. The analysis did not include the costs of vehicle repairs, since emissions control equipment could still be covered by warranties depending on the age of the vehicle.

The subcommittee determined that although there is a net cost associated with this strategy, expanding OBD statewide would result in significant HAP emissions reductions. The subcommittee believes that the costs are reasonable given the large HAP benefits gained from this strategy, and is therefore recommending that the full ATAC adopt this strategy as a "low-cost" option.

2. Reduce VMT and increase vehicle occupancy

The benefits predicted from the existing and pending regulations will be diminished if Vehicle Miles Traveled (VMT) increases beyond the modeled predictions. Therefore, the subcommittee explored several strategies aimed at reducing VMT, including changes to land use policy. A detailed evaluation of the impact of land-use policy and VMT was beyond the expertise of the Mobile Sources Subcommittee. Therefore, MEDEP contracted with the Center for Clean Air Policy (CCAP) to assess the reduction potential (and thus air toxic reductions) from changes to policies that govern land development in Maine. CCAP is currently supporting efforts to enact Vehicle Miles Traveled (VMT) -reduction actions identified in Maine's 2004 Climate Action Plan. These VMT reduction strategies will also have co-benefits of reducing air toxics from mobile sources. CCAP is working separately with the Climate Action Plan VMT Mitigation Work Group to refine smart growth policies and measures to reduce VMT growth along the Lewiston/Portland/ Brunswick Corridors. CCAP will quantify the greenhouse gas, energy and air pollution reduction potential from such policies and develop policy implementation strategies.

This work will provide additional analysis of Maine's Climate Action Plan's transportation sector recommendations and synergize air toxic and greenhouse gas reduction efforts to improve air quality.

CCAP provided the subcommittee a list of nineteen potential VMT reduction policy options, a brief description of each option, the transportation category that is targeted by the policy (e.g. light-duty vehicles, heavy-duty trucks, transit buses, freight trains, marine vessels, etc.), and a general description of the portions of the state that would be impacted by the policy (e.g. urban versus rural, statewide, Lewiston/Portland/Brunswick Corridors, Cumberland County, etc). CCAP developed the list by reviewing the Maine Climate Action Plan, discussions with Portland and Lewiston/Auburn Municipal Planning Organizations, the SmartGrowth Network, a literature search, and other appropriate review. More details on these options is included in MoSS Appendix VII: CCAP Options Matrix of Changes to Land Use Planning to Reduce VMT
By the Center for Clean Air Policy (CCAP) beginning on page 77.

The subcommittee selected for screening analysis five development strategies, which included Targeted Infrastructure Development, Transit Oriented Development, Permitting and Zoning Reform, Bus Rapid Transit, and Comprehensive Smart Growth. CCAP's work products are included in MoSS Appendix VIII through MoSS Appendix XII, beginning on page 85.

After further consideration, the subcommittee determined that enhancing existing infrastructure rather than building new infrastructure would lead to more dense urban development, sustaining transit and reducing travel demand. Therefore, MoSS directed CCAP to undertake a detailed analysis on two options: Transit Oriented Development (TOD) (see MoSS Appendix XIII on page 105) and Targeted Infrastructure Funding (TIF) (see MoSS Appendix XIV on page 109). CCAP estimated VMT reductions from these strategies by looking at the effects these tools had in other States. MEDEP then estimated HAP reductions from these strategies, based on the VMT reductions.

Important strategies that reduce VMT and increase vehicle occupancy from the light-duty gas vehicle category include the following, in the order of the greatest potential for air toxics emissions reductions:

2(a) Promote Transit Oriented Development

Transit Oriented Development (TOD) is a strategy that promotes mixed use development around transportation stops. This, in turn, focuses new development and transportation investments on reducing VMT and mitigating public health impacts from air pollution, promotes physical activity, reduces greenhouse gas emissions and preserves open space resources and wildlife habitat. Generally increases in transit use, walking, and bicycling lead to local reductions in VMT of 20-30% from Transit Oriented Development. However, the reductions achieved from TOD in Maine will likely be lower than the general estimates because Maine has fewer centers with population densities that are high enough to support transit, and few destinations that are transit accessible. To ensure the highest benefit of TOD, Maine must make commensurate investments in new and improved transit infrastructure to serve and connect higher density, mixed use developments.

Based on a rough estimate of potential VMT reductions in Maine developed by CCAP, MEDEP estimates that this strategy could reduce air toxics emissions by approximately 9,399 toxicity-weighted tons per year, with a net savings to Maine citizens.

Maine DOT in cooperation with University of Southern Maine, MEDEP, State Planning Office, and local governments will be undertaking a refined study of the possibility of implementing TOD in the State of Maine. This study will give decision-makers more concrete data about the benefits of implementing TOD in their cities, towns and regions. Different build-out land use scenarios will be analyzed for a specific area in the State of Maine. One of these scenarios will include future land use development that implements the principles of Transit Oriented Development. Another scenario will assume “business as usual” development. The two scenarios will be compared to determine the difference in vehicles miles traveled and to identify any reduction in traffic congestion.

2(b) Promote Targeted Infrastructure Funding

Targeted infrastructure funding is a strategy that establishes additional criteria for awarding existing public funds, towards those projects that will help reduce VMT, usually by focusing on existing infrastructure rather than greenfield development. Developing a Maine specific quantification of VMT reduction potential associated with TIF development requires knowledge of the infrastructure likely to be targeted, understanding all the complementary policies, and estimates of development diverted from greenfield projects. Thus targeted infrastructure funding is more applicable to post-analysis. However, by using a general assumption that TIF could divert a development generating 5,000 trips per day from an urban edge greenfield site to a centrally located brownfield site, the approximate VMT savings would be 23 percent (2.1 million vehicle miles avoided annually) at a given location. These VMT savings would be based on increased transit use (from 0 to 1.5 percent), biking and walking, and shorter average vehicle trip lengths (from 5.0 to 3.9) miles per trip.

2(c) Expand public transit

Expanding public transit to reduce vehicle miles traveled by 5% from the targeted passenger cars and light-duty trucks would result in a net savings of $24,686 per toxicity weighted tons per year of air toxics. Based on the assumption that average rider ship equals 50% of capacity, each bus deployed removes approximately twenty cars from the road at any given time it is in service.

2(d) Promote telecommuting

This option would evaluate and promote workplace policies allowing employees to work at home. It has been successful at some large corporations and EPA has a model "Best Work Places for Commuters". The effectiveness of this program depends on the degree of penetration, but the subcommittee estimated that this option could reduce toxicity-weighted emissions of the on-road sector by almost 2%, at a net savings of $13,900 per toxicity-weighted ton.

2(e) Increase carpool parking lots

Based on the assumption that a commuter travels on average 18 miles roundtrip per day, if four people carpooled that would be equivalent to reducing on average 54 miles per day. Doubling the number of spaces available in current carpool lots from 2000 to 4000 would achieve a reduction of 183 toxicity-weighted tons of air toxics, at a net savings of $21 per toxicity-weighted tons. However, success is dependent on siting new carpool lots in the most congested areas of the state. Maine DOT should focus on leasing developed lots that have unused capacity during peak commuting hours, such as shopping malls.

3. Adopt a No-idling Regulation in combination with an education and outreach campaign

The first phase of further promoting no-idling in Maine should focus on education and outreach, followed by adoption of a no-idling regulation.

3(a) Develop voluntary no-idling campaign and driver education

A voluntary campaign would support community efforts with training and materials for a no idling campaign and develop a driver education module to include the benefits of not idling and fuel savings techniques. The estimated 15% reduction of idling emissions from approximately one million cars would have a net savings of $3,187/tons per year of toxicity-weighted air toxics. It was assumed that a driver education program could achieve 5% in fuel savings. Most of the education and outreach materials necessary for this option have been developed.

3(b) Adopt statewide no-idling regulations

While being more costly to implement and enforce than a voluntary program, the air toxics reductions would be more than three times greater from adopting a no-idling regulation than implementing only a voluntary program. The subcommittee estimated that a no-idling law in combination with community education and outreach could reduce idling emissions by 50%, for a net savings of $11,641 per toxicity-weighted ton per year. Maine should follow the other New England States and adopt a no-idling law that would target all transportation sectors and vehicle categories.

During this legislative session, LD 533 proposed establishing Clean Air Zones which required no-idling around public buildings, ferry landings and approaches to draw bridges. The legislature's Transportation Committee voted ought not to pass but directed the MEDEP and Maine DOT to study the feasibility of a state wide regulation and report back next session. The MEDEP has also been tasked with drafting a no-idling policy for state government fleets through the Clean Government Initiative legislation. Therefore, there is an opportunity for presenting a no-idling regulation to the legislature next session.

Adopt Reformulated Gas (RFG)

Adoption of a Reformulated Gas requirement is one option that the subcommittee is *not* recommending at this time, due to the relatively high cost of $1,831 per toxicity-weighted ton. However, given this option's high potential for air toxic reductions and the recent increase in air toxic emissions from the gasoline reaching the Maine market, this strategy should be reconsidered if additional air toxics emission reductions are necessary to reach Ambient Air Guidelines. The Governor can opt-in to requiring RFG at any time.

Some areas in the country with severe air quality pollution are required in the Clean Air Act to use RFG. Reformulated gas caps benzene at .95% by volume with the average level of benzene at .62%. Maine is not required to have reformulated gas and receives conventional fuel. However, during ozone season the Reid Vapor Pressure for gasoline is reduced from 9.0 to 7.8 in Maine's seven southern counties for reduction of volatile organic compound emissions. MTBE was widely used as a fuel oxygenate to reduce air toxic emissions and improve overall combustion efficiency. Because Maine did not have an MTBE ban in effect until January 2007, Maine did receive some RFG shipments during ozone season in southern Maine. In 2005, 35 out of 307 fuel shipments were RFG compared to 3 out of 315 shipments in 2006, in anticipation of Maine's MTBE ban.

The Energy Policy Act of 2005 passed without a ban on MTBE, but did include a renewable fuels standard as well as removing the oxygenate requirement from the RFG program. Because of the removal of the fuel oxygenate requirement and the state bans on MTBE, 10% ethanol has replaced MTBE in RFG to maintain the air quality improvements. All of the northeastern states with the exception of Maine and Vermont are receiving 10% ethanol in their fuel supply. Because Maine is not required to use RFG, we continue to receive conventional gasoline without MTBE or ethanol. As a result, in 2006 the average levels of benzene were 0.92 % by volume, which is higher than the levels of 0.81% vol. reported in 2005. The number of shipments with benzene levels above the federal cap of .95% by volume tripled from previous years with a maximum level reported as high as 4.03% by volume.

MEDEP used MOBILE 6.2 to model the air toxics reductions from using RFG. The analysis indicates that adoption of RFG statewide would achieve a 6% reduction in air toxics reductions from the on-road sector. However, the subcommittee raised concerns regarding the potential price increase of RFG and potential limited capacity to blend ethanol at the terminals, as well as storage and distribution issues. Handling of ethanol has unique requirements and would require a significant investment in infrastructure.

In addition, EPA's Mobile Sources Air Toxic Rule will go into effect in 2011 requiring a nation wide average level of benzene to not exceed .62% by volume. This requirement would apply to all fuels including the conventional fuel shipped to Maine.

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MoSS Appendix IV: On the Books and Proposed Mobile Source Controls to Reduce Air Toxics in Maine

Mobile Source Emission Reduction Strategies	**Agency lead**	**Sector**	**Benefits/Costs**	**Air Toxic Reductions (H,M,L) and phase in period**	
California Low Emission Vehicle Program including ZEV	State	On-road - Autos (including light, medium & other trucks under 8,500 lbs, GVW))	**Benefits** l lower PM emissions and VOCs, ozone precursors, NO_X and hydrocarbons	**L**	CA LEVII implemented in 2004. GHG emission standards (Pavley) & ZEV will be phased in starting in 2009. There will be more benefits over EPA Tier II controls in the out years. Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
On-Board Diagnostic Inspection Program: All vehicles in Cumberland county must have an OBD inspection with annual safety inspection. 520 inspection stations, statewide.	Federal	On-road - Autos (including light, medium & other trucks under 8,500 lbs, GVW))	**Benefits:** 1996 and newer vehicles are equipped with computers that indicate when emission control systems are malfunctioning. In Cumberland County, owners are required to repair emissions equipment. In other areas, repair is voluntary. [16]	**L**	Mandatory in Cumberland county only, but important for reducing hot-spot risks in Portland area. Began in 1999. Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs: Full Credit gas cap in Cumberland Co, no credit for inspection stations.
Tier 2 Emission Stds/Sulfur in Gasoline: SUVs, pickups, vans subject to emission stds. 30 ppm average S in fuel (2005) w/ 80 ppm max..	Federal	On-Road - Autos (including light, medium & other trucks under 8,500	**Benefits:** 90% reduction of S from the national average, allows pollution control devices. Tier 2 also refers to the substantially cleaner federal car enabled by using the cleaner gasoline. Maine	**H**	**C**ontrols accounted for in the Mobile model, and increase over time with fleet turnover. Emission reductions are off-set somewhat by increased VMT. Phase in complete by Jan 2006 of Low Sulfur gasoline.

[16] 1996 or newer car & light truck are equipped with "on-board" computer system that monitor engine, transmission, and emissions control components. "Check Engine" light identify minor problems before they become major repair bills. OBD is an important air improvement tool in Cumberland County. Technicians use OBD checks to identify vehicles that are in need of repair and therefore are exceeding emissions standards. The State program REQUIRES vehicles in Cumberland County to get repairs Everywhere else for newer cars-if their OBD2 light (or MIL) is on, it informs everyone that their (1996 and newer) vehicle is operating improperly and should be repaired.

Mobile Source Emission Reduction Strategies	**Agency lead**	**Sector**	**Benefits/Costs**	**Air Toxic Reductions (H,M,L) and phase in period**	
		lbs, GVW))	has adopted CA LEV as the State's "new car" program		Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Executive Order Requires the state to purchase low emission and most fuel efficient vehicle in vehicle class. Requires the state fleets to report VMT and improved fuel efficiency of new vehicle purchases.	State	On-road – Autos (including light, medium & other trucks under 8,500 lbs, GVW))	**Benefits:** 59% of new vehicle purchases improve emissions. Reduced 396 tons of CO_2 for FY 2005-2007 7 & associated ATs.	**L**	Low statewide impact, but important in fostering markets for low emission vehicles. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Education and Outreach Program CBSM campaign for reduced idling.	State	On Road - Autos (including light, medium & other trucks under 8,500 lbs, GVW))	**Benefits:** Reduced idling;	**L**	Idling emissions comprise and unknown % of the inventory. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Clean Car Labeling Program: Label vehicles that get 30 mpg or better	State	On Road - Autos (including light, medium & other trucks under 8,500 lbs, GVW))	**Benefits:** Promote incentives to purchase cleaner vehicles;	**L**	Low statewide impact since is a voluntary program, but important in fostering markets for low emission vehicles. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Mobile Source Air Toxics Rule:	Federal	On Road - Autos (including light, medium &	**Benefits:** Rule Proposed on March 29, 2006 will revise MSAT 1, establish national average benzene in fuel standards at current RFG	**H-M**	The national benzene standards for gasoline, as proposed, allow for national trading so may or may not reduce HAPs in Maine. The emission standards for cold temperature operation should reduce

Mobile Source Emission Reduction Strategies	Agency lead	Sector	Benefits/Costs	Air Toxic Reductions (H,M,L) and phase in period	
		other trucks under 8,500 lbs, GVW))	levels, establish emissions for automobiles running at cold temperatures, and require spill proof gas-cans nation wide.		HAPs in Maine. The gas can law will have no additional impact, since the std is required already under state law. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Education and Outreach - targeting young people and new drivers about transportation alternatives and ways to reduce the impacts of driving. Statewide -- Maine Energy Education Program (MEEP) http://home.psouth.net/~meep/main.html. Kids in Transportation, http://www.gpcog.org/info.php?p=ODk0Mi4yMg (Cumberland County) and http://www.katyc.org/ (York County). .	State	On Road - Autos (including light, medium & other trucks under 8,500 lbs, GVW))	**Benefits:** Reduce VMT, etc. for nominal costs. **Costs:** All three programs work together but are funded differently	**L**	Not included in mobile6.2 Runs
Car Pooling - GoMaine http://www.gomaine.org/ program will soon be increased from 12 to 21 vans for vanpools and a large database of potential and existing carpoolers.	State	On Road - Autos (including light, medium & other trucks under 8,500 lbs, GVW))		**L**	Included in Mobile6.2 Model
Heavy Duty Diesel: Heavy Duty Diesels engine emission	Federal	On-Road-Heavy Duty	**Benefits:** Emission controls and lower S content in fuel,	**H**	Engine manufacturers will have flexibility to meet the new standards through a

Mobile Source Emission Reduction Strategies	**Agency lead**	**Sector**	**Benefits/Costs**	**Air Toxic Reductions (H,M,L) and phase in period**	
standards and cleaner diesel fuel		Diesel	will cut criteria pollution by 95 percent. Sulfur in diesel fuel will be lowered by 97% (from 500 parts per million to 15 parts per million). Diesel exhaust comprises a significant portion of the cancer risk from air toxics in Maine.		phase-in approach between model years 2007 and 2010. The fuel provision will go into effect in June 2006 and will be phased-in through 2009. Fleet turn-over will eventually lead to reduced emissions. Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Expedite Fleet Turn-over of transit buses: DOT has a fleet turnover policy to accelerate transit fleet turnover by replacing half the transit fleet at half its useful life (~every six years), if funding is available. An example is the replacement of island explorer buses in Acadia National Park.	State	On Road – Public Transit	**Benefits:** Fleet turnover will place the cleanest vehicles available in the ME fleet sooner. New vehicles are much cleaner than retrofit vehicles, reducing PM emissions by 90% and NO_X by 95% **Costs:** The cost differential for the 2007 compliant buses would be included in operators' capital budgets,@ $7,000.	**L**	Toxicity-weighted Emissions from Heavy duty vehicles comprises about 19% of the on-road mobile emissions and about 4% of total state-wide emissions. Transit buses comprise .09% of the Heavy duty vehicle emissions. However, this may be a necessary strategy to reduce ATs to acceptable risk levels, particularly if the reductions focus on hot-spot locations. Now approximately 13 buses are replaced each year, primarily in the Portland region. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Creation of new transit services. Maine DOT is in the process of creating new transit services in the State of Maine – including the South Coast shuttle service in Ogunquit and Wells and the Midcoast transit service in Brunswick.	State - DOT	On-Road – Public Transit	**Benefit:** This will reduce the amount of VMT traveled and air toxics generated. **Costs**: [Anna Price is researching COST]	**L**	A relatively small portion of total VMT will be reduced by these transit services. While these two new services will produce minor reductions, additional transit service and expansion could add up, especially in southern Maine. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.

Mobile Source Emission Reduction Strategies	Agency lead	Sector	Benefits/Costs	Air Toxic Reductions (H,M,L) and phase in period	
Expansion of existing propane transit services: Maine DOT is the process of expanding existing transit services. The Island Explorer service on Mount Desert Island. The fleet is growing from 17 to 29 propane buses. Downeast Transportation Industries is also providing year-round service to commuters in the area.	State - DOT	On-Road – Public Transit	**Benefit**: This will reduce VMT and air toxics generated. **Costs**: Approximately $250,000. Federal incentives will reduce the cost of new 2007 HD NGV or LPG vehicles by up to $32,000.	**L**	A relatively small portion of total VMT will be reduced by these transit services. According to the Propane Education and Research Council (PERC), propane vehicles reduce air toxics by 98%, including benzene, 1,3 butadiene, formaldehyde and acetaldehyde. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
Compressed Natural Gas Fleet: Portland METRO built a CNG fueling station with public access 13 CNG transit buses and 3 CNG school buses in fleet	State	On-Road – Public Transit	**Benefits:** 90 % reduction of PM Beginning with 2007 engines, new NG engines will produce one-sixth the NOx of new diesel engines. Fuel Station is publicly accessible which means other fleets can use it. Guaranteed use by 15 to 20 vehicles is enough to induce private enterprise to build and operate additional CNG infrastructure with a pre-negotiated fuel charge.	**L**	Toxicity-weighted emissions from Heavy duty vehicles comprise about 19% of the on-road mobile emissions and about 4% of total state-wide emissions. Transit buses comprise .09% of the Heavy duty vehicle emissions. However, this may be a necessary strategy to reduce ATs to acceptable risk levels, particularly if the reductions focus on hot-spot locations. Not Included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs.
• **School bus 12 year fleet turnover policy**	State	On Road – School	**Benefits:** New school buses would have factory-installed	**L** **M**	There are 2600 school buses owned by Maine Municipalities. School buses make

Mobile Source Emission Reduction Strategies	**Agency lead**	**Sector**	**Benefits/Costs**	**Air Toxic Reductions (H,M,L) and phase in period**	
to insure school buses would be compliant with the 2007 HDDE standards. • With current fleet turnover rates, this would be accomplished by 2019.		Buses	Diesel Particulate Filters (DPFs) and emissions controls for the ozone precursor, NO_X. **Costs:** The cost differential for the 2007 compliant buses would be included in operators' capital budgets.[17]		up a small fraction of total statewide toxicity weighted emissions (TWE), but are very important in protecting sensitive subpopulations (children). The national turnover rate is included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs, but not increased turnover rate. School buses comprise 0.2% of the VMT in the MOBILE 6.2 model.
Retrofit and replacement of the existing school bus fleet. 180 diesel school buses will be replaced with 2007-compliant buses under current fleet turnover schedules. To date 69 new (2005-2006) school buses retrofitted with DOCs. 416 older buses are currently being retrofitted with DOCs and closed crankcase ventilation systems.	State	On-Road - School Buses	**Benefits:** This maximizes reductions of PM2.5 from the school bus fleet on the most aggressive schedule. **Costs**:.$500,000 for installation of diesel oxidation catalysts (DOCs) and crankcase controls using the existing contract with Donaldson Company.	**L**	There are 2600 school buses owned by Maine Municipalities. School buses comprise 0.2% of the VMT in the MOBILE 6.2 model. School buses make up a small fraction of total statewide toxicity weighted emissions (TWE), but are very important in protecting sensitive subpopulations (children). Voluntary programs have less penetration than required programs. Not included in MATI Revised On-Road HAP Emission Trends Mobile6.2 Runs

[17] Federal incentives will reduce the cost of new 2007 HD NGV or LPG vehicles by up to $32,000. Meanwhile, 2007 compliant diesel vehicles will cost $10,000+ more than comparable 2006 vehicles. Beginning in October, 2006 federal tax credits for CNG and LPG will be $.50/gal for non-profit fleets and slightly less for for-profit fleets. Operating and maintenance costs for 2007-compliant diesel vehicles are expected to increase due to loss of efficiency. New NG engines are already meeting 2010 standards.

Mobile Source Emission Reduction Strategies	Agency lead	Sector	Benefits/Costs	Air Toxic Reductions (H,M,L) and phase in period	
Marine Diesel Engines (commercial ships, recreational diesel etc.)[18] EPA will propose more stringent emission standards for all new commercial, recreational, and auxiliary marine diesel engines except the very large engines used for propulsion on deep-sea vessels. Stds & technology based on the Nonroad Diesel engines program. Requires low S fuel. Maine has 3 main ports for shipping freight: Portland, Eastport and Searsport. Maine DOT is planning to expand capacity at each of these ports in the coming years. Freight is measured in terms of tonnage that passes through these ports, which indicates port use.	Federal	Off-road – Marine Diesel	Benefits: EPA estimates that NOx and PM emissions could be reduced by 90 percent with emission controls. Low sulfur fuel required by the Clean Air Nonroad Diesel Rule, (May, 2004) will decrease PM and associated HAPs from existing engines.	**L**	Portland is the busiest port in New England[19], but our emission estimates in this sector are highly uncertain. statewide emissions likely low, but could be essential to hot-spot locations Lower sulfur fuels will be introduced in 2011 (500 ppm) and 2012 (15 ppm) (except Small refineries, etc can sell over 500 ppm fuel until 2009 and are not subject to the 15 ppm std until 2014). Emission reductions from emission controls are subject to fleet turn-over - fleet turnover is slow since these engines have a long life span and are expensive.

[18] Diesel boats and ships, which range in size and application from small recreational runabouts to large ocean-going vessels, are significant contributors to air pollution in many of our nation's cities and ports.
[19] Based on U.S. PORT RANKING BY CARGO VOLUME 2004, Portland ME is the 27th largest Port in the country (Boston is ranked 31). See http://www.aapa-ports.org/pdf/2004_US_PORT_CARGO_TONNAGE_RANKINGS.xls

Mobile Source Emission Reduction Strategies	Agency lead	Sector	Benefits/Costs	Air Toxic Reductions (H,M,L) and phase in period	
Locomotives **engine emission stds:** EPA will propose more stringent locomotive engine emission standards. Stds & technology based on the heavy-duty diesel trucks and buses program. Availability of low Sulfur diesel fuel required under the new nonroad fuel rule allows use of this technology on locomotive engines	Federal EPA	Off-road - Locomotive s	EPA estimates that NOx and PM emissions could be reduced by 90 percent Phased in over time with fleet replacement Low S fuel will create immediate benefits by reducing PM from existing engines. Locomotive engines must meet relatively modest emission requirements set in 1997. In May 2004, as part of the Clean Air Nonroad Diesel Rule, EPA finalized new requirements for nonroad diesel fuel that will decrease the allowable levels of sulfur in fuel used in locomotives by 99 percent.	**L**	Emission estimates for this sector are poor. Each unit can be a significant source. Statewide emissions likely low, but could be essential to hot-spot locations. Lower sulfur fuels will be introduced in 2011 (500 ppm) and 2012 (15 ppm) (except Small refineries, etc can sell over 500 ppm fuel until 2010 and are not subject to the 15 ppm std until 2014).
The SmartWay^{TM} Transport Partnership is a voluntary collaboration between U.S. EPA and the freight industry to increase energy efficiency. Focuses on fuel-saving strategies. Also has a model state anti-idling law. http://www.epa.gov/smartway/	Federal EPA	Off and On-Road Freight	Benefits: Focus on energy savings for multi-pollutant benefits, including calculation tools for companies. Costs: Focus on low cost and no-cost solutions at the company level.	**L**	Need to ensure that shifting from on-road sector (with controls) to rail or marine (with limited controls) does not negate HAP reduction benefits.
Aviation (aircraft, ground support equipment, etc.) that	Federal	Off-road - Aircraft	EPA is amending the existing emission standards	**L**	The emission estimates for this source category are highly uncertain. Reductions

Mobile Source Emission Reduction Strategies	Agency lead	Sector	Benefits/Costs	Air Toxic Reductions (H,M,L) and phase in period	
are modeled after the Clean Air Nonroad Diesel Engines Program. Would require advanced emission-control technologies like those upcoming for heavy-duty diesel trucks and buses..			for NOx for new commercial aircraft engines. Standards are equivalent to the NOx standards of the United Nations International Civil Aviation Organization (ICAO), aligning US with the international standards.		statewide are expected to be low, but may be significant for hot-spot locations. Stds effective on December 19, 2005 and apply to new aircraft engines utilized on commercial aircraft that include small regional jets, single-aisle aircraft, twin-aisle aircraft, and 747s and larger aircraft
Compression-Ignition Engines (farm, construction, mining, etc.)	Federal	Off-road – Construction Diesel	**Benefits:** Nonroad diesel engines are a significant source. Recently EPA set emission standards[20] for the engines used in most construction, agricultural, and industrial equipment. EPA also adopted nonroad diesel fuel sulfur stds, to prevent damage to advanced emission control equipment. The most recent nonroad engine and fuel regulations complement similarly stringent on-road regs	**H**	Lower sulfur fuels will be introduced in 2007 (500 ppm) and 2010 (15 ppm) (except Small refineries, etc can sell over 500 ppm fuel until 2009 and are not subject to the 15 ppm std until 2014). Emission Controls phased in with replacement of equipment, beginning with the smallest engines in 2008 larger engines in 2014, & 750+ horsepower in 2015.
Small Spark-Ignition Engines (lawn mowers, leaf blowers, chainsaws, etc.) [21]	Federal	Off-road – Small Gas Engines	In July 1995, EPA finalized the first federal regulations affecting small nonroad SI engines at or below 19	**H**	"Phase I" (1997-2007) : 32 percent reduction in HC emissions. Phase 2 (2001-2007): 70 percent reduction in HC+NOx emissions from hand-held

[20] See: www.epa.gov/nonroad-diesel/ for information on EPA's nonroad regs.

[21] Small spark-ignition engines are generally divided into 5 different classes. For the non-handheld categories, Class I engines are used primarily in walk-behind lawnmowers and Class II engines are used primarily in lawn and garden tractors. For the handheld categories, Class III and IV engines are used primarily in residential equipment such as string trimmers, leaf blowers and chainsaws. Class V engines are used primarily in commercial equipment such as chainsaws.

Mobile Source Emission Reduction Strategies	Agency lead	Sector	Benefits/Costs	Air Toxic Reductions (H,M,L) and phase in period	
			kilowatts (kW), or 25 horsepower. EPA is presently looking at Phase 3 of these standards- primarily affecting non handheld Class I and II engines.		engines beyond the 32 percent reduction expected from the Phase 1 standards.[22] This reduction in HC+NOx emissions will be accompanied by an overall reduction in fuel consumption. Small SI engines currently produce approximately one tenth of U.S. mobile source HC emissions and are the largest single contributor to nonroad HC inventories nationwide.
Large Spark-Ignition Engines (forklifts, generators, etc.)	Federal	Off-road – small Gas engines	These standards cover nonroad spark-ignition (si) engines over 19 KW (25 hp). This includes many kinds of equipment including forklifts, generators, and many other farm, industrial and construction applications. These engines may operate on propane, gasoline, or natural gas.	**L**	Beginning MY 2004: EPA expects many manufacturers will add three-way catalysts to their engines and use electronic closed-loop fueling systems[23]. Beginning in 2007: Manufacturers will be able to control emission levels more broadly across the range of engine speeds and loads by improving control of air-fuel ratios at different operating modes. These improvements will reduce both steady-state and transient emission levels.
Marine Spark-Ignition Engines (boats, personal watercraft, etc.)	Federal	Off-road – Recreational	Emission standards for new SI gasoline marine engines used in outboards, personal watercraft, and jetboats (OB/PWC). Current, unregulated, stern drive/ inboards (SD/Is) are far cleaner than OB/PWC.	**L**	1998- 2006 phase in. OB/PWC were primarily 2-stroke engines that emitted high rates of HC exhaust and were the largest source of SI pollution. OB/PWC engines will be dramatically cleaner: They will be near the lower emission levels exhibited by today's SD/I engines.

[22] This is equivalent to an annual reduction of 500,000 tons of exhaust HC+NOx emissions by the year 2027.
[23] These technologies have been available for industrial engines for many years.

Mobile Source Emission Reduction Strategies	**Agency lead**	**Sector**	**Benefits/Costs**	**Air Toxic Reductions (H,M,L) and phase in period**	
Recreational Vehicles (snowmobiles, dirt bikes, all-terrain vehicles, etc.)	Federal	Off-road - Recreational	Regs have separate emission standards for snowmobiles, off-highway motorcycles, and all-terrain vehicles. For snowmobiles, Three phases of standards for HC and CO emissions[24]. For off highway motorcycles and all-terrain vehicles, EPA standards mainly move engines from two-stroke to four-stroke technology with the use of some secondary air injection. EPA adopting requirements to address permeation emissions from all three types of recreational vehicles.	M	This is a significant source category. Emission reductions are subject to fleet turn-over.
Gas Can Rule Gas can manufactured with impermeable materials	State	All Mobile	**Benefits:** Reduced VOC emissions & associated HAPs	**L**	This is not a large source of TWEs, but may be important for reducing indoor air exposure.

[24] First phase standards for snowmobiles are a mixture of technologies ranging from clean carburetion and engine modifications to direct fuel injection two-stroke technology and some conversion to four-stroke engines. The second and third phases involve significant use of direct fuel injection two-stroke technology and conversion to four-stroke engines.

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MoSS Appendix V: Funding Options for Mobile Source Air Toxic Reduction Programs

Mobile Source Emission Reduction Funding Mechanism	**Feasibility**
Clean Diesel Fund: Set up a state clean diesel fund, similar to the Carl Moyer Program in California,[1] the TERP[2] program in Texas or New Jersey's temporary reprogramming of corporate business taxes.	**Political considerations:** Strong lobby opposed to new taxes – need to clearly articulate the need. Structures are in place to establish a funding mechanism, but would need to develop political support
Air Quality Fee on New Car Purchase designated for AT reductions.	**Political considerations:** Strong lobby opposed to new taxes – need to clearly articulate the need. Logistically fairly easy to implement and does not have constitutional barriers. $100/car would raise 8,000,000
Tax incentives to support transit & VMT reductions, etc.	**Political considerations: Would need to find off-sets for lost funding, & there is a s**trong lobby opposed to new taxes – need to clearly articulate the need.
AQ Fee on Automobile Registration	**Political considerations:** Strong lobby opposed to new taxes – need to clearly articulate the need. The Maine Constitution requires excise taxes to only be used to fund road construction. Additionally, would need to work with each town, since cars are registered by the towns.
AQ fee collected at toll booths	**Political considerations:** Strong lobby opposed to new taxes – need to clearly articulate the need. Need to research constitutional issues & likely resistance from the TPA.
Feebate Program – Additional fees for higher emitting, low fuel economy vehicles, are used for rebates on low emitting vehicles.	**Political Considerations:** Strong lobby opposed to new taxes – need to clearly articulate the need. Cost neutral. Would have to overcome historic poor reception by legislature due to concern for low income people. Federal study on feasibility to be completed in 2007.
AQ fee on fuel supplier	**Political considerations:** Strong lobby opposed to new taxes – need to clearly articulate the need. Similar mechanisms are already in place with the DEP Groundwater Fund

[1] See http://www.arb.ca.gov/msprog/moyer/carl_moyer_board_presentation_1_20_05.pdf

[2] See http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/rg/rg-388.html.

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MoSS Appendix VI: Top Ranking Strategies for Air Toxic Reductions from Mobile Sources, with Estimated Implementation Costs.

The Shaded Strategies are recommended by MoSS for full ATAC recommendations

Reduction Program Title	Implementation Approach	Sector that the strategy targets	Goals		AT reductions from strategy (TW-TPY)	% Reduction in Total Non-road	% Reduction in Total On-road inventory	Annual Cost ($Million)	Normalized Annual Cost ($/TW-TPY)	Implementation Timeframe	Hot-Spot Strategy?	GHG Benefit?	CAP benefit?
Expand Mandatory On-board Diagnostics & Repair Program Statewide	Regulatory	On-road - Light Vehicles & Trucks	20 %	Emission Reduction in light duty vehicles with statewide OBD program	35,660	0%	15%	$3.1	$86	Mid	N	N	Y
Reduce VMT & increase vehicle occupancy, increase fuel efficiency	E&O	On-road - Light Vehicles & Trucks	10 %	Reduction in VMT traveled by all light duty vehicles & Motor Cycles	17,830	0%	8%	($681)	($38,177)	mid	Y	Y	Y
Driver education outreach on how to save fuel	E&O	On-Road: all	5%	HAP emissions from Overall Fuel Savings for all on-road fleet	11,748	0%	5%	($108)	($9,158)	Short	N	Y	Y
Transit Oriented Development	Land Planning	On-Road: all	4%	Reduction in total VMT. (See CCAP report)	9,399	0%	4%	$0.0	$0	Long	Y	Y	Y

Expand Public Transit	Voluntary	On-road - Light Vehicles & Trucks	5%	Reduction in commuter VMT.	8,913	0%	4%	($220)	($24,686)	Long	Y	Y	Y
Telecommuting & Working at Home via workplace policies	Voluntary	On-road - Light Vehicles & Trucks	2%	Reduction in HAP emissions per year.	4,119	0%	1.8%	($57.3)	($13,920)	Short	Y	Y	Y
State-wide No-Idling Regulation for all motor vehicles.	Regulatory	On-Road: all	50 %	Reduction in idling of on-road Sector	3,065	0%	1%	($36)	($11,641)	Mid	Y	Y	Y
Anti-Idling campaign	E&O	On-Road: all	15 %	Reduction in idling of on-road Sector	920	0%	0%	($3)	($3,187)	Short	Y	Y	Y
Increase carpool parking lots	Voluntary	On-road - Light Vehicles & Trucks	0.10 3%	Reduction in commuter VMT by doubling current number of available parking spaces	183	0%	0.078%	($21)	($114,016)	Long	Y	Y	Y
Statewide use of Reformulated Gasoline:	Fuel	On-Road: all	6%	Reduction in On-Road HAPs by adopting statewide RFG. Estimated emission	13,994	0%	6%	$ 26	$1,831	Mid	N	N	Y

				reductions from MOBILE 6.2 model run & Connecticut's formulation of RFG.									
Emission Control Retrofits for older Heavy Duty Diesel Engines	Voluntary/incentives	On & Off-Road HDDE	5%	Reduction in PM emissions from On & Off Road Heavy Duty Diesel Engines	2,374	4%	3.2%	$ 17.25	$7,266	Mid	Y	N	Y
Transit Fuel Switching: purchase alternative fuel transit vehicles.	Voluntary	On-Road-Public Transit	10 %	Of existing diesel buses convert to CNG or LPG	82	0%	0.04%	$3	$38,862	Long	Y	Y	Y

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MoSS Appendix VII: CCAP Options Matrix of Changes to Land Use Planning to Reduce VMT

By the Center for Clean Air Policy (CCAP)
750 First Street, NE, Suite 940, Washington, DC 20002
For The Maine Department of Environmental Protection

Measure, Description	Target Sector	Location
Transit Oriented Development	Light duty	Urban & older suburbs
Transit Oriented Development (TOD) integrates higher density development, within an easy walk of a major transit stop, with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding cars. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use.		
Infill & Brownfield Development	Light duty	Urban & abandoned suburban sites
Infill and brownfield policies attempt to guide development away from greenfield sites and city edges towards underutilized/abandoned properties within the urban core. These forms of compact urban development make use of existing infrastructure and relieve growth pressure placed on outlying areas. Brownfields can also occur outside of city center, for example closed factories, malls (sometimes called 'greyfields'), airports or military bases, which can host mixed-use development.		
Pedestrian Oriented Design	Light duty	Urban & Suburban
Pedestrian-oriented design (also known as New Urbanism and Traditional Neighborhood development) integrates both smart growth planning and urban design principles in order to improve the pedestrian environment by making walking easier, safer and more attractive. The creation of more walkable urban environments requires both larger scale planning efforts to promote higher density, mixed use and transit-oriented communities, and urban design features that promote safety and access to local services on foot.		Even in suburban areas, improving pedestrian connectivity can displace some car trips, e.g., by creating attractive walking paths between subdivisions and the back of strip malls.
Smart School Siting		Urban & older suburbs

Measure, Description	**Target Sector**	**Location**
Smart school siting policies are aimed at the retention of existing schools, or the construction of new schools within established communities. These policies can refocus development within existing urban areas and reduce the trend towards sprawling suburban regions fueled by the development of large schools at the urban edge. Reinvestment in existing local schools with pedestrian and bicycle access can result in greater accessibility for students and parents without the need for a motor vehicle.	Light duty & Heavy duty Buses	
Permitting & Zoning Reform	light duty	Urban and Suburban
Local ordinances can be a barrier to smart growth development by requiring, for example, the separation of uses and high parking minimums. By reforming statutes, local codes and ordinances and building codes state and local governments can facilitate the development of pedestrian oriented streets, traditional neighborhood developments, mixed uses, transit-oriented developments and improved parking design. These forms of urban development focus on reducing the orientation of new and existing communities away from the car towards walking, bicycling and public transit.		
Improved Transit Service	light duty	Urban and Suburban
Investment in existing transit services improves accessibility and can increase ridership levels, facilitating a reduction in the number of cars on the road, congestion levels and VMT. Investments in transit include increasing existing service levels, enhancing operational characteristics and providing incentives to encourage greater transit ridership.	Could increase Heavy Duty Bus emissions	Transit will have limited applications in very low density areas, but may be appropriate for some commuter applications, such as van pools.
Light Rail Transit	light duty	Urban, high density corridors
The key characteristics of light rail transit (LRT) include: electric rail cars operated on tracks in a fixed guide-way, location within part of a roadway or in completely separated rights-of-way, station-to-station service, stations located at intervals of approximately 0.5 to 1.5 miles, presence of parking facilities and local bus services. LRT has the flexibility to be implemented in either a corridor or on a system-wide basis.	could potentially displace some Heavy Duty Bus or Vans	Light rail typically requires high density to accommodate sufficient ridership.

Measure, Description	Target Sector	Location
Bus Rapid Transit	light duty	Urban, high density corridors
Bus Rapid Transit (BRT) refers to a permanent system of facilities, services and amenities that collectively improve the speed, reliability and identity of bus transit. BRT systems provide a roadway-based rapid transit alternative that mimic light rail in terms of high capacity vehicles, frequent service exclusive running ways, stations with pre-boarding fare collection, multiple door boarding to reduce station times, and low emissions technologies . BRT can be implemented more quickly and cheaply than LRT, but may not offer the same land use "anchor" or attractiveness to consumers.	Could increase Heavy Duty Bus emissions	Due to its lower cost, BRT may work at lower densities than LRT.
Bicycle Infrastructure & Initiatives	light duty	Urban & Suburban
Bicycle programs can include a variety of initiatives to increase safety and accessibility for cyclists. Program options may include but are not limited to promotion and education programs, bicycle lanes and bikeways, enhanced signage, improved connectivity with transit, bike lockers and work-place showers.	could potentially displace some Heavy Duty Bus or Vans	
Targeted Infrastructure Funding	light duty	Urban & older suburbs
State and local governments direct the investment of hundreds of millions of dollars of state and federal funding of transportation and other key infrastructure (schools, sewers, utilities, etc.). The reorientation of transportation and infrastructure spending towards efficient transportation and land use alternatives can enhance smart growth and air quality objectives. State and local governments can also use this 'power of the purse' to withhold funding from projects that do not conform to such policies, providing a strong disincentive for sprawling growth patterns. Some states direct growth by prioritizing infrastructure funding for preferred areas, as defined by local governments and/or state criteria. Other states have adopted fix-it-first policies to instruct state agencies to build upon and maintain existing assets before investments are made in new infrastructure. Leveraging funds that will be spent "anyway" may be one of the most effective means for state and local governments to reduce VMT and air pollution criteria pollutant emissions in addition to slowing the		

Measure, Description	**Target Sector**	**Location**
loss of natural and agricultural land to development.		
Road Pricing	All road vehicles	Major roadways
Road pricing applies a user fee to existing transportation infrastructure to more efficiently balance the supply and demand. The function of road pricing is twofold; it attempts to manage congestion levels while generating revenue used to maintain transportation networks. Some forms of road pricing initiatives utilize variable fees that are assessed based on the time of day, level of congestion or occupancy of the vehicle. Programs can focus on providing an incentive to shift trips to off-peak times, less congested routes, alternative modes of travel or higher occupancy vehicles. Further, new automated technologies have made tolling much less obstructive, allowing toll collection along the route which lessens the impact of congestion.		
Commuter Incentives	light duty	Urban and Suburban
Commuter incentive programs take advantage of a variety of options used to reduce single occupancy vehicle (SOV) trips for workplace travel. Employers can adopt programs that best suit the needs of their employee base, some methods include: subsidizing employees commuting costs with tax-free transit benefits; allowing the use of pre-tax dollars to pay for alternative commute costs; facilitating tele-work and alternative work schedule programs; providing incentives to carpool, vanpool, bicycle or walk; parking cash-out; and guaranteed ride home programs.		

Measure, Description	Target Sector	Location
Pay As You Drive Insurance	light duty	Urban and Suburban
Pay-As-You-Drive automobile insurance is a system where participants are assessed based on the number of vehicle miles traveled in combination with traditional risk based rates. PAYD goes beyond what current insurance companies are offering in premiums to low distance drivers. Shifting to this type of mileage-based auto-insurance system allows motorists to reduce their costs while encouraging them to drive less.		
Location Efficient Mortgage	light duty	Urban & older suburbs
Location Efficient Mortgages (LEM) provide discounted mortgages to people who chose to buy a home in compact, mixed-use communities serviced by public transportation. In these communities, residents have the opportunity to walk, bike or take public transportation from their homes to stores, schools, recreation, and work. Lenders recognize that living in these types of communities reduces, if not eliminates, the homebuyers need to drive, thereby lessening the homebuyer's transportation and energy costs.		
Comprehensive Smart Growth Programs	light duty	Urban and suburban
Comprehensive smart growth programs employ multiple strategies and a coordinated approach to policy development to address the impacts of conventional growth patterns. Key elements needed to successfully implement smart growth policies include: comprehensive regional planning, regional cooperation, funding for efficient transportation alternatives, targeted infrastructure spending, incentives to redevelop the center city, elimination of regulatory or financial disincentives that encourage sprawl, and strong political leadership.	May also reduce some Heavy Duty VMT, but most efforts and studies haven't focused on freight.	
Municipal Parking Programs	light duty	Urban

Measure, Description	Target Sector	Location
Parking pricing and supply restrictions are two methods used to deter personal vehicle use, especially single occupancy vehicle (SOV) use, in areas with easily accessed transit alternatives. Parking supply restrictions, like parking pricing, encourage utilization of transit, cycling and walking. When designed in conjunction with other land use and pricing measures, parking pricing policies are one of the most effective ways to reduce VMT, congestion and air pollution. Policy makers must consider the extent to which parking initiatives deter urban development given the availability of free parking in suburban areas.		
Safe Routes to School	light duty,	Urban and Suburban
Safe routes to School programs encourage parents and children to walk and bike to school through the provision of safer pedestrian environments. By creating more walkable and bikeable communities, these initiatives help achieve air quality targets while promoting local health benefits. School zones, particularly at the urban edge where zones tend to be larger, are hot spots for vehicle exhaust during peak hours. Safe Routes to School programs, by reducing the number of vehicles, can help reduce peak concentration of vehicle emissions.	Heavy Duty Buses	
Fuel Tax	All road vehicles	All areas of state,
Fuel taxes are considered a form of user fees levied against drivers based on fuel consumption, and can serve as a financial incentive for consumers to reduce the number of vehicle miles traveled (VMT) and/or consider switching to a more fuel- efficient vehicle. Increasing the per-mile cost of driving with a fuel tax can affect both fuel consumption and efficiency. Further reductions in local and regional VMT can occur through the reallocation of gas tax revenues to fund investments in alternatives to single occupancy vehicle use. Increases in the gas tax can serve as a dedicated revenue stream for local transit systems that can fund service improvements and infrastructure investments.		Greatest benefits in urban areas and older suburbs with more travel choices.
Freight Mode Shift	Heavy Duty Trucks	Major highways and interstate corridors

Measure, Description	Target Sector	Location
Intermodal freight is the transport of cargo containers via railways, ocean going vessels, inland ship/barge, ferries, and trucks. Intermodal ground freight transportation makes greater use of rail as an alternative to congested roadways and expanding highway systems. Intermodal infrastructure facilitates a greater use of railways that can help to maximize transportation efficiencies and offset rapid future growth in truck traffic. Rail offers a greater efficiency on a per ton mile basis than containers moved by truck over long distances, or through high volume corridors.		

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MoSS Appendix VIII: CCAP Screening Analysis of Transit Oriented Development

By the Center for Clean Air Policy (CCAP), 750 First Street, NE, Suite 940, Washington, DC 20002
For The Maine Department of Environmental Protection

Implementation Scale: Site Level
VMT Reduction Potential Rating: High
Feasibility/Ease of Implementation Rating: Medium

Transit Oriented Development (TOD) is becoming recognized as a viable form of growth management that addresses the needs of rapidly growing communities both large and small. As defined by the California Department of Transportation, TOD typically integrates "moderate to higher density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding the auto. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use."[25]

TODs facilitate reduction in household automobile usage through the provision of both accessible transit alternatives and local employment and retail locations. The development of systematic TOD networks can change transportation behaviors at both local and regional scales. Analyses of the travel characteristics of California TODs conducted by Lund et al. indicate a 5.0 times greater rate of transit use for residents of TODs than those of comparable or adjacent locations. Similarly, transit use for office workers was 3.5 times greater for TODs.[26]

Transit oriented development can result in local and regional benefits in addition to reductions in VMT and associated air pollutant emissions. There are many economic, social and transportation benefits including:

- increased mobility options for heavily congested regions
- improved mobility for segments of the population, such as youth and the elderly, without access to cars
- enhanced public safety through the development of more pedestrian oriented communities
- increased cost effectiveness of transit investment through improved ridership
- potential reductions household transportation costs of up to $3-4,000 per household annually[27]
- preservation of agricultural and open space areas by redirecting greenfield development to urban areas
- increased local retail development and economic revitalization
- reduced public infrastructure costs through more efficient use of existing resources
- increased affordability of housing with increased densities and lower transportation costs
- rising property values and local tax revenues
- increased accessibility to housing options
- enhanced livability of communities through improvements in air quality, public health, accessibility to public spaces, commute times etc[28]

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[25] Cal Trans (2002) "Statewide Transit-Oriented Development Study Final Report": http://transitorienteddevelopment.dot.ca.gov/PDFs/Statewide%20TOD%20Study%20Final%20Report%20Sept.%2002.pdf
[26] Lund et al. (2004) "Travel Characteristics of Transit-Oriented Development in California" http://www.csupomona.edu/%7Erwwillson/tod/Pictures/TOD2.pdf
[27] Cal Trans (2002), *op cit.*
[28] Reconnecting America (2002) "Transit Oriented Development: Moving from Rhetoric to Reality": http://www.reconnectingamerica.org/pdfs/DBelzerTOD.pdf

VMT REDUCTION POTENTIAL

Local reductions in VMT of 20-30% result from increased transit use, walking and bicycling as modes of transportation. Achieving regional reductions - estimated at 5% for widespread TODs - would likely require locating new growth around multiple transit-accessible corridors.[29] Consequently, air pollution emissions and energy consumption decrease for households within TODs. Rates of greenhouse gas emissions have been shown to be 2.5 to 3.7 tons per year per household lower within TOD locations.[30,31]

A Canadian study found that the most significant emissions reductions occur by changing regional location, which reduces CO_2 emissions 21 - 58%, while changing the 3-Ds (density, diversity and design) alone (without the context of regional access) can reduce CO_2 emissions by 15 - 50%.[32] Such savings from regional location are also seen in the well-cited Atlantic Station project (14-52%). Changing site design alone can also result in VMT savings of up to 6% (without changing mix of use, density or location).[33]

While TOD is generically estimated to result in VMT reductions of 20-30 percent, it is important to note that this estimate is based on similar land use patterns differing only in access to transit. In practice, TOD will most likely be developed in conjunction with infill or smart growth policies. Therefore, site-specific VMT savings may exceed the generic 20-30 percent estimate. Also, since TOD will likely reduce the quantity of short vehicle trips taken (which contribute a greater proportion to mobile air toxics than indicated by proportional VMT), emission levels may drop by an even greater percentage than VMT (holding other things constant).

In quantifying the potential impacts for Maine, it will be necessary to identify prime potential areas. Using Maine-specific data where possible, we will compare VMT profiles in expected TOD areas to both average areas and greenfield development areas to show the savings in both scenarios. Maine-specific information on number of trips, trips taken and mode split is essential for determining the VMT impacts of TOD. Note that TOD projects are often best evaluated on a case-by-case basis, rather than through a generic estimation framework.

FEASIBILITY

In the report *Shifting Gears*, released earlier this year by Natural Resources Council of Maine and Environment Maine, it recommends supporting transit-oriented development as one of 20 policies to reduce VMT and reduce the state's GHG emissions.[34] While market demand for TODs is no longer

[29] A recent study by the Canadian Mortgage Housing Corporation (CMHC) quantifies how density, diversity and design elements interact across suburban, medium density and neo-traditional (urban) forms. The CMHC study provides clarity on the impact of the so-called three Ds (diversity, design and density) with and without regional access. The study concludes that while building in the style of an urban town center (neo-traditional) is helpful, smart growth style planning is most successful when done on a regional basis. For more information, see http://www.cmhc.ca/en/index.cfm

[30] Based on expected TOD household savings of 5,000-7,500 VMT per year. This anticipated reduction estimate is based on the Deborah Dagang and Terry Parker, "Transportation Land Use Strategies to Minimize Motor Vehicle Emissions: An Indirect Source Research Study", for the California Environmental Protection Agency, Air Resources Board, 1995.

[31] Cal Trans (2002) "Statewide Transit-Oriented Development Study Technical Appendices": http://transitorienteddevelopment.dot.ca.gov/PDFs/Statewide%20TOD%20Study%20APPENDIX%20Final%20Sept.%2002.pdf

[32] CMHC, *op cit.*

[33] Walters, G. et al., "Adjusting Computer Modeling Tools to Capture Effects of Smart Growth: Or 'Poking at the Project Like a Lab Rat', "*Transportation Research Record 1722* (2000), pp. 17-26.

[34] http://environmentmaine.org/envmaine.asp?id2=24142

considered a barrier to implementation with the success of numerous TOD projects nationwide, these projects, however, continue to face many implementation challenges[35] including:

- lack optimal development standards and systems to coordinate development processes
- no cohesive regulatory and policy framework
- difficulty obtaining financing for mixed use developments due to concerns of private lenders, lengthy approvals processes and limited public funding in many regions
- local tax structure often promote large scale retail development over residential land uses
- poor transit design often isolates the station area from the community (i.e. limited pedestrian access and large parking facilities)
- obtaining development approvals is often slow as local zoning may be unsupportive of transit
- local community opposition based on density, traffic and parking concerns
- parking challenges impact costs, financing and public support[36]
- land aggregation is difficult, particularly, for urban and infill sites
- limited use of financial tools to (i.e., tax increment financing)
- information and expertise on implementation is limited

A variety of broad implementation strategies have been used to promote Transit Oriented Developments nationwide and could work in Maine. They include:

- supporting TOD Planning through the transfer of federal transportation funds to local governments for TOD planning and implementation
- abatement of taxes for TODs to aid market development for higher density, mixed use communities
- transit joint development which allows transit agencies to use, sell or lease land that will help generate ridership
- direct participation of local governments in financing and building TODs

OTHER RESOURCES & REFERENCES

California Department of Transportation- searchable database for 21 statewide TOD projects include information on stations, projects, processes photos and links to Caltrans: http://transitorienteddevelopment.dot.ca.gov/

Caltrans- "Statewide Transit Oriented Development Study- Factors for Success in California" includes links to the executive summary, final report, technical appendices and supplementary report on parking and TODs:
http://transitorienteddevelopment.dot.ca.gov/miscellaneous/StatewideTOD.htm

Envision Utah- provides information on Envision Utah's Transit-Oriented Development initiatives: http://www.envisionutah.org/trans_land.html

Orenco Station Development- contains access to information on housing options within the transit oriented community and access to virtual tours:
http://www.orencostation.com/home.htm

[35] The Great American Station Foundation (2002) "Challenges to Implementing Transit-Oriented Development": http://www.stationfoundation.org/pdfs/TODchallenges.docNEW.doc
[36] Cal Trans (2002) "Statewide Transit-Oriented Development Study Final Report:" http://transitorienteddevelopment.dot.ca.gov/PDFs/Statewide%20TOD%20Study%20Final%20Report%20Sept.%2002.pdf

Reconnecting America- Center for Transit Oriented Development provides access to resources that promote the further market development of TODs:
http://www.reconnectingamerica.org/html/TOD/index.htm

San Francisco Bay Area Rapid Transit District- "BART Transit-Oriented Development Guidelines" includes information on building and planning successful TOD projects:
http://www.bart.gov/docs/BARTTOD.pdf

The Great American Station Foundation- website includes access to information, case studies and prominent reports on transit oriented developments:
http://www.transittown.org/

US Environmental Protection Agency- "Our Built and Natural Environment, a Technical Review of the Interactions between Land Use, Transportation and Environmental Quality":
http://www.epa.gov/livability/pdf/built.pdf

MoSS Appendix IX: CCAP Screening Analysis of Permitting & Zoning Reform

By the Center for Clean Air Policy (CCAP), 750 First Street, NE, Suite 940, Washington, DC 20002
For The Maine Department of Environmental Protection

Implementation Scale: State or Regional
VMT Reduction Potential Rating: Medium to Low
Feasibility/Ease of Implementation Rating: Medium

Local regulations pose significant barriers to smart growth through the prohibition of mixed use and mixed income developments, and the fostering of automobile dependent forms of growth. Often regulations governing land development are outdated, as many planning statutes originated as early as the 1920s.[37]

By reforming statutes, local codes and ordinances and building codes state and local governments can encourage infill and brownfield development and facilitate the development of pedestrian oriented streets, traditional neighborhood developments, mixed uses, transit-oriented developments and improved parking design.[38] These forms of urban development focus on reducing the orientation of new and existing communities away from the car towards walking, bicycling and public transit. As a result, emissions of criteria air pollutants and greenhouse gases decline due to reductions in local VMT.

The types of permitting and zoning reforms that reflect smart growth principles vary widely, some of which include:

- traditional neighborhood development codes[39]
- form-based zoning[40]
- live /work and mixed use codes
- transit area codes
- design regulations
- reduced parking requirements
- streamlined development approval process for smart growth projects
- performance criteria standards replacing zoning regulations
- rural zoning districts

Undertaking initiatives to reform land use regulations and encouraging the implementation of smart growth projects, can result in benefits to the community beyond air quality improvements, these can include:

- increased walkability of communities
- safe routes to schools
- creation of livable neighborhoods for aging populations[41]
- higher levels of daily physical activity
- decreased municipal infrastructure costs

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[37] American Planning Association (1999) "Planning Communities for the 21st Century": http://www.planning.org/growingsmart/pdf/planningcommunities21st.pdf
[38] Local Government Commission (2003) "An Executive Summary of Smart Growth Zoning Codes: A Resource Guide": http://www.lgc.org/freepub/PDF/Land_Use/sg_code_exec_summary.pdf
[39] University of Wisconsin Extension (2001) "A Model Ordinance for a Traditional Neighborhood Development": http://www.wisc.edu/urpl/people/ohm/projects/tndord.pdf
[40] American Planning Association: http://www.planning.org/conferencecoverage/2004/tuesday/formbased.htm
[41] National Governors Association: http://www.subnet.nga.org/ci/5-top20.html

- decreased exposure to congestion levels
- increased accessibility to a range of housing choices
- improved transportation choice
- greater diversity in urban design

VMT REDUCTION POTENTIAL

By removing the regulatory barriers to infill and brownfield development projects through permitting and zoning reform, governments can address local air quality and greenhouse gas concerns by reducing VMT and allowing for easier access to transit and pedestrian facilities. US Environmental Protection Agency assessments of selected infill developments indicate significant reductions in vehicle miles traveled, VOC and NOx emissions.[42] The environmental implications of school siting, for example, is just one area where the impacts of permitting and zoning ordinances are often overlooked. Setting large minimum acreage sizes for schools or requiring the development of schools on greenfields in new growth areas can lead to dramatic increases in VMT along with other social and economic impacts.

The potential for VMT reduction is rated medium to low, because removing barriers alone does not directly result in reductions, but it is a good initial step. There are no generic estimation techniques applicable to permitting and zoning reform. Once a specific policy is decided upon, then we can present estimate. For example, if permitting allows for TOD, then the TOD estimation procedure (as described) can be used. Other targets for reform will require alternative estimation techniques.

Likely relevant variables for Maine specific estimation include mode split, average trip quantities and lengths under alternative densities and land-use mixes etc.

FEASIBILITY

Maine's zoning and permitting ordinances typically vary by town and region. This lack of cohesiveness and guiding framework for tackling this issue often creates problems for smaller localities in dealing with the issues that come with urban and rural growth. Without the necessary tools, local governments are left on their own to tackle issues such as big box development, new housing, and even military base closures. While Maine's State government has done some work in the area of school siting (e.g., their Department of Education developed a primer on the topic called the *ABC's of School Site Selection*) other states can provide useful case studies for Maine in the larger context of zoning and permitting reform. For example, planning officials in Pennsylvania have introduced three new zoning districts for a primarily rural section of the township to address issues associated with traditional suburban development.[43] The districts include a Town Center district, Traditional Neighborhood Development (TND) district, and a Mixed-Use Corridor district. The Town Center and TND areas will include pedestrian-oriented street design and mixed housing styles that integrate into predominantly commercial and retail zones.

Regulations governing land use must take into consideration issues of private property and public opposition to restrictive zoning policies. Local governments need to attain a successful balance between community goals and individual property rights. An overly prescriptive approach can restrict organic growth processes. Zoning regulations should be grounded in the government interest

[42] US EPA (2001a), "Comparing Methodologies to Assess Transportation and Air Quality Impacts of Brownfields and Infill Development": http://www.epa.gov/livability/pdf/comparing_methodologies.pdf

[43] http://www.smartgrowth.org/news/article.asp?art=4343

in advancing public health and general welfare and not simply in aesthetics.[44]

OTHER RESOURCES & REFERENCES

American Planning Association- an overview of Enabling Legislation for Traditional Neighborhood Development Regulations from the 2001 APA National Planning Conference: http://www.asu.edu/caed/proceedings01/SITOW/sitow.htm

American Planning Association- a summary of "Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change" is available online and includes tools available to help state and local governments reform planning and zoning legislation: http://www.planning.org/growingsmart/summary.htm

Congress for New Urbanism- this site provides access to resources on new urbanism including a catalogue of smart growth model codes, state building codes, state enabling legislation and local regulations from across the United States:
http://www.cnu.org/
http://www.cnu.org/pdf/code_catalog_8-1-01.pdf

Local Government Commission- "An Executive Summary of Smart Growth Zoning Codes: A Resource Guide" provides an assessment of best practices in zoning codes to address issues such as traditional neighborhood development and transit oriented development: http://www.lgc.org/freepub/PDF/Land_Use/sg_code_exec_summary.pdf

University of Wisconsin Extension- provides an example of "A Model Ordinance for a Traditional Neighborhood Development" was adopted by the Wisconsin State Legislature in 2001: http://www.wisc.edu/urpl/people/ohm/projects/tndord.pdf

US Department of Energy- the Smart Communities Network website provides examples of Smart Land Use Codes/Ordinances that have been adopted my state and local governments: http://www.sustainable.doe.gov/landuse/lucodtoc.shtml

[44] American Planning Association: http://www.planning.org/PEL/oct01comm.htm

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MoSS Appendix X: CCAP Screening Analysis of Bus Rapid Transit

By the Center for Clean Air Policy (CCAP), 750 First Street, NE, Suite 940, Washington, DC 20002
For The Maine Department of Environmental Protection

BUS RAPID TRANSIT
Implementation Scale: Regional or Corridor
VMT Reduction Potential Rating: Medium to High
Feasibility/Ease of Implementation Rating: Medium

Bus Rapid Transit (BRT) consists of a variety of components used to enhance the level of service relative to traditional public transportation systems. BRT integrates a variety of technologies to provide public transportation services that are appropriate to the market for which they are designed. BRT can be broadly defined as "[a] permanent system of facilities, services and amenities that collectively improve the speed, reliability and identity of bus transit".[45] BRT systems provide a roadway-based rapid transit alternative that combines high levels of service, intelligent transportation systems (ITS) and low emission vehicle technologies.

The focus of BRT improvements is often beyond the buses themselves and aims to improve overall system performance. Operational systems integrate some or all of the following elements:

- *running ways*- vehicles can operate in exclusive transit-ways, HOV lanes, expressway or general traffic
- *stations*- are attractive, easily accessible and well integrated into the community
- *vehicles*- most often are rubber tired, high capacity, quiet and make use of available low emissions technologies
- *service*- is higher frequency all day service based on headway times, fewer stops and integrated with local service to reduce waiting times
- *intelligent transportation systems (ITS)*- include advanced digital technologies such as transit signaling priority and global positioning systems (GPS) used to provide real time service information
- *fare collection*- pre-boarding fare collection machines, smart cards and multiple door boarding reduce station times
- *route structure*- simple often color-coded routes provide direct rides, with fewer required transfers[46]

BRT enhances the quality of transit service available to the public, making public transportation a more attractive transportation alternative. Traveling by transit uses significantly less energy and produces less pollution per person per mile than the equivalent trip by private vehicle. In addition, BRT provides transportation benefits that may make it preferable to light rail or traditional bus service. The benefits attributable to BRT may include:

- lower economic and environmental costs associated with BRT than with automobile infrastructure facilities
- lower capital cost than rail projects
- reduced commute times
- increased transit ridership
- expanded transit accessibility in suburban regions that lack the density to make rail transportation an effective option

[45] Journal of Public Transportation (2002) : http://www.nctr.usf.edu/jpt/pdf/JPT%205-21.pdf
[46] Center for Transportation Excellence: http://www.cfte.org/trends/brt.asp#1

- implementation that can be quick and incremental
- fuller use of existing infrastructure through the use of pre-existing running ways
- adequate capacity for high volume transportation corridors
- enhanced system flexibility allows for a variety of service options in a range of urban and suburban environments
- easily integrated into transit and pedestrian oriented developments
- promotes development and redevelopment in station areas

There are currently more than 20 BRT systems in full operation or under development in the United States and Canada.

VMT REDUCTION POTENTIAL

Traveling by transit uses significantly less energy and produces less pollution per person per mile than the equivalent trip by private vehicle. BRT enhances the quality of transit service available to the public, making public transportation a more attractive transportation alternative. Developing a complementary land use pattern and creating accessibility for bicycles and pedestrian movement along the transit system is critical in achieving the greatest long term benefits from public transportation -- benefits in terms of level of ridership, displacement of vehicle trips to public transit and reduction in emissions. Some other benefits of BRT include the fact that compared to a Light Rail Transit (LRT) line or a metro line, the BRT corridor is significantly less expensive and involves less construction time. BRT is typically estimated to cost $1-10 Million/km versus $20-220 million/km for metro or rail[47]; further the planning and construction time is typically 12-18 months versus 3-30 years for metro.[48]

BRT systems have significant potential to reduce VMT as they provide a flexible alternative to personal vehicle use that consumers strongly prefer to regular bus service. Bus rapid transit policy thus effects reductions by impacting mode split. Mode split shifts away from automobile use as more transportation choices become viable. BRT can be implemented regionally or on individual corridor basis. BRT also potentially improves air quality by displacing older, heavily polluting buses. There may also be some air quality benefits from improved traffic flow, but these congestion impacts would likely have to be modeled to get an accurate estimate.

Quantifying the impacts for Maine will require emissions data on potentially replaced bus fleet, new buses emission data, current transit ridership, expected increases in ridership, and if possible, estimated congestion improvements.

FEASIBILITY

The feasibility exists for the development BRT corridors in Maine. In fact, in *Destination Tomorrow*, the PACTS Long Range Regional Transportation Plan recommends “BRT as a strategy for maintaining capacity on key arterials through ITS technology and by making roadway operational improvements”.[49] The effectiveness of a BRT system must be considered relative to other available transit options. The needs of the individual community will dictate whether BRT is the most appropriate alternative. The Center for Transportation Excellence has outlined several questions that should be considered in assessing the appropriateness of a BRT system,[50] they include:

- What is the goal?

[47] Fjellstrom, Karl, GTZ. Mass Transit Options: Recent Developments in Asia. Presentation at Envirotech October 2003.
[48] Ibid.
[49] http://www.gpcog.org/transit-planning.php#tids
[50] Center for Transportation Excellence: http://www.cfte.org/trends/brt.asp

- What are the current deficiencies in the system and what alternatives are available to solve them?
- Who is the system trying to attract?
- Is a large right of way acquisition a potential option?
- Are transit efforts aligned with other efforts?

The answers to these questions may indicate whether BRT is the most effective transit investment option. BRT systems are often considered an alternative to costly light rail transit investments. LRT has substantially higher capital costs due to infrastructure requirements, particularly the need for an imbedded track structure and the purchase of light rail vehicles. This makes BRT an attractive investment option for smaller medium-sized cities, with costs ranging from 40 to 70 percent of LRT estimates.[51] In those urban areas where there may be a limited difference in potential BRT vs. LRT ridership, BRT is often a more cost effective option. Additionally, BRT can also add an element of service flexibility that facilitates use in suburban locations that LRT cannot provide with a fixed guideway system.

OTHER RESOURCES & REFERENCES

Center for Transportation Excellence- BRT 101 provides the basics of BRT information including definitions, characteristics and comparisons to other modes of transportation:
http://www.cfte.org/trends/brt.asp#1

Federal Transit Association- includes information on a variety of BRT projects, resources and program evaluations:
http://www.fta.dot.gov/initiatives_tech_assistance/technology/2381_ENG_HTML.htm

Federal Transit Administration- "Characteristics of Bus Rapid Transit for Decision-Making for Decision-Making" details major elements of BRT systems, system performance, and benefits:
http://www.fta.dot.gov/documents/CBRT-DecisioMaking.pdf

Institute for Transportation and Development Policy- "Sustainable Transport: a Sourcebook for Policy Makers in Developing Cities", module 3b of the guidebook discusses Bus Rapid Transit and is one of 20 modules aimed at providing policy tools for developing cities:
http://www.itdp.org/STe/STe4/readSTe4/BRT.PDF

Journal of Public Transportation- an issue dedicated to Bus Rapid Transit:
http://www.nctr.usf.edu/jpt/pdf/JPT%205-21.pdf

National BRT Institute- provides links to a variety of BRT resources and projects including TRB/APTA PowerPoint presentations**:**
http://www.nbrti.org/

Transit Cooperative Research Program- "Report 90 Bus Rapid Transit, Volume 1: Case Studies in Bus Rapid Transit", includes an overview of the findings of fourteen North American and twelve international BRT examples:
http://gulliver.trb.org/publications/tcrp/tcrp_rpt_90v1.pdf

[51] Sislak, K.G. "Bus Rapid Transit as a Substitute for Light Rail Transit":
http://www.apta.com/research/info/briefings/documents/sislak.pdf

"Report 90 Bus Rapid Transit, Volume 2: Implementation Guidelines", a detailed report on the technological, operational and financial components of BRT systems:
http://trb.org/publications/tcrp/tcrp_rpt_90v2.pdf

United States General Accounting Office- "Bus Rapid Transit Shows Promise" provides a comparison of capital and operating costs for Light rail and BRT systems, as well as possible funding mechanisms for BRT projects:
http://www.apta.com/research/info/briefings/documents/d01984.pdf

WestStart-CalStart- "Vehicle Catalog: a Compendium of Vehicles for Bus Rapid Transit Service" contains a summary of BRT vehicles in production by international and national manufacturers:
http://www.gobrt.org/vehiclecatalog.pdf

MoSS Appendix XI: CCAP Screening Analysis of Targeted Infrastructure Funding

By the Center for Clean Air Policy (CCAP), 750 First Street, NE, Suite 940, Washington, DC 20002
For The Maine Department of Environmental Protection

Implementation Scale: State
VMT Reduction Potential Rating: High
Feasibility/Ease of Implementation Rating: Medium to Low

State governments direct the investment of billions of dollars of state and federal funding of transportation and other key infrastructure (schools, sewers, utilities). The reorientation of transportation and infrastructure spending towards efficient transportation and land use alternatives can enhance smart growth and air quality objectives. States can also use this 'power of the purse' to withhold funding from projects that do not conform to such policies, providing a strong disincentive for sprawling growth patterns.[52,53,54]

Targeting infrastructure funds to existing urban and suburban areas can help redirect growth inward, thereby relieving development pressures on greenfield areas at the urban fringe. Some states direct growth by prioritizing infrastructure funding for preferred areas, as defined by local governments and/or state criteria. Similarly, some states have adopted fix-it-first policies to instruct state agencies to build upon and maintain existing assets before investments are made in new infrastructure.[55]

Targeted infrastructure funding can help states to grow in a more compact manner and provides greater accessibility and mobility options for individuals. Funding to enable and support denser development may be one of the most effective means for state and local governments to reduce VMT and criteria pollutant emissions in addition to slowing the loss of natural and agricultural land to development.

By reducing the growth of new urban greenfield areas through targeted infrastructure spending additional benefits can be achieved, including:

- reduced pressure on agricultural, open space and environmentally sensitive areas
- more efficient use of funds through greater inter-departmental coordination
- lowered infrastructure costs
- revitalization of downtown areas
- more efficient transit operation with higher development densities

VMT REDUCTION POTENTIAL

Targeted infrastructure funding is another option for which it is difficult to develop a priori quantification methods. A fix-it-first approach would lead to more dense urban development, sustaining transit, reducing travel demand, and shifting mode split towards public transit (assuming options are available). These effects can be estimated by looking at the relationship between urban

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[52] Center for Clean Air Policy, "Two for the Price of One: Smart Growth and Clean Air," December 2004. http://www.ccap.org/transportation/smart_two.htm
[53] Linking Vision with Capital: Challenges and Opportunities in Financing Smart Growth, September 2001 http://www.housingamerica.org/order.cfm.
[54] Real Estate Research Corporation (1974), "The Costs of Sprawl: Detailed Cost Analysis," prepared for the Council on Environmental Quality; the Office of Policy Development and Research, Department of Housing and Urban Development; the Office of Planning and Management, Environmental Protection Agency. See: http://www.smartgrowth.org/pdf/costs_of_sprawl.pdf
[55] National Governors Association (2004) "Fixing It First: Targeting Infrastructure Investments to Improve State Economies and Invigorate Existing Communities": http://www.nga.org/cda/files/0408FIXINGFIRST.pdf

density and VMT, and also the impact of infill growth versus greenfield growth. If the targeted infrastructure funding prevents greenfield development, this option will likely significantly reduce VMT growth.

Developing a Maine-specific quantification requires a comprehensive understanding of the infrastructure likely to be targeted. After the targets are selected, appropriate travel demand and density data will have to be gathered.

FEASIBILITY

Maine already has a successful case study in this area through its State Housing Authority. By scoring projects based on a number of criteria including transit availability, it encourages smarter development by sending a message to developers and local governments that this is the way development should be need to be done if it is to receive State funding.

To build on this success, other barriers to the implementation of targeted infrastructure funding programs that will perhaps need to be overcome in Maine include:[56]

- contradictory government policies that promote smart growth principles while maintaining incentives supporting uncontrolled growth
- lack of political leadership to co-ordinate land use, transportation and environmental decisions
- local level regulations that do not effectively support smart growth goals
- resistance by local decision makers to implement state policies to actively redirect growth
- vague comprehensive plans with limited guidance on how to achieve goals or measure progress towards them

Massachusetts provides a good example of the potential effectiveness of a targeted infrastructure funding program. The Office of Commonwealth Development (OCD), which directs smart growth policies in the housing, transportation, energy and environment agencies, coordinates the allocation of $2 billion in state and federal funding to direct development in areas supported by pre-existing infrastructure.[57] One of the central OCD initiatives is the *Commonwealth Capital* policy which strives to coordinate capital spending programs to ensure consistency between development projects and sustainable development principles. Specifically, it has developed a set of criteria that prioritize housing, transportation and parks funding for projects that promote efficient land use, travel alternatives and petroleum conservation. Commonwealth Capital serves as a tool to influence municipal land use practices by rewarding municipalities engaged in smart growth planning. The state has also introduced a *Fix-It-First Policy* which prioritizes maintenance of existing infrastructure over new construction. Fix-It-First has extended to transportation policy focusing on repairing the state's existing roads and highways and enhancing opportunities for transit and non-motorized transportation options.

New Jersey provides another good case study. In 2002, Governor James McGreevy issued *Executive Order 4* establishing the Smart Growth Policy Council.[58] The council's mandate was to ensure that State transportation and infrastructure funding, inter-departmental procedures, programs, and projects were consistent with the State Plan and smart growth principles. The state plan placed a high priority

[56] 1000 Friends of Maryland (2001) "Smart Growth: How is Your County Doing? A Report on the Metropolitan Baltimore Region": http://www.friendsofmd.org/data/smartgrowth.pdf

[57] http://www.mass.gov/ocd/comcap.html

[58] http://www.nj.gov/dca/osg/commissions/sgpc.shtml

on investments in areas with existing infrastructure that would help create more compact growth patterns.

OTHER RESOURCES & REFERENCES

National Governors Association- a policy issue brief, “Fixing It First: Targeting Infrastructure Investments to Improve State Economies and Invigorate Existing Communities”:
http://www.nga.org/cda/files/0408FIXINGFIRST.pdf
http://www.nga.org/cda/files/0408FIXFIRSTCHART.pdf

1000 Friends of Maryland- “Smart Growth: How is Your County Doing?” provides an overview of issues faced in Maryland counties with the implementation of their Priority Funding Areas:
http://www.friendsofmd.org/data/smartgrowth.pdf

US Environmental Protection Agency- Redeveloping brownfields with federal transportation funding:
http://smartgrowth.org/pdf/brownfields_tea21.pdf

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MoSS Appendix XII: CCAP Screening Analysis of Comprehensive Smart Growth

By the Center for Clean Air Policy (CCAP), 750 First Street, NE, Suite 940, Washington, DC 20002
For The Maine Department of Environmental Protection

Implementation Scale: State or Regional
VMT Reduction Potential Rating: Medium to High
Feasibility/Ease of Implementation Rating: High

Comprehensive Smart Growth Programs at both state and local levels of government have arisen in response to community concerns over the social, economic and environmental costs of building road-centered, automobile-dependent, low density developments in North America over the last 50 years. The principles of smart growth provide a framework through which decisions as to how and where communities grow can be viewed.[59]

Comprehensive smart growth programs employ multiple strategies and a coordinated approach to policy development to address the impacts of conventional growth patterns. The creation of regulatory bodies to ensure the coordination and implementation of smart growth plans and policies helps ensure that branches of the government do not adopt contradictory initiatives. Key elements needed to successfully implement smart growth policies include:

- comprehensive regional planning
- regional cooperation
- funding for efficient transportation alternatives
- targeted infrastructure spending
- incentives to redevelop the center city
- elimination of regulatory or financial disincentives that encourage sprawl
- strong political leadership

MPO studies from around the country show smart growth policies have the potential to reduce regional and statewide VMT reductions by 3-25 percent, as seen in the table below. The VMT savings from these analyses result from a combination of transit improvements, land use modifications and complementary policies such as open space protection and measures (including in some cases, congestion pricing, zoning, etc). With the exception of Sacramento's Blueprint project however, the savings may not fully capture micro-scale trips, trip-chaining and/or induced travel.

Regional VMT Reductions from Smart Growth and Transit

Study Location	Regional VMT Reduction (from business-as-usual)	Implementation Timeframe
Albany[60]	**7 - 14%**	2000 – 2015
California[61]	**3 - 10%**	2000 – 2020

[59] Smart Growth Network (2002) "Getting to Smart Growth: 100 Policies for Implementation": http://www.smartgrowth.org/pdf/gettosg.pdf
[60] Capital District Transportation Committee, *New Visions 2021*, Draft approved October 2000.
[61] Parsons Brinckerhoff, for the California Energy Commission, *California MPO Smart Growth Energy Savings MPO Survey Findings.* September, 2001.

Portland[62]	**6 - 8%**	1995 – 2010
Puget Sound[63]	**10 - 25%**	2005 – 2050
Sacramento[64]	**15-25%**	2005 – 2050
Salt Lake City[65]	**3%**	2000 – 2020

The successful implementation of comprehensive smart growth programs reduces congestion and VMT, which improves air quality and provides environmental, social and economic co-benefits. Environmental benefits include:[66]

- reducing the rate of land use change, habitat loss and fragmentation
- improving levels of water pollution resulting from surface water runoff
- protecting ground water resources
- reducing levels of air pollutant deposition

Social benefits include:

- reduced rates of obesity by increasing levels of physical activity[67]
- fewer health related impacts of vehicle emissions[68]
- reduced climate change impact on health[69]
- greater social equity due to improved transportation and housing choices[70]

Researchers at Rutgers University estimate that smart growth strategies, relative to conventional growth patterns, can yield an economic savings of $250 billion over the next 25 years.[71] Developers, new home buyers and commercial tenants, as well as local and state governments would reap these savings. Additional benefits include:

- decreased expenditure on public infrastructure i.e. roads, sewers, schools[72]
- lower private costs for transportation i.e. fuel, car insurance
- reduced costs of congestion to individuals and businesses[73]
- lower public and private health care expenditures

[62] Cambridge Systematics, Inc. and Parsons, Brinckerhoff, Quade & Douglas. *Making the Land Use Transportation Air Quality Connection: Analysis of Alternatives.* Vol. 5. Prepared for Thousand Friends of Oregon. May, 1996.
[63] CCAP estimate based on Puget Sound Regional Council, *Destination 2030*: http://www.psrc.org/projects/mtp/ and the USDOE, Energy Information Administration, *Annual Energy Outlook*: http://www.eia.doe.gov/oiaf/aeo/.
[64] SACOG, Preferred Blueprint Scenario: http://www.sacregionblueprint.org/sacregionblueprint/the_project/discussion_draft_preferred_scenario.cfm.
[65] Envision Utah, Quality Growth Strategy and Technical Review, January 2000: http://envisionutah.org/January2000.pdf
[66] US EPA (2001) "Our Built and Natural Environments": http://www.epa.gov/smartgrowth/pdf/built.pdf
[67] Environmental and Energy Study Institute (2004) "The Public Health Effects of Sprawl: http://www.eesi.org/publications/Briefing%20Summaries/10.2.03%20Briefing%20Summary.pdf
[68] New England Journal of Medicine (2004) "The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age":http://content.nejm.org/cgi/content/short/351/11/1057
[69] Pollution Probe (2004) "Primer on Climate Change and Human Health": http://www.pollutionprobe.org/Reports/climatechangeprimer.pdf
[70] Atlanta Neighborhood Development Partnership Inc: http://www.andpi.org/mici/
[71] Burchell, R., and D. Listokin *Linking Vision With Capital: Challenges and Opportunities In Financing Smart Growth*, Center for Urban Policy Research, Edward J. Bloustein School of Planning and Public Policy, Rutgers and the Research Institute for Housing America, Institute Report No. 01-01, September 2001. : http://www.housingamerica.org/docs/RIHA01-01.pdf
[72] Center for Clean Air Policy (2003) "State and Local Leadership on Transportation and Climate Change": http://www.ccap.org/pdf/2003-Jan-state_transport_climate.pdf
[73] Texas Transportation Institute (2004) "2004 Urban Mobility Study": http://mobility.tamu.edu/ums/report/

VMT REDUCTION POTENTIAL

By adopting a multi-faceted policy approach – including shifting regional development patterns to more centrally-located communities – comprehensive smart growth programs effect emissions reductions through changes in mode split, number of trips taken and average trip length.

The scale associated with any particular smart growth program will greatly influence the expected impacts. Comprehensive region-wide programs may yield regional reductions of 20 percent. Overall reductions associated with this program are expected to be significant.

Smart growth involves a comprehensive package of options, requiring either modeling or a top down estimate to get a feel for the associated emissions reductions. For the illustrative calculation, we will examine various smart-growth packages that seem likely based on input from key Maine sources. Once the likely scenarios are determined, impacts on relevant variables will be estimated to determine expected changes in VMT and air quality.

FEASIBILITY

Getting smart growth policies implemented in any town, region or state is a difficult and challenging task and Maine is no different. Barriers typically include:[74]

- lack of public participation in the planning process
- prevalence of 'not in my back yard' (NIMBY) attitudes
- inconsistency between local plans and land use regulations
- land use regulations that continue to discourage smart growth e.g., large lot sizes
- state and federal transportation infrastructure spending policies often pull investments to previously undeveloped areas, with transportation spending often focusing on new highways
- finance redevelopment in the urban core is often difficult and more expensive
- mixed use developments face complex and time consuming approval processes

GrowSmart Maine's Model Town Community Project will be an important first step in demonstrating how smart growth can be implemented in Maine.[75] Through leadership, technical expertise, and public involvement this pilot project will provide a concrete example to other towns on how to manage growth in a more sustainable manner. This project will also bring to light the specific implementation barriers that Maine communities are facing and hopefully provide strategies to overcome them.

For a comprehensive smart growth program to take hold in Maine however, leadership and guidance will need to come from the top and the State Planning agency will need to play a critical role. Given Maine's size, its positive track record for inter-governmental discourse, and its apparent openness to new ideas, the feasibility of developing and delivering such a program is promising.

OTHER RESOURCES & REFERENCES

American Planning Association- policy guide of smart growth includes the APA adopted definition of smart growth, description and history of the issues and APA smart growth policy motions and their outcomes:
http://www.planning.org/policyguides/smartgrowth.htm

[74] Vermont Forum on Sprawl (2001) "Growing Smarter: Making Smart Growth Work": http://www.vtsprawl.org/Pdfs/bestresource.pdf
[75] http://www.growsmartmaine.org/Model%20Town%20Project.htm

Brookings Metropolitan Policy Program – "Redefining the challenges facing metropolitan America and promoting innovative solutions to help communities grow in more inclusive, competitive, and sustainable ways." The website includes reports, commentary and analysis: http://www.brookings.edu/metro/metro.htm

Canadian Mortgage and Housing Corporation- "Greenhouse Gas Emissions from Urban Travel: Tool for Evaluating Neighborhood Sustainability", highlights the importance of macro scale urban structures on greenhouse gas emissions reductions
http://www.cmhc.ca/publications/en/rh-pr/socio/socio050.pdf

Center for Clean Air Policy- "Two for the Price of One: Smart Growth and Clean Air," a background primer for a policy forum hosted by CCAP and LGC in December 2004, provides an overview of 1) Clean Air Act structure and the federal policy framework as it relates to the implementation of smart growth and other state and federal air quality and transportation policies and programs, 2) transportation planning and emissions modeling, and 3) implementation of land use and air quality policies and programs. http://www.ccap.org/transportation/smart_two.htm

Fannie Mae Foundation- "Retracting Suburbia: Smart Growth and the
Future of Housing", a report highlighting the way housing can be used to support smart growth policies:
http://www.fanniemaefoundation.org/programs/hpd/pdf/hpd_1003_danielsen.pdf

Georgia Tech – Released in 2004 the Strategies for Metropolitan Atlanta's Regional Transportation and Air Quality (SMARTRAQ) study illustrates the relationship between urban form, transportation and health. The study emphasized the connection between areas of higher residential and employment density, mixed land uses and street connectivity with lower levels of VMT and air pollution emissions and elevated levels of physical activity and transit use.
Strategies for Metropolitan Atlanta's Regional Transportation and Air Quality
http://www.smartraq.net/

Metro-region- information on the Portland regional 2040 Growth Concept, adopted as part of the Region 2040 growth plan in 1995, in addition to other regional land use initiatives:
http://www.metro-region.org/article.cfm?articleID=231

National Center for Smart Growth Research and Education- provides information on smart growth research at the University of Maryland, including information on the state's past and present smart growth policies:
http://www.smartgrowth.umd.edu/index.htm

Smart Growth America- "Measuring Sprawl and its Impact: The Character & Consequences of Metropolitan Expansion", a report that evaluates and measures urban sprawl and its impacts, including the sprawl index which ranks major US cities:
http://www.smartgrowthamerica.org/sprawlindex/sprawlindex.html

Smart Growth Network- "Getting to Smart Growth I & II: 100 Policies for Implementation", outlines 10 principles of smart growth and policies that can be used to implement them:
http://www.smartgrowth.org/pdf/gettosg.pdf
http://www.smartgrowth.org/pdf/gettosg2.pdf

US Environmental Protection Agency- "Our Built and Natural Environment, a Technical Review of the Interactions between Land Use, Transportation and Environmental Quality. In the report, the U.S. EPA summarizes technical research on the relationship between the built and natural environments, as well as current understanding of the role of development patterns, urban design, and transportation in improving environmental quality. http://www.epa.gov/livability/pdf/built.pdf

MoSS Appendix XIII CCAP Detailed Analysis of Targeted Infrastructure Funding

By the Center for Clean Air Policy (CCAP), 750 First Street, NE, Suite 940, Washington, DC 20002
For The Maine Department of Environmental Protection

Implementation Scale: State
VMT Reduction Potential Rating: High
Feasibility/Ease of Implementation Rating: Medium to Low

CONTEXT

Characteristic patterns of urban growth and development in post-WWII North America have created cities and regions that heavily depend on cars to meet transportation needs. Land use functions (residential, commercial, employment) are estranged from one another, origins and destinations are farther apart, infrastructure design is oriented toward the automobile, and low population densities are not conducive to public transportation. With the automobile as the only realistic mode of transportation, commuters are faced with increased driving distances and congested roadways. This has resulted in increasing VMT, deteriorating urban air quality and human health, increased greenhouse gas emissions, limited transportation and housing choices, inefficient use of infrastructure, and ultimately, communities that are less able to meet the needs of their residents.

Smart growth has emerged as a viable alternative growth strategy that can develop healthy and sustainable urban environments. The central tenet of smart growth is the return to more compact communities that are more walkable, more livable and less reliant on the automobile for daily transportation needs. A comprehensive smart growth effort that includes such measures as targeted infrastructure funding and transit-oriented development will reduce VMT and the resulting air toxics and greenhouse gas emissions, as well as promote physical activity (e.g., more walking, biking), improve public health, and preserve open space resources and wildlife habitat.

TARGETING INFRASTRUCTURE INVESTMENT

State governments direct the investment of billions of dollars of state and federal funding of transportation and other key infrastructure (schools, sewers, utilities). The reorientation of transportation and infrastructure spending towards efficient transportation and land use alternatives can enhance smart growth and air quality objectives. States can also use this 'power of the purse' to withhold funding from projects that do not conform to such policies, providing a strong disincentive for sprawling growth patterns.[76,77,78]

Targeting infrastructure funds to existing urban and suburban areas can help redirect growth inward, thereby relieving development pressures on greenfield areas at the urban fringe. Some states direct growth by prioritizing infrastructure funding for preferred areas, as defined by local governments

[76] Center for Clean Air Policy, "Two for the Price of One: Smart Growth and Clean Air," December 2004. http://www.ccap.org/transportation/smart_two.htm
[77] Linking Vision with Capital: Challenges and Opportunities in Financing Smart Growth, September 2001 http://www.housingamerica.org/order.cfm.
[78] Real Estate Research Corporation (1974), "The Costs of Sprawl: Detailed Cost Analysis," prepared for the Council on Environmental Quality; the Office of Policy Development and Research, Department of Housing and Urban Development; the Office of Planning and Management, Environmental Protection Agency. See: http://www.smartgrowth.org/pdf/costs_of_sprawl.pdf

and/or state criteria. Similarly, some states have adopted fix-it-first policies to instruct state agencies to build upon and maintain existing assets before investments are made in new infrastructure.[79]

Targeted infrastructure funding can help states to grow in a more compact manner and provides greater accessibility and mobility options for individuals. Funding to enable and support denser development may be one of the most effective means for state and local governments to reduce VMT and criteria pollutant emissions in addition to slowing the loss of natural and agricultural land to development.

By reducing the growth of new urban greenfield areas through targeted infrastructure spending additional benefits can be achieved, including:

- reduced pressure on agricultural, open space and environmentally sensitive areas
- more efficient use of funds through greater inter-departmental coordination
- lowered infrastructure costs
- revitalization of downtown areas
- more efficient transit operation with higher development densities

Further, by targeting public investments to redevelopment areas local governments “can reduce risk by creating more upside potential for loan collateral”.[80] In other words, enhancing the value of these areas through public investment will make it a more palatable risk for developers and lending institutions.

FEASIBILITY IN MAINE

Maine is projected to grow nearly twice as fast is this decade than in the previous one. Channeling this growth into existing areas will significantly reduce the rate of VMT growth. Targeting infrastructure funding to built-up areas is consistent with the recommendations in the Brooking Report, *Charting Maine's Future: An Action Plan for Promoting Sustainable Prosperity and Quality Places*.[81] Brookings recommends a variety of measures to help combat sprawl and encourage smarter development including large bond investments in existing town centers; the proposed *Maine Quality Places Fund* for example, promotes community revitalization and land and farm conservation.

Maine already has a successful case study in the area of targeted investment through its State Housing Authority. By scoring projects based on a number of criteria, including transit availability, the program sends a message to developers and local governments that this is the way development should be done if it is to receive State funding, thereby encouraging smarter development.

To build on this success, Maine should remove other possible barriers to the implementation of targeted infrastructure funding programs including:[82]

- contradictory government policies that promote smart growth principles while also maintaining incentives supporting uncontrolled growth at the same time
- lack of political leadership to co-ordinate land use, transportation and environmental decisions

[79] National Governors Association (2004) “Fixing It First: Targeting Infrastructure Investments to Improve State Economies and Invigorate Existing Communities”: http://www.nga.org/cda/files/0408FIXINGFIRST.pdf
[80] Burchell et al. *Linking Vision With Capital: Challenges and Opportunities in Financing Smart Growth, Research Institute for Housing America*, September 2001.
[81] http://www.brookings.edu/metro/maine
[82] 1000 Friends of Maryland (2001) “Smart Growth: How is Your County Doing? A Report on the Metropolitan Baltimore Region”: http://www.friendsofmd.org/data/smartgrowth.pdf

- local regulations that do not effectively support smart growth goals
- resistance by local decision makers to implement state policies to actively redirect growth
- vague comprehensive plans with limited guidance on how to achieve goals or measure progress towards them

Another avenue for Maine would be to follow the example of recent efforts in California. With over $40 billion dollars in bonds passed in late 2006, efforts are underway to ensure that these bonds and their implementation plans are allocated in such as way as to decrease VMT, GHGs and petroleum dependence. It has been suggested that few governors "have been in as powerful — and enviable — a position to shape California's future growth".[83] In fact, even though the State government does not typically have a direct role in the growth patterns of its cities, it "does 'set the table' for growth through spending decisions, especially on transportation projects".[84] While half of the bond money, $20 billion through proposition 1B, is for transportation projects, only $1 billion of this has been allocated for specific projects. Other bond money that could be used to support this effort include the $5.4 billion open space and parks bond (Proposition 84) and the $2.9 billion housing bond (Proposition 1C). The latter already specifically sets aside $850 million for building projects in redevelopment areas and $300 million for TOD projects. State and local officials are working hard to ensure that all the bond monies will help target development into areas with rich transportation choices and that support efficient development patterns.

Massachusetts provides a good example of the potential effectiveness of a targeted infrastructure funding program. The Office of Commonwealth Development (OCD), which directs smart growth policies in the housing, transportation, energy and environment agencies, coordinates the allocation of $2 billion in state and federal funding to direct development in areas supported by pre-existing infrastructure.[85] One of the central OCD initiatives is the *Commonwealth Capital* policy which strives to coordinate capital spending programs to ensure consistency between development projects and sustainable development principles. Specifically, it has developed a set of criteria that prioritize housing, transportation and parks funding for projects that promote efficient land use, travel alternatives and petroleum conservation. Commonwealth Capital serves as a tool to influence municipal land use practices by rewarding municipalities engaged in smart growth planning. The state has also introduced a *Fix-It-First Policy* which prioritizes maintenance of existing infrastructure over new construction. Fix-It-First has extended to transportation policy focusing on repairing the state's existing roads and highways and enhancing opportunities for transit and non-motorized transportation options.

New Jersey provides another good case study. In 2002, Governor James McGreevy issued *Executive Order 4* establishing the Smart Growth Policy Council.[86] The council's mandate was to ensure that State transportation and infrastructure funding, inter-departmental procedures, programs, and projects were consistent with the State Plan and smart growth principles. The state plan placed a high priority on investments in areas with existing infrastructure that would help create more compact growth patterns.

Implementing these targeted measures, as seen in the case studies, typically requires a high level champion who can navigate many barriers. For instance, since local decision makers are often

[83] Schwarzenegger's golden opportunity: Op-Ed by William Fulton, LA times, February 4, 2007, http://www.latimes.com/news/opinion/commentary/la-op-fulton4feb04,0,968503.story?coll=la-news-comment-opinions
[84] Ibid.
[85] http://www.mass.gov/ocd/comcap.html
[86] http://www.nj.gov/dca/osg/commissions/sgpc.shtml

resistant to the State setting (more) requirements on funding, the State needs to present a solid vision for the future that local leaders, and the public, can get behind. And while Maine does not have the billion dollars in bonds that California is currently grappling with, the State should leverage what money it does have to make changes where it can. Infrastructure typically has a 50 to 100 year lifespan, so small changes in current infrastructure spending will make a big difference over time.

VMT REDUCTION POTENTIAL

Targeted infrastructure funding is an option for which it is difficult to develop a priori quantification methods. Still, the difficulties in predicting a specific level of VMT reduction should not prevent a fix-it-first approach from forming the core of any comprehensive plan to manage VMT. Enhancing existing infrastructure rather than building new infrastructure would lead to more dense urban development, sustaining transit, reducing travel demand, and shifting mode split towards public transit (assuming options are available).

Although it is difficult to estimate the impact TIF has in isolation, the effects of a comprehensive policy can be generally estimated by looking at the relationship between urban density and VMT, and also the impact of infill growth versus greenfield growth. If the targeted infrastructure funding prevents greenfield development, this option will likely significantly reduce VMT growth.

Developing a Maine-specific quantification requires knowledge of the infrastructure likely to be targeted, understanding of the suite of complementary policies, and estimates of development diverted from greenfield projects. Thus, TIF is better suited to after-the-fact (ex post) analysis.

OTHER RESOURCES & REFERENCES

National Governors Association- a policy issue brief, “Fixing It First: Targeting Infrastructure Investments to Improve State Economies and Invigorate Existing Communities”:
http://www.nga.org/cda/files/0408FIXINGFIRST.pdf
http://www.nga.org/cda/files/0408FIXFIRSTCHART.pdf

1000 Friends of Maryland- “Smart Growth: How is Your County Doing?” provides an overview of issues faced in Maryland counties with the implementation of their Priority Funding Areas:
http://www.friendsofmd.org/data/smartgrowth.pdf

US Environmental Protection Agency- Redeveloping brownfields with federal transportation funding:
http://smartgrowth.org/pdf/brownfields_tea21.pdf

MoSS Appendix XIV: CCAP Detailed Analysis of Transit Oriented Development

Implementation Scale: Site Level
Feasibility/Ease of Implementation Rating: Medium
VMT Reduction Potential Rating: High

CONTEXT

Characteristic patterns of urban growth and development in post-WWII North America have created cities and regions that heavily depend on cars to meet transportation needs. Land use functions (residential, commercial, employment) are estranged from one another, origins and destinations are farther apart, infrastructure design is oriented toward the automobile, and low population densities are not conducive to public transportation. With the automobile as the only realistic mode of transportation, commuters are faced with increased driving distances and congested roadways. This has resulted in increasing VMT, deteriorating urban air quality and human health, increased greenhouse gas emissions, limited transportation and housing choices, inefficient use of infrastructure, and ultimately, communities that are less able to meet the needs of their residents.

Smart growth has emerged as a viable alternative growth strategy that can develop healthy and sustainable urban environments. The central tenet of smart growth is the return to more compact communities that are more walkable, more livable and less reliant on the automobile for daily transportation needs. Transit-oriented development (TOD), which focuses development and transportation investments, along with other smart growth policies reduce VMT, mitigate the public health impacts of air pollution, promote physical activity (e.g., more walking, biking), reduce greenhouse gas emissions, and preserve open space resources and wildlife habitat.

WHAT IS TOD?

Transit Oriented Development is becoming recognized as a viable form of growth management that addresses the needs of rapidly growing communities both large and small. As defined by the California Department of Transportation, TOD typically integrates "moderate to higher density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding the auto. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use."[87]

TODs facilitate reduction in household automobile usage through the provision of both accessible transit alternatives and local employment and retail locations. The development of systematic TOD networks can change transportation behaviors at both local and regional scales. Analyses of the travel characteristics of California TODs conducted by Lund et al. indicate a 5.0 times greater rate of transit use for residents of TODs than those of comparable or adjacent locations. Similarly, transit use for office workers was 3.5 times greater for TODs.[88]

Transit oriented development can result in local and regional benefits in addition to reductions in VMT and associated air pollutant emissions. There are many economic, social and transportation benefits including:

- increased mobility options for heavily congested regions

[87] Cal Trans (2002) "Statewide Transit-Oriented Development Study Final Report": http://transitorienteddevelopment.dot.ca.gov/PDFs/Statewide%20TOD%20Study%20Final%20Report%20Sept.%2002.pdf
[88] Lund et al. (2004) "Travel Characteristics of Transit-Oriented Development in California" http://www.csupomona.edu/%7Erwwillson/tod/Pictures/TOD2.pdf

- improved mobility for segments of the population, such as youth and the elderly, without access to cars
- enhanced public safety through the development of more pedestrian oriented communities
- increased cost effectiveness of transit investment through improved ridership
- potential reductions in household transportation costs of up to $3-4,000 per household annually[89]
- preservation of agricultural and open space areas by redirecting greenfield development to urban areas
- increased local retail development and economic revitalization
- reduced public infrastructure costs through more efficient use of existing resources
- greater affordability of housing with increased densities and lower transportation costs
- rising property values and local tax revenues
- increased accessibility to housing options
- enhanced livability of communities through improvements in air quality, public health, accessibility to public spaces, commute times etc[90]

IMPLEMENTING TOD IN MAINE

Maine has a sparse population relative to its land area, with just 41 residents per square mile. Maine's population density ranks 38th among all states, and it is the least dense of the six New England states. Consequently, public transportation is not prominent in Maine and the state possesses a relatively high cost per resident of constructing and maintaining highway infrastructure. In 2000, vehicles traveled an estimated 14.2 billion miles on Maine roads, a 20 percent increase over 1990 levels. Over the next 20 years, it is estimated that the amount of VMT in Maine will increase more than 18 percent, to 17 billion.[91]

While this growth in VMT is not unique to New England, Maine's landscape is. The state's small and medium-sized towns are widely interspaced between forest, farm and coastal landscapes that, while beloved by residents and visitors alike, create a land use and transportation planning challenge. How do you promote in-fill development, provide alternatives to single occupant vehicle driving and sustain cost-effective transit within these low density transportation corridors? Over the last two decades, despite greater relative spending on transportation, rapid growth in low-density development (e.g., strip malls), rural VMT and congestion have increased, exacerbating air pollution and greenhouse gas emissions from mobile sources. The environmental impacts are particularly harmful to Maine's sensitive ecosystems.

The report *Shifting Gears*, released by Natural Resources Council of Maine and Environment Maine, recommends supporting transit-oriented development as one of 20 policies to reduce VMT and reduce the state's GHG emissions.[92] With the success of numerous TOD projects nationwide, the market demand for TODs is no longer considered a barrier to implementation. Still, these projects continue to face many implementation challenges[93] including:

- lack optimal development standards and systems to coordinate development processes
- no cohesive regulatory and policy framework

[89] Cal Trans (2002), *op cit.*
[90] Reconnecting America (2002) "Transit Oriented Development: Moving from Rhetoric to Reality": http://www.reconnectingamerica.org/pdfs/DBelzerTOD.pdf
[91] *Transportation Indicators Report* prepared by Maine Dept. of Transportation Systems Management Division, April, 2002
[92] http://environmentmaine.org/envmaine.asp?id2=24142
[93] The Great American Station Foundation (2002) "Challenges to Implementing Transit-Oriented Development": http://www.stationfoundation.org/pdfs/TODchallenges.docNEW.doc

- difficulty obtaining financing for mixed use developments due to concerns of private lenders, lengthy approvals processes and limited public funding in many regions
- local tax structure often promote large scale retail development over residential land uses
- poor transit design often isolates the station area from the community (i.e. limited pedestrian access and large parking facilities)
- obtaining development approvals is often slow as local zoning may be unsupportive of transit
- local community opposition based on density, traffic and parking concerns
- parking challenges impact costs, financing and public support[94]
- land aggregation is difficult, particularly, for urban and infill sites
- limited use of financial tools (i.e., tax increment financing)
- information and expertise on implementation is limited

A variety of broad implementation strategies have been used to promote Transit Oriented Developments nationwide and could work in Maine. They include:

- supporting TOD Planning through the transfer of federal transportation funds to local governments for TOD planning and implementation
- abatement of taxes for TODs to aid market development for higher density, mixed use communities
- transit joint development which allows transit agencies to use, sell or lease land that will help generate ridership
- direct participation of local governments in financing and building TODs

Further, in October 2006, the Brookings Institution, released a report titled, *Charting Maine's Future: An Action Plan for Promoting Sustainable Prosperity and Quality Places*.[95] In it they recommend a variety of measures to help combat sprawl and encourage smarter development including, among others, large bond investments in existing town centers and providing incentives for towns to cooperate regionally. Maine's traditional town centers are the ideal place to plan for new development in efforts to help absorb projected population growth. The proposed *Maine Quality Places Fund* and the Community Enhancement Fund could be important investment vehicles to help encourage measures such as TOD. The former is suggested to promote community revitalization and land and farm conservation, while the latter is suggested to provide grants to reform building codes, provide visioning assistance and planning tools for towns and provide incentives to encourage multi-city and regional-scale planning.

VMT REDUCTION POTENTIAL OF TOD IN MAINE

Generally, increases in transit use, walking and bicycling lead to local reductions in VMT of 20-30% from TOD. Achieving regional reductions - estimated at 5% for widespread TODs - would likely require locating new growth around multiple transit-accessible corridors.[96] Consequently, air pollution emissions and energy consumption decrease for households within TODs. Rates of

[94] Cal Trans (2002) "Statewide Transit-Oriented Development Study Final Report:" http://transitorienteddevelopment.dot.ca.gov/PDFs/Statewide%20TOD%20Study%20Final%20Report%20Sept.%2002.pdf
[95] http://www.brookings.edu/metro/maine
[96] A recent study by the Canadian Mortgage Housing Corporation (CMHC) quantifies how density, diversity and design elements interact across suburban, medium density and neo-traditional (urban) forms. The CMHC study provides clarity on the impact of the so-called three Ds (diversity, design and density) with and without regional access. The study concludes that while building in the style of an urban town center (neo-traditional) is helpful, smart growth style planning is most successful when done on a regional basis. For more information, see http://www.cmhc.ca/en/index.cfm

greenhouse gas emissions have been shown to be 2.5 to 3.7 tons per year per household lower within TOD locations.[97,98]

A Canadian study found that the most significant emissions reductions result when development occurs in central regional locations, as opposed to more remote locations. Improving regional location can reduce CO_2 emissions 21 - 58%, while changing the 3-Ds (density, diversity and design) alone (without the context of regional access) can reduce CO_2 emissions by 15 - 50%.[99] Such savings from regional location are also seen in the well-cited Atlantic Station project (14-52%). Changing site design alone can also result in VMT savings of up to 6% (without changing mix of use, density or location).[100]

While TOD is generically estimated to result in VMT reductions of 20-30 percent, it is important to note that this estimate is based on similar land use patterns differing only in access to transit. In practice, TOD will most likely be developed in conjunction with infill or smart growth policies. Therefore, site-specific VMT savings may exceed the generic 20-30 percent estimate. Also, since TOD will likely reduce the quantity of short vehicle trips taken (which contribute a greater proportion to mobile air toxics than indicated by proportional VMT), emission levels may drop by an even greater percentage than VMT (holding other things constant).

The reductions achieved from TOD in Maine will likely not meet the general estimates for either the local or regional areas however. Because Maine has fewer areas with population densities high enough to support transit and few destinations that are transit accessible, impacts in Maine will likely be lower than the general estimates.

Maine has three characteristics that reduce VMT savings from TOD--relatively low population density, ease of vehicle travel, and modest transit networks. For these reasons, overall use of transit in Maine is estimated to be only 0.5 percent of all trips taken. Within urban areas such as Portland, greater transit options and more transit accessible destinations lead to increased transit use--over 1.5 percent. According to PACTS modeling, areas within the city that have better transit options show an even greater level of transit use—approximately three percent on average. At the best locations, with good transit access and centrally located mixed-use development TODs should expect a 3-5 percent improvement in mode split, with another 10 percent VMT savings possible through

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[97] Based on expected TOD household savings of 5,000-7,500 VMT per year. This anticipated reduction estimate is based on the Deborah Dagang and Terry Parker, "Transportation Land Use Strategies to Minimize Motor Vehicle Emissions: An Indirect Source Research Study", for the California Environmental Protection Agency, Air Resources Board, 1995.
[98] Cal Trans (2002) "Statewide Transit-Oriented Development Study Technical Appendices": http://transitorienteddevelopment.dot.ca.gov/PDFs/Statewide%20TOD%20Study%20APPENDIX%20Final%20Sept.%2002.pdf
[99] CMHC, *op cit.*
[100]Walters, G. et al., "Adjusting Computer Modeling Tools to Capture Effects of Smart Growth: Or 'Poking at the Project Like a Lab Rat',"*Transportation Research Record 1722* (2000), pp. 17-26.

centralized location (i.e. shorter trip lengths). Of course, the actual impact of any TOD will be determined by location and development characteristics.

Standard assumptions regarding scale (5,000 trips per day), and trip length, combined with Maine and Portland transit characteristics predict the following VMT and emissions savings:

Transit Oriented Development		VMT Reduction (%)	CO_2 (annual metric tons)	N_2O (annual metric tons)	CH_4 (annual metric tons)	Annual Fuel Cost Savings	Annual Fuel Savings (Gallons)
Total		**14%**	502	0.036	0.107	$102,200	51,100

Transit Oriented Development		NOx	PM-10	PM-2.5	SO_2	CO	VOC
Annual Emission Reductions (Tons)		1.972	0.092	0.067	0.108	29.886	3.910
Tons Per Day		0.005	0.000	0.000	0.000	0.082	0.011

As urban density increases, and as more origins and destinations become transit accessible, the VMT reductions associated with TOD in Maine will increase.

OTHER RESOURCES & REFERENCES

California Department of Transportation- searchable database for 21 statewide TOD projects include information on stations, projects, processes photos and links to Caltrans: http://transitorienteddevelopment.dot.ca.gov/

Caltrans- "Statewide Transit Oriented Development Study- Factors for Success in California" includes links to the executive summary, final report, technical appendices and supplementary report on parking and TODs: http://transitorienteddevelopment.dot.ca.gov/miscellaneous/StatewideTOD.htm

Envision Utah- provides information on Envision Utah's Transit-Oriented Development initiatives: http://www.envisionutah.org/trans_land.html

Orenco Station Development- contains access to information on housing options within the transit oriented community and access to virtual tours: http://www.orencostation.com/home.htm

Reconnecting America- Center for Transit Oriented Development provides access to resources that promote the further market development of TODs: http://www.reconnectingamerica.org/html/TOD/index.htm

San Francisco Bay Area Rapid Transit District- "BART Transit-Oriented Development Guidelines" includes information on building and planning successful TOD projects: http://www.bart.gov/docs/BARTTOD.pdf

The Brookings Institution- *Charting Maine's Future: An Action Plan for Promoting Sustainable Prosperity and Quality Places, October 2006***:** http://www.brookings.edu/metro/maine

The Great American Station Foundation- website includes access to information, case studies and prominent reports on transit oriented developments:

http://www.transittown.org/

US Environmental Protection Agency- "Our Built and Natural Environment, a Technical Review of the Interactions between Land Use, Transportation and Environmental Quality": http://www.epa.gov/livability/pdf/built.pdf

Attachment 4: Science Advisory Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007

Science Advisory Subcommittee Report to the Air Toxics Advisory Committee:

Verification Projects for Phase II of the Maine Air Toxics Initiative With Recommended Follow-up Actions

Revision of June 7, 2007

The Air Toxics Advisory Committee (ATAC) established the Science Advisory Subcommittee (SAS) in November of 2005 to continue to evaluate and verify the scientific data used in phase I of the Maine Air Toxics Initiative (MATI). Specifically, the ATAC charged SAS with verifying the scientific underpinnings of the Air Toxics Priority List; locating regions of the state where air toxics are of particular concern; and evaluating the assumptions that underlie air toxics reduction options. In addition to this broad scope of work, the ATAC tasked SAS with further verification of several other scientific issues from the ATAC's Phase I work and assisting the other two subcommittees when needed. This report summarizes the work of the SAS during Phase II of the Maine Air Toxics Initiative.

Toxicity-Factor Revisions

The amount of an air toxic that can be breathed without causing an adverse impact varies widely. Therefore, the MATI inventory is presented as a "Toxicity-Weighted" emissions inventory; tons of emissions are multiplied by Toxicity-Factors that are specific to each pollutant in order to allow a comparison on a common weighting scale. During the verification phase, SAS also assisted MEDEP and the Maine Center for Disease Control (MECDC - formerly the Maine Department of Human Services) with revising the toxicity-factors that MEDEP used to weight the inventory. These revisions bring the toxicity-factors into alignment with the risk endpoints used in establishing Maine's Ambient Air Guidelines, in addition to capturing the latest available data on toxicity. The revised toxicity-factors, and a narrative on their use and derivation, are available at: http://www.maine.gov/dep/air/toxics/mati-docs.htm.

Inventory Revisions

In Phase I of MATI, the ATAC identified numerous improvement opportunities for the DEP's air toxics inventory. The SAS recommended that the MEDEP improve the transparency, accuracy, and reproducibility of the Hazardous Air Pollutant (HAP) emissions inventory of point sources. To accomplish these goals, for large facilities for emission year 2005, MEDEP overhauled the electronic reporting protocols, and stepped-up its quality assurance review process. Revised reporting guidance and protocols is available on the DEP's Emissions Inventory Website at: http://www.maine.gov/dep/air/emissions/haps-rptng.htm.

SAS input also led to improvements in the Department's emission estimates for residential wood combustion, on-road mobile sources, and non-road mobile emission estimates. Additionally, the transparency and reproducibility of MEDEP inventory has improved. The MEDEP is now poised to improve future estimates of marine vessel, railroad, and airport emissions; increase the speed of inventory development; develop web-based reporting tools for large stationary sources; and increase the public availability of inventory data. Further, MEDEP is working with EPA on national workgroups to use the lessons-learned from MATI to improve emissions inventories across the US. The revised MATI inventory, Mobile Emission Projections, and summary tables are posted on the MATI website at: http://www.maine.gov/dep/air/toxics/mati-docs.htm.

MEDEP is continuously improving the accuracy, reproducibility, and transparency of its emissions inventory and the MATI process has been vital to these improvements. However, this means that the inventory is necessarily dynamic; as conditions change, the science evolves, and sampling/testing is refined, the priority list may change and as such, source and air toxic priorities may change. The revised 2005 toxicity-weighted inventory is significantly different from the previous estimated 2005 inventory due to inventory improvements, significant changes in toxicity-factors, use of different units and better guidance to point sources resulting in consistent inclusion of combustion HAPs.

Due to these improvements, the earlier projected inventory is not directly comparable to the revised inventory. However, air toxics from combustion sources still dominate the toxicity-weighted emissions, and reduction of combustion HAPs is the target of both the Mobile and Stationary Sources recommended reduction strategies. These strategies will also have the co-benefit of reducing Green House Gas and Criteria Pollutant emissions.

Recommendation for ATAC consideration: While undertaking these revisions, one of the pollutants that was on the ATPL, 2, 4 toluene diisocyanate (2,4 TDI), was found to no longer be emitted from the graphic arts industry. With this change and better emissions from the point source sector, virtually zero 2,4 TDI is emitted in the state. Therefore, SAS recommends that this pollutant be dropped from the ATPL

Acrolein

EPA's most recent National Air Toxics Assessment (NATA) found that Acrolein is a state, regional, and national risk driver for air toxics. MATI's phase I data also found that Acrolein is an air toxic of relatively high concern. However, the ATAC also found that there was significant uncertainty concerning the actual risks posed by this compound. MEDEP developed a white paper, "Acrolein: Air Quality Science and Policy Issues (revision of October, 24 2006)", that summarized the current science and uncertainty behind the toxicity, emissions, and ambient concentrations of acrolein. SAS and the Stationary Sources Subcommittee (SSS) reviewed the acrolein white paper and provided comments and inputs to the MEDEP, which has not been revised at this date. In general, due to the high uncertainty in the science underlying the emission factors, chemical analysis, toxicity-factors and modeling of acrolein, the subcommittee did not reach agreement on the risk currently posed by ambient concentrations of acrolein.

To help resolve the high uncertainty with EPA's acrolein emission factor for large industrial wood boilers, and the SAS's lack of success in having EPA review the factor's basis, the largest stationary sources in Maine that burn wood initiated source-specific stack-testing. Additionally, MEDEP undertook a study to refine its approach to sampling and analyzing acrolein in ambient air at its HAP sampling locations across the state. This study helped support the MEDEP's application to EPA for an Air Toxics Monitoring Grant, aimed in part at purchasing new equipment to accurately sample and analyze acrolein in ambient air. EPA intends to announce Grant recipients after July 1, 2007.

Ambient Air Data

Maine DEP extracted ambient air data from its HAP monitoring programs to update HAP trends, which are available at http://www.maine.gov/dep/air/toxics/mati-docs.htm. Since 1997, MEDEP has monitored for HAPs off and on at about a dozen locations across the state for various HAPs. MEDEP does not have the resources to monitor at all locations of potential impact. Nonetheless, the HAP data, coupled with emissions and modeling, can be instructive as to ambient concentrations of HAPs in Maine. The ambient HAP monitoring data shows that background levels of metals are low as compared to Maine Ambient Air Guidelines (MAAGs). Average Benzene concentrations exceed MAAGs over the Interstate 95 corridor in Portland, but are generally well below MAAG at background locations. A spot check of acrolein at locations where HAPs have historically been the highest, suggests that acrolein may exceed the MAAG by over 10 times; however, it must be noted that acrolein is extremely hard to accurately measure and there are very few ambient air monitoring results in the state of Maine. One HAP on the ATPL, carbon tetrachloride, has low current emissions, but due to persistence continues be high in ambient air relative to MAAGs.

Hotspot analysis

In phase I of MATI, risk calculations were only available at a state-wide and county-wide level. However, the ATAC found that achieving the MAAG for individual air toxics based on average county-wide exposure is not a true reflection of the potential risk attributed to air toxics. Therefore, the ATAC directed the science advisory subcommittee to evaluate hot-spot exposures at localized areas of highest impact. The subcommittee reviewed EPA's 1999 National Air Toxics Assessment, traffic congestion, ambient air monitoring data and point source emissions, in an effort to locate areas of the state that are likely to have the highest air toxic impacts. Overall, however, this evaluation is incomplete and point and area source hot-spots have not been adequately defined.

Mobile Sources: In order to assess potential air toxic hot spots from mobile sources, SAS worked with the Mobile Source Subcommittee. The Maine Department of Transportation (DOT) analyzed high traffic areas in Maine by compiling annual average daily traffic versus the road capacity for all of the road segments in Maine. DOT compared this information to a table to determine the average speed for all the road segments. For traffic density on each road segment, DOT divided the annual average traffic by the speed to obtain the number of vehicles hours of travel per day. DOT ranked the segments from highest traffic density to lowest. This screening analysis is available in an excel workbook, and is plotted on interactive pdf maps. See http://www.maine.gov/dep/air/toxics/mati-docs.htm for maps. These maps provide an excellent screening assessment of potential mobile source hot-spot locations.

Area Sources: Maine DEP extracted from the 1999 National Air Toxics Assessment (1999 NATA) the risk estimations for the highest cancer and non-cancer census tracts in the state. The hope was that this information might be able to assess hot-spot locations from area sources. However, this approach was not fruitful, so further evaluation is needed.

Point Sources: The MEDEP attempted to use historic modeling results for criteria air pollutants (CAPs) from select facilities to assess potential hot spots from point sources. The approach was to use the ratio of HAPs to CAPs at the facility and area of highest ground level impact (known as the "Point of Impingement"). However, recent CAP modeling was not available for any of the facilities that were among the top toxicity-weighted emissions, so this approach was not fruitful. Therefore, further evaluation is needed.

Ambient Monitoring Results: Some HAP monitoring sites have been located in areas the MEDEP believed to be highly impacted by local emission sources, such as the former BEAM site in Portland. However, MEDEP did not establish HAP monitoring locations at the point of impingement of the current highest emission sources. Based on emissions inventories, the mobile source hot-spot maps, and existing monitoring results, MEDEP has applied for an air toxics monitoring grant to evaluate potential hot-spots in Portland, Maine's largest city. If awarded this grant, MEDEP will be able to evaluate the "patchiness" of HAP impacts in Portland, and use this information to assess other monitoring sites in the state.

Recommendation to ATAC: MEDEP should first focus on identifying hot-spots stemming from emissions from point and area sources. The MEDEP should then continue to routinely identify and evaluate potential risk attributed to air toxics in hot-spots. The MEDEP should consider cumulative exposure to multiple air toxics, bioaccumulation, transport/background concentrations, and environmental persistence of air toxics in this evaluation.

Risk Assessment Protocols and Risk Communication

During phase I of the MATI, the ATAC raised several issues regarding how MEDEP and MECDC conduct risk assessments and communicate risk results. It became apparent that many of these issues stemmed from a lack of common understanding of the current risk assessment process. Therefore, MEDEP, in consultation with SAS and SSS, used the Healthy Communities Grant money to host a Risk Assessment Training course for 34 members of the MEDEP and ATAC. This training, held October 25 – 27, 2006, taught the risk assessment protocols spelled out in the Air Toxics Risk Assessment Reference Library[101]. Joann Held, a retired risk assessor from the NJ DEP, and Marybeth Smuts, EPA Region I toxicologist, were the primary instructors for the course. The participants provided positive comments on the course. MEDEP will continue to use the risk assessment protocols in the Air Toxics Risk Assessment Reference Library when conducting risk assessments.

Recommendation to ATAC: While the protocols now exist for risk assessment, the subcommittee also decided that conducting detailed risk assessment on the vast majority of stationary sources in the state is not a prudent use of resources. Rather, SAS and SSS recommend that these resources be used to foster HAP reductions at emission sources, primarily through energy efficiency evaluations and improvements. However, risk assessment protocols may be appropriate for evaluation of potential hot-spots, as discussed above.

Early Actions

Outdoor wood boilers – SAS helped the Stationary Sources Subcommittee drafted a white paper that explored impacts from Outdoor Wood Boilers (OWBs) that are used for residential heating. This white paper documented the available information, and concluded that OWBs are a growing emission source with high localized HAP impacts that is not subject to federal regulation. This white paper was then used as the basis for a recommended early action on OWBs. The early action of December 12, 2007, recommended that the Commissioner of DEP impose a moratorium and meaningful regulation on Outdoor Wood Boilers.

[101] See EPA's Website at: http://www.epa.gov/ttn/fera/risk_atra_main.html

Environmental Notebooks for Schools: One early action that MEDEP committed to undertaking when applying for the MATI grant was aimed at improving air quality in Maine's schools and reducing children and teachers exposure to toxic chemicals. In late 2006, the MEDEP provided reference notebooks to all accredited Maine K-12 school systems and web information specifically designed to address school environmental, health, and safety concerns. The notebook explains in simple language all environmental statutes, regulations, and initiatives by state government and EPA that are aimed at reducing exposure to toxics in school settings.

Unknowns

The ATAC asked the SAS to develop criteria for evaluating previously unknown air toxics, and whether any previously unknown air toxics should be added to the ATPL. Maine DEP developed a white paper on unknowns which it revised based on comments of the SAS. Subsequent to development of the whitepaper, the European Community and Canada have developed protocols for evaluating the host of compounds that are used in commerce, but which have not been evaluated for health risks. DEP will monitor the findings of these systems to see if other pollutants should be added to the ATPL. At this time, SAS is not recommending that additional pollutants should be added to the ATPL.

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Attachment 5: 2005 Maine Air Toxics Emissions Inventory Summary Data

Maine Department of Environmental Protection
for the
Maine Air Toxics Advisory Committee

Revision of July 31, 2007

Notes

- Emissions are in toxicity-weighted tons
- Toxicity-Factors have been adjusted to achieve parity with the Maine Ambient Air Guidelines. These factors do not account for persistence or bioaccumulation
- There remains high uncertainty with acrolein emission values, and with emissions from outdoor wood boilers, commercial marine vessels, trains and airplanes
- Emission estimates are based on the DEP inventory that was submitted to USEPA in June of 2007 for the National Emissions Inventory, 2005
- Point Source Estimates are based on facility submittals using the i-STEPS software
- On-Road Mobile Source estimates are based on EPA's Mobile 6.2 model, using state specific inputs
- Off-Road estimates (except for trains, planes, and commercial marine vessels) are based on EPA's Non-Road Model, using state specific inputs, and speciated using the NMIM speciation tables

Table 9: Phase II Inventory Improvements for Select Pollutants

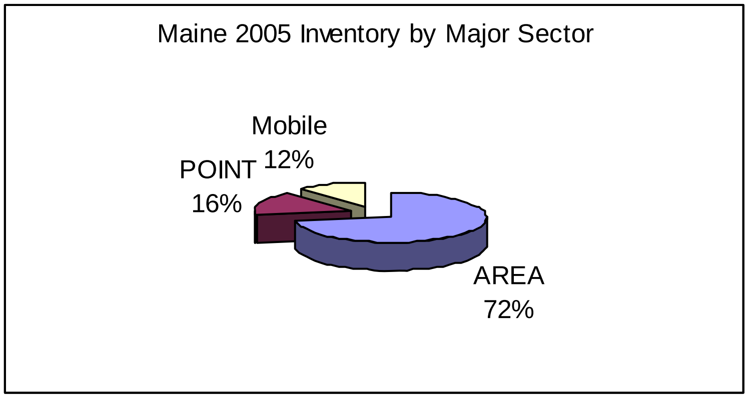
Rank		**Pollutant**	**MATI Tox Factor-I**	**TW-Tons base on TF I**	**Tons EM**	**MATI Tox Factor II**	**TW-Tons base on TF II**	**Tons EM**	**Basis for inclusion on Air Toxics Priority List of July 2007**
New	**Old**		**Old**			**New**			
1	2	Polycyclic Organic Matter	6,400.00	807,079	126.11	6,400.00	1,423,435	222	Toxicity-Weighted Emissions and NATA risk
2	2*	Naphthalene	6,400.00	456,232	71	6,400.00	1,079,688	169	Toxicity-Weighted Emissions and NATA risk
3	1	Acrolein	90,000.00	8,180,679	90.90	3,600.00	491,593	137	Toxicity-Weighted Emissions and NATA risk
4	4	Formaldehyde	600.00	493,497	822.49	93.00	158,534	1705	Toxicity-Weighted Emissions and NATA risk
5	10	Benzene	56.16	87,143	1,551.71	56.00	145,789	2603	Toxicity-Weighted Emissions and NATA risk
6	15	Chromium Compounds	86,000.00	20,696	1	2,580 To 86,000 depending on % Cr+6	123,147	2	Toxicity-Weighted Emissions and NATA risk
7	32+	Cobalt Compounds	90,000.00	3,314	0.04	34,000.00	76,243	2	Toxicity-Weighted Emissions and NATA risk
8	6	1,3-Butadiene	2,000.00	380,325	190.16	210.00	61,823	294	Toxicity-Weighted Emissions and NATA risk
9!	9	Sulfuric Acid	1,400.00	157,903	112.79	72.00	28,487	396	Toxicity-Weighted Emissions and NATA risk
11	5	Nickel Compounds	36,000.00	4,978,44	138.29	1,900.00	27,471	14	Toxicity-Weighted Emissions and NATA risk

Rank		Pollutant	MATI Tox Factor-I	TW-Tons base on TF I	Tons EM	MATI Tox Factor II	TW-Tons base on TF II	Tons EM	Basis for inclusion on Air Toxics Priority List of July 2007
New	Old		Old			New			
				3					
12!	16	Arsenic Compounds	31,000.00	20,219	0.65	31,000.0 0	24,406	1	Toxicity-Weighted Emissions and NATA risk
15	21	Acetaldehyde	200.00	66,007.4 5	330.04	16.00	11,063	691	Toxicity-Weighted Emissions and NATA risk
16!	12	Lead Compounds	200 to 5,000,000 dependin g on compoun d	62,162	5.55	352 to 200,000 dependin g on compoun d	9,391	26	Toxicity-Weighted Emissions and NATA risk
17!	13	Cadmium Compounds	90,000.00	55,324	0.61	13,000.0 0	8,008	1	Toxicity-Weighted Emissions and NATA risk
18!	23	Chloroform	160.00	20,696	129.35	160.00	7,957	50	Toxicity-Weighted Emissions and NATA risk
19	3	Manganese Compounds	36,000.00	584,238	16.23	144.00	3,165	22	Emerging risk update & persistence
20	22	Tetrachloroethylen e (Perchloroethylene)	42.00	5,295	126.07	42.00	2,182	52	Monitoring exceeds Maine Ambient Air Standard
21	27	Methyl Bromide (Bromomethane)	360.00	50,087	139.13	14.40	1,897	132	Persistence
22	24	Carbon Tetrachloride	110.00		-	110.00	837	8	Persistence
23	14	Dioxins and	27143 to			81429 to		5.65E-	Persistence & bioaccumulation

Rank		Pollutant	MATI Tox Factor-I	TW-Tons base on TF I	Tons EM	MATI Tox Factor II	TW-Tons base on TF II	Tons EM	Basis for inclusion on Air Toxics Priority List of July 2007
New	Old		Old			New			
		Furans	271428576 depending on isomer	27,266		271428576 depending on isomer	793	05	
24		H2S	310.00	1,690	5.45	12.40	779	63	Acute Risk incidents
25	25	Ethylene Dichloride (1,2-Dichloroethane)	190.00	38	0.20	190.00	177	1	Persistence
26	26	Ethylene Dibromide (Dibromoethane)	1,600.00	5	0.00	1,600.00	110	0.1	Persistence
27	18	Mercury Compounds	6,000.00	1,260	0.21	240.00	108	0.5	Persistence & bioaccumulation
N/A	28-30	Chlorine Compounds	9,000.00	85,683	9.52	360.00	6,628	18	Removed: Updated inventory & revised toxicity
N/A	29	Hydrochloric Acid	90.00	44,819	497.98	3.60	2,459	683	Removed: Updated inventory & revised toxicity
N/A	17	Cyanide Compounds	600.00	18,355	30.59	24.00	1,452	60	Removed: Updated inventory & revised toxicity
N/A	8	2,4 Toluene Diisocyante	26,000.00	276,385	10.63	1,040.00	>10	>.01	Removed: Updated inventory & revised toxicity

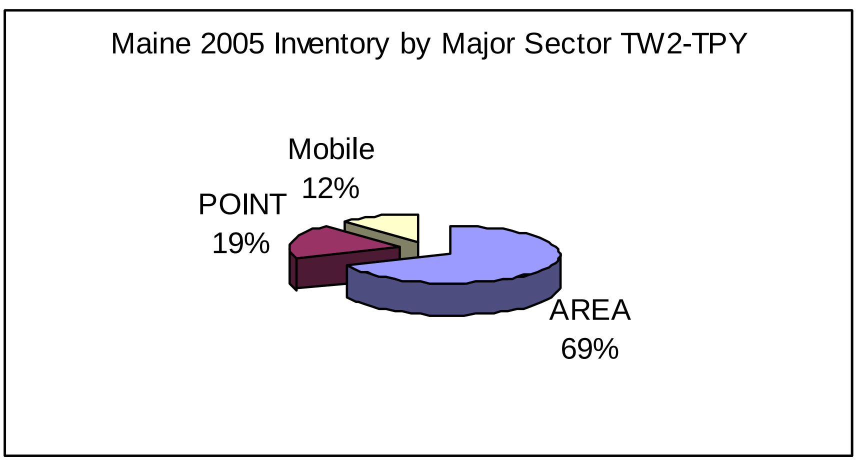
Toxicity-Weighted Emissions by Sector

Figure 10: Maine 2005 Inventory by Major Sector, version 1



Note: Approx 109,092 toxicity-weighted tons of emissions that facilities reported to Maine DEP using the point source software (i-STEPS) were moved to Area Sector when reported to EPA, since they were associated with a ten digit SCC. Had these emissions been included in the point inventory, the split would look like:

Figure 11: Maine 2005 Inventory by Major Sector, version II



Combustion Related Emissions

Figure 12: Combustion Vs. Non-combustion: 2005 Maine Air Toxic Emissions (Tox-Weighted)

Air Toxics released as a by-product of combustion are the primary source of the 2005 emissions.

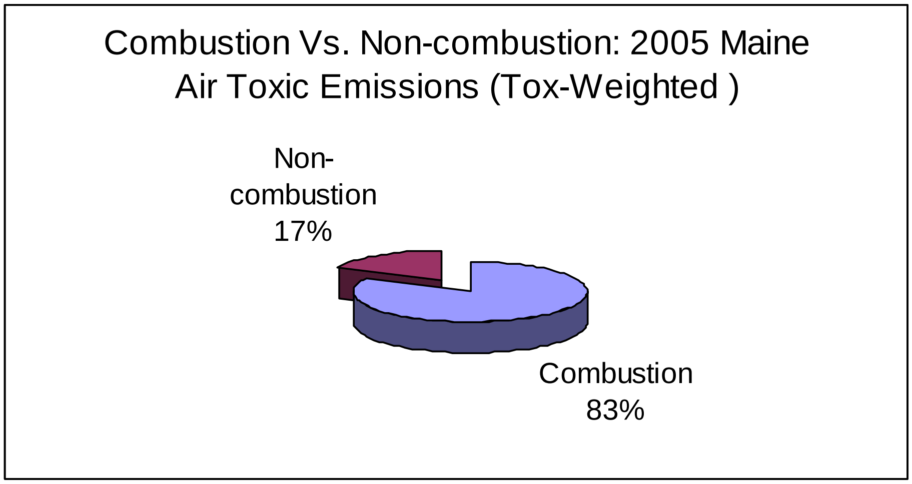


Table 10: 2005 Maine Air Toxic Emissions from Combustion by SCC groups

MEDEP_SCC_Descr_1	Tox Weighted TPY
Residential Fuel Combustion	2,230,765
Industrial Fuel Combustion	367,717
Gasoline Truck	102,337
Gasoline Vehicle	101,320
Off-highway Vehicle Gasoline, 2-Stroke	56,380
Aircraft	42,529
Off-highway Vehicle Gasoline, 4-Stroke	38,138
Wildfires	35,066
Pleasure Craft	29,023
Diesel Vehicle	22,515
Off-highway Vehicle Diesel	17,070
Petroleum Handling and Storage	10,970
Commercial Marine Vessels	10,058
Railroad Equipment	6,111
Waste Combustion	5,435
Commercial Fuel Combust	5,237
Motor Cycle	2,819
Diesel Bus	968
Gasoline Bus	956
Diesel Truck	715
LPG	85
Grand Total	3,086,212

Table 11: 2005 Maine Air Toxic Emissions from Combustion by alternative SCC Groups

MEDEP_SCC_Descr_1	Tox Weighted TPY
Manufacturing	314,390
Coating and other Solvent Use	295,801
Food Production and Processing	18,375
Waste Handling - not combustion	8,461
Health Care	18
Grand Total	637,044

Largest Emission Sources Based on Toxicity-Weighted Emissions

Figure 13: 2005 Maine Air Toxic Emissions by Source Category (TW-TPY)

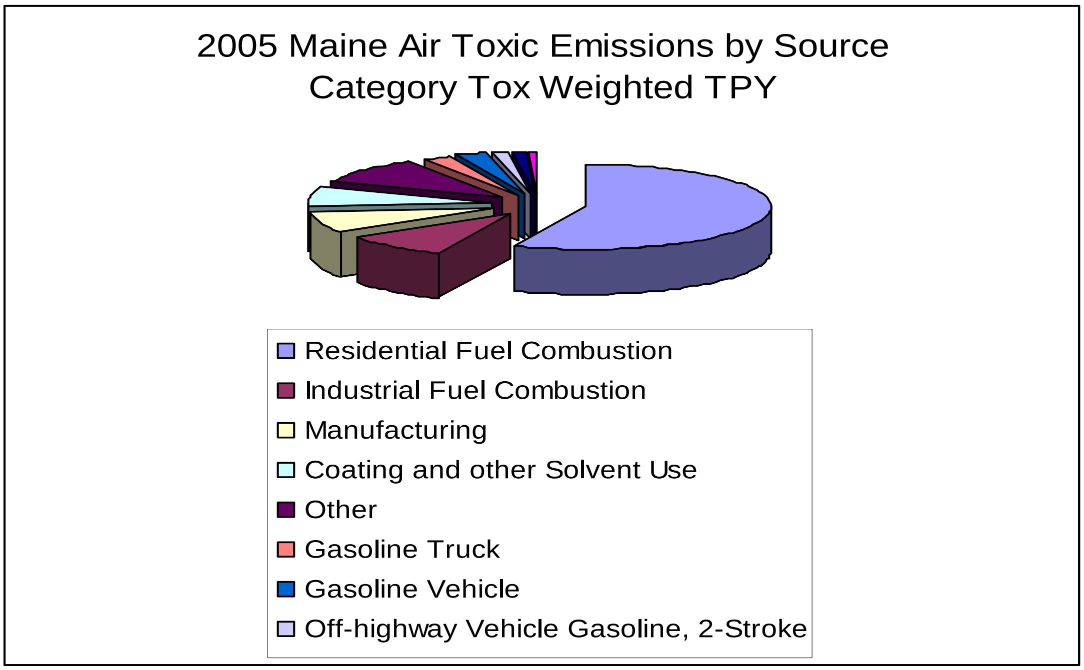


Figure 14: Toxicity-Weighted Emissions from Residential Fuel Combustion

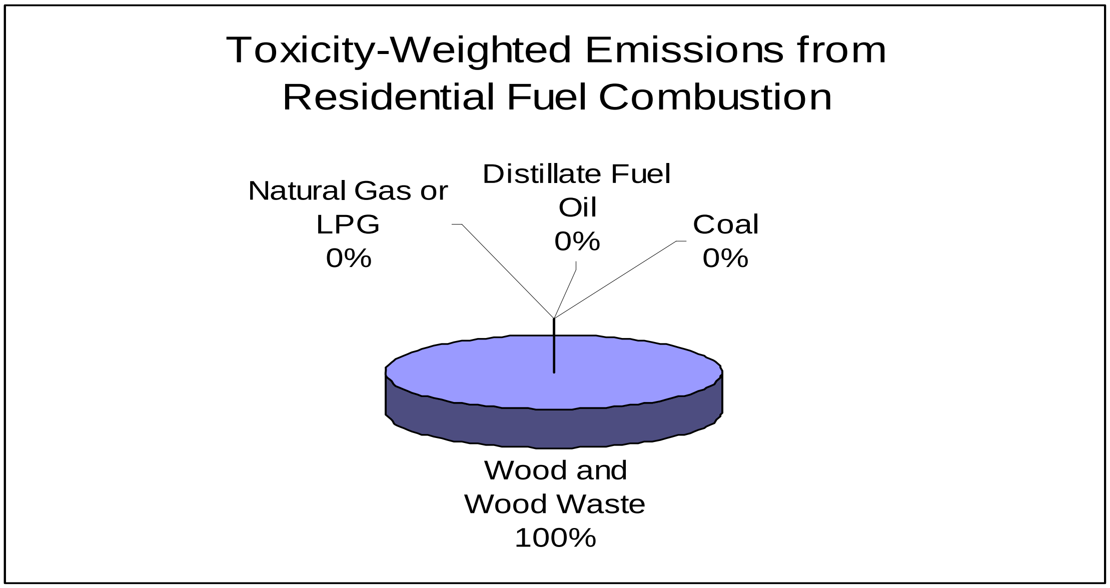
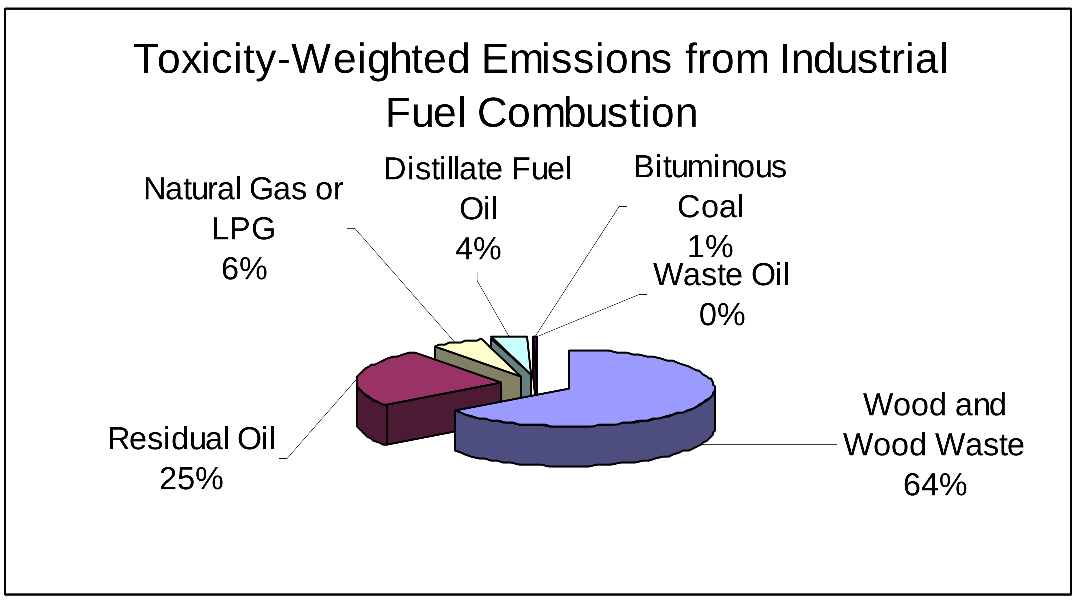


Figure 15: Toxicity-Weighted Emissions from Industrial Fuel Combustion



Air Toxics of Concern

Polycyclic Organic Matter, Naphthalene, and Acrolein emissions dominate the 2005 emissions inventory on a toxicity-weighted basis.

Figure 16: 2005 Maine Air Toxic Emissions by Pollutant Group (TW-TPY)

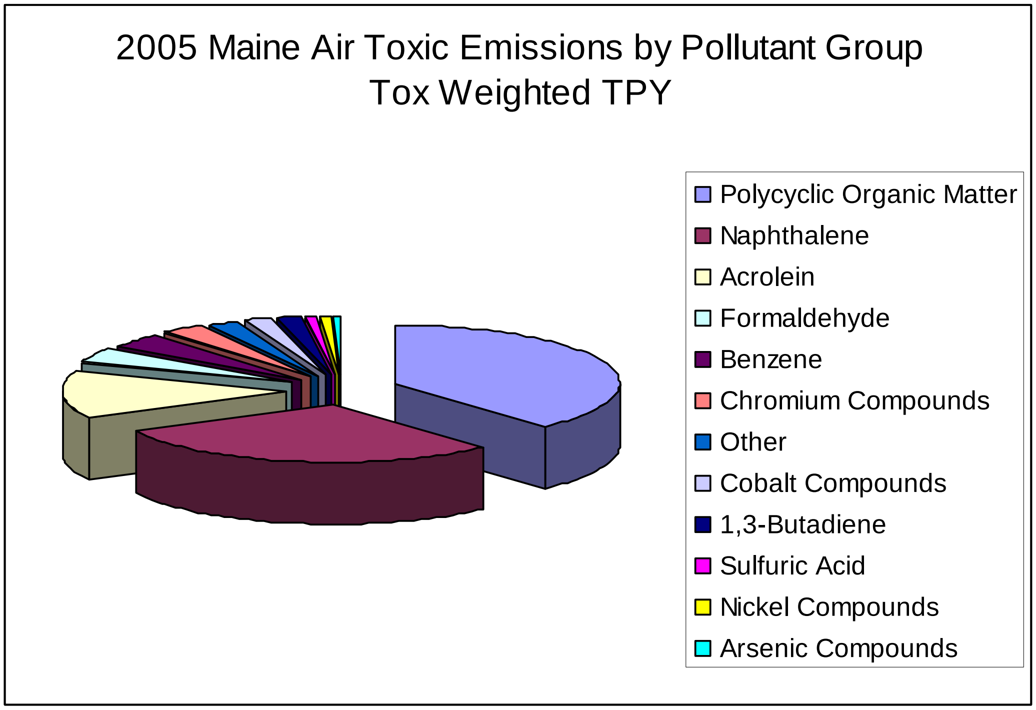


Figure 17: Sources of Polycyclic Organic Matter

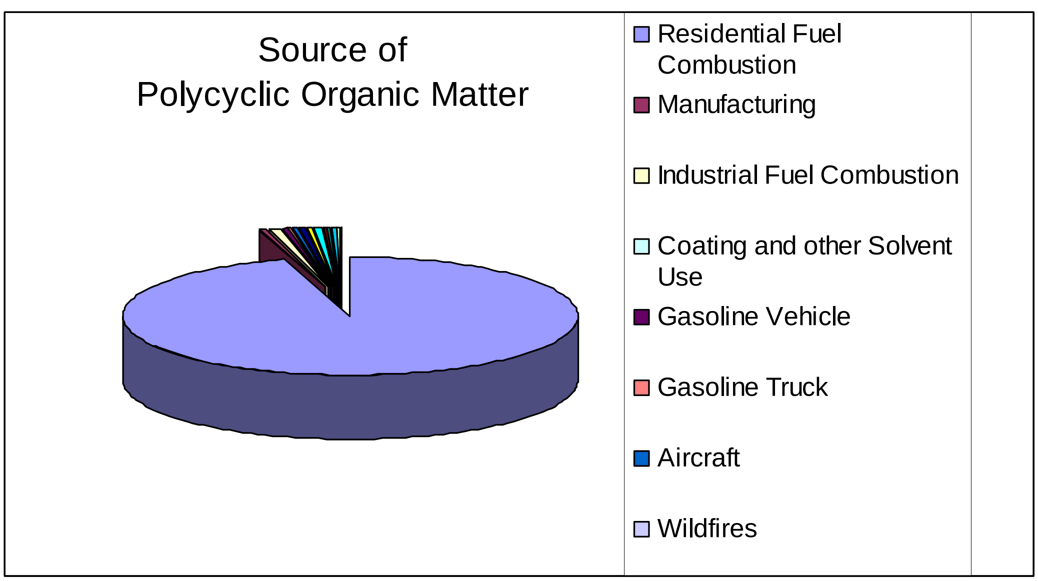


Figure 18: Sources of Naphthalene

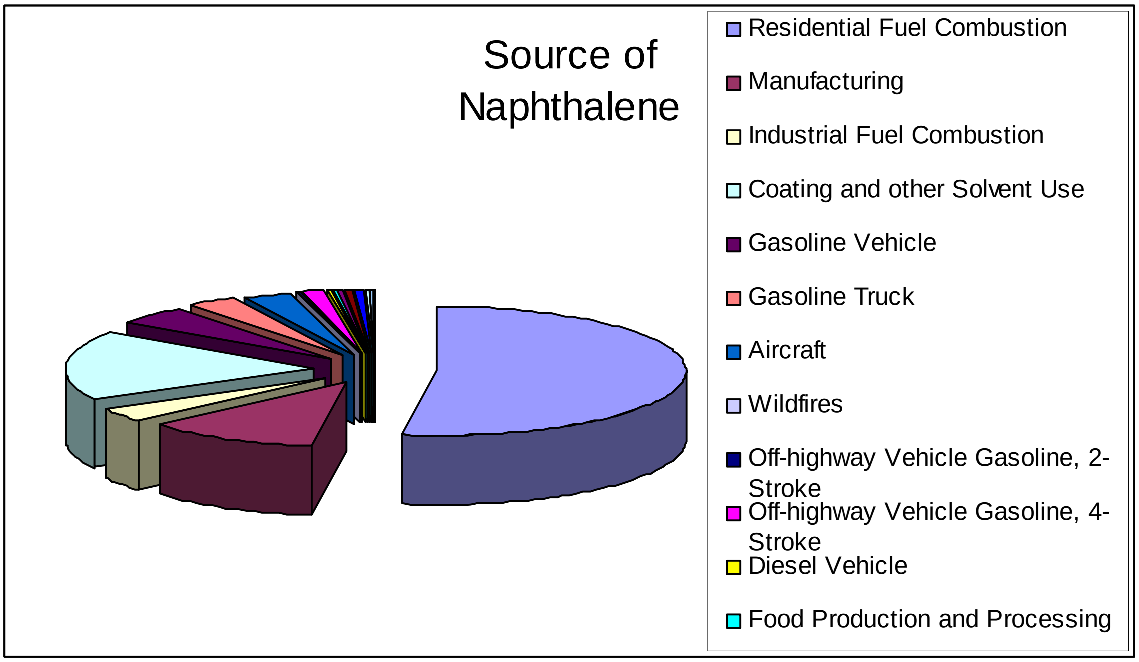
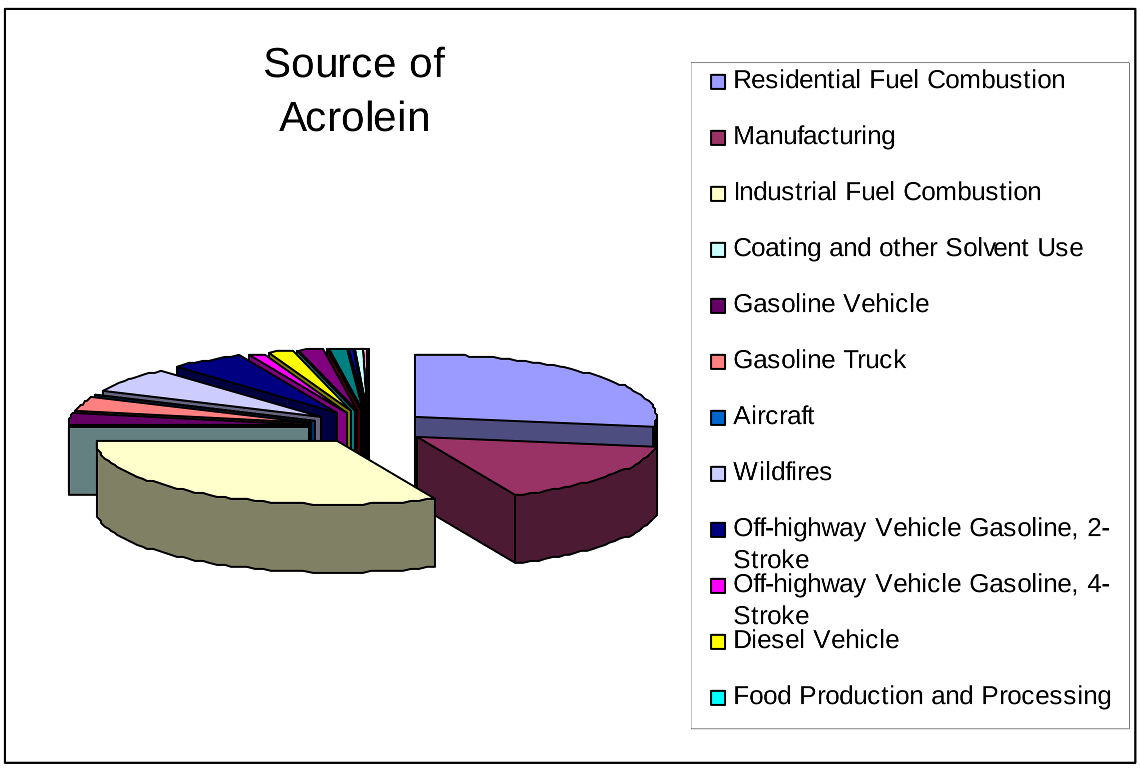


Figure 19: Sources of Acrolein



AREA Source Emissions

Combustion of wood for residential heating dominates the Area Source emissions inventory.

Figure 20: Air Toxics from the Area Source Sector (TW-TPY)

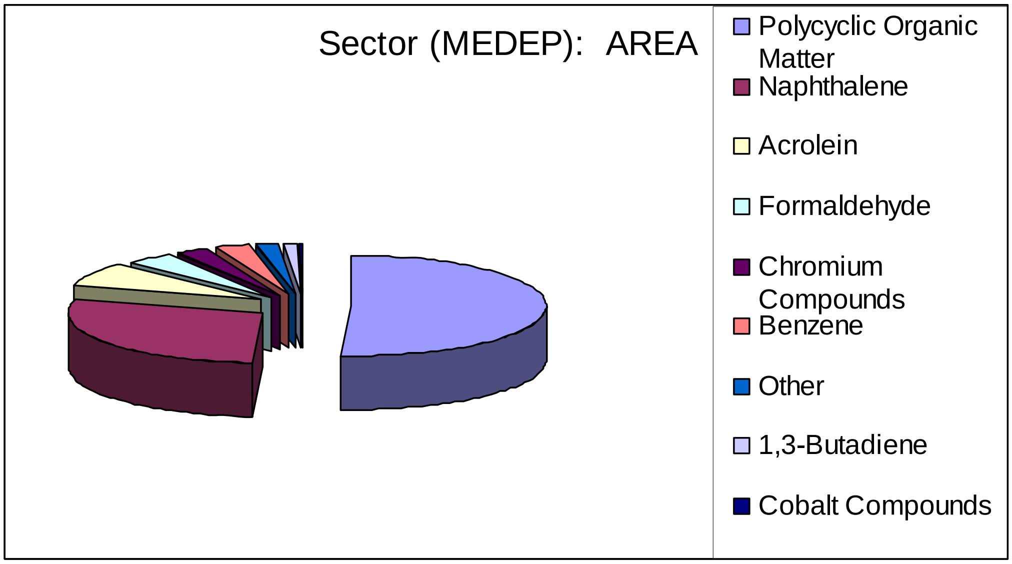


Figure 21: Sources of Air Toxics in the Area Source Sector (TW-TPY)

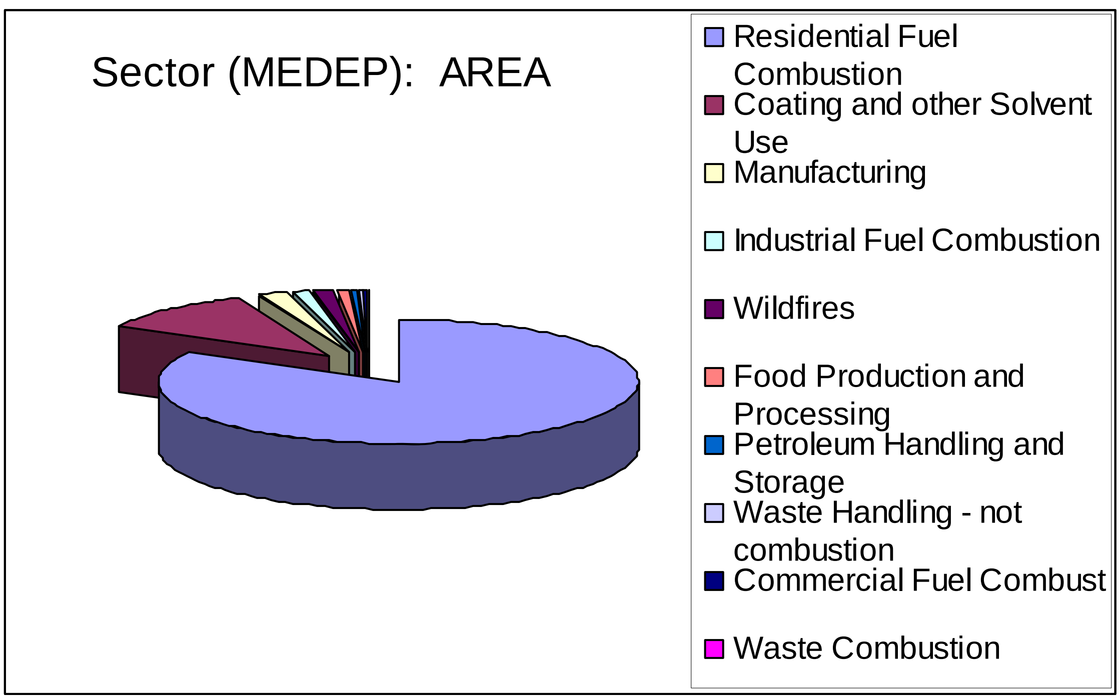
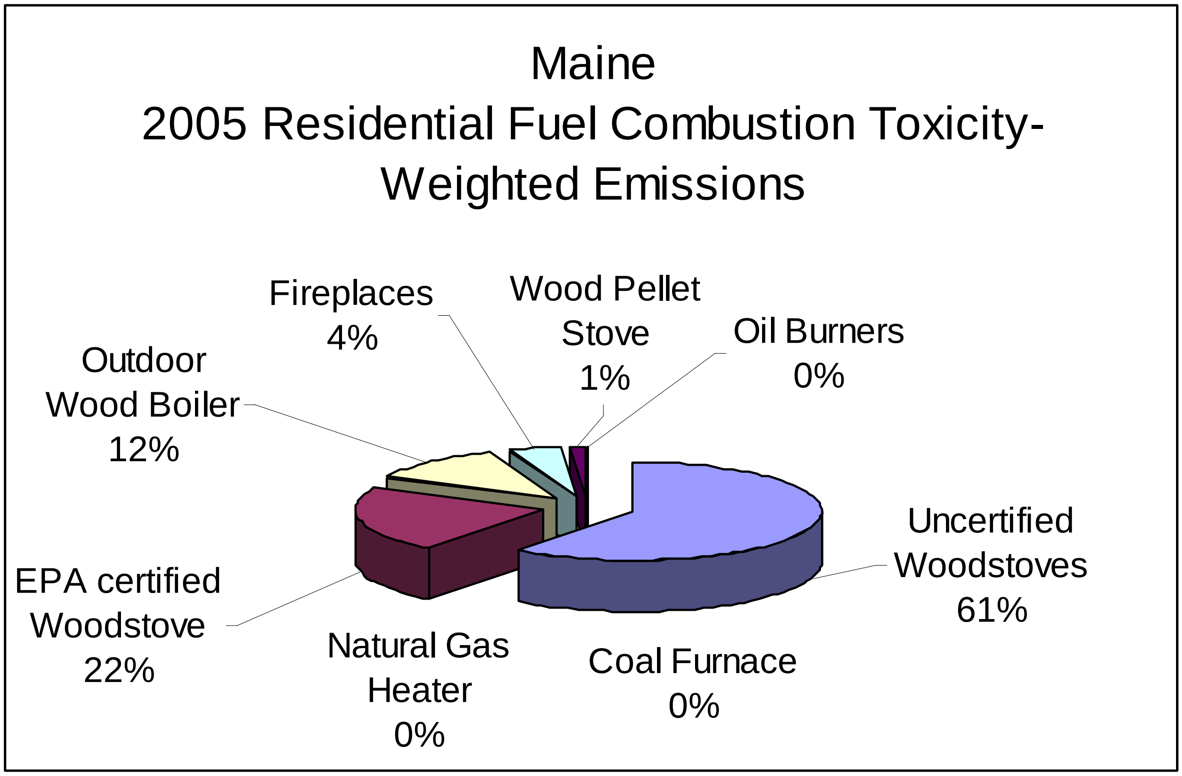


Figure 22: Sources of Toxicity-Weighted Emissions from Residential Fuel Combustion



POINT Source Emissions

Figure 23: Pollutants of Concern from the Point Source Sector

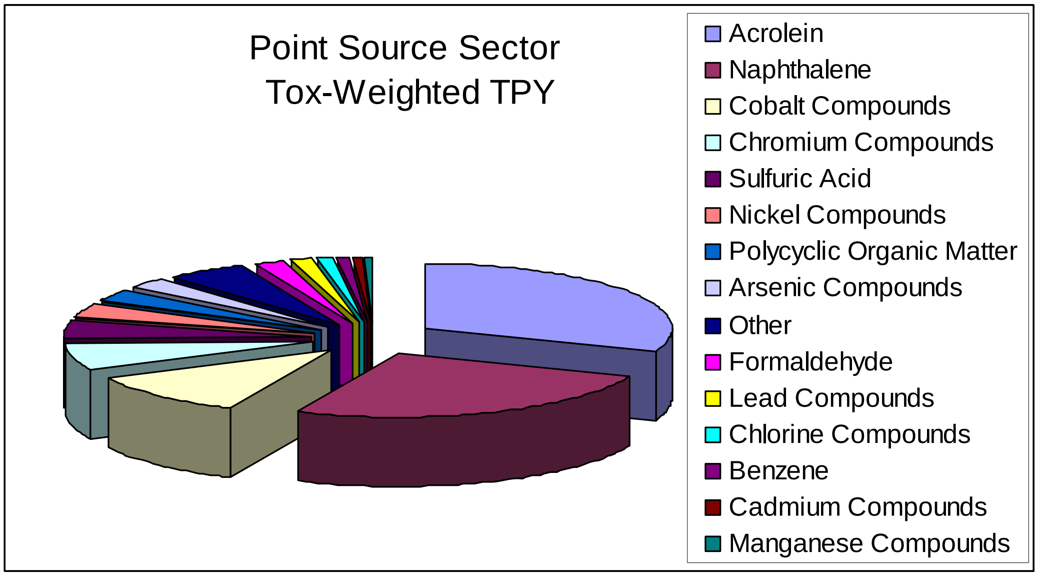


Figure 24: Point Source Emissions by Major SCC Groups (TWE-TPY)

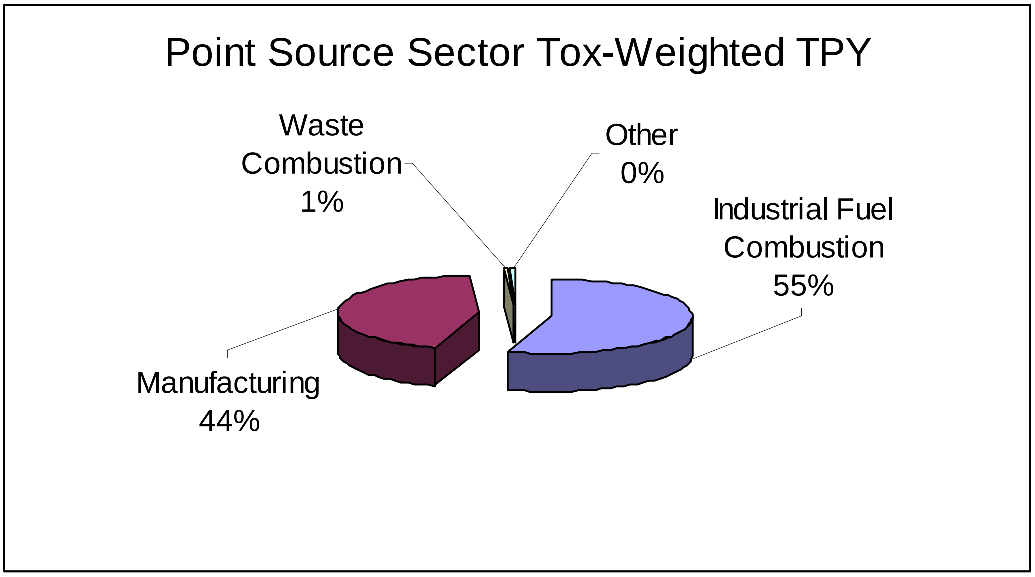


Figure 25: Point Source Detail – Industrial Fuel Combustion Sources of TWE

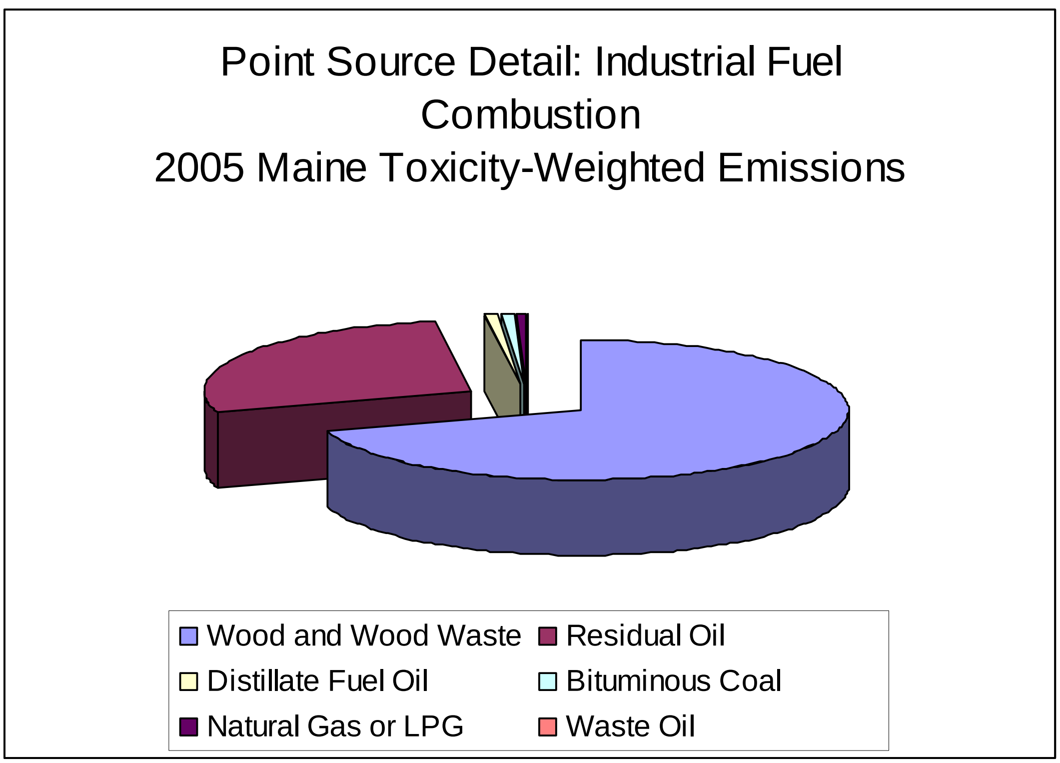


Figure 26: Point Source Detail – Manufacturing Sources of TWE

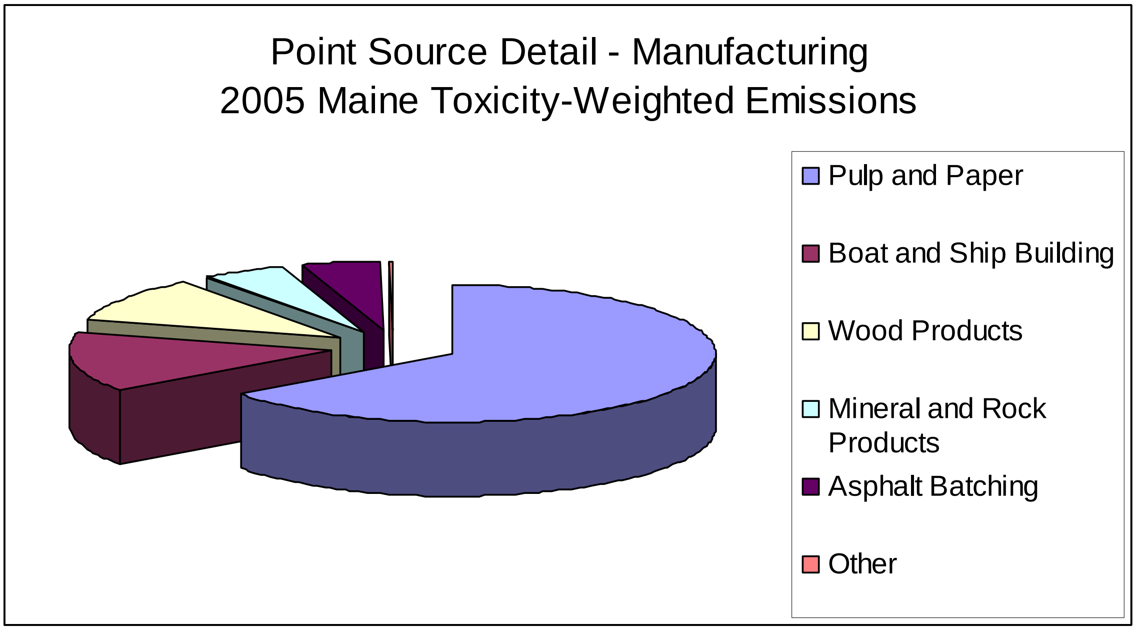
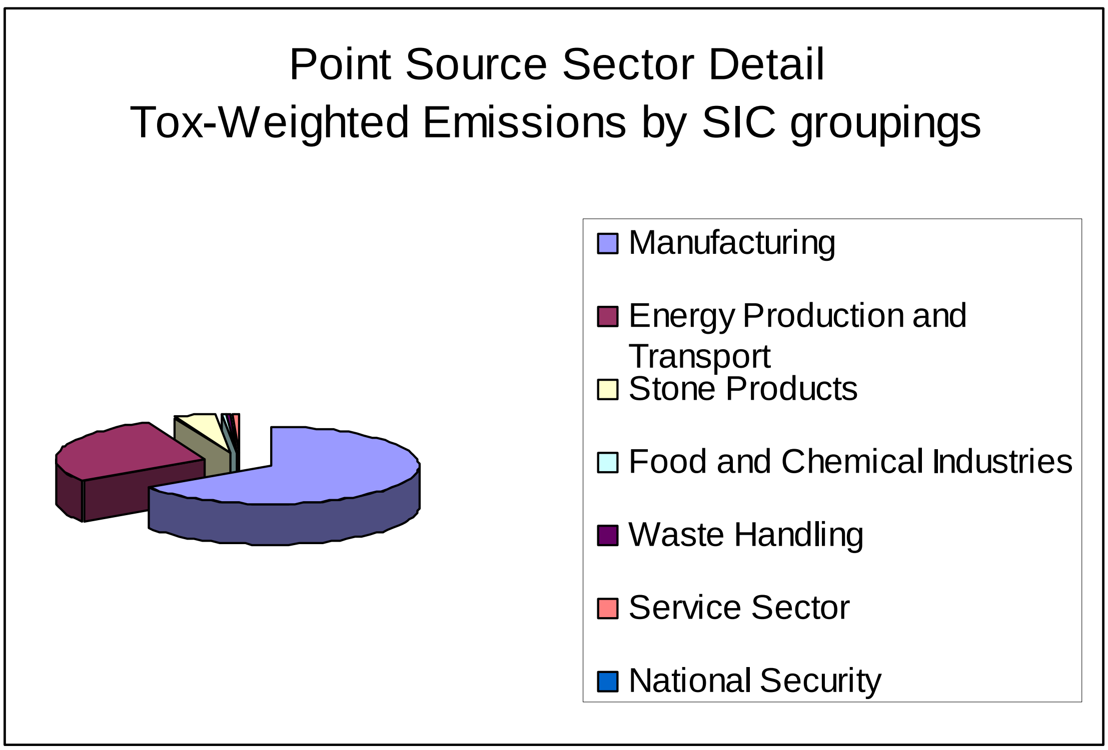


Figure 27: Point Source Detail – TWE by SIC Groupings



MOBILE Source Emissions

Figure 28: Mobile Source Emissions by Pollutant (TW-TPY)

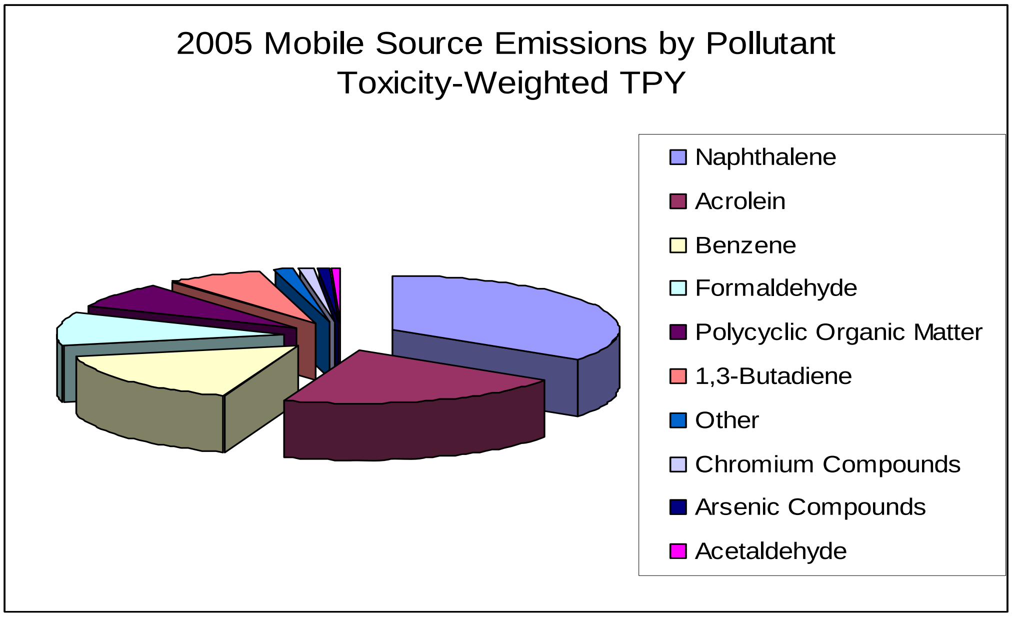


Figure 29: Mobile Source Emissions by Vehicle Type (TWE-TPY)

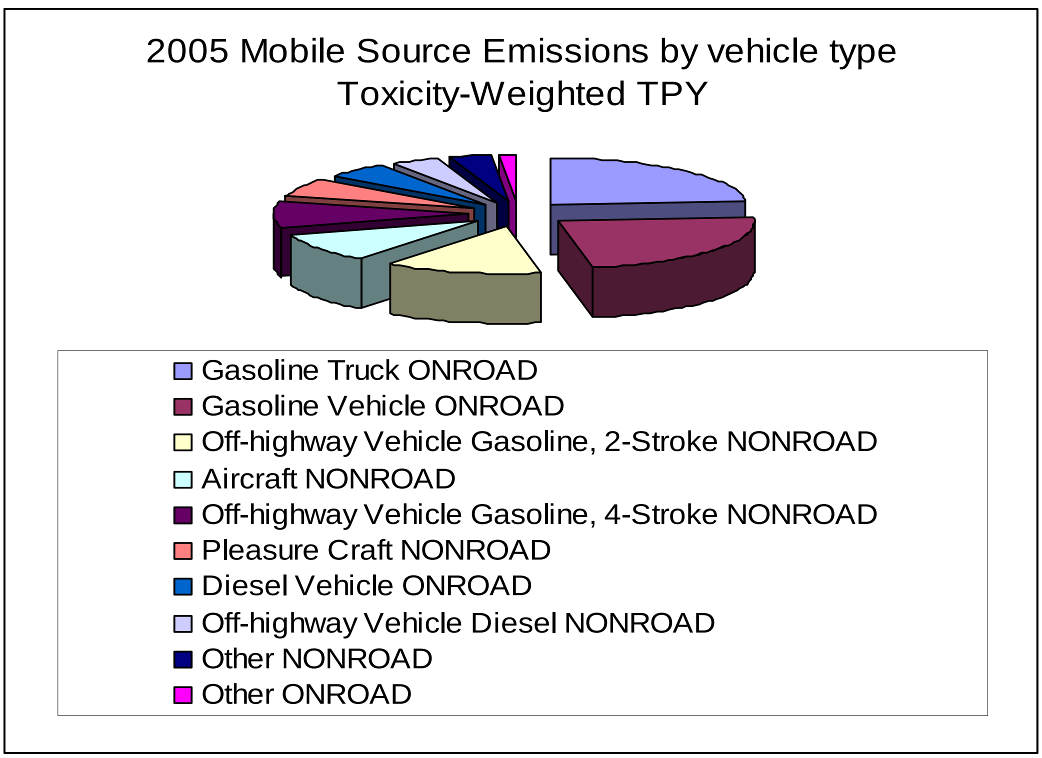


Table 12: 2005 Maine Air Toxic Emissions by Pollutant Group

MEDEP_POL_CATEGORY_NAME	Tox Weighted TPY
Polycyclic Organic Matter	1,423,435
Naphthalene	1,079,688
Acrolein	491,593
Formaldehyde	158,534
Benzene	145,789
Chromium Compounds	123,147
Cobalt Compounds	76,243
1,3-Butadiene	61,823
Sulfuric Acid	28,487
Nickel Compounds	27,471
Arsenic Compounds	24,406
Acetaldehyde	11,063
Lead Compounds	9,391
Cadmium Compounds	8,008
Chloroform	7,957
Ammonia	7,502
Chlorine Compounds	6,628
Manganese Compounds	3,165
Beryllium Compounds	2,872
1,3-Dichloropropene	2,705
Xylenes (Mixed Isomers)	2,504
Hydrochloric Acid (Hydrogen Chloride [Gas Only])	2,459
Tetrachloroethylene (Perchloroethylene)	2,182
Methyl Bromide (Bromomethane)	1,897
Glycol Ethers	1,882
Methyl Mercaptan	1,698
Cyanide Compounds	1,452
Toluene	1,338
Carbon Tetrachloride	837
Dioxins and Furans	793
H2S	779
Trichloroethylene	508
Methylene Chloride (Dichloromethane)	507
Diisocyanate Compounds	498
1,4-Dichlorobenzene	387
Hexachlorocyclopentadiene	373
Methyl Chloroform (1,1,1-Trichloroethane)	281
Antimony Compounds	249
Hexane	247
Ethylene Oxide	223
Ethylene Glycols	221
Acrylonitrile	212
Ethylene Dichloride (1,2-Dichloroethane)	177
Nitric Acid	134
Vanadium and Vanadium Compounds	130

MEDEP_POL_CATEGORY_NAME	Tox Weighted TPY
Acetone	125
Propylene Dichloride (1,2-Dichloropropane)	112
Ethylene Dibromide (Dibromoethane)	110
Mercury Compounds	108
Phenol	99
Copper Compounds	92
Hydrogen Fluoride (Hydrofluoric Acid)	83
Propylene Oxide	81
Ethylbenzene	54
2,2,4-Trimethylpentane	50
Methanol	44
Vinyl Chloride	43
1,1,2-Trichloroethane	41
Molybdenum Trioxide	33
Triethylamine	30
Propionaldehyde	29
2-Nitropropane	28
Zinc Compounds	24
Methyl Tert-Butyl Ether	21
Hexachlorobenzene	20
2,4-Dinitrotoluene	20
Turpentine	18
Styrene	12
Cumene	12
Cresol Compounds	9
Chloroacetic Acid	9
Biphenyl	8
Methyl Ethyl Ketone (2-Butanone)	7
1,2,4-Trichlorobenzene	7
Methyl Isobutyl Ketone (Hexone)	7
Titanium Dioxide	5
Aluminum Compounds	5
1,1,2,2-Tetrachloroethane	4
BariumCompounds	4
Polychlorinated Biphenyls	3
Chlorobenzene	3
Selenium Compounds	3
Bis(2-Ethylhexyl)Phthalate (Dehp)	2
p-Dioxane	2
N,N-Dimethylaniline	2
Benzyl Chloride	2
Carbon Disulfide	2
Methyl Chloride (Chloromethane)	2
Methyl Methacrylate	1
Chloroprene	1
Isophorone	1

MEDEP_POL_CATEGORY_NAME	Tox Weighted TPY
Allyl Chloride	1
2,4,6-Trichlorophenol	1
Acetophenone	1
Methyl Iodide (Iodomethane)	1
o-Toluidine	1
Phosphorus Compounds	0
Pentachlorophenol	0
Acetonitrile	0
Nitrobenzene	0
Epichlorohydrin (1-Chloro-2,3-Epoxypropane)	0
Ethylidene Dichloride (1,1-Dichloroethane)	0
1,2,4- Trimethylbenzene	0
Ethyl Acrylate	0
Carbonyl Sulfide	0
Vinylidene Chloride (1,1-Dichloroethylene)	0
Vinyl Acetate	0
2,4-Dinitrophenol	0
Sulfur Compounds	0
Dibutyl Phthalate	0
Dibenzofuran	0
N,N-Dimethylformamide	0
Acetamide	0
Dimethyl Phthalate	0
Hexachlorobutadiene	0
Grand Total	3,723,257

Table 13: 2005 Maine Air Toxic Emissions by Source Category

MEDEP_SCC_Descr_1	MEDEP_SCC_Descr_2	Tox Weighted TPY
Residential Fuel Combustion	Wood and Wood Waste	2,228,047
	Distillate Fuel Oil	2,683
	Natural Gas or LPG	29
	Coal	8
Industrial Fuel Combustion	Wood and Wood Waste	237,032
	Residual Oil	92,546
	Natural Gas or LPG	21,381
	Distillate Fuel Oil	14,224
	Bituminous Coal	2,343
	Waste Oil	191
Manufacturing	Pulp and Paper	172,170
	Wood Products	75,799
	Boat and Ship Building	37,236
	Mineral and Rock Products	14,277
	Asphalt Batching	12,405
	Surface Coating	1,422
	Chemical Manufacturing	502
	Metal Fabrication	312
	Machinery	188
	Misc Fugitive Emissions	38
	Leather Products	35
	Electrical Equipment Mfg	5
	Rubber and Plastic Products	3
	Textiles	2
Coating and other Solvent Use	Misc Fugitive Emissions	280,361
	Surface Coating	13,731
	Dry Cleaning	953
	Degreasing	337
	Construction	335
	Printing and Publishing	51
	Rubber and Plastic Products	33
Gasoline Truck	Light Duty	102,337
Gasoline Vehicle	Light Duty	69,125
	Heavy Duty	32,194
Off-highway Vehicle Gasoline, 2-Stroke	Recreational Equipment	50,094
	Lawn and Garden Equipment	4,482
	Logging Equipment	1,237
	Construction and Mining Equipment	377
	Commercial Equipment	185
	Agricultural Equipment	3
	Industrial Equipment	1
Aircraft	Commercial Aircraft	42,199
	Military Aircraft	330
Off-highway Vehicle Gasoline, 4-Stroke	Lawn and Garden Equipment	19,863

MEDEP_SCC_Descr_1	MEDEP_SCC_Descr_2	Tox Weighted TPY
	Recreational Equipment	8,237
	Commercial Equipment	7,542
	Construction and Mining Equipment	807
	Logging Equipment	778
	Industrial Equipment	760
	Agricultural Equipment	142
	Airport Ground Support Equipment	10
Wildfires	Wood and Wood Waste	35,066
Pleasure Craft	Gasoline 2-Stroke	24,081
	Gasoline 4-Stroke	4,515
	Diesel	427
Diesel Vehicle	Heavy Duty	22,339
	Light Duty	175
Food Production and Processing	Cooking	13,699
	Farming	4,439
	Food Processing	237
Off-highway Vehicle Diesel	Construction and Mining Equipment	9,201
	Agricultural Equipment	2,376
	Industrial Equipment	1,745
	Logging Equipment	1,684
	Commercial Equipment	1,493
	Lawn and Garden Equipment	433
	Airport Ground Support Equipment	76
	Recreational Equipment	63
Petroleum Handling and Storage	Gasoline	9,971
	Other Petroleum Product	920
	Distillate Fuel Oil	79
Commercial Marine Vessels	Diesel	8,329
	Residual	1,730
Waste Handling - not combustion	Wastewater Treatment	8,016
	Composting	304
	Landfill	140
	Accidental Releases	1
Railroad Equipment	Locomotives	6,021
	Diesel	79
	Gasoline, 4-Stroke	11
Waste Combustion	Solid Waste	3,934
	Wood and Wood Waste	1,478
	Human Cremation	22
	Natural Gas or LPG	1
Commercial Fuel Combust	Distillate Fuel Oil	3,964
	Coal	1,217
	Wood and Wood Waste	51
	Natural Gas or LPG	5
Motor Cycle	Light Duty	2,819
Diesel Bus	Heavy Duty	968

MEDEP_SCC_Descr_1	MEDEP_SCC_Descr_2	Tox Weighted TPY
Gasoline Bus	Heavy Duty	956
Diesel Truck	Light Duty	715
Off-Road LPG fueled equipment	Industrial Equipment	80
	Commercial Equipment	4
	Construction and Mining Equipment	1
	Lawn and Garden Equipment	1
	Airport Ground Support Equipment	0
	Recreational Equipment	0
Health Care	Hospital Sterilization	18
Grand Total		3,723,257

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Attachment 6: Additional Science Advisory and Stationary Sources Subcommittee Report to the Maine Air Toxics Advisory Committee of June 26, 2007

Addendum to the Stationary Sources and Science Advisory Subcommittee Recommendations to the Air Toxics Advisory Committee
Revision of June 21, 2007

The Maine DEP and Science Advisory Subcommittee developed a revised air toxics inventory at the same time that the Stationary and Mobile Subcommittees were evaluating air toxic reduction options. MEDEP did not complete this revised inventory until June 21, 2007. The revised inventory included a significant increase in the estimated air toxic releases from residential wood combustion. Since this information was not available until recently, the Stationary Sources Subcommittee did not conduct a detailed evaluation of reduction alternatives for this source category.

Therefore, the Stationary Sources Subcommittee believes that the ATAC should recommend that the MEDEP explore low-cost or no-cost reduction alternatives for air toxics from Residential Wood Combustion. Since this source category is also a relatively large source of some criteria air pollutants, but can be low in terms of net Green House Gas emissions, this evaluation should be done on a multi-pollutant basis. DEP should consult stakeholders as it evaluates low-cost/no-cost alternatives, preferably through existing stakeholder groups working on Green House Gas reductions. Alternatives that MEDEP should consider include:

1. Education and outreach on proper stove use, maintenance, and the fuel savings achievable with the lower emitting stoves;

2. Woodstove change-out programs that promote use of cleaner existing home heating technologies, including how tax incentives could be used;

3. Promotion of new home-heating technologies based on cleaner burning fuels that are derived from wood or other renewable resources.

Additionally, the Science Advisory Subcommittee believes that the ATAC should recommend that the MEDEP continue to refine the emissions inventory of Residential Wood Combustion. MEDEP should undertake additional surveys to determine the amount of wood burned for residential heating in Maine. Additionally, MEDEP should encourage EPA to develop a complete set of accurate emission factors for this important source category.

-End-

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