FINAL WORK PLAN
MASSPORT AIR QUALITY MONITORING STUDY, YEAR 2
LOGAN INTERNATIONAL AIRPORT

Prepared for

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May 2011
Version: Revised
Original: August 2010
EA Project No.: 14774.01

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LIST OF ACRONYMS

AAL	Allowable ambient limits
APU	Auxiliary power unit
AQCR	Air Quality Control Region
BAM	Beta attenuation monitor
BC	Black carbon
CAA	Clean Air Act
CO	Carbon monoxide
DNPH	2,4-dinitrophenylhydrazine
EA	EA Engineering, Science, and Technology, Inc.
EIR	Environmental Impact Report
EOEA	(Massachusetts) Executive Office of Environmental Affairs
EPA	(U.S.) Environmental Protection Agency
ESPR/EDR	Environmental Status and Planning Report/Environmental Data Report
FAA	(U.S.) Federal Aviation Administration
GC/MS	Gas chromatography/mass spectrometry
GSE	Ground support equipment
HAP	Hazardous air pollutant
HPLC	High-performance liquid chromatography
LAIP	Logan Airside Improvements Project
MADPH	Massachusetts Department of Public Health
MassDEP	Massachusetts Department of Environmental Protection
MEPA	Massachusetts Environmental Policy Act
MHD	Massachusetts Highway Department
NAAQS	National ambient air quality standards
NO_2	Nitrogen dioxide
O_3	Ozone
PAH	Polynuclear aromatic hydrocarbon
Pb	Lead
PM	Particulate matter
$PM_{2.5}$	Particulate matter with an equivalent aerodynamic diameter of 2.5 micrometers
PM_{10}	Particulate matter with an equivalent aerodynamic diameter of 10 micrometers

ppbv	Parts per billion by volume
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RfC	Reference concentrations
SO_2	Sulfur dioxide
SVOC	Semi-volatile organic compound
TAP	Toxic air pollutant
$\mu g/m^3$	Micrograms per cubic meter
VHB	Vanasse Hangen Brustlin, Inc.
VOC	Volatile organic compound

EXECUTIVE SUMMARY

As part of the Massachusetts Environmental Policy Act (MEPA) Certificate on the Final Environmental Impact Report (EIR) for the Logan Airside Improvements Project (LAIP), the Secretary of the Executive Office of Environmental Affairs (EOEA) has called for an air quality study to be conducted by Massport (Study). The purpose of the Study is to monitor air quality conditions with a focus on air toxics in the vicinity of Logan International Airport (Logan) in advance of, and following, the implementation of the new Centerfield Taxiway. The Centerfield Taxiway is one of the primary components of the LAIP.

This document contains the final Work Plan for conducting the second year of the Study, based on the first year's work plan, and reflects input from the Massachusetts Departments of Public Health (MADPH) and Environmental Protection (MassDEP), as required in the MEPA Certificate. This Study will be completed by the Massachusetts Port Authority (Massport), the owner and operator of Logan. The primary components of the Work Plan are described below:

Monitoring Sites

Because the monitoring site locations can directly affect the utility and representativeness of the collected data, several key considerations were made in their selection, including:

- Consistency with the MEPA Certificate as being under (or near) the airport flight paths and in neighborhoods surrounding Logan

- Distance and direction from the Centerfield Taxiway

- Prevailing wind directions, other nearby sources of emissions, and site access and security.

Based upon these criteria, coupled with input from MADPH and MassDEP, three primary sites have been established to carry out the air monitoring methods specifically selected for this Study. In addition, seven satellite sites and one urban background site will be monitored for PM 2.5. The urban background site will be located at the MassDEP Harrison Avenue site.

Target Pollutants

Air toxics (also known as hazardous air pollutants [HAPs]) are emitted from a variety of emission sources, both natural and manmade. Therefore, the target pollutants for the Study are specifically selected as they represent the primary forms of combustion products or evaporative emissions from airport-related sources. They include:

- Volatile organic compounds (VOCs)
- Carbonyls (e.g., formaldehyde)
- Semi-volatile organic compounds (SVOCs)/polynuclear aromatic hydrocarbons (PAHs)
- Particulate matter (PM)
- Black carbon (BC).

Although not classifiable as HAPs by the U.S. Environmental Protection Agency (EPA), PM and BC serve as indicators (or surrogates) to the presence of fuel combustion products. Moreover, both PM and BC are pollutants of concern to MassDEP, MADPH, and the general public.

Monitoring Methods

Both continuous (real-time) and time-integrated monitoring methods are included in the Study. This combined approach blends together the benefits of two distinct but related methods.

Importantly, the primary sites will utilize monitoring methods that have been identified by EPA as representing the best elements of peer-reviewed, standardized methods for the determination of toxic organic compounds in ambient air.

A telemetry system will be incorporated into the monitoring approach to maximize data recovery and provide remote access to the data in real time.

Data Analysis and Reporting

Data analysis and reporting will be performed after completion of the Study. To distill the data into meaningful information, it will be assimilated into summary statistics that are intended to give the reviewers a comprehensive, yet concise, interpretation of the findings.

Schedule

This work plan is for the second period, which will commence in September 2010 and extend for 12 months.

1. INTRODUCTION

This document represents the Work Plan for conducting Year 2 of the Logan International Airport Air Quality Monitoring Study (Study). This document incorporates revisions based on comments received from the Massachusetts Departments of Public Health (MADPH) and Environmental Protection (MassDEP).

The Study is required by the Secretary of the Executive Office of Environmental Affairs (EOEA) in a Massachusetts Environmental Policy Act (MEPA) Certificate on the final Environmental Impact Report (EIR) for the Logan Airside Improvements Project (LAIP)[1]. Briefly stated, the Study is comprised of a monitoring program designed to measure air quality conditions (with a focus on air toxics) under (or near) the flight paths and in the neighborhoods surrounding Logan International Airport (Logan). The Study will be completed by the Massachusetts Port Authority (Massport), which owns and operates Logan.

Within the sections that follow, the Study objectives are clearly defined, the overall approach to meeting the objectives is discussed, and the technical elements of the monitoring program are presented. Summarized below is further information on Logan, the LAIP, and the MEPA Certificate as it pertains to the Study.

1.1 MEPA CERTIFICATE AND STUDY OVERVIEW

Logan is New England's largest transportation center and occupies approximately 2,400 acres in East Boston, Massachusetts (see Figure 1). In 2005, Logan ranked as the 20th busiest airport in the U.S. based on volume of over 27 million passengers. The airfield contains six runways (4R/22L, 4L/22R, 15R/33L, 15L/33R, 9/27 and 14/32) and associated taxiways, aprons, and terminal facilities and is surrounded by Boston Harbor and the communities of East Boston, South Boston, and Winthrop.

On 15 June 2001, the EOEA Secretary issued a MEPA certificate on the LAIP Final EIR. The LAIP serves as the blueprint for a series of improvements to Logan over several years. One important component of the LAIP is the Centerfield Taxiway, a new 9,300-foot taxiway to be constructed between existing runways 4R/22L and 4L/22R.

[1] Massachusetts Executive Office of Environmental Affairs, *Certificate of the Secretary of Environmental Affairs of the Final Environmental Impact Report,* Logan Airside Improvements Planning Projects, June 15, 2001.

	MASSPORT AIR QUALITY MONITORING STUDY		FIGURE 1 SITE LOCUS	
PROJECT MGR: RN	CREATED BY: PT	0 0.5 1 2 Miles	DATE: JULY 2010	EA PRJT NO: 14774.01	FILE: FIG1_LOCUS.MXD

The EOEA Secretary issued the following condition in the MEPA certificate with respect to the Centerfield Taxiway.

> *"[I]n addition, within the ESPR process Massport shall conduct follow-up air quality monitoring in neighborhoods surrounding the airport and under the flight path of Logan Airport. This information will be shared with the Department of Public Health (DPH) and reported in the ESPR update, to provide baseline data for future studies. Massport should consult with DEP and DPH in developing an air quality monitoring protocol using periodic air sampling in residential areas with a special focus on air toxics. Massport should also complete within the next five years a special air toxics monitoring study that will include a public meeting to discuss the results."*

The Study has taken place over five years (2007-2011), and air monitoring will be performed over two distinct periods: the completed 12-month baseline period (September 2007 – September 2008) and the existing (September 2010 –August 2011) 12-month period. Massport expects that the data will be used for future studies by MADPH and MassDEP or others.

1.2 EXISTING AIR QUALITY

To protect public health and welfare, the U.S. Environmental Protection Agency (EPA) has promulgated national ambient air quality standards (NAAQS) for the following seven air pollutants, referred to as criteria pollutants: carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter with an equivalent aerodynamic diameter of 10 micrometers (PM_{10}), particulate matter with an equivalent aerodynamic diameter of 2.5 micrometers ($PM_{2.5}$), and lead (Pb). MassDEP has also adopted these standards.
Logan is located in the Metropolitan Boston Intrastate Air Quality Control Region (AQCR), which includes the City of Boston and its outlying suburbs.[2] As shown in Table 1, this area is presently designated by EPA as being in attainment with all of the NAAQS with the exception of CO and O_3, for which it is designated as maintenance and non-attainment, respectively[3].

[2] Beverly, Boston, Brockton, Cambridge, Chelsea, Everett, Gloucester, Lynn, Malden, Marlborough, Medford, Melrose, Newton, Peabody, Quincy, Revere, Salem, Somerville, Waltham, Woburn.

[3] Attainment means there are no recorded exceedances of the NAAQS in the area, non-attainment means exceedances of the NAAQS have occurred in the area, and maintenance means the area is in transition from non-attainment to attainment.

TABLE 1 ATTAINMENT/NON-ATTAINMENT DESIGNATIONS FOR METROPOLITAN BOSTON

Pollutant	***Designation***
CO	Maintenance
Pb	Attainment
NO_2	Attainment
$Ozone_3$ (8-hour)	Non-attainment
PM_{10}	Attainment
$PM_{2.5}$	Attainment
SO_3	Attainment
Source: U.S. EPA, Green Book, 2011	

There are no NAAQS for toxic air pollutants similar to those for criteria pollutants. MassDEP has developed allowable ambient limits (AALs) for source permitting purposes. As part of its statewide air monitoring network, MassDEP operates an air monitoring station on Harrison Avenue in Roxbury, approximately 4 miles southwest of Logan. This is the closest urban-scale monitoring station to the airport; is located in an urban setting; and is used to monitor the EPA criteria pollutants, as well as a variety of toxic air pollutants. MassDEP also operates a similar air monitoring station in Lynn, approximately 7.5 miles north-northeast of Logan and in a more rural setting. A third station was located on Bremen Street adjacent to the airport but was closed.

2. STUDY OBJECTIVES

2.1 INTRODUCTION

This section identifies and describes the specific objectives of the Study based on the MEPA certificate. The importance of the Study objectives cannot be overstated as they form the guiding principles upon which the Work Plan is designed. These principles include the locations of air monitoring sites, the selection of the pollutants analyzed, and the monitoring or sampling methods employed.

2.2 UNDERSTANDING THE MEPA CERTIFICATE PERTAINING TO THE AIR QUALITY MONITORING STUDY

The MEPA Certificate contains four statements on the intended scope of the Study. These are restated below (*in italics*), followed by explanations of how they are incorporated within this Work Plan.

A. *Within the ESPR process Massport shall conduct follow-up air quality monitoring in neighborhoods surrounding the airport and under the flight path of Logan Airport.*

   In this context, the term *follow-up air quality monitoring* is taken to mean air monitoring following the implementation of the Centerfield Taxiway. The expression *in neighborhoods surrounding the airport and under the flight path* is interpreted to comprise areas in Winthrop, East Boston, and South Boston that are closest to the airport <u>and</u> under (or near) the arrival and departure tracks for inbound and outbound aircraft.

B. *This information will be shared with the Massachusetts Department of Public Health (MADPH) and reported in the ESPR Update, to provide baseline data for future studies.*

   It is understood that Massport will report on the Study in the annual *ESPR/EDR* documents, and the collected data will be provided to MADPH/MassDEP[4]. The term *baseline data* is taken to mean the data collected before the implementation of the Centerfield Taxiway. The reference to *future studies* means the follow-up air monitoring discussed under Item "A" above.

C. *Massport should consult with MassDEP and MADPH in developing an air quality monitoring protocol using periodic air sampling in residential areas with a specific focus on air toxics.*

   From this, it is understood that Massport will develop an approach for conducting the Study and consult with MassDEP/MADPH on the approach and its implementation. The term *protocol* is taken to include this Work Plan as well as the Quality Assurance Project Plan

[4] EDR/ESPR – Boston Logan International Airport Environmental Data Report/Environmental Status Progress Report.

(QAPP). The term *periodic air sampling* is taken to mean air sampling (or monitoring) on a temporal (i.e., seasonal, monthly, weekly, and/or daily) basis that will best evaluate air toxics in the vicinity of the airport. The term *residential areas* includes the same neighborhoods mentioned above under Item “A”. Finally, the term *air toxics* is considered to be synonymous with toxic air pollutants (TAPs) and hazardous air pollutants (HAPs), but may also include PM and/or BC as potential indicators (or “surrogates”) of fine PM and jet exhaust.

D. Massport should also complete within the next five years a special air toxics monitoring study that will include a public meeting to discuss the results.

Based on this statement, it is understood that the entire Study must be completed in the next five years and the results will be presented to the general public. The term *special air toxics monitoring study* is understood to mean the Study outlined in this Work Plan. The term *public meeting* is taken to mean a forum, announced in advance and planned for a certain time and place, where the public has the opportunity to review, ask questions, and discuss the Study findings.

This information is used as the framework for formulating the objectives for this Study, which are subdivided below into Primary and Supporting Objectives.

2.3 PRIMARY OBJECTIVE

As a means of focusing and simplifying the Work Plan, the primary objective of the Study has been summarized into one sentence, as follows:

> **Primary Objective -** *Collect air quality data with an emphasis on air toxics under (or near) the flight paths and in the neighborhoods surrounding Logan International Airport in advance of, and following, the implementation of the Centerfield Taxiway.*

This simple and direct understanding of the MEPA Certificate’s intent facilitates the formulation of the Work Plan, enables the work to fully address the specific aims of the Study, and increases the likelihood that the program will reach successful completion.

2.4 SUPPORTING OBJECTIVES

From the MEPA Certificate, it is clear that there are other particular elements to the air monitoring program that are considered necessary (bulleted under “MEPA Certificate” below). These include consultation with MADPH/MassDEP, sharing and reporting of collected data, and a timeframe for completing the Study.

Added to these are several features (bulleted under “Other Considerations” below) of any investigation of ambient air quality conditions that are regarded as essential to achieving a successful outcome. These factors are particularly applicable when measuring toxic air pollutants that are emitted from many and varied sources. Such considerations include the use of reliable and cost-feasible methods; efficient use of funds and resources; and the ability to evaluate the findings properly based on the potential uncertainties, limitations, and unforeseen events that are inherent to this type of investigation.

For clarity and simplicity, these supporting objectives are restated below as one-sentence summaries.

Supporting Objectives

MEPA Certificate

- Consult with MADPH and MassDEP on the preparation of the Air Quality Protocol
- Share the collected baseline data with MADPH for future studies
- Provide information on the program in the annual ESPR/EDR documents
- Complete the study within five years
- Hold a meeting for the public to review and discuss the findings.

MADPH, MassDEP, and Community Comments

- Collect one year of data in advance and following the implementation of the Centerfield Taxiway

- Perform real-time measurements

- Discuss scientific findings in terms that are comprehensible to laypersons.

Other Considerations

- Use reliable and scientifically-proven monitoring methods that allow for multiple locations and extended periods of monitoring.

- Monitor compounds that are representative of airport-related emission sources.

- Select monitoring sites that are feasible and secure for data collection.

- Use general findings from air monitoring studies already completed or underway at other airports and specific local monitoring data collected by MassDEP.

- Identify and evaluate possible cause(s) of data trends, outliers, and other findings.

- Identify and evaluate potential effects on data from meteorology, temporal, and spatial influences.

- Allow for adjustments and other changes to the Work Plan as the monitoring program progresses and data become available.

- Identify and evaluate potential impacts on data from airport-related and non-airport related emission sources.

- Identify and evaluate both the strengths and weaknesses of the air monitoring program.

The approach and methodology for accomplishing the objectives of the Study are discussed in the following sections.

3. TECHNICAL APPROACH OVERVIEW

This section summarizes the overall technical approach for conducting the Study and addresses several important considerations such as the choice and locations of air monitoring sites, the selection of the pollutants analyzed, and the monitoring or sampling methods to be used. Notably, the development of this approach relies heavily on input from MassDEP/MADPH, the prior experiences of the Project Team in this highly specialized field, as well as the outcomes of similar air monitoring programs conducted at other airports both in the U.S. and abroad.

3.1 MONITORING SITES

The identification, evaluation, and selection of the monitoring sites are among the most important elements of the Study. This process involved several key considerations that can have direct and significant effects on the utility of the data collected and the overall success of the program. The most significant of these factors are briefly discussed below.

3.1.1 Evaluation Criteria

For this assessment, relevant information for each potential site was obtained from several sources including the review of up-to-date aerial photography; maps and charts of the airport and surrounding areas; online computer searches of sites and addresses; consultations with Massport, MassDEP/MADPH, and Federal Aviation Administration (FAA) staffs; and in-the-field site visits by the Project Team. This information was assessed using the following criteria:

- *MEPA Certificate Requirements* – In keeping with the Primary Objective of the Study, potential monitoring site locations were evaluated with respect to the inbound and outbound flight tracks as well as their proximity to residential neighborhoods surrounding the airport. Sites that are characterized as being both residential and near the flight paths, with those located closest to the airport, are of greatest potential interest.

- *Distance and Direction from the Centerfield Taxiway* – Because the primary aim of the Study is to monitor the potential effects of the Centerfield Taxiway on air quality conditions, the distances and directions from this new facility to the candidate monitoring sites were considered. In this analysis, it is given that the new taxiway will be located midway between Runways 4L/22R and 4R/22L, and the shortest straight-line measurements were used. Sites located one mile away or closer to the Centerfield Taxiway are of more interest than those further away.

- *Nearby Emission Sources and Other Potential Influences* – Logan is located in an urban area characterized by a wide assortment of other emission sources including motor vehicle surface traffic, railroads, ships and other marine port activities, home heating units, industry, and power generation. All of these were considered as potential influences on data collected from the candidate sites.

- *Meteorological Conditions* – Although wind direction and speed in the vicinity of Logan vary throughout the year, some consistent patterns occur. Wind direction and wind speed data collected at Logan over a representative five-year period (1991-1995) was used to develop wind roses (i.e., wind frequency distribution data) to determine seasonal and annual wind patterns. For example, in the winter months the winds are predominately from the WNW varying to the SW, with an average speed of 14 miles per hour (mph), and few calm periods. In the summer months, the prevailing winds switch direction and are mostly from the SW varying to the WNW, with an average speed of 11 mph, and more frequent calm periods. (During the spring and fall months, the winds are generally in transition between the NW and SW.) From this information, downwind locations from the airport are mostly to the E and SE (i.e., Winthrop, Boston Harbor, Deer Island, and Port Shirley) in winter and to the E and NNE (i.e., Winthrop and East Boston) in summer. For this assessment, monitoring sites in neighborhoods that are located generally downwind of the airport are of greatest potential interest.

- *Site Ownership, Accessibility, and Security* – Air quality sampling involves monitoring equipment, devices, and various other apparatus that require shelter from the elements, routine maintenance, and security from vandalism. Some of the equipment is sensitive to disturbance and costly; therefore, the property owner, ease of access, and other safeguards are important considerations. In locations where access is limited due to security concerns, FAA involvement also becomes a factor.

- *Other Factors and Considerations* – Several other potentially important factors were also considered in the identification, evaluation, and selection of air monitoring sites. For example, the availability of a building to house the equipment and electricity to power the equipment are two practical considerations. The availability of the site in the immediate term and over the five-year timeframe was also considered. Finally, areas around the airport historically experiencing odor complaints were evaluated, and particular notice was given to runway landing/take-off events as well as areas located closest to ground-based operations (i.e., taxi-in, taxi-out, and queues).

The monitoring sites and the basis for their selections are discussed in Section 5.

3.2 TARGET POLLUTANTS

The MEPA Certificate states that the Study should place “a special focus on air toxics.” Toxic air pollutants, also referred to as HAPs, include a broad range of pollutants (i.e., organic and inorganic gases, aerosols, and particles) for which there are no NAAQS. However, under the federal Clean Air Act (CAA), EPA currently recognizes and regulates a total of 188 compounds (or compound categories) as HAPs emitted by industrial sources.

3.2.1 Background Information

HAPs are emitted from a variety of emission sources, both natural and anthropogenic. Within the environs of a commercial airport, such as Logan, categories of HAPs emission sources can include stationary point sources (e.g., boilers, backup generators, and fuel facilities), area sources (e.g., fire training and construction activities), on-road mobile sources (e.g., cars, vans, and buses), and non-road mobile sources (e.g., aircraft, ground support equipment [GSE], auxiliary power units [APUs], and snow removal and melting equipment).

Because the products of combustion from airport-related sources are so similar to those from sources present in an urban area (motor vehicles traveling on the surface roadway network, power plants and other industries, home heating units, etc.), it has proven difficult to differentiate these sources of HAPs from one another. In other words, HAPs emitted from sources on an airport are similar to those emitted from the myriad sources off the airport. The majority of HAPs derived as products of combustion or released as evaporative emissions from fuel are generally classifiable into three categories, as briefly discussed below:

- *VOCs* – These pollutants are either gaseous or may readily volatilize at ambient (e.g., outdoor) conditions due to their high vapor pressures. The list of VOCs is extensive, but some of the more common species include benzene, ethyl benzene, toluene, xylenes, and 1,3-butadiene.

- *Carbonyls* – These pollutants are similar to VOCs but are more chemically reactive at ambient conditions. The category of carbonyls comprises several subcategories such as aldehydes (e.g., acetaldehyde, acrolein, and formaldehyde) and ketones (e.g., methyl ethyl ketone and methyl isobutyl ketone).

- *SVOCs* – Compared to VOCs, these pollutants have a lower vapor pressure, are less reactive than carbonyls, and include PAHs such as anthracene, benzo(a)pyrene, and naphthalene.

Potentially classifiable as a HAP, particulate matter can adversely affect lung function and play a role in the formation and dispersion of HAPs. Segregated by size--PM_{10} (inhalable), $PM_{2.5}$ (fine) and $PM_{0.1}$ (ultrafine)--the term particulate matter generally represents more common references to atmospheric fallout, soot, and dust.

PM may contain constituents from natural sources such as smoke particles from forest fires, salt particles from sea spray, windblown dust from unstabilized soil, or viable particles such as pollen and spores. From anthropogenic activities, PM can contain inorganic materials such as trace metals (e.g., arsenic, cadmium, and lead), pure elemental material (e.g., elemental carbon), or complex mixtures of unburned and partially burned hydrocarbons (e.g., fine and ultrafine PM). PM may also form in the atmosphere from chemical reactions involving precursor inorganic compounds, such as oxides of nitrogen or sulfur, and form inorganic particulate compounds (e.g., nitrates and sulfates).

3.2.2 Evaluation Criteria

As with the monitoring site selection process, the identification and selection of pollutants to be included in the Study is central to its overall success. This process involves several key considerations, the most significant of which are briefly discussed below.

- *Representative of Airport-related Emissions* – It is important that the collected data be representative of pollutants that are associated with aircraft and airport activities. Notably, EPA and FAA have identified the 13 compounds listed in Table 2 that are classifiable as toxic and together represent over 96 percent of the total HAPs associated with airports.[5] Adding fine PM (i.e., $PM_{2.5}$) to this list provides a comprehensive record of pollutants expected to occur near Logan and, taken together, these pollutants serve as plausible candidate target pollutants for inclusion in the monitoring program.

- *Useful as Baseline Data for Future Studies* – Consideration is given to the usefulness and application of the collected data by other researchers in the future. These studies will likely focus on compounds that are common to airport activities and of potential interest from the standpoint of human health. For example, trace levels of benzene, which is a known human carcinogen, exist in the exhausts of aircraft, GSE, and other airport sources. In elevated concentrations, $PM_{2.5}$ is reported to potentially have adverse health effects.

- *Comparison to Criteria and Other Monitoring Data* – As noted above, there are no NAAQS for the vast majority of compounds classifiable as air toxics or HAPs (except lead). However, EPA has published guideline values (called Reference Concentrations [RfCs]) for acceptable inhalation exposure levels of some HAPs. Another potential basis for comparison is air monitoring data collected in other areas of Boston, such as the MassDEP Harrison Avenue and Lynn monitoring sites.[6] These factors are considered, and other attempts are made to select compounds to which the results of the Study can be meaningfully compared and evaluated.

TABLE 2 AIRPORT-RELATED HAPS

1,3-Butadiene (VOC)	Lead (Metal)
Acetaldehyde (Carbonyl)	Naphthalene (SVOC)
Acrolein (Carbonyl)	Proprionaldehyde (Carbonyl)
Benzene (VOC)	Styrene (VOC)
Ethylbenzene (VOC)	Toluene (VOC)
Formaldehyde (Carbonyl)	Xylene (VOC)
PAHs: 2,2,4-Trimethylpentane,Acenaphthylene, Phenanthrene, Fluorene, Fluoranthene, Pyrene, Anthracene, Acenphthene, Benzo(ghi)perylene, Benzo(bk)fluoranthene, Benzo(a)anthracene, Benzo(a)pyrene, Chrysene, Indeno(123-cd)pyrene, and Dibenzo(ah)anthracene (SVOCs)	
Source: FAA, 2003.	

- *Substitute and Surrogate Compounds* – Because outdoor levels of HAPs occur in such very low concentrations, it can be difficult to obtain air samples that contain sufficient amounts of the compounds to measure. This is particularly true when sampling in real-time and over short time intervals (e.g., < 24 hours for some compounds and < 3 days for others).

[5] Select Resource Materials and Annotated Bibliography on the *Topic of Hazardous Air Pollutants Associated with Aircraft, Airports and Aviation*, prepared for the Federal Aviation Administration, July 2003.

[6] The Harrison Avenue site in Roxbury is approximately four miles SW of Logan, and the Lynn site is approximately 7.5 miles north-northeast of Logan.

Therefore, consideration is also given to monitoring substances that are not classifiable as HAPs but may serve as indicators of their presence and relative abundance. For this Study, these surrogates include $PM_{2.5}$, BC, and total VOCs.

The recommended Target Pollutants and the basis for their selections are discussed in Section 4.

3.3 MEASUREMENT METHODS

Equally important to the selection of the monitoring sites and the target pollutants for the Study is the evaluation and choice of monitoring methods.[7] Ambient levels of HAPs typically occur in very low concentrations, and many of them are easily volatilized or are otherwise reactive. These characteristics present a unique set of challenges that are less important when monitoring other types of air pollutants.

Over the years, numerous methods have been developed to collect and analyze air pollutant samples. In general terms, typical sampling techniques involve using mechanical means (e.g., a pump) to move air into, or through, a collection medium to capture a sample for analysis. Typical examples include samplers for PM, VOCs, SVOCs, and carbonyls as well as continuous monitors for CO, O_3, and black carbon. Applied to this Study, the evaluation of candidate monitoring methods for HAPs involved the assessment of the following factors:

- *Reliability of Measurements* - Because the results of the Study will be used to evaluate low levels of air pollutants and be shared with MassDEP/MADPH, the data must be as accurate and reliable as possible. Therefore, EPA approved methods are to be used wherever possible.

- *Applicability to Periodic and Follow-up Monitoring* – The MEPA Certificate calls for the periodic air sampling of HAPs – meaning monitoring on a regular and repetitive basis. Similarly, monitoring in advance of, and following, implementation of the Centerfield Taxiway is also required. These two directives involve the equipment setup, calibration, and take-down between sampling periods or events. Therefore, the evaluation of monitoring methods takes into consideration the time and financial resources, as well as the potential wear and tear on the equipment during this process.

- *Cost-effectiveness of Measurements* – In order to evaluate air quality conditions around the airport both spatially and temporally, a number of monitors or sampling devices must be run simultaneously at multiple locations. For this Study, meeting these requirements involves the careful balancing of available resources so that the types and quantity of data are appropriate and optimal, while ensuring that the data quality is not compromised.

Based upon these criteria, the recommended monitoring methods and the basis for their selections are discussed in Section 6.

[7] For the purposes of this Work Plan, the terms “monitoring” and “sampling” are used interchangeably.

3.4 OTHER CONSIDERATIONS

As discussed above and in keeping with the MEPA Certificate as well as the objectives of the Study, the overall technical approach for the Work Plan is aimed at collecting the air quality data in locations around the airport using the most appropriate, reliable, and cost-effective methods possible. Coupled with what has been learned from similar monitoring programs and responsive to the inherent difficulties in measuring low levels of air pollutants, this approach is also earmarked by several other important attributes, including:

- *Responsiveness to New Information and Changing Conditions* – During the initial stages of monitoring, new information will be developed as the monitoring stations are deployed, the sampling methods are activated, and the data is reviewed. This information may lead to adjustments in the Work Plan that improve data collection and address other unforeseen opportunities or problems.

- *Primary and Satellite Monitoring Sites* - It is not feasible to monitor HAPs in every neighborhood surrounding Logan. Moreover, air monitoring programs have shown that carefully selected sampling locations can provide representative information on the levels of air pollutants surrounding the airport. In this case, the establishment of primary sites in select areas of particular interest, coupled with satellite sites, enables the collection of representative data at multiple locations in the Study area.

In the sections that follow, the individual components of the Work Plan are discussed in greater detail and enable the reviewer a more complete understanding of the approach including the recommended monitoring sites, the target pollutants, and the monitoring methods and how their selections will help meet the objectives of the Study. Information pertaining to Quality Assurance/Quality Control (QA/QC) procedures and team roles and responsibilities are also provided.

4. TARGET POLLUTANTS

4.1 INTRODUCTION

The purpose of this section is to identify, evaluate, and select the individual species of HAPs that are considered to be the most appropriate for this monitoring program. Therefore, they are called "Target Pollutants" in this Work Plan.

4.2 SELECTION CRITERIA

The basis for the identification, evaluation, and selection of the Target Pollutants is centered largely on the following factors or considerations:

- Classifiable as a HAP by EPA
- Representative of airport-related emissions
- Useful as baseline data for future studies
- Comparable to regulatory criteria and monitoring data collected elsewhere by MassDEP
- Identified in other studies as being useful in the assessment of potential airport air quality impacts.

The full listing of compounds classified as HAPs by EPA is too voluminous to be reprinted here, so the reviewer is referred to the agency website on this topic.[8] The categories and individual species of HAPs most commonly associated with airports by the FAA are listed in Table 2 in Section 3.

4.3 SELECTED POLLUTANTS

Following the approach and consideration discussed above, the Target Pollutants selected for this Study are listed in Table 3. For ease of reference, both the categories and names of the pollutants are shown, along with indicators of their compatibility with the selection criteria. Importantly, VOCs, carbonyls, and SVOCs/PAHs are included among the group, as they represent all the forms of combustion products or evaporative emissions from airport-related sources.

Although not classified as HAPs by EPA, PM and BC also play a role in the formation and dispersion of HAPs. Moreover, aircraft-related emissions have been characterized by the presence of fine PM and BC. As surrogates to HAPs, they offer the double advantage of being quantifiable and potential indicators of airport air quality impacts. Therefore, they are also included as Target Pollutants for this Study.

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[8] EPA HAPs can be found at http://www.epa.gov/ttn/atw/188polls.html.

TABLE 3 TARGET POLLUTANTS

Category	*Pollutant*[1]	*Classifiable HAPs*[2]	*Airport-related*[3]	*Baseline Useful*[4]	*Criteria Comparable*	*Other Studies*[5]
VOCs	**1,3-butadiene**	x	x	x	x	x
	Benzene	x	x	x	x	x
	Carbon tetrachloride	x			x	
	Chloroform	x			x	
	Ethene	x			x	
	Ethylbenzene	x	x	x	x	x
	Styrene	x	x	x	x	x
	Toluene	x	x	x	x	x
	Vinyl chloride	x			x	
	Xylenes	x	x	x	x	x
Carbonyls	**Acetaldehyde**	x	x	x	x	x
	Acrolein	x	x	x	x	x
	Formaldehyde	x	x	x	x	x
	Propionaldehyde	x	x	x	x	x
Metals	Arsenic	x			x	
	Cadmium	x			x	
	Chromium	x			x	
	Lead	x			x	
	Manganese	x			x	
	Zinc	x			x	
SVOCs /PAHs	**Naphthalene**	x	x	x	x	x
	1-Methyl Naphthalene	x[6]	x	x	x	x
	2-Methyl Naphthalene	x[6]	x	x	x	x
PM	**$PM_{2.5}$**	See footnote 7	x	x	x	x
	Black carbon	See footnote 7	x	x	x	x

[1] Bolded compounds are included as Target Pollutants for this Study.
[2] Compounds classified as HAPs by EPA and MassDEP.
[3] HAPs most commonly associated with airports by EPA and FAA.
[4] Based on how well the findings can ascertain the effects of the Centerfield Taxiway on air quality by comparison to pre-construction conditions and monitoring conducted elsewhere in the Boston area.
[5] Identified as beneficial for assessing air quality conditions at other airports based upon other similar studies.
[6] As constituents of Polycyclic Organic Matter (POM).
[7] As a surrogate for products of combustion.

5. MONITORING LOCATIONS

5.1 INTRODUCTION

Prior to the first year of monitoring, three primary monitoring sites and eight satellite monitoring sites were established. These locations were selected based on several criteria including MEPA Certificate requirements, distance and direction from the Centerfield Taxiway, nearby emission sources and potential influences, meteorological conditions, site ownership accessibility and security and other factors, including shelter and the availability of electricity. Descriptions of each of the selected monitoring locations are provided in the following sections.

5.2 PRIMARY MONITORING LOCATIONS

Based on an analysis of potential sites and after consultation with MassDEP and MADPH, three sites--Annavoy Street, Court Road, and Bremen Street--were chosen as the primary monitoring locations. Brief descriptions of these primary sites are presented below, and the site locations can be seen in Figure 2.

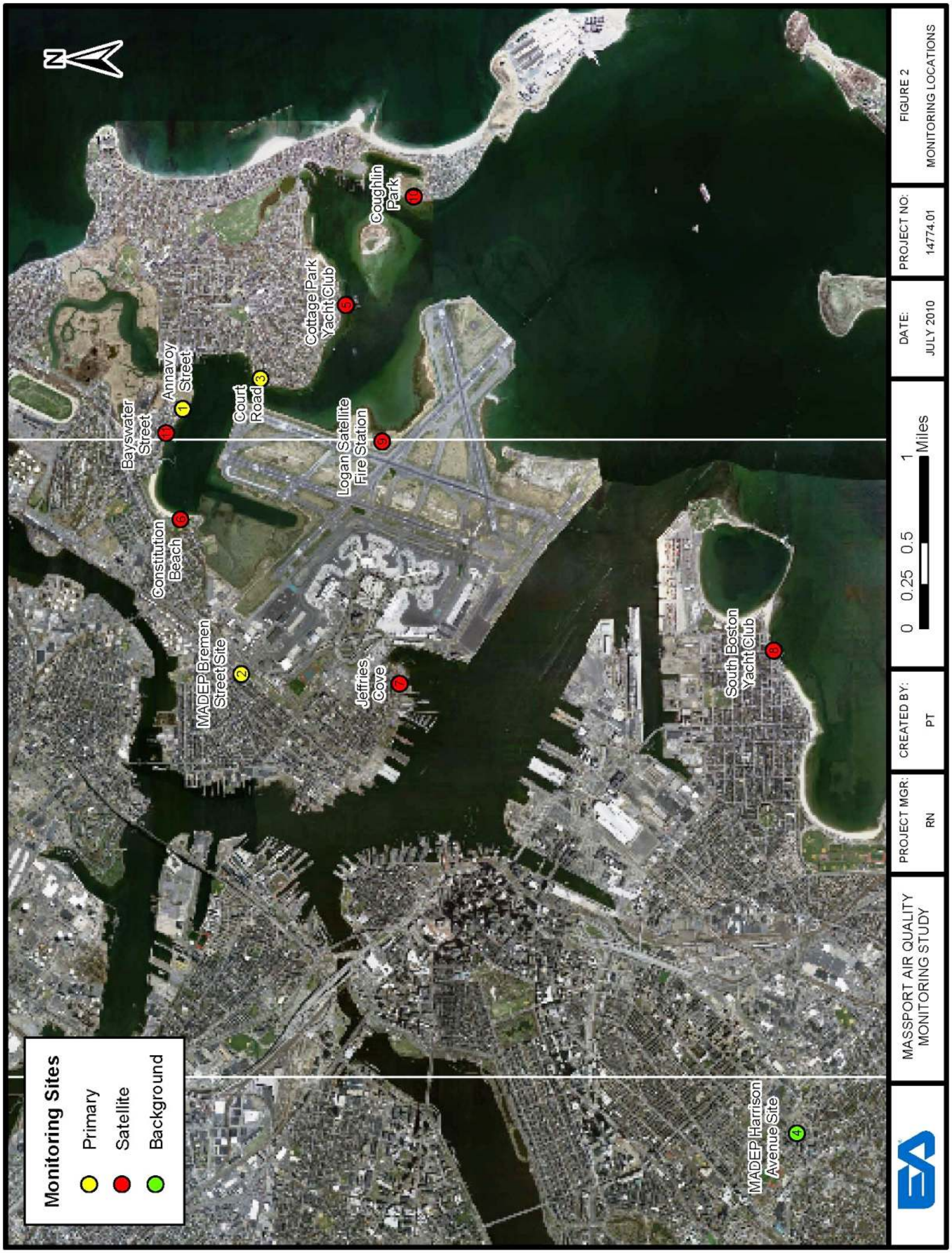
- Annavoy Street (Location 1 on Figure 2): This site is located in East Boston near the intersection of Annavoy Street and Saratoga Street (Route 145). It is adjacent to the Winthrop town line directly across from the northern end of the Centerfield Taxiway. The location is separated from the airport by approximately 0.4 mile of open water and is located adjacent to a residential neighborhood and under the primary Logan flight path (Runway 4R/22L). This site is also predominantly downwind from the airport during the summertime and periodically during the remainder of the year. The site is owned by Massport and partially occupied by an FAA navigation aid system. Other nearby emission sources include motor vehicle traffic operating on the local roadway network and the burning of fuel for residential and commercial heating.

- Bremen Street (Location 2 on Figure 2): This site is formerly a MassDEP monitoring site and is located in East Boston approximately 1.2 miles to the west of the Centerfield Taxiway. It meets the study objectives of being located in a residential neighborhood and near the flight path of Runway 33L/15R. This site is predominantly upwind from the airport. Nearby sources of emissions include local traffic and the nearby commercial/light-industrial areas.

- Court Road (Location 3 on Figure 2): This site is located in Winthrop approximately 0.3 mile east of the proposed Centerfield Taxiway. It meets the primary objective of being located in a residential neighborhood and in close proximity to the Centerfield Taxiway. This site is frequently downwind from Logan during both the winter and summer.

5.3 SATELLITE MONITORING LOCATIONS

The purpose of using satellite sites was to expand the Study area into neighborhoods surrounding the airport that are spatially more distant from the primary monitoring locations.


Monitoring Sites
Primary
Satellite
Background
Bayswater Street
Annavoy Street
Court Road
Cottage Park Yacht Club
Coughlin Park
Logan Satellite Fire Station
Constitution Beach
MADEP Bremen Street Site
Jeffries Cove
South Boston Yacht Club
MADEP Harrison Avenue Site
0 0.25 0.5 1 Miles
FIGURE 2
MONITORING LOCATIONS
PROJECT NO: 14774.01
DATE: JULY 2010
CREATED BY: PT
PROJECT MGR: RN
MASSPORT AIR QUALITY MONITORING STUDY

Seven Satellite neighborhood monitoring locations and one urban background monitoring location (Harrison Avenue) were used in the Study, including:

- Harrison Avenue (MassDEP site), Roxbury (Site 4)
- Cottage Park Yacht Club, Winthrop (Site 5)
- Constitution Beach, East Boston (Site 6)
- Jeffries Cove, East Boston (Site 7)
- South Boston Yacht Club, South Boston (Site 8)
- Logan Satellite Fire Station, Logan Airport (Site 9)
- Coughlin Park, Winthrop (Site 10)
- Bayswater Street, East Boston (Site 11).

Two background monitoring sites were designated for the Study: the MassDEP station on Harrison Avenue in Roxbury and the MassDEP station at the Lynn Water Treatment Plant. The first was selected as urban background and the second as suburban background. They were selected to provide ambient concentration data away from Logan. Although both of these MassDEP sites are considered urban and center-city monitoring locations, the Harrison Avenue site is in Suffolk County within the immediate Boston metropolitan area, whereas the Lynn site is in southern Essex County, farther removed from Boston. The MassDEP station on Harrison Avenue measures toxic air pollutants, $PM_{2.5}$ and BC. The MassDEP Lynn site measures toxic air pollutants and $PM_{2.5}$. These monitoring methods are described in Section 2.5.

The Year 1 Project Work Plan (CDM, September 2007) provides additional details on the site selection process.

TABLE 4 AIR MONITORING LOCATIONS

Candidate Sites	***Monitoring Station Type***
Annavoy Street, East Boston	Primary
MassDEP Bremen Street, East Boston	Primary
Court Road, Winthrop	Primary
Coughlin Park, Winthrop	Satellite
Jeffries Cove, East Boston	Satellite
South Boston Yacht Club, South Boston	Satellite
Bayswater Street, East Boston	Satellite
Cottage Park Yacht Club, Winthrop	Satellite
Constitution Beach, East Boston	Satellite
Logan Satellite Fire Station, East Boston	Satellite
MassDEP Harrison Avenue Site, Roxbury	Background
Note: Primary stations include both active and passive monitoring, and satellite stations include primarily passive monitoring. Passive monitors will also be set up at the MassDEP Harrison Avenue site.	

6. MONITORING METHODS

Section 4 identified the Target Pollutants selected for the Study. This section describes the monitoring methods that are based on these pollutants of interest.

A combination of both real-time and time-integrated monitoring was developed for this application at Logan. This monitoring approach expands the effectiveness of the monitoring network and enables the most comprehensive assessment of ambient conditions possible in keeping with established monitoring methods and reference conditions.

The selected methodology monitors air quality both in real-time and as integrated samples over short time intervals (i.e., 1 minute to 24 hours). Combined with concurrent meteorological and airport operational data, these measurements may lead to a better understanding of emissions from airport activities or events.

Table 4 summarizes the air monitoring methods planned for use in the Study. These monitoring methods are discussed further below.

6.1 ACTIVE METHODS

Active sampling typically involves using mechanical means (e.g., a pump) to move air into (or through) a collection medium (e.g., activated charcoal, chemically-treated sieves, and vacuum cylinders). The collected samples are then extracted for analysis in a laboratory using assorted chemical and physical methods. A variation on the collection and analytical steps involves continuous monitoring instruments that collect and analyze the air sample *in situ* (or in the monitoring device).

6.1.1 Time-Integrated Sampling Devices

The time-integrated techniques are described below, by pollutant:

- **VOCs -** An active VOC sampler consists of an evacuated stainless steel canister having the interior surface polished, cleaned, and passivated using the Summa® process. A metal bellows-type pump is used to draw outside ambient air into the canister, pressurizing it to slightly above atmospheric pressure. Outside ambient air is drawn into the canister through a Teflon sampling line and particulate filter with the flow rate controlled by a calibrated volumetric flowmeter. A timer equipped with a solenoid valve controls the duration of sampling. Ambient samples are typically collected in a 6-liter canister, but canisters of different volumes (e.g., 1 liter and15 liter) may also be used. This method is consistent with EPA Method TO-15, Determination of VOCs in Air Collected in Specially-Prepared Canisters and Analyzed by GS/MS.

TABLE 5 AIR MONITORING METHODS

Pollutant and Method	***Technique***	***Averaging Time***
Meteorology (wind speed and direction, temperature, and humidity)	Active	Continuous
$PM_{2.5}$ mass using beta attenuation monitor with very sharp cut cyclone	Active	Real-time
BC using seven-wavelength aethalometer	Active	Real-time
VOCs using Summa canister with GC/MS[1] analysis[2]	Active	Integrated
$PM_{2.5}$ Federal Reference Method (FRM)	Active	Integrated
$PM_{2.5}$ (MiniVol)	Active	Integrated
Carbonyl compounds using DNPH[3] adsorber with HPLC[4] analysis[5]	Active	Integrated
PAH using sequential sampler with Teflon-coated glass-fiber filter and XAD®[6] cartridge with GC/MS analysis[7]	Active	Integrated

[1]GC/MS = gas chromatography/mass spectrometry.
[2] Target VOCs include benzene, toluene, ethyl benzene, xylenes, styrene, and 1,3-butadiene.
[3] DNPH = diphenylhydrazine.
[4] HPLC = high performance liquid chromatography.
[5]Target carbonyl compounds include acetaldehyde, acrolein, formaldehyde, and propionaldehyde.
[6] XAD® = a proprietary resin XAD sorbent.
[7]Target PAHs include naphthalene, 1-methyl naphthalene, and 2-methyl naphthalene.

- **Carbonyls** - An active carbonyl sampler consists of a prepackaged cartridge containing acidified 2,4-dinitrophenylhydrazine (DNPH). A sampling pump provides the mechanical means to induce air flow into the cartridge. Outside ambient air is drawn through the cartridge using a stainless steel sampling line having the sample rate controlled by a calibrated pump. The pump also controls the duration of sampling. The flow rate is established to sample a known volume of air for an appropriate integration period. This method is consistent with EPA Method TO-11A, Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by HPLC.

- **SVOCs/PAHs** - An active PAH sampler consists of a high-volume air sampler utilizing a filter and sorbent cartridge containing Poly-Urethane Foam (PUF) and XAD-2 sorbent in a “sandwich” configuration. Outside air is drawn into a sampling train with the sampling rate controlled by a calibrated blower fan, bringing the air sample through the filter then through the sorbent cartridge. A timer controls the duration of sampling. The flow rate is established to sample a known volume of air for an appropriate integration period. This method is consistent with EPA Method TO-13A, Determination of Polycyclic Aromatic Hydrocarbons in Ambient Air Using GC/MS.

- **$PM_{2.5}$** – An active $PM_{2.5}$ sampler consists of a low-volume air sampler utilizing a filter substrate to collect fine particulate matter. Outside air is drawn through a precision cut-point inlet head by a calibrated blower fan, bringing the air sample through the filter. The blower fan also controls the duration of sampling. The flow rate is established to sample a known volume of air for an appropriate integration period. At one of the primary sites (Annavoy Street), $PM_{2.5}$ will be collected using an EPA federal reference (or equivalent) method (40 CFR 50 Appendix L—Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere). At all primary and all satellite sites, $PM_{2.5}$ will also be collected using a technique not currently recognized as a federal reference (or equivalent) method (Airmetrics MiniVol™ Portable Air Sampler) but has shown good correlation to results from FRM sampling.

A sampling period of 24 consecutive hours (midnight to midnight) is planned for these time-integrated sampling methods to obtain adequate sample for analysis with low levels of detection. An air inlet, manifold system, and blower will supply outside air to the samplers (except for the $PM_{2.5}$, samplers which have their own inlets), drawing air from a height above the ground representing the breathing zone of an adult human. Each sample will be documented with a unique sample number, and sample handling will be controlled following strict chain-of-custody procedures.

6.1.2 Real-Time Continuous Monitoring Devices

The real-time techniques are described below, by pollutant:

- **$PM_{2.5}$** - Ambient concentrations of $PM_{2.5}$ will be monitored in real-time using a beta attenuation monitor (BAM) with a very sharp cut cyclone $PM_{2.5}$ sampling inlet. The BAM uses a continuous glass fiber filter tape to measure nearly continuous concentrations of $PM_{2.5}$. The instrument uses a small ^{14}C source of beta particles coupled with a sensitive detector to count the beta particles. The detector measures the transmission of beta particles through a clean section of the tape. The tape is then mechanically advanced, ambient air is drawn into the instrument sampling inlet, and particulate matter is deposited on the tape. At completion of the sampling period, the tape is returned to the original location and the beta particle transmission is reassured. The difference between the two measurements is proportional to the $PM_{2.5}$ concentration; as the mass of particulate matter deposited on the tape increases, the measured beta particle count is reduced according to a known equation. While this monitoring instrument has not yet been designated by EPA as a reference or equivalent method for purposes of $PM_{2.5}$ compliance monitoring, research studies have found it to produce reliable measurements.

- **BC** - Ambient concentrations of BC will be monitored continuously using a seven-wavelength aethalometer. The aethalometer collects particulate matter continuously on a quartz fiber filter tape and determines the increment of optically absorbing material collected per unit volume of sampled air. Since elemental (or black) carbon is the dominant optically absorbing material in the submicron size range, this measurement is interpreted as a mass of BC according to calibrations determined by intercomparisons with chemical analysis techniques. The optical measurement is ratiometric, and no external calibration materials are required.

- Both the BAM and the aethalometer require a 110-volt, 60-Hz power supply in a stable, temperature-controlled environment, since the instruments contain sensitive electronics. Again, an air inlet, manifold system, and blower will supply outside air for the monitors, drawing from a height above the ground representing the breathing zone of an adult human being.

- **Meteorological Parameters –** Wind speed and direction, temperature and humidity measurements will be made at each active monitoring station. Instruments will be mounted on a mast and installed on top of two of the active monitoring stations (Annavoy Street and Court Road stations). Data will be collected in a data logger and downloaded to a laptop weekly. Data will be retrieved from NStar's meteorological station at the MassDEP Bremen Street active monitoring station, and data will also be retrieved from the National Weather Service meteorological station at Logan Airport to compare to data collected at each active monitoring site.

6.2 MONITORING SCHEDULE

The real-time measurements of $PM_{2.5}$ and BC will occur continuously throughout the 12-month monitoring period. The monitoring program for the other compounds will follow the USEPA Ambient Monitoring Technology Information Center 6 day sampling schedule. The set sampling schedule provides an unbiased and standardized sampling approach over a consecutive 12-month period. Following this schedule provides representative annual average concentrations for pollutants being sampled on a non-continuous basis.

A telemetric system will be implemented in Year 2 of the study to maximize data recovery and provide all invested parties access to real time data. The units that will be connected to the telemetry system include the aethelometer (black carbon), the BAM ($PM_{2.5}$), and the meteorological station.

TABLE 6 SUMMARY OF MONITORING AND SAMPLING FREQUENCY

Parameter	***Type***	***Frequency***	***Duration***	***Averaging Time***	***Start Time***
Meteorology	Active real-time	Continuous	Continuous	15 minute	NA
$PM_{2.5}$ (BAM)	Active real-time	Continuous	Continuous	1 hour	NA
Black Carbon (aethalometer)	Active real-time	Continuous	Continuous	5 minutes	NA
$PM_{2.5}$ (FRM)	Active integrated	Every 6th day	24 hours	24 hours	12 Midnight
$PM_{2.5}$ (MiniVol)	Active integrated	Every 6th day	24 hours	24 hours	12 Midnight
VOC	Active integrated	Every 6th day	24 hours	24 hours	12 Midnight
Carbonyls	Active integrated	Every 6th day	24 hours	24 hours	12 Midnight
PAH	Active integrated	Every 6th day	24 hours	24 hours	12 Midnight

7. LABORATORY METHODS

Samples collected using as discussed in Section 6 will be preserved, stored, and transported to appropriate laboratories for subsequent analyses. In accordance with the QAPP, all samples will be transferred between the field and laboratory following chain-of-custody procedures. Applicable holding times and preservation methods will also be followed for all samples.

Real time instrument measurements will be verified by EA Engineering, Science, and Technology (EA) at its offices in Warwick, Rhode Island, and active samples collected for chemical or gravimetric analyses will be sent to Alpha Analytical Laboratory in Mansfield, Massachusetts.

7.1 ACTIVE SAMPLES

Analysis of the active VOC samples will be performed to be consistent with EPA Method TO-15, Determination of VOCs in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). A known volume of sample is directed through a solid multi-sorbent concentrator. After the concentrating and drying steps, VOCs are thermally desorbed and carried to a gas chromatograph for separation followed by mass spectrometry for analysis.

Analysis of the active carbonyl samples will be performed to be consistent with EPA Method TO-11A, Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High-performance Liquid Chromatography (HPLC). The DNPH derivative is determined using isocratic reverse phase HPLC with an ultraviolet absorption detector. The HPLC system is operated in the linear gradient program mode.

Analysis of the active PAH samples will be performed to be consistent with EPA Method 13-A, Determination of PAHs in Ambient Air Using GC/MS. The exposed filters and sorbent media are extracted by Soxhlet extraction with appropriate solvent. The extract is concentrated by a Kuderna-Danish evaporator, followed by silica gel cleanup using column chromatography to remove potential interferences prior to analysis by GC/MS.

Analysis of the time-integrated $PM_{2.5}$ samples will be performed using gravimetric analysis either consistent with or similar to EPA Method 40 CFR 50 Appendix L - Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere. Following conditioning for a 24-hour period in a temperature- and humidity-controlled environment, an analytical balance is used to weigh both clean and exposed filters to the nearest 1 microgram. The weight difference between the exposed and clean filter is divided by the volume of air sampled to determine the concentration of $PM_{2.5}$ in the sample.

8. QUALITY ASSURANCE PROJECT PLAN

As an important element of the Study, measures will be developed and implemented to help ensure that the monitoring methods and collected data are as reliable as possible. Using EPA guidance as a model, this initiative is referred to as the Quality Assurance Project Plan (QAPP) and will serve several purposes (EPA 1998). These purposes include providing a uniformed approach to the following aspects of the project:

- Project Management
- Sampler Analysis
- Data Generation and Acquisition
- Assessment and Oversight
- Data Management
- Data Validation.

According to the EPA guidance, projects involving environmental data collection should be conducted in three phases: a) Planning, b) Implementation, and c) Assessment. In the Planning phase, project objectives are clarified so that the requirements for the end user of the data are met. In the Implementation phase, the QAPP translates these data requirements into measurement performance specifications and QA and quality control QC procedures. In the Assessment phase, the collected data are evaluated using statistical tools to evaluate whether the project objectives were met and whether the data are suitable for scientific interpretation and (if applicable) policy-making.

This Work Plan represents the first phase (Planning) of the QAPP by stating the primary and supporting objectives of the Study, including the purpose of the program and the intended use of the data. The second phase (Implementation) and third phase (Assessment) will be preceded by a written QAPP that will contain the QA/QC procedures for field and laboratory personnel and data management efforts. This information will be contained in a stand-alone document, separate from this Work Plan and made available to MassDEP and MADPH for technical review and the general public.

9. DATA ANALYSIS AND REPORTING

9.1 INTRODUCTION

This section describes the types of data that will be collected during the course of the Study and how it is expected to be analyzed and reported. The overall approach to this process is based upon several factors including:

- The selected target pollutants (see Section 4)
- The monitoring methods, timeframes, and frequencies (see Section 6)
- The potential use of the collected data.

Importantly, this approach does not preclude additional or alternative analyses in response to changes in the amounts of and types of data collected, any emergent trends, and other notable findings and/or other potential uses of the data that are presently unanticipated.

9.2 MEASUREMENT AND REPORTING UNITS OF TARGET POLLUTANTS

Table 7 contains a summary listing the target pollutants (and other parameters) identified for inclusion into the Study. As shown, the pollutants comprise components of particulate matter (i.e., $PM_{2.5}$ and BC) as well as an assortment of gaseous compounds (i.e., VOCs, PAHs, and carbonyls).

Because particulate matter measurements are based on the mass (or weight) of the substance in the collected volume of air (i.e., mass/volume), these pollutants will be reported in units of micrograms/cubic meter ($\mu g/m^3$). By comparison, gases are measured based on the amount of pollutant relative to the amount of collected air (i.e., volume/volume), and will be reported in units of parts per billion by volume (ppbv). These two sets of concentration units represent the common industry-accepted conventions for these types of pollutants.

9.3 MEASUREMENT TIMEFRAMES AND FREQUENCIES

Table 7 also shows the measurement (or sampling) averaging time periods and frequencies for the target pollutants and monitoring methods.

TABLE 7 SUMMARY OF STUDY PARAMETERS, REPORTING UNITS, AND STATISTICS

Parameter	*Reporting Units*	*Averaging Time Period*	*Summary Statistics*
$PM_{2.5}$	µg/m^3	1 hour 24-hour	Maximum, minimum, and means by site - overall, by day of the week, month, and 12-month period. (As above)
BC	µg/m^3	5-minute	(As above)
VOCs	ppbv	24-hour	(As above, by compound)
Carbonyls	ppbv	24-hour	(As above, by compound)
PAHs	ppbv	24-hour	(As above, by compound)
Meteorology Wind Direction Wind Speed Temp. Rel. Humidity	 degrees mph °F %	 1 hour 1 hour 1 hour 1 hour	 12-month period, monthly, daily, and hourly, 15 min (As above) (As above) (As above)
Airport Operations	Landings and Takeoffs	1 hour	12-month period, monthly, daily, and hourly
Traffic	Vehicles	1 hour or 24-hour	12-month period, monthly, daily, and hourly

This wide variation in sampling timeframes and frequencies reveals that the amounts of collected data will also vary according to the pollutant types (particulates vs. gases) and measurement methods (active real-time and active time integrated). For example, over a 12-month sampling period, real-time monitoring (5-minute sampling) will yield approximately 100,000 measurements and active time-integrated will yield 60 measurements at each monitoring site.

9.4 METEOROLOGICAL AND OTHER SUPPORTING PARAMETERS

The monitoring and reporting of meteorological conditions, airport operations, and motor vehicle traffic will also be conducted as part of the Study. It is expected that the assessment of these parameters will aid in the understanding of the measured pollutant levels and their trends.
As discussed in Section 6, wind speed and direction, temperature, and humidity measurements will be made at each primary monitoring station. The reporting units are based on degrees of compass direction (^{o}), miles per hour (mph), degrees Fahrenheit (°F), and percent (%), respectively. The data from the Annavoy Street and Court Road stations will be collected in an electronic data logger and downloaded weekly to a laptop computer. Data will also be retrieved from NStar's meteorological station adjacent to the MassDEP monitoring station and the National Weather Service meteorological station at Logan Airport.

Airport operational data will be obtained by Massport for the entire Study period and be included in the second year monitoring results, this data will consist of aircraft landings and takeoffs, and will be segregated by runway (e.g., 22R) and time of day (e.g., 0900 – 1000).

Surface traffic (e.g., motor vehicle) data was collected during the first year study from Saratoga Street in East Boston from July to October 2008. This data may be supplemented with additional traffic data to be collected during the second year of monitoring if deemed necessary. Additional data for the Study area roadway system may be obtained from the Massachusetts Highway Department (MHD), Massport, and other state or local agencies (to the extent it is available). Notably, these data are used to establish general conditions and trends and not to monitor individual roadways.

9.5 DATA ANALYSIS AND PRESENTATION

As presented in Sections 5, air monitoring will be undertaken at three primary as well as seven satellite sites and one urban background site surrounding Logan and conducted over a 12 month period. Combined with the meteorological and other supporting data, a vast amount of information will be collected and assessed.

To verify and distill this material into meaningful information, the data (i.e., individual compound or pollutant category) will be assimilated into summary statistics that are intended to give the reviewers a comprehensive, yet concise, interpretation of the findings. For the target pollutants, the data will be compiled for each site according to the overall highs, lows, and average values for the overall sampling period, by day of the week (Monday, Tuesday, etc.), month (January, February, etc.), and each 12-month sampling period. For ease in reviewing, the data will be presented both in tabular and graphic (bar-chart) forms.

Wind speed and direction will be summarized in the form of monthly and annual wind roses. Furthermore, each analyte will be graphed in several formats to determine trends and peak values of analyte concentrations. In most cases, the summary data will be presented in hard copy and the actual measurement data will be provided in electronic formats.

The continuous $PM_{2.5}$ monitoring data collected at each of the three primary sites will be analyzed to provide 24-hour and annual values that will be compared to the $PM_{2.5}$ NAAQS as well as $PM_{2.5}$ monitoring data collected by MassDEP at the Harrison Avenue site. $PM_{2.5}$ MiniVol data collected at all primary and satellite stations every 12 days for 24 hours and the $PM_{2.5}$ FRM data collected at the Annavoy Street monitoring station every six days for 24 hours will be compared to the $PM_{2.5}$ 24-hour NAAQS and data collected by the BAMs at each of the primary sites and at the MassDEP Harrison Avenue site.

The 24-hour VOCs and carbonyl monitoring data will be used to develop annual average concentrations for comparison to data collected at both the Harrison Avenue and Lynn monitoring stations.

All of the monitoring results will be quality assured by Massport’s consultants based on methods and procedures presented in the QAPP (See Section 8).

9.6 DATA REPORTING

Upon completion of the data quality review and data analyses, quarterly reports will be prepared during each 12-month monitoring period. These reports will be made available to MassDEP and MADPH for review.

10. ROLES AND RESPONSIBILITIES

Massport is responsible for overall implementation and completion of the Study. Within Massport, the work is being managed by the Environmental Project Manager, with oversight by the Assistant Director of Capital Programs and Environmental Management. Other key roles taken by Massport staff include Agency Coordination and EDR/ESPR Coordination. The technical aspects of the Study are being managed by EA under the direction of Robert Newman, P.E., BCEE,. Other key contributors include Ronald Mack, E.I.T. of EA, who will oversee implementation of the field monitoring effort and Jason Samus of EA, who will manage implementation of an internet website for data hosting. Andy Rezendez of Alpha Analytical Laboratory will manage all analytical processes. Mike Kenney of KB Environmental will oversee data analysis at the conclusion of data collection. Figure 3 presents the EA Project Team organizational chart.

The staffs of MADPH and MassDEP will be responsible for reviewing the Work Plan and providing input on the air quality monitoring program.

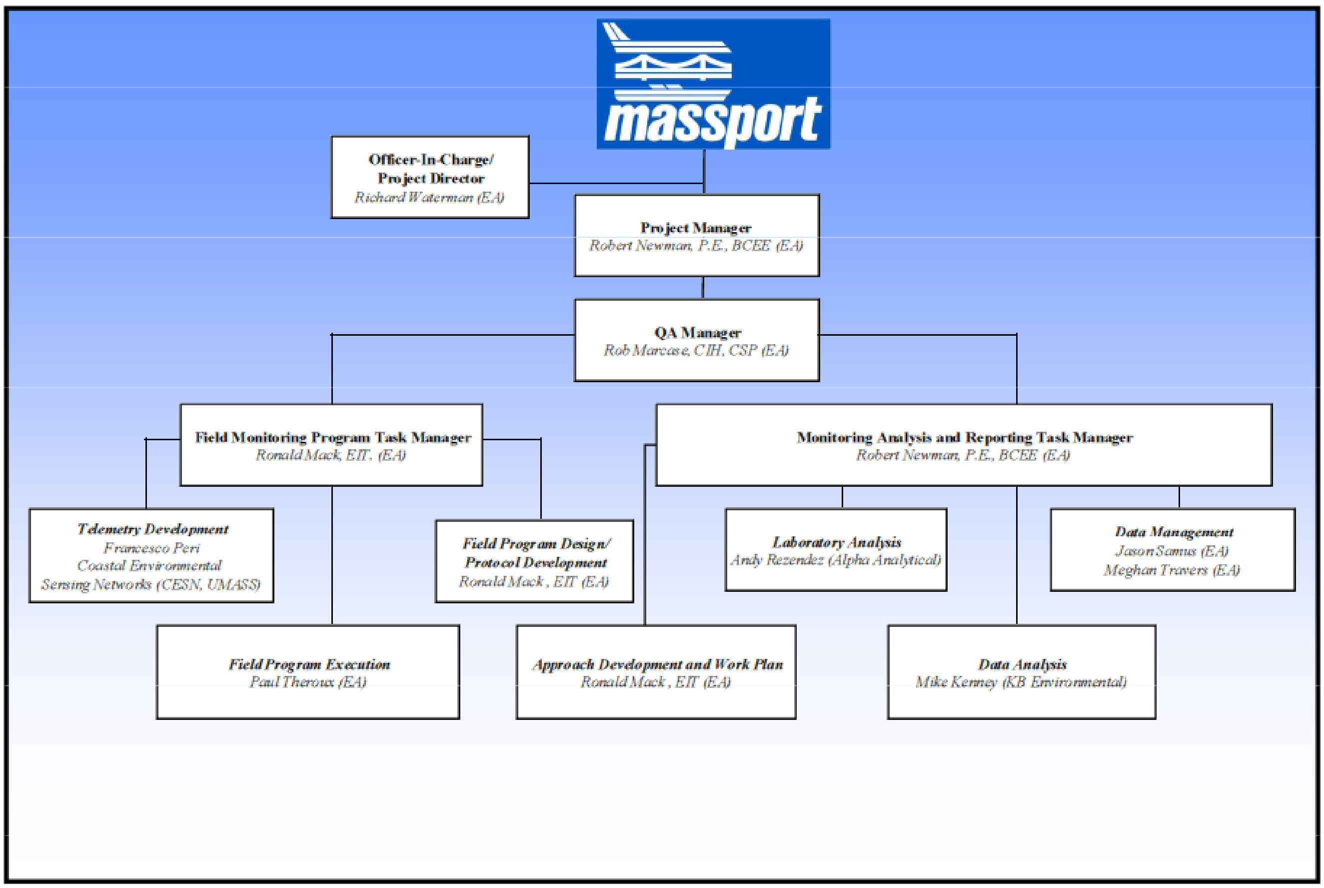


Figure 3 EA Project Team Organizational Chart

11. SCHEDULE

The schedule for completing the baseline year of the Study is presented in Table 8.

TABLE 8 BASELINE YEAR AIR MONITORING SCHEDULE

Task	***Description***	***Start Date***	***End Date***
1	Prepare Technical Work Plan – first draft	July 2010	July 2010
2	Prepare QAPP- first draft	July 2010	July 2010
3	Procure/Service Field Equipment	July 2010	August 2010
4	Setup and Calibrate Equipment	August 2010	August 2010
5	Conduct Baseline Monitoring Program	September 2010	August 2011
6	Analyze Second-Year Monitoring Results	September 2011	November2011
7	Prepare Second-Year Monitoring Report	November 2012	January 2012

12. REFERENCES

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