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Addressing Air Toxics in Massachusetts

The air we breathe can become contaminated with pollutants from a variety of natural and man-made sources. When federal law addressing air quality was enacted in 1970, air pollution control was focused on the most prevalent air pollutants, including sulfur dioxide, carbon monoxide, nitrogen oxides, ozone, and particulate matter. These pollutants (referred to as "criteria" pollutants) are primarily byproducts of fossil fuel combustion, and can injure health, harm the environment and cause property damage. Criteria pollutants were selected based on their prevalence in the outdoor air throughout the U.S.

However, due to increasing scientific evidence of their effects on human health, other toxic air pollutants have been targeted for controls in Massachusetts since the 1980s and by the U.S. Environmental Protection Agency (EPA) since the passage of the 1990 amendments to the federal Clean Air Act. In order to protect the health of Massachusetts residents and preserve the environment, the Massachusetts Department of Environmental Protection (MassDEP), working with EPA, seeks to reduce emissions to the ambient (outdoor) air of a number of toxic air pollutants used by business, industry, and individuals in the state.

MassDEP does not regulate air toxics in indoor air in homes, offices or workplaces except when indoor air quality has been, or may be impacted, by a spill or release of oil or a hazardous chemical.

What are toxic air pollutants?

Toxic air pollutants, also referred to as air toxics or hazardous air pollutants (HAPs), are pollutants that, at sufficient concentrations and exposure, are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or to cause adverse environmental effects. Generally, the toxic air pollutants of greatest concern are those that are released to the air in amounts large enough to create a risk to human health, and to which many people may be exposed. Title III of the Clean Air Act Amendments of 1990 identified 188 hazardous air pollutants (HAPs). The 188 HAPs are the toxic air pollutants considered most likely to have the greatest impact on ambient air quality and human health even when their emissions are

controlled through available technology. The list of HAPs regulated by EPA is published in Section 112 of the 1990 Clean Air Act Amendments.

Toxic air pollutants may exist as particles, liquid aerosols, or gases. Examples of gaseous toxic air pollutants include benzene, toluene, and xylenes, which are found in gasoline; perchloroethylene, which is used in the dry cleaning industry; and methylene chloride, which is used as a solvent by a number of industries. Examples of air toxics typically associated with particles include heavy metals such as cadmium, mercury, chromium, and lead compounds; and semi-volatile organic compounds, such as polycyclic aromatic hydrocarbons (PAHs), which are generally emitted during the combustion of wastes and fossil fuels.

What are the effects of toxic air pollutants?

Toxic air pollutants can have serious effects on human health and the environment. Human exposure to these pollutants can include short-term (acute) and long-term (chronic) effects. Many factors can affect how different toxic air pollutants affect human health, including the quantity to which a person is exposed, the duration and frequency of the exposure, the toxicity of the pollutant, and the person's overall health and level of resistance or susceptibility.

Short-term exposures can include effects such as eye irritation, nausea, or difficulty in breathing. Long-term exposures may result in damage to the respiratory or nervous systems, birth defects, and reproductive effects. In addition, toxic air pollutants can have indirect effects on human health through deposition onto soil or into lakes and streams, potentially affecting ecological systems and, eventually, human health through consumption of contaminated food.

EPA has published the following documents containing additional information about the health effects of air toxics:

- Air Pollution and Health Risk. How do we know when a risk from a hazardous substance is serious? This brochure shows how researchers estimate risk, and how the government uses this information to develop regulations that limit our exposure to hazardous substances.
- Evaluating Exposures to Toxic Air Pollutants: A Citizen's Guide. Toxic air pollutants can increase the chance of health problems and cause ecological impacts. This brochure discusses the process used to determine how much of a toxic air pollutant people are exposed to and how many people are exposed.
- Risk Assessment for Toxic Air Pollutants: A Citizen's Guide. Risk assessment is the process used to estimate the risk of illness from a specific human exposure to a toxic air pollutant. This brochure gives an overview of EPA?s 4-step assessment process.

What are the sources of air toxic pollutants?

There are many sources of toxic air pollutants. These sources can be divided into four categories:

- Major stationary sources
- Area sources
- Mobile sources
- Naturally-occurring sources

The Clean Air Act defines a *major stationary source* as a stationary source that emits, or has the potential to emit, 10 tons or more per year of any one of the 188 listed HAPs, or 25 tons or more per year of combined HAPs. Examples of major sources include chemical plants, paper mills, large printing and coating operations, power plants, and waste incinerators. These sources can release air toxics through emissions stacks and vents, fugitive process emissions, equipment leaks during material transfer and handling, or accidental releases. Nationally, EPA has estimated that about 24 percent of all man-made air toxic emissions come from major sources.

Area sources are smaller air toxic sources, each releasing less than 10 tons per year of any individual HAP and less than 25 tons per year of combined HAPs. Examples of area sources include dry cleaners, gas stations, small print shops, auto-body shops, electroplaters, and furniture manufacturers. Area sources also include consumer products in homes and offices, such as cleaners, pesticides, paints, and glues. Even though emissions from each individual area source may be small, their collective emissions can create significant health risks, particularly where there are large numbers of area sources located in a small geographic area, or when they are located in highly populated areas. Nationally, EPA has estimated that about 26 percent of all man-made air toxic emissions are attributable to area sources.

Mobile sources include automobiles, trucks and buses and ?non-road? engines. Despite major improvements in vehicle emissions over the past two decades, EPA estimates that nationally 50 percent of all man-made air toxic emissions come from mobile sources. Toxic air pollutants are generated by mobile sources through incomplete combustion of fuel as well as evaporation of toxic components of the fuel from within the fuel system.

Nonroad or "off-road" mobile sources include outdoor power equipment, recreational vehicles, farm and construction equipment, boats, and locomotives. Engines that burn gasoline or diesel fuel power most nonroad equipment and vehicles. Pollution from these engines is a significant source of air pollution across the country.

Some air toxics are released from natural sources. These include emissions from forests, gases from volcanoes, radon gas, and forest fires. Although many natural

sources of air toxics exist, most toxics originate from the man-made sources described above.

What is being done to control air toxic pollutant emissions in Massachusetts?

There are multiple programs aimed at reducing toxic air emissions. EPA programs are reducing air toxics emissions nationwide and Massachusetts has a number of additional measures that control the emissions of toxic air pollutants within the Commonwealth. These state and national programs include the following:

- *Massachusetts Toxics Use Reduction Act (TURA)*. TURA was enacted in 1989 to promote pollution prevention while increasing the economic competitiveness of Massachusetts industry. TURA requires Massachusetts companies that use large quantities of specific toxic chemicals to evaluate pollution prevention opportunities, implement them if practical, and measure and report their results on an annual basis. They must also evaluate their efforts and update their toxics use reduction plans every other year. TURA set a goal of reducing toxic byproduct generation by 50 percent, which was met in 1998. Progress toward this goal is measured by using data normalized for changes in production reported by a core group of industries that have been subject to reporting since 1990. See MassDEP's TURA home page for additional information, including the most recent Toxics Use Reduction Annual Information Release.
- *Ozone Reduction Programs*. One component of MassDEP?s ongoing efforts to address unhealthy concentrations of ozone (smog) in Massachusetts is the reduction of volatile organic compound (VOC) emissions from a variety of sources, including industrial and mobile sources. These control programs have a direct effect on air toxics, since many VOCs are toxic and some can cause cancer. Benzene is an example of a VOC that also is an air toxic. MassDEP?s programs to reduce VOC emissions include controls on large industrial sources, gasoline vapor recovery systems, federal reformulated gasoline, automobile inspection and maintenance, low emission vehicle performance standards, and reformulated consumer products and architectural coatings. Several of these programs are discussed in more detail below.
- *Permitting of Large Industrial and Commercial Sources*. Major stationary sources of HAPs (and some smaller area sources that are of particular concern) in Massachusetts are subject to the National Emissions Standards for Hazardous Air Pollutants pursuant to Title III of the Clean Air Act. EPA has established technology-based standards using maximum achievable control technologies (MACT) for 175 source categories. MACT standards require sharp reductions of routine toxic air pollutant emissions. When fully implemented, the standards are expected to significantly cut total annual HAP emissions from major sources to the ambient air. See the MACT standards that have been adopted by EPA to date.

In addition to the national MACT program, in the late 1980s MassDEP developed 115 health-based air toxics guidelines (Allowable Ambient Limits or AALs), which have been used in permitting certain stationary sources. These AALs are based on potential known or suspected carcinogenic and toxic health properties of individual compounds. Safety factors are incorporated into the AALs to account for exposures from pathways other than air. AALs are reviewed and updated periodically to reflect current toxicity information.

- *Mobile Source Emission Reductions*. Motor vehicles are an integral part of our society and virtually everyone is exposed to their emissions. EPA estimates that mobile source (car, truck, and bus) air toxics cause up to 1,500 cases of cancer nationwide each year, or about half of the cancers caused by all outdoor sources of air toxics. EPA and MassDEP have several programs to reduce emissions of air toxics from mobile sources.
- *National Vehicle Emissions Controls*. The control of air toxics emissions from motor vehicles has been addressed at the federal level through controls on motor vehicles such as catalytic converters. Pre-1975 vehicles without catalytic converters, and even pre-1981 vehicles with simple catalysts, emit far more air toxics than do newer vehicles. New cars today are designed to emit 90 percent fewer hydrocarbons over their lifetimes than the uncontrolled models of the 1960s, but they must be maintained and periodically tested to ensure emissions stay low.
- *Gasoline Vapor Recovery Programs*. Distribution and marketing of gasoline can be one of the largest sources of uncontrolled air toxic emissions.Gasoline vapors contain benzene, a known carcinogen, as well as many other toxic substances. Massachusetts has programs to control emissions from these sources. Gasoline vapor recovery systems capture the vapors released when gasoline is stored and transferred to and from bulk storage plants. Another vapor recovery system captures gasoline vapors that would otherwise be vented during individual vehicle refueling at gas stations. In addition, all gasoline tank trucks operating in Massachusetts must be equipped with gasoline vapor control equipment. Starting with the 1998 model year, federal rules require the phase-in of fueling vapor emissions control systems on new cars and light-duty trucks. These programs significantly reduce public exposure to toxic gasoline fumes.
- *Reformulated Gasoline (RFG)* is blended to reduce volatility and significantly reduces air toxics emissions. Massachusetts chose to participate in the RFG program in order to reduce emissions of VOCs that contribute to unhealthy ozone concentrations but also has benefited from a reduction in toxic emissions. Phase I of the national RFG program began in 1995 and resulted in a 17 percent reduction in toxic emissions from cars and trucks. Phase II of the program began on January 1, 2000 and resulted in a 22 percent reduction in air toxic emissions from conventional gasoline. EPA's Web site provides additional information about RFG.
- *The Massachusetts Vehicle Check program (formerly known as the Massachusetts Enhanced Emissions & Safety Test)* has been in effect since October 1999 for all motor vehicles registered in the Commonwealth, including

buses and trucks. The program, which is required by the Clean Air Act of 1990, is part of a comprehensive plan to reduce air pollution and its impact on public health. This program tests vehicle emissions once every two years using a high-tech dynamometer to more accurately measure emissions and identify polluting vehicles. (A dynamometer is a large treadmill that enables the testing of emissions from a running car under several modes of operation.) In addition, the program employs a sophisticated auditing and quality control system to eliminate "sticker fraud." See the program Web site.

In Massachusetts testing of heavy-duty diesel vehicles began February 1, 2001. Diesel exhaust contains 40 substances that EPA lists as hazardous air pollutants; 15 of these are considered probable or known human carcinogens. Of greatest concern are acetaldehyde, benzene, 1,3-butadiene, formaldehyde, and polycyclic aromatic hydrocarbons (PAHs). Learn more about air toxics from motor vehicles and the health effects of diesel emissions.

Mercury is a naturally occurring element that is toxic to people and wildlife. Because of the importance of reducing mercury emissions, MassDEP has developed a Mercury Resources Page to provide one-stop access to helpful information about mercury, its environmental and public health impacts, safe management of products and wastes that contain mercury, and state government efforts to reduce and ultimately eliminate the mercury threat.

Are Massachusetts toxic air pollutant control strategies working?

MassDEP has been actively involved in developing and using tools to gauge the effectiveness of the state's toxics control strategies. Several of these tools are outlined below.

- *Photochemical Assessment Monitoring System (PAMS)*. MassDEP monitors nearly 60 pollutants as part of the program. Many of these pollutants are air toxics. From June through August, volatile organic compounds (VOCs), nitrogen oxides (NOx), and ozone are monitored at six sites. In 1999, DEP added two year-round monitors for toxics. One of the two sites (Harrison Avenue, Boston) is a National Air Toxics Trends Site, which has resulted in the expansion of the list of toxic pollutants measured to include carbonyls (formaldehyde and acetaldehyde), toxic metals and chromium+6. Analysis of ambient concentrations showed a significant drop in concentrations of certain toxics in 1995, probably due to the introduction of reformulated gasoline that year. Since then, concentrations of compounds such as benzene, toluene, ethyl benzene and xylene have remained steady at the sub-part per billion range.
- *Toxic Release Inventory (TRI)*. EPA maintains a program for reporting releases of toxic chemicals to the environment known as the Toxic Release Inventory (TRI). The TRI is a database of release and waste management information for more than 650 toxic chemicals from certain industrial facilities throughout the U.S. that use listed chemicals above a specific threshold. Massachusetts

facilities subject to TRI report annually to EPA and DEP. Although the TRI database represents only a subset of total toxic emissions, the information can be used to identify trends in the release of toxics emissions over time. The Massachusetts Toxics Use Reduction Program incorporates TRI data in its reporting. Based on reported TURA/TRI data, Massachusetts manufacturers and other businesses statewide have reduced their reliance on toxic chemicals dramatically, making Massachusetts the national leader in demonstrable reductions in toxic chemical use and providing clear evidence of tremendous progress in pollution prevention.

- *EPA's NATA Program*. EPA has developed the National Air Toxics Assessment (NATA) program to evaluate the potential risks of human exposure to air toxics. This assessment reviews and analyzes data, and helps EPA set program priorities, characterize risks, and track progress towards meeting the overall goals of the national air toxics program. Specific activities include:
- Expanding air toxics monitoring
- Developing toxic emission inventories
- Conducting national and local-scale air quality analyses
- Modeling human exposure to toxic air pollutants
- Characterizing risks associated with air toxics exposures
- Researching the health and environmental effects of ambient and indoor exposures

NATA includes screening-level assessments to characterize the potential health risks associated with inhalation exposures. The 1996 NATA assessment examined 32 air toxics and diesel particulate matter, which were identified in EPA's Urban Air Toxics strategy as priority pollutants.

The assessment included:

- Compiling a 1996 national emissions inventory for outdoor sources of the 32 air toxics emissions and diesel particulate.
- Estimating 1996 air toxics ambient concentrations across the continental US.
- Estimating 1996 population exposures across the continental US.
- Characterizing potential public health risks due to inhalation of the 32 air toxics and diesel particulate.

The national screening-level assessment was initially performed for 1996. EPA is expected to conduct an updated assessment every three years and to release the 1999 NATA in 2005.

For More Information

EPA National Air Toxics Assessment: NATA Home Page

General Information About Air Toxics:

- EPA Air Toxics in New England Page
- MassDEP Contact: Eileen Hiney, 617-292-5520