Final Report

Longview Air Toxics Monitoring Project

March 21, 2007

Southwest Clean Air Agency

TABLE OF CONTENTS

Acknowledgements	4
Executive Summary	5
Chapter 1 Introduction	8
1.1 Background	8
1.2 Project Purpose and Context	9
1.3 Monitoring Site Location	9
1.4 Meteorological Data	10
1.5 Study Design	10
Chapter 2 Longview Air Toxics Monitoring Data	14
2.0 Data Reporting, Management and Reduction	14
2.1 All results less than the Oregon Method Reporting Limits	14
2.2 Frequency Analysis	15
2.3 Annual Averages	16
2.4 Study Maximums during the February 2005 Inversion	19
Chapter 3 Comparison to Other Studies, NATA and Standards	20
3.1 Comparison to Seattle and Vancouver	20
3.1.1 Longview Compared to Seattle	20
3.1.2 Longview Compared to Vancouver	21
3.2 Comparison to NATA Modeled Ambient Concentrations	22
3.3 Acceptable Source Impact Level (ASIL) Assessment	23
3.3.1 Compounds with an Annual ASIL	24
3.3.2 Compounds with 24-hour average ASIL	25
3.3.3 Compounds without an established ASIL	25
3.4 Comparison to National Ambient Air Quality Standard for Lead	26
Chapter 4 Health Risk Estimates and Screening Analysis	27
4.1 NATA Risk Estimates	27
4.2 Preliminary Health Risk Screening Analysis	28
4.2.1 Health Risk Screening Levels	28
4.2.2 Longview Air Toxics Health Risk Screening Analysis Protocol	29
4.2.3 Results of the Analysis	30
Chapter 5 Sources of Air Toxics	34
Chapter 6 Conclusions and Recommendations for Future Study	36
References	38
Appendix A Longview Air Toxics Quality Assurance Project Plan	39
Appendix B – Longview Health Risk Screening Analysis Tables	40

Tables

Table 1: Study Target Air Toxics 11
Table 2: Study Compounds with No Detections..........15
Table 3: Longview Air Toxics Study Averages 17
Table 4: February 3, 2005 Maximums, Averages and Reading Frequencies 19
Table 5: Longview and Seattle Annual Average Comparisons..........20
Table 6: Longview and Vancouver Annual Average Comparisons 21
Table 7: Longview Monitored Average and NATA Predicted Concentrations 23
Table 8: Compounds with an Annual ASIL and ASIL Status..........24
Table 9: Compounds With a 24-hour ASIL..........25
Table 10: Quarterly Lead Averages..........26
Table 11: Longview Health Risk Screening Analysis..........31
Table 12: Sources of the Top Air Toxics and Their Detection Status in Longview..........34
Table 13: Sources of Other Compounds Detected in Longview 35

Figures

Figure 1: Longview Toxics Monitoring Site Location 10

References..........38

Appendices

Appendix A Longview Air Toxics Quality Assurance Project Plan 39
Appendix B Longview Health Risk Screening Analysis Tables 40

Acknowledgements

Southwest Clean Air Agency Team

Randy Peltier, Operations Manager, Project Manager
Laurie Hulse-Moyer, Air Quality Scientist, Site Operator
Natalia Kreitzer, Air Quality Engineer, Project Support/Backup Operator

The following people and organizations contributed to this project. SWCAA would like to acknowledge their contributions and extend our thanks.

Douglas Knowlton, Air Monitoring Specialist
Washington Department of Ecology
Northwest Regional Office

Bob Jones, Laboratory Project Manager
Oregon Department of Environmental Quality

Paul McKay, Lab Quality Assurance Officer
Oregon Department of Environmental Quality

Holly Stewart, Sample preparation and receipt, primary operator contact/liaison
Oregon Department of Environmental Quality

Keith Rose, Regional Project Officer
United States Environmental Protection Agency Region 10

Also, thanks to Ecology, Puget Sound Clean Air Agency and ODEQ reviewers:
Elena Guilfoil, Washington Department of Ecology
Ranil Dhammapala, Washington Department of Ecology
Katherine Himes, Puget Sound Clean Air Agency
Gregg Lande, Oregon Department of Ecology
John Williamson, Washington Department of Ecology

Special Thanks to
Marciano “Rocky” Sanchez, B.S. Chemical Engineering, Intern
Texas A&M University, Kingsville

Executive Summary

The Southwest Clean Air Agency's (SWCAA) mission is to preserve and enhance air quality in southwest Washington. SWCAA is interested in the public's exposure to air toxics from all sources. The cities of Longview and Kelso are in Cowlitz County and are home to a number of significant industrial sources, including two pulp and paper mills, as well as other businesses characteristic of most urban areas. Diesel traffic and wood stove use are also prevalent. Cowlitz County has consistently ranked relatively high in annual reported releases of industrial toxic chemicals and in modeled national risk assessments of air toxics. SWCAA applied for and received a grant to conduct air toxics monitoring in Longview, Washington. This study occurred from May 2004 through May 2005.

SWCAA established and operated the Longview monitoring site using equipment loaned by the Washington Department of Ecology (Ecology). The Oregon Department of Environmental Quality (ODEQ) analyzed the samples and provided results.

Longview air toxics monitoring results were evaluated in a number of ways. Because no federal or state ambient air quality standards exist for air toxics (except lead), comparisons and assessments were made using information drawn from related sources such as similar studies in Vancouver and Seattle, Washington, Washington's Acceptable Source Impact Levels (ASILs) and the U.S. Environmental Protection Agency's (EPA) National Air Toxics Assessment (NATA). Finally, a health risk screening analysis was done using information from EPA, Ecology and ODEQ as guidance.

Longview toxics data was compared to similar studies in Vancouver and Seattle, Washington. Longview toxic metal levels were slightly higher than Seattle numbers, but this may be attributable to a difference in sampling method and/or the uncertainties associated with analytical methods. Due to differences between Oregon and Washington data reporting methods, some results could not be compared to similar Vancouver and Seattle studies and some air toxics' potential health concerns could not be confirmed. In summary, *the air toxics found in Longview were consistent with the type of compounds and concentrations found in other urban areas.*

EPA regulates air toxics from industrial sources through Maximum Achievable Control Technology (MACT) standards. EPA regulates toxics from motor vehicle emissions through emission and fuel standards. Also, EPA works to prevent accidental releases of toxic chemicals by requiring prevention programs.[1] Washington State regulates air toxics from new industrial sources using ASILs. *Longview annual average concentrations were above the respective ASILs for the following compounds:* ***arsenic, benzene**, **acetaldehyde*** *and* ***formaldehyde***. No air toxics that have 24-hour average ASILs exceeded these concentrations. Longview measured results were also compared to concentrations estimated by the NATA. Monitored manganese and arsenic levels were higher than

[1] EPA, Taking Toxics Out of the Air, EPA-452/K-00-002, August 2000, page 2

NATA estimates. But, acetaldehyde, benzene and formaldehyde concentrations were lower than the NATA predicted.

In addition, a limited health risk screening analysis was conducted on data from this study. The measured ambient concentrations were compared with EPA and other health risk screening factors to identify hazardous air pollutants of potential health concern. The EPA factors take into consideration the relative difference in toxicity between various air toxics.

The 1999 National Air Toxics Assessment (NATA) identified fourteen compounds as air toxics of highest health risk concern in Cowlitz County. Not all of these predicted compounds could be measured using the study methods. Also, in some cases, a determination could not be made because of the reporting limits on the lab results. Then again, manganese and arsenic were determined to be of potential health concern by this report's health risk screening analysis, but were not identified by the national assessment. Air toxics 1,3 butadiene, chloroform, ethylene dibromide and tetrachloroethane were predicted to be significant in Cowlitz County by NATA models, but these compounds were not measured in Longview in an amount over the Method Reporting Limit (MRL) at any time during the study.

In some cases, Longview's ambient air contains several compounds at levels that exceed their respective health risk screening values. This is similar to other urban areas. Air toxics that exceed at least one of the health screening values are: ***acetaldehyde, arsenic, benzene, formaldehyde and manganese***. Many air toxics were detected at their maximum levels during a winter inversion in February 2005. These higher winter readings bear out that air quality can deteriorate during periodic stagnant winter conditions.

There was another group of air toxics for which the health screening analysis was not conclusive because the data reporting limits as provided by ODEQ were not sensitive enough to confirm whether the screening values were exceeded or not. Those air toxics that may possibly exceed their screening values and be of potential health concern are listed in Chapter 4, Section 4.2.

In addition, some air toxics do not have established health risk screening levels. And finally, where data quality allowed, some compounds were cleared of being potential health concerns.

Sources of acetaldehyde, arsenic, benzene and formaldehyde are vehicle and engine exhaust, wood burning and other combustion sources. Formaldehyde comes not only from these sources but also pulp, paper or plywood mills, paint and varnishes, foods and cooking and tobacco smoke. Arsenic comes from burning fuel oil, pulp and paper mills, volcanic ash and the burning of treated wood. In addition to engine exhaust and wood burning, another source of benzene is gasoline fueling. Manganese is released from steel, battery and fertilizer production, cutting and welding and water purification. It is unknown what manganese sources are specific to Cowlitz County. Diesel emissions and wood smoke are identified as two major sources of a number of air toxics.

Further analytical work could focus on the pollutants of potential health concern identified in this study and improving analytical sensitivities. Opportunities for improving the sensitivities of analytical measurements should be critically explored before pursing any future monitoring studies. Also, since diesel particulate and wood smoke could not be measured by the methods available during this study, sampling or analysis methods should be expanded so that levels of these air pollutants can be quantified and assessed.

While *acetaldehyde, arsenic, benzene, formaldehyde and manganese* are of potential health concern, air toxics levels in Longview are similar to levels in other urban areas. Further study could focus on these pollutants and their sources.

Chapter 1 Introduction

Air toxics are of concern nationally and in Washington State. The EPA's Integrated Urban Toxics program seeks to reduce the public health risk associated with exposure to air toxics in the nation's cities. Air toxics are those pollutants known to cause cancer or other serious health problems. The Clean Air Act lists 188 hazardous air pollutants; the EPA Urban Air Toxics Strategy identifies 33 of these compounds that pose the greatest threat to urban populations. Toxic air pollutants (TAPs) emitted from new sources in Washington are regulated under the state air toxics rule **(**Chapter 173-460 WAC**)**. Using the EPA National Air Toxics Assessment (NATA) data, Ecology estimated that the nineteen air toxics that are most likely significant in Washington are acrolein, diesel particles[2], formaldehyde, benzene, ethylene dibromide, butadiene, chloroform, carbon tetrachloride, acetaldehyde, tetrachlorethane, napthlene, chromium VI, Bis(2-ethylhexyl)phthalate (DEHP), Polycyclic Organic Matter (POM) Group 1, ethylene dichloride, quinoline, trichloroethylene, tetrachloroethylene (PERC) and arsenic compounds[3]. According to the 1999 NATA data, Cowlitz County ranked in the top 1% of air pollution exposure in the United States, due to the high concentration of industry in this area, but included emissions from an aluminum plant that is now closed[4]. Urban air toxics come from many sources. Cars, trucks and many other types of engines, businesses and industries as well as smoke from wood burning, all are sources of air toxics.

Another part of EPA's Strategy is to expand air toxics monitoring to validate NATA estimates, identify areas of concern, prioritize efforts to reduce risks and track progress. To contribute to this effort, the Southwest Clean Air Agency (SWCAA) applied for and received a grant to conduct air toxics monitoring in Cowlitz County.

1.1 Background

SWCAA is interested in the public's exposure to air toxics from all sources. One area of concern within SWCAA's jurisdiction is the Longview/Kelso area in Cowlitz County. This area is highly industrial with several existing pulp and paper mills and several power plants under construction. A high volume of diesel traffic serves the area and woodstove use is prevalent. Cowlitz County ranks consistently high in the state for air releases of total air emissions and recognized carcinogens based on Toxic Release Inventory (TRI) data[5]. For example, Cowlitz County had the highest percentage of any county for on site point source releases in 2004 data. Total onsite point source releases (both fugitive and stack emissions) for Washington were 10,500,574 pounds in this year. Cowlitz County releases for 2004 from this same category were 3,443,867 pounds or 33% of the state total. From 1998 through 2004 the onsite air emission totals for Washington and Cowlitz County have been decreasing, however Cowlitz County's contribution still represents a

---

[2] While many of the toxic compounds comprising diesel emissions are on the list of 188 toxic air pollutants, diesel particles are not.
[3] Washington Department of Ecology, 1999 NATA Toxic Air Pollutants in Washington State, 2/23/2006.
[4] Washington Department of Ecology, Focus on the National Air Toxics Assessment (NATA), 1999 data, January 2006, 06-02-001
[5] EPA Toxic Release Inventory data, e.g., TRI Explorer, Geography County Report, largest Total Air Emissions, based on 2000 and 1995 data, largest onsite point source air emissions in Washington based on 2004 TRI data

significant percentage. In reviewing the 10-year trend, Cowlitz County releases have represented 20 to 30% of total Washington on-site air emissions since 1994.[6] TRI estimates are coarse estimates of industrial emissions of both fugitive and stack emissions, of which stack emissions generally disperse away from the local area and monitoring site. However, since Cowlitz county releases represent a large percentage of Washington toxic release totals, it is logical to identify Cowlitz County for ambient monitoring to access actual ambient air toxics levels. No previous ambient toxics monitoring had been performed in the Longview/Kelso area.

1.2 Project Purpose and Context

The purpose of the Longview air toxics study was to supplement the data developed from the national ambient air toxics monitoring network in the Northwest by performing ambient monitoring at a previously unmonitored area, the Longview/Kelso area. The data was used to assess relative exposure of the Longview/Kelso residents to air toxics by comparing the measured concentrations to those typical of other urban areas. Longview levels were also compared to NATA estimates and Washington's Acceptable Source Impact Levels (ASIL). Also, a potential health risk screening assessment was conducted on the study air toxics.

SWCAA was the EPA 105 grant recipient and lead agency for this monitoring project. SWCAA conducted air toxics monitoring in Longview from May 2004 through May 2005.

SWCAA staff was responsible for establishing and operating the monitoring site, transporting samples to and from the Oregon Department of Environmental Quality (ODEQ) Lab, maintaining field notebooks and data records, and project management. The ODEQ Laboratory was responsible for sample preparation and analysis, data reduction and reporting, including entry of the monitoring results into the AIRS database maintained by EPA. The ODEQ Laboratory has an air toxics Quality Assurance Project Plan (QAPP) for the associated work that is on file at EPA Region 10, titled the ODEQ Air Toxics QAPP. The Washington Department of Ecology (Ecology) loaned all of the sampling equipment to SWCAA for this project. Ecology also provided operator training and technical support as required. SWCAA developed a QAPP similar to the Washington Department of Ecology QAPP, but specific to this project. This document can be found as Appendix A.

1.3 Monitoring Site Location

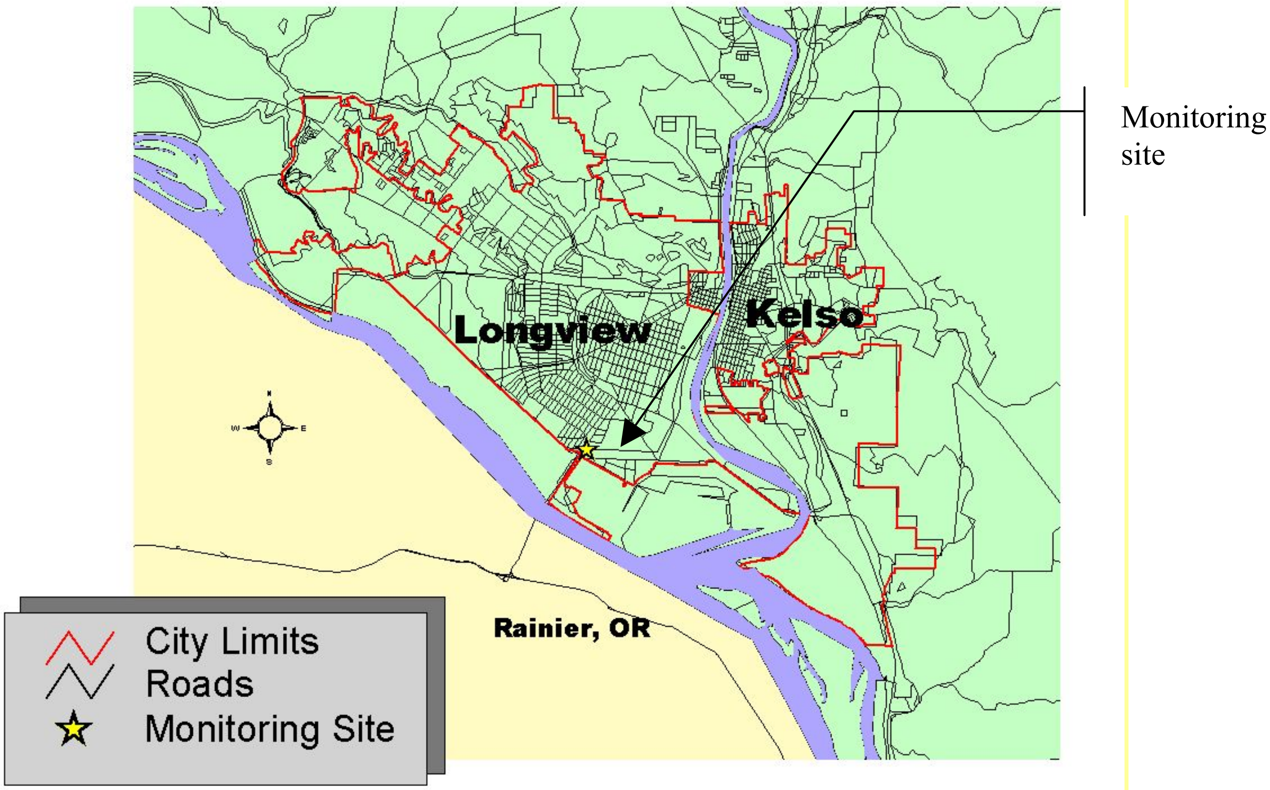
A single monitoring site was established in the Longview area and was operated for one year, beginning in May 2004. The site was located at 254 Oregon Way, in Longview, Washington. The location is close to commercial businesses to the east and residential neighborhoods to the west. It is not located adjacent to any specific industrial facility, however, it is located between two pulp mills, near residential wood stove use and in the vicinity of major heavy truck traffic routes. This site was chosen to represent ambient concentrations that a residential population may be exposed to from a variety of sources

---

[6] .When comparing 1998 through 2004 values, the results do not include chemicals that were added to the TRI since 1988 or those compounds whose reporting requirements have changed over time.

within the Longview/Kelso area. This site was previously used for Total Suspended Particulate (TSP) and then Particulate Matter < 10 microns (PM_{10}) monitoring from 1978 into early 2001. Accordingly, an EPA site number was previously established for this site; the AIRS number is 53-015-0006. A map showing the monitoring site location is included as Figure 1 below.

Figure 1 Longview Toxics Monitoring Site Location



Other nearby monitoring includes a nephelometer operated by Ecology at Olympic Elementary School at 1324 30th Avenue. The nephelometer uses optical methods to monitor the light scattering characteristics of fine particles suspended in the ambient air. Correlated nephelometer values could provide $PM_{2.5}$ level estimates; these values are not included in this study.

1.4 Meteorological Data

Local meteorological data used in calculating ambient concentrations was taken from the Weather Underground website at www.wunderground.com. Temperature and barometric pressure was gathered at the Kelso, Washington Airport station (KKLS), which is located about four miles from the monitoring site.

1.5 Study Design

The Longview air toxics study was patterned after other air toxics studies performed in Oregon and Washington. The information on sampling and analytical methods, sampling schedule and dates, target analytes and QA/QC are found in the Longview Air Toxics QAPP plan in Appendix A. Integrated 24-hour samples were collected on the EPA established one-in-six-day monitoring schedule. The analysis was accomplished by using four separate sampling/analytical methods shown below:

- Toxic metals were measured by Compendium Method IO-3.5 using high volume sampling of particulate matter smaller than 10 microns in diameter (PM_{10}) onto 8" x 10" quartz glass filters;
- Volatile organic compounds (VOCs) were measured by EPA Compendium Method TO-15 using passivated stainless steel (SUMMA) canisters;
- Carbonyls (i.e., aldehydes and ketones) were measured by Compendium Method TO-11A using dinitrophenylhydrazine (DNPH) coated solid sorbent cartridges;
- Semi-volatile organic compounds (SVOCs) were measured by Compendium Method TO-13A using polyurethane foam (PUF) cartridges with a 4" quartz glass filter.

Field sampling and sample transport was conducted by SWCAA. Sample preparation and analysis was performed by the ODEQ Lab. The product of these sampling and analytical efforts is the 24-hour average ambient concentration of each hazardous air pollutant for every sixth day over the one-year term of the project.

The carbonyl samples were collected without the sampled air passing through an ozone scrubber (i.e., denuder). SWCAA conducted this study using equipment borrowed from Washington State Department of Ecology. Ecology does not consider ozone levels significant enough to cause interference. Therefore, Ecology does not use an ozone scrubber on its carbonyl sampler. ODEQ does use an ozone scrubber in their carbonyl sampling equipment. Therefore, ODEQ flagged the Longview carbonyl data because of this difference in equipment configuration. Also, it should be noted that the results for carbonyl samples taken from June 26, 2004 through September 12, 2004 were not used for calculating the annual averages due to a sampling intake configuration error. On average, the carbonyl sample results from this period were conspicuously higher (3-5x) than those from the periods when the intake was properly configured. The reason for this anomaly is not understood, but prudence dictates that the affected results not be used, although the final health risk screening results would have been no different.

The target compounds for each of the above methods are shown in Table 1 in their respective groups. The target compounds that are on the EPA Urban Air Toxics list are marked with an asterisk; the seven Polyaromatic Hydrocarbons (7-PAHs)[7] are italicized.

Table 1: Study Target Air Toxics

	Compound Name	CAS No.		Compound Name	CAS No;
	Volatile Organic Compound			Metals	
	1,1,1-Trichloroethane	71-55-6	*	Arsenic	7440-38-2
*	1,1,2,2-Tetrachloroethane	79-34-5	*	Beryllium	7440-41-7

[7] As defined at Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants

	Compound Name	CAS No.		Compound Name	CAS No;
*	1,1,2,2-Tetrachloroethylene	127-18-4	*	Cadmium	7440-43-9
	1,1,2-Trichloroethane	79-00-5		Chromium	7440-47-3
*	1,1-Dichloroethane	75-34-3		Cobalt	7440-48-4
	1,1-Dichloroethylene	75-35-4	*	Lead	7439-92-1
	1,2,4-Trichlorobenzene	120-82-1		Manganese	7439-96-5
	1,2,4-Trimethylbenzene	95-63-6	*	Nickel	7440-02-0
*	1,2-Dibromoethane	106-93-4		Selenium	7782-49-2
	1,2-Dichlorobenzene	95-50-1		Semi-Volatiles	
	1,2-Dichloroethane	107-06-2		Acenaphthene	83-32-9
*	1,2-Dichloropropane (propylene dichloride)	78-87-5		Acenaphthylene	208-96-8
	1,2-Dimethylbenzene	95-47-6		Anthracene	120-12-7
	1,3,5-Trimethylbenzene	108-67-8		Benzo[e]pyrene	192-97-2
*	1,3-Butadiene	106-99-0		Benzo[g,h,i]perylene	191-24-2
	1,3-Dichlorobenzene	541-73-1		*Benzo[k]fluoranthene*	*207-08-9*
	1,4-Dichlorobenzene	106-46-7		*Chrysene*	*218-01-9*
	1,4/1,3-Dimethylbenzene	108-38-3		Coronene	191-07-1
	2,2,4-Trimethylpentane	540-84-1		*Dibenz[a,h]anthracene*	*53-70-3*
	2-Butanone (MEK)	78-93-3		Dibenzofuran	132-64-9
	2-Hexanone	591-78-6		Dibenzothiophene	132-65-0
	3-Chloropropene	107-05-1		Fluoranthene	206-44-0
	4-Ethyltoluene	622-96-8		Fluorene	86-73-7
	4-Methyl-2-Pentanone (MIBK)	108-10-1		*Indeno[1,2,3-cd]pyrene*	*193-39-5*
	Acetone	67-64-1		Naphthalene	91-20-3
*	Acrylonitrile	107-13-1		Perylene	198-55-0
*	Benzene	71-43-2		Phenanthrene	85-01-8
	Bromodichloromethane	75-27-4		Pyrene	129-00-0
	Bromoform	75-25-2		*Benzo[a]anthracene*	*56-55-3*
	Bromomethane	74-83-9		*Benzo[b]fluoranthene*	*205-99-2*
	Carbon Disulfide	75-15-0		*Benzo[a]pyrene*	*50-32-8*
	Carbon Tetrachloride	56-23-5		Carbonyls	
	Chlorobenzene	108-90-7		2,5-Dimethylbenzaldehyde	5779-94-2
	Chloroethane	75-00-3		2-Butanone (MEK)	78-93-3
*	Chloroform	67-66-3	*	Acetaldehyde	75-07-0
	Chloromethane	74-87-3		Acetone	67-64-1
	cis-1,2-Dichloroethylene	156-59-2		Benzaldehyde	100-52-7
*	cis-1,3-Dichloropropene	10061-01-5		Butyraldehyde	123-72-8
	Cyclohexane	110-82-7		Crotonaldehyde	4170-30-3
	Dibromochloromethane	124-48-1	*	Formaldehyde	50-00-0
	Dichlorodifluoromethane	75-71-8		Hexaldehyde	66-25-1
	Dichlorotetrafluoroethane	1320-37-2		Isovaleraldehyde	590-86-3
	Ethyl Benzene	100-41-4		m-Tolualdehyde	620-23-5
	Hexachloro-1,3-Butadiene	87-68-3		o-Tolualdehyde	529-20-4
	Isopropanol	67-63-0		p-Tolualdehyde	104-87-0
	Methyl-tert-Butyl Ether (MTBE)	1634-04-4		Propionaldehyde	123-38-6
*	Methylene Chloride	75-09-2		Valeraldehyde	110-62-3
	n-Heptane	142-82-5			
	n-Hexane	110-54-3			
	Styrene	100-42-5			

	Compound Name	CAS No.	Compound Name	CAS No;
	Volatile Organic Compounds, cont.			
	Tetrahydrofuran	109-99-9		
	Toluene	108-88-3		
	trans-1,2-Dichloroethene	156-60-5		
	trans-1,3-Dichloropropene	10061-02-6		
	Trichloroethylene	79-01-6		
	Trichlorofluoromethane	75-69-4		
	Trichlorotrifluoroethane	26523-64-8		
	Vinyl bromide	593-60-2		
*	Vinyl Chloride	75-01-4		

The methods described above can detect compounds on the target study air toxics list, some of which are on the EPA Integrated Urban Air Toxics Strategy list. The Integrated Urban Air Toxics list contains 33 of the pollutants posing the greatest health threat to urban populations and is shown below.

Acetaldehyde	Formaldehyde
Acrolein	Hexachlorobenzene
Acrylonitrile	Hydrazine
Arsenic compounds	Lead Compounds
Benzene	Manganese Compounds
Beryllium Compounds	Mercury Compounds
1,3 Butadiene	Methylene Chloride
Cadmium compounds	Nickel Compounds
Carbon Tetrachloride	Polychlorinated Biphenyls (PCBs)
Chloroform	Polycyclic Organic Matter (POM)
Chromium Compounds	Quinoline
Coke Oven Emissions	1,1,2,2 Tetrachloroethane
Dioxin	Perchloroethylene
1,2 dichloropropane	Trichloroethylene
Ethylene Dichloride	Vinyl Chloride
Ethylene Oxide	

From EPA Air Toxics Emissions, EPA/453-F-99-002, July 1999

However, not all 33 EPA identified Urban Air Toxics are on the Longview study list. The 1999 NATA projected that both acrolein and diesel particulate are likely contributors to the potential health risk in Cowlitz County. At the time of the study, there were some difficulties associated with acrolein sampling and analysis. Compendium Method TO-11A was used at one time to try to detect acrolein, but was determined to have low recovery success and chemical reactions that interfered with accurate quantifications. There has since been successful application of Compendium Method TO-15 using SUMMA canisters with proper quality control demonstrations. There is currently no direct monitoring method for diesel particulate. Also, quinoline and PCBs are not included on the Longview list. Some Polycyclic Organic Matter (POM) values were monitored in the Longview study as the seven Polyaromatic Hydrocarbons (7-PAHS).

Chapter 2 Longview Air Toxics Monitoring Data

2.0 Data Reporting, Management and Reduction

Sample analysis was conducted and results were provided by the Oregon Department of Environmental Quality (ODEQ). The Longview air toxics data was provided in four groups corresponding to the analytical method as follows: volatile organic compounds (VOC), metals, carbonyls, and polycyclic aromatic hydrocarbons (semi-volatiles). The data was prepared to be compared to 1999 NATA data concentrations, Washington ASILs, Vancouver and Seattle measured air toxics values and potential health risk screening criteria from EPA and other sources.

Data was evaluated to determine whether any compound's measured concentration exceeded the ODEQ Method Reporting Limit (MRL). The MRL must be above the statistically calculated Method Detection Limit (MDL). It is also based on the concentration of the lowest standard used in the lab's calibration curve (according to the National Environmental Laboratory Accreditation Conference (NELAC))[8]. MRLs are typically higher than MDLs by a factor of 3 to 5, but the factor may be significantly greater in some cases. These MRLs served as the minimum benchmark reportable concentrations for data reported to SWCAA by DEQ according to their QA program.

Annual averages were calculated for comparison and screening purposes as described in Section 2.3 below. In order to compare Longview numbers with Vancouver and Seattle numbers, annual averages were calculated in as close to the same manner as possible as in the other studies. For example, Vancouver data was reduced by substituting ½ the MRL for all samples reported at or below the MRL. For comparison with the Seattle study, annual averages were calculated without any MRL substitutions. Although MRLs are higher than MDLs, when the number of total samples reported over the MRL for a given compound equaled or exceeded 75% frequency, there is more confidence in the study values and that the locations are being compared on a similar basis. Only those air toxics having 75% percent frequency above the MRL in the Longview study were compared to the Vancouver and Seattle studies. Minimum detection criteria also informed whether a compound could be confirmed as one of potential health concern in the health risk screening analysis in Chapter 4.

2.1 All results less than the Oregon Method Reporting Limits

For some compounds, 100% of the samples were reported as being less than the MRL over the entire study period. Those compounds are shown in Table 2 below. Although these air toxics levels did not exceed the MRL, these compounds may contribute to the overall air toxics levels in Longview. Remember, MRL values may greatly exceed MDLs, therefore, it cannot be said for certain that these study compounds listed below were not detected (that is, are not present) in Longview. It can only be said that values for those compounds are below the MRL. Some concentrations could still be considered important as some health risk screening levels are below MRLs. Values below the MRL

[8] Definition provided by Raeann Haynes of Oregon DEQ's Inorganic Laboratory, email 2/28/07

could still be above the MDL, but none of this information was reported by the ODEQ laboratory.

Table 2. Study Compounds with No Values above MRL

Compounds with no values over MRL		MRL	units
Perylene	198-55-0	0.0004	µg/m^3
1,1,1-Trichloroethane	71-55-6	0.1	ppbv
1,1,2,2-Tetrachloroethane	79-34-5	0.1	ppbv
1,1,2-Trichloroethane	79-00-5	0.1	ppbv
1,1-Dichloroethane	75-34-3	0.1	ppbv
1,1-Dichloroethylene	75-35-4	0.1	ppbv
1,2,4-Trichlorobenzene	120-82-1	0.1	ppbv
1,2-Dibromoethane	106-93-4	0.1	ppbv
1,2-Dichlorobenzene	95-50-1	0.1	ppbv
1,2-Dichloroethane	107-06-2	0.1	ppbv
1,2-Dichloropropane	78-87-5	0.1	ppbv
1,3-Butadiene	106-99-0	0.1	ppbv
1,3-Dichlorobenzene	541-73-1	0.1	ppbv
1,4-Dichlorobenzene	106-46-7	0.1	ppbv
3-Chloropropene	107-05-1	0.1	ppbv
Acrylonitrile	107-13-1	0.1	ppbv
Bromodichloromethane	75-27-4	0.1	ppbv
Bromoform	75-25-2	0.1	ppbv
Bromomethane	74-83-9	0.1	ppbv
Chlorobenzene	108-90-7	0.1	ppbv
Chloroform	67-66-3	0.1	ppbv
cis-1,2-Dichloroethylene	156-59-2	0.1	ppbv
cis-1,3-Dichloropropene	10061-01-5	0.1	ppbv
Dibromochloromethane	124-48-1	0.1	ppbv
Hexachloro-1,3-Butadiene	87-68-3	0.1	ppbv
Methyl-tert-Butyl Ether (MTBE)	1634-04-4	0.1	ppbv
Tetrahydrofuran	109-99-9	0.1	ppbv
trans-1,2-Dichloroethene	156-60-5	0.1	ppbv
trans-1,3-Dichloropropene	10061-02-6	0.1	ppbv
Vinyl bromide	593-60-2	0.1	ppbv
Vinyl Chloride	75-01-4	0.1	ppbv
o-Tolualdehyde	529-20-4	0.08	µg/m^3

2.2 Frequency Analysis

In order to gain a broader view of which compounds were measured in amounts over the MRL most often, a frequency assessment was performed. Measurement frequencies were calculated due to a concern that a compound detected too infrequently would have a skewed annual average concentration. For example, chromium was detected above the MRL only once during the entire sampling period. This one reading is shown as the annual maximum, and well exceeds the MRL. This one reading was likely due to a winter stagnation condition. While this concentration may be characteristic of the Longview area when meteorological conditions are stagnant, it is not representative of the entire study period. Frequency of measurements over the MRLs were calculated by summing the number of readings above the MRL for each compound and dividing this value by the total number of sample days for that compound. This number represents the percentage of observances over the MRL occurring during the sampling period. Several compounds were measured over the MRL in every sample analyzed, while other compounds were measured in excess of that amount only once in the entire year, or not at all as described in Section 2.1. The following compounds were identified in amounts over the MRL in more than 75% of the samples:

Acetaldehyde	Acetone	Anthracene	Arsenic
Benzaldehyde	Benzene	Butyraldehyde	Cobalt
Chloromethane	Dibenzofuran	Dichlorodifluoromethane	Formaldehyde
Fluoranthene	Fluorene	Hexaldehyde	Isopropanol
Isovaleraldehyde	Lead	Manganese	MEK
Phenanthrene	Propionaldehyde	Pyrene	Toluene

2.3 Annual Averages

In order to compare Longview values to Vancouver and Seattle values and to facilitate other comparisons, annual averages were calculated three ways because of differences in data reduction methods between Oregon and Washington labs. This was done so that comparisons could be made on a similar basis. The methods are described below.

1. For comparison with the Vancouver 2005 (ODEQ processed) data - reported ***data below*** the MRL was r***eplaced with ½ the MRL***

2. For comparison with health risk screening levels representing a ***maximum average***, data below the MRL was ***replaced with the full MRL value.*** Annual averages thus calculated are presented as <x.xx μg/m^3.

3. For comparison with Washington and other national data, ***no substitutions*** of data reported below the MRL were made and averages were calculated using available data. Comparisons using this data were generally made when monitored frequency of values over the MRL was 75% or greater. Annual averages thus calculated are presented as x.xx μg/m^3.

Only those air toxics with monitored frequency values over 75% were compared with Vancouver and Seattle data. Care should be used in comparing Longview values to values in other cities recognizing that the treatment of results below the MDL or MRL may differ among various data sets. Such differences can have a significant impact on the calculated annual average, depending on the reading frequency. Rankings for those compounds with lower frequency values are used here to identify air toxics of potential health concern.

All annual averages were calculated using a method similar to the method used by Ecology for the year long study. Ecology calculates four sequential seasonal quarterly averages, and then averages the four seasonal quarterly averages to compute annual averages. Occasionally sample results were not obtained for a particular sampling date possibly due to equipment malfunction, operator error, power problems or some other event. By first taking the average of a quarter it ensures that when sampling results are missing, the seasonal variability of the pollutants is given equal weight in calculating the annual average. The Longview air toxics study began in May 2004 and ended in May

2005. Therefore, calculating four traditional sequential seasonal quarterly averages was not possible. Consequently, the data was separated into four roughly equal sequential quarterly periods[9] and each of these quarters was averaged to produce an annual average. Also, the entire study period average was calculated. There were essentially no differences between values calculated using these two methods. The averages presented in this report are those calculated using the four roughly equal quarterly periods, not traditional quarters. See Table 3 below for the air toxic compounds that were measured above the MRL in this study, their Chemical Abstract Services (CAS) numbers, reading frequencies over the MRL and annual averages. The annual averages shown below for those compounds with frequencies over the MRL of 75% or more was calculated using Method 3 above, that is, no substitutions of data with the MRL were made. The annual averages for those compounds with frequencies of less than 75% were calculated using Method 2 above, that is, using the maximum average and are shown in the tables as < xx.x μg/m^3. Compounds with monitored frequencies of less than 75% over the MRL will not be used to compare to the Vancouver and Seattle studies.

Table 3. Longview Air Toxics Study Averages

Compound	CAS No.	Frequency of Readings > MRL	Longview Annual Average, (μg/m^3)
Acetone	67-64-1	100.0%	1.44
Arsenic	7440-38-2	100.0%	1.202E-03
Formaldehyde	50-00-0	100.0%	0.792
Lead	7439-92-1	100.0%	5.157E-03
Manganese	7439-96-5	100.0%	7.801E-03
Acetaldehyde	75-07-0	98.3%	1.362
Butyraldehyde	123-72-8	98.3%	0.217
Hexaldehyde	66-25-1	98.3%	0.179
Propionaldehyde	123-38-6	96.6%	0.232
Benzaldehyde	100-52-7	94.9%	0.178
Chloromethane	74-87-3	92.1%	0.84
Dichlorodifluoromethane	75-71-8	92.1%	1.95
Toluene	108-88-3	92.1%	3.57
2-Butanone (MEK)	78-93-3	89.8%	0.358
Isopropanol	67-63-0	84.1%	1.66
Benzene	71-43-2	82.5%	1.27
Cobalt	7440-48-4	82.5%	3.241E-04
Fluoranthene	206-44-0	82.3%	2.4E-03
Anthracene	120-12-7	80.6%	1.36E-03
Dibenzofuran	132-64-9	80.6%	1.694E-03
Fluorene	86-73-7	80.6%	3.0E-03
Phenanthrene	85-01-8	80.6%	1.09E-03
Pyrene	129-00-0	80.6%	1.8E-03
Isovaleraldehyde	590-86-3	78.0%	0.176
1,4/1,3-Dimethylbenzene	108-38-3	74.6%	< 3.14
Acenaphthene	83-32-9	66.1%	< 1.1E-03
Valeraldehyde	110-62-3	59.3%	< 0.075

[9] Not aligned with traditional seasonal quarters

Compound	CAS No.	Frequency of Readings > MRL		Longview Annual Average, (μg/m^3)
Dibenzothiophene	132-65-0	58.1%	<	5.45E-04
Naphthalene	91-20-3	58.1%	<	1.7E-03
Selenium	7782-49-2	57.9%	<	1.7E-04
n-Heptane	142-82-5	57.1%	<	1.09
Methylene Chloride	75-09-2	55.6%	<	0.67
1,2,4-Trimethylbenzene	95-63-6	54.0%	<	1.16
Acenaphthylene	208-96-8	53.2%	<	1.1E-03
Nickel	7440-02-0	52.6%	<	1.84E-03
1,2-Dimethylbenzene	95-47-6	52.4%	<	0.86
Cadmium	7440-43-9	47.4%	<	2.28E-04
Benzo[b]fluoranthene	205-99-2	45.2%	<	7.23E-04
Trichlorofluoromethane	75-69-4	44.4%	<	0.85
Ethyl Benzene	100-41-4	38.1%	<	0.71
Benzo[a]pyrene	50-32-8	32.3%	<	4.36E-04
Indeno[1,2,3-cd]pyrene	193-39-5	30.6%	<	5.52E-04
Benzo[a]anthracene	56-55-3	29.0%	<	5.27E-04
Benzo[g,h,i]perylene	191-24-2	27.4%	<	4.73E-04
Chrysene	218-01-9	27.4%	<	5.161E-04
Trichlorotrifluoroethane	26523-64-8	27.0%	<	0.83
2-Hexanone	591-78-6	23.8%	<	0.49
m-Tolualdehyde	620-23-5	22.0%	<	0.087
Benzo[k]fluoranthene	207-08-9	21.0%	<	3.7E-04
Cyclohexane	110-82-7	15.9%	<	0.66
Crotonaldehyde	4170-30-3	15.3%	<	0.071
Coronene	191-07-1	14.5%	<	8.5E-04
Dibenz[a,h]anthracene	53-70-3	12.9%	<	4.24E-04
1,3,5-Trimethylbenzene	108-67-8	12.7%	<	0.58
n-Hexane	110-54-3	12.7%	<	0.40
Carbon Tetrachloride	56-23-5	11.1%	<	0.67
Trichloroethylene	79-01-6	9.5%	<	0.60
p-Tolualdehyde	104-87-0	6.8%	<	0.084
Styrene	100-42-5	6.3%	<	0.49
Beryllium	7440-41-7	5.3%	<	1.0E-05
1,1,2,2-Tetrachloroethylene	127-18-4	4.8%	<	0.95
4-Ethyltoluene	622-96-8	4.8%	<	0.52
4-Methyl-2-Pentanone (MIBK)	108-10-1	4.8%	<	0.44
2,2,4-Trimethylpentane	540-84-1	3.2%	<	0.49
Chromium*	1606-583-1	1.8%	<	3.29E-3
2,5-Dimethylbenzaldehyde*	5779-94-2	1.7%	<	0.084
Benzo[e]pyrene*	192-97-2	1.6%	<	4.07E-04
Carbon Disulfide	75-15-0	1.6%	<	0.33
Chloroethane*	75-00-3	1.6%	<	0.28
Dichlorotetrafluoroethane*	76-14-2	1.6%	<	0.73

*detected only once during the study

2.4 Study Maximums during the February 2005 Inversion

The maximum concentration for several compounds was recorded on February 3, 2005, including seven of the metals. The only time chromium was detected during entire sampling period was on this day. The compounds whose maximums were detected on February 3, 2005 are shown in Table 4 below.

Table 4. February 3, 2005 Maximums, Averages and Reading Frequencies

Compound	Frequency of Readings > MRL	24-hour Maximum, $\mu g/m^3$
Acetone	100%	7.09E+00
Formaldehyde	100%	5.92
Lead	100%	2.63E-02
Manganese	100%	3.80E-04
Acetaldehyde	98%	4.29E+00
2-Butanone (MEK)	90%	4.29
Benzene	83%	4.00E+00
Cobalt	82%	2.30E-03
Anthracene	81%	3.90E-03
Phenanthrene	81%	2.60E-02
Nickel	53%	1.66E-02
Cadmium	47%	1.80E-06
4-Methyl-2-Pentanone (MIBK)	5%	6.84E-01
Beryllium	5%	2.10E-08
2,2,4-trimethylpentane	3%	6.40E-01
Chromium Compounds	2%	8.40E-03

Many of the readings from February 3, 2005 were the highest in the year long study. Meteorological data for this day show virtually no wind was measured suggesting an air inversion condition existed on this day. Readings taken during the February 2005 inversion may be characteristic of worst case winter air quality conditions, but are not representative of the air quality during most of the study.

Chapter 3 Comparison to Other Studies, NATA and Standards

3.1 Comparison to Seattle and Vancouver

Concentrations from the Longview study were compared to values measured in Vancouver and Seattle. The Seattle values are from the six site average for air toxics monitoring conducted in and averaged for 2000 and 2001[10].The six sites are located at various locations in the Seattle area.[11] The study conducted in Vancouver, Washington was done in 2005; this data was collected by the Oregon Department of Environmental Quality at a site located at 27th and Kauffman in downtown Vancouver. Not all the same compounds were targeted between these two studies and the Longview study. Where there were results for the same compounds and monitored reading frequencies over the MRL were 75% or higher, comparisons were made.

3.1.1 Longview Compared to Seattle

Results in Longview were similar to those in Seattle. Some Seattle air toxics results appear to be slightly higher than results in Longview; for other compounds, Longview values were higher. Table 5 below shows the annual averages for compounds that have results for both Seattle and Longview and that have monitored frequencies over the MRL of 75% or more in the Longview study. The annual average calculation method used to compare Longview data with Seattle data is Method 3, described in Section 2.2, that is, ***no substitutions*** of data below the MRL were made and averages were calculated using available data above the MRL. Acetaldehyde, arsenic, lead and manganese values were slightly higher in Longview than in Seattle, but comparisons between these two sets of data should be considered carefully. The differences between the two sets of results are relatively small, could be explained by the uncertainties in the measurements and could be insignificant. Also, differences in data reduction methods between the two studies are notable.

Table 5: Longview and Seattle Annual Average Comparisons, µg/m^3

(Longview Reading Frequencies Over 75% > MRL)

Compound	CAS No.	Longview Reading Frequency > MRL	Longview Annual Average (2004-2005), (µg/m^3)	Seattle, 6 site, 2-year Averages (2000 and 2001), µg/m^3
Arsenic	7440-38-2	100.0%	1.20E-03	1.12E-03
Lead	7439-92-1	100.0%	5.16E-03	4.81E-03
Manganese	7439-96-5	100.0%	7.80E-03	6.44E-03
Formaldehyde	50-00-0	100.0%	0.998	1.31
Acetaldehyde	75-07-0	98.3%	1.36	1.23
Benzene	71-43-2	82.5%	1.27	1.32

[10] PSCAA/Washington DOE, Final Report: Puget Sound Air Toxics Evaluation, October 2003, Table 3-2, page 17

[11] See PSCAA 2003 report for complete description of the six sites.

3.1.2 Longview Compared to Vancouver

Where the same toxics were analyzed between the Longview and Vancouver studies, comparisons were made. Twenty-four compounds that had reading frequencies of at least 75% over the MRL in the Longview study could be compared to the Vancouver study. Comparisons between these two sets of data should be considered carefully. The differences between the two sets of results are relatively small, could be explained by the uncertainties in the measurements and could be statistically insignificant. Air toxic levels in Longview are similar to those in Vancouver, except for phenanthrene. The cause of the phenathrene difference is unknown. For the purposes of this comparison, Longview averages were calculated using Method 1 described in section 2.3 above, that is, *data below the MRL* was r*eplaced with ½ the MRL.* Table 6 below compares the Vancouver and Longview averages.

Table 6. Longview and Vancouver Annual Average Comparisons
(Longview Reading Frequencies over 75% > MRL)

Compound	CAS No.	Longview Reading Frequency >MRL	Longview Annual Average, (2004-2005) (µg/m^3)	Vancouver Annual Average, (2005) µg/m3
Acetone	67-64-1	100.0%	1.136	1.509
Arsenic	7440-38-2	100.0%	1.202E-03	1.06E-03
Formaldehyde	50-00-0	100.0%	0.792	1.949
Lead	7439-92-1	100.0%	5.157E-03	3.92E-03
Manganese	7439-96-5	100.0%	7.801E-03	8.00E-03
Acetaldehyde	75-07-0	98.3%	1.053	1.430
Butyraldehyde	123-72-8	98.3%	0.172	0.198
Hexaldehyde	66-25-1	98.3%	0.147	0.220
Propionaldehyde	123-38-6	96.6%	0.182	0.260
Benzaldehyde	100-52-7	94.9%	0.141	0.128
Chloromethane	74-87-3	92.1%	0.78	0.91
Dichlorodifluoromethane	75-71-8	92.1%	1.82	1.59
Toluene	108-88-3	92.1%	3.24	3.45
2-Butanone (MEK)	78-93-3	89.8%	0.268	0.46
Benzene	71-43-2	82.5%	1.06	0.98
Cobalt	7440-48-4	82.5%	2.761E-04	1.38E-04
Fluoranthene	206-44-0	82.3%	1.993E-03	2.877E-03
Anthracene	120-12-7	80.6%	1.123E-03	1.49E-03
Dibenzofuran	132-64-9	80.6%	1.394E-03	2.11E-03
Fluorene	86-73-7	80.6%	2.469E-03	2.77E-03
Phenanthrene	85-01-8	80.6%	8.781E-03	1.34E-01
Pyrene	129-00-0	80.6%	1.489E-03	1.58E-03
Isovaleraldehyde	590-86-3	78.0%	0.122	0.141
1,4/1,3-Dimethylbenzene	108-38-3	74.6%	2.98	1.72

3.2 Comparison to NATA Modeled Ambient Concentrations

The National Air Toxics Assessment (NATA) estimates concentrations nationwide based on emission inventories using computer models. The significant air toxic pollutants identified on the basis of potential health risk for Cowlitz County (Cowlitz 14) in the 1999 NATA are:

Acrolein	Ethylene Dibromide
Benzene	Formaldehyde
Bis (2-ethylhexyl) phthalate	Napthalene
Butadiene	Quinoline
Carbon Tetrachloride	Tetrachloroethane
Chloroform	POM Group 1
Chromium VI	
Diesel Particles	

Longview measured annual average air toxic concentrations were compared to mean annual ambient concentrations predicted by the NATA. The NATA concentration estimates were generated using the ASPEN air dispersion model and using 1999 air toxics emission information and Cowlitz County data. When EPA has compared their modeled concentrations with ambient monitors, they have found that the model generally underestimated values for metals. This effect is not the same for VOCs. Air toxics 1,3 butadiene, chloroform, ethylene dibromide and tetrachloroethane were predicted to be significant in Cowlitz County by NATA models, but these compounds were not measured in Longview in an amount over the MRL at any time during the study. This does not mean that these compounds are not present in Longview, just that the values are below the MRL. Some compounds predicted by NATA may be present in an amount below the MRL. Table 7 shows Longview monitored values and NATA predicted concentrations for air toxics determined to be of highest potential health risk concern in Cowlitz County by NATA. Also shown in this table are acetaldehyde, arsenic and manganese. These air toxics are not on the NATA list of significant chemicals but were confirmed to be of potential health concern in this report's health screening analysis found in Chapter 4. The averages included in this table are those calculated by Method 3 described in Section 2.3 above, that is, no substitutions for data below the MRL were made.

Table 7. Longview Monitored Average and NATA Predicted Concentrations

Compound	CAS No.	Longview Reading Frequency > MRL	Longview Annual Average, (µg/m3)	NATA predicted concentrations, (µg/m3)	Higher Value Determination
Acetaldehyde	**75-07-0**	**98%**	**1.36E+00**	**1.69E+00**	NATA
Arsenic	**7440-38-2**	**100%**	**1.20E-03**	**3.02E-05**	Longview
Benzene	**71-43-2**	**83%**	**1.27E+00**	**1.18E+00**	Longview
Formaldehyde	**50-00-0**	**100%**	**9.98E-01**	**1.46E+00**	NATA
Manganese	**7439-96-5**	**100%**	**7.80E-03**	**8.28E-04**	Longview
Carbon Tetrachloride	56-23-5	11.1%	<6.70E-01	4.52E-01	Indeterminate
Naphthalene	91-20-3	58.1%	<1.70E-03	3.54E-02	NATA
POM Group 1	Na	45.2%	<5.01E-03	2.93E-01	NATA
1,3 Butadiene	106-99-0	0%	<8.04E-01	7.77E-02	Indeterminate*
Chloroform	67-66-3	0%	<5.11E-01	1.00E+00	NATA
Ethylene Dibromide	106-93-4	0%	<8.04E-01	1.69E-02	Indeterminate*
Tetrachloroethane	79-34-5	0%	<7.19E-01	4.55E-02	Indeterminate*

*Measured by study methods but not detected above the MRL in any samples.

Not measured by study methods: acrolein, bis (2-ethylhexyl) phthalate, chromium VI, diesel particles, quinoline

Bolded air toxics determined to be of potential health concern during risk screening analysis, Chapter 4

For arsenic and manganese, the Longview actual *annual averages* were higher than the NATA estimated values. For the other Longview air toxics measured during the study, the NATA values for acetaldehyde, benzene, chloroform, formaldehyde, naphthalene and POM Group 1 were higher. For the rest of the Cowlitz 14 compounds, either their *maximum annual average concentrations* were above the NATA concentrations or the compounds were not measured by the study methods. When a compound's *maximum* annual average concentration is above the NATA value, the true value could be either above or below the NATA predicted concentration

3.3 Acceptable Source Impact Level (ASIL) Assessment

Longview air toxics data was compared to Washington State ASILs. ASILs are not ambient air quality standards, they are levels set in Washington State rules (Chapter 173-460 WAC) for establishing controls on new sources of toxic air pollutants. These regulatory levels establish the maximum ambient air quality impact that a new source of toxic air pollutants may be allowed without unreasonably endangering human health in the surrounding community. The ASILs were established in 1994 considering cancer and non-cancer health risk information current at that time. Ecology is currently reviewing all ASILs considering the most current health risk information and the rules will be revised accordingly.

There were four air toxics whose measured annual average concentrations exceeded their respective annual ASILs. No study compounds were detected in amounts over their 24-hour average ASILs. Table 8 shows the study compounds with annual ASILs and their ASIL status. Table 9 shows compounds with 24-hour average ASILs.

3.3.1 Compounds with an Annual ASIL

Comparing compounds with an established ASIL to Longview results shows four compounds are above these levels. Arsenic, benzene, acetaldehyde and formaldehyde annual averages were confirmed to exceed their respective Washington State ASILs. Beryllium, cadmium, nickel and tetrachloroethylene were measured below their annual ASILs. For the other compounds in the table, an ASIL status could not be determined because their maximum annual averages were above their respective ASILs. The compounds that were compared with their annual ASILs are shown in Table 8 below with their CAS numbers, monitored frequencies and ASIL status. The Air Toxics Rule (Chapter 173-460-050(4)(c)WAC) requires that the total of the seven PAHs be used to determine compliance with the ASIL.

Table 8. Compounds with an Annual ASIL and ASIL Status

Air toxics with an Annual ASIL	CAS No.	Longview Reading Frequency >MRL	Longview Annual. Ave. (μg/m^3)	ASIL[12], Annual (μg/m^3)	ASIL Status
Acetaldehyde	75-07-0	98.31%	1.36	0.45	Above ASIL
Arsenic	7440-38-2	100.00%	1.20E-03	2.30E-04	Above ASIL
Benzene	71-43-2	82.54%	1.27	0.12	Above ASIL
Formaldehyde	50-00-0	100.00%	1.00	0.08	Above ASIL
Beryllium	7440-41-7	5.26%	<1.03E-05	4.20E-04	Below ASIL
Cadmium	7440-43-9	47.37%	<2.28E-04	5.60E-04	Below ASIL
Nickel	7440-02-0	52.63%	<1.84E-03	2.10E-03	Below ASIL
Tetrachloroethylene	127-18-4	4.76%	<0.95	1.10	Below ASIL
Bromoform	75-25-2	0.0%	<1.08	0.91	Indeterminate
1,3,-Butadiene	106-99-0	0.0%	<0.23	3.60E-03	Indeterminate
Carbon Tetrachloride	56-23-5	11.11%	<0.67	0.07	Indeterminate
Chloroform	67-66-3	0.0%	<0.51	0.04	Indeterminate
Methylene Chloride	75-09-2	55.56%	<0.67	0.56	Indeterminate
Trichloroethylene	79-01-6	9.52%	<0.60	0.59	Indeterminate
Vinyl Chloride	75-01-4	0.0%	<0.27	0.01	Indeterminate
7-PAHs:					
Benzo[a]anthracene	56-55-3	32.3%	<5.27E-04		
Benzo[a]pyrene	50-32-8	32.3%	<4.37E-04		
Benzo[b]fluoranthene	205-99-2	48.4%	<7.23E-04		
Benzo[k]fluoranthene	207-08-9	12.9%	<3.70E-04		
Chrysene	218-01-9	33.9%	<5.16E-04		
Dibenz[a,h]anthracene	53-70-3	21.0%	<4.24E-04		
Indeno[1,2,3-cd]pyrene	193-39-5	37.1%	<5.52E-04		
7-PAH Total			<3.55E-03	4.80E-04	Indeterminate

[12] ASILs shown in Table 8 and 9 are found in the 7/21/98 revision of Chapter 173-460 of the Washington Administrative Code (WAC) Controls for New Sources of Toxic Air Pollutants. These ASILs are presently under scientific review by the Washington Department of Ecology to evaluate the most current health effects information. Revision of WAC 173-460 will follow accordingly.

3.3.2 Compounds with 24-hour average ASIL

The compounds shown with 24-hour average ASILs are shown in Table 9 below with their reading frequencies and the maximum 24 hour concentration measured over the study period. No study maximums exceeded any of the established 24-hour average ASILs.

Table 9. Compounds with a 24-hour average ASIL

Compound	CAS No.	Longview Reading Frequency >MRL	Maximum (μg/m^3)	ASIL[1], 24 hour, (μg/m^3)	ASIL Status
1,2-Dimethylbenzene	95-47-6	52.38%	5.46E+00	1.50E+03	Below ASIL
1,3,5-Trimethylbenzene	108-67-8	6.71%	1.80E+00	1.50E+03	Below ASIL
1,4/1,3-Dimethylbenzene	108-38-3	74.60%	2.26E+01	1.50E+03	Below ASIL
2-Butanone (MEK)	78-93-3	69.84%	1.34E+00	1.00E+03	Below ASIL
2-Hexanone	591-78-6	23.81%	1.41E+00	6.70E+01	Below ASIL
4-Methyl-2-Pentanone (MIBK)	108-10-1	4.76%	6.84E-01	6.80E+02	Below ASIL
Acetone	67-64-1	73.02%	1.54E+01	5.90E+03	Below ASIL
Carbon Disulfide	75-15-0	1.59%	4.56E-01	1.00E+02	Below ASIL
Chloroethane	75-00-3	1.59%	3.59E-01	1.00E+04	Below ASIL
Chloromethane	74-87-3	92.06%	1.25E+00	3.40E+02	Below ASIL
Cobalt	7440-48-4	82.46%	2.30E-06	1.70E-01	Below ASIL
Crotonaldehyde	4170-30-3	15.25%	2.90E-01	2.00E+01	Below ASIL
Cyclohexane	110-82-7	15.87%	7.93E+00	3.40E+03	Below ASIL
Dichlorodifluoromethane	75-71-8	92.06%	4.45E+00	1.60E+04	Below ASIL
Dichlorotetrafluoroethane	76-14-2	1.59%	7.32E-01	2.30E+04	Below ASIL
Ethyl Benzene	100-41-4	38.10%	3.68E+00	1.00E+03	Below ASIL
Isopropanol	67-63-0	84.13%	3.09E+01	3.30E+03	Below ASIL
Lead	7439-92-1	100.00%	2.63E-02	5.00E-01	Below ASIL
Manganese	7439-96-5	100.00%	4.56E-02	4.00E-01	Below ASIL
Naphthalene	91-20-3	58.06%	1.40E-02	1.70E+02	Below ASIL
n-Heptane	142-82-5	57.14%	5.58E+00	5.50E+03	Below ASIL
n-Hexane	110-54-3	12.70%	9.96E-01	2.00E+02	Below ASIL
Selenium 10μm	7782-49-2	57.89%	3.80E-04	6.70E-02	Below ASIL
Styrene	100-42-5	6.35%	1.61E+00	1.00E+03	Below ASIL
Toluene	108-88-3	92.06%	2.05E+01	4.00E+02	Below ASIL
Trichlorofluoromethane	75-69-4	44.44%	1.59E+00	1.90E+04	Below ASIL
Trichlorotrifluoroethane	76-13-1	27.0%	0.962632	2.70E+04	Below ASIL
Valeraldehyde	110-62-3	59.32%	2.00E-01	5.90E+02	Below ASIL

3.3.3 Compounds without an established ASIL

The following compounds were measured in an amounts above the MRL at various frequencies during the study but do not have either a 24-hour or an annual average ASIL. Those compounds marked with an asterisk were measured infrequently, (i.e., in less than 10% of the study samples):

2,5-Dimethylbenzaldehyde*
Benzaldehyde
Butyraldehyde
Hexaldehyde
Isovaleraldehyde
m-Tolualdehyde
Propionaldehyde
p-Tolualdehyde*

3.4 Comparison to National Ambient Air Quality Standard for Lead

The National Ambient Air Quality Standard (NAAQS) for lead (based on a quarterly average) is 1.5 $\mu g/m^3$; The quarters for which there are complete quarterly averages are shown in Table 10 below and are all well below the quarterly standard of 1.5 $\mu g/m^3$. The Longview area is safely under the NAAQS for lead.

Table 10: Quarterly Lead Averages

Quarter	*$\mu g/m^3$*
July, August, September 2004	0.0025
October, November, December 2004	0.0056
Jan, Feb, March 2005	0.0098

Chapter 4 Health Risk Estimates and Screening Analysis

4.1 NATA Risk Estimates

The 1999 NATA risk estimates identify nineteen compounds as the air toxics of highest potential health risk concern in Washington State. Fourteen of the nineteen compounds are predicted to be in Cowlitz County at ambient air concentrations that could potentially cause adverse health effects, cancerous or non-cancerous. Regarding cancer-based risk EPA explains that "[a] risk level of 1 in a million implies that up to one person, out of one million equally exposed people would contract cancer if exposed continuously (24-hours per day) to the specific concentration over 70 years (an assumed lifetime). This is in addition to those cancer cases that would normally occur in an unexposed population of one million people. This is lifetime cancer risk, not annual cancer risk"[13]. This is sometimes called excess life time cancer risk. EPA's non-cancer risk levels are based on reference concentrations as found in the Integrated Risk Information System (IRIS) database. The reference concentration for a given air toxic is the concentration in air below which little or no harmful health effects are expected to result with chronic exposure. Non-cancer risks are other negative health effects, both chronic and acute that do not cause cancer. Examples include birth or reproductive effects or other detrimental health effects. The EPA NATA risk estimate data from 1999 includes values for Cowlitz County. This assessment included emissions from the now closed Reynolds aluminum plant that was operating in Longview in 1999. The fourteen significant air toxic pollutants predicted to have the highest potential health risk concerns for Cowlitz County in the 1999 NATA are:

Acrolein	Ethylene Dibromide
Benzene	Formaldehyde
Bis (2-ethylhexyl) phthalate	Napthalene
Butadiene	Quinoline
Carbon Tetrachloride	Tetrachloroethane
Chloroform	POM Group 1
Chromium VI	
Diesel Particles	

Acrolein is the only non cancer causing toxic air pollutant on the list. Acrolein does not cause cancer, but can cause other respiratory health effects, such as respiratory irritation[14]. Carbon Tetrachloride, no longer in general use, is projected at about the same background level in each county in Washington.[15] The health risks associated with formaldehyde are currently under much debate. However, recent research reaffirms the carcinogenicity of formaldehyde[16].

Of the fourteen compounds predicted to be of significant health risk concern in Cowlitz County, the following five could not be measured by the methods used in this study:

---

[13] 1999 NATA List of Toxic Air Pollutants Modeled in Washington State, February 23, 2006, page 8

[14] Washington Department of Ecology, Focus on the National Air Toxics Assessment (NATA), 1999 data, January 2006, 06-02-001, page 2

[15] 1999 NATA List of Toxic Air Pollutants Modeled in Washington State, February 23, 2006, page 2

[16] WHO, Press Release, IARC Classifies Formaldehyde as Carcinogenic to Humans, June, 2004, page 1

acrolein, bis (2-ethylhexyl) phthalate, chromium VI, diesel particles and quinoline. The remaining compounds that were measured in this study were subject to a health risk screening analysis as described in Section 4.2. Of the compounds on the Cowlitz 14 list, this analysis confirmed benzene and formaldehyde to be of potential health risk concern and naphthalene was confirmed to not be of concern. The rest of the measured compounds could not be confirmed one way or the other due to limited sensitivity of the analytical measurements (i.e., the high incidence of samples reported below the MRL).

4.2 Preliminary Health Risk Screening Analysis

While a comprehensive health risk assessment is beyond the scope of this study, a health risk screening analysis is useful for identifying pollutants of potential health concern. In order to determine pollutants of potential concern, the annual averages of the study air toxics were compared with established health risk screening values, when available. Not all of the pollutants have published health screening guidelines that may be used for comparison, but available information from several sources was considered as described in Section 4.2.1. Accordingly, Longview data is compared to: EPA Final Screening Values, Oregon's Ambient Benchmark Concentrations and Washington's annual ASILs.

4.2.1 Health Risk Screening Levels

The health risk screening levels used for this screening analysis were taken from three sources: the EPA Final Screening Values, Oregon's Ambient Benchmark Concentrations and Washington's annual ASILs.

4.2.1.1 EPA Final Screening Values

EPA recently published a risk based screening approach for air toxics monitoring data[17]. This publication establishes Final Screening Values for a number of air toxics. The Chronic Screening Values are used to indicate a concentration of an air toxic in the air to which a person could be continually exposed for a lifetime (assumed 70 years) and which would be unlikely to result in a deleterious effect; The chronic screening value considers both cancer and non-cancer risks. The final screening values used are the lesser of the noncancer or cancer chronic inhalation risk values. Annual averages from the Longview study were compared with these final health risk screening values.

4.2.1.2 Oregon Ambient Benchmark Concentrations

The Oregon DEQ has recently established Ambient Benchmark Concentrations (ABCs) for a number of air toxic compounds that can be used for health screening comparisons. The Oregon ABCs are based on a thorough review of all the health based standards and guidance currently available and were recently enacted into rule (OAR 340-246-0090, 8-16-06). Each ABC is based on either a cancer or a non-cancer risk, whichever is lower. The cancer health risks are based on a risk level of one in one million which implies that up to one person, out of one million equally exposed people would contract cancer if exposed continuously (24 hours per day) to the specific concentration over 70 years (an assumed lifetime). The non-cancer health risks are typically based on the lowest

[17] United States Environmental Protection Agency, A Preliminary Risk-Based Screening Approach for Air Toxics Monitoring Data Sets, Publication EPA-904-B-06-001, February 2006

concentration at which harmful non-cancer health effects would be expected to occur with chronic exposure (i.e., reference concentration).

4.2.1.3 Washington's ASIL

Washington's ASILs are not ambient air quality standards, they are levels set in state rules for establishing controls on new sources of toxic air pollutants at Chapter 173-460-050(4)(c)WAC) . However, ASIL levels establish the maximum ambient air quality impact (µg/m^3) that a new source of toxic air pollutants (TAPs) may contribute that will not unreasonably endanger human health in the surrounding community.

4.2.2 Longview Air Toxics Health Risk Screening Analysis Protocol

Annual averages for the air toxics measured in this study were compared to the available health risk screening values described above. For the purposes of this screening analysis, annual averages were calculated and presented in one of two ways:

- If the air toxic's reported data met the minimum frequency requirement of 75% of the samples reported over the MRL with all four quarters represented in the 75%, then the annual average was calculated using only these data reported over the MRL (Method 3 described in Section 2.3). Annual averages thus calculated are presented as x.xx µg/m^3. For the purposes of this screening analysis, these are considered "valid" annual averages allowing a definite determination as to whether or not a toxic can be confirmed as a potential health risk concern.

- If the air toxic's reported data did not meet the minimum frequency requirement, the annual average was calculated using any data reported above the MRL and substitution of the MRL for any samples reported at or below the MRL (Method 2 described in Section 2.3). Annual averages thus calculated are presented as < x.xx µg/m^3. For the purposes of this screening analysis these are considered "maximum" annual averages allowing a definite determination only in cases where the "maximum" average is less than the screening values (i.e., confirmed not to be a potential health risk concern).

An air toxic compound is *confirmed* to be of potential health concern only if the frequency of samples reported above the MRL is high enough to allow calculation of a "valid" annual average as described above and if that "valid" annual average equals or exceeds any of the compound's screening values.

A compound is considered *possibly* to be of potential health concern if the frequency of samples reported above the MRL is not high enough to allow calculation of a "valid" annual average and if the "maximum" annual average, calculated as described above, equals or exceeds any of the compound's screening values. In these situations, it is known that the true annual average is somewhere below the "maximum" average but it cannot be determined with any certainty whether it falls above or below any of the health screening levels.

A compound is *confirmed not* to be of potential health concern if either its "valid" annual average or its "maximum" annual average, calculated as described above, is less than all of the compound's screening values. In these situations, it is known that regardless of the frequency requirement, the true annual average is somewhere below all of the health risk screening levels for the compound.

Finally, some compounds do not have any available health risk screening levels among the guidance considered. These compounds are identified and listed below.

4.2.3 Results of the Analysis

A detailed summary table of the results of this health risk screening analysis for all study compounds is in Appendix B. Compounds that are *confirmed* to be of potential health risk concern and compounds that may *possibly* be of potential health risk concern are shown in Table 11. This table shows each compound's CAS number, annual average, reading frequency, screening values (ODEQ ABC, EPA Final Screening Value, ASIL) and a determination of whether the compound is of potential health concern. These compounds are further discussed in Sections 4.2.3.1 and 4.2.3.2.

Compounds that were ruled out as *not* being a potential health concern in Longview are discussed in Section 4.2.3.3 and the compounds that have no established health risk screening values available are shown in Section 4.2.3.4.

Table 11. Longview Air Toxics Health Risk Screening Analysis Summary - Compounds of Confirmed and Possible Health Concern

				Screening Values			
Compound	CAS No.	Longview Frequency Measured >MRL (% of samples)	Longview Annual Average Conc. (ug/m^3)	ODEQ Ambient Benchmark Concentration - ABC (ug/m^3)	EPA Final Chronic Screening Value (ug/m^3)	WDOE Acceptable Source Impact Level - ASIL (ug/m^3)	Potential Health Concern ?
Acetaldehyde	75-07-0	98.3%	1.362	0.45	0.45	0.45	Yes
Arsenic	7440-38-2	100.0%	1.20E-03	0.0002	0.00023	0.00023	Yes
Benzene	71-43-2	82.5%	1.27	0.13	0.13	0.12	Yes
Formaldehyde	50-00-0	100.0%	0.792	3	0.98	0.077	Yes
Manganese	7439-96-5	100.0%	7.80E-03	0.2	0.005	0.4	Yes
1,1,2,2-Tetrachloroethylene	127-18-4	4.8%	< 0.95	35	0.17	1.1	Possibly
Carbon Tetrachloride	56-23-5	11.1%	< 0.67	0.07	0.067	0.067	Possibly
Chromium[c.]	1606-583-1	1.8%	< 3.29E-03	na	0.000083	0.17 [d.]	Possibly
Methylene Chloride	75-09-2	55.6%	< 0.67	2.1	2.1	0.56	Possibly
PAH (OR Group) - ABC [a.]	na	50.0%	< 1.10E-03	0.0009 (a.)	na	na	Possibly
PAH (WA Group) - ABC [b.]	na	28.3%	< 3.50E-03	na	na	0.00048 [b.]	Possibly
Trichloroethylene	79-01-6	9.5%	< 0.6	0.5	0.5	0.59	Possibly
1,1,2,2-Tetrachloroethane	79-34-5	0.0%	< 0.719	na	0.017	23	Possibly
1,1,2-Trichloroethane	79-00-5	0.0%	< 0.571	na	0.063	180	Possibly
1,2-Dibromoethane (EDB)	106-93-4	0.0%	< 0.804	0.002	0.002	0.005	Possibly
1,2-Dichloroethane	107-06-2	0.0%	< 0.424	0.04	0.004	0.038	Possibly
1,2-Dichloropropane	78-87-5	0.0%	< 0.484	na	0.053	4	Possibly
1,3-Butadiene	106-99-0	0.0%	< 0.232	0.03	0.03	0.004	Possibly
1,4-Dichlorobenzene	106-46-7	0.0%	< 0.629	0.09	0.091	1.5	Possibly
3-Chloropropene	107-05-1	0.0%	< 0.327	na	0.1	1	Possibly
Acrylonitrile	107-13-1	0.0%	< 0.227	0.01	0.015	0.015	Possibly
Bromoform	75-25-2	0.0%	< 1.082	na	0.91	0.91	Possibly
Chloroform	67-66-3	0.0%	< 0.511	98	9.8	0.043	Possibly
Hexachloro-1,3-Butadiene	87-68-3	0.0%	< 1.116	na	0.045	0.7	Possibly
Vinyl bromide	593-60-2	0.0%	< 0.458	na	0.031	73	Possibly
Vinyl Chloride	75-01-4	0.0%	< 0.268	0.1	0.11	0.012	Possibly

a. ABC is compared to the toxicity equivalency factor weighted sum of concentrations for up 15 individual PAH compounds (Oregon DEQ PAH Group).

b. ASIL is compared to the sum of up to 7 PAH compounds as one TAP equivalent in potency to BaP (Washington DOE PAH Group).

c. Chromium was reported above the MRL only once over the term of the study.

d. ASIL is for chromium compounds not including hexavalent chromium.

4.2.3.1 Air Toxics of Potential Health Concern

Those compounds *confirmed* to be of potential health concern are **acetaldehyde, arsenic, manganese**, **benzene, and formaldehyde**. Of these, benzene and formaldehyde were predicted by the NATA to be among the air toxics of highest potential health risk concern in Cowlitz County. These air toxics were present in Longview in amounts higher than one or more of their respective health risk screening levels. The air toxics of potential health concern are shown in Table 11 above with their corresponding health screening levels.

4.2.3.2 Air Toxics That May Possibly Be of Potential Health Concern

Many compounds could not be determined with any certainty whether they are of potential health concern nor ruled out as a potential health concern. For example, in some cases, the method MRL alone was higher than an air toxic's minimum health screening level. Those compounds that may *possibly* be of potential health concern are listed in the second half of Table 11.

4.2.3.3 Air Toxics Determined Not to Be of Potential Health Concern

Some air toxics can be ruled out as being a potential health concern. Their "valid" or "maximum" annual average was low enough when compared to the respective health screening levels to allow a definitive determination. Those compounds are:

Carbonyls:
2-5-Dimethylbenzeladehyde, 2-Butanone (MEK), Acetone, Benzaldehyde, Butyraldehyde, Crotonaldehyde, Hexaldehyde, Isovalderaldehyde, m-, o-, p-Tolualdehyde, Propionaldehyde, Valderdehyde

PAHs (individual):
Benzo(e)pyrene, Corene, Dibenzofuran, Dibenzothiophene, Napthlene, Perylene

VOCs:
1,1,1-Trichloroethane, 1,1-Dichloreethane, 1,1-Dichlorethylene, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,2-Dimethylenebenzene, 1,4/1,3-Dimethylebenzene, 2-Hexnone, 4-Methyl-2-Pentanone (MIBK), Acetone, Bromomethane, Carbon Disulfide, Chlorobenzene, Chlororethane, Chloromethane, Cyclohexane, Dichlorodifluoromethane, Ethyl Benzene, Isopropanol, Methyl-tert-Butyl Ether (MTBE), n-Heptane, n-Hexane, Styrene, Tetrahydrofuran, Toluene, trans-1-2-Dichloroethene, Trichlorotrifluoroethane,

Metals:
Beryllium, Cadmium, Cobalt, Lead, Nickel, Selenium

4.2.3.4 Air Toxics with No Screening Values

The following compounds have no health risk screening values available from among the three sources considered.

VOCs:
1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, 1,3-Dichlorobenzene, 2,2-4-Trimethylpentane, 4-Ethyletoluelne, Bromodichloromethane, cis-1,2-Dichloroethylene, cis-1,3 Dichloropropene, Dibromochloromethane, trans-1,2-Dichloroethene, trans-1,3-Dichloropropene,

Chapter 5 Sources of Air Toxics

There are many sources of air toxics. Table 12 below lists those fourteen air toxics predicted by the NATA as being of the highest potential health risk concern in Cowlitz County and some of their common sources. The two air toxics not predicted by NATA, but confirmed to be of potential health concern by this study are shown in Table 13. These two tables also show which compounds were monitored for and/or detected in Longview or whether they could not be measured using the methods in the study. A*cetaldehyde*, a*rsenic, benzene, formaldehyde and manganese* were confirmed to be *of potential health risk concern* in the preliminary health risk screening analysis presented in Chapter 4 and are bolded in Tables 12 and 13 below.

Table 12: Sources of the Top Air Toxics and Their Detection Status in Longview

Top Chemicals	Sources	Monitored/Detected in Longview
Acetaldehyde	**Vehicle/engine exhaust, wood burning, other combustion.**	**Detected** (>0% freq. above MRL)
Benzene	**Vehicle/engine exhaust, petroleum refineries, gasoline fueling and other combustion**	**Detected** (>0% freq. above MRL)
Bis (2-ethylhexyl) phthlalate (DEHP)	Plasticizer used in industry in most plastic containers; Projected at a similar background level in each county in Washington.	Not measured by study methods
Butadiene	Vehicle/engine exhaust, wood burning, industrial processes – mainly petroleum refineries	Not Detected (0% freq. above MRL)
Carbon Tetrachloride	No longer in use, historical use as a solvent or degreaser; projected at a similar background level in each county in Washington	Detected (>0% freq. above MRL)
Chloroform	Publicly owned treatment works (sewage treatment plants), consumer products	Not Detected (0% freq. above MRL)
Chromium VI	Industries – largely chrome electroplaters	Cr VI not measured by study methods (Total Chromium detected only once)
Diesel Particles	Exhaust from diesel vehicles	Not measured by study methods
Ethylene Dibromide (1,2, Dibromoethane)	Historically used in leaded gasoline, pesticides; Projected at a similar background level in each county in Washington	Not Detected (0% freq. above MRL)
Formaldehyde	**Vehicle/engine exhaust, wood burning; other combustion; pulp/paper/plywood mills, foods and cooking, tobacco smoke, paints and varnishes, some building materials, carpets and disinfectants**	**Detected** (>0.0% freq. >MRL)
Naphthalene	Burning of wood and fossil fuels; ;moth repellants; industrial discharges; vehicle/engine exhaust	**Detected** (>0% freq. above MRL)
POM Group 1 (unspeciated POMs)	Fires, burning fossil fuels, vehicle/engine exhaust, aluminum plants. POM compounds are formed primarily from combustion and are present in the atmosphere as particles.	**Detected** (>0% freq. above MRL for all except perylene)
Quinoline	Aluminum plants (now shut down in Longview)	Not measured by study methods
Tetrachloroethane	Rarely used today to produce other chemicals, historical use in paints, solvents and pesticides, Projected at similar background level in each county in Washington	Not Detected (0% freq. above MRL)

Arsenic and manganese were measured in the Longview study at annual average concentrations above health risk screening values but these air toxics were not predicted by the NATA assessment to be among the fourteen top pollutants of potential health risk concern. Sources of these two air toxics are shown in Table 13 below.

Table 13. Sources of Other Compounds Detected in Longview

Air Toxics	Sources	Monitored/Detected in Longview
Arsenic Compounds	**Burning coal or fuel oil; metals production; refineries, pulp/paper mills, burning of treated wood, volcanoes**	**Detected** (>0% freq. above MRL)
Manganese Compounds	**Steel production, battery production, fertilizer production, water purification**	**Detected** (>0% freq. above MRL)

Chapter 6 Conclusions and Recommendations for Future Study

Ambient air toxics levels in Longview are not significantly different from levels in other urban areas in Washington. Actual monitored results differ slightly from model predicted NATA concentrations. During winter inversions, air toxics levels can reach peak levels. Those air toxics confirmed to be of potential health risk concern in Longview are **acetaldehyde, arsenic, benzene, manganese and formaldehyde**. These compounds could be the focus of future studies or other inquiries.

Sources of these chemicals are vehicle and engine exhaust, wood burning and other combustion sources. Formaldehyde and arsenic can come from pulp, paper or plywood mills. Other sources of formaldehyde are paints and varnishes, foods and cooking, tobacco smoke and some building materials and disinfectants[18]. Arsenic comes from burning fuel oil, pulp and paper mills, volcanic oil and the burning of treated wood. Benzene also is emitted from gasoline fueling. Manganese compounds can come from steel, battery or fertilizer production, cutting and welding operations and water purification. It is unknown what manganese sources are specific to Cowlitz County.

Diesel emissions are considered to be the greatest contributor to potential cancer risk in Washington State[19]. In addition to diesel particulate matter (DPM), diesel engine emissions include at least 40 other cancer causing substances. While no direct monitoring method currently exists for measuring DPM, many of the other constituents of diesel emissions are on the list of urban air toxics.[20]

Wood smoke is composed of harmful particulates and contains cancer causing chemicals.[21] No direct monitoring method currently exists for measuring wood smoke particulate. Wood smoke emissions sources are residential woodstoves and fireplaces as well as outdoor burning, including large-scale land-clearing, silvicultural and agricultural burning.

The 1999 NATA assessment ranks acrolein as one of the air toxics of highest health risk concern in Washington. Although acrolein does not cause cancer, it can cause respiratory irritation. Acrolein is not listed in this study because no adequate ambient monitoring method was available at the time of the study. Because highly industrialized areas can expect higher population exposure to acrolein[22] and since Longview is an industrialized area, recently developed acrolein monitoring methods should be utilized if further studies are planned for this area. Sources of acrolein are wood burning, vehicle/engine exhaust and pulp, paper and plywood mills[23].

---

[18] WHO, Press Release, IARC Classifies Formaldehyde as Carcinogenic to Humans, June, 2004, page 1
[19] Department of Ecology, Focus on the NATA, 06-02-001, January 2006, page 1,
[20] Department of Ecology, Focusing on a Healthier Tomorrow,
https://fortress.wa.gov/ecy/aqp/Toxics/WhatWeAreDoing1.shtml (downloaded 11/29/06)
[21] https: fortress.wa.gov/ecy/aqp/Toxics/WhatWeAreDoingshtml (11/29/06).
[22] ERG Technical Assistance Document for the National Ambient Air Toxics Program, Carbonyl Recovery and Stability Study in Canisters, page 1
[23] 1999 NATA Toxic Air Pollutants in Washington State, February 23, 2006, page 2

Further analytical work could focus on the pollutants of potential health concern identified in this study and improving analytical sensitivities. Opportunities for improving the sensitivities of analytical measurements should be critically explored before pursuing any future monitoring studies. Method detection limits that are closer to the health risk screening levels would allow more definitive health risk screening assessments. This is of particular import for those air toxics predicted by NATA to be of the highest potential health risk concern for the area, but which could not be confirmed by this monitoring study (i.e., 1,3-butadiene, carbon tetrachloride, chloroform, ethylene dibromide, POM, tetrachloroethane, tetrachloroethylene, and trichloroethylene). Also, since diesel particulate and wood smoke could not be measured by the methods available during this study, expanding sampling or analysis methods to allow these air pollutants to be quantified and assessed should be evaluated. Future studies could include computer modeling or other research to identify sources of these compounds. With the appropriate monitoring data, wood smoke emissions and diesel particulate contributions could be apportioned using a Positive Matrix Factorization (PMF) apportionment model or Chemical Mass Balance (CMB) modeling. Other pollutants of concern potentially present in Longview are hydrogen sulfide, methyl mercaptan and methanol. These compounds are byproducts of pulp and papermaking, industries prevalent in Longview. Methods for measuring acrolein, hydrogen sulfide, methyl mercaptan and methanol should be evaluated if future monitoring is conducted. There are no future studies planned at this time. Any future studies would be contingent on justification of need and availability of funding.

References

- U.S. Environmental Protection Agency, National Scale Air Toxics Assessment for 1999, Office of Air Quality Planning and Standards, February 2006
- Washington Department of Ecology, Focus on the National Air Toxics Assessment (NATA), 1999 data, January 2006, 06-02-001
- Environmental Protection Agency, Taking Toxics Out of the Air, EPA-452/K-00-002, August 2000
- Environmental Protection Agency, Toxic Release Inventory data, from TRI Explorer, Geography County Report, downloaded for Cowlitz County 1988 through 2004 air releases
- Environmental Protection Agency, Air Toxics Emissions, EPA's Strategy for Reducing Health Risks in Urban Areas, EPA/453-F-99-002, July 1999
- Puget Sound Clean Air Agency/Washington DOE, Final Report: Puget Sound Air Toxics Evaluation, October 2003
- Puget Sound Clean Air Agency, 2004 Air Quality Data Summary, July 2005
- Department of Ecology, Focusing on a Healthier Tomorrow, https://fortress.wa.gov/ecy/aqp/Toxics/WhatWeAreDoing1.shtml (downloaded 11/29/06)
- National Air Toxics Program: The Integrated Urban Strategy; Notice; Federal Register / Vol. 64, No. 137 / Monday, July 19, 1999
- Eastern Research Group for the OAQPS,, Technical Assistance Document for the National Ambient Air Toxics Program, Trends and Assessment Program, Carbonyl Recovery and Stability Study in Canisters, May 17, 2004
- Environmental Protection Agency, Office of Air Quality Planning and Standards (OAQPS), Tabulated Dose-Response Assessments, Table 1, Prioritized Chronic Dose-Response Values, 2/28/05, http://epa.gov/ttn/atw/toxsource/summary.html
- World Health Organization, International Agency for Research on Cancer, Press Release: IARC Classifies Formaldehyde as Carcinogenic to Humans, June 15, 2005, http://www.iarc.fr/ENG/Press_Releases/archives/pr153a.html

Appendix A Longview Air Toxics Quality Assurance Project Plan

Appendix B – Longview Health Risk Screening Analysis Tables