OMB Number: 4040-0004
Expiration Date: 01/31/2009

Application for Federal Assistance SF-424

Version 02

* 1. Type of Submission:	* 2. Type of Application:	* If Revision, select appropriate letter(s):
○ Preapplication	● New	
● Application	○ Continuation	* Other (Specify)
○ Changed/Corrected Application	○ Revision	

* 3. Date Received:	4. Applicant Identifier:
04/17/2007	

5a. Federal Entity Identifier:	* 5b. Federal Award Identifier:
EPA-R10-WCC-2006	

State Use Only:

6. Date Received by State:	7. State Application Identifier:

8. APPLICANT INFORMATION:

* a. Legal Name: Puget Sound Clean Air Agency

* b. Employer/Taxpayer Identification Number (EIN/TIN):	* c. Organizational DUNS:
91-0823558	363422374

d. Address:

* Street1:	1904 Third Avenue, Suite 105
Street2:	
* City:	Seattle
County:	King
* State:	WA: Washington
Province:	
* Country:	USA: UNITED STATES
* Zip / Postal Code:	98101

e. Organizational Unit:

Department Name:	Division Name:
Air Resources	Operations

f. Name and contact information of person to be contacted on matters involving this application:

Prefix:	Mr.	* First Name:	Mike
Middle Name:			
* Last Name:	Gilroy		
Suffix:			

Title: Manager, Meteorological and Technical Service

Organizational Affiliation:

* Telephone Number:	206-295-5844	Fax Number:	206-343-7522

* Email: mikeg@pscleanair.org

OMB Number: 4040-0004
Expiration Date: 01/31/2009

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9. Type of Applicant 1: Select Applicant Type:

D: Special District Government

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

Environmental Protection Agency

11. Catalog of Federal Domestic Assistance Number:

66.034

CFDA Title:

Surveys, Studies, Investigations, Demonstrations and Special Purpose Activities Relating to the Clean Air Act

*** 12. Funding Opportunity Number:**

EPA-OAR-OAQPS-07-01

* Title:

Community-Scale Air Toxics Ambient Monitoring

13. Competition Identification Number:

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

Washington counties of: King, Kitsap, Pierce and Snohomish

*** 15. Descriptive Title of Applicant's Project:**

Seasonal and Spatial Characterization of Tacoma and Seattle Area Air Toxics

Attach supporting documents as specified in agency instructions.

OMB Number: 4040-0004
Expiration Date: 01/31/2009

Application for Federal Assistance SF-424

Version 02

16. Congressional Districts Of:

* a. Applicant: WA-001
* b. Program/Project: WA-001

Attach an additional list of Program/Project Congressional Districts if needed.

2778-Additional_Congressional_Districts.doc

17. Proposed Project:

* a. Start Date: 09/01/2007
* b. End Date: 09/30/2009

18. Estimated Funding ($):

* a. Federal	541,217.00
* b. Applicant	100,000.00
* c. State	0.00
* d. Local	0.00
* e. Other	0.00
* f. Program Income	0.00
* g. TOTAL	641,217.00

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

○ a. This application was made available to the State under the Executive Order 12372 Process for review on [ ].

○ b. Program is subject to E.O. 12372 but has not been selected by the State for review.

● c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes", provide explanation.)**

○ Yes ● No

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

☑ **** I AGREE**

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

Authorized Representative:

Prefix: Mr. * First Name: Dennis

Middle Name: J.

* Last Name: McLerran

Suffix:

* Title: Executive Officer

* Telephone Number: 206-689-4004 Fax Number:

* Email: DennisM@pscleanair.org

* Signature of Authorized Representative: Tina Draughon * Date Signed: 04/17/2007

Authorized for Local Reproduction

Standard Form 424 (Revised 10/2005)
Prescribed by OMB Circular A-102

Application for Federal Assistance SF-424

Version 02

*** Applicant Federal Debt Delinquency Explanation**

The following field should contain an explanation if the Applicant organization is delinquent on any Federal Debt. Maximum number of characters that can be entered is 4,000. Try and avoid extra spaces and carriage returns to maximize the availability of space.

BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 4040-0006
Expiration Date 04/30/2008

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. Community-Scale Air Toxics Ambient Monitoring	66.034			$541,217.00	$100,000.00	$641,217.00
2.						$0.00
3.						$0.00
4.						$0.00
5. Totals		$0.00	$0.00	$541,217.00	$100,000.00	$641,217.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1) Community-Scale Air Toxics Ambient Monitoring	(2)	(3)	(4)	
a. Personnel	$53,545.00				$53,545.00
b. Fringe Benefits	$13,386.00				$13,386.00
c. Travel	$3,500.00				$3,500.00
d. Equipment					$0.00
e. Supplies	$15,000.00				$15,000.00
f. Contractual	$340,772.00				$340,772.00
g. Construction					$0.00
h. Other	$193,281.00				$193,281.00
i. Total Direct Charges (*sum of 6a-6h*)	$619,484.00	$0.00	$0.00	$0.00	$619,484.00
j. Indirect Charges	$21,733.00				$21,733.00
k. TOTALS (*sum of 6i and 6j*)	$641,217.00	$0.00	$0.00	$0.00	$641,217.00
7. Program Income					$0.00

Standard From 424A (Rev. 7-97)
Prescribed by OMB Circular A-102

SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8. Community-Scale Air Toxics Ambient Monitoring	$100,000.00			$100,000.00
9.				$0.00
10.				$0.00
11.				$0.00
12. TOTAL (sum of lines 8-11)	$100,000.00	$0.00	$0.00	$100,000.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**
13. Federal	$281,384.00	$82,496.00	$66,296.00	$66,296.00	$66,296.00
14. Non-Federal	$50,000.00	$12,500.00	$12,500.00	$12,500.00	$12,500.00
15. TOTAL (*sum of lines 13 and 14*)	$331,384.00	$94,996.00	$78,796.00	$78,796.00	$78,796.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16. Community-Scale Air Toxics Ambient Monitoring	$259,833.00			
17.				
18.				
19.				
20. TOTAL (*sum of lines 16-19*)	$259,833.00	$0.00	$0.00	$0.00

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges:	22. Indirect Charges:
23. Remarks:	

a. Title: Seasonal and Spatial Characterization of Tacoma and Seattle Area Air Toxics

b. Category: Community-Scale Monitoring

c. Applicant Information:

Puget Sound Clean Air Agency
1904 Third Avenue, Suite 105
Seattle, WA 98101

Mike Gilroy (mikeg@pscleanair.org), (206) 295-5844
Katherine Himes (kathyh@pscleanair.org), (206) 689-4095

The Agency is an air pollution control organization as defined in section 302(b) of the Clean Air Act. The Agency currently receives federal assistance funding and is eligible to receive grant funds under both sections 105 and 103 of the Clean Air Act. Please see http://www.pscleanair.org/about/default.aspx and http://apps.leg.wa.gov/RCW/default.aspx?cite=70.94.143.

d. Funding Requested. The total funding requested is **$541,217** for 24 months.

e. Total Project Cost.

The cost of the entire project is estimated at approximately $641,217. $541,217 will be provided by the requested EPA grant, and the remaining cost will be absorbed by the Agency and its partners. The Agency is contributing a significant amount of its own resources to offset the cost to EPA. In addition, the University of Washington is contributing significant technical expertise beyond federal assistance. These actions show our resolve toward the success of the project while maximizing the EPA's investment.

f. Project Period.

The project is expected to start in September 2007 and will last for 24 months (September 2009).

g. Descriptions of Proposed Projects.

1. Background.

Underlined air toxics in this section are of top priority locally and/or nationally, and are included for study in this proposal.

Seattle and Tacoma Urban Areas

The Environmental Protection Agency's (EPA) National Air Toxics Assessment (NATA) places the Seattle, Washington and Tacoma, Washington urban areas (in King and Pierce counties) in the top 5th percentile of the country for potential health (cancer) risk from air toxics.[1]

Seattle is home to a National Air Toxics Trend Site (NATTS) at Beacon Hill. In 2001, the Washington State Department of Ecology (Ecology) conducted toxics monitoring through an EPA grant at five additional sites in the Seattle urban area. These five additional monitoring sites were run for one year, and were located in a variety of areas to represent different source impacts. This monitoring, combined with receptor modeling performed on Beacon Hill speciation data, contributed to an air toxics evaluation for the Seattle area.[2] This evaluation, published by the Puget Sound Clean Air Agency (the Agency) and Ecology and partners, prioritized risk from diesel particulate matter and wood smoke, as well as priority urban area air toxics such as formaldehyde, hexavalent chromium, and benzene (polycyclic aromatic hydrocarbons (PAHs) were not included in this evaluation).

These same air toxics, as well as polycyclic organic matter (including PAHs) were identified in EPA's 1999 NATA at elevated potential cancer risk for this area.[3] NATA did not include estimates for wood smoke particulate matter. Currently, the Agency continues to publish NATTS data from Seattle Beacon Hill in its annual data summary, and rank toxics according to potential cancer risk.[4,5] In the industrial Duwamish valley neighborhoods, there is a great deal of community interest in air toxics from the port and nearby industrial sources. The Agency partners with the local health department and community environmental justice groups in these areas.

The Tacoma urban area, connected to Seattle via the Interstate 5 corridor, is host to many of the same air toxics sources as the Seattle urban area, including a major port, an interstate corridor, some industry, and neighborhood woodstoves and fireplaces. Census tracts in the Tacoma area were among those ranked highest

in the 1999 NATA for potential cancer risk of any census tracts in the Puget Sound area (King, Snohomish, Pierce, and Kitsap counties). Additionally, the monitor for the South End area of Tacoma will likely be designated non-attainment under EPA's stricter daily $PM_{2.5}$ standards. Monitoring has shown that elevated $PM_{2.5}$ levels mainly occur during the heating months, when a main source of fine particulate is wood smoke. The Agency has taken the initiative to begin actively working with a neighborhood council in the South End neighborhood to address air quality issues, and has performed temporary monitoring (using integrating nephelometers) during the last heating season to determine the extent of elevated $PM_{2.5}$ levels. Most of the focus in the Tacoma area has been "criteria pollutant-centric" – no air toxics monitoring has yet been conducted in the Tacoma area. Community members in the Tacoma area have expressed interest in local air toxics monitoring.

Both Seattle and Tacoma have major ports predicted to have major expansion in the next decade, due largely to increased demand for goods from Asia. There is growing interest in marine diesel emissions, and the Agency and partners in the Puget Sound Maritime Air Forum recently completed a comprehensive marine inventory including ports of Seattle and Tacoma.[6]

Air Toxics – A mixture of Particulates and Vapor Phase Pollutants

Air toxics encompass a diversity of chemicals, including both particulate and vapor phase components. Diesel exhaust and wood smoke are two of the highest priority sources of air toxics in Region 10 and nationally. Both of these sources emit complex chemical mixtures including both particulate and vapor phase air toxics. This proposal is unique in that it will address both components of air toxics, for a more comprehensive understanding of the concentrations and variability of these sources and toxics.

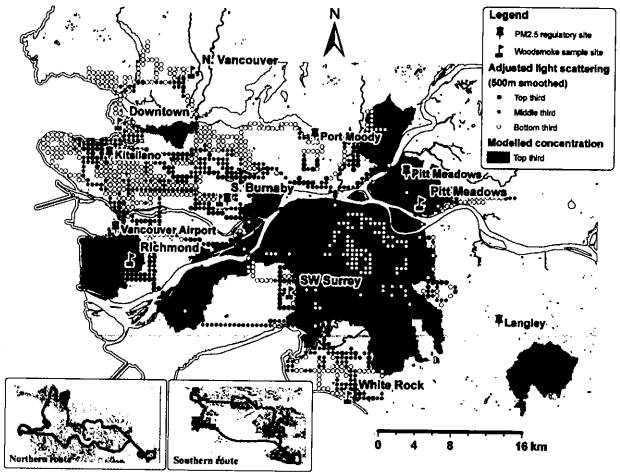
Diesel exhaust, and specifically diesel particulate matter, is considered a top air toxic of concern in the Puget Sound area, with over 75% of the potential cancer risk from air toxics attributed to DPM.[2] Resource-intensive receptor modeling based on fine particulate speciation data is considered the "gold standard" to estimate DPM concentrations. In addition, continuous methods measuring black carbon, related to elemental carbon, are used to inform on the scale and variation of DPM. While these continuous measurements are not specific to diesel, data collected in this study can be used for future analysis of DPM.

Diesel exhaust has been shown to present health risk and is classified as a probable human carcinogen (classified 2A by IARC).[7,8] The California Air Resources Board has established a quantitative risk factor based on the particulate matter portion of diesel exhaust.[9] The gases contained in diesel exhaust are also listed as priority air toxics by EPA. These include but are not limited to: PAHs, benzene, formaldehyde, and acrolein.[10]

Wood smoke, known to present health risk, was recently assessed as a category 2A carcinogen by the International Agency for Research on Cancer (IARC).[11] As with diesel exhaust, wood smoke has both a particulate component demonstrated to present health risk, as well as several vapor phase air toxics. These include but are not limited to: PAHs, benzene, formaldehyde, acetaldehyde, 1,3-butadiene, and acrolein.[12,13]

Several useful metrics have been established to estimate woodsmoke. These are much less labor and resource intensive than the gold standard of receptor modeling with fine particulate speciation data. Levoglucosan and methoxyphenols are two of these metrics. Levoglucosan, an anhydrous sugar derived from the pyrolysis of the major wood polymer cellulose, is one of the most abundant organic compounds associated with particles in woodsmoke.[14,15] It is stable in the environment and has been used extensively to estimate wood smoke levels in ambient particulate matter (PM) samples.[16,17] Methoxyphenols are derived from the pyrolysis of the wood polymer lignin – their presence in atmospheric samples is a unique tracer for biomass combustion. Guaiacol is the simplest and most abundant of the methoxyphenols in wood smoke, and it exists almost exclusively in the vapor phase.[18] Several methoxyphenols have been used in source attribution models to determine the contribution of wood smoke to ambient PM.[19]

Figure1. Regions of High, Medium, and Low Woodsmoke in British Columbia



A number of recent studies have shown that there can be substantial spatial variability of selected air pollutants within urban areas.[20,21,22,23,24] These findings have important implications for the design and interpretation of epidemiological analyses and for air quality management.[25,26,27,28,29,30]

A better understanding of the neighborhood scale spatial variability in urban wintertime wood smoke will aid in the interpretation of the resulting measurements and emissions reduction strategies. Likewise, a better understanding of variability in summertime vehicle pollutants will similarly aid in prioritizing areas for emissions reductions.

The University of Washington in collaboration with the University of British Columbia recently used a combination of mobile and fixed-location monitoring to collect a set of spatially resolved fine particle mass and levoglucosan measurements in Vancouver and Victoria, British Columbia.[31] These measurements were incorporated into a geographic information systems (GIS)-based model framework in order to identify sub-regions of 20-to-50 square kilometers within an urban area that are categorized as having high, medium or low woodsmoke (see Figure 1). The overall approach resulted in the ability to identify the location of elevated, persistent night-time levels of fine particles that are consistent with the presence of wood smoke and that are not captured by a relatively dense regulatory ambient monitoring network.

2. Project objectives.

The main project objectives are:

1. Determine base-line (fixed site) air toxics concentrations for the Tacoma area and provide select sites in the Seattle area for comparison.
2. Characterize seasonal spatial patterns of key air toxics.
3. Determine health risks from exposure to air toxics, and communicate them clearly to the community.

Objective 1. Determine base-line air toxics concentrations for the Tacoma area and provide select sites in the Seattle area for comparison. Seattle sites will complement the NATTS site at Beacon Hill and will also build on the pilot study conducted in 2001 as part of an EPA air toxics community grant. Concentrations at Seattle sites will be compared to Tacoma sites to inform intra-city variability. The Agency will monitor at up to five fixed sites, potentially including:

1. South End Tacoma site – This site has $PM_{2.5}$ concentrations that will likely violate EPA's new, stricter $PM_{2.5}$ daily standard, and is representative of a "maximum concentration urban wood smoke" site in our 4-county jurisdiction. This site is situated in an area with an active neighborhood council concerned about air quality. We will leverage speciated trends network (STN) speciation data currently being collected at this site.
2. Port of Tacoma site – The Agency will work with the Port and partners to establish a site that will be representative of port impacts as well as community impact. The Agency may consider conducting $PM_{2.5}$ speciation sampling at this site to better understand the composition and sources of $PM_{2.5}$.
3. Tacoma neighborhood scale site – The Agency will identify a third air toxics monitoring site in the Tacoma area. This site will be situated in an area near several high volume arterials and with high population density, and will ideally be placed in an environmental justice community.
4. Port of Seattle/Urban industrial site – This site will be impacted by both the Port of Seattle, as well as industry. If possible, the Agency will leverage the existing Duwamish site, which currently has STN speciation data. This site is located in the Duwamish valley, near the South Park and Georgetown environmental justice community. This Agency has a relationship with this community who is very

involved in air quality concerns. In addition, this site is very close to the Georgetown 2001 pilot study site.

5. Seattle roadway site – This site may leverage the Olive Street site, where STN speciation data is currently conducted. This site, located on an apartment building, is unique in that it is directly adjacent to Interstate 5 and may represent a "worst case" near roadway exposure.

Table 1 summarizes the air toxics the Agency proposes to monitor at up to five sites throughout the Tacoma and Seattle area. Fixed site monitoring will be conducted at each site at a sampling frequency of 1 in 6 days, for one year.

Table 1. Proposed air toxics at fixed sites

Air Toxic	Method	3. Tacoma Neighborhood 5. Seattle roadway	1. Tacoma South End 2. Tacoma Port 4. Seattle Port/Industrial
Benzene	TO-15	X	X
1,3-Butadiene	TO-15	X	X
Carbon Tetrachloride	TO-15	X	X
Chloroform	TO-15	X	X
Dichloromethane	TO-15	X	X
1,2-Dichloropropane	TO-15	X	X
Tetrachloroethylene	TO-15	X	X
Trichloroethene	TO-15	X	X
PAHs	TO-13A		X
Acetaldehyde	TO-11A	X	X
Formaldehyde	TO-11A	X	X

In the interest of maximizing resources, the Agency does not propose to measure air toxic metals at these five sites. Instead, the Agency will leverage the $PM_{2.5}$ metals data that are already collected at STN sites at the Tacoma South End (1), Seattle Port/Industrial (4), and Seattle roadway (5) sites. Although air toxics and STN metals data are different particle sizes (<10 and <2.5 μm) and represent different analytical techniques, our comparison of the two at Beacon Hill reflects the differences to be inconsequential. In the Seattle and Tacoma urban areas, PM_{10} levels are typically very low, so one would expect PM_{10} metals to be roughly equivalent to $PM_{2.5}$ levels. In addition, in our area, metals do not drive risk, with the exception of hexavalent chromium. Hexavalent chromium is an air toxic of concern in our area, but is not addressed in this current proposal largely due to uncertainty in the reliability of existing monitoring and analysis methods. The Agency is open to conducting additional metal sampling and analysis if required by EPA, but these costs would need to be added to the expense totals for the submitted proposal.

The Agency proposes to monitor PAHs at only three sites in the interest of conserving resources. These three sites include the South End Tacoma site and the two sites located near ports (sites 1, 2, and 4 in Table 1). Presumably, these will be most impacted by wood smoke and diesel emissions, both primary sources of PAHs.

For fixed site monitoring, the Agency will adopt Ecology's existing EPA-approved air toxics monitoring quality assurance plan.[32] The Agency will send samples for analysis at an EPA-approved contract lab, such as Eastern Research Group.

The Agency will conduct meteorology measurements at all sites: wind speed, wind direction, temperature, humidity. The Agency will also conduct $PM_{2.5}$ and black carbon (aethalometer) measurements at all sites.

The Agency will leverage resources available to them, rather than purchasing new monitoring equipment. For example, the Washington State Department of Ecology can provide equipment as available, which may include: canister samplers for VOCs, carbonyl samplers and cans, and samplers for PAHs. In addition, the University of Washington has agreed to provide canisters for VOC samples, as available.

The Agency's plan for Objective 1, fixed site monitoring, clearly leverages both federal and local resources and previous work conducted with EPA grants. This work builds on relationships the Agency has already developed with proposed communities. Additionally, air toxics to be measured are local/national priorities.

Objective 2. Characterize seasonal spatial patterns of key air toxics. The Agency and partners will collect monitoring information that better informs how wood smoke concentrations and diesel exhaust, and the air

toxics associated with them (PAHs, volatile organic compounds [VOCs]), vary spatially across and within neighborhoods. This monitoring will be conducted seasonally with a "tiered approach."

Previous experience in Seattle and Vancouver using mobile light scattering measurements have proved successful in identifying elevated nighttime levels of fine particles in certain residential areas not captured by traditional fixed-site regulatory monitors.[33,34] and in identifying "hot spots" of particulate black carbon during evening rush hour in the summertime.[35] We propose employing these same methods and complementing them with additional air toxics measurements.

Table 2. Measurements to characterize community-wide spatial variation in ambient concentrations of wood smoke and diesel exhaust associated air toxics

Tier	Activity Description	Instruments Used (measurements collected)	Frequency
1	"Preliminary identification" via mobile monitoring to identify air pollution "hotspots"	Nephelometer (PM); PSAP (black carbon); Ecochem (particle bound PAHs); GPS	Up to 20 nights/ season (heating & non-heating)
2	Intensive continuous measurements of HAPs at approximately 3 "hotspots" identified in Tier 1	Nephelometer (PM); PSAP (black carbon); Ecochem (particle bound PAHs); MIMS (guaiacol; BTEX); GPS	Up to 2 weeks/ season
3	24-hr fixed site measurements at selected "hotspots" to validate continuous data and to compare with community monitors	Filters ($PM_{2.5}$, levoglucosan); sorbent tubes (aldehydes); summa canisters (BTEX, other VOCs)	Up to 10 days/ season

Sampling plan overview

Monitoring will be conducted, at a minimum, in the neighborhoods surrounding the three fixed air toxics sites in Tacoma. These are neighborhoods that will potentially be designated non-attainment under EPA's new $PM_{2.5}$ daily standard, and have previously not been monitored for air toxics. Where resources allow, we will include the Seattle air toxics sites. Monitoring will be conducted in each of two seasons (heating, non-heating).

Tier 1 and 2 monitoring will be conducted during periods of poor ventilation using meteorological data to forecast these periods, and are thus dependent on meteorology. For wood smoke, winter monitoring will be performed on cold, calm winter evenings at times when wood burning is expected to be relatively high and traffic is at a minimum. For diesel exhaust, monitoring periods will favor daytime afternoon traffic peaks when the daytime mixing depths are relatively constant.

Tier 1 – Preliminary identification mobile monitoring

Tier 1 "qualitative" monitoring will involve a continuously moving platform and will provide a highly spatially resolved map of a relatively limited number of pollution measures within each neighborhood (within 10 km of the community monitoring site). As in our previous studies, the instrumentation will be placed inside a vehicle and connected to a sampling manifold inlet placed out an otherwise sealed window. A field log will record any close encounters with heavy-duty diesel vehicles that would otherwise cause excessively high spikes in the data record. Sampling instruments will include:

- A nephelometer (Radiance Research M903, Seattle, WA.), equipped with a small air blower and air pre-heater and the averaging time set at 15 seconds.
- A GPS receiver logging position every 5 seconds.
- A particle soot absorption photometer (this instrument has been shown to be successful in a moving vehicle/resistant to vibration interference).
- An EcoChem PAS 2000 instrument set at a 15 second averaging time for PAHs.

The neighborhood sampling routes will be established prior to sampling and traversed in either a clockwise or counterclockwise direction on any given evening as determined randomly. These routes will be established based on neighborhood characteristics such as location of major roads and populated areas and census tract level wood smoke use surveys, as well as air quality monitoring the Agency has recently conducted in the Tacoma area. Routes will be constrained based on the time it takes to traverse them. Temporal adjustments of night-to-night variations in measured concentrations will likely be necessary. For this reason, we will site a nephelometer and an aethelometer at the appropriate fixed air quality monitoring site during the nightly traverses. These fixed-site measurements should sufficiently control for temporal variation and allow us to composite the mobile measurements over time.

Tier 2 – Intensive continuous samples

Tier 2 quantitative monitoring will be done at five to seven "Tier 2 satellite" locations surrounding each of the three air toxics sites in Tacoma. These locations will be identified by Tier 1 measurements as being consistently higher, lower or similar in magnitude to the corresponding Tier 1 values at the community monitoring site locations. These Tier 2 satellite sites will be visited for 15 to 30 minutes each during a given sampling day. The mobile platform will move from one of these locations back to the community monitoring site to sample for a similar length of time prior to moving to the next Tier 2 satellite site. In this way, we will tightly control for variations over time that could otherwise confuse our understanding of the spatial variability across sites.

We anticipate completing two sets of measurements at each satellite location in a single evening. The Tier 2 studies will use the sample equipment used for the Tier 1 characterization [Nephelometer (PM); PSAP (black carbon); Ecochem (particle bound PAHs)], with the addition of an MIMS system. The MIMS instrument will provide simultaneous measurement of guaiacol (a wood smoke specific VOC), BTEX and other selected VOCs, with 10-15 minute resolution, as described below.

Membrane introduction mass spectrometry (MIMS):

Membrane introduction mass spectrometry (MIMS) has been used for over 25 years as a direct sampling interface for mass spectrometry. Over the last decade, its use for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) in air has been well documented.[36]

A coaxially heated MIMS system, operated in the pulsed heating mode, provides temporally resolved measurements in the parts-per-billion to parts-per trillion range every 15 minutes for a variety of toxicologically important VOCs and SVOCs. This MIMS system can be located at a fixed site (e.g., a speciation or air quality monitoring site), or it can be mounted on a mobile platform and used to measure VOC and SVOC levels in transects through an air shed. MIMS data are shown below in Figure 2 for VOCs as part of a study in British Columbia. Figure 3 shows MIMS data for both VOCs and methoxyphenols.

Tier 3 – Fixed site filter sampling for $PM_{2.5}$, levoglucosan, aldehydes and selected VOCs

Tier 3 monitoring will involve establishing and operating fixed "Tier 3 satellite" sites at two locations near the South End Tacoma site (site 1 in Table 1) and two locations near the Port of Tacoma site (site 2). The Tier 3 satellite site locations will be chosen based on the Tier 2 results such that one site is co-located with the fixed monitor and at a site with higher air toxics concentrations. In the unlikely case that no gradients are seen at a site, then the Agency and partners will not conduct Tier 3 sampling at that location.

Figure 2. Urban Airshed Transects from British Columbia using MIMS

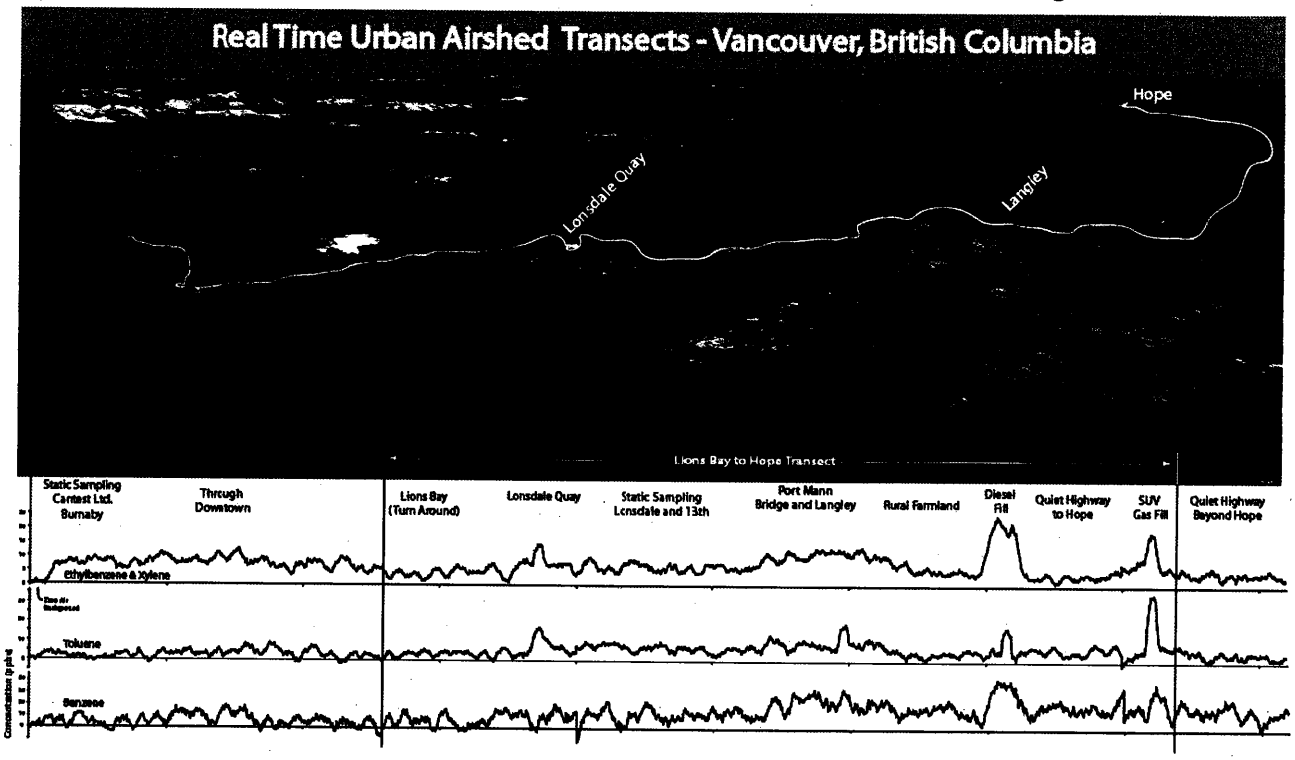
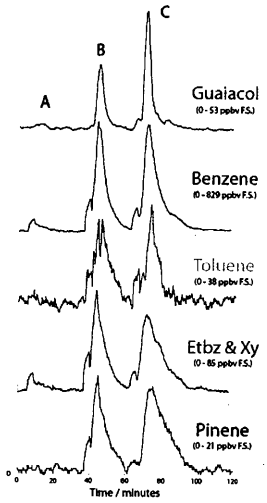


Figure 3. MIMS Data



Tracer molecule concentration comparisons may facilitate source identification.

Woodsmoke Fuel Source / Ratio, Corrected [ ]	[Benzene] [Guaiacol]	[Benzene] [Toluene]	[Benzene] [Etbz & Xy]
A. Cedar (Evergreen)	38.2	28.2	5.52
B. Douglas Fir (Evergreen)	28.3	25.6	9.71
C. Big Leaf Maple (Hardwood)	15.2	21.3	12.5

Ambient Air Background 0-5 min.

The Tier 3 satellite monitors will be operated for approximately 10 days in each of the two sampling seasons at times when the community sites are also sampling. Samples will include Teflon filters for measurement of $PM_{2.5}$, and levoglucosan (wood smoke tracer); sorbent tubes for measurement of aldehydes (formaldehyde, acetaldehyde) and summa canisters for measurement of BTEX and other VOCs. These time-integrated samples will also be sent to the same EPA-approved contract lab as the fixed site samples. For each measured species, the relative ranking of each site's average concentration compared with the community monitor will be compared with that derived from the measurements taken with the mobile MIMS platform.

Spatial characterization of air toxics concentrations and identifying areas of peak concentrations for top air toxics of concern will contribute to the most effectively targeted emissions reductions.

Objective 3. Determine health risks from exposure to air toxics, and communicate them clearly to the community. The Agency and partners will use annual ambient air toxic statistics to estimate potential health risk. These will be summarized and communicated in a report to the community.

Data Analysis. Fixed site monitoring data will be statistically summarized, with any outliers flagged/addressed. Potential cancer risk estimates will be generated from annual concentrations at fixed sites. Additional non-cancer risk reference concentrations will also be compared to ambient concentrations.

Air toxics evaluation. The Agency and partners will publish an air toxics evaluation following conclusion of monitoring. The report will include both quantitative and qualitative components to describe the results of fixed site and mobile monitoring. The evaluation will help the Agency to communicate air toxics risk to the community and prioritize air toxics for reduction. The evaluation will include, at a minimum:

- A statistical summary of fixed site monitors. The Beacon Hill NATTS site data for the same time period will also be included in the summary.
- A complete description of the fixed sites, including what scale they represent, what sources they're likely impacted by, meteorology, topography, land use, demographics, etc.
- A potential cancer risk ranking of air toxics at fixed monitors.
- A screening and discussion of non-cancer health risks.
- A discussion/comparison of fixed sites, both inter- and intra-city.
- A comprehensive discussion of the spatial variation of air toxics near fixed monitors (a summary of Objective 2).
- Correlations of the fine scale spatial variations of several air toxics with fine particulate and particle bound wood smoke tracers (levoglucosan and guaiacol).
- GIS-based displays of concentrations overlaid with relevant demographic information.
- Results of this evaluation will influence areas that the Agency targets for wood smoke/air toxics reductions. Also, results of this mobile monitoring will be shared with the community to help highlight the health risks associated with woodsmoke.
- The Agency is well-positioned with community groups and local health departments in both the Tacoma and south Seattle (Duwamish) area, and will perform outreach and education to share results of this report.

3. Project tasks, deliverables, and timeline. All tasks are dependent upon funding availability in July 2007. Because the mobile sampling has a strong seasonal component, any change to the funding award date may significantly change the Tier 1, 2, and 3 sampling schedule.

Table 3. Tasks, deliverables, responsible parties, and timelines

Task	Deliverable	Responsible Party/ Accountable Party	Timeline
EPA awards grant and funding	Region makes funding available	EPA	July 2007
Quarterly progress reports to EPA	Quarterly report	Puget Sound Clean Air Agency(PSCAA)	Quarterly – to be established
Complete, submit quality assurance (QA) plan for mobile monitoring	QA plan	University of Washington (UW)	September 2007
Complete and submit data quality objectives (DQOs)	Data quality objectives	PSCAA/UW	September 2007
Determine mobile monitoring routes, begin Tier 1 sampling	Memo with rationale	UW/PSCAA	September/October 2007
Finalize fixed site monitor locations, set up monitoring logistics	Memo with rationale	PSCAA/UW	October 2007
Fixed site sampling (5 sites)	All data uploaded to AQS	PSCAA/UW/EPA contract lab	Monitoring: approx. October 2007- October 2008. AQS data will be uploaded within 4 months after conclusion of monitoring
Tier 2 mobile sampling	Data collection and analysis completed	PSCAA/UW	Winter 2007 and 2008, Summer 2008 and 2009
Tier 3 mobile sampling	Data collection and analysis completed	PSCAA/UW/EPA contract lab	Winter 2007 and 2008, Summer 2008 and 2009
Draft air toxics evaluation	Draft air toxics evaluation	PSCAA/UW	5 months after data collected
Final air toxics evaluation	Final air toxics evaluation	PSCAA/UW	2 months after draft
Community outreach – results and recommendations from air toxics evaluation	Outreach events/ community feedback	PSCAA	Summer/fall 2009
Final report to EPA	Final report	PSCAA	<90 days after end of project
Presentation at EPA national monitoring conference	Presentation	PSCAA/UW	To be determined

4. Environmental outputs/outcomes.

Air Quality System (AQS) air toxics data. Fixed site monitoring and Tier 3 monitoring will provide additional air toxics data to EPA's Air Quality System (AQS).

Leveraging of speciation data and future source apportionment. Where possible, air toxics monitors will be placed at sites that have speciation trends network (STN) speciation data. These two sites will include: the Tacoma South L site and the Seattle Duwamish site. Data collected as part of and in conjunction with this grant will be used in the future for source apportionment. This is especially important for those air toxics of concern without direct monitoring methods (for example diesel and wood smoke particulate matter).

Model validation. Air toxics data from this project will be shared with the NW AIRQUEST consortium, a Region 10 community of regulatory and academic experts dedicated to improving technology tools for air quality management. NW AIRQUEST currently runs a community-scale CMAQ model (AIRPACT) including

air toxics for the Tacoma and Seattle areas.[37] Data validation for air toxics measured in the AIRPACT system has been historically sparse, with only the Beacon Hill NATTS site. Additionally, concentrations will be compared to model predictions when the 2002 National Air Toxics Assessment (NATA) becomes available.

Inform/improve emission reduction strategies. By targeting geographic areas of concern as well as air toxics of concern, the Agency can incorporate findings into its strategic planning and emission reduction programs. The Agency recently completed a strategic plan, to be implemented over the next ten years.[38] The data collected from this study will directly support several of the key focus areas of this strategic plan.

Community outreach and environmental justice. The Agency already has contact with the communities in areas included in this proposal, considered environmental justice communities. Results from these studies will help these communities to estimate their risk from air toxics and prioritize their advocacy and emission reduction efforts. To aid communicating results and risks, the Agency will prepare "fact sheets" to summarize results. Staff from the Agency's communications department will assist in this area.

Transferability to other projects. Data from fixed site monitors in two urban areas and mobile monitoring focused on those monitors will contribute to the assessment of both inter- and intra-city variability. This information may be applied to other urban areas with similar characteristics/sources.

Support health assessments. Data and reports will be shared with partners at the local and state health departments, who have expressed interest in incorporating results into future health risk assessments and epidemiological studies.

5. Roles and qualifications of applicant and subgrantee partners.

Contract Manager - Mike Gilroy will be responsible for the successful execution of the contract. Mr. Gilroy will regularly interact with team members, including Agency and University of Washington staff. Mr. Gilroy will regularly interface with EPA's contract officer regarding project-related issues and the Agency's team performance to ensure that all work performed adheres to the approved budget and schedule, while meeting expectations of the project.

Project Operations Coordinator- Kathy Himes will be responsible for operational oversight of the projects routine activities ensuring that milestones are being met and that required reports are generated and submitted promptly. As Ops Coordinator, along with the Contract Manager she will interact routinely with the University of Washington participants providing project guidance and support ensuring they are delivering expected products and showing required progress toward the successful outcome of the overall project.

Monitoring Supervisor- Matt Harper will oversee Agency monitoring-related matters and personnel, including set-up and operation of the fixed sites, trouble-shooting challenges that arise, and coordinating monitoring personnel schedules.

Quality Assurance/Quality Control Manager - Erik Saganic will ensure quality assurance and control, per the Washington State Quality Assurance Plan.

6. Biographical information of the key personnel.

Mike Gilroy, Puget Sound Clean Air Agency - Mr. Gilroy is a Meteorologist and Manager of Technical Services. He has more than 35 years of meteorological experience and nearly 12 years of experience in ambient air monitoring network design and new technology implementation. He has been an active partner on a number of EPA national air monitoring and air toxics monitoring committees.

Kathy Himes, Puget Sound Clean Air Agency - Ms. Himes holds a Bachelor of Science in Engineering from the University of Michigan as well as a Master's in Environmental Health from the University of Washington, and is a Professional Engineer in Washington State (#41906, Environmental). Ms. Himes brings 3 years of air quality management experience, as well as 8 years environmental consulting and outreach experience.

Matt Harper, Puget Sound Clean Air Agency - Mr. Harper holds a Master's in Business Administration from the University of New Haven, CT as well as a Bachelor of Science in Manufacturing Engineering from Boston University, MA. In his current role, he is in charge of the team that operates and maintains 20 monitoring sites, and over 80 monitoring and meteorological monitoring instruments throughout the Puget Sound. He brings 4 years of ambient air monitoring experience as well as 7 years of professional engineering, management, and training experience in his service with the United States Navy.

Erik Saganic, Puget Sound Clean Air Agency - Mr. Saganic has a B.S. in Chemistry from Brown University and an M.S. in Chemistry from the University of Washington. He has over 7 years of data analysis and research experience from the private sector and academia, and has published a number of papers. He has worked in the field of environmental science for over 3 years. He currently co-manages quality assurance responsibilities and assists air monitoring projects.

Dr. Michael Yost, University of Washington - Dr. Yost is a professor and the director of the Industrial Hygiene and Safety program at UW. He received his Ph.D. from the UC Berkeley in Environmental Health Sciences with a minor in Electrical Engineering and Biostatistics. He founded and directs the optical remote sensing lab at UW and has published widely on remote sensing measurements of chemical and aerosol contaminants.

Dr. Timothy Larson, University of Washington - Dr. Larson is the Alan and Inger Osberg Professor of Civil and Environmental Engineering at the University of Washington and also holds an adjunct appointment in the Department of Occupational and Environmental Health Sciences. His expertise is in characterization of urban air pollution, exposure assessment of airborne particles and gases, and source/receptor relationships of ambient air pollutants.

Dr. Chris Simpson, University of Washington – Dr. Simpson is a Professor in the Department of Environmental and Occupational Health Sciences. He received his Ph.D. from the University of British Columbia in Chemistry, and has a Master's and Bachelor's in Chemistry and Biochemistry, respectively. Dr. Simpson's expertise is developing sensitive analytical methods for measuring exposure to airborne contaminants, including chemicals derived from diesel exhaust and wood smoke.

h. Itemized Budget.

Category	Amount	Notes
1. Personnel	$ 53,545	approximately 0.4 FTE
2. Fringe Benefits	$ 13,386	
3. Contractual Costs – Contract Lab	$340,772	418 VOC, 490 carbonyl, and 216 PAH samples
4. Travel	$ 3,500	travel for 2 to present at conference
5. Equipment	$ 0	no equipment purchase necessary
6. Supplies	$ 15,000	filters, samplers, tubes, and monitoring supplies
7. Other (sub-award)	$193,281	UW sampling assistance and expertise
8. Total Direct Costs	$619,484	
9. Total Indirect Costs	$ 21,733	
10. Total Cost	**$641,217**	
11. Total Cost after Agency Contribution	**$541,217**	**the Agency will contribute up to $100,000**

i. Environmental Results Past Performance: The Puget Sound Clean Air Agency has been the recipient of several EPA grant awards. The Agency has accounting procedures in place that are compliant with federal auditing and reporting requirements, including on-time submittal of required, quarterly progress reports. During the past three years, the Puget Sound Clean Air Agency has received the following federal grants. Progress and results under these agreements were achieved according to established goals and timelines.

Grantor Agency	Program Name	Federal CFDA #	Current Year Expenditures
U.S. EPA	Outdoor Burning Communication & Education	66.034	$ 14,900
U.S. EPA	Air Quality Forecasting & Special Air Quality Studies	66.034	$ 24,562
U.S. EPA	Biowatch-Homeland Security	66.034	$ 329,931
U.S. EPA	Western Washington Clean Buses, Healthy Kids	66.034	$ 45,297
	Total FY 2006		$ 414,690
U.S. EPA	Clean Diesel School Bus	66.606	$ 88,977
U.S. EPA	Air Quality Forecasting & Special Air Quality Studies	66.034	$ 45,642
U.S. EPA	Biowatch-Homeland Security	66.500	$ 252,931
U.S. EPA	Western Washington Clean Buses, Healthy Kids	66.034	$ 172,342
	Total FY 2005		$ 559,892

U.S. EPA	Clean Diesel School Bus	66.606	$ 157,380
U.S. EPA	Air Quality Forecasting & Special Air Quality Studies	66.034	$ 27,842
U.S. EPA	Biowatch-Homeland Security	66.500	$ 147,601
U.S. EPA	Collaborative Process for Puget Sound Air Quality Management & Energy Efficiency	66.034	$ 30,000
		Total FY 2004	$ 362,823
		3-Year Total	**$1,337,405**

j. Programmatic Capability. The Puget Sound Clean Air Agency has successfully completed or is continuing work on the three projects listed below. These projects are similar in size, scope, and relevance to the proposed project.

Grantor Agency	Program Name	Federal CFDA #	Expenditures
U.S. EPA	Biowatch-Homeland Security	66.500	$ 748,563
U.S. EPA	Clean Diesel School Bus	66.606	$ 281,812
U.S. EPA	Air Quality Forecasting & Special Air Quality Studies	66.034	$ 98,046

For these three projects, the Agency is meeting, or has met, all technical and reporting requirements including submission of periodic and final technical reports. As a frequent recipient of federal funds, our Agency has developed an experienced finance and technical staff with proven ability to manage grants efficiently and effectively. Our staff is regularly trained in contracts management and our Agency is audited annually. Our technical project officers have years of experience directing technical studies and managing projects, including a state-funded diesel retrofit grant program of nearly $2 million annually.

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