Overview of 1999 NEI for HAPs: Data Quality and Trends

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INTRODUCTION

Requirements of the Clean Air Act (CAA) and Government Performance Results Act (GPRA) have established the need for a more comprehensive hazardous air pollutant (HAP) emissions inventory effort that can be used to track progress by the Environmental Protection Agency (EPA) over time in reducing HAPs in ambient air. In response to these needs, the EPA has developed the National Air Toxics Assessment (NATA) to estimate the magnitude of HAP emissions reductions and demonstrate reduced public risk from HAP emissions attributable to Clean Air Act (CAA) toxics programs. To estimate risk and HAP emission reductions, EPA compiles the National Emissions Inventory (NEI) to provide a model-ready emissions inventory as part of NATA. The EPA previously compiled a baseline 1990 and 1996 National Toxics Inventory (NTI) and compiled the release of the 1999 NEI for HAPs in July 2003. The EPA is currently preparing the 2002 NEI.

This paper briefly discusses the compilation of the 1999 NEI for HAPs, highlights its data their sources and quality, and presents the 1999 data summaries and trends in HAP emissions from 1990 to 1999. Similar analyses are used to evaluate the success of EPA's national air toxics program.

COMPILATION OF THE 1999 NATIONAL EMISSIONS INVENTORY

Complete source category coverage is needed, and the NEI contains estimates of emissions from stationary point and non-point and mobile source categories. The stationary point source inventory contains estimates of facility-specific HAP emissions and their source-specific parameters necessary for modeling such as location and facility characteristics (stack height, exit velocity, temperature, etc.). Point source categories include major and area sources as defined in section 112 of the CAA. Nonpoint source categories include area sources and other stationary sources that may be more appropriately addressed by other programs rather than through regulations developed under certain air toxics provisions (sections 112 or 129) in the CAA.

Data Sources for the 1999 NEI

Sources of data in the NEI are state and local agency data and tribal data, industry data, data gathered by the EPA's Emission Standards Division (ESD) while developing Maximum Achievable Control Technology (MACT), Toxic Release Inventory (TRI) data, data developed by the EPA's Office of Transportation and Air

Quality, and EPA-estimated non-point emissions for sources not included in the state, local and tribal data. Because of the multiple sources of data, the compilation of the 1999 NEI requires many steps.

Key processing activities include submittal of 1999 HAP inventory data by state and local agencies, tribes, and industry; blending/merging of data from multiple data sources; augmentation of blended data for missing data elements; QA/QC of the data; preparation of draft NEI for external review; incorporation of external review comments; and preparation of final NEI. The final NEI for HAPs contains over 27 million emission records.

Point Source Data Quality Checks

The point source data files undergo a series of rigorous quality checks for: data content errors (e.g., identifying outliers), format errors (e.g., correcting field lengths), and data integrity problems (e.g., identifying widows/orphan records). Additionally, missing or inconsistent data elements are augmented (reviewing location/stack parameters). Data augmentation of location and stack parameters are discussed further.

Location parameters of stacks, fugitive sources, and/or facilities, such as latitude/longitude coordinates (or the corresponding UTM coordinates) were submitted for 170,759 of the total 225,618 stack/facility emission release points (75.7%) in the NEI. If the location parameters were incomplete or plotted outside the county boundaries, geocoding software was utilized to retrieve the correct coordinate data. Table 1 lists the 9 states in which at least 90% of their location parameters were submitted. Table 2 lists the 6 states in which less than 50% of the location parameters were submitted.

Stack parameters, such as stack height, stack diameter, exit gas velocity, exit gas temperature, and exhaust flowrate, were submitted for 38,718 of the total 143,833 stack emission release points (26.9%). If the stack parameters were incomplete, out of range, or inconsistent, then default data (at the SCC-, SIC-, or national-level) were utilized. Table 3 lists the 6 states in which greater than 50% of stack parameters were submitted. Table 4 lists the 9 states in which at least 5% of stack parameters were submitted.

Nonpoint and Mobile Source Data Quality Checks

Although the nonpoint source inventory is at the county-level, the data quality checks are similar to the point source quality checks. An additional check for nonpoint sources involves the potential double counting between the nonpoint sources and point sources. Three types of overlap analysis were performed between these inventories: 1) direct SCC-HAP at the county-level; 2) direct MACT-HAP at the county-level; and 3) specific overlap of four non-MACT EFIG-calculated categories (graphic arts, stage II gasoline distribution, autobody refinishing, and industrial surface coating).

For mobile sources, quality checks for data content errors, format errors, and data integrity problems were performed.

COMPARISON BETWEEN THE 1990 NEI AND 1999 NEI

The 1990 NEI was compiled originally from several HAP emission inventories, such as the 112(k), 112(c)(6), pre-MACT baseline emissions inventory, and TRI. The 112(k), 112(c)(6), and pre-MACT baseline emissions inventory were primarily developed as top-down emission inventories. Emissions were

calculated at the national-level, and then allocated to the county-level using surrogates (county business patterns, county population, etc.). Additionally, county-level data HAP emission inventories provided by the Great Lakes Commission (GLC), California's Air Resources Board (ARB), and EPA inventories of Harris County, TX and Maricopa County, AZ were integrated into the inventory.

Source Category Trends

Prior to 1999, EPA has implemented 16 of the 26 MACTs that have been promulgated (http://www.epa.gov/ttn/atw/mactfnl.html). An additional four MACTs (HON, Marine Vessel Loading Operations, Printing and Publishing - Surface Coating, and Primary Aluminum) were implemented during 1999, and are not included in this analysis. In the 1990 NEI, the MACTs of Polymers and Resins I, II, and IV were all combined. For this comparison, the same MACTs were combined from the 1999 NEI. Total HAP emissions of the 14 implemented MACTs for 1990 and 1999 are summarized in Table 5. For these implemented MACTs, HAP emissions decreased by 73%.

Source categories which showed a total HAP reduction between 1990 and 1999 are italicized. Of the 15 promulgated MACTs, 12 showed a decrease in total HAP emissions, ranging from as low as 2.9% (Gasoline Distribution - Stage I) to as high as a 98.8% (Magnetic Tapes - Surface Coating). Two MACTs increased their total emissions: Commercial Sterilizers (+12.1%) and Polymers and Resins I, II, and IV (combined 130.7%). The 1990 sources of data for these categories were primarily from TRI. In the 1999 NEI, less than 30% of the Commercial Sterilizers and less than 1% of the Polymers and Resins I, II, and IV emissions data came from TRI. The 1999 data sources for these categories were from state/local agencies and ESD.

HAP Trends

Five HAPs, as well as total HAPs were analyzed for further trend analysis (Table 6). Total emissions, MACT emissions, non-MACT emissions, and total mobile source emissions were compared between 1990 and 1999. Methyl methacrylate, methylene chloride, and tetrachloroethylene are only emitted by stationary sources, while benzene and formaldehyde are emitted by stationary and mobile sources. The following observations were made:

- Benzene: Stationary sources of benzene accounted for 22% of the total benzene emissions in 1990 and 32% in 1999. Overall benzene emissions decreased by nearly 29% between 1990 and 1999. The mobile sources portion of benzene decreased substantially during that time period (38%); however, the MACT source categories exhibited the highest percentage decline (~46%). The primary MACTs implemented during this time period that emit benzene include: Coke Ovens, Gasoline Distribution (Stage I), Secondary Lead Smelters, Petroleum Refineries, and Aerospace (Surface Coating).

- Formaldehyde: Stationary sources of formaldehyde accounted for 45% of the total formaldehyde emissions in 1990 and 53% in 1999. Overall formaldehyde emissions decreased by over 22% between 1990 and 1999. The mobile sources portion of formaldehyde decreased substantially during that time period (~34%); the MACT source categories exhibited a 13% decrease in emissions. The primary MACTs implemented during this time period that emit formaldehyde include: Secondary Lead Smelters, Aerospace (Surface Coating), and Wood Furniture (Surface Coating).

- Methylene Chloride: Overall methylene chloride emissions decreased by nearly 38% between 1990 and 1999. The MACT source categories exhibited over 44% decrease in emissions. The primary

MACTs implemented during this time period that emit methylene chloride include: Degreasing Organic Cleaners, Secondary Lead Smelters, Aerospace (Surface Coating), and Wood Furniture (Surface Coating).

- Tetrachloroethylene: Overall tetrachloroethylene emissions decreased by nearly 64% between 1990 and 1999. The MACT source categories exhibited over a 69% decrease in emissions. The primary MACTs implemented during this time period that emit tetrachlorethylene include: Dry Cleaning, Degreasing Organic Cleaners, and Aerospace (Surface Coating).

- Total HAPs: Total HAP emissions decreased by nearly 30% between 1990 and 1999. The MACT source categories exhibited over a 50% decrease in emissions, while the mobile sources totaled a 32% decrease. The implemented MACTs, along with Mobile Source Onroad regulations (e.g, the use of reformulated gasoline in ozone and carbon monoxide nonattainment areas) contributed to these significant decreases..

CONCLUSIONS

Significant decreases in HAP emissions have occurred in the 1990s due to the implementation of MACT standards and Mobile Source Onroad regulations. Inventory methodologies have also improved greatly between the compilation of the 1990 NTI and 1999 NEI for HAPs. Improvements to the 1999 NEI for HAPs include higher resolution of data to support modeling, improved speciation of HAPs, participation by most state and local agencies and tribes, increased the number of source categories, inclusion of facility and stack specific data, electronic QA/QC of data, and external review of inventory by a large number of individuals within state and local agencies, tribes, industry, and EPA.

Table 1 - States Which Had Greater Than 90% of Emission Release Point Location Data Submitted

State	Submitted # Emission Release Point Locations (1999 NEI)	Total # Emission Release Point Locations (1999 NEI)	% Submitted
West Virginia	2,652	2,769	95.8
Illinois	14,186	14,825	95.7
Texas	22,163	23,307	95.1
Pennsylvania	5,526	5,883	93.9
Colorado	11,041	11,991	92.1
Minnesota	5,047	5,490	91.9
North Carolina	5,009	5,512	90.9
Delaware	441	488	90.4
Kansas	1,428	1,583	90.2

Table 2 - States Which Had Less Than 70% of Emission Release Point Location Data Submitted

State	Submitted # Emission Release Point Locations (1999 NEI)	Total # Emission Release Point Locations (1999 NEI)	% Submitted
California	41,730	76,787	54.3
North Dakota	148	263	56.3
Massachusetts	673	1,097	61.3
New York	2,299	3,633	63.3
Hawaii	136	212	64.2
Tennessee	1,655	2,470	67.0
Nebraska	540	801	67.4
Wyoming	348	510	68.2
Georgia	1,114	1,616	68.9
Michigan	4,086	5,925	69.0

Table 3 - States Which Had Greater Than 50% of Stack Parameter Data Submitted

State	Submitted # Stack Emission Release Points (1999 NEI)	Total # Stack Emission Release Points (1999 NEI)	% Submitted
Illinois	11,444	14,386	79.5
Maryland	587	774	75.8
Wisconsin	2,057	3,106	66.2
Rhode Island	80	123	65.0
Alabama	1,201	2,058	58.4
Florida	1,199	2,129	56.3

Table 4 - States Which Had Less Than 5% of Stack Parameter Data Submitted

State	# Emission Release Points (1999 NEI)	Submitted Emission Release Points (1999 NEI)	% Submitted
Hawaii	2	182	1.1
California	634	44,207	1.4
Utah	13	739	1.8
Kansas	34	1,382	2.5
Alaska	5	179	2.8
Wyoming	13	315	4.1
Iowa	18	431	4.2
New Hampshire	21	436	4.8
Minnesota	262	5,346	4.9

Table 5 - Summary of Emissions for Implemented MACTs

MACT Standard	CFR Subpart	Total 1990 Stationary Emissions (tpy)	Total 1999 Stationary Emissions (tpy)	% Change
Coke Ovens	L	1,761	631	-64.2
Dry Cleaning	M	95,700	28,426	-70.3
Chromium Electroplating	N	175	22	-87.4
Commercial Sterilizers	O	305	342	+12.1
Industrial Cooling Towers	Q	25	NA[a]	
Gasoline Distribution (Stage I)	R	42,673	41,428	-2.9
Degreasing Organic Cleaners	T	13,510	44,671	-65.8
Polymers and Resins I, II, and IV	U, W, JJJ	2,967	6,845	+130.7
Secondary Lead Smelters	X	2,005	57	-97.2
Petroleum Refineries	CC	92,575	24,842	-73.2
Magnetic Tapes (Surface Coating)	EE	4,470	53	-98.8
Aerospace (Surface Coating)	GG	234,726	3,312	-98.6
Shipbuilding and Ship Repair (Surface Coating)	II	7,913	2,702	-65.9
Wood Furniture (Surface Coating)	JJ	29,858	10,530	-64.7
	TOTAL[b]	**652,048**	**174,267**	**-73.3**

italicized = source category emissions were lower in 1990 than 1999

[a] = per discussion with the ESD Lead for this source category, all MACT IDs were removed from these facilities in the 1999 NEI. Thus, a comparison was not possible.

[b] = does not include Industrial Cooling Towers

Table 6 - Comparison of Selected HAP Emissions

HAP	Total Emissions			MACT Sources			Non-MACT Sources			Mobile Sources		
	1990 (tpy)	**1999 (tpy)**	**% Change**	**1990 (tpy)**	**1999 (tpy)**	**% Change**	**1990 (tpy)**	**1999 (tpy)**	**% Change**	**1990 (tpy)**	**1999 (tpy)**	**% Change**
Benzene	493,424	350,775	-28.9	38,892	20,302	-46.4	71,312	91,187	+27.9	384,220	239,286	-37.7
Formaldehyde	380,264	295,911	-22.2	38,860	33,864	-12.9	132,142	123,446	-6.6	209,262	138,601	-33.8
Methyl Methacrylate	1,924	1,929	+0.3	749	1,069	+42.7	1,175	860	-26.8	NA	NA	NA
Methylene Chloride	134,254	83,432	-37.9	100,547	56,110	-44.2	33,707	27,322	-18.9	NA	NA	NA
Tetrachloro-ethylene	128,102	46,793	-63.5	115,285	35,478	-69.2	12,817	11,315	-11.7	NA	NA	NA
Total HAPs	7,242,454	5,084,805	-29.8	2,647,469	1,300,953	-50.9	4,594,986	3,783,852	-17.7%	3,300,901	2,227,232	-32.5%