Development and Evaluation of an Air Toxics Emission Inventory in Jacksonville, Florida

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ABSTRACT

The City of Jacksonville, Air & Water Quality Division's air toxic program consists of tracking Toxic Release Inventory (TRI) data, conducting risk assessments, air toxics monitoring and calculation of a Hazardous Air Pollutants (HAP) emission inventory. Air toxics monitoring began in July of 1997 utilizing a mobile monitoring laboratory, and two stationary sites were added in January of 1999. The first HAP inventory was completed in 1998 using 1997 data. A second inventory was conducted using 2000 data. The inventories were developed for several uses, such as: air dispersion modeling, local strategy development, regulation development, air toxics risk assessment, and tracking trends in emissions over time. The HAP inventory was also used as an indicator in determining the sources of HAP emissions being recorded by the ambient air toxic monitors in Jacksonville. Compiling a HAP inventory requires a substantial amount of effort but the results can be very helpful in determining which pollutants may be of concern in a particular geographical area, which pollution sources are contributing to emissions of a particular pollutant and establishing trends. This paper outlines the methods used for the HAP inventory development, compares the 2000 inventory with the 1996 National Toxics Inventory (NTI) conducted by the Environmental Protection Agency (EPA) and evaluates the data in relation to local ambient air toxics monitoring data.

INTRODUCTION

In the late 1980's the air section of the City of Jacksonville's Air & Water Quality Division (AWQD) began developing an air toxics program. The program consisted mostly of tracking Toxic Release Inventory (TRI) data and conducting risk assessments which included comparing air pollution dispersion modeling results with health benchmarks[1]. In 1997 Jacksonville began ambient air monitoring for air toxics using EPA Method TO-15 for measurement of thirty-eight volatile organic compounds[2]. Twenty-six of these compounds are identified on EPA's list of 188 Hazardous Air Pollutants (HAPs) in Section (b)(1) of Title III of the 1990 Clean Air Act Amendments. Ambient monitoring was conducted utilizing a mobile monitoring laboratory. Two stationary air toxics monitoring sites were added in 1999. After several years of monitoring, it became apparent that certain of these pollutants were continually present in the ambient air.

In 1998, Jacksonville conducted it's first emission inventory for HAPs, using 1997 data. Prior to 1998, a criteria pollutant emission inventory was conducted every three years as well as an ozone inventory, a requirement of the State Implementation Plan (SIP). For the HAP inventory, point, area and mobile source emissions were calculated for the 188 pollutants on EPA's HAP list. This inventory was developed for several uses, one of which was to determine the origin of air toxic pollutants being found in the ambient air from air monitoring. A second HAP inventory was conducted using 2000 data. This paper describes the efforts undertaken to develop the inventory, compares the inventory with the 1996 NTI conducted by EPA, and evaluates the data in relation to local ambient air toxics monitoring data.

INVENTORY METHODS

With the onset of the 1990 Clean Air Act Amendments and the development of the Maximum Achievable Control Technology (MACT) standards, more data became available for the calculation of HAP emissions. Prior to the 1990 Clean Air Act Amendments, HAP emission factors could be found for only a few source categories, making it difficult to calculate a HAP inventory. EPA's Compilation of Air Pollutant Emission Factors (AP-42) began to contain more emission factors for HAPs in the early 1990's, and other sources became available[3]. In both the 1997 and 2000 Jacksonville HAP inventories, emissions for fourteen source categories were calculated using AP-42 emission factors. These categories included: coal combustion, fuel oil combustion, natural gas combustion, wood waste combustion, waste oil combustion, sewage sludge incineration, medical waste incineration, landfills, stationary gas turbines for electricity generation, human crematories and hot mix asphalt plants. EPA developed several other documents as a result of requirements of the 1990 Clean Air Act Amendments, which contain emission factors or other data that can be used for emission estimation. These documents are Gasoline Distribution Industry (Stage I) – Background Information for Proposed Standards, 1990 Emissions Inventory of Forty Section 112(k) Pollutants and the 1990 Emissions Inventory of Section 112©(6) Pollutants[4,5,6]. Other sources of reference include EPA's Factor Information Retrieval (FIRE) Data System, SPECIATE, Locating & Estimating (L&E) Documents and the Emission Inventory Improvement Program Technical Reports[7,8,9,10]. These references and the source categories associated with them are included in Table 1.

The inventory includes emission estimates for point, area and mobile sources. The point source section of the inventory addresses those facilities or industrial plants for which individual source records are maintained. Actual process or throughput information was used to calculate the point source portion of the inventory. In Jacksonville, these sources are required to submit Annual Operating Reports (AORs) for each calendar year of operation, which include process rate information, plus emission calculations for criteria pollutants and some HAPs. In 1998, many of the major point sources were submitting Title V permit applications as required by Title V of the 1990 Clean Air Act Amendments. These permit applications included HAP emission calculations, which were also used to define HAP emissions for some of the major sources in the point source section of the inventory. Many of the air pollution permits require the facilities to submit records of evaporative emissions. These reports often include Material Safety Data Sheets (MSDS). Throughput information from AORs and MSDS were used to calculate HAP emissions for pesticide manufacture, degreasing, surface coating, printing/publishing and organic chemical storage sources.

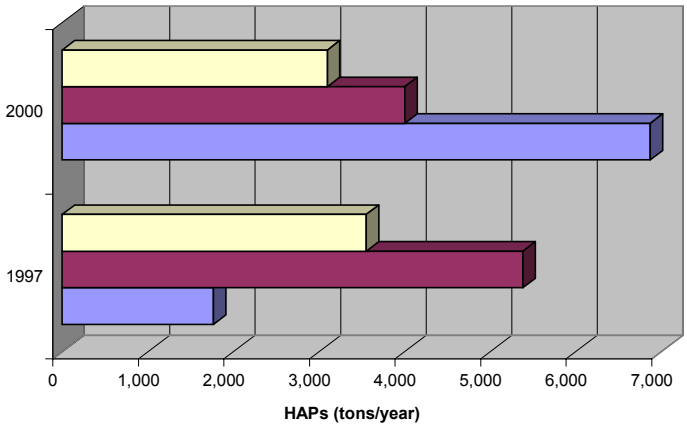
The HAP area and mobile source inventory was developed by first establishing a list of source categories to be included in the inventory. This was accomplished by reviewing the criteria pollutant and SIP inventory source category list. Those source categories, which were believed to emit HAPs, were included in the HAP inventory. Once the source list was established, references for HAP emission factors were identified. Many of the same references used to calculate the point source section of the inventory were also used to calculate area source HAP emissions. In some cases local data were used, such as for the area source pesticide application category. MSDS and application rates for pesticides use were obtained from the county's Mosquito Control Division and used for emission estimation. TRI information, submitted by industries and not included in the point source section of the inventory, was used to calculate emissions for the miscellaneous organic area source category. The documentation for EPA's 1996 NTI was also used as a reference for the area source inventory[11]. The NTI included emission factors for the following area source categories: hospitals, vehicle fires, wild fires, prescribed burning, structure fires, residential wood combustion, residential distillate oil combustion and architectural surface coating. Emission factors from the EPA document: Toxic Air Pollutant Emission Factors – A Compilation For Selected Air Toxic Compounds And Sources were used to calculate

emissions for forest fires and agricultural burning[12]. Additional area source categories and the references used for emission calculation are listed in Table 1. Emissions from the mobile source categories, which include on-road, non-road, aircraft, trains and ships, were calculated using emission estimation methods obtained from the 1996 NTI.

Table 1. Sources of reference for the 1997 & 2000 HAP Inventory.

Source Category	Reference	Classification
Coal Combustion	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Fuel Oil Combustion	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point/Area Source
Natural Gas Combustion	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point/Area Source
Wood Waste Combustion	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Waste Oil Combustion	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Sewage Sludge Incineration	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Medical Waste Incineration	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Landfills	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Stationary Gas Turbines for Electricity Ge	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Hot Mix Asphalt Plants	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Asphalt Concrete Production	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Internal Combustion Engines	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Steel Manufacturing	FIRE	Point Source
Secondary Metal Production	FIRE	Point Source
Asphalt Roofing Manufacture	FIRE	Point Source
Glass Manufacture	FIRE	Point Source
Rubber & Miscellaneous Products	EPA 112 (k) Document	Point Source
Gasoline Marketing & Distribution	EPA Gasoline Distribution MACT BID	Area Source
Aircraft Refueling	Industry Data	Area Source
LPG Combustion	Industry Data	Area Source
Hospitals	EPA 1996 NTI	Area Source
Surface Coating Architectural	EPA 1996 NTI	Area Source
Vehicle Fires	EPA 1996 NTI	Area Source
Wild Fires	EPA 1996 NTI	Area Source
Prescibed Burning	EPA 1996 NTI	Area Source
Structure Fires	EPA 1996 NTI	Area Source
Residential Wood Combustion	EPA 1996 NTI	Area Source
Residential Distillate Oil Combustion	EPA 1996 NTI	Area Source
Dry Cleaning	EPA EIIP Document	Area Source
Consumer/Commercial Solvent Use	EPA EIIP Document	Area Source
Traffic Markings	EPA EIIP Document	Area Source
Surface Coating Wood Coating	SPECIATE	Area Source
Surface Cleaning/Degreasing	SPECIATE	Area Source
Graphic Arts	SPECIATE	Area Source
Asphalt Paving	SPECIATE	Area Source
POTW	FIRE	Area Source
Animal Crematory	FIRE	Area Source
Leaking Underground Storage Tanks	State Air Stipper Policy	Area Source
Human Crematory	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Area Source
Open Burning	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Area Source
Forest Fires	EPA Toxic Air Pollutant Emission Factors – A Complilation For S	Area Source
Agricultural Burning	EPA Toxic Air Pollutant Emission Factors – A Complilation For S	Area Source
On-Road	EPA 1996 NTI	Mobile Source
Non-Road	EPA 1996 NTI	Mobile Source
Aircraft	EPA 1996 NTI	Mobile Source
Trains	EPA 1996 NTI	Mobile Source
Ships	EPA 1996 NTI	Mobile Source

Figure 1. 1997 vs 2000 HAP Inventory for Jacksonville



	1997	2000
Point Source	3,556	3,098
Area Source	5,384	4,003
Mobile Source	1,766	6,875

RESULTS AND DISCUSSION

The HAP inventory data were developed for several uses, such as: air dispersion modeling, local strategy development, regulation development, air toxics risk assessment, and tracking trends in emissions over time. Although HAP inventories were calculated for both 1997 and 2000 in Jacksonville, it is difficult to compare the results of the two inventories because in 1997, the data available to calculate the inventory was far less comprehensive than what is available today. The 1997 and 2000 inventory data for point, area and mobile source emissions are shown in Figure 1. The point and area source emissions were both slightly lower in 2000 then in 1997. This reduction in emissions may be due to the implementation of EPA's technology-based MACT standards for industrial sources that were developed as part of the 1990 Clean Air Act Amendments. Once fully implemented, these standards will cut emissions of toxic air pollutants nationwide by nearly 1.5 million tons per year from 1990 levels[13]. Mobile source emissions increased significantly from 1997 to 2000 according to the inventory, however this difference can be attributed to a lack of emission factor data for mobile sources in 1997. Mobile source emissions were calculated for only nineteen pollutants in 1997 versus almost eighty pollutants in 2000.

Figure 2 is a pie chart showing the point source HAP emissions for the year 2000 by major source categories. According to the inventory, 93% of the point source HAP emissions can be attributed to electric power generation sources. Other point source categories include incineration, surface coating, petroleum product storage and mineral product processing. As shown in Figure 3, degreasing, commercial/consumer solvent use and surface coating account for almost 75% of area source emissions, with each of these categories representing approximately 25% of the total emissions for area sources. The other 25% of area source HAP emissions are from sources such as graphic arts, dry cleaning, gasoline marketing, prescribed burning, structure fires, residential LPG combustion and miscellaneous organics. According to Figure 4, on-road mobile sources account for almost 70% of emissions for the mobile source section of the inventory. Non-road sources account for almost 29% of emissions for mobile sources. The small remaining amount of mobile source emissions can be attributed to aircraft, trains and ships.

Figure 2. 2000 Point Source HAP Emissions for Jacksonville.

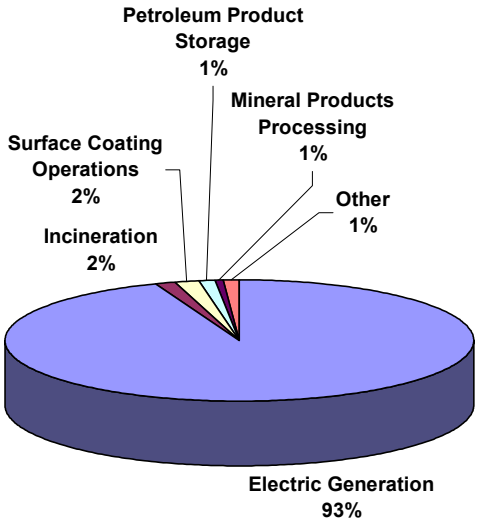


Figure 3. 2000 Area Source HAP Emissions for Jacksonville.

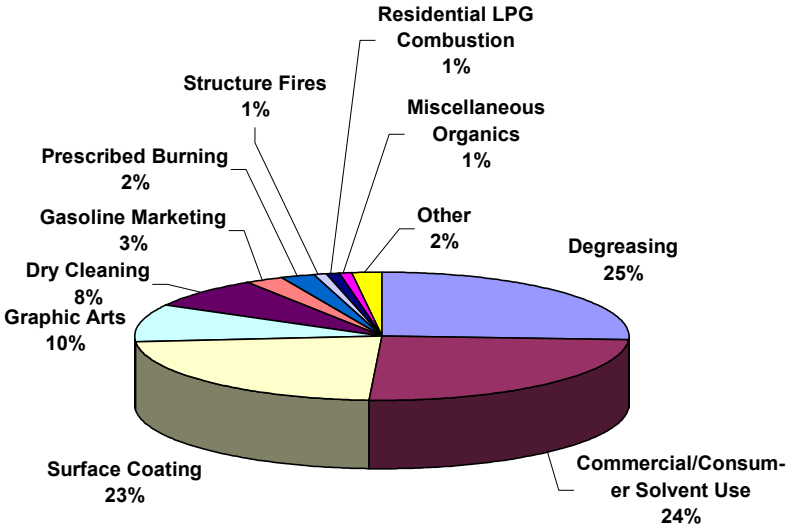


Figure 4. 2000 Mobile Source HAP Emissions for Jacksonville.

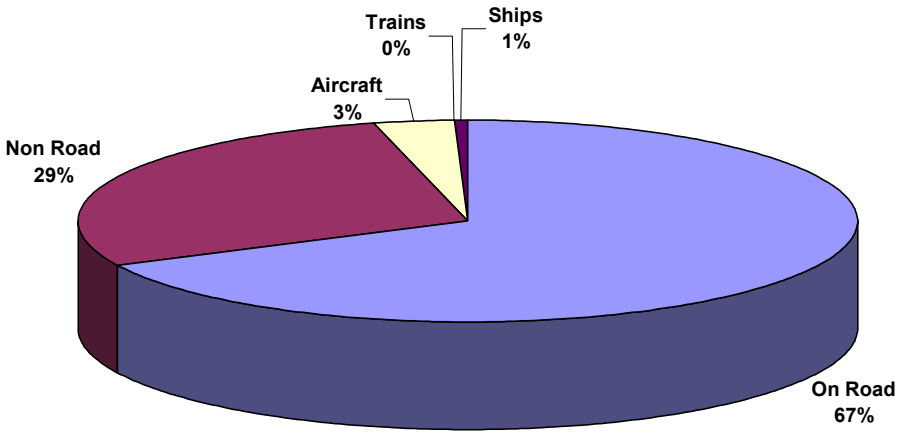
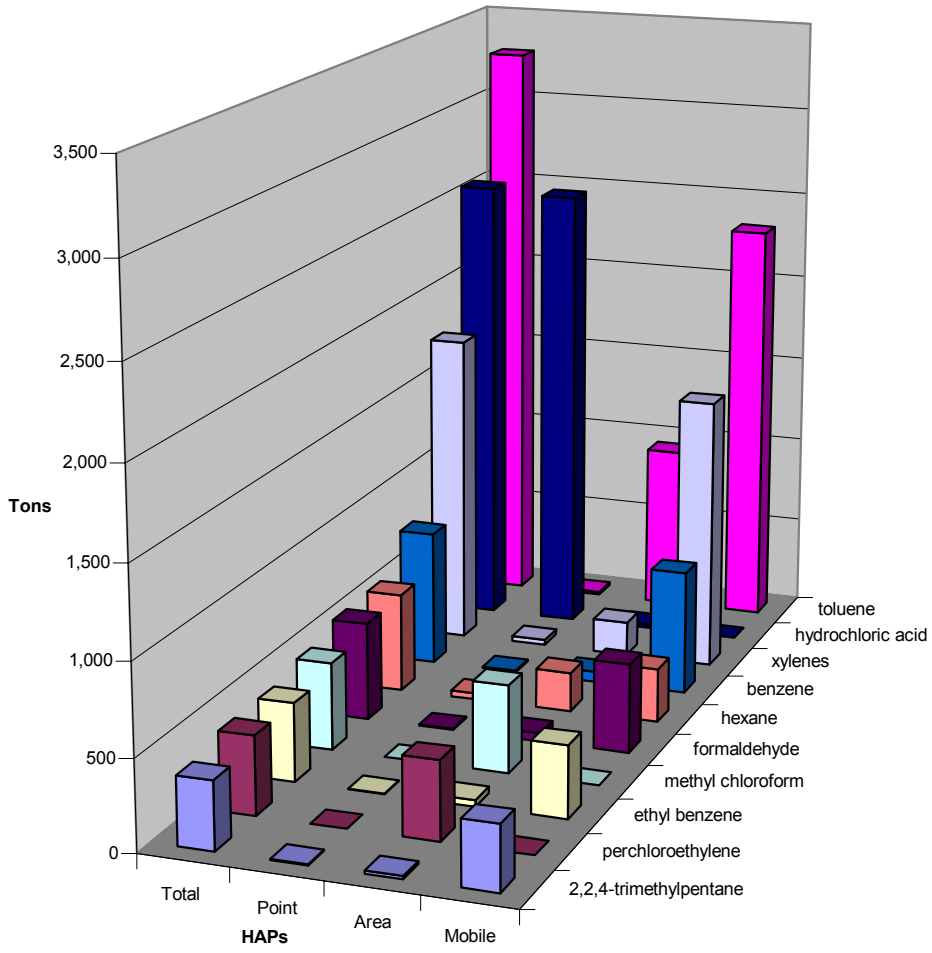


Figure 5 shows the top ten HAPs emitted according to the 2000 inventory in total and by inventory section. Inventory data were compiled for these ten HAPs based on Source Classification Code (SCC) to determine which source categories were emitting these HAPS. Toluene is the pollutant with the greatest mass emissions, mostly from on-road mobile sources. Toluene is also emitted by non-road mobile sources, and by surface coating, degreasing and graphic arts area sources. Hydrochloric acid emissions account for the second highest mass emissions in the inventory, with emissions mainly from point source coal combustion. Other sources of hydrochloric acid are point source sewage sludge incineration and medical waste incineration. Six of the remaining pollutants, xylene, benzene, hexane, formaldehyde, ethyl benzene and 2,2,4-trimethylpentane, are mostly emitted by mobile sources. Area source degreasing accounts for the majority of the emissions for the last two pollutants, methyl chloroform and perchloroethylene. Other source categories emitting these two pollutants include area source Publicly Owned Treatment Works (POTWs), landfills and surface coating operations.

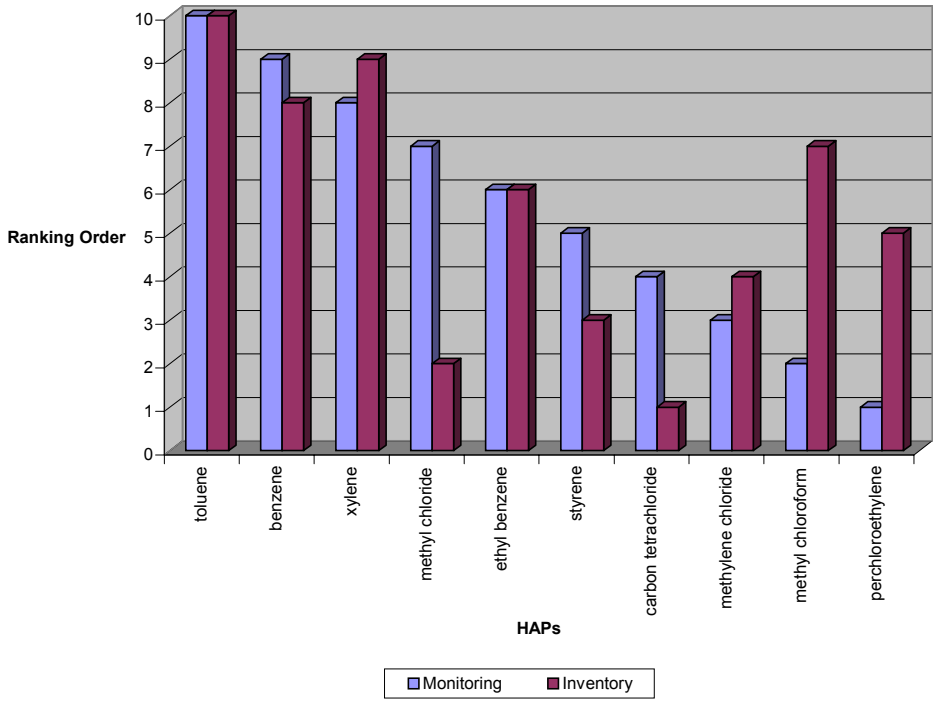
The HAP inventory was also compared with the HAP emissions being recorded by the ambient air toxic monitors in Jacksonville to determine if the HAPs consistently found in the air monitoring samples were the same HAPs found in the greatest mass in the inventory. Of thirty-eight pollutants monitored, sixteen are present in the majority of the monitoring samples. Ten of these sixteen pollutants are HAPs, being benzene, ethyl benzene, toluene, xylene, styrene, carbon tetrachloride, methyl chloride, methylene chloride, methyl chloroform and perchloroethylene. These ten pollutants were ranked from one to ten with ten being the HAP with the highest concentration of the ten monitored HAPs and one being the lowest concentration of the ten monitored HAPs. These same ten HAPs were also ranked according to their mass emissions in the inventory. The pollutant with the greatest mass in the inventory was given a rank of ten and the pollutant with the least mass in the inventory was ranked as one. These HAPs and their corresponding rank were compared in a bar graph, Figure 6. Six of the ten HAPs were prevalent in both the ambient air monitoring samples and the inventory. These HAPs are toluene, benzene, xylene, ethyl benzene, styrene and methylene chloride. Methyl chloride and carbon tetrachloride were both more prevalent in air monitoring samples than in the inventory. Methyl chloroform and perchloroethylene were both more prevalent in the inventory than in air monitoring samples.

Figure 5. Emission inventory top ten HAPs in Jacksonville.



	Total	Point	Area	Mobile
2,2,4-trimethylpentane	376	6	15	355
perchloroethylene	434	1	433	0
ethyl benzene	435	3	35	397
methyl chloroform	487	0	487	0
formaldehyde	548	6	47	495
hexane	558	34	221	303
benzene	764	8	58	698
xylenes	1,768	32	194	1,542
hydrochloric acid	2,571	2,551	20	0
toluene	3,276	17	942	2,317

Figure 6. Top ten air monitoring HAPs vs inventory HAPS.

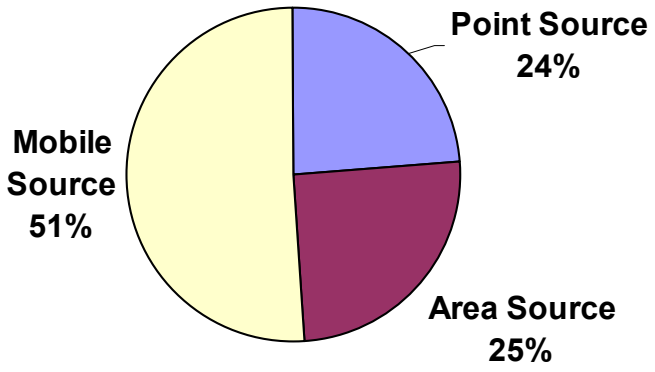


CONCLUSIONS

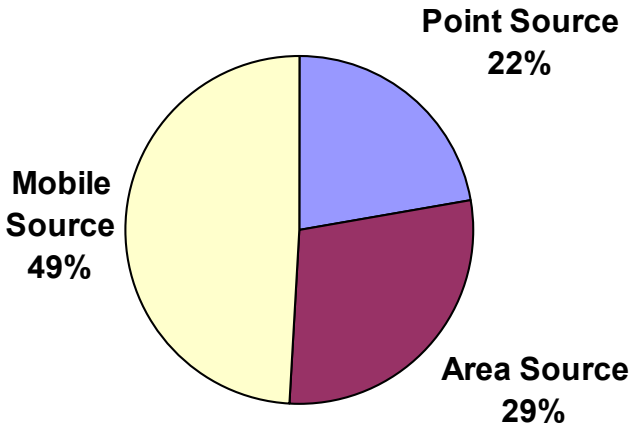
The 2000 HAP emission inventory conducted in Jacksonville compares favorably with the 1996 NTI developed by EPA. Figures 7a and b show the distribution of emissions among the point, area and mobile source sectors in Jacksonville and in the 1996 NTI. Both inventories indicate that the majority of HAP emissions are from mobile sources, 49% for the Jacksonville inventory and 51% for the national inventory. The area sources are the next highest sector of emissions, at 29% and 25%, respectively. The point and area source emissions for both inventories each account for approximately a quarter of the total emissions while the mobile source emissions are about half of the total emissions.

Compiling a HAP inventory requires a substantial amount of effort but the results can be very helpful in determining which pollutants may be of concern in a particular geographical area, which pollution sources are contributing to emissions of a particular pollutant and in establishing trends. The HAP inventory data has aided Jacksonville in determining which source categories are contributing to ambient levels of particular pollutants. On-road mobile sources are a significant contributor to at least five pollutants found from ambient monitoring. Degreasing is a significant contributor for at least three of the monitored pollutants. Other significant contributors include surface coating, prescribed burning, coal combustion from electric generation, commercial/consumer solvent use and POTWs. This data can be used for local rule development and air pollution dispersion modeling. Pollutants also have been identified for potential ambient air monitoring in the future. Periodic HAP inventories will aid in establishing trends over time, which can be used to gauge the success of regulatory efforts.

Figure 7a. 1996 National Toxic Inventory (NTI)



igure 7b. 2000 Jacksonville Inventory



REFERENCES

1. Toxics Release Inventory (TRI) Program. U. S. Environmental Protection Agency, 6 February 2003 <http://www.epa.gov/tri/>.
2. McClenny, W.A.; Holdren, M.W. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air,* U. S. Environmental Protection Agency, Cincinnati, OH, 1999; EPA/625/R-96/010b.
3. Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources. U. S. Environmental Protection Agency, 20 December 2002 <http://www.epa.gov/ttn/chief/ap42/index.html>.
4. Jordan B.C. *Gasoline Distribution Industry (Stage I) – Background Information for Proposed Standards*, U. S. Environmental Protection Agency, Research Triangle Park, NC, 1994; EPA-453/R-94-002a.
5. Section 112(k) – Urban Air Toxics Program Development of Air Emissions Inventory. U. S. Environmental Protection Agency, 1 September 1997 <http://www.epa.gov/ttnatw01/urban/112karchi/112kfac.html>.
6. Notice of Source Category Listings for the Specific Pollutants (Section 112©(6)). U. S. Environmental Protection Agency, April 1998 <http://www.epa.gov/ttnatw01/112c6/112c6fac.html>.
7. Factor Information Retrieval (FIRE). U. S. Environmental Protection Agency. 9 May 2002 <http://www.epa.gov/ttn/chief/software/fire/index.html>.
8. SPECIATE. U. S. Environmental Protection Agency. 4 November 2002 <http://www.epa.gov/ttn/chief/software/speciate/index.html>.
9. Locating & Estimating (L&E) Documents. U. S. Environmental Protection Agency. 26 July 2002 <http://www.epa.gov/ttn/chief/le/index.html>.
10. Emission Inventory Improvement Plan . U. S. Environmental Protection Agency. 11 February 2003 <http://www.epa.gov/ttn/chief/eiip/>.
11. Documentation for the 1996 Base Year National Toxics Inventory for Area Sources. 4 December 2001 <http://www.epa.gov/ttnchie1/nti/area96.pdf.
12. Pope A.; Brooks. G.R.; Carfagna, P.F.; Lynch, S.K. *Toxic Air Pollutant Emission Factors – A Compilation For Selected Air Toxic Compounds And Sources,* U. S. Environmental Protection Agency, Research Triangle Park, NC, 1990; EPA-450/2-90-011.
13. Air Trends. U. S. Environmental Protection Agency. 4 September 2002 <http://www.epa.gov/airtrends/toxic.html>.

Key Words

City of Jacksonville
Toxic Release Inventory
Hazardous Air Pollutants (HAP) Emission Inventory
1996 National Toxics Inventory (NTI)
Hazardous Air Pollutants (HAPS)
Air Toxics Monitoring
Toluene
Hydrochloric Acid
Xylene
Benzene
Hexane
Formaldehyde
Methyl Chloroform
Ethyl Benzene
Perchloroethylene
2,2,4-trimethylpentane
Methyl Chloride
Ethyl Benzene
Styrene
Carbon Tetrachloride
Methylene Chloride

Table 1. Sources of reference for the 1997 & 2000 HAP Inventory.

Source Category	Reference	Classification
Coal Combustion	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
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Internal Combustion Engines	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Point Source
Steel Manufacturing	FIRE	Point Source
Secondary Metal Production	FIRE	Point Source
Asphalt Roofing Manufacture	FIRE	Point Source
Glass Manufacture	FIRE	Point Source
Rubber & Miscellaneous Products	EPA 112 (k) Document	Point Source
Gasoline Marketing & Distribution	EPA Gasoline Distribution MACT BID	Area Source
Aircraft Refueling	Industry Data	Area Source
LPG Combustion	Industry Data	Area Source
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Dry Cleaning	EPA EIIP Document	Area Source
Consumer/Commercial Solvent Use	EPA EIIP Document	Area Source
Traffic Markings	EPA EIIP Document	Area Source
Surface Coating Wood Coating	SPECIATE	Area Source
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Asphalt Paving	SPECIATE	Area Source
POTW	FIRE	Area Source
Animal Crematory	FIRE	Area Source
Leaking Underground Storage Tanks	State Air Stipper Policy	Area Source
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Open Burning	EPA's Compilation of Air Pollutant Emission Factors (AP-42)	Area Source
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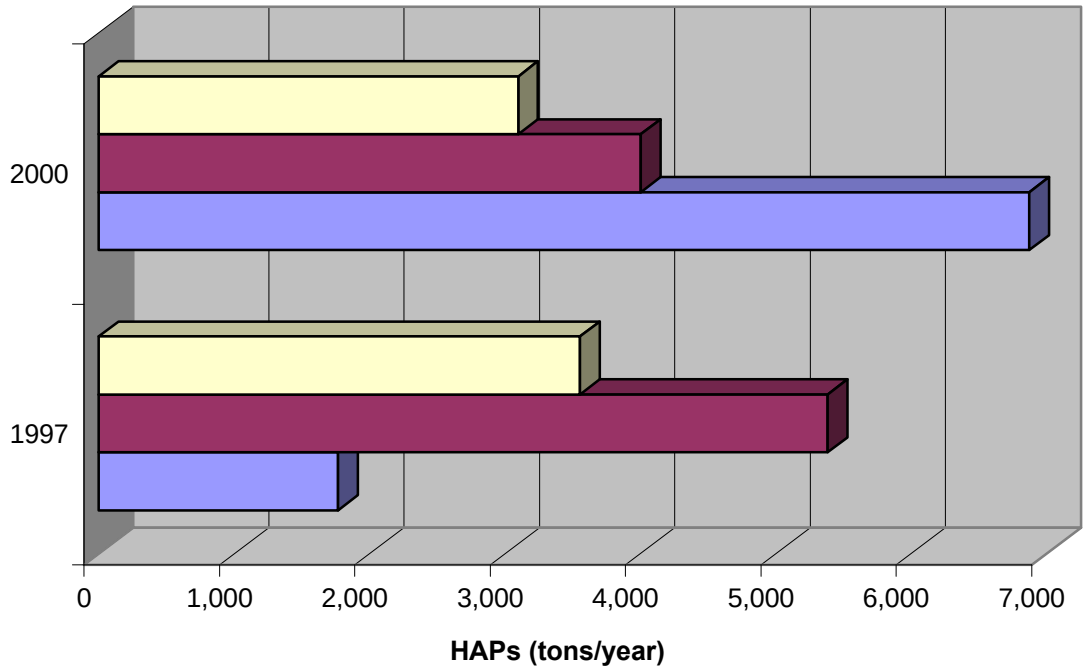
Non-Road	EPA 1996 NTI	Mobile Source
Aircraft	EPA 1996 NTI	Mobile Source
Trains	EPA 1996 NTI	Mobile Source
Ships	EPA 1996 NTI	Mobile Source

Figure 1. 1997 vs 2000 HAP Inventory for Jacksonville



	1997	2000
Point Source	3,556	3,098
Area Source	5,384	4,003
Mobile Source	1,766	6,875

Figure 2. 2000 Point Source HAP Emissions for Jacksonville.

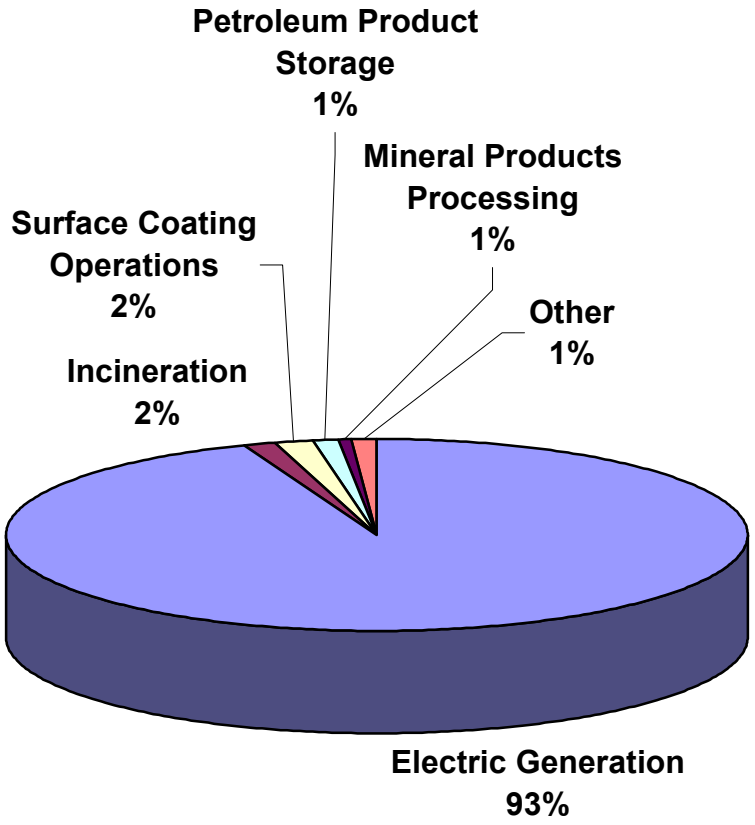


Figure 3. 2000 Area Source HAP Emissions for Jacksonville.

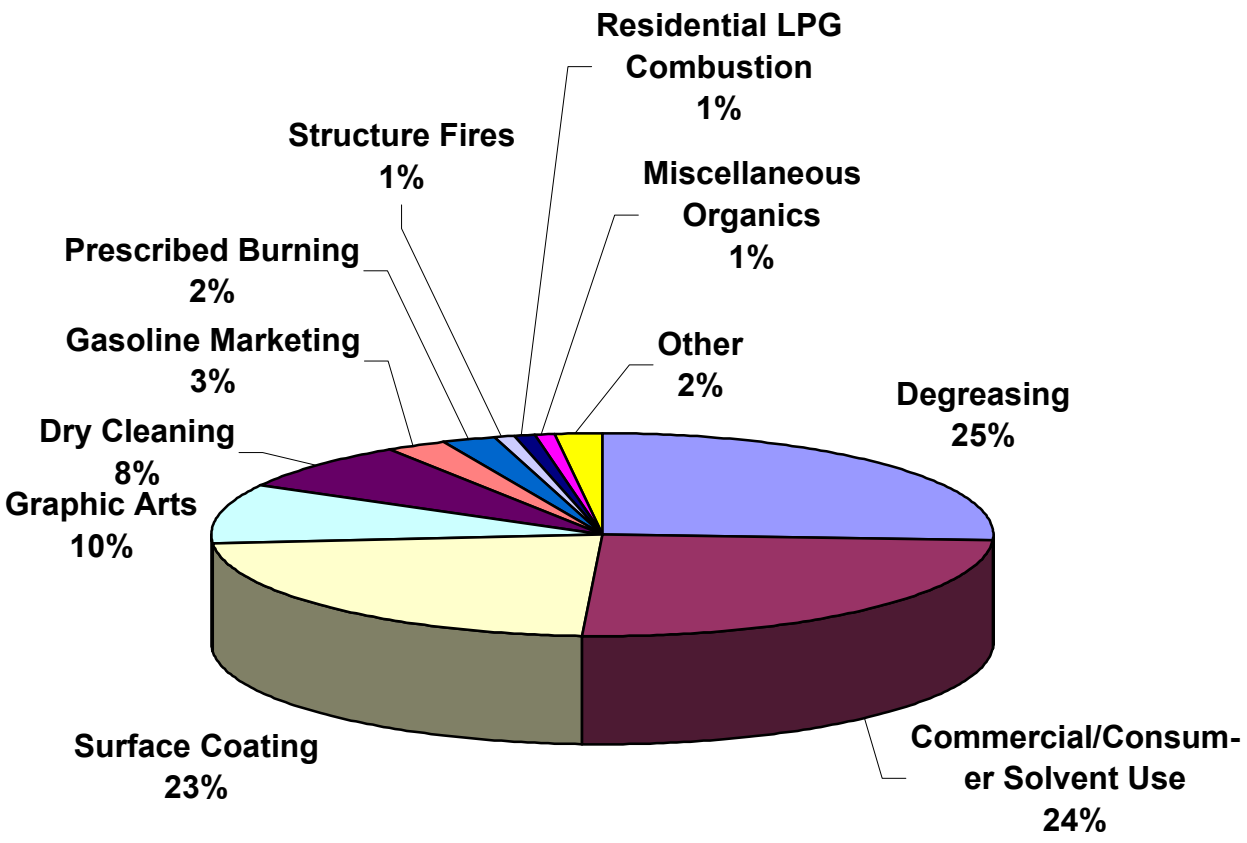


Figure 4. 2000 Mobile Source HAP Emissions for Jacksonville.

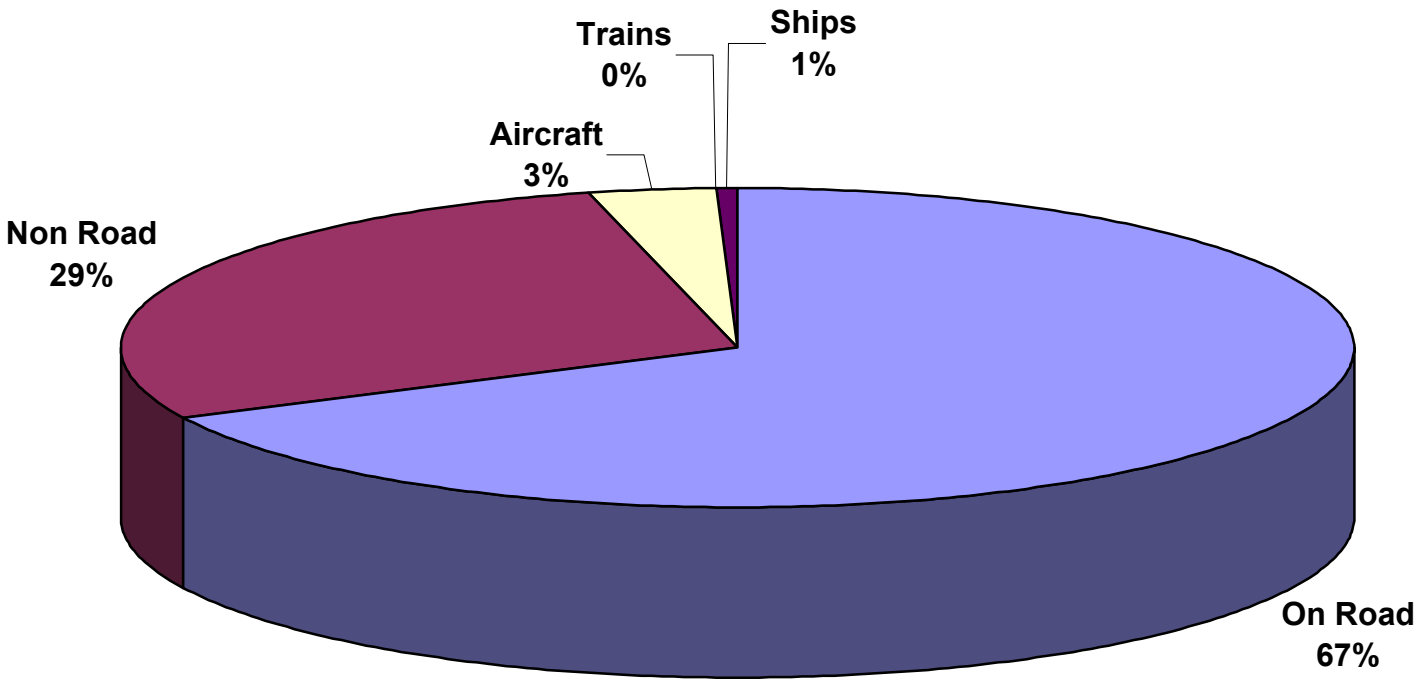
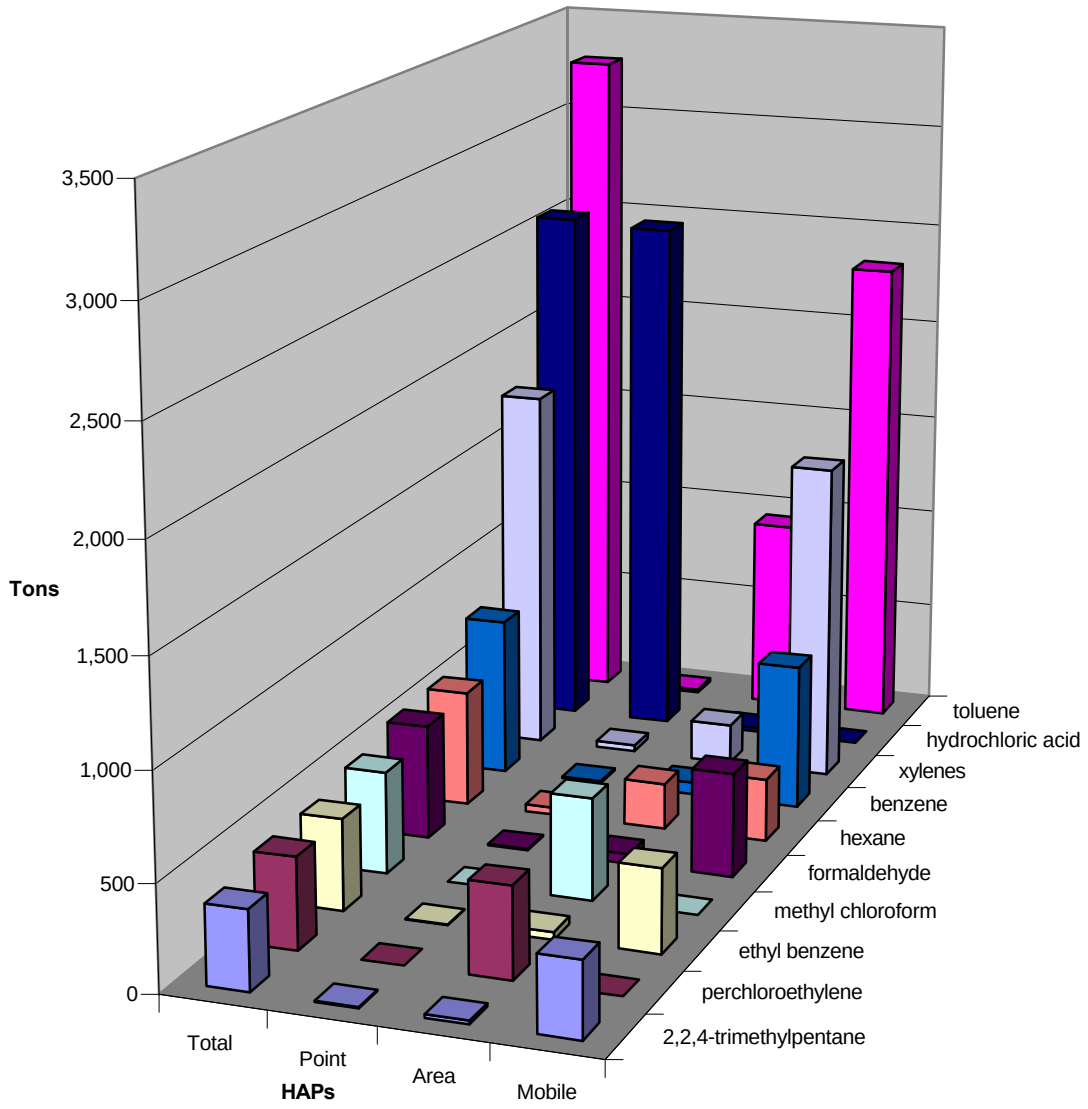


Figure 5. Emission inventory top ten HAPs in Jacksonville.



	Total	Point	Area	Mobile
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perchloroethylene	434	1	433	0
ethyl benzene	435	3	35	397
methyl chloroform	487	0	487	0
formaldehyde	548	6	47	495
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Figure 6. Top ten air monitoring HAPs vs inventory HAPS.

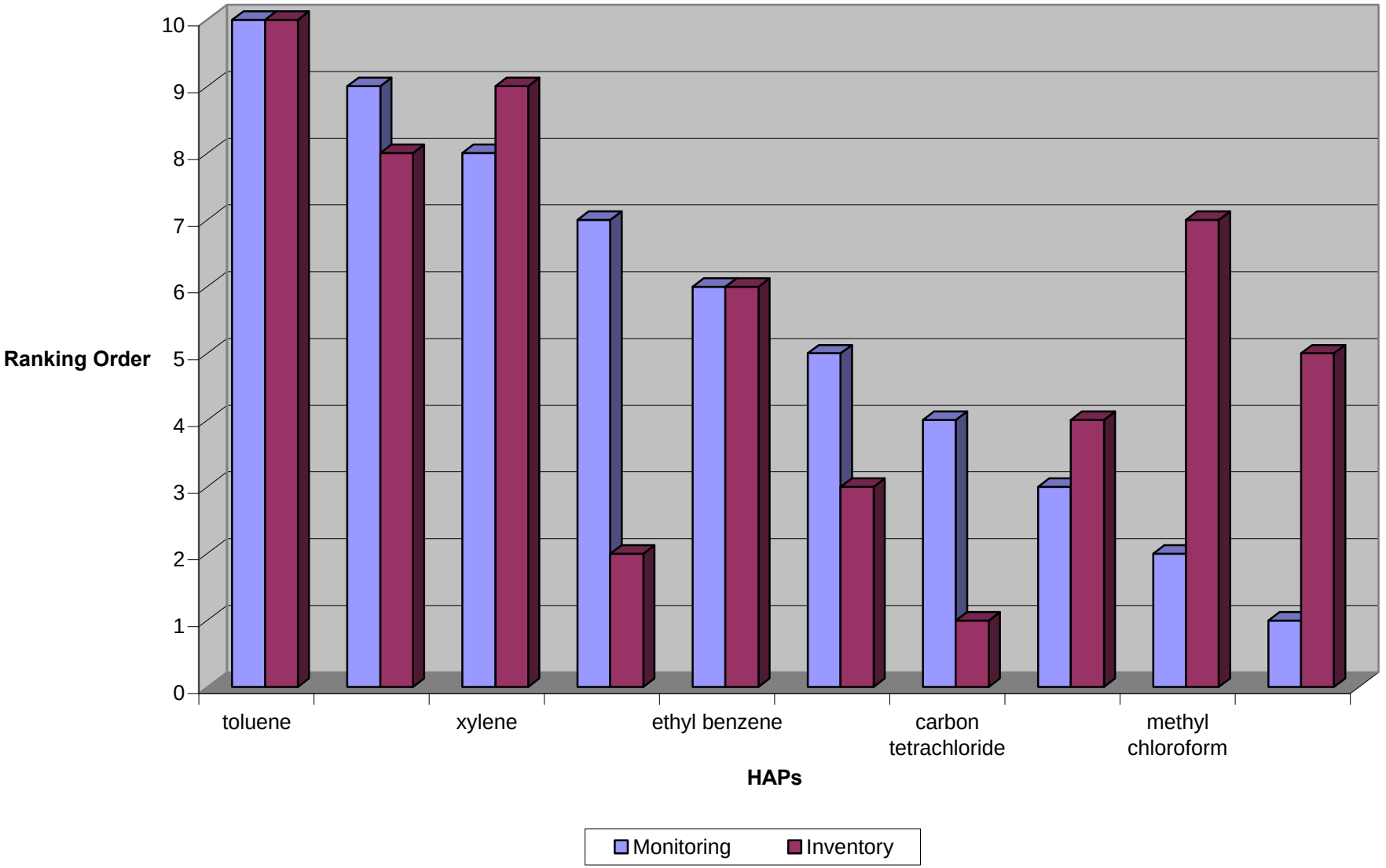


Figure 7a. 1996 National Toxic Inventory (NTI)

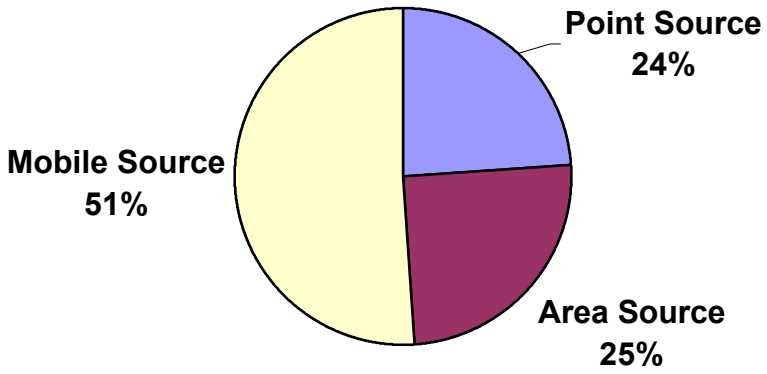
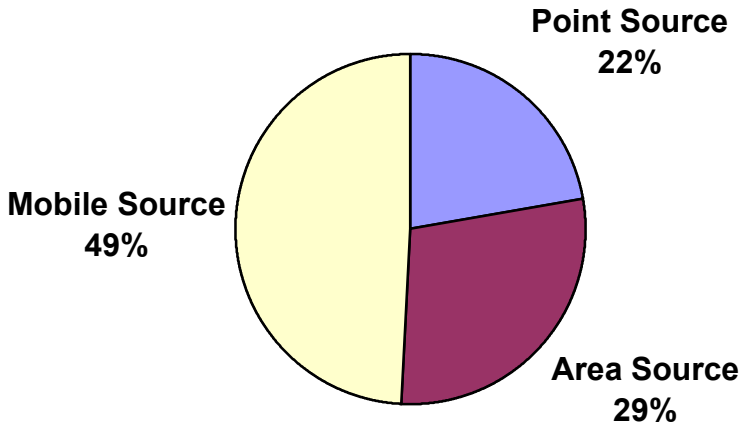


Figure 7b. 2000 Jacksonville Inventory



1997 vs 2000 HAP Inventory for Jacksonville
Point, Area and Mobile Source Emissions (tons/year)

	1997	2000
Mobile Source	1,766	6,875
Area Source	5,384	4,003
Point Source	3,556	3,098
TOTAL	**16,089**	**13,976**

2000 Point Source HAP Emissions

SCC Description	(tons/yr) TOTAL HAPS	Percent
Electric Generation	2914.04	94
Incineration	49.82	2
Surface Coating Operations	47.29	2
Petroleum Product Storage	36.51	1
Mineral Products	19.07	1
Degreasing	5.66	0
Industrial Processes - Pulp & Paper & Wood Products - Pulpboard Manufacture	5.12	0
Petroleum & Solvent Evaporation - Printing/Publishing	4.68	0
External Combustion Boilers - Industrial/Commercial	4.58	0
Waste Disposal - Solid Waste Disposal - Landfill	3.94	0
Internal Combustion Engines	3.41	0
Industrial Processes - In-Process Fuel Use	1.82	0
Petroleum & Solvent Evaporation - Organic Chemical Storage - Misc	1.18	0
Industrial Processes - Secondary Metal Production	0.85	0
Industrial Processes - Chemical Manufacturing - Pesticides	0.01	0
Industrial Processes - Fabricated Metal Parts - Electroplating Operations	0.01	0
Industrial Processes - Rubber & Misc Plasics Products - Other Fabricated Plastics	0.00	0
	3097.99	

Electric Generation	2914.04	94
Incineration	49.82	2
Surface Coating Operations	47.29	2
Petroleum Product Storage	36.51	1
Mineral Products Processing	19.07	1
Other	31.26	

2000 HAP Inventory for Duval County
Area Source Emissions (tons/year)

Source Category	Total HAP	Percent
Surface Cleaning/Degreasing	1035.8560	26
Commercial/Consumer Solvent Use	1001.4325	25
Surface Coating/Wood Coating	469.5600	12
Graphic Arts	382.3900	10
Surface Coating/Architectural	324.6680	8
Dry Cleaning	309.1900	8
Surface Coating/Auto Refinishing	111.6100	3
Gasoline Use	100.7600	3
Prescribed Burning	85.7100	2
Structure Fires	38.9000	1
LPG/Residential	34.3400	1
Miscellaneous Organics	28.7390	1
Traffic Markings	15.2040	0
LPG/Industrial	14.1100	0
Wild Fires	9.2108	0
POTW	8.1628	0
Natural Gas/Industrial	6.5982	0
LPG/Commercial	6.0600	0
Open Burning	4.1976	0
Forest Fires	4.0700	0
Hospitals	3.0000	0
Natural Gas/Commercial	1.6576	0
Asphalt Paving	1.5900	0
Agricultural Burning	1.3700	0
Aircraft Refueling	1.2400	0
Vehicle Fires	1.1229	0
Leak Underground Storage Tanks	0.7290	0
Natural Gas/Residential	0.6475	0
Residual Oil/Industrial	0.6061	0
Pesticide Application/Nonagricultural	0.1360	0
Distillate Oil/Residential	0.1059	0
Distillate Oil/Industrial	0.0668	0
Wood/Residential	0.0341	0
Distillate Oil/Commercial	0.0189	0
Human Crematory	0.0044	0
Residual Oil/Commercial	0.0025	0
Animal Crematory	0.0004	0
Total HAP	**4,003**	

Degreasing	1035.8560
Commercial/Consumer Solvent Use	1001.4325
Surface Coating	905.8380
Graphic Arts	382.3900

Dry Cleaning	309.1900
Gasoline Marketing	100.7600
Prescribed Burning	85.7100
Structure Fires	38.9000
Residential LPG Combustion	34.3400
Miscellaneous Organics	28.7390
Other	79.9455

2000 HAP Inventory for Duval County
Mobile Source Emissions (tons/year)

	On Road	Non Road	Aircraft	Trains	Ships
Total HAP Per Source Category	**4654.11**	**1961.77**	**218.28**	**1.89**	**38.74**
		2220.68			

2000 HAP Inventory for Duval County
Total Emissions Per Pollutant (lbs/year)

	Total	Point	Area	Mobile
2,2,4-trimethylpentane	752,536.25	11,616.25	30,700.00	710,220.00
perchloroethylene	867,032.57	1,690.17	865,342.40	0.00
ethyl benzene	870,811.58	6,490.98	70,400.00	793,920.60
methyl chloroform	974,160.14	160.14	974,000.00	0.00
formaldehyde	1,095,839.60	12,670.96	93,483.44	989,685.20
hexane	1,116,133.33	68,860.18	441,909.15	605,364.00
benzene	1,527,840.55	16,479.55	115,800.00	1,395,561.00
xylenes	3,535,470.08	63,638.08	388,000.00	3,083,832.00
hydrochloric acid	5,141,683.49	5,102,432.04	39,251.45	0.00
toluene	6,551,866.43	33,334.53	1,883,722.90	4,634,809.00

	Total	Point	Area	Mobile
2,2,4-trimethylpentane	376	6	15	355
perchloroethylene	434	1	433	0
ethyl benzene	435	3	35	397
methyl chloroform	487	0	487	0
formaldehyde	548	6	47	495
hexane	558	34	221	303
benzene	764	8	58	698
xylenes	1,768	32	194	1,542
hydrochloric acid	2,571	2,551	20	0
toluene	3,276	17	942	2,317

	Rank			
HAPs	Monitoring	Inventory	Monitoring	Inventory
toluene	57	57	10	10
benzene	55	54	9	8
xylene	53	55	8	9
methyl chloride	52	23	7	2
ethyl benzene	51	50	6	6
styrene	49	36	5	3
carbon tetrachloride	48	1	4	1
methylene chloride	45	40	3	4
methyl chloroform	44	51	2	7
perchloroethylene	43	49	1	5

	Monitoring	Inventory
toluene	1023	3276
benzene	1006	764
xylene	910	1,768
methyl chloride	810	6
ethyl benzene	736	435
styrene	681	77
carbon tetrachloride	679	0
methylene chloride	320	111
methyl chloroform	291	487
perchloroethylene	133	434

	Monitoring	Inventory
toluene	10	10
benzene	9	8
xylene	8	9
methyl chloride	7	2
ethyl benzene	6	6
styrene	5	3
carbon tetrachloride	4	1
methylene chloride	3	4
methyl chloroform	2	7
perchloroethylene	1	5

1	57
2	56
3	55
4	54
5	53
6	52
7	51
8	50
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42	16
43	15
44	14
45	13
46	12
47	11
48	10
49	9
50	8
51	7
52	6
53	5
54	4
55	3
56	2
57	1

Point Source	24
Area Source	25
Mobile Source	51

Source Type	Total HAP (tons/yr)
Point Source	3,098.00
Area Source	4,003.00
Mobile Source	6,875.00
TOTAL	**13,976.00**