Great Lakes Binational Toxics Strategy

Draft Report for

BENZO(A)PYRENE (B(A)P): REDUCTION OPTIONS

Prepared for

U.S. EPA
Great Lakes National Program Office
Contract # 68-W-99-033

JUNE 15, 2000

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1.0 INTRODUCTION

On April 7, 1997, Canada and the United States signed the *Great Lakes Binational Toxics Strategy: Canada-United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes* (Binational Toxics Strategy). The Binational Toxics Strategy identified twelve bioaccumulative substances having sufficient toxicity and presence in water, sediments and/or aquatic biota of the Great Lakes system to warrant concerted action to eliminate their input to the Great Lakes. They are called "Level 1 substances." Benzo(a)pyrene (B(a)P) is one of the Level 1 substances. B(a)P is the subject of this report, which is in response to the "Challenge" written in the strategy:

> *Seek, by 2006, reductions in releases that are within, or have the potential to enter the Great Lakes Basin, of B(a)P from sources resulting from human activity.*

To guide Environment Canada (EC) and the United States Environmental Protection Agency (EPA), along with their partners, as they work toward virtual elimination of the strategy substances, the strategy outlined a four-step analytical framework:

1. Information gathering

2. Analyze current regulations, initiatives, and programs which manage or control substances

3. Identify cost-effective options to achieve further reductions

4. Implement actions to work toward the goal of virtual elimination

An analysis of the first two steps in this four-step framework has been documented in a previous report entitled *Great Lakes Binational Toxics Strategy Final Report for Benzo(a)pyrene (B(a)P): Sources and Regulations*. That report identified the sources of B(a)P in the U.S. and assessed existing regulations and programs and their influence on the presence of B(a)P in the Great Lakes Basin.

This report documents the analysis associated with Step 3 of the four-step process for B(a)P reductions in the U.S. Step 3 encompasses identification of options that may offer opportunities for new or modified approaches, pollution prevention programs, or other alternative measures, to accelerate the pace or increase the level of reductions, taking into account cost-effectiveness. In implementing the strategy, EC and EPA agreed to favor "cleaner, cheaper, and smarter" ways of preventing or reducing pollution from strategy substances in a common sense, practical approach to achieving environmental objectives. The governments also agreed to share scientific information and work with other nations toward international accords that address strategy substances, and to collaborate in and support voluntary initiatives by major use and release sectors and others to reduce and eliminate the use, generation, and release of strategy substances. These commitments will be taken into account in identifying possible cost-effective options to reduce B(a)P within the Great Lakes Basin.

The purpose of this report is to present potential reduction opportunities for achieving the Binational Toxics Strategy challenge goal for B(a)P. It is not intended to recommend specific actions for EPA. The potential reduction opportunities presented in the report should be evaluated by EPA, in conjunction with stakeholders, to determine which actions are most appropriate for strategy efforts.

Section 2 of this report provides a brief summary description of B(a)P. Further information on the sources, exposure routes, toxicity, effects on human health and the environment, and relevant programs and lists to which B(a)P has been nominated is provided in the Steps 1 and 2 report, "*Great Lakes Binational Toxics Strategy Final Report for Benzo(a)pyrene (B(a)P): Sources and Regulations*". Section 3 of the report provides a brief description of each source category, followed by reduction options, including, where possible, a description of the proposed action, the release reduction potential, its cost effectiveness, implementation issues (e.g., technical feasibility), and where to find additional information. A few examples of successful efforts to reduce B(a)P are highlighted in Section 4.

2.0 DESCRIPTION OF B(a)P

Benzo(a)pyrene [B(a)P, CAS number 50-32-8] is a member of a class of compounds known as polycyclic aromatic hydrocarbons (PAHs). PAHs generally occur as complex mixtures and not as single compounds. B(a)P is not manufactured or used commercially. It is primarily a by-product of incomplete combustion, but also occurs naturally in petroleum-based tars. It enters the air through natural combustion processes, including forest fires and volcanic eruptions, and is emitted to air in vehicle exhaust, coke oven emissions, and contemporary fossil fuel combustion releases. Because of its relatively low vapor pressure, it is found largely on the soot (particulate matter), rather than in the vapor phase, of combustion emissions. When B(a)P adsorbs on particulate matter, it is sufficiently stable to permit long range transport and deposition in locations distant from the primary source.

Aquatic organisms bioconcentrate B(a)P from water, sediment, and food. The extent to which this occurs depends on the ability of the species to metabolize the B(a)P. High levels of B(a)P have been reported in organisms suitable for human consumption, including oysters, rainbow trout, and bluegills (ATSDR, 1999). Because of its potential to bioconcentrate in lipids, B(a)P is found at the highest levels in the fatty deposits of tissue and in the liver.

Human exposure to B(a)P occurs mainly through cigarette smoke and other tobacco products. Non-smokers are exposed to B(a)P via environmental tobacco smoke and ingestion of smoked or charcoal-broiled foods, such as meats and fish. Consumption of leafy vegetables represents another, albeit low, route of exposure, which is due to atmospheric deposition onto plants and crops, especially those crops located near roads and industrial areas (Menzie et al., 1992). B(a)P is also found in indoor residential air as a result of using wood fireplaces and wood-stoves, coal and oil furnaces, and kerosene heaters (ATSDR, 1999). Occupational exposure can occur in coal-tar-production plants, coking plants, petroleum refineries, smoke houses, trash incinerators, asphalt-production plants, or other facilities that burn wood, coal, or oil. Workers may also be exposed to B(a)P in road sealing and roofing work involving coal tar

and asphalt (ATSDR, 1999), and in areas where high-temperature broilers and food fryers are in use. Exposure to B(a)P also occurs for workers, vehicle occupants, or pedestrians via inhalation of diesel and gasoline engine exhaust, and for residents living near industrial sources of B(a)P (e.g., coke plants).

B(a)P is designated a probable human carcinogen by EPA and an animal carcinogen by the International Agency for Research on Cancer (IARC) (EPA, 1998a). According to EPA's Integrated Risk Information System (IRIS), quantitative data linking B(a)P to carcinogenic effects in humans are not currently available. However, mixtures of PAHs known to contain B(a)P, such as cigarette smoke, roofing tar, and coke oven emissions, have been shown to induce lung cancer in humans. Numerous animal studies have demonstrated the carcinogenicity of B(a)P by various routes. Animal studies also suggest developmental and reproductive problems with long-term B(a)P exposure.

Due to its persistence, bioaccumulation, and toxicity, B(a)P is targeted on many lists for control or regulation, often as a member of the broader class of PAHs or polycyclic organic matter (POM). B(a)P is regulated under the Clean Air Act, the Clean Water Act, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and the Emergency Planning and Community Right to Know Act (EPCRA). B(a)P is a targeted chemical in the Great Lakes Regional Air Toxic Emissions Inventory Project, designated as a "Lakewide Critical Pollutant" in Lakewide Management Plans (LaMPs), identified as a critical pollutant by the International Joint Commission, and included in the development of protocols to control and reduce persistent organic pollutants (POPs) and heavy metals under the United Nations Economic Commission for Europe Convention on Long Range Transboundary Air Pollution (LRTAP).

3.0 OPTIONS FOR REDUCING RELEASES

This section discusses each major source of B(a)P as identified in the B(a)P Steps 1 and 2 report, briefly describes the source, and then discusses reduction opportunities. Because most point sources of B(a)P are being addressed by current regulations, much of the potential for B(a)P reduction lies with many area sources, which are more difficult to control. Reduction options for these sources include non-traditional, more innovative approaches such as education, incentives, and voluntary actions.

3.1 RESIDENTIAL WOOD COMBUSTION

Source Characterization

Residential wood combustion has been estimated to account for the majority of B(a)P emissions in the Great Lakes basin (USEPA, 1999). This includes wood burned in fireplaces and wood-burning devices such as wood stoves, furnaces, and fireplace inserts. Wood-stoves built after 1990 are required by EPA to be certified to meet threshold particulate emission rates, ensuring cleaner burning wood stoves than most of those built before 1990. However, the life of a wood-stove is greater than 10 years, and the majority of wood-stoves in use are the older "non-

EPA certified" devices. Of the 9.3 million wood-stoves in the U.S., approximately 10%, or 1 million, are EPA-certified (Houck et al., 1999).

In addition to the type of wood-burning device, wood-burning practices affect the efficiency of combustion and level of emissions. Smoldering combustion emits a more toxic mix, and higher levels, of pollutants than oxygen-rich combustion. To some extent, smoldering combustion can be avoided through proper wood-burning techniques, such as the use of fully seasoned, dry wood.

Reduction Options

Emissions from residential wood combustion are a concern not only for the B(a)P Workgroup of the Binational Toxics Strategy, but also for the Dioxin Workgroup due to dioxin/furan releases. As described above, about 10% of wood stoves currently in use in the U.S. were built before 1990 and are not EPA-certified. This represents a significant opportunity for emissions reductions. In the 1996 report produced by the Great Lakes Regional Air Toxic Emissions Inventory Project, 126,600 lbs out of a total of 218,000 lbs of B(a)P emissions in the Great Lakes Basin are attributed to residential wood combustion (EPA, 1999). Options to reduce these emissions include:

- Expanding wood-stove changeout programs. Two pilot wood-stove changeout programs have been organized by the Hearth Products Association, with support from government agencies, in the northern Michigan and northeastern Wisconsin areas. By offering 10-15 percent discounts on new wood- or gas-burning stoves to customers who trade in their old wood-burning stoves to be recycled, these programs represent an excellent opportunity for both upgrading technology and reducing emissions in the residential sector. Expanding these programs to offer residents in other Great Lakes states an incentive to purchase cleaner burning stoves will help further reduce the amount of B(a)P produced by wood smoke.

- Coordinating with gas utilities to provide financial or other incentives to customers for converting traditional fireplaces to natural gas or for upgrading old wood stoves.

- Educating consumers on the hazards of wood combustion emissions, proper wood-burning techniques that minimize emissions, and low-emission alternatives to wood-burning devices. Local health and fire departments, economic development offices, environmental compliance bureaus, or other community groups can be solicited to help in this type of pollution prevention activity. At relatively little cost, community based programs (i.e., literature displayed in libraries, shops, restaurants) can inform residents of their impact on the environment and how they can reduce the amount of wood smoke generated by their wood-stoves. Gas companies might include educational information on the toxicity of wood combustion emissions in customers' monthly bills, both as a public service and as a way to help persuade residents to switch to natural gas.

- ♦ Consideration of regulatory measures that address phase-out or limitations on the use of older wood-stoves in localities with air quality concerns.

3.2 PETROLEUM REFINING

Source Characterization

Catalytic cracking units have been identified as the major source of B(a)P releases at petroleum refineries. The catalytic cracking process utilizes heat and a catalyst to break down heavier weight, higher boiling hydrocarbons such as gas oil into lower boiling, higher value hydrocarbons such as gasoline and heating fuels. The source of emissions from fluidized-bed catalytic cracking units (FCCUs), predominantly used by petroleum refineries for catalytic cracking, is a regenerator flue gas stream.

A maximum achievable control technology (MACT) standard has been proposed for petroleum refineries that is expected to control emissions from catalytic cracking units by requiring that combustion of the regenerator off-gas stream meet a 500 ppm carbon monoxide (CO) standard. Although compliance will be measured in terms of CO emissions, meeting this standard by complete combustion will reduce particulate and PAH emissions. Complete combustion is already required under a New Source Performance Standard (NSPS) for the industry, and refineries complying with the NSPS are considered in compliance with the proposed MACT. Under the proposed MACT, only a few FCCUs that are thought to not currently meet the full combustion requirements are expected to achieve further B(a)P emissions reductions (Coburn, 1999).

Reduction Options

The proposed MACT is expected to control emissions from the few catalytic cracking units not currently in compliance with the NSPS for the industry. However, more information is needed on the level of B(a)P emissions from petroleum refining, the effect of the MACT in reducing B(a)P emissions, and whether further reductions are achievable.

3.3 COKE OVENS

Source Characterization

Blast furnaces and steel mills produce coke in coke oven batteries. Emission points in the coking process are associated with charging, pushing, and quenching operations. Fugitive emissions occur at doors, charging lids, and oven offtakes and are highly dependent on the maintenance of the coke ovens and worker practice. Stack emissions occur at the battery stacks. The emission rates for doors are dependent on how well the seals around the doors are maintained. The emissions from lids and offtakes are dependent on worker practice in applying sealants around the gaps, the size of the gaps, and pressure fluctuations around the coke oven. Charging emission rates are a function of the time over which the coal is loaded into the oven, the pressure fluctuations around the oven, and the gap size around the charging ports.

Under the Clean Air Act (CAA), a MACT standard for coke ovens, which applies to charging, topside, and door leaks, was promulgated, and B(a)P emissions are estimated to have been reduced to approximately 1,000 lbs in 1996. A second MACT standard for coke ovens, which applies to pushing, quenching, and battery stacks, has a year 2000 promulgation date and is expected to decrease PAH emissions from current estimates. A residual risk standard is also being developed under the MACT program for the entire coke oven operation to address remaining risks from coke ovens.

In addition, EPA is reassessing the effluent limitations guidelines and standards for the iron and steel point source category. According to a preliminary study of the industry, completed by EPA in 1995, there have been substantial changes in how the industry operates. The consolidation and modernization of many integrated mills has led to a greater number of non-integrated or mini mills. More efficient process operations, increased wastewater recycle rates, elimination of obsolete processes, improved wastewater treatment processes, and computerized manufacturing have resulted in wastewater discharge loadings well below EPA's current standards for many mills. However, not all mills in the industry have improved wastewater treatment operations or implemented pollution prevention practices, and some mills continue to discharge in excess of current effluent guidelines. The rule reassessment is scheduled to be proposed in October 2000 (Jett, 1999).

Reduction Options

In the U.S., coke plants are subject to stringent environmental regulations and enforcement that are not imposed on many global competitors. These regulations, coupled with economic pressure from Chinese coke producers who are not required to implement strict control technologies, may make it difficult to obtain additional voluntary commitments from U.S. coke producers to further reduce B(a)P emissions. Reductions may be possible, however, on an individual facility basis through refurbishment and upgrades of old coke oven batteries, or through improved effluent abatement practices. An example of a coke plant making upgrades to its coke oven batteries is provided by Stelco Inc. and described in Section 4.

A tax on imported iron/steel/coke may be an option to ensure funds are available for cleanup of abandoned sites.

3.4 PUBLICLY OWNED TREATMENT WORKS

Source Characterization

Sources of B(a)P to publicly owned treatment works (POTWs) include residential releases, industrial/commercial discharges, and sewer runoff (EPA, 1999). Exhaust from on-road vehicles that is deposited onto roads, highways, and parking lots also contributes to contamination via runoff. In the 1996 report produced by the Great Lakes Regional Air Toxic Emissions Inventory Project, one state reported B(a)P emissions of 14,700 lbs from POTWs (EPA, 1999). The validity of the data source for these reported emissions, and whether these emissions are representative of other Great Lakes states, is not known.

Reduction Options

Since there are potentially many sources of B(a)P to POTWs, and significant resources are necessary to train and maintain staff in implementing POTW pollution prevention programs, it may be necessary that a broad array of toxic chemicals be targeted in POTW monitoring and toxic reduction efforts. These pollution prevention programs can focus on the sources of B(a)P to POTW facilities, as well as other problem chemicals such as mercury, and work with waste generators to reduce toxics in the waste stream.

Previous work on toxic chemical reduction efforts for wastewater treatment plants may inform the development of POTW pollution prevention programs. The Michigan Department of Environmental Quality, through a grant issued by the U.S. Environmental Protection Agency Great Lakes National Program Office, developed a pollution prevention training module for industrial and municipal wastewater treatment plant operators. The written course materials address pollutants of concern in the Lake Superior basin (and other water basins), the impact of pollutants on wastewater treatment plant operations, and pollution prevention practices that reduce or eliminate the generation of these substances. Although B(a)P is not among the pollutants of concern, the procedures for identifying sources and reducing toxic substances outlined in these materials will pertain to B(a)P as well. The training materials are available on the Internet at http://www.deq.state.mi.us/ead/potw/.

Using a grant from the U.S. Environmental Protection Agency Great Lakes National Program Office, the Western Lake Superior Sanitary District (WLSSD) in Superior, Wisconsin worked with four pilot communities to develop and implement community toxic reduction plans. As part of this project, WLSSD developed a short presentation for wastewater treatment plant managers and operators on the regulatory need to reduce toxics in POTW discharge and the advantages of pollution prevention. Results of the project include written reports of the toxic reduction plans developed for each of the four pilot communities. Similar community toxic reduction programs, focusing on pollution prevention efforts to reduce B(a)P and other toxics, may be developed in cooperation with other local POTWs. More information concerning the four pilot community plans may be obtained from WLSSD at (218) 722-3336.

3.5 COMMERCIAL MEAT CHARBROILING

Source Characterization

Charbroilers and meat cooking operations, such as fast-food restaurants, have been identified as sources of B(a)P emissions by Rogge (1991). The emissions from meat charbroiling were found to depend on the cooking method used, the fat content of the meat, and the type of exhaust system used above the cooking surface to remove grease.

B(a)P emissions from meat charbroiling vary with many factors. An emission rate determined by Rogge (1991) in a study of meat cooking operations was 0.19 mg/kg for a regular hamburger charbroiled over a natural gas flame with an overhead exhaust hood.

Reduction Options

Reduction options may be achieved best when coupled with particulate matter reductions. For example, commercial restaurants that charbroil meat may be interested in voluntary efforts to install catalytic converters to address concerns over particulate matter emissions and/or grease odors in residential areas. One commercial meat charbroiling fast-food restaurant chain is already installing catalytic converters on charbroilers in urban areas with air quality concerns. The catalytic converters decrease particulate emissions by about 88 percent and can be expected to reduce B(a)P emissions as well.

3.6 WILDFIRES AND PRESCRIBED BURNING

Source Characterization

Wildfires and prescribed burning represent a large source of B(a)P emissions. While wildfires are unwanted wildland fires, prescribed fires are fires that are managed to achieve resource benefits in an ecosystem. In the wildlands (areas with little development), fires occur naturally, usually by lightening strikes when conditions are right (e.g., dry grass, leaves, shrubs or branches).

EPA has issued an Interim Air Quality Policy on Wildland and Prescribed Fires in recognition of the natural benefit that fire has and can play in maintaining healthy wildland ecosystems (EPA, 1998b). Since recognizing this benefit, federal, tribal and state wildland owners/managers have begun plans to significantly increase the use of wildland and prescribed fires for ecosystem management to correct damage done under past management strategies. At the same time, EPA realizes that the resource benefits to be achieved should be balanced with the need to protect public health and welfare by mitigating the impacts of air pollution emissions on air quality and visibility. Therefore, the interim policy recommends that states and tribes implement smoke management programs to protect both health and visibility. As an incentive for states and tribes to implement smoke management plans, the policy states that EPA will consider redesignating an area as nonattainment if there is sufficient evidence that fires managed for resource benefits caused or significantly contributed to violations of daily or annual PM2.5 (particulate matter <2.5 μm in diameter) or PM10 standards. Efforts to control particulate matter are expected to also control B(a)P.

Reduction Options

Wildfires and prescribed burning are estimated to account for over 70 percent (1.9 million lbs) of 7-PAH emissions in EPA's draft 1993 National Toxics Inventory (Pope, 1999). The 7-PAH category includes B(a)P and six other compounds of similar molecular weight and toxicity. Thus, while the reduction potential for this source category, for B(a)P specifically, has not been quantified, it is expected to be large. EPA's Interim Air Quality Policy on Wildland and Prescribed Fires (EPA, 1998b) encourages air quality managers to:

- help evaluate the potential impacts of alternative resource treatments and assure that air quality concerns (also visibility and regional haze concerns, where appropriate) are adequately addressed in the public land use planning process;
- participate in public land use planning activities that involve selecting appropriate resource management treatments, including the use of fire, and help identify air quality criteria for fire management plans; and
- solicit information from private and Indian wildland owners/managers on plans to use fire for resource management, to encourage them to consider appropriate alternative treatments, and to assist them in evaluating the potential air quality impacts of alternatives to meet particular management objectives.

Wildland owners/managers are encouraged to:

- notify air quality managers of plans to significantly increase their future use of fire for resource management,
- consider the air quality impacts of fires and take appropriate steps to mitigate those impacts,
- consider appropriate alternative treatments, and
- participate in the development and implementation of state/tribal smoke management programs.

3.7 OPEN BURNING OF SCRAP TIRES

Source Characterization

Like wildfires and prescribed burning, the open burning of scrap tires has been identified as a source of 7-PAH emissions in EPA's draft 1993 National Toxics Inventory (NTI) (Pope, 1999). Vandalism and lightning strikes may cause stockpiled tires to ignite and burn for several days. Scrap tire fires are estimated to account for 4% (105,000 lbs) of 7-PAH emissions in EPA's draft 1993 NTI. Although nearly 100 million tires are estimated to have been removed from stockpiles in 1996-1998, approximately 500 million scrap tires remain (as of 1998) in 2,791 stockpiles across the U.S. (STMC, 1999). In addition, it is estimated that one scrap tire per person is generated every year (EPA, 1997a). Each state manages its own scrap tire program. In the Great Lakes, there are significant differences among the states both in the status of their stockpile clean-up efforts and in the development of markets for the safe disposal of newly generated scrap tires. In many states there remain significant stockpiles that have the potential to result in unwanted fires. Funding issues are generally the biggest hindrance to a more accelerated clean-up of scrap tire stockpiles.

Reduction Options

The biggest potential for reducing emissions from the open burning of scrap tires lies in eliminating the largest stockpiles of used tires; however, this is a costly endeavor which sometimes takes years to accomplish. While some states in the Great Lakes region have invested resources in removing large stockpiles of used tires, other states have little or no money to fund their clean-up efforts. Additional options to reduce emissions include removing scrap tires from

small tire dumps, providing opportunities to properly dispose of scrap tires and curb illegal dumping, and training firefighting staff in methods of preventing and suppressing tire fires. Details on some of these options are described further in the bullets below.

- Advocate the need for funding for scrap tire programs to the appropriate state legislatures. Since adequate funding is the biggest roadblock to the clean-up of existing scrap tire stockpiles in several Great Lakes states, stakeholder proposals may be developed for state legislators to obtain the appropriation of additional funds (e.g., higher fees on used tire returns).

- Look for opportunities to substitute credit projects for environmental penalties. In lieu of fines for environmental violations, credit projects allow companies to pay their penalties by undertaking projects that provide an environmental benefit. Enforcement officials may propose credit projects whereby companies pay for the clean-up of scrap tire piles in their local solid waste management district.

- Generate community support for the clean up of small, local tire accumulations, such as those along roadsides or streambanks. Although the potential reduction in B(a)P emissions may not be large, cleaning up tire accumulations while they are small prevents the pile from growing into a mass of scrap tires that poses a much larger risk to the environment. These clean-up events may be organized by solid waste management districts or local public interest groups. Due to the threat of disease-carrying mosquitos, health departments may be interested in co-sponsoring clean-up programs. Volunteers or individuals sentenced to community service may be used to help offset costs. Minority and low-income communities may find support through EPA's Environmental Justice through Pollution Prevention grants program.

- Hold community or county tire clean-up days for the public to recycle or properly dispose old tires. These collections have been popular in the state of Illinois, where they are co-sponsored by EPA and units of local government or other local sponsors. In Illinois, EPA provides funding for the collection and transportation of the scrap tires to a processing facility and the local co-sponsor provides advertising and a facility for the collection. As described above, while the potential reduction in B(a)P emissions from these collections may be small, every scrap tire collected represents a tire that otherwise may have contributed to a growing scrap tire pile.

- Provide fire prevention training for firefighting management. Tire fires differ from conventional fires in many respects, and fire departments may be ill-equipped or untrained in the management of these fires, especially in rural areas, where many scrap tire piles are located. Training in the prevention, planning, and management of scrap tire fires can help to mitigate the risks presented by tire fires, when they occur. This training includes information on developing pre-fire plans for storage facilities, preventing fires through storage and security requirements, recognizing health and safety concerns, and implementing fire suppression tactics that are unique to tire fires. Information and training sessions are offered by the Scrap Tire Management Council

to help reduce the occurrence and severity of scrap tire fires. The cost of this training is likely outweighed by the costs of fighting a scrap tire fire and cleaning up a site where a fire has occurred. More information is available from the Scrap Tire Management Council (http://www.rma.org/tiresn.html).

3.8 MOBILE SOURCES

Source Characterization

The Great Lakes Regional Air Toxic Emissions Inventory Project prepared an inventory of mobile source toxic air emissions in the Great Lakes (USEPA, 2000). Mobile source categories inventoried for this project include on-road highway vehicles (e.g., gasoline- and diesel-powered trucks and vehicles), non-road sources (e.g., agricultural, construction, and industrial equipment and vehicles, marine vessels, and pleasure craft), aircraft, and locomotives. In this inventory, mobile sources contribute approximately 1,200 lbs of B(a)P emissions (0.5% of total B(a)P inventory). Mobile source B(a)P emissions are due to on-road vehicles (35%), non-road sources (64%), and aircraft (1%).

EPA's Office of Transportation and Air Quality is charged with controlling air pollution from motor vehicles, fuels, and non-road equipment, as well as encouraging travel choices that minimize emissions. Links to the many programs and regulations that EPA is undertaking to control mobile sources can be accessed from the Office of Transportation and Air Quality home page at http://www.epa.gov/otaq/.

Reduction Options

Primary reduction options would be expected to be pursued outside of the Binational Toxics Strategy framework. For example:

- EPA's Office of Transportation and Air Quality is focused on efforts to reduce air toxic emissions from mobile sources. These efforts include changing fuel composition, improving vehicle technology and performance, requiring vehicle emission controls, and promoting alternative fuel options.
- Other agencies (e.g., Department of Transportation, Federal Highway Administration) are also involved in efforts to reduce emissions from mobile sources (e.g., promoting bicycle and pedestrian transportation accessibility, use, and safety).

In addition, reduction options that may be pursued include tighter restrictions on diesel engines, educational programs for truck owners and operators to maintain low emissions during the life of an engine, incentive programs to accelerate turnover of in-use equipment for lower emission technologies, and greater planning for light rail and urban transportation options. [More information about possible control measures may be found at the California Air Resources Board's web site at www.arb.ca.gov.] In addition, proper disposal of used crankcase and motor oils may be promoted by providing readily available disposal sites and community collections.

3.9 OPEN TRASH BURNING

Source Characterization

B(a)P was detected in an emissions characterization study undertaken by EPA to quantify emissions from the simulated burning of household waste material in barrels (EPA, 1997b). Estimated B(a)P emissions were higher for a non-recycling household than for an avid recycler. Total PAH emissions from approximately nine non-recycling open-burning households were estimated to equal the emissions from one "well-operated full-scale" municipal waste combustor unit.

The prevalence of open trash burning in the Great Lakes is not certain but is thought to be common in rural areas where there are fewer waste removal alternatives. In a survey of 760 residents of northeast Minnesota and northwest Wisconsin, 28% of all respondents admitted that they currently use a burn barrel or other device to burn household garbage or other materials (Zenith Research Group, 2000). In this study, 45% of respondents indicated that convenience was the primary reason for burning garbage, and the primary material burned was paper.

There is currently no federal legislation that addresses open barrel or backyard trash burning. Various state, local, and tribal regulations govern the practice, but enforcement may be a low priority.

Reduction Options

Open barrel/backyard trash burning is estimated to potentially release significant amounts of dioxins and furans per year and has been identified as a high priority for the Binational Toxics Strategy Dioxin Workgroup. Open trash burning is also a concern due to HCB emissions. Therefore, reduction options for B(a)P from open barrel/backyard trash burning may be coordinated with reduction efforts of the Dioxin and HCB workgroups. Potential options include:

- Increase the ease of recycling and alternative means of disposal to discourage open burning. This may require assessing policy, infrastructure, economic, and other barriers to eliminating waste disposal by open burning, particularly in rural areas. The degree to which the convenience factor can be addressed will be key to reducing the practice. The economics and feasibility of trash pickup or convenient drop-off locations to recycle paper, cardboard, junk mail, and other items that are routinely burned need to be understood and documented. Based on this understanding, strategies for increasing the convenience of waste disposal options other than open burning can be developed. These may include the promotion of lower cost and easier alternatives as well as increased penalties associated with open burning.

- A second option is to educate consumers on the health and environmental effects of backyard burning through public education campaigns. As indicated in the survey of northeast Minnesota and northwest Wisconsin residents, a television or direct mailing campaign may be an effective means of informing the public about the environmental

and health effects of open burning. Pollution prevention grants or support from local groups might be sought to help defray expenses. Local newspaper and television stations might be contacted about running a news story on the hazards of open trash burning and its prevalence in the area. Other cost-effective alternatives may be to display educational information for the public in local restaurants, libraries, or grocery stores, or to link with local non-government environmental groups to publicize the issue in newsletters and announcements.

- A third option is to generate community support for local burn barrel ordinances and to encourage residents to assist in enforcement. This may be accomplished through community-based campaigns that inform the public of the hazards of backyard burning (see Option 2), the need for an ordinance, alternative disposal and recycling methods, and opportunities for the public to become involved. Presentations may be made at community meetings to inform governing councils and residents of the need for a burn barrel ordinance and to gain their support. Such programs may be organized through a collaboration of local officials from environmental program offices, local health and/or fire departments, public works divisions, and solid waste offices, or through chambers of commerce, universities, or public interest groups. Information on the implementation of successful ordinances could be prepared and distributed to other communities.

4.0 HIGHLIGHTED EXAMPLES OF SUCCESSFUL REDUCTION EFFORTS

This section seeks to demonstrate the feasibility and merit of pollution prevention opportunities such as those identified in this report. A few examples of successful efforts to implement reduction opportunities for both point and area sources are described. This is not a comprehensive list, and it is acknowledged that other successful reduction efforts have been undertaken by both the private and government sectors to bring about reductions in B(a)P releases. For example, many companies, for various reasons (e.g., MACT regulations), have achieved reductions through the implementation of add-on controls. The three examples described below indicate the potential for B(a)P reductions resulting from implementation of the types of options identified in this report.

In 1997, Stelco Inc. began a program to upgrade its Hilton Works cokemaking operations in Ontario. Construction of the first Canadian Pulverized Coal Injection facility in 1995 decreased the facility's dependence on coke for blast furnace ironmaking, allowed three of the five coke oven batteries at Hilton Works to be idled, and resulted in a 40 percent decrease in particulate, volatile organic carbon (VOC), and PAH emissions. The upgrade strategy also included refurbishing one of the remaining coke oven batteries and assessing the viability of the second remaining coke oven battery if a major refurbishment were undertaken. Refurbishing a coke oven battery involves replacement of refractory brickwork and improved sealing design to help eliminate leak sources from all points of the battery structure during operation, thus resulting in decreased emissions.

The *Great Lakes Wood Stove Changeout* program was co-sponsored by the Michigan Office of the Great Lakes, Michigan Department of Environmental Quality, Grand Traverse Bay Watershed Initiative, Steel Recycling Institute, Hearth Products Association, and local hearth retailers, with support from Region 5 of the United States Environmental Protection Agency. This program offered incentives for residents in northern Michigan to trade in their old wood-stoves for newer, cleaner burning hearth products. The newer technology stoves reduce wood smoke emissions by about 85 percent and generate less B(a)P and particulate matter emissions. A similar program was held in the northeastern Wisconsin area. [*Details on the results of the wood stove changeout pilot programs will be available for the final report.*]

The Environmental Programs office of the Red Cliff band of Lake Superior Chippewa, located near the Apostle Islands in northwest Wisconsin, has been working for two years to generate support for a community ban on burn barrels. A waste transfer station has been opened to collect solid waste and recyclable materials free of charge. Residents have traditionally burned household wastes in metal burn barrels, a practice which has been found to emit a number of toxic chemicals. The Environmental Programs office on the reservation has been successful in educating residents on the hazards of open burning, and a recommendation for a burn barrel ordinance is being forwarded to the tribal council for a vote. For more information on the status of this ordinance, contact Red Cliff reservation at (715) 779-3700.

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