

Air Monitoring Program
Quality Assurance Project Plan
Wills Wharf Office Project

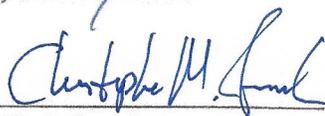
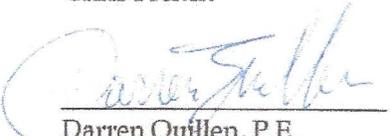
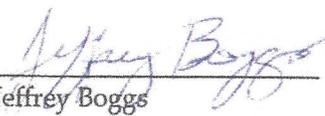
Baltimore Works Site
Baltimore, Maryland

25 April 2016

By:
Environmental Resources Management Inc.
Harbor Point Development LLC

For:
U.S. Environmental Protection Agency - Region III
Maryland Department of the Environment

APPROVAL AND SIGNATURE PAGE FOR THE AIR MONITORING PROGRAM
QUALITY ASSURANCE PROJECT PLAN WILLS WHARF OFFICE PROJECT

	<u>Approval</u>	<u>Date</u>
Project Manager (Harbor Point Development LLC)	 Jonathan Flesher	8/21/16
Project Manager (Honeywell International)	 Chris French	9/23/16
Project Manager (ERM, Inc.)	 Darren Quillen, P.E.	9/21/16
* Project Quality Assurance Manager (ERM, Inc.)	 Jeffrey Boggs	9/21/16
Partner-in-Charge (ERM, Inc.)	 Leonard Rafalko	9/21/16

A signed copy of this Air Monitoring Program Quality Assurance Project Plan is stored in the Harbor Point Development office. Please see the contact in the Acknowledgement Section.

* ERM notes that reference herein to a Quality Assurance (QA) Manager is solely with respect to the construction air monitoring program and not as QA Manager for all construction related activities.

REVISION HISTORY FOR THE AIR MONITORING PROGRAM QUALITY ASSURANCE PROJECT PLAN AREA 1, PHASE I DEVELOPMENT, VERSION 1, FEBRUARY 24, 2014

Date	Revision Description	Initials

TABLE OF CONTENTS

LIST OF ACRONYMS	vi
1.0 PROJECT MANAGEMENT	1
1.1 ROLES AND RESPONSIBILITIES	1
1.2 PROJECT BACKGROUND, OVERVIEW, AND INTENDED USE OF DATA	5
1.3 DATA QUALITY OBJECTIVES	6
1.3.1 <i>State the Problem</i>	6
1.3.2 <i>Identify the Decision</i>	7
1.3.3 <i>Identify Inputs to the Decision</i>	8
1.3.4 <i>Define the Site Boundaries</i>	11
1.3.5 <i>Develop a Decision Rule</i>	12
1.3.6 <i>Specify Limits on Decision Errors</i>	13
1.3.7 <i>Optimize the Sampling Design</i>	14
1.4 MEASUREMENT PERFORMANCE CRITERIA	14
2.0 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATION	15
2.1 DOCUMENTATION AND RECORDS REQUIREMENTS	15
3.0 DATA ACQUISITION	17
3.1 SAMPLE COLLECTION PROCEDURES, DESIGN, & SAMPLING TASKS OVERVIEW	17
3.2 SAMPLING PROCEDURES AND REQUIREMENTS	19
3.3 SAMPLING HANDLING, CUSTODY PROCEDURES, AND DOCUMENTATION	20
3.4 ANALYTICAL METHOD REQUIREMENTS	24
3.5 FIELD QUALITY CONTROL REQUIREMENTS	24
3.6 FIELD INSTRUMENT/EQUIPMENT CALIBRATION AND MAINTENANCE REQUIREMENTS	24
3.6.1 <i>CrVI Air Sampling Instrumentation</i>	26
3.6.2 <i>Total PM Sampling Instrumentation</i>	26

3.7	LABORATORY QUALITY CONTROL REQUIREMENTS	27
3.8	DATA MANAGEMENT REQUIREMENTS	27
4.0	ASSESSMENTS	30
4.1	FIELD DATA REVIEW	30
4.1.1	<i>Sampling Program Design Execution</i>	30
4.1.2	<i>Sample Collection Procedures</i>	30
4.1.3	<i>Sample Handling</i>	30
4.1.4	<i>Quantitative Field Data</i>	31
4.2	LABORATORY DATA	31
4.2.1	<i>Laboratory Data Review and Reduction</i>	31
4.2.2	<i>Laboratory Data Review and Validation</i>	32
4.3	AUDITS OF DATA QUALITY	32
4.3.1	<i>Laboratory Performance Audits</i>	33
4.3.2	<i>System Audits</i>	33
4.4	SURVEILLANCE OF OPERATIONS	35
4.5	ASSESSMENT OF DATA QUALITY	35
4.5.1	<i>Field Data Quality</i>	35
4.5.2	<i>Laboratory Data Reduction</i>	36
4.6	QUALITATIVE AND QUANTITATIVE COMPARISONS TO ACCEPTANCE CRITERIA	37
4.6.1	<i>Accuracy</i>	37
4.6.3	<i>Representativeness</i>	38
4.6.4	<i>Comparability</i>	38
4.6.5	<i>Completeness</i>	38
4.6.6	<i>Sensitivity (Method Detection Limit)</i>	39
4.7	INTERIM ASSESSMENTS OF DATA QUALITY	40
5.1	DATA VERIFICATION AND VALIDATION TARGETS AND METHODS	40
5.2	QUANTITATIVE AND QUALITATIVE EVALUATIONS OF USABILITY	40
5.3	POTENTIAL LIMITATIONS ON DATA INTERPRETATION	43
5.4	RECONCILIATION WITH PROJECT REQUIREMENTS	44
5.4.1	<i>Conduct Preliminary Data Review</i>	44
5.4.2	<i>Draw Conclusions from the Data</i>	44

5.5	REPORTS TO MANAGEMENT	44
5.5.1	Daily Data Summary Tables	44
5.5.2	Event Logs	45
5.5.3	Data Quality Assessment Reports	45
5.5.4	Performance Evaluation and Audit Reports	46
5.5.5	Summary Data Reports	46

LIST OF TABLES

1	<i>Roles and Responsibilities</i>
2	<i>Measurement Quality Objectives</i>
3	<i>Records and Storage Locations</i>
4	<i>Construction Monitoring Samples</i>
5	<i>Field Calibrations, Testing, and Inspection</i>
6	<i>Field Equipment Maintenance, Testing, and Inspection</i>

LIST OF APPENDICES

A	<i>Figures</i>
1	<i>Project Organization</i>
2	<i>Construction Air Monitoring Locations</i>
3	<i>Data Management Process</i>
B	<i>Field Sampling Method SOP</i>
B1	<i>Field Sampling Protocol and Standard Operating Procedure - Real-Time Air Sampling for Total Particulate Matter in Ambient Air</i>
B2	<i>Field Sampling Protocol and Standard Operating Procedure - Sampling of Hexavalent Chromium in Ambient Air</i>
C	<i>Laboratory Analytical Method SOP</i>
D	<i>Standard Operating Procedure for Response Actions and Notifications</i>

LIST OF ACRONYMS

BTV - Background Threshold Value

CFR - Code of Federal Regulations

CL - Confidence Limit

COC - Chain of Custody

CAMP - Construction Air Monitoring Plan

CrVI - Hexavalent Chromium

° C - Degrees Celsius

° F - Degrees Fahrenheit

DQO - Data Quality Objectives

EPA - U.S. Environmental Protection Agency

ERG - Eastern Research Group

ERS - Environmental Remediation System

IDC - Initial Demonstration of Capability

LOD - Limit of Disturbance

Lpm - Liters per Minute

M³ - Cubic Meters

MDE - Maryland Department of the Environment

MQO - Measurement Quality Objectives

µg - Microgram

mg - Milligram

LIST OF ACRONYMS (continued)

ng - Nanogram

PWAM - Perimeter Wills Air Monitor

PM - Particulate Matter

QA - Quality Assurance

QAPP - Quality Assurance Project Plan

QC - Quality Control

SOP - Standard Operating Procedures

SSO - Site Safety Officer

Total PM - Total Particulate Matter

µg - Microgram

µm - Micron

DOCUMENT DISTRIBUTION LIST

QAPP Recipient	Project Role	Organization	Address / E-mail / Phone
Moshood Oduwole, RPM	EPA Project Coordinator	EPA Region 3	Office of Remediation 3LC20 1650 Arch Street Philadelphia, PA 19103-2029 oduwole.moshood@epa.gov (215) 814-3362
Ruth Prince	EPA Technical Lead	EPA Region 3	Office of Technical and Administrative Support 3LC10 1650 Arch Street Philadelphia, PA 19103-2029 prince.ruth@epa.gov (215) 814-3118
Edward Dexter	MDE Project Coordinator	MDE	Solid Waste Program 1800 Washington Boulevard, Suite 605 Baltimore, MD 21230-1719 ed.dexter@maryland.gov (410) 537-3315
Mark Mank	MDE Technical Lead	MDE	Solid Waste Program 1800 Washington Boulevard, Suite 605 Baltimore, MD 21230-1719 mark.mank@maryland.gov (410) 537-3437
Jonathan Flesher	Project Manager	Harbor Point Development LLC (HPD)	1300 Thames Street, Suite 10 Baltimore, MD 21231 jflesher@beattydevelopment.com (443) 463-3937
Chris French	Project Manager	Honeywell International	115 Tabor Road Morris Plains, NJ 07950 chris.french@honeywell.com (973) 455-4131
Darren Quillen	Project Manager	Environmental Resources Management, Inc. (ERM)	180 Admiral Cochrane Drive, Suite 400 Annapolis, Maryland 21401 darren.quillen@erm.com (410) 972-0234
Jeff Boggs	Quality Assurance (QA) Manager for the Construction Air Monitoring Program	ERM	75 Valley Stream Parkway, Suite 200 Malvern, PA 19355 jeff.boggs@erm.com (443) 803-8495
Leonard Rafalko	ERM Technical Lead/Partner-in- Charge	ERM	75 Valley Stream Parkway Suite 200 Malvern, PA 19355 leonard.rafalko@erm.com (484) 913-0428
Julie Swift	Laboratory Program Manager	Eastern Research Group. Inc. (ERG)	601 Keystone Park Drive, Suite 700 Morrisville, NC 27560 julie.swift@erg.com (919) 468-7924

1.0

PROJECT MANAGEMENT

Harbor Point Development LLC (HPD or Developer) and its consultants have prepared this Quality Assurance Project Plan (QAPP) for air monitoring associated with the Wills Wharf Office Project (Project). The Project is planned for a portion of the former AlliedSignal Baltimore Works Site (Site), located at Harbor Point in Baltimore, Maryland. The QAPP has been prepared as part of the Detailed Development Plan (DDP) for Project. The QAPP is to be used in conjunction with the Construction Air Monitoring Plan (CAMP), Material Handling Management Plan (MHMP), Spill Prevention and Response Plan (SPRP), and the Storm Water Pollution Prevention Plan (SWPPP) prepared for the Project.

The QAPP outline and format are substantively consistent with the policies and guidance specified in the *EPA Guidance on Quality Assurance Project Plans* (CIO 2106-G-05 QAPP), EPA, 2012. The QAPP presents the rationale and scope of work associated with field activities (e.g., sample types, sample locations), the Project data quality objectives, protocols for collecting samples, field and laboratory analytical procedures, quality assurance/quality control (QA/QC) procedures, data quality evaluation criteria, and procedures for documenting field and laboratory methods so that data are technically and legally defensible.

1.1

ROLES AND RESPONSIBILITIES

The Developer's Project Team consists of personnel from HPD, Environmental Resources Management, Inc. (ERM), and Eastern Research Group, Inc. (ERG). ERG has been selected to perform the hexavalent chromium (CrVI) air analysis. An independent third-party data validator, Laboratory Data Consultants, Inc. (LDC), will validate the CrVI air sample results.

The following paragraphs describe the major positions and responsibilities of the team along with the approach to quality assurance management. The United States Environmental Protection Agency (EPA) EPA is the lead regulatory agency for this program with key input from the Maryland Department of the Environment (MDE).

Key Project personnel and regulatory personnel and their responsibilities for quality assurance (QA) activities are described below in Table 1. The Project Organization chart (Figure 1) presents the lines of communication and data flow between the individuals listed in Table 1. Reference to ERM's Project team (Project Manager, QA Manager, Field Manager or

Field Technician/Engineer) also implicitly includes reference to a “designee” as someone qualified to perform the work under the direction of the primary responsible party even if not stated explicitly.

Table 1 Roles and Responsibilities

Name	Title/Role	Organizational Affiliation	Responsibilities
Jonathan Flesher	Project Manager	HPD	<ul style="list-style-type: none"> • Oversees all Project activities. • Directs the scope of work to the ERM PM. • Reviews and approves all documents and coordinate transmittal of documents to appropriate parties for review. • Communicates with stakeholders regarding Project activities.
Leonard Rafalko	Technical Lead/ Partner-in-Charge (PIC)	ERM	<ul style="list-style-type: none"> • Oversees entire program for ERM. • Reviews all final deliverables and invoices. • Seeks HPD feedback on performance of Project managers. • Addresses program-level issues.
Darren Quillen	Project Manager (PM)	ERM	<ul style="list-style-type: none"> • Reports to ERM Partner-in-Charge (Leonard Rafalko) and HPD (Jonathan Flesher). • Directs ERM FM and subcontractors. • Communicates questions or issues to Agency leads (Ed Dexter, MDE and Moshood Oduwole, EPA). • Ensures that assigned staff has been trained in SOP implementation. • Ensures that all key decisions and Project deliverables are subjected to independent technical review by qualified personnel within the time frame of the Project schedule.
Jeff Boggs	QA Manager	ERM	<ul style="list-style-type: none"> • Monitors subcontractors (ERG and LDC) for compliance with Project and data quality requirements records, costs, and progress, and plans and schedules work tasks as appropriate. • Ensures and document that QC checks on field equipment are performed according to schedule and meet acceptance criteria.

Name	Title/Role	Organizational Affiliation	Responsibilities
Jeff Boggs (<i>cont'd</i>)			<ul style="list-style-type: none"> • Resolves field QA/QC issues. • Audits, if necessary, sample preservation, handling, transport, and custody procedures throughout the Project. • Reviews and approves all data reduction and reporting procedures for inclusion in deliverables. • Reviews and determines the root cause for any nonconformance, confers with the ERM PM and PIC on corrective measures, and ensures that procedures are modified to reflect the corrective action and are distributed to all field personnel, including subcontractors. • Reports QA and any procedural problems to the ERM PM and PIC. • Tracks the data, corresponds with laboratory about analytical issues, and assists with database issues.
ERM Personnel To be Determined (TBD)	Field Manager (FM)	ERM	<ul style="list-style-type: none"> • Provides technical support to ERM's PM, QA Manager, and Field Engineer as needed. • Performs monitoring and collects samples according to Project QAPP. • Reports to ERM PM. • Prepares and implements this QAPP and deliverables. • Ensures data collection activities are consistent with the QAPP. • Oversees evaluation of data received from the laboratory in accordance with the Project requirements. • Prepares or oversees the preparation of portions of the reports that summarize data results.

Name	Title/Role	Organizational Affiliation	Responsibilities
ERM Personnel TBD	Field Engineer/ Technician (FE / FT)	ERM	<ul style="list-style-type: none"> • Performs monitoring and collects samples according to Project approved QAPP. • Reports to ERM FM (if Field Manager not available, reports to ERM PM). • Communicates any problems or deviations from Project plans to ERM FM. • Ensures that all data collection and handling activities comply with applicable SOPs, including audits, if any, conducted in the presence of Agency personnel. • Prepares and maintains field forms, notebooks, and equipment. • Implements technical procedures applicable to tasks. • Inspects and accepts supplies and consumables. • Coordinates and schedules sample shipment to analytical laboratory to meet holding times and analytical procedure specifications.
Julie Swift or Qualified Designee	Vice President Program Manager Chemist	ERG	<ul style="list-style-type: none"> • Reviews and implements analytical laboratory elements of this QAPP with regards to the CrVI analysis. • Manages analytical chemists to complete the sample analyses selected in this QAPP, according to the approved methods. • Monitors, reviews, and documents the quality of all analytical chemistry work performed by ERG under this QAPP. • Oversees laboratory management of analytical data at the laboratory.
Laura Van Enwyck	Project Manger	ERG	<ul style="list-style-type: none"> • Transmits completed data packages to the ERM QA Manager. • Promptly informs ERM's QA Manager of any laboratory analytical problems, data quality issues, or delays in sample analysis. • Promptly responds to any data quality issues identified through the independent data validation process.

PROJECT BACKGROUND, OVERVIEW, AND INTENDED USE OF DATA

The Site is located on a peninsula on the northeast shore of the Patapsco River of the Inner Harbor in the Fells Point section of Baltimore City. The historical manufacturing processes on a portion of the Site resulted in chromium impacts (hexavalent chromium [CrVI]) to soil and groundwater. The original buildings and associated infrastructure have been removed from the Site.

An Environmental Remediation System (ERS) is maintained and operated by Honeywell International Inc. (Honeywell) to contain CrVI-impacted ground water and control the potential for human exposure to affected soil in "Area 1." Area 1 was the principal site of Honeywell's Baltimore Works Facility where chromium ore was processed from 1845 to 1985. The ERS consists of a Multimedia cap (MMC), Hydraulic Barrier (HB), Head Maintenance System (HMS), a ground water storage and transfer system, and Outboard Embankment. The HMS maintains an inward ground water gradient to mitigate the migration of chromium-impacted ground water from the site.

The Site includes two other areas, referred to as Area 2 and Area 3. These areas were used for various industrial and warehousing operations, including chromate ore storage (Area 2) and brass foundry casting, oil blending and storage, coating/plastics production, lumber storage and foundry (Area 3). Areas 2 and 3 currently include the Thames Street Wharf (TSW) Office Building and its associated parking lots, where construction was completed in 2010.

The majority of the Project will occur in the western region of Area 2, south of Point Street (formerly Block Street). The construction of Wills Street as part of the Project will involve a limited area along the southeastern portion of Area 1. The Project will also include other non-designated areas that are outside of Area 1 or Area 2 but within the Project's limits of disturbance (LOD) presented in the DDP. The Project will not disturb Area 3 or the TSW Office Building.

The primary concern addressed by this QAPP is the potential for particulates containing CrVI to be generated during the period of construction that involves intrusive activities. Intrusive activities (as defined in the MHMP) occur any time there is disturbance or exposure of the surface immediately below the MMC synthetic layers inside the HB in Area 1 or the upper geotextile that was constructed as part of the Layered Soil Cap (LSC) in Area 2.

Because of the dynamic nature of dust-disturbing activities during construction, providing real time information on concentration levels of particulates to Project personnel during construction is appropriate to support dust controlling measures. Real-time instrumentation is available to measure ambient concentrations of total particulate matter (Total PM), but such instrumentation is not available for measuring CrVI concentrations in real-time. Air samples for measuring CrVI concentrations require laboratory analysis.

To address the data objectives, air monitoring data will be collected throughout the construction period that involves intrusive activities, in accordance with the CAMP. Real-time dust control will be accomplished by the monitoring of real-time Total PM for action level compliance. The intended use of the air monitoring data is to ensure the efficiency of on-going dust-suppression activities such that dust control measures can be implemented, augmented or adjusted, as appropriate. Dust controlling measures are described in the MHMP.

Air monitoring will also include the collection of air samples for analysis of CrVI during intrusive construction activities in Area 1. The CrVI data will be viewed as a delayed confirmation of the effectiveness of dust control at the site, since the CrVI samples must be analyzed by a fixed off-site laboratory with a minimum three to five day delay between sampling and receipt of non-validated results.

1.3 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are an integrated set of qualitative and quantitative decision statements that define data quality requirements based on the end use of the data. The EPA has developed a seven-step process (shown in bold italics below) to clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. The DQO process is described in detail in the EPA guidance document, *Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4* (February 2006).

1.3.1 State the Problem

The problem being addressed is to ensure that representative and accurate real-time particulate (Total PM) and airborne CrVI data are collected to ensure that the Project perimeter and work zones are accurately

monitored during intrusive construction activities to control any potential release in a timely manner.

1.3.2 *Identify the Decision*

Are the real-time Total PM and airborne CrVI concentrations accurate and representative of routine city traffic conditions?

1. Possible Outcome - Collected data shows acceptable variability and expected airborne concentrations.
 - a. No Action.
2. Possible Outcome - Collected data shows extreme concentration variability.
 - a. Possible Actions -
 - i. Option - Accept data as representative of urban setting.
 - ii. Option - Review field logs to determine if there were any conditions (unusual traffic, extreme weather, etc.) that could explain the variability.
 - iii. Option - Conduct 100% raw data validation.
 - iv. Option - Use additional statistical analysis to remove significant outliers and evaluate the influence on data.
3. Possible Outcome - Collected data shows unexpected elevated airborne concentrations.
 - a. Possible Actions -
 - i. Option - Accept data as representative of urban setting.
 - ii. Option - Review field logs to determine if there were any conditions (unusual traffic, extreme weather, etc.) that could explain the unexpected elevated airborne concentrations.
 - iii. Option - Conduct 100% raw data validation.
 - iv. Option - Use additional statistical analysis to remove significant outliers and evaluate the influence on data.

1.3.3 *Identify Inputs to the Decision*

This section summarizes the variables to be measured, the quality assurance/quality control mechanisms in place, measurement quality objectives, data validation and audit results, and statistical analyses to be performed to resolve the decision (Section 1.3.2, above).

1.3.3.1 *Variables to be Measured*

Variables to be measured include:

- Total PM concentrations during intrusive construction activities;
- 24-hour particulate CrVI concentrations during intrusive construction activity in Area 1; and
- Observations of ambient conditions and activities in the vicinity of each monitoring station.

1.3.3.2 *Quality Assurance/Quality Control Mechanisms*

Quality assurance/quality control (QA/QC) mechanisms are described in detail in Sections 2.5 through 2.7. QA/QC mechanisms include:

- Accuracy, precision, and sensitivity of analysis – review the Measurement Quality Objectives (MQOs) are met;
- Representativeness and comparability of field data;
- Sample documentation (including field and laboratory records);
- Maintenance and calibration of field and laboratory equipment;
- Analytical procedures for CrVI that comply with ASTM Standard Test Method D7614-12 Determination of Total Suspended Particulate (TSP) Hexavalent Chromium in Ambient Air Analyzed by Ion Chromatography and Spectrophotometric Measurements; and all of the associated QA/QC requirements of the method (ERG's Laboratory Standard Operating Procedure (SOP) is included as Appendix C).
- Review of field and laboratory data by qualified personnel.

1.3.3.3

Measurement Quality Objectives (MQOs)

MQOs are designed to evaluate and control various phases of the measurement process to ensure that total measurement uncertainty is within a range that will meet the DQO requirements. The MQOs (provided in Table 2) can be defined in terms of the following data quality indicators.

Table 2 Measurement Quality Objectives

Analyte	Reporting Units	Bias*	Representativeness	Comparability/ Method Selection	Completeness	Method Detection Limit
Total Particulate Matter	µg/M ³	NA	Air shed within Project LOD & surrounding site vicinity during intrusive activities.	Direct Read Instrument DustTrak 8533; factory and field calibrated	Fifteen (15) minute average Total PM concentration measurements for 24-hour sampling day at each fixed, monitoring location.	1.0 µg/M ³
Hexavalent Chromium (CrVI)	ng/ M ³	25%	Air shed within Project LOD & surrounding vicinity during intrusive activities.	ERG-specific method ERG-MOR-063 based on ASTM Test Method D7614-12	90% of proposed samples. Three samples collected (one from each fixed station) per 24-hour sampling day during Area 1 intrusive activities. Sample analysis by laboratory is dependent on conditions described in CAMP.	0.0078 ng/ml (0.0036 ng/ M ³ based on 21.6 M ³ sample volume)

* = These are estimates. The methods do not state the precision or bias. Refer to ERG SOP.

ASTM = American Society for Testing and Materials

µg/M³ = Micrograms per cubic meter

ng/M³ = Nanograms per cubic meter

A more detailed description of these MQOs and how they will be used to control and assess measurement uncertainty will be described in the following elements of the QAPP.

- Precision – a measure of mutual agreement among individual measurement of the same property usually under prescribed similar conditions. This is the random component of error.
- Bias – the systematic or persistent distortion of a measurement process which causes error in one direction. Bias is determined by estimating the positive and negative deviation from the true value as a percentage of the true value.
- Representativeness – a measure of the degree to which data accurately and precisely represent a characteristic of population, parameter variations at a sampling point, a process condition, or an environmental condition.
- Sensitivity – the determination of the low range critical value of a characteristic that a method-specific procedure can reliably discern.
- Completeness – a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.
- Comparability – a measure of the level of confidence with which one data set can be compared to another.

1.3.3.4 *Data Validation*

Data validation is discussed in detail in Section 4.1. Data validation will include the following:

- The laboratory will review and reduce the data internally prior to submitting the data to ERM. Laboratory SOPs for internal data review procedures are included in the laboratory's QAPP;
- Laboratory data (non-validated) will be reviewed by ERM;

- Following receipt of the laboratory report, ERM will send the sample group QC package data to Laboratory Data Consultants, Inc. (LDC), an independent third-party validator. The validator will perform a Level II validation with 40% re-calculation of raw data. Data validation results will be reported to ERM's QA Manager using a Level IV template. Validation will follow EPA's *Guidance on Environmental Data Verification and Data Validation* (2002). The validation process is described in detail in Section 5.

1.3.3.5 *Statistical Analysis*

Laboratory statistics will be performed to assure precision, accuracy, and sensitivity of the collected CrVI data. These measures and statistics are discussed in Section 4.6.

1.3.4 *Define the Site Boundaries*

The target media is air at the Project boundary. As described in the CAMP, perimeter air monitoring for Total PM will be performed during intrusive construction activities. CrVI air samples will be also be collected from the fixed perimeter monitoring stations during Area 1 intrusive work. The CrVI air samples will be collected over a 24-hour interval as described in the CAMP. Figure 2 shows the fixed perimeter air monitoring locations (designated as PWAM for "Perimeter Wills Air Monitoring").

Work zone monitoring for Total PM with mobile equipment will be performed during intrusive activities in Area 1.

The primary practical constraints include:

- Methods to measure particulate CrVI are limited to analytical laboratory methods. Particulate CrVI cannot be determined real-time in the field;
- Severe weather would create a safety concern and may also damage equipment and influence the monitoring results. Sample collection may be delayed if severe weather is encountered;
- Samples for particulate CrVI must be stored at 0°C or less;
- Monitoring locations will require electric power to operate instruments and sampling pumps;

- The monitoring locations are subject to dust generating activities unrelated to intrusive construction work;
- Monitoring locations must have safe access for personnel and security for instruments and sampling pumps.

The scale of decision for this Project is air at the Project LOD.

1.3.5 *Develop a Decision Rule*

For this Project, the decision is whether the data collected meet quality requirements and therefore can be accepted as valid representations of airborne Total PM and particulate CrVI concentrations during intrusive activities. The parameters of interest are the concentrations of Total PM and particulate CrVI in the air shed at the Project LOD. The decision making scale during construction is a rapid response (within 15 minutes) to Total PM concentrations at or above a dust action level (the Background Threshold Value or “BTV”) such that dust suppression measures can be promptly implemented.

The outcome of the construction air monitoring is the collection of valid data, representative of intrusive construction activities, which demonstrate that concentrations are at or below the BTVs. The BTV for Total PM and CrVI were determined and approved by EPA and MDE during a pre-construction air monitoring program that was performed as part of the Exelon Project (“Harbor Point Area 1, Phase 1 Development Project”). The BTV for Total PM and CrVI for this Project are the same as the Exelon Project. Specifically, the Project will:

- Collect Total PM and particulate CrVI data using accurate methods, including data quality review. Ensure that the samples are collected using calibrated equipment. Analyze CrVI concentrations in an EPA-certified laboratory. Ensure that samples are collected when intrusive activities occur. Ensure that appropriate quality assurance/quality control measures are followed to confirm data accuracy and precision; and
- Collect and analyze Total PM and particulate CrVI using the same methods during construction as were used for previous construction monitoring during the Exelon Project. Collect real-time Total PM data from locations as close as safely possible to intrusive construction activities and from locations approximating, to the extent practical, the Project LOD to ensure any increases in Total PM above the BTV are identified and dust suppression measures are implemented.

Hypotheses and decision error is discussed in the following section.

1.3.6 *Specify Limits on Decision Errors*

The problem statement is to ensure that representative and accurate real-time particulate and airborne CrVI data is collected to define air quality relative to these two parameters during intrusive activities for the Project. During construction, use of the BTVs to determine whether particulate CrVI concentrations exceed ambient conditions is a decision making problem, as defined in the EPA guidance document, *Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4* (February 2006).

The BTV for Total PM and CrVI were determined and approved by EPA and MDE during a pre-construction air monitoring program that was performed as part of the Exelon Project. The BTV for Total PM and CrVI for this Project are the same as described in the CAMP.

The hypotheses and associated decision errors are:

- Ho: Total PM concentration is greater than the BTV
 - Type II error (false acceptance): Total PM concentration is identified as greater than the BTV, but is actually less than or equal to the BTV
- Ha: Total PM concentration is less than or equal to the BTV
 - Type I error (false rejection): Total PM concentration is identified as less than or equal to the BTV, but is actually greater than the BTV

Third-party data validation, as required for this project by the agencies, is for CrVI data, only. Collected data must meet all EPA quality requirements and will be validated according to the guidance provided in *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (January 2010) and ASTM Standard Test Method D7614-12. Air monitoring data collected during the intrusive activities will be validated. Appropriate calibration of equipment during field activities and during laboratory analysis will be performed (see Sections 2.6 and 2.7 and Appendices B and C).

1.3.7 *Optimize the Sampling Design*

The sampling design is described in the CAMP. Total PM and air samples for CrVI will be collected from three fixed station perimeter air monitoring locations (Figure 2) placed in the prevailing downwind and cross wind direction from the Project LOD. In addition, work zone monitoring will occur in Area 1 during intrusive activities using a mobile station monitor for Total PM.

The CAMP describes the air monitoring design, and the frequency and duration of air monitoring during intrusive activities for the Project. The CAMP also describes the conditions under which air samples would be submitted for laboratory analysis of CrVI.

1.4 **MEASUREMENT PERFORMANCE CRITERIA**

The quality of the collected air sampling data must be evaluated and controlled to ensure that data quality is maintained within the established acceptance criteria. Measurement quality objectives for the data apply to both collection of the data (e.g., trip and field blanks) and the analysis procedures (e.g. lab blanks). The measurement objectives for this Project are as described in the Laboratory Analytical Method SOP in Appendix C. The analytical method meets specific criteria for precision, bias, representativeness, minimum detection limits, comparability and completeness as shown on Table 2. EPA's definitions for these terms were described previously in Section 1.3.3.3.

2.0

SPECIAL TRAINING REQUIREMENTS AND CERTIFICATION

Each analyst analyzing samples under this Project will have an Initial Demonstration of Capability (IDC) on file for the analysis of Cr(VI) in ambient air at the laboratory. The IDC will be available upon request.

The personnel performing the field tasks will be able to demonstrate by training records and documented experience that they can operate, troubleshoot and maintain the equipment and perform QC checks.

2.1

DOCUMENTATION AND RECORDS REQUIREMENTS

Documentation and records anticipated to be generated during the Project are listed below in Table 3, along with their storage location:

Table 3 Records and Storage Locations

Record	Storage Location
<i>Sample Collection and Handling Records</i>	
Daily per-sample field data sheets (including DustTrak 8533 readings) (see Section 2.2. & Appendix B for field sheet contents; information collected will include field equipment maintenance information, see Sections 2.2 & 2.3)	Field (hard copy); Faxed copies scanned or electronic documents stored weekly in ERM's office (ERM's Annapolis, Maryland office) Project file (electronic copy).
Field Notebooks	Field (hard copy); Scanned and stored in ERM's office Project file at the conclusion of the field work. Electronic copy will be stored.
Sample COC sheets	Field (hard copy); Faxed copies scanned or electronic documents stored weekly electronically in ERM's office Project file.
Sample receipt acknowledgement from the laboratory	Electronic copies stored weekly in ERM's office Project file.
Corrective Action Reports (if any)	Field (hard copy); ERM's Office Project file (electronic copy).
Field SOPs	Field (hard copy); ERM's Office Project file (electronic copy). Electronic copy will be stored.

Record	Storage Location
<i>Analytical Records</i>	
Laboratory Sample Management Records ⁽¹⁾	ERG (electronic).
Test method raw data & reported results ⁽¹⁾	ERG (electronic), ERM Project file (electronic).
QA/QC reports (general QC records, MDL info, calibration, etc.) ⁽¹⁾	ERG (electronic), ERM Project file (electronic).
Test Method SOP	ERG (electronic), ERM Project file (electronic).
DustTrak 8533 data logs	Upload data logs to field computer once per day (electronic), Backup to ERM's Office Project within 36 hours of field upload (electronic) and upload to Project website during construction within the next business day of field upload.
<i>Data Assessment Records</i>	
Data validation reports	ERM receives electronic copy from third party data validator (LDC) and stores electronic copy.

(1) Included in the ERG Laboratory Report

All electronic versions/copies of data and reports will be initially stored on ERM's secure server. Data and reports will be transmitted to HPD, and HPD will supply records to Honeywell, EPA, and MDE as required, unless otherwise directed by HPD.

The results of air sampling during construction will be posted to the Project website per agreement between HPD and EPA and MDE. The CrVI analytical results will be posted after validation.

The URL for the Project website is: <http://harborpointbaltimore.info>.

Electronic copies of data will be retained on file at ERM for one year after the cessation of air monitoring, and will be readily available for audits and data verification activities. After one year, hardcopy records (if any) and computer backup electronic media will be discarded.

3.0 DATA ACQUISITION

3.1 SAMPLE COLLECTION PROCEDURES, DESIGN, & SAMPLING TASKS OVERVIEW

Sample collection is based on a judgmental design (rather than probability-based). Sample locations, frequency and duration are described in the CAMP.

During construction, dust levels (Total PM) will be monitored at three fixed perimeter stations during intrusive activities. Air samples for CrVI will also be collected at each of these three fixed stations during intrusive construction activities in Area 1.

Fixed perimeter monitoring will start and end prior to daily work hours for beginning each work day that will include intrusive construction activities. ERM anticipates that the work week will be Monday through Friday, excluding holidays and weather permitting. As such, the 24-hour monitoring period will start on the Sunday evening prior to the start of the work week and cease Friday evening after intrusive construction has ended for the week. However, this schedule may be adjusted in the future depending on actual field conditions encountered, identified efficiencies for improvements, and the construction schedule.

In addition, one work zone station with a mobile dust monitor will also be used during intrusive activities in Area 1. The work zone monitors for Total PM will be operational during intrusive work in Area 1 as described in the CAMP. As described in the CAMP, multiple work zones mobile monitors for Total PM may be used depending on the construction sequence and schedule.

The air monitors for Total PM (fixed perimeter and mobile station) will be set to send an alert in the event the Total PM action level is exceeded, providing immediate feedback to workers as to when dust levels might require additional controls. Table 4 summarizes the number of samples and analytical methods used for construction sampling.

Table 4 Construction Monitoring Samples

Sampling Location	Sample Methods	Monitoring/ Sampling Equipment	Sampling Duration	QA/QC Events
PWAM-1, PWAM-2, and PWAM-3.	Real-time total PM: Equipment-specific method.	(1) DustTrak Model 8533.	Duration of intrusive activities, 24-hour continuous monitoring.	Zero check calibration before first use Clean inlet every 2 weeks Replace internal filters every 2 weeks or sooner if error message noted. Flow rate calibration at beginning and end of sample collection.
One Work Zone Total PM Monitor in Area 1. Multiple units may be deployed depending on construction progress and sequence.	Real-time total PM: Equipment-specific method	(1) DustTrak Model 8533.	During Area 1 Intrusive activities as specified in the CAMP.	Zero check calibration before first use. Clean inlet every 2 weeks Replace internal filters every 2 weeks or sooner if error message noted. Flow rate calibration at beginning and end of sample collection.
Three CrVI Samplers paired each with PWAM-1, PWAM-2, and PWAM-3.	CrVI: Laboratory-specific method ERG-MOR-063.	(1) BGI Model PQ-100 pump with NaHCO ₃ -impregnated Whatman 541 filter cassettes.	Duration of intrusive activities in Area 1, 24-hour sample collection as specified in the CAMP.	Flow rate calibration at beginning and end of sample collection. Confirm start and stop flow rates within ±10%. Confirm sample operation within time parameters.

Each perimeter air monitoring location (for Total PM and CrVI air sampling) will be sited in accordance with EPA monitor siting guidelines established in 40 CFR Part 58, Appendix E, to provide representative data for the area. This guidance ensures monitoring locations and equipment will be sited, to the extent possible, away from trees, buildings, roadways, or other obstacles that may cause undue influence on the measured concentrations. Sampler inlets will be placed not less than 2 meters above ground level and have unrestricted air flow for at least 270 degrees around each sampler. The monitoring location selection will be verified by EPA and MDE personnel in the field.

A meteorological monitoring station will be sited following EPA siting guidance in EPA-454/B-08-002 *Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV: Meteorological Measurements Version 2.0*

(Final), March 2008. The wind speed and direction sensors for the meteorological monitoring system will be situated approximately 10 meters above ground, mounted to one of the temporary construction office trailers housing the either Developer's or General Contractor's representatives. The meteorological sensors will be calibrated on-site during installation following the guidance of EPA-454/B-08-002.

3.2 SAMPLING PROCEDURES AND REQUIREMENTS

Details of sample collection procedures are provided in the CAMP. Sample start time, end time, beginning and ending flow rate (see Section 4.6), and total sample volumes will be recorded on the field sheets (Appendix B) along with any other pertinent information regarding sample collection.

Field sheet entries will be dated and signed. Information entered in the field sheets will include, at a minimum, the following items:

- Project name and number;
- Dates and times of entries;
- Weather conditions;
- Names of personnel performing the activities;
- A description of sample locations, including sample name and type;
- Field instrument calibration information;
- Field instrument readings; and
- Health and safety information.

Information recorded in the field sheets should be neat, legible, completed in dark, permanent ink, and signed and dated by the person completing the entry.

Copies of the field sheets will be provided to the PM, as appropriate, and the data will be summarized for reporting purposes and retained in the appropriate Project file. During the intrusive activities, the field sheets will be in a secure location when not in use (e.g., construction trailer, etc.).

Corrections to field documentation will be made by striking out the incorrect entry, entering the corrected value or text, and dating and initialing the document; the original entry will remain visible.

3.3

SAMPLING HANDLING, CUSTODY PROCEDURES, AND DOCUMENTATION

CrVI samples will be stored in an on-site freezer and shipped to the laboratory twice per week during construction monitoring. CrVI samples have a holding time of 21 days according to the laboratory SOP, providing they are kept frozen. For this project, the holding time will be considered 10 days, which is consistent with the holding time established for the Exelon project. Sample coolers will be refreshed with ice packs as necessary to ensure a nominal temperature of 0°C is maintained until receipt by the laboratory. Samples will be stored in the laboratory freezer until extraction and sample analysis.

CrVI samples are collected on specific, laboratory-prepared filters that are loaded by the laboratory into cassettes. In the field, the cassettes are loaded into the sample pump for collection of primary samples. Filters will be considered invalid if any of the following occur:

- Filter cassette has been dropped or contaminated with any foreign matter (such as dirt, finger marks, ink, liquids, etc.);
- Filter with tears or pinholes;
- The start and stop flow rates differ more than $\pm 10\%$; or
- Filter sample operates less than 23 hours or more than 25 hours (i.e., the air sample for possible CrVI analysis is collected from a sample duration of less than 23 hours or more than 25 hours).

The filter cassettes sent by the laboratory will be sealed in zip lock plastic bags. The zip lock-sealed bag with the filter cassette and a pre-cleaned, glass funnel, sealed in a separate zip lock bag (“sample media”), will be placed by the laboratory in a plastic container with a numbered lid. The sealed container will be placed in a sealed zip lock bag (“sample container”), along with the chain of custody form. The sample containers will be packed into a cooler with ice packs prior for shipment from the laboratory to the field to maintain a nominal temperature of 0° C or less. The coolers will be sealed with tape and a chain of custody seal.

Upon receipt in the field from the laboratory, the sample containers will be removed from the coolers, logged in the freezer chain of custody and stored in the on-site secure freezer. The freezer chain of custody will include date and time placed into the freezer with the signature of ERM's FM placing them into the freezer, and the same information will be recorded upon retrieval from the freezer as discussed below.

At the beginning of each sampling day, sample containers retrieved from the on-site secure freezer for that day's sampling will be recorded as logged-out on the freezer chain of custody and will be placed in coolers with ice packs for transit from the freezer to the sampling locations. At the conclusion of each day's sampling, the sample media will be recovered, placed in the sealed sample containers, temporarily stored in coolers with ice packs during transit from the sampling stations to the on-site secure freezer, logged in to the freezer chain of custody and placed in the on-site, secured freezer to maintain a nominal temperature of 0° C or less.

For shipment of samples to the laboratory from the field, the sample containers will be logged out on the freezer log. The sample containers will then be shipped back to the laboratory inside the sealed zip lock-sealed bag in which they were received from the laboratory, along with the executed COC, fastened by rubber band to the sample container. The sample containers will be placed in a sturdy cooler with frozen ice packs to maintain a nominal temperature of 0° C. The cooler will be lined with plastic bubble wrap or other appropriate cushioning material for shipment back to the laboratory. The shipping coolers will be sealed with tape.

The sample date and time collected, Project name and number, and unique sampling number associated with the filter will be recorded on the sample label. CrVI samples will be placed in a cooler with ice packs immediately after removing filter cassettes from the sample pump, as CrVI samples must arrive at the laboratory at nominal temperature of 0°C.

The chain of custody (COC) of the physical sample and its corresponding documentation will be maintained throughout the handling of the sample. All samples must be identified, labeled, logged in a COC form, and recorded in the field notebook as a part of the procedure to ensure the integrity of the resulting data. Information required on the COC form includes the following:

- Project name, location, and number;
- Name of ERM PM;

- Sampler name and signature;
- Location and time of sampling;
- Total volume of air that passed through the filter, including both the calculated total volume and the total volume reported by the BGI PQ-100 sampler;
- Unique sampling number associated with the filter;
- Sample type and matrix;
- Requested analytical parameters or methods;
- Laboratory name and contact information;
- Signature of person relinquishing samples;
- Date and time of relinquishing;
- Special instructions, if any;
- Signature of receiver and date and time samples received (completed by laboratory upon receipt).

The record of the physical sample (location and time of sampling, total volume of air that passed through each filter) will be related to the analytical results through accurate accounting of the sample custody. Sample custody applies to both field and laboratory operations. Analytical requests will be identified on the form. The information (for each sample) provided on the COC form will duplicate the information provided on the sample label of each sample container. A carbon copy of the COC form completed by the field team will be submitted to the ERM QA Manager. The original and carbon copy COC form will be placed in protective plastic and will be taped to the inside lid of the cooler containing samples for transport to the laboratory. The COC forms (electronic or paper copies) will be retained in the ERM Project file by the ERM's PM.

Sampling personnel will be responsible for the care and custody of the samples from the time they are collected until they are transferred to another individual. A sample is under an individual's custody if one of the following criteria is met:

- It is in the sampler's possession;

- It is in the sampler's view after being in possession;
- It is in the sampler's possession and secured to prevent tampering;
- It is in a designated secure area.

Sampling personnel will complete the COC form for each sample shipment. When transferring custody, the individuals relinquishing and receiving samples will sign, date, and note the time of the exchange on the record. The COC record will be completed using waterproof ink. Corrections will be made by drawing a single line through the error and initialing and dating the correction. Information will not be erased or rendered unreadable.

When the samples arrive at the laboratory, the laboratory personnel receiving the sample cooler will evaluate the integrity of the samples and sign the COC form. The laboratory will assign work order numbers to the samples for use in its internal tracking system. Damaged sample containers, sample labeling discrepancies between sample container labels and the COC form, and analytical request discrepancies will be noted on the COC form. The laboratory will contact the ERM FM or ERM QA Manager by sending the COCs and the sample non-conformance report electronically within 24 hours of sample receipt.

The laboratory will also provide a sample acknowledgment to ERM indicating field sample identification, laboratory identification number, and analytical testing logged for each sample. ERM will review this information for correctness within approximately 24 hours of receipt and provide feedback to the laboratory. The status of a sample can be checked at any time by referring to the laboratory numbers on the COC form and the laboratory work order numbers in the notebook. Both the laboratory and unique sampling numbers will be cited when the analytical results are reported. The laboratory will send the carbon copy of the COC form and the analytical data package to ERM's PM.

Standard Operating Procedures (SOPs) and data collection forms have been developed for sample custody, sample labeling, analysis requests, and shipping and tracking procedures. Field SOPs are included in Appendix B of this QAPP. Analytical laboratory sample custody procedures are included in the laboratory SOP (Appendix C), which identify the roles of both the sample custodian and the laboratory coordinator.

3.4 ANALYTICAL METHOD REQUIREMENTS

CrVI concentrations from submitted samples will be determined in the laboratory in accordance with the Standard Operating Procedure for the Preparation and Analysis of Hexavalent Chromium by Ion Chromatography prepared by Eastern Research Group, Inc. (ERG), dated February 2014, as provided in the SOP found in Appendix C of the QAPP. ERG's document references ASTM Standard Test Method D7614-12 Determination of Total Suspended Particulate (TSP) Hexavalent Chromium in Ambient Air Analyzed by Ion Chromatography (IC) and Spectrophotometric Measurements.

The required laboratory turn-around time (TAT) will be 10 business days from receipt of samples by the laboratory unless written approval is received from EPA and MDE to adjust the TAT.

3.5 FIELD QUALITY CONTROL REQUIREMENTS

Field blank filters in sample cassettes will be sent to the field, opened, and re-packaged as with the sample filter cassettes but not exposed to the air on a sampling device, and returned to the laboratory along with the primary samples according to the schedule shown in Table 4. Blank filters will be provided by the laboratories from the same lot as the filters provided for sample collection.

Additionally, a trip blank will be included in each sample set shipped to the laboratory. A trip blank is shipped to the field and back to the laboratory but never opened. All filters will be maintained at a nominal temperature of 0°C from the time of shipment from the laboratory until the time of analysis, except during field sampling.

3.6 FIELD INSTRUMENT/EQUIPMENT CALIBRATION AND MAINTENANCE REQUIREMENTS

Maintenance and calibration of field instruments are included in the Field Sampling Method SOP in Appendix B. Sampling equipment will be maintained according to the manufacturer's specifications. A summary of the daily field calibration procedures is provided in Table 5 and a summary of field equipment maintenance procedures is provided in Table 6.

Table 5 Field Calibrations, Testing, and Inspection

Field Equipment	Calibration Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria
BGI Model PQ-100.	Pump flow rate.	One point calibration using BGI TetraCal.	Initial daily flow check. Start/stop flow rates.	Beginning and end of each sample collection period.	Initial flow rates $\pm 4\%$. Start and stop flow rates $\pm 10\%$. Flow rate at 15 L/min.
DustTrak DRX 8533.	Zero instrument. Pump flow rate.	1-point check with zero filter One point calibration using BIOS Defender 510-H.	Zero value. Initial daily flow check. Start/stop flow rates.	Once per day. Once per day.	3 liters per minute, $\pm 5\%$. ± 0.001 milligrams per cubic meter.

Table 6 Field Equipment Maintenance, Testing and Inspection

Field Equipment	Parameter	Maintenance Activities	Inspection Activity	Frequency	Acceptance Criteria
BGI Model PQ-100.	Pump flow rate.	Replace diaphragms, valves, and bearings after 5000 hours of use	Check pump cumulative time.	Beginning of each week.	Less than 4,500 cumulative hours.
DustTrak DRX 8533.	Zero instrument. Clean instrument.	1-point check with zero filter. Clean inlet and internal filters. Factory cleaning and calibration.	Zero value. Confirm that no error indicators are present on instrument screen. Confirm with rental agency that factory cleaning has occurred.	Once per day. Check instrument screen once per day; clean once every two weeks. Beginning of Project.	± 0.001 milligrams per cubic meter. Confirm maintenance schedule in field notebook.

3.6.1 *CrVI Air Sampling Instrumentation*

Air samples for CrVI analysis will be collected using BGI Model PQ-100 or equivalent samplers. Sampling will be performed at 15 L/min during the sampling period. Sampling flow rates will be checked at the beginning and end of each sampling period, using BGI TetraCal flow standard and flow rates recorded on the field sampling form (form included in Appendix B). If the initial daily flow check varies from the pre-set sampling flow rate by more than 4 percent, a full recalibration will be performed.

The total volume reported by the BGI PQ-100 will be provided on the field sheets with the data reports. For QC comparison, the average flow rate reported by the BGI PQ-100 will be multiplied by the exact duration of time the sample was being collected in order that the total volume can also be calculated for each sample. Note that the instrument is designed to maintain a steady flow rate.

If the beginning and ending flow rates vary by more than 10%, the filter is invalidated. Calibration records and the individual air volumes per filter, including all volume calculations will be documented and provided with data reports. The BGI Model PQ-100 instruction manual is provided in the Field Sampling Method SOP (Appendix B).

3.6.2 *Total PM Sampling Instrumentation*

The DustTrak Model 8533 monitors Total PM concentrations and stores 1-minute averages on an internal data logger. The manufacturer lists daily maintenance and calibration procedures that will be followed in the field. In addition, other maintenance and calibration procedures that will be used are as follows:

- Before each use: perform a zero check according to manual instructions;
- Manufacturer instructions recommend cleaning the inlet after every 350 hours if total dust concentrations are at 1 mg/M³. As a practical matter in the field, the inlet will be cleaned every two (2) weeks and the cleaning date and time recorded in the field notebook;
- Manufacturer instructions recommend replacing internal filters every 350 hours if total dust concentrations are at 1 mg/M³ or

when indicated by the main screen filter error indicator. As a practical matter in the field, if no error message has been noted, the inlet will be cleaned every two (2) weeks and the cleaning date and time recorded in the field notebook.

Because the DustTrak Model 8533 will be operated in the Total PM mode rather than size-specific classifications, the factory-set photometric calibration factor (PCF) of 1.0 and size correction factor (SCF) of 1.0 will be used. As recommended by the manufacturer, the Ambient Air calibration factor will be selected to represent outdoor ambient dust. The DustTrak Model 8533 instruction manual is provided in the Field Sampling Method SOP (Appendix B).

3.7 *LABORATORY QUALITY CONTROL REQUIREMENTS*

Laboratory records are defined as all written, recorded, and electronic documentation necessary to reconstruct all laboratory activities that produce data and include all information relating to the laboratory's equipment, analytical test methods, and related activities.

The laboratory will retain copies of all sample, sample QC and calibration runs, quantitation reports, injection logs, preparation summary sheets, corrective action reports, and summary information in a central file location for 5 years from the date of analysis. Electronic copies of raw data should also be retained by the laboratory for 5 years from the date of analysis.

Specific laboratory instrument calibration procedures for various instruments are described in detail in the method-specific procedures and laboratory SOPs for the analytical laboratory selected, as provided in Appendix C.

3.8 *DATA MANAGEMENT REQUIREMENTS*

This section describes the data management process and methods to ensure data integrity from data production in the field to final use and retention. All data will be reviewed and verified for accuracy by ERM's FM and/or QA Manager. The ERM FM will ensure that the field and technical data obtained for the Project will provide the end user with acceptable data.

All field and technical data shall be reviewed by the ERM QA Manager to ensure that the final data is accurate prior to the inclusion in the Project

report. The field data sheets, log books, COC forms, and DustTrak data are reviewed and submitted (faxed, electronic, or hard copy) by the ERM FM to the ERM QA Manager daily.

The analytical data processing procedure is presented on Figure 3 and summarized as follows:

1. Samples are sent to the laboratory under COC;
2. The laboratory enters the sample information into their tracking system and performs the analysis;
3. The laboratory electronically submits raw data, sample results, and their QA information to ERM's PM and to an independent third party validator, who in turn performs Level II validation, as described in EPA's *Guidance on Environmental Data Verification and Data Validation* (2002). Validation will include 40% re-calculation of raw data. Data validation results will be reported to ERM's QA Manager using a Level IV template;
4. The third party validator electronically submits their validation report to ERM's QA Manager.
5. ERM reviews the data validation report, and, if acceptable, stores all data into the Project files. If unacceptable, ERM may request re-analysis of the data by the laboratory. Under this condition, the ERM PM will bring this result to the attention of EPA and MDE and request their concurrence of ERM's recommendation of whether or not to perform the re-analysis.
6. Once the ERM QA Manager completes the accuracy review, the ERM FM, then stores the validated information electronically into ERM's Project files and uploads the summary tables to the Project website.

Real-time data processing is summarized as follows:

1. The field data sheets (real-time Total PM) and real-time instrument data logs are submitted (faxed, electronic, or hard copy) by field personnel to the ERM PM weekly. The ERM PM checks all metadata for accuracy, and then stores the information electronically into ERM's Project files.

Real-time Total PM concentration data will be provided as 15-minute averages based on one (1) minute frequency data collection. The 15-

minute average real-time Total PM concentration data will be compared to the dust action level, i.e., BTV.

4.0 ASSESSMENTS

4.1 FIELD DATA REVIEW

The process of reviewing field data will involve evaluating field records for consistency and completeness. The review will focus on assuring that each sample result is fully supported by accurate metadata, reviewing quality control (QC) and calibration information, summarizing deviations and determining their impact on data quality, summarizing the samples collected, and summary of the review in the Project report.

Field data (provided to the ERM PM by fax, electronically or hard copy) will be scanned at least weekly and stored electronically as part of the Project database maintained by ERM

4.1.1 *Sampling Program Design Execution*

Sample collection records (provided to ERM PM by fax, electronically or hard copy) will be reviewed weekly by the ERM QA Manager to ensure that samples have been collected according to the sampling design. Items to be reviewed include the types and numbers of samples collected, sampling locations and frequencies, and measurement parameters of interest. Deviations must be reported to ERM's PM promptly. Under this condition, the ERM PM will bring this result to the attention of EPA and MDE and request their concurrence with ERM's recommendation of whether or not the identified deviation requires any additional attention.

4.1.2 *Sample Collection Procedures*

Sample collection procedures will be reviewed by the ERM FM and QA Manager to ensure that the appropriate procedures have been followed. Items to be reviewed include sampling methods and equipment, sample type, time, location and sample preservation requirements. Deviations must be reported to the ERM PM promptly. The PM will determine whether the samples meet the field quality control requirements specified in Section 4.5.1. Under this condition, the ERM PM will bring this result to the attention of EPA and MDE and request their concurrence with ERM's recommendation of whether or not the identified deviation requires any additional attention.

4.1.3 *Sample Handling*

Sample handling procedures will be reviewed by the ERM FM and the ERM QA Manager to ensure that the appropriate procedures have been

followed. Items to be reviewed include sample labeling, COC documentation, sample preservation and holding times, sample packaging, and shipment. Deviations from established procedures must be reported to the ERM PM promptly. Under this condition, the ERM PM will bring this result to the attention of EPA and MDE and request their concurrence with ERM's recommendation of whether or not the identified deviation requires any additional attention.

4.1.4 *Quantitative Field Data*

The volume calculations performed in the field will be verified by the ERM FM and the ERM QA Manager, along with the sample collection and handling procedures noted above.

4.1.5 *Field and Technical Data Reduction*

Field and analytical data will be summarized in tables as appropriate. ERM will perform a 100% check of all data presented on data summary tables.

4.2 **LABORATORY DATA**

This section describes the data review, reduction, and verification processes for laboratory data, as well as who is responsible for executing each process.

4.2.1 *Laboratory Data Review and Reduction*

The laboratory will review and reduce the data internally in accordance with its SOP (Appendix C) and established internal procedures prior to submitting the data to the ERM PM. The ERG SOP contains all quality control requirements, as shown in ERG's SOP Tables 24-1 and 24-2. Laboratory SOPs for internal data review procedures are to be maintained electronically in the Project files. Specifically, the laboratory will review the data package to ensure the following:

- Sample preparation information is correct and complete;
- Holding times have been met;
- Analytical information is complete and was generated within acceptable criteria;

- Any discrepancies/corrective actions identified during sample login, preparation or analysis have been addressed and documented;
- The appropriate SOPs have been followed;
- QC samples were within established control limits;
- Analytical requirements have been met (e.g., the correct analytical procedures were used as defined by the COC);
- Documentation is complete and any QC issues are fully explained in a detailed case narrative; and
- An authorized laboratory employee must sign the data package to indicate the data have been reviewed.

Data will be reduced in the laboratory following method protocols and reported in standard formats. The data will be peer-reviewed by a qualified analyst before it is released to ERM's PM. The review will be documented with a standard checklist that has been initialed and dated by the peer reviewer. Reporting requirements for analytical data pertain only to the final data report to be submitted to ERM's PM.

4.2.2 *Laboratory Data Review and Validation*

Following receipt of the laboratory report for CrVI air samples, ERM will send the report (including raw data and all QA/QC information) to the designated third-party validator. The third party will perform Level II validation, as described in EPA's *Guidance on Environmental Data Verification and Data Validation* (2002). Level II validation will include 40% raw data re-calculation. Data validation results will be reported to ERM's QA Manager using a Level IV template.

4.3 *AUDITS OF DATA QUALITY*

A performance audit is defined as a review of the existing procedures and analytical data (sample and QA) to determine the accuracy of the total measurement systems, or a component of the system. The analysis of a Project-specific laboratory Performance Evaluation (PE) sample is the primary method for a performance audit of the laboratory.

4.3.1 *Laboratory Performance Audits*

In a performance audit, a PE sample is submitted to the laboratory and analyzed for the purpose of evaluating the performance of the measurement or analytical procedures used by the laboratory. The PE sample consists of some type of environmental matrix (e.g., air, soil, water) which contains a known amount of a particular analyte(s).

ERG's most recent PE sample result will be submitted to EPA and MDE, if requested by the agencies, prior to initiating construction air monitoring. Along with the PE result, ERG will provide the results of an independent assessment of its performance including the following:

- Sample analysis was completed following the correct methodology;
- Correct identification and quantitation of sample analytes;
- Accurate and complete reporting of data to meet Project specifications; and
- Instruments are operating within established precision and accuracy control limits.

Results that do not fall into the certified limits of acceptability may indicate a laboratory performance problem and will trigger immediate corrective actions. All particulate CrVI air samples will be analyzed by ERG for this Project.

4.3.2 *System Audits*

The ERM QA Manager may conduct a laboratory systems audit to ensure that all instruments proposed or in use are appropriate for the given methods and functioning properly. Additional external audits may be performed as needed. Internal laboratory audits should be performed by the Laboratory QA Manager, Laboratory PM, annually.

During internal and external audits, the auditor may observe and review laboratory procedures and analytical results to ensure that they conform to the operating procedures and reporting requirements. Prior to the laboratory audit, the auditor will prepare a list of items and procedures to be audited. Audit items may be tied to the analyses of the samples in progress rather than be restricted to a specific list. Internal systems audits will include a review of the following:

- Sample custody and tracking procedures;

- Calibration procedures and documentation;
- Completeness of data forms, notebooks, and other data reporting documents;
- Compliance with laboratory SOPs;
- Data storage, filing, and record-keeping procedures;
- QC procedures, criteria, and documentation;
- Operating conditions of equipment and facilities;
- Employee training records; and
- Laboratory information and management system procedures and security.

External systems audits will include a review of the previous items plus a review of laboratory internal assessment SOPs and laboratory internal assessment documentation. The auditor will meet with key staff members to evaluate the program and determine if corrective actions are necessary to improve the data quality.

If a laboratory audit is performed for the Project, the auditor will submit a report in writing to ERM QA Manager within five (5) business days of completing the audit. The report will include the documentation of on-site meetings, findings, and proposed revisions. A written assessment of the laboratory with any suggested changes in procedures will be provided to the laboratory. Follow-up audits may be conducted, if warranted by the audit findings. If changes in the systems are necessary, the Laboratory PM will make the changes. Written confirmation within 10 days will document any corrective actions the laboratory has implemented to meet requirements of the measurement system. The letter should be directed to the ERM's PM or QA Manager's attention.

After the ERM PM has been notified (following the initial systems audit) that the laboratory systems are all satisfactory, quality control (QC) measures will be implemented. After implementation of the plan, all procedures will be monitored internally by the laboratory to facilitate compliance with the requirements. Any significant problems within the system will be verbally reported immediately to ERM's QA Manager. Verbal notification will be followed by a written report within 10 working days from completion of the audit and/or the resolution of the change. Written reports (electronic or hard copy) will be retained in the

laboratory's Project files, as well as in ERM's Project file for a minimum of one year.

4.4 *SURVEILLANCE OF OPERATIONS*

The results of monitoring will be posted to the Project-dedicated website within approximately 24 hours, as practicable, of real-time collection of Total PM or receipt of validated laboratory results for CrVI air samples. In this manner the public will have ready access to monitoring results. The website will also post any response actions deemed necessary due to the air monitoring results.

The Developer's representative is responsible for all necessary notifications to both the MDE and EPA representatives. The Developer's representative on site will ensure both EPA and MDE's representatives are apprised of the air monitoring activities and results on a daily basis as practicable. In this manner, the agencies can assess the need to notify the public of the air monitoring results and related response actions, as appropriate.

4.5 *ASSESSMENT OF DATA QUALITY*

4.5.1 *Field Data Quality*

Data quality assessment criteria for field measurements include the following parameters:

- **Completeness** – Field completeness is a measure of the number of valid field measurements obtained relative to the total number of field measurements. The percent of completeness for field data can be expressed by the following formula:

$$\text{Percent Completeness} = (V/T) \times 100$$

Where:

V = Number of valid data points

T = Total number of data points

Field completeness is based on the number of samples or field tests planned and the actual number collected or performed.

The completeness objective for field measurements is 90 percent.

- **Representativeness** – Representativeness in the field will be ensured by following standard procedures during data collection. The ERM PM will monitor the sampling program to ensure that field activities are being conducted consistently according to the procedures outlined in the QAPP and the CAMP.
- **Comparability** – Measures to ensure comparability of field data include field personnel reviewing the QAPP and the CAMP. ERM’s FM and/or QA Manager will routinely verify that proper field activity procedures are being followed. To facilitate comparability of field data, ERM field staff will only utilize the approved CAMP and Field SOPs (Appendix B).
- **Sensitivity** – Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest, or to detect or reliably measure low levels of a variable of interest. Field sensitivity basically refers to the smallest value or change in value a field instrument can reliably measure above background noise. For the pre-construction and construction phases of this Project, this concept applies to measurement of Total PM. The sensitivity objectives for the DustTrak include the following specifications:
 - Concentration Range = 0.001 to 150 mg/m³
 - Resolution = ±0.1% of reading or 0.001 mg/m³, whichever is greater
 - Flow Accuracy = ±5% of factory set point

4.5.2 *Laboratory Data Reduction*

Field and analytical data will be summarized in tables as appropriate and discussed in the text of the data report.

The quality of laboratory data will be evaluated based on accuracy, sensitivity, representativeness, completeness, and comparability of the data generated by each type of analysis. These data assessment parameters are described in the following sections. The specific analytical criteria including reporting limits and control limits for QC results are provided in the laboratory SOP in Appendix C.

Blank samples are used to determine contamination arising from principally four sources: the environment from which the sample was collected/analyzed; the reagents used in the analysis; the apparatus used; and the operator/analyst performing the analysis. Three types of blanks will be implemented in the in this monitoring program:

- **Field blanks** - Field blank cassettes will be included for CrVI samples yielding one filter cassette blank per day that samples are collected. Blank filter cassettes will be sent to the field, opened, but not placed on the sampling devices, and then packaged like the actual samples. Field blank cassettes will be returned to the laboratories in the same shipment as the primary samples.
- **Trip blanks** - Trip blank cassettes will be included for CrVI samples yielding one filter cassette blank per sample shipment. The trip blank is an un-opened, un-handled filter cassette.
- **Lab blanks** - Standard Operating Procedure for the Preparation and Analysis of Hexavalent Chromium by Ion Chromatography prepared by Eastern Research Group, Inc. (ERG-MOR-063), dated February 2014 is included with this QAPP in Appendix C. This SOP includes procedures and criteria for lab blanks, spiked samples, and duplicate analyses.

4.6 **QUALITATIVE AND QUANTITATIVE COMPARISONS TO ACCEPTANCE CRITERIA**

4.6.1 **Accuracy**

Accuracy is the amount of agreement between a measured value and the true value. It will be measured as the percent recovery of blank spike samples and performance evaluation (PE) samples by the laboratory.

Accuracy shall be calculated as percent recovery of spiked analytes as follows:

$$\%R_i = (Y_i \div X_i) \times 100\%$$

where:

$$\%R_i = \text{percent recovery for compound } i$$

Y_i = measured spike concentration in sample i
(sample concentration with the spike - original
sample concentration)

X_i = actual spike amount in sample i

The resultant percent recoveries will be compared to acceptance criteria described ERG-MOR-063 and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will supply a justification of why the acceptability limits were exceeded and implement the appropriate corrective actions.

LDC, the third-party data quality reviewer, will assess laboratory %R and deviations from the specified limits will be noted and the effect on reported data commented upon by LDC, as described in Section 4.0. The data review will be provided to the ERM QA Manager and FM, who will take corrective actions described in Section 4.0.

4.6.3 *Representativeness*

Representativeness is a qualitative parameter that expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness of the environmental conditions at the time of sampling is achieved by selecting sampling locations, methods, and times so that the data describe the site conditions that the Project seeks to evaluate. Representative samples will also be ensured through following proper protocols for sample handling (storage, preservation, packaging, custody, and transportation), sample documentation, and laboratory sample handling and documentation procedures.

4.6.4 *Comparability*

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. The comparability goal is achieved by maintaining consistency in sampling conditions, selection of sampling procedures, sample preservation methods, and analytical methods.

4.6.5 *Completeness*

Completeness for usable data is defined as the percentage of usable data out of the total amount of planned data. The higher the percentage, the more complete the measurement system. The target goal for completeness is 90 percent for all data. Completeness will be calculated as follows:

$$\%C = \frac{A}{I} \times 100\%$$

where:

$\%C$ = Percent completeness (analytical)

A = Number of usable sample results reported
(all results not rejected)

I = Total number of results reported

Non-valid data (i.e., data qualified as “R” rejected) will be identified during the data review and the reasons for rejection explained in the data review report.

4.6.6 *Sensitivity (Method Detection Limit)*

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest, or to detect or reliably measure low levels of a variable of interest. Sensitivity defines the method detection limit (MDL) as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the concentration is greater than zero. The MDL for particulate CrVI is provided in Table 2.

The MDL is determined every year according to the procedure in 40 CFR, Part 136, Appendix B. A standard is spiked onto at least seven prepared filters at a concentration one to five times the estimated detection limit. These filters are extracted and analyzed according to the method outlined. The MDL is calculated as follows:

$$MDL = (t) \times (SD)$$

where:

t = Student’s t value for a 99% confidence level and a standard deviation estimate with $n - 1$ degrees of freedom [$t = 3.14$ for seven replicates]

SD = Standard deviation of the replicate analysis

The laboratory will maintain current records of DL studies for each instrument, and will have established reasonable accuracy (lower control limits should be 10 percent or greater) and precision goals for the analytical method utilized. The laboratory should perform DL verification studies at least annually for each method, as stipulated by National Environmental Laboratory Accreditation Conference. The concentration of the standards used to determine the DLs should be no more than five times the expected DL value. Historical DL studies, accuracy, and precision limit control charts should be retained in the laboratory archives for five (5) years.

4.7 INTERIM ASSESSMENTS OF DATA QUALITY

Evaluation of field and laboratory QC data and/or audits conducted for field operations and/or laboratory operations may indicate the need for a corrective action. Problems with analytical QC data will be addressed by the laboratory QC officer. Problems arising during field operations, however, will be addressed by the ERM Technical Lead through communication of the identified problem and proposed corrective action to the ERM PM. The ERM PM and ERM Technical Lead will discuss the appropriate actions with the MDE and EPA representatives to obtain concurrence, and then relay this information to the field personnel for implementation. The field personnel will then report back to the ERM PM upon successful implementation of the corrective act.

5.0 Review, Evaluation of Usability and Reporting Requirements

5.1 DATA VERIFICATION AND VALIDATION TARGETS AND METHODS

All data will be verified by a review of the completeness and accuracy of each result's metadata. Field operations will be fully documented, reviewed, and audited. All CrVI data will undergo Level II third party data validation, with 40% re-calculation of raw data. Data validation results will be reported using a Level IV template.

5.2 QUANTITATIVE AND QUALITATIVE EVALUATIONS OF USABILITY

When the results of the measurements have been obtained, the ERM PM, ERM QA Manager and ERM Technical Lead will determine whether the Project QA/QC goals have been achieved. Whether the overall Project QA/QC goals have been met will be assessed by review of the analytical data quality assessment reports generated using data verification/validation.

All laboratory results will be reviewed by the ERM QA Manager to verify that the data package is complete. The completeness check will include a brief screening of six basic elements that should be included in each data package, including:

- Verification that sample numbers and analyses match the chain-of-custody request;
- Are all analyses that are requested on the COC and any change orders present in the data package?
- Does the data package include a copy of the COC?
- Has the laboratory placed any data qualifier flags on the analytical results?
- Does the laboratory's case narrative identify problems, including an explanation of flagged data?
- Does the data package include reports for all QA/QC samples?

The completeness, correctness, and conformance/compliance of the data will be verified and validated against the method, procedural, or contractual requirements. Guidance for data verification/validation is provided in EPA's *Guidance on Environmental Data Verification and Data Validation* (EPA 2002b). Laboratory data will be validated in accordance with ERG-MOR-063 and the EPA document *EPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review*, October 2010. One hundred percent of laboratory data will be validated by LDC. A Level II data review will be conducted, which consists of the following elements:

- Verification that sample numbers and analyses match the chain-of-custody request;
- Verification that sample preservation and holding times are met.;
- Verification that instrument performance checks were performed and acceptable;
- Verification that calibrations were performed at the appropriate frequency and met method criteria;

- Verification that field, trip, and laboratory blanks were performed at the proper frequency and that no analytes were present in the blanks;
- Verification that laboratory control samples were run at the proper frequency and that control limits were met;
-
- Verification that Project reporting limits have been achieved.

Data review and verification will be performed for 100 percent of the data. In addition, the third-party reviewer (LDC) will re-calculate 40% of the raw data, which will include the following additional elements:

- Initial Calibration Review: Review initial calibration calculations for agreement with summary form results, linearity, and method-specified minimum requirements;
- Continuing Calibration Review: Review continuing calibration calculations for agreement with summary form results, linearity, and method-specified minimum requirements;
-
- Target Compound Identification Review: Review target compounds identified in Project and QC samples and ensure that calculated concentrations and identifications are accurate; and
- Manual Integrations will be reviewed.

If deemed appropriate according to the EPA National Functional Guidelines, Contract Laboratory Program data qualifiers will be applied to indicate potential concerns regarding data quality. Data qualifiers that may be applied to Project data based on data validation are listed below:

- U: The analyte was analyzed, but not detected above the reported MDL/RL or the MDL/RL was raised to the concentration found in the sample due to blank contamination;
- J: The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample or result/ MDL/RL is estimated due to quality control issues identified during the verification or validation process;

- N: The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification;”
- NJ: The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents its approximate concentration;
- UJ: The analyte was not detected above the reported MDL/RL; however, the MDL/RL is approximate and may or may not represent the actual MDL/RL necessary to accurately and precisely measure the analyte in the sample; and
- R: The sample result or MDL/RL is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.

Data validation results will be reported by LDC to ERM’ PM using a Level IV template. Electronic copies will be retained in the Project file for one year.

5.3

POTENTIAL LIMITATIONS ON DATA INTERPRETATION

Field and laboratory data generated for this Project will be reviewed to ensure that all Project objectives are met. If any non-conformances are found in the field procedures, sample collection procedures, field documentation procedures, laboratory analytical and documentation procedures, and data evaluation and quality review procedures, the impact of those non-conformances on the overall Project objectives will be assessed. Appropriate actions, including resampling and reanalysis, may be recommended to the Project team so that the Project objectives can be accomplished.

Evaluation of field and laboratory QC data and/or audits conducted for field operations and/or laboratory operations may indicate the need for a corrective action. Problems with analytical QC data will be addressed by the laboratory QC officer. Problems arising during field operations, however, will be addressed by the ERM Technical Lead through communication of the identified problem and a proposed corrective action to the ERM PM. The ERM PM will discuss the appropriate actions with the HPD representative and EPA and MDE Project Coordinators to obtain concurrence, and then relay this information to the field personnel for implementation. The field personnel will then report back to the ERM PM upon successful implementation of the corrective action.

5.4 *RECONCILIATION WITH PROJECT REQUIREMENTS*

The Project management team, QA Manager, and sampling and analytical team members are responsible for ensuring that all measurement procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. Prompt action must be taken to correct any problem that may arise.

5.4.1 *Conduct Preliminary Data Review*

A preliminary data review will be performed to uncover potential limitations to using the data, to reveal outliers, and generally to explore the basic structure of the data.

5.4.2 *Draw Conclusions from the Data*

If the sampling design and statistical tests conducted during the final laboratory reporting process show results that meet acceptance criteria, it can be assumed that the network design and the uncertainty of the data are acceptable. This conclusion can then be reported to EPA.

5.5 *REPORTS TO MANAGEMENT*

This subsection describes the types of reports that may be produced for the Project. The types of reports that may be produced include daily data summary tables, event logs, data quality assessment reports, and PE and audit reports (if an audit is performed).

5.5.1 *Daily Data Summary Tables*

Electronic spreadsheet data summary tables with hourly airborne Total PM concentrations for each fixed DustTrak station, hourly wind speed, wind direction and daily rainfall will be prepared by the field staff daily, as practicable, for the previous 24-hour monitoring acquisition period.

The electronic spreadsheets will then be uploaded to ERM's Project files and the Project website the following business day following the data acquisition, as practicable, for access by the agencies and the public.

Following the receipt of the validated CrVI air sample results, the results will be added to the daily electronic spreadsheet summary tables and uploaded to ERM's Project files and the Project website the following business day, as practicable for access by the agencies and the public.

ERM's FM will upload the DustTrak data logs with the Total PM to the field computer once per day (electronic), and provide backup to ERM's PM within 36 hours of the field upload. ERM's FM will also upload the data logs to Project website during construction within approximately 24 hours of field upload.

5.5.2 *Event Logs*

When applicable, event logs (which are related to Total PM data in comparison to the Total PM BTV, see Appendix D of this QAPP) will be generated to identify nonconforming situations and corrective actions taken per the SOP for Response Actions and Notifications provided Appendix D of the QAPP. Corrective actions to remedy a nonconforming situation in the field can be defined by the ERM FM, ERM QA/QC Officer or ERM PM. A description of the required action will be documented in an event log. Corrective actions must be approved verbally by ERM's QA/QC Officer and by both the EPA and MDE representatives prior to implementation. Upon implementation of the corrective action, the ERM QA/QC Officer or PM will be provided with the completed event log, which becomes part of the Project file.

Copies of completed event logs will also be provided electronically to the agencies as soon as possible but within approximately 24 hours of the event. ERM's FM will also upload the event logs to the Project website as soon as possible but within approximately 24 hours of the event.

5.5.3 *Data Quality Assessment Reports*

The FM will report to the PM on the progress of each phase of field work and any QA/QC issues associated with field activities. Additionally, the laboratory will maintain detailed procedures for record-keeping and reporting to support the validity of all analytical work. The Laboratory QA Manager will provide the ERM QA Manager applicable certifications and audit reports upon request.

Data quality assessment reports will be submitted electronically and hard copy to the agencies on a monthly basis throughout the intrusive construction activity duration. Field verification and data validation information will be included, electronically. The assessment reports will include the laboratory data packages for CrVI, third party data validation reports, and related metadata.

5.5.4 *Performance Evaluation and Audit Reports*

As discussed in Section 3.1, laboratory PEs and audits may be performed during the course of the Project. If performed, the ERM QA Manager will prepare a report summarizing the results.

5.5.5 *Summary Data Reports*

The final summary data report titled, “Wills Wharf Office Building Construction Air Monitoring Report”, will be prepared and distributed to the stake holders and will combine all of the interim reports described above, electronically.

Appendix A
Figures

Figure 1—Project Organization Chart

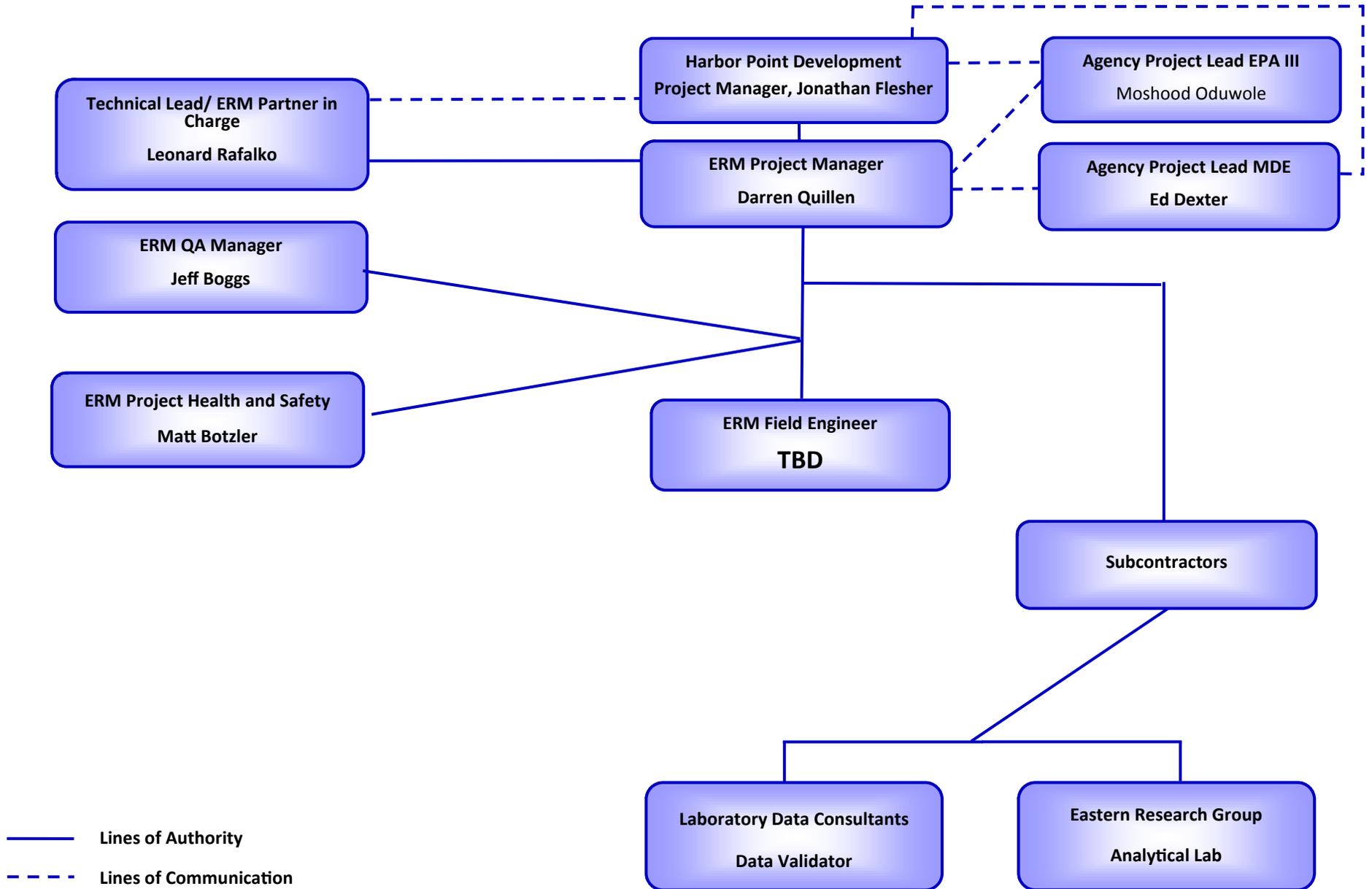
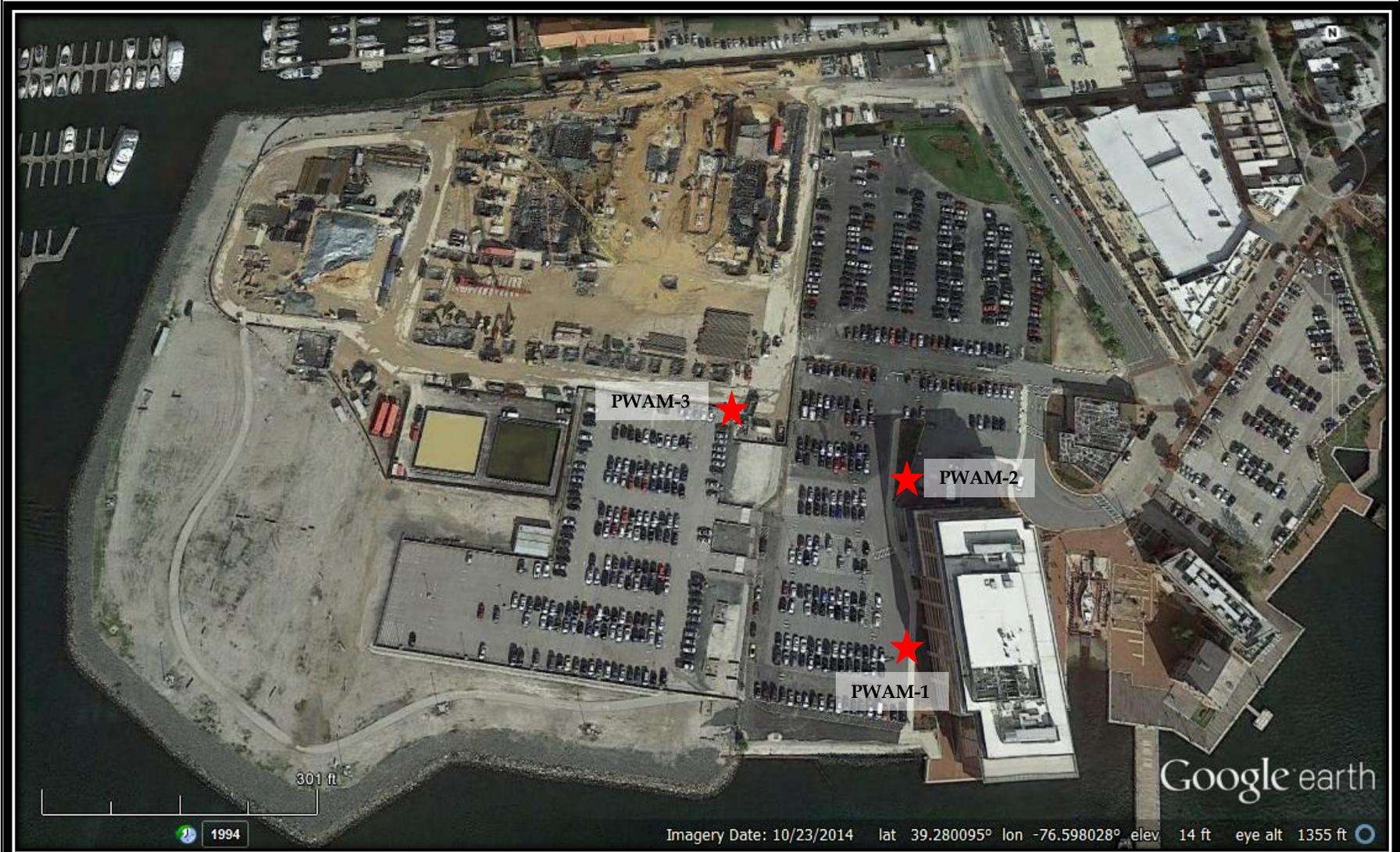
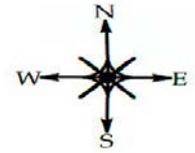


Figure 2
Construction Perimeter Fixed Air Monitoring Locations
Wills Wharf Office Project
Baltimore, Maryland



PWAM - Perimeter Wills Air Monitor, locations are approximate.

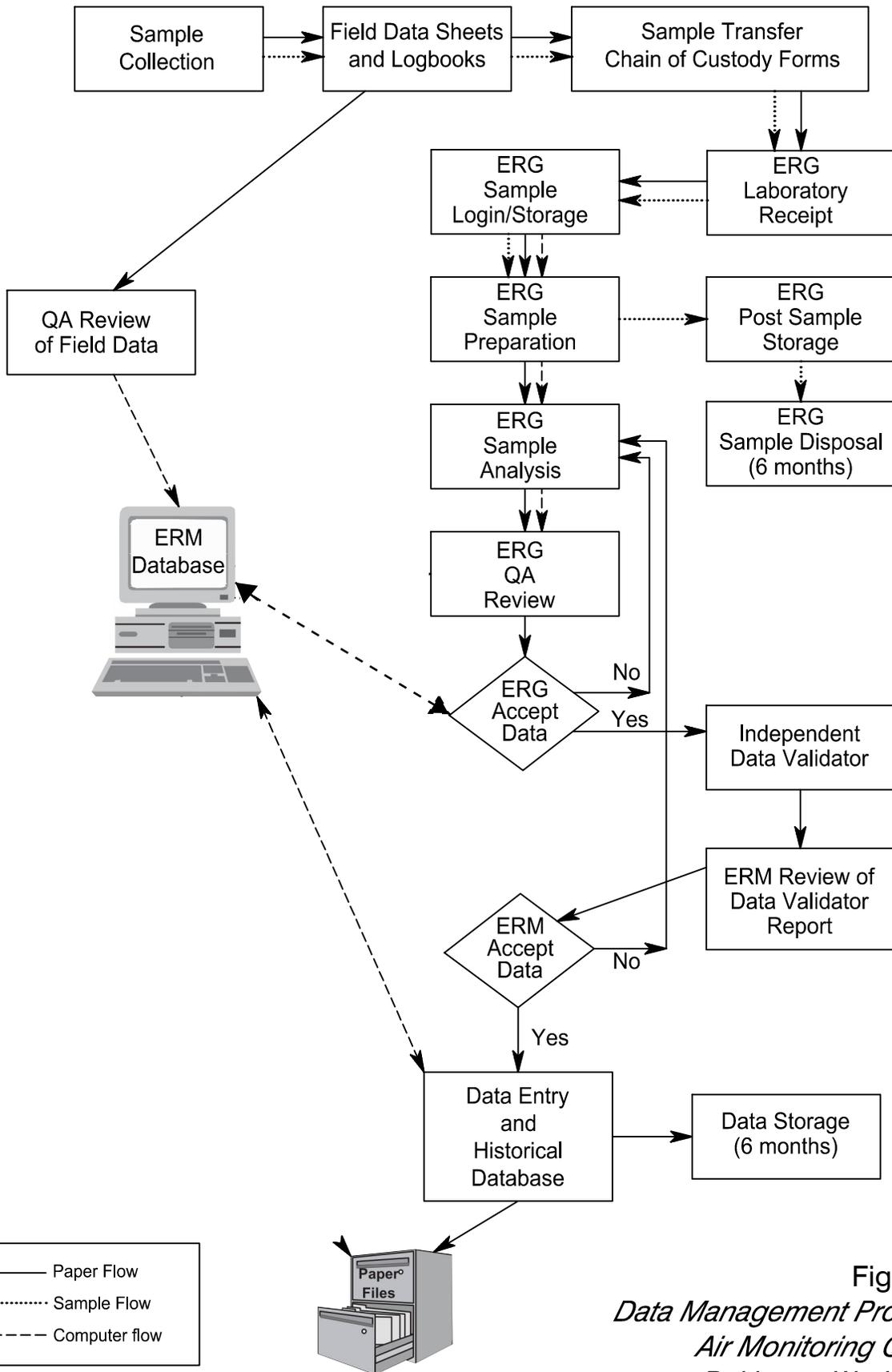


Figure 3
Data Management Process
Air Monitoring QAAP
Baltimore Works site
Baltimore, Maryland

Appendix B
Field Sampling Method SOPs



**Appendix B1 to the QAPP for the Wills Wharf Office Project
Field Sampling Protocol and Standard Operating Procedure**

**REAL-TIME AIR SAMPLING FOR TOTAL PARTICULATE MATTER
IN AMBIENT AIR**

19 January 2016

TABLE OF CONTENTS

1.0 INTRODUCTION..... 1

2.0 EQUIPMENT LIST 1

3.0 HEALTH AND SAFETY 2

4.0 MONITOR SET-UP AND OPERATION..... 2

4.1 DRX AEROSOL MONITOR MODEL 8533..... 2

4.2 INSTALLATION 3

5.0 INITIAL MONITOR SETUP AND PROGRAMMING 3

5.1 INSTRUMENT SETUP..... 3

5.2 SETUP MENU 4

5.3 ZERO CALIBRATION..... 5

5.4 SAMPLE FLOW RATE SETTING 6

5.5 MONITOR DATE AND SETTINGS..... 7

6.0 MONITOR OPERATION 8

7.0 TAKING MASS CONCENTRATION MEASUREMENTS..... 9

8.0 ALARM..... 11

9.0 MONITOR MAINTENANCE..... 13

10.0 CONTACTS..... 18

APPENDIX

A DUSTTRAK FIELD DATA SHEETS FOR MOBILE AND FIXED STATION

1.0 INTRODUCTION

This protocol and standard operating procedure (SOP) is intended to provide a general overview and step-by-step instructions for personnel in the field responsible for carrying out real-time ambient air sampling for total particulate matter (Total PM). The instructions cover assembly of the instrument, instrument programming and operation, deployment and field data recording. This SOP has been prepared in accordance with the guidance documents *Guidance for Preparing SOPs* (USEPA 2007) and *Quality Assurance Handbook for Air Pollution Measurement Systems* (USEPA 1994, USEPA 2008).

This document assumes that instrument location siting has already been successfully completed ensuring each location meets the acceptable criteria with regards to the proximity of obstructions (i.e. buildings, trees, etc.), technician safety, and any potential contamination contributions from surrounding operations.

2.0 EQUIPMENT LIST

The following equipment will be required for the air monitoring program:

- DustTrak® DRX Aerosol Monitor Model 8533, including:
 - TrakPro™ Software
 - Zero Filter
 - Power Supply
 - 6600 mAH Lithium Ion Rechargeable Battery
 - USB Cable
 - Analog alarm/output cables
 - Calibration Certificate
 - Spare Internal Filter Elements
 - Flexible Teflon tubing and connectors
- BIOS Defender 510-H Air Flow Calibrator unit;
- Laptop PC with TrakPro™ Software;
- Waterproof case for each instrument;
- Rigid stand with legs to support Waterproof case 2 meters above ground; and
- Field data sheets – provided in Appendix A, clipboards, pens.

Additional Field Supplies:

- Miscellaneous tools (wrenches, screwdrivers, pliers, etc.);
- Electric extension cords;
- Ground Fault Interrupter power strips

- Personal protective equipment (PPE), see the site specific Health and Safety Plan (HASP);
- Field notebook.

3.0 HEALTH AND SAFETY

All monitoring activities undertaken at the Site must be completed under the Project-specific Health and safety Plan (HASP). The HASP identifies the hazards, personal protective equipment, monitoring, and emergency procedures for conducting work at the Site. Monitoring and support personnel must acknowledge their review of the HASP prior to performing work at the Project.

4.0 MONITOR SET-UP AND OPERATION

4.1 DRX AEROSOL MONITOR MODEL 8533

The monitor used within this SOP is the DustTrak® DRX Aerosol Monitor Model 8533 (the “monitor”) manufactured by TSI Incorporated. The monitor employed during this program uses TrakPro™ Software. The DRX 8533 monitors Total PM concentration and stores 1-minute averages on an internal data logger. The instrument measures real-time aerosol mass readings using light-scattering laser photometers for particles approximately 15 µm or less in diameter. The DRX 8533 monitors can be operated at flow rates up to three (3) liters per minute (Lpm). Figure 1 presents the typical DRX 8533 monitor.



Figure 1. DRX8533

For purposes of this monitoring program, the DRX 8533 monitor will be operated in the “Total” mass concentration channel, i.e., Total PM data collection without the particle size impactor.

The DRX 8533 contains an internal 6600 mAH Lithium Ion rechargeable battery. For purposes of this monitoring program, AC power will be available for providing the

monitor with constant power therefore the internal battery will only be used to maintain instrument operation in the event monitoring could be interrupted by AC power loss.

4.2 *INSTALLATION*

This document assumes that sample locations have already been sited and adhere to the proper sample location criteria. The monitor should be placed on a reasonably level surface with the sample inlet at a height of no less than two (2) meters with unobstructed air flow for at least 270 degrees around the monitor. For duplicate monitoring, each monitor will be connected to the same monitor inlet.

The monitors should be secured from the effects of wind loading to prevent tipping over in elevated wind conditions. The tripod stand with weatherproof case housing the monitor can be secured with cinder blocks on each leg and will be attached by chain with lock to an unmovable object to protect from theft.

5.0 *INITIAL MONITOR SETUP AND PROGRAMMING*

5.1 *INSTRUMENT SETUP*

The DustTrak DRX monitor can be connected to a computer to download data and upload sampling programs.

Connecting to the Computer

Connect the USB host port of a Microsoft[®] Windows[®]-based computer to the USB device port on the side of the DustTrak monitor.

Installing TrakPro[™] Data Analysis Software

TrakPro software can preprogram the DustTrak monitor, download data, view and create raw data and statistical reports, create graphs, and combine graphs with data from other TSI instruments that use TrakPro software. The following sections describe how to install the software and set up the computer.

Note

To use TrakPro software with the DustTrak Aerosol Monitor, the PC must be running Microsoft Windows® and the computer must have an available Universal Serial Bus (USB) port.

®Microsoft and Windows are registered trademarks of Microsoft Corporation

1. Insert the TrakPro Data Analysis Software CD into the CD-ROM drive.
The install screen starts automatically.

Note

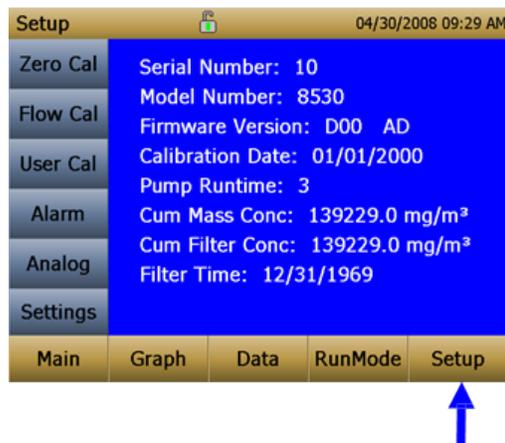
If the software does not start automatically after a few minutes, manually run the program listed on the label of the CD using the **Run** command on the Windows Start Menu.

2. Follow the directions to install TrakPro software.

TrakPro software contains a comprehensive installation guide. TSI recommends printing out this guide prior to starting the TrakPro software installation on your computer, so it may be consulted during the installation. The TrakPro Software manual is located in the Help file in TrakPro software. There is no separately printed TrakPro Data Analysis software manual.

5.2 SETUP MENU

Pressing Setup activates the Setup Menu touchscreen buttons along the left edge of the screen. Setup is not accessible when the instrument is sampling.



The main screen of the **Setup** screen displays the following information:

Serial Number	The instruments serial number.
Model Number	The instruments model number.
Firmware	Instruments current version of firmware.
Calibration Date	Date of the last factory calibration.
Pump Run Time	Pump running time in hours.
Cum Mass Conc.	Amount of mass run through instrument over life.
Cum Filter Conc.	Amount of mass run through instrument since last filter
Filter Time	Date of last filter change.

5.3 *ZERO CALIBRATION*

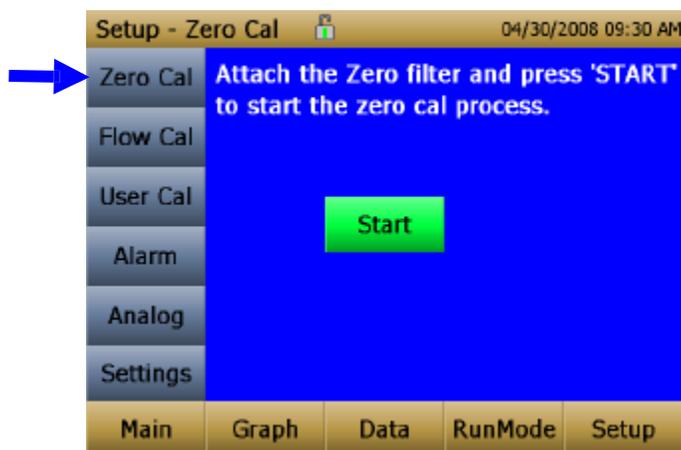
TSI recommends performing a zero check prior to each use for the DustTrak monitor, before running any extended tests, and after the instrument experiences a significant environmental change. Examples of significant environmental changes would be ambient temperature changes that exceed 15°F (8°C) or moving from locations with high aerosol concentrations to low concentrations.

Zeroing Instrument



Run **Zero Cal** prior to every 24-hour sampling event. Zero Cal requires that the zero filter be attached prior to running. Zero Cal must also be performed if the unit is reading negative concentrations. It is not possible for the DustTrak monitor to read negative concentrations. Negative concentrations are a symptom of zero drift.

Zero Cal



Never perform a zero cal. without attaching a zero filter.

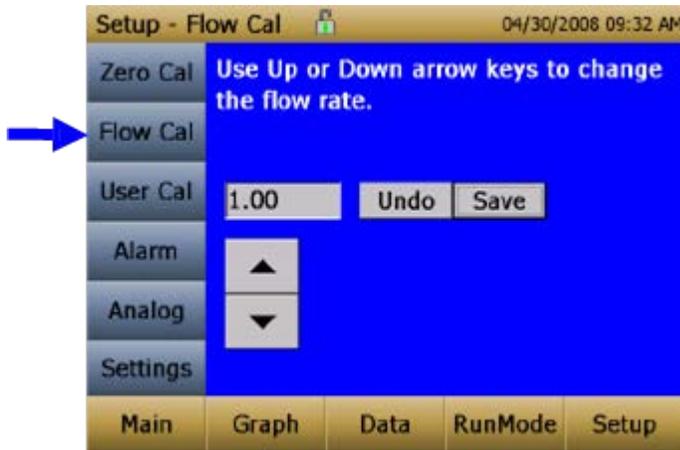
1. Press Zero Cal Button
2. Attach Zero Filter
3. Press the **Start** button to start Zeroing process.
4. A count-down clock will appear indicating the time remaining. The screen with indicate Zero Cal Complete when done.

Remove filter after zeroing has been completed. The instrument is now zero calibrated and ready for use.

5.4 SAMPLE FLOW RATE SETTING

For purposes of this monitoring program, the flow rate setting shall be 2.0 Lpm. For DustTrak DRX Model 8533, *the flow cannot be changed*. Run **Flow Cal** to calibrate the flow set point. The flow set point is factory set to 3 Lpm total flow; two (2) Lpm of the total flow is measured aerosol flow, and one (1) Lpm of total flow is split off, filtered, and used for sheath flow. There is an internal flow meter in the DustTrak DRX instrument that controls flow rate to $\pm 5\%$ if factory set point. TSI recommends checking the flows with an external flow reference meter, especially when collecting data. The pump will automatically start when entering the Flow Cal screen.

Flow Cal

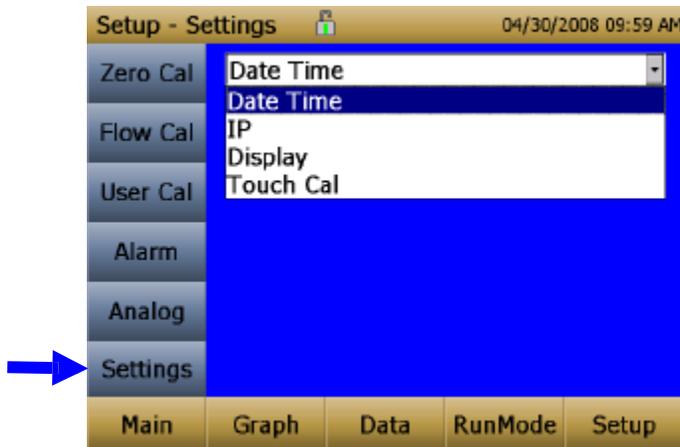


1. Attach a flow calibrator (BIOS Defender 510-H) to inlet port.
2. Move the arrows up or down to achieve desired flow on the reference flow meter. Each up or down arrow will change the flow about 1%. Allow time between button presses to let pump change to the new flow rate.
3. Select **Save** once the desired flow rate is achieved. Select **Undo** to return to the factory set point.
4. Record the calibration data in the field logbook.

5.5 MONITOR DATE AND SETTINGS

Set the DRX 8533 to the correct date and time prior to use. Follow the procedure below for setting the monitor date and time.

Settings



Settings screen sets basic unit parameters:

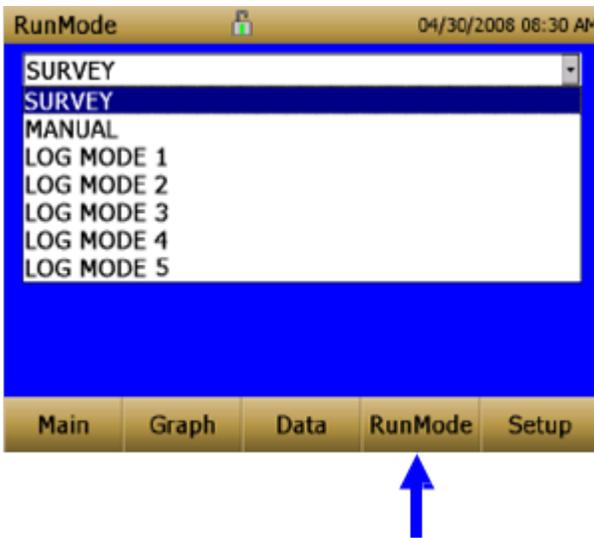
Set current date, current time and date/time format. Time can be set in 12 or 24 hour format. Date can be set in yyyy/dd/mm, yyyy/mm/dd or mm/dd/yyyy. The date format for the project will be **yyyy/mm/dd** to ensure consistency with the format adopted all other sampling documentation.

6.0 MONITOR OPERATION

Follow the procedure below for operating the DRX 8533 aerosol monitor:

The **RunMode** tab brings up sampling mode options.

Run Mode

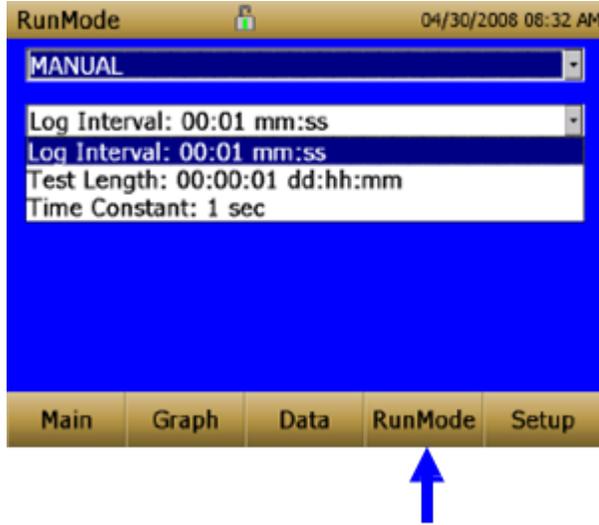


Sampling mode options include **Survey Mode**, **Manual Log**, and **Log Mode 1-5**.

Survey	Survey Mode runs a real time, continuous active sample, but does not log data.
Manual	Manual Log sets the instrument to log data for a specified run time
Log Modes	Log Mode starts and stops the instrument at specified times, run for a specified test length, and perform multiple tests of the same length with a specified time period between tests.

The **Manual** sampling mode is to be set for this project.

Manual Mode



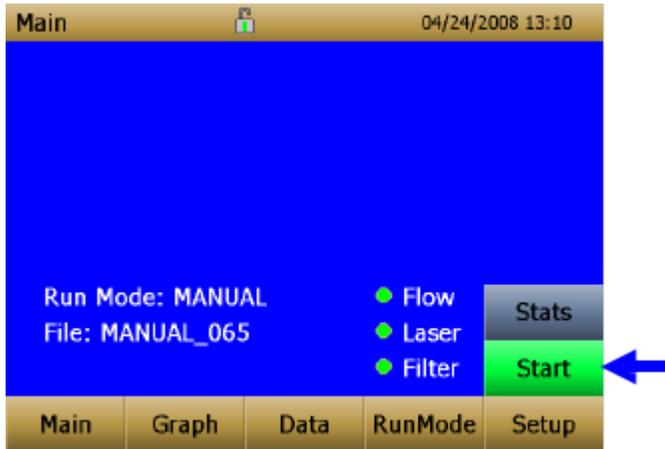
Log Interval	The log interval can be set from 1 second to 60 minutes. It is the amount of time between logged data points.
Test Length	Test length can be set from 1 minute to the limit of the data storage.
Time Constant	Time Constant can be set from 1 to 60 seconds. This will control the update rate of the main screen. It is the rolling average of data displayed on the main screen and is not linked to logged data in either Manual or Program Log modes.

The Log Interval will be set to 15-minute, the Test Length will be set to allow 24-hours storage (“storage limit”) and the Time Constant will be set to one (1) minute for this project.

In Manual mode, data will be stored to a file named –*Manual_XYZ* where XYZ is an incrementing integer.

7.0 TAKING MASS CONCENTRATION MEASUREMENTS

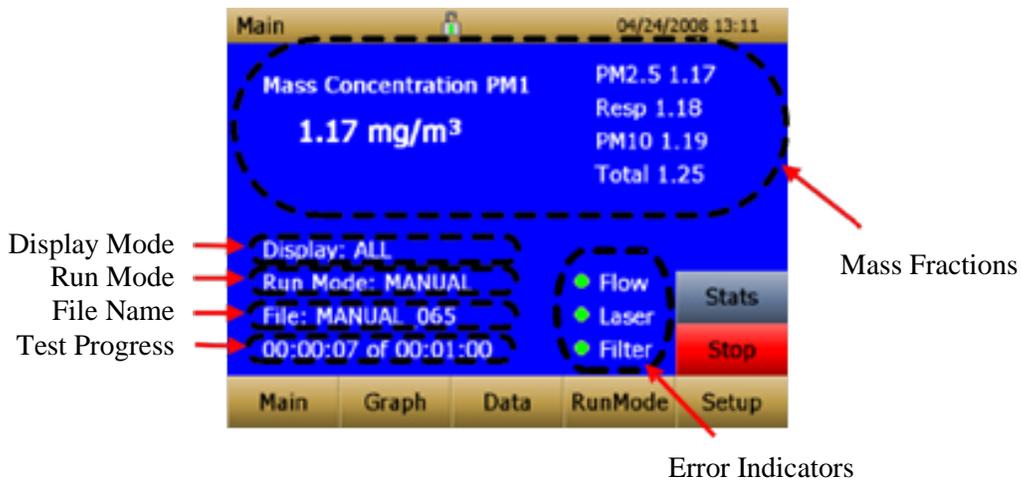
Measurements are started and controlled from the main screen. The Total mass concentration will be selected for measurement and display. Prior to starting a measurement the instrument should be zeroed from the Setup screen and the run mode should be configured and selected from the RunMode screen.



When the instrument is on, but not taking any mass measurements the start button will be green and instruments pump will not be running. To start taking a measurement, press the green **Start** button.

While taking a measurement the screen will display the current measured mass concentration. The various regions of the screen are shown below:

Screen Regions

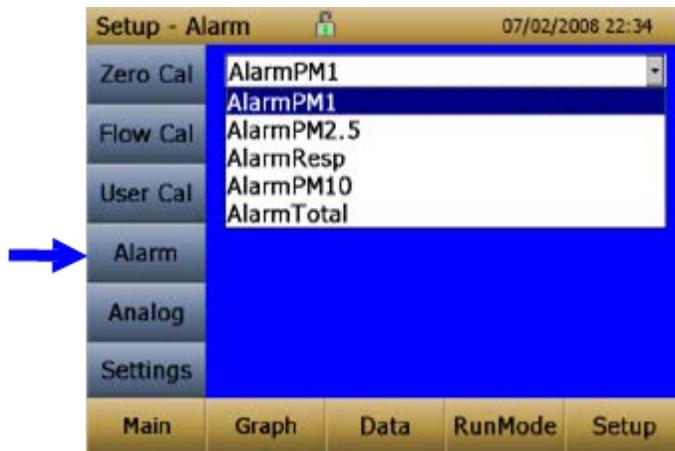


<p>Mass Fractions Region (live keys)</p>	<p>Shows the size segregated mass measurements. The highlighted channel displayed in larger font on the left can be changed by touching on the screen the measurement of most interest on the right- hand side of the screen. Set the Total channel as the highlighted display during monitoring.</p>
---	---

Display Mode Region (live key)	The size segregated mass fractions displayed in this area can be selected by touching in the -Display mode region. The modes that can be selected with this live key are: All: PM1, PM2.5, Resp. PM10 and Total IAQ-ENV: PM1, PM2.5 PM10 and Total IH: Resp., PM10 and Total
Run Mode Region	Shows the run mode selected from the RunMode screen.
File Name Region	Displays the file name to which the data is currently being saved.
Test Progress Region	Shows the time-based progress of the test.
Error Indicator	Shows the current stats of the instrument

8.0 ALARM

Alarm allows you to set alarm levels on any of the 5 mass channels PM1, PM2.5, RESP, PM10 and Total. However, the alarm functioning is determined by the logging interval. The alarm will turn ON only if the average concentration over the logging interval exceeds the set point. If the logging interval is too long and the concentration exceeds the set point and stays at that level, the alarm will not turn ON until after the logging interval has passed. Likewise, the alarm will not stop until after the concentration has dropped below 5% of the threshold and after the logging interval has passed.



The Alarm is dependent on the logging interval. For the DustTrak to alarm as soon as the Alarm Setpoint is exceeded, the logging interval must be set as low as possible (i.e., 1 second or 2 seconds). If long test durations do not permit setting such a short logging interval, use the STEL alarm instead. The STEL is always based on 1 second concentrations and is independent of the logging interval. For more details on the STEL alarm, see section below on STEL.

In Survey mode, the alarm is dependent on the time constant.

<p>Alarm1 Setpoint [mg/m³]</p>	<p>The alarm1 setpoint is the mass concentration level upon which the alarm1 is triggered. Alarm will trigger if the mass concentration, taken at the logging interval, rises above the setpoint. <i>Note: Alarm 2 must be lower than Alarm 1 when both alarms are enabled.</i></p>
<p>Relay1 [On, Off]</p>	<p>When the relay alarm is turned on, unit will close relay switch when Alarm1 level is surpassed. Relay alarm can only be linked to one mass channel at a time. Relay selection is available on the 8533 desktop model only.</p>
<p>STEL 1 [On, Off]</p>	<p>When the STEL alarm is turned on, STEL data will be collected when Alarm1 level is surpassed. STEL alarm can only be linked to one mass channel at a time. STEL selection is available on the 8533 desktop model only.</p>
<p>Alarm2 Setpoint [mg/m³]</p>	<p>The alarm2 setpoint is the mass concentration level upon which the alarm2 triggers. Alarm triggers if the mass concentration, taken at the logging interval, rises above the setpoint. <i>Note: Alarm 2 must be lower than Alarm 1 when both alarms are enabled.</i></p>
<p>Alarm2 Enable [On, Off]</p>	<p>Enables Alarm2 to be logged and will activate the Audible or Visible alarms if they are enabled.</p>

Audible [On, Off]	When the audible alarm is turned on, the instrument will activate internal beeper when Alarm1 or Alarm2 level is surpassed. Audible alarm can only be linked to one mass channel
Visible [On, Off]	When the visible alarm is turned on, unit will show the alarm icon (Alarm1  , Alarm 2 ) in title bar when Alarm1 or Alarm2 level is surpassed.

STEL Alarm

STEL stands for **Short Term Exposure Limit**. When a STEL alarm is selected, the instrument will inspect the data on a second by second basis, independent from the selected logging interval. If the mass exceeds the STEL limit, a STEL alarm triggers and the following actions will be taken.

STEL indicator	The STEL indicator will show Red on the main screen. 
Data	Data will be taken off the STEL alarm channel at a 1 minute logging interval for 15 minutes . This data will be stored in a separate file named STEL_XXX, where XXX will be matched to the logged data file. The instrument will also continue to log the mass concentration data at the logging interval selected.
STEL Alarm repeat	If the instrument remains over the STEL limit after the 15 minute interval, or if the instrument exceeds the STEL limit later during the sample period, additional STEL files will be generated.

9.0 *MONITOR MAINTENANCE*

The DustTrak DRX Aerosol Monitor requires maintenance on a regular basis. The table below lists the factory recommended maintenance schedule.

Some maintenance items are required each time the DustTrak monitor is used or on an annual basis. Other items are scheduled according to how much aerosol is drawn through the instrument. For example, TSI recommends cleaning the inlet sample tube after 350 hours of sampling a 1 mg/M³ concentration of aerosol. This recommendation should be pro-rated according to how the instrument is used. 350 hours at 1 mg/M³ is the same amount of aerosol as 700 hours at 0.5 mg/M³ or 175 hours at 2 mg/M³, etc.

Recommended Maintenance Schedule

Item	Frequency
Perform zero check	Before each use.
Clean inlet	350 hr. at 1 mg/m ³ *
Clean 2.5 µm calibration impactor	Before every use.
Replace internal filters	350 hr. at 1 mg/m ³ * or when indicated by the main screen filter error indicator.
Return to factory for cleaning and calibration (For 8533EP, TSI recommends that both the DustTrak monitor and the External Pump Module be returned to TSI)	Annually
Replace the internal HEPA filters in the External Pump module	Annually

*Pro-rated, see discussion above.

The DustTrak monitor keeps track of the accumulated amount of aerosol drawn through it since its last cleaning. When the internal filter replacement is due, the filter error indicator will turn from green to red.

Cleaning the Inlet

The inlet should be cleaned based on the schedule in Table 4-1.

1. Turn the DustTrak monitor off.
2. Unscrew the inlet nozzle from the instrument.



Unscrew Inlet Nozzle

3. Clean the inlet port. Use a cotton swab to clean the outside of the inlet port. The swabs can be dampened with water or a light solvent (e.g., isopropanol). Clean the inside of the sample tube by using a small brush, along with a light solvent. Dry the tube by blowing it out with compressed air, or let it air-dry thoroughly.



Do NOT Blow into Instrument

- a. Screw (hand-tighten) inlet back into instrument.

Replacing the Internal Filters

Replace the internal filters based on the schedule in Table 4-1 or when the filter indicator on the main screen changes to red.

1. Turn the instrument off.
2. Remove old filters from the instrument.

Desktop Model

- a. Open filter access door on the back of the instrument.
- b. Use the enclosed filter removal tool (PN 801668) to unscrew the filter cap.
- c. Pull out single cylindrical filter from filter well. If filter well is visibly dirty, blow out with compressed air.



Pull out Single Cylindrical Filter from Filter Well

- d. Put a new filter (P/N 801673) back into filter well and screw filter cap back into place.
- e. Open blue retention clip by pinching ends inward and pushing down.



Open Blue Retention Clip

- f. Remove 37-mm filter cassette by pulling downward and outward.



Remove 37-mm Filter Cassette

- g. Open filter cassette using enclosed tool PN 7001303.



Open Filter using Enclosed Tool

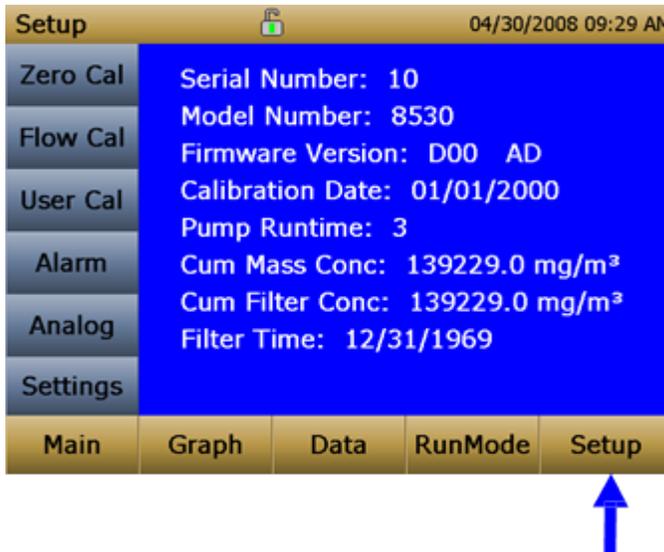
- h. Remove screen mesh from filter cassette and blow out using compressed air. Blow in reverse direction to remove captured particulate.
- i. Replace mesh in filter cassette and press halves together. Ensure filter has been fully closed. The filter tool PN 7001303 can be used to ensure the filter is fully closed.



Replace Mesh in Filter Holder

- j. Place filter cassette back into position and close blue retaining clip. Make sure retaining clip snaps back into place.

3. It is important to reset the instruments filter counter after replacing filters. Resetting the counter will clear the filter error condition shown on the main screen. Reset the counters by the following:
 - a. Turn on the instrument.
 - b. Press the Setup button to go into the setup screen.
 - c. Touch the Cum Filter Conc.: (live key) to reset the aerosol mass.



- d. *Replace user serviceable filters?* Dialog will appear. Press **OK**.
- e. *Reset filter concentration?* Dialog will appear. Press **Yes** to reset the cumulative filter concentration to zero.
- e. The Setup screen will not show zero for the **Cum Filter**.
- f. **Concentration and** the current date for the **Filter Time**.

10.0 CONTACTS

In the event you must reach ERM for any reason please use the following contact information:

Jeff Boggs - QA Manager

Mobile: (443) 803-8495
 Email: jeff.boggs@erm.com

Darren Quillen - Project Manager

Office: (410) 266-0006
 Mobile: (410) 991-9568
 Email: darren.quillen@erm.com

APPENDIX A

Field Data Sheets for Mobile and Fixed Station

Date: _____

Field Technician (Print and Sign): _____

Others Present During Equipment Calibration, Operation or Maintenance? Provide Name(s):

Weather Observations (rain, dry, windy, etc.):

Prevailing wind direction (from on-site weather station):

Any observed ambient conditions that may have potential to affect equipment operation or results?

Identify type of work in progress (Excavation, pile driving, etc.):

Take Photographs ^(2, 3)

Recommendations for Corrective Actions:

TIME ^(a)	WIND DIRECTION	IS MOBILE STATION RE-LOCATION REQUIRED? ⁽³⁾
0800		
1000		
1200		
1400		
1600		

(a) Document wind direction at approximately two hour intervals throughout the intrusive construction workday

Indicate if Recommended Maintenance Performed	Yes	No
Perform Zero Check before each use		
Clean Inlet at 350 hours at 1 milligram per cubic meter		
Clean 2 um calibration impactor before every use		

Calibration Using BIOS Defender 510-H									
Location ID	Work Zone Location/Description ⁽¹⁾	Distance from Work Zone (ft.)	DustTrak Serial ID	Time (24 hr. clock)	Start Flow (Lpm)	End Time (24 hr. clock)	End Flow (Lpm)	Photograph Label ⁽²⁾	Observations/Relocated?/Comments ⁽³⁾

WZ - Work Zone Air Monitor

(1) Identify Work Zone activity and location direction relative to work, e.g., Excavation/east of Pile Cap ##

(2) Photograph the monitor in relation to the Work Zone; Label each file uniquely by Location ID and date, e.g., WZ-1_YYYY-MM-DD

(3) Note monitor re-location during work day, if any, and photograph new location in relation to the Work Zone

Date: _____

Field Technician (Print and Sign): _____

Others Present During Equipment Calibration, Operation or Maintenance? Provide Name(s):

Weather Observations (rain, dry, windy, etc.):

Prevailing wind direction (from on-site weather station):

Any observed ambient conditions that may have potential to affect equipment operation or results?

Identify type of work in progress (Excavation, pile driving, etc.):

Photographs taken? (Subject)

Recommendations for Corrective Actions:

Indicate if Recommended Maintenance Performed	Yes	No
Perform Zero Check before each use		
Clean Inlet at 350 hours at 1 milligram per cubic meter		
Clean 2 um calibration impactor before every use		

Calibration Using BIOS Defender 510-H							
Location ID	DustTrak Serial ID	Start Time (24 hr. clock)	Start Flow (Lpm)	End Time (24 hr. clock)	End Flow (Lpm)	Photograph Label ⁽¹⁾	Observations/Comments

PAM - Perimeter Air Monitor; OAM - Off-site Air Monitor

(1) Name file by Location ID and date, e.g., PWAM-1_YYYY-MM-DD

(2) Format will be: Pic 1- site, Pic 2- DustTrack calibration, Pic 3- BGI calibration



Appendix B2 to the QAPP for the Wills Wharf Office Project

Field Sampling Protocol and Standard Operating Procedure

Sampling of Hexavalent Chromium in Ambient Air

19 January 2016

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	EQUIPMENT LIST.....	1
3.0	HEALTH AND SAFETY.....	2
4.0	SAMPLE MEDIA AND RECEIPT FROM LABORATORY.....	2
5.0	SAMPLER APPARATUS, ASSEMBLY, AND INSTALLATION.....	2
5.1	BGI PQ100 APPARATUS.....	2
5.2	BGI PQ100 ASSEMBLY AND RETROFIT.....	4
5.3	BGI PQ100 INSTALLATION AT THE SAMPLE SITE.....	7
6.0	INITIAL SAMPLER SETUP AND PROGRAMMING.....	7
6.1	SAMPLE FLOW RATE SETTING.....	7
6.2	SAMPLER DATE, TIME, TEMPERATURE, AND BAROMETRIC PRESSURE SETTINGS.....	9
7.0	SAMPLE MEDIA INSTALLATION.....	11
8.0	SAMPLER PRE-TEST FLOW VERIFICATION AND INITIATING A SAMPLE RUN.....	12
8.1	PRE-TEST FLOW VERIFICATION.....	12
9.0	SAMPLE RECOVERY.....	14
9.1	SAMPLE RUN ENDING AND FINAL FLOW VERIFICATION PROCEDURES.....	14
9.2	SAMPLE REDEPLOYMENT.....	15
10.0	SAMPLE STORAGE, PACKAGING, AND SHIPPING.....	16

11.0 QUALITY ASSURANCE/QUALITY CONTROL 17

 11.1 FIELD BLANKS..... 17

 11.2 TRIP BLANKS..... 18

 11.3 FLOW RATE CALIBRATION 18

 11.4 DAILY FLOW RATE VERIFICATIONS..... 18

12.0 SAMPLER MAINTENANCE..... 18

13.0 CONTACTS..... 18

ATTACHMENT A - FILED SHEET AND COC

1.0 INTRODUCTION

This protocol and standard operating procedure (SOP) is intended to provide a general overview and step-by-step instructions for personnel in the field responsible for carrying out ambient air sampling for hexavalent chromium (CrVI). The instructions cover assembly of the sampler apparatus, sampler programming and operation, sample media preparation, deployment, sampling, monitoring/checking, field data recording, sample recovery, labeling, chain-of-custody procedures, and final shipping to the analytical laboratory.

This document assumes that sample location siting has already been successfully completed ensuring each location meets the acceptable criteria with regards to the proximity of obstructions (i.e. buildings, trees, etc.), technician safety, and any potential contamination contributions from surrounding operations.

2.0 EQUIPMENT LIST

The following equipment will be required for the sampling program:

- BGI Model PQ100 Sampler Kits Including:
 - PQ100 Sampler with firmware version 6.0 or 1.0M or higher
 - Tripod base assembly with legs
 - Downtube assembly
 - Retrofit kit from Eastern Research Group (ERG)
 - BGI flow adapter fitted with a stainless steel Swagelock union
 - ¼” Stainless steel U-tube
 - Pre-cleaned Teflon filter holder pre-charged with a pre-cleaned sodium bicarbonate impregnated cellulose fiber filter
 - Glass funnel inlet assembly
 - PQ101 battery charger/AC power supply
 - CQ2 PC Communication Adapter Cable
 - Flexible tubing for pump connection
- BGI tetraCal (formerly triCal) Calibrator unit (Note: Dry calibrators and rotometers are not recommended);
- Laptop PC with BGI software installed – software available for download at <http://www.bgiusa.com/aam/portable.htm>;
- Field data sheets/ chain-of-custody (COC) – provided in Attachment-A, clipboards, pens;
- Rigid coolers with ice packs - filters are to be kept at 0 °C or below at all times except during the actual sample periods;
- Secure, on-site freezer for temporary sample storage.

Additional Field Supplies:

- Miscellaneous tools (wrenches, screwdrivers, pliers, etc.);
- Hand-held GPS with extra batteries;
- Camera;
- Personal protective equipment (PPE), see the site specific Health and Safety Plan (HASP);
- Shipping supplies;
- Field notebook;
- Powder-free Nitrile gloves;
- Ziploc bags;
- Laser print label maker – hand printed labels are also acceptable.

3.0 HEALTH AND SAFETY

All sampling activities undertaken at the Site must be completed under an approved, site-specific HASP. The HASP identifies the hazards, personal protective equipment, monitoring, and emergency procedures for conducting work at the Site. Samplers and support personnel must acknowledge their review of the HASP prior to performing work at the Site.

4.0 SAMPLE MEDIA AND RECEIPT FROM LABORATORY

The sodium bicarbonate impregnated cellulose fiber filters will arrive pre-loaded into pre-cleaned Teflon filter holders from ERG eliminating the need for technicians to directly handle the filters both during pre-sampling setup and post-sampling recovery procedures. The filter holders will also arrive with a pre-cleaned glass funnel sample inlet assembly. The filter holders will arrive in a cooler with frozen ice packs and must be kept in the freezer until ready for deployment into the field.

The Teflon filter holders have inlet and outlet connections that accept ¼" OD tubing using Swagelok style compression fittings. Each filter holder will arrive with a Teflon plug inserted into both the inlet and outlet to seal against contamination until ready for deployment.

The glass funnel inlet apparatus will also arrive pre-cleaned from the laboratory and should remain sealed in its packaging until deployment into the field for sampling.

5.0 SAMPLER APPARATUS, ASSEMBLY, AND INSTALLATION

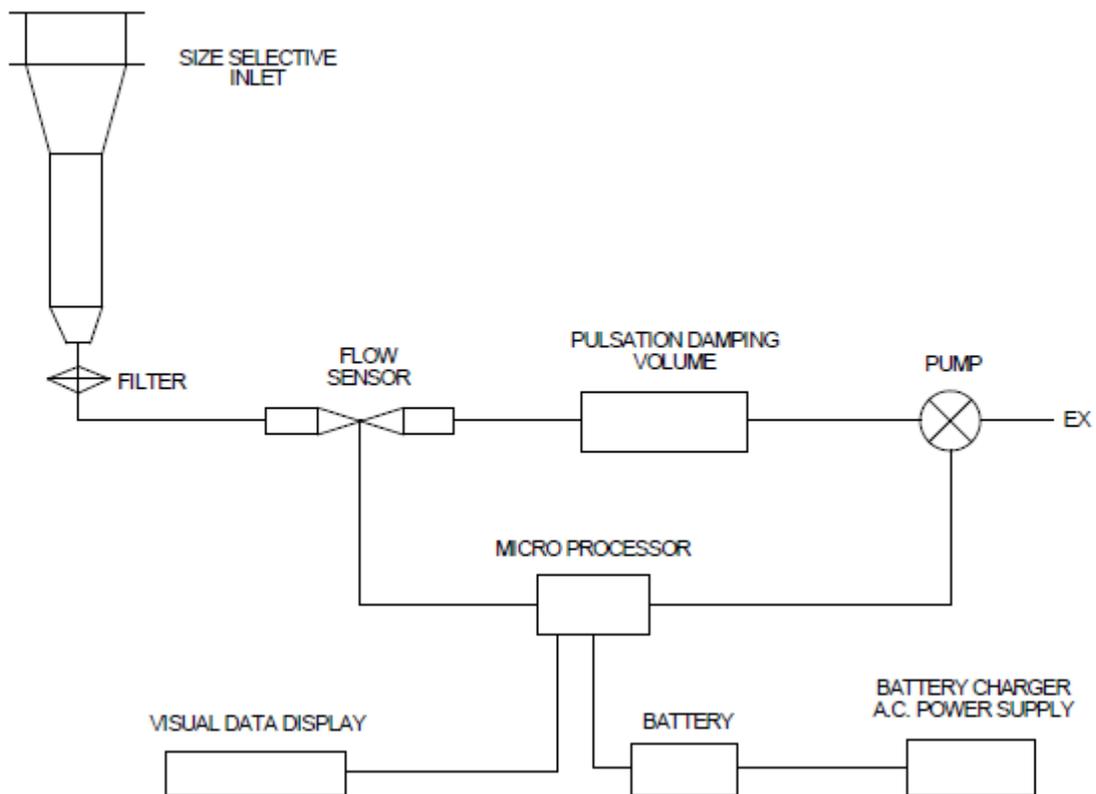
5.1 BGI PQ100 APPARATUS

The sampler used within this SOP is the Model PQ100 Air Sampler manufactured by BGI Incorporated. The unit employed during this program uses firmware version 6.0 or 1.0M or higher. The PQ100 uses a programmable pump and associated control logic that allows the unit to monitor its own air flow rate and adjust the pump speed to compensate for changes in load pressure and/or other forces that may affect the air flow rate. This allows the user to maintain a steady flow rate through the sample media throughout the sample duration. Figure 5-1 presents the typical PQ100 sampler and an example of installation on the tripod assembly. Figure 5-2 presents a simplified schematic of the PQ100 and associated process flow.

Figure 5-1. BGI PQ100 Sampler and Installation on Tripod Assembly



Figure 5-2. BGI PQ100 Sample System



For purposes of this monitoring program, the PQ100 sampler will be operated without the particle size selector and filter holder shown in Figures 5-1 and 5-2. The sampler will be retrofitted with a custom apparatus supplied by ERG. The retrofit replaces the typical BGI F20 filter holder and particle sizing inlet with a section of stainless steel tubing used to attach a Teflon filter holder assembly and glass funnel inlet apparatus.

Air is drawn by the pump through the glass funnel sample inlet and through the sample media, into the stainless steel U-tube, through the downtube into the flow sensor. The signal generated by the sensor is then routed to a microprocessor which determines if the flow is at the set point value and adjusts the pump speed as necessary to maintain the correct flow rate. A pulsation damping volume has been incorporated into the unit to compensate for pulsation effects from the pump.

The PQ100 contains an internal 12-volt battery but can also be operated using an external 12-volt deep cycle battery. For purposes of this test program, AC power will be available for providing the sampler with constant power therefore the internal 12-volt battery will only be used to maintain sampler operation in the event sampling is interrupted by AC power loss.

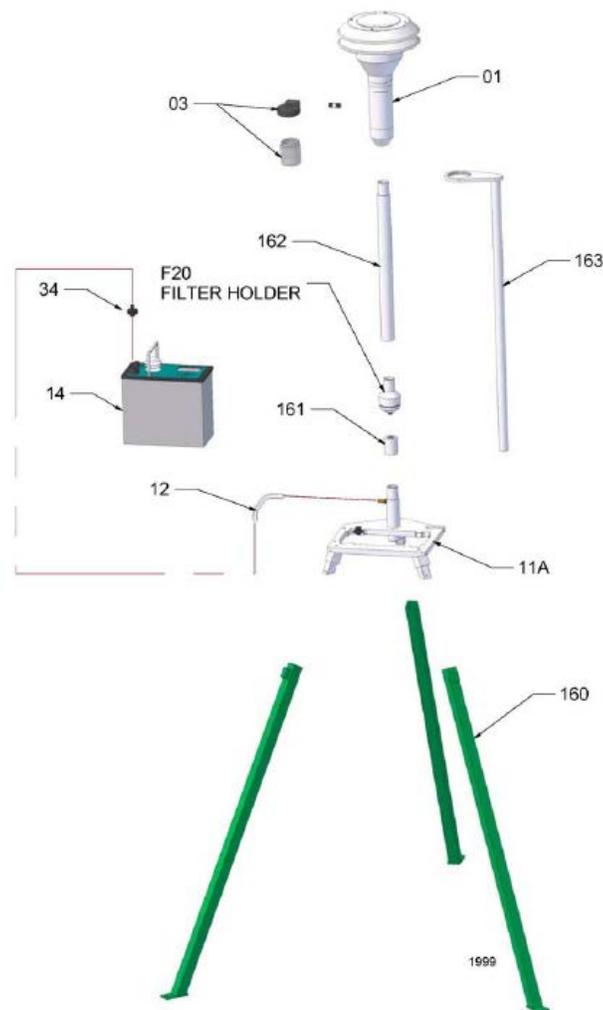
5.2 BGI PQ100 ASSEMBLY AND RETROFIT

Refer to Figures 5-4 and 5-5 as well as the BGI PQ100 Instruction Manual and Quick Start Guide during assembly of the PQ100 sampler apparatus. The sampler will be assembled without the use of the particle size inlet (01), water jar (03), filter holder adapter (161), F20 filter holder, and brace (163) as shown in Figure 5-4 and will instead be fitted with the ERG retrofit apparatus as shown in Figure 5-5. The item numbers listed below in the following steps will refer to the Figure 5-4 schematic.

1. Unpack the instrument and legs checking the packing list against received items. Attach the legs (160) to the rigid base (11A) using attached knurled snap lock fittings.
2. Attach the downtube (162) onto the cylindrical base fitting in the rigid stand. The filter holder adapter (161) and F20 filter holder that typically go between the base and the downtube are omitted (See Figure 5-5).
3. Attach the flow adapter piece fitted with the stainless steel Swagelok fitting onto the top of the downtube. This piece is supplied by ERG specifically for this retrofit (See Figure 5-5).
4. Attach the stainless steel U-tube supplied by ERG to the Swagelok fitting on top of the flow adapter and tighten the nut. Make sure that the inlet to the stainless steel tubing is capped off until ready to attach the sample media to avoid potential contamination.
5. Set the PQ100 pump into the stand, screw in the hose adapter, and attach the flexible hose from the pump to the downtube base.
6. Attach the PQ101 battery charger/AC power supply to the PQ100 unit and place up inside the charger box and hook along the edge of box.

7. Plug the other end into standard 115-120 VAC, 15-amp power. If using an extension cord, ensure that the cord has been inspected and is in good operating condition with no cracks or frays of the insulation and uses a proper three-prong grounded plug. Protect the power connection (AC plug) from moisture and possible shorting by sealing the connection using nylon electrical tape. If possible, also place the connection in an area protected from weather such as beneath the sample platform (if so equipped). A plastic Ziploc bag sealed around the connection has also been used successfully.
8. It is recommended that the unit be plugged in for at least 24 hours prior to sample initiation to allow the internal battery to charge.

Figure 5-4. Standard PQ100 Assembly



Note: The BGI particle size selector (01), water jar (03), filter holder adapter (161), F20 filter holder, and brace (163) will be omitted and replaced by the retrofit apparatus shown in Figure 5-5.

Figure 5-5. PQ100 Assembly with ERG Retrofit



5.3 BGI PQ100 INSTALLATION AT THE SAMPLE SITE

This document assumes that sample locations have already been sited and adhere to the proper sample location criteria. The sampler should be placed on a reasonably level surface with the sample inlet at a height of 2-15 meters (EPA-specified breathing zone). The height of the sample inlet should be appropriate as assembled but should be double-checked to ensure sampling no less than 2 meters above ground and with unobstructed air flow for at least 270 degrees around the sampler. For collocated sampling, each sampler should be placed at a distance of no less than 2 meters and no more than 4 meters from each other and have sample inlet heights that differ by no more than 1 meter (in most situations using collocated samplers the sample inlets will be at the same approximate height).

The samplers should be secured from the effects of wind loading to prevent tipping over in elevated wind conditions. Weighted wooden platforms have been used during prior test programs for adjusting the height of the sampler and securing the sampler firmly to the ground. Attaching 1' lengths of 2"x4" boards to the feet of the stand using lag bolts and securing with sandbags has also been used successfully.

6.0 INITIAL SAMPLER SETUP AND PROGRAMMING

6.1 SAMPLE FLOW RATE SETTING

The PQ100 may be delivered from the supplier with a default setting of 16.67 lpm based on the EPA standard. For purposes of this test program, the flow rate setting shall be 15.0 lpm. To set the flow rate to 15.0 lpm, choose the "Set Flow Rate" option in the main menu of the PQ100 and set the value to 15.0 lpm. After setting the flow rate, perform a calibration of the PQ100 following the calibration procedure outlined below using the tetraCal unit in direct or manual modes. Use a spare ERG filter assembly marked "calibration" for performing the flow setting and calibration. You will not use the glass funnel sample inlet for the initial flow calibration.

First ensure the PQ100 unit is set to "Volume Flow" under the "Select F Unit" menu title. See procedure below.

>Select Flow Rate Measurement

Flow rate may be controlled in two modes, either as Actual Flow which means the flow rate at the instantaneous Barometric Pressure and Ambient Temperature, in which case it is known as Q_A . Alternatively Standard flow may be selected. This is the flow rate at a set of standard conditions. In the case of the US EPA, Standard conditions (for PM10) are 25 C and 760 mm of Hg. This system is also referred to as Mass Flow.



```
Escape to Exit
Date and Time
Cal: lpm.
Cal: MP
+Cal: Flow Rate
+select MP unit
+select F unit
Enter to Select
```

>Select F unit



```
Escape to Cancel
+Volume Flow
Mass Flow
Enter to Accept
```

Attach the tetraCal unit to the inlet of the calibration filter holder assembly using an appropriate length of ¼” OD Teflon or polyethylene tubing. The tubing should fit directly into the filter holder inlet and be secured and sealed by tightening the nut. Attach the other end of the tubing to the tetraCal unit. You may need to use a piece of flexible rubber tubing to attach the ¼” Teflon tubing to the tetraCal inlet. Follow the instructions below as presented in the BGI PQ100 Instruction Manual to calibrate the PQ100 flow rate setting to 15.0 lpm. Record the calibration data in the field logbook.

7.0 CALIBRATION

7.1 Calibrate Flow rate:

The preferred way to calibrate the PQ100 is to use the tetraCal **Direct Cal** mode.

The tetraCal Direct Cal works as follows:
 The tetraCal puts out a continuous stream of flow rate information in ascii format. When the tetraCal Direct Cal mode is selected on the pump menu (D:cal), the pump is instructed to look for the stream of flow rate data. It then compares the tetraCal flow rate data to it’s own flow rate information and calculates an offset and then automatically adjusts the pump motor speed to match the data coming from the tetraCal.

At the Setup and Calibration Menu:

- 1) Scroll using the Up and Down buttons to the "Cal. Flow Rate" position. Press the Enter button to accept.

```

Escape to Exit
Date and Time
tetraCal: lpm.
tetraCal: lpm.
tetraCal: Flow Rate
select BP unit
select F unit
Enter to Select
  
```

At D:cal menu

Connect the Pump and calibrator using tubing and filter

- 1) Turn the tetraCal "ON" and allow it to zero, itself.
- 2) Using the Up and Down buttons, scroll to the "D:Cal" position and press the Enter button. The pump will automatically begin to run. At this point the pump instantaneously compares its data to the tetraCal data and calculates an offset.

```

Escape to Cancel
Manual
D:cal
Reset
Enter to Select
  
```

- 3) When the flow readings on the PQ100 is stable press the "Enter" button.

```

Escape to Cancel
Calibration in
Progress

Is D:cal
connected??
Press Enter
when stable
  
```

7.2 Manual Calibration

- 1) Using the Up and Down buttons, scroll to the "Manual" position and press the Enter button. The pump will automatically begin to run.

```
Escape to Cancel
+Manual
D'cal
Reset
Enter to Select
```

>Adjusting Flow:

- 1) Adjust the flow reading on the tetraCal or any other calibration device, to match the reading on the PQ100, using the Up and Down buttons. One button push is approximately equivalent to a change of 0.1 lpm. Either button may be held down to effect large changes.
- 2) Press the Enter button to accept the Calibration.

```
Escape to Cancel
Manual Cal.
16.67 LPM
up dn to match
flow meter
Enter to Accept
```

If the tetraCal unit is not available, then use of an equivalent flow rate standard is acceptable for calibrating the PQ100 in manual mode as outlined above. Note that piston-type dry calibrators and rotameters are not recommended as calibration standards for the PQ100.

6.2 SAMPLER DATE, TIME, TEMPERATURE, AND BAROMETRIC PRESSURE SETTINGS

Set the PQ100 to the correct date and time prior to use. Follow the procedure below for setting the sampler date and time.

>Making a Selection:

- 1) To select "Date and Time", scroll using the Up and Down buttons, then press the Enter button to accept.

```
Escape to Exit
+Date and Time
C'cal: 1 LPM.
D'cal: 100
C'cal: Flow Rate
D'cal: BP Unit
E'cal: F Unit
Enter to Select
```

Setting the Date and Time:

- 1) Move the (→) using the Up and Down buttons.
- 2) Press the Enter button to select the item. The item will then flash.
- 3) Use the Up and Down buttons to correct the numeric value. Press and hold to accelerate the speed of the numeric change.
- 4) Press the Enter button to accept the value and the (→) will automatically advance to the next item.
- 5) Select "Done" to return to the "Setup and Cal Menu".



Escape to Cancel
→2008 Year
11 Month
10 Day
15 Hour
45 Minute
Done
Enter to Change

The tetraCal unit can be used to calibrate the temperature and barometric pressure of the PQ100 as well. These parameters should already be in calibration when received from the equipment supplier however if it is observed that the temperature and barometric pressure parameters are potentially out of calibration, follow the procedures below to calibrate these parameters using the tetraCal unit. Record any calibrations performed in the field logbook.

> Calibrate Temperature:

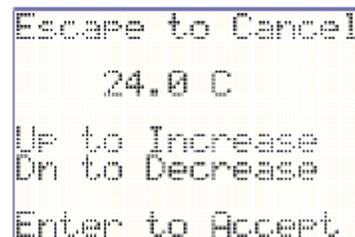
- 1) To select "Cal. Temp.", scroll using the Up and Down buttons, then press the Enter button to accept.



Escape to Exit
Date and Time
→Cal. Temp.
Cal. BP
Cal. Flow Rate
Select BP unit
Select F unit
Enter to Select

> Adjusting the Temperature

- 1) Compare the temperature reading from the PQ100 to a tetraCal or other standard.
- 2) If they differ, change the numeric value on the PQ100 using the Up and Down buttons.
- 3) Press the Enter button to accept the value and return to the "Setup and Cal Menu".



Escape to Cancel
24.0 C
Up to Increase
Dn to Decrease
Enter to Accept

>Calibrate Barometric Pressure:

- 1) To select "Cal. BP.", scroll using the Up and Down buttons, then press the Enter button to accept.

```
Escape to Exit
Date and Time
Cal: Temp.
→Cal: BP
Cal: Flow Rate
Select BP unit
Select F unit
Enter to Select
```

>Adjusting the Barometric Pressure

- 1) Compare the Barometric Pressure reading from the PQ100 to a tetraCal or other standard.
- 2) If they differ, change the numeric value on the PQ100 using the Up and Down buttons.
- 3) Press the Enter button to accept the value and return to the "Setup and Cal Menu".

```
Escape to Cancel
760 mm of Hg
Up to Increase
Dn to Decrease
Enter to Accept
```

7.0 SAMPLE MEDIA INSTALLATION

Follow the procedure below for installation of the filter holder containing the sample filter and sample inlet apparatus. Refer to Figure 5-5 for an example of the completed sampler unit.

- 1) Ensure that the sample media are delivered to the sample site within a cooler with ice packs to keep the filters cold and protected from the elements.
- 2) Prior to installation of the filter holder and glass funnel apparatus onto the PQ100 sampler, ensure that the sampler is free of dust and debris buildup. Wipe the sampler down with a damp cloth as appropriate.
- 3) Wearing powder-free nitrile gloves, remove the filter holder from its packaging. Note the filter ID (if so identified by the lab). If the filter is not marked with an identifying number, mark the filter holder packaging with an appropriate sample ID indicating sample location, day, and time. Record all sample media identification on the field data sheet. The field data sheet is included as an attachment to this SOP and is also used as the COC (Chain-of-Custody).
- 4) Mark the corresponding glass funnel inlet assembly packaging with the same identification parameters as the filter holder.
- 5) Loosen the nut on the filter holder outlet fitting and remove the Teflon plug. Store the Teflon plug in the filter holder packaging to protect it from contamination. Install the filter holder onto the end of the stainless steel U-tube by inserting the tubing into the filter holder outlet fitting and tightening the nut.
- 6) Leave the Teflon plug in the inlet side of the filter holder until ready to perform the initial flow rate verification.

8.0 SAMPLER PRE-TEST FLOW VERIFICATION AND INITIATING A SAMPLE RUN

The sample runs conducted during this test program will be initiated and terminated manually by the field technician. This eliminates the need for programming the PQ100 for pre-determined start/stop times and run durations. As such, procedures for programming pre-set start/stop times have been omitted from this SOP.

8.1 PRE-TEST FLOW VERIFICATION

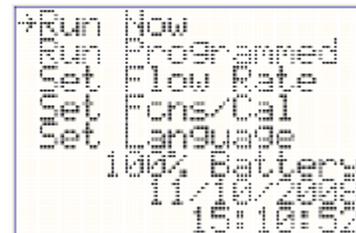
A pre-test flow rate verification will be conducted following the installation of the filter holder assembly and prior to initiation of the sample run in order to ensure proper operation and flow rate of the PQ100. Following installation of the filter holder assembly onto the stainless steel U-tube, connect the tetraCal unit (or other primary flow standard) to the inlet of the filter holder as was done during the initial flow rate setting calibration. Follow the instructions below for performing the initial flow rate verification:

- 1) Manually start the PQ100 from the menu presented below by selecting the “Run Now” option.

>At the Main Menu:

- 1) Scroll using the up and down buttons to make a selection. Position the → in front of the selection and press the enter button.

→ Run Now	Initiates a sampling event.
→ Run Programmed	Setup and initiate a programmed sampling event.
→ Set Fcns/Cal	Setup Time, Units and calibration Functions.
→ Set Language	Choice of English or Spanish



Note: Prior to using the PQ100, it is wise to set up the Date, Time and Preferences. Advance to the “Set Preferences” section of this manual.

- 2) Allow the unit to warm up for 5 minutes. The display should read the actual flow, standard flow, barometric pressure, and elapsed time as shown below.



- 3) After warm up, record the flow rate reading indicated by the tetraCal and the PQ100. The unit is acceptable if the flow rate indicated by the PQ100 is within $\pm 4.0\%$ of the flow indicated by the tetraCal unit.
- 4) Stop the pump by depressing the “Enter” button. See the example screenshot below.

6.2 Stopping the Run:

- 1) While the pump is running, press the “Enter” button, to stop the run.
- 2) The final run data will be displayed on the LCD.

Note: After the “Run”, pressing “ESC” will cause the elapsed run data to disappear. Pressing “ESC” will cause it to reappear. *Run information is not lost until overwritten by a new run.*



- 5) Detach the tetraCal unit at the filter holder inlet and replace the Teflon plug.
- 6) Wearing powder-free nitrile gloves, remove the glass funnel sample inlet assembly from its packaging (ensuring once again that the packaging has been appropriately labeled to correspond to the filter holder).
- 7) Loosen the nut on the filter holder inlet fitting and remove the Teflon plug. Store the Teflon plug in the filter holder packaging to protect from contamination. Install the glass funnel sample inlet assembly onto the filter holder by inserting into the inlet fitting of the filter holder and tightening the nut.
- 8) After installation of the filter holder and glass funnel inlet assemblies, the sampling run is ready to begin. Start the sampling run by depressing the “Enter” button to start the sample pump. The run data recorded by the PQ100 during the initial flow rate verification should reset once the new sampling run is started. Record all of the following parameters on the field data sheet:
 - Operator Name
 - Sample ID
 - Sample Location
 - Sampler Serial No.
 - Sample Start Date
 - Sample Start Time
 - Initial Elapsed Time reading (should be 00:00)
 - Ambient Temperature and Pressure (current instantaneous values)
 - Sample flow (aLpm and sLpm)
 - Note any unusual or notable activities in the area in the comments section
- 9) The sample event is now running. Operate the sampler for a period of 24 hours \pm 30 minutes. Repeat this procedure for each additional sample location making sure to stagger the start times of each sample location to allow enough time for the completion of recovery and re-deployment

procedures (presented below) at each location prior to the anticipated end time of the previous sample.

9.0 SAMPLE RECOVERY

9.1 SAMPLE RUN ENDING AND FINAL FLOW VERIFICATION PROCEDURES

Samples will be operated for a period of 24 hours \pm 30 minutes. Make sure to plan ahead in order to arrive at the sample locations in time to end the sample event while also allowing enough time for preparation of recovery and re-deployment procedures. Follow the instructions below for sample recovery and re-deployment:

- 1) After arriving at the sample location, ensure the sampler continued to operate normally throughout the sample period and that nothing has been disturbed. Note any issues encountered or potential disturbances on the field data sheet. Note also any unusual activities in the surrounding area.
- 2) Record the final sample flow rate (aLpm and sLpm) on the field data sheet. Stop the sample pump by depressing the “Enter” button as described above in item No. 4 of Section 8.1. The PQ100 screen will display the run parameters as indicated below.

Total volume is displayed as Actual volume or as Standard volume, corrected to sea level and Standard temperature. The information will alternately be displayed on the last line.



```
Escape to Clear
Run Completed:
S:05/05 14:52:30
E:05/05 14:54:15
Avg BP: 753 mm
Avg T: 21.9 C
Flow: 16.27 sLPM
StdVol: 28.5 L
```

- 3) Record the data on the field data sheet including:
 - a. Sample End Date
 - b. Sample End Time
 - c. Total Elapsed Sample Time
 - d. Ambient temperature and barometric pressure (current instantaneous values)
 - e. Average barometric pressure (on PQ100)
 - f. Average temperature (on PQ100)
 - g. Total sample volume (on PQ100)
 - h. Average flow rate
 - i. Total calculated standard volume
 - j. Note any unusual or notable activities in the area in the comments section
- 4) Wearing powder-free nitrile gloves, remove the glass funnel inlet assembly from the filter holder and place into the original packaging that has been properly labeled. Store in the sample media cooler with ice packs.

- 5) Attach the tetraCal (or other flow standard) to the inlet of the Teflon filter holder with the Teflon tubing used during the calibration and initial flow verification.
- 6) After ensuring all sample run data has been collected from the PQ100 unit, re-start the pump. As the unit had previously been running and was manually shut down after the end of the sample period, it should already be at or near operating temperature and therefore the warmup period will be minimal. Obtain the flow rate readout from the tetraCal unit after two minutes of warmup time. Record this data on the field data sheet under the final flow rate verification.
- 7) Disconnect the tetraCal unit from the inlet of the filter holder.
- 8) Replace the Teflon plug in the filter holder inlet and tighten the nut.
- 9) Remove the filter holder from the sampler by loosening the nut on the outlet fitting and removing from the stainless steel U-tube.
- 10) Replace the Teflon plug at the filter holder outlet and tighten the nut.
- 11) Per ASTM Standard D7614-12, Section 13.6, the following conditions will render the sample invalid:
 - a. Filters that are dropped or become contaminated with any foreign matter (dirt, finger marks, ink; or
 - b. Filters with tears or pin holes; or
 - c. Start and stop flow rates differ by more than 10%: or
 - d. Filter samples collected by the samplers which operated less than 23 hours or more than 25 hours; or
 - e. A power failure occurs during a sample run which causes the stop time or sample duration requirements to be violated; or
 - f. Filed blank fails if the concentration is higher than 3 times the method detection limit.
- 12) Ensure there is no excess dust or debris on the outside of the filter holder and return the sample into its packaging from the laboratory that was previously labeled. As soon as possible place the sample into the cooler with ice packs to maintain sample integrity during storage and shipping.
- 13) If sample run data is to be downloaded from the PQ100 unit, do so at this time using a laptop computer with the appropriate BGI software.

9.2 *SAMPLE RE-DEPLOYMENT*

If excessive dust or debris is observed on the sampler, use a damp cloth to wipe down the unit before proceeding to installation of sample media and initiation of the next sample run.

Following recovery of the sample at a particular location and any maintenance activities, prepare the next sample for deployment following the procedures outlined in the sections above. Install the filter holder, perform the initial flow rate verification, install the glass funnel sample inlet assembly, and initiate the sample run, recording all data as outlined in the previous sections. It is suggested that each location be recovered and re-deployed before moving on to the next sample location. Make sure to stagger the start times at each location during the program initiation to allow sufficient time to conduct recovery and redeployment procedures at each location while maintaining the ability to end sampling at each location at approximately the 24-hour mark \pm 30 minutes.

10.0 SAMPLE STORAGE, PACKAGING, AND SHIPPING

Once the samples from all locations have been recovered and new samples have been deployed, take the cooler containing the recovered samples to a clean location protected from the wind; a lab or office location is recommended. Follow the instructions below for storage and preparation for shipping.

- 1) Ensure that enough ice packs is available for keeping all of the samples cold during transport from the site and during shipping. Samples can be stored sealed in their packaging in the freezer until ready for shipping. The hold time for these samples is a maximum of 10 days.
- 2) The field data sheets filled out for each sample location are also to be used as the laboratory COC forms for each sample. Fill out the appropriate “Field Recovery” section with the relinquishing individual and date/time. Normally these data sheets will be provided by the laboratory in triplicate forms in which the original will remain with the samples during return shipping and the collector will keep the back copy. If however the forms are not provided as triplicate, make copies of all data sheets/COCs prior to sending with the samples. Original copies are retained and the copy will accompany the samples.
- 3) Line the bottom of the cooler with brown paper packing material then add a layer of ice packs. Do not use bubble wrap or foam packing peanuts as this tends to deplete the ice packs much faster than the paper material. Cover the ice packs with another layer of paper packing material.
- 4) Ensure each sample is sealed in its packaging from the laboratory. It is recommended that each sample be double bagged using plastic Ziploc bags. Ensure that each sample is properly labeled.
- 5) Place the samples into the cooler and fill in the gaps between samples with paper packing material. Place a layer of paper packing material over the samples. If desired, place more ice packs along the sides of the samples but remember to cover the ice packs with paper packing material to slow sublimation. Place enough packing material into the cooler so that the samples will not shift around during shipping.
- 6) Place the COC forms into a Ziploc bag and place these on top of the packing material inside the cooler. Seal the cooler with packing tape. It is not required, however, the use of a custody seal on the cooler is recommended to ensure sample integrity during shipping.

- 7) It is anticipated that samples will be shipped to the analytical laboratory in two batch shipments per week following the schedule outlined below. The laboratory turnaround time will be 5 business days.

Anticipated Sample Shipping Schedule (subject to change depending subset of deployed sampling media to be submitted for laboratory analysis):

<u>Shipping Day:</u>	<u>Samples Recovered on:</u>
Monday	Friday, Saturday, Sunday, Monday
Thursday	Tuesday, Wednesday, Thursday

- 8) Ship the samples to the analytical laboratory at the following address via priority overnight shipping (next day AM delivery):

Eastern Research Group
 Sample Receiving
 PM: Julie Swift
 601 Keystone Park Drive
 Morrisville, NC 27560
 919-468-7924

11.0 QUALITY ASSURANCE/QUALITY CONTROL

11.1 FIELD BLANKS

Daily field blanks will be collected and submitted for analysis. Collect a field blank each day of sampling at one selected sample location following the procedures below:

- 1) The field blank must be collected prior to the installation of the actual sample media.
- 2) Using powder-free nitrile gloves remove a new pre-charged filter holder from its packaging and record the filter ID on the field data sheet as well as on the media packaging. Make sure to note in the sample log that this sample is a field blank.
- 3) Remove the Teflon plugs and install the filter holder onto the stainless steel U-tube as instructed in Section 7.0.
- 4) Do not perform flow verification on the field blank sample. Proceed directly to attaching the glass funnel sample inlet assembly to the filter holder.
- 5) After installation of the glass funnel inlet assembly, wait for 10 seconds to allow exposure then remove the glass funnel sample inlet assembly and filter holder.
- 6) Replace the Teflon plugs and place the filter holder and the sample inlet assembly into their respective packages and seal.

- 7) Place each component in the cooler with ice packs for transport from the site. Store the samples in the freezer until ready for shipping to the laboratory.

11.2 TRIP BLANKS

One trip blank will accompany each shipment of samples to the laboratory. Follow the instructions below to collect the trip blank:

- 1) Obtain a new pre-charged filter holder and glass funnel sample inlet assembly and identify them with an appropriate sample ID on both the sample packaging and the field data sheet/COC. Identify the units as trip blanks in the sample log.
- 2) Do not open the packaging and in no way expose the sample filter holder or glass funnel assembly.
- 3) After properly identifying each, place the filter and glass funnel assembly into the shipment for return to the laboratory. Two trip blanks will be sent each week corresponding to the two sample batches shipped each week.

11.3 FLOW RATE CALIBRATION

The sampler flow rate will be calibrated at 15.0 lpm prior to test program initiation using the manufacturers recommended flow rate standard (tetraCal) or other equivalent calibration standard (DeltaCal). Dry piston-type and rotameter flow standards are not recommended for the PQ100. The calibration will be checked monthly or sooner if it is suspected that the flow rate calibration has drifted.

11.4 DAILY FLOW RATE VERIFICATIONS

Sample flow rate will be checked prior to the initiation of sampling and at the end of each sample period. The average flow rate calculated will be coupled with the total elapsed sample time to determine the total sample volume. This value can also be compared to the total sample volume reported by the PQ100 for validation purposes.

12.0 SAMPLER MAINTENANCE

The samplers should require little to no maintenance with the exception of routine cleaning of excess dust and dirt buildup between sampling events. Pay attention to sampler operation looking for any abnormal noises and or behaviors. The sample pumps have a rebuild period of 5000 hours and since the units employed during this test program will be supplied from an equipment vendor, it is anticipated that each unit will be delivered in good operating condition with no overdue maintenance requirements. It is recommended that the operator check with the equipment vendor to ensure all sampler maintenance has been conducted and is up to date.

13.0 CONTACTS

In the event you must reach ERM for any reason please use the following contact information:

Jeff Boggs – QA Manager

Mobile: (443) 803-8495

Email: *jeff.boggs@erm.com*

Darren Quillen – Project Manager

Office: (410) 972-0234

Mobile: (410) 991-9568

Email: *darren.quillen@erm.com*

ATTACHMENT – A

Field Data Sheet and COC

Site Location: _____

BGI Sampler #: _____

Filter Container #⁽¹⁾: _____

ERM QA Manager (or Designee): Print/Sign/Date

START: Technician: (Print) _____ (Sign) _____

Date: _____

Time (24 hour, hh:mm): _____ **(BGI)**

Sampler Indicated Flow Rate (lpm): _____ Tolerance = +/- 4% of 15 lpm [14.4 - 15.6]

Calibrator Flow Rate (lpm): _____ Tolerance = +/- 4% Sampler Indicated Flow Rate

END: Technician: (Print) _____ (Sign) _____

Date: _____

Time (24 hour, hh:mm): _____ **(BGI)**

BGI Sampler Indicated Avg. Flow Rate (lpm): _____ Tolerance = +/- 10% of Starting Flow Rate

Calibrator Flow Rate (lpm): _____ BGI Flow Rate (lpm): _____

BGI Indicated Actual Total Volume Sampled (m³): _____ **(Enter Total Volume Sampled on COC)**

BGI Elapsed Time (hh:mm): _____ **(Enter Elapsed Time on COC)** Tolerance = 24 +/- 1 hour [23 - 25 hours]

Manual Total Elapsed Time (hh:mm): _____ BGI End Time minus BGI Start Time **(Total Minutes)**

Manual Calculated Total Sample Volume (m³): 0.00 (Calibrator Start Flow Rate (lpm) + Calibrator End Flow Rate (lpm)) / 2 x Manual Total Elapsed Time

FIELD BLANK: Filter Container #: _____
(e.g., PAM-21)

TRIP BLANK: Filter Container #: _____
(e.g., PAM-31)

COMMENTS:

Note - (1) Unique filter container number cross referenced to same on COC.



Harbor Point Development
Baltimore, MD

ERG Lab ID #

601 Keystone Park Drive, Suite 700, Morrisville, NC 27560

AMBIENT HEXAVALENT CHROMIUM CHAIN OF CUSTODY FORM

Lab Pre-Sampling	Batch I.D.: _____ Filter Container #: _____ <small>(Reference BGI-100 Field Sheet)</small> Relinquished by: _____ Date: _____
Field Setup	Received by: _____ Date: _____ Site Location: _____ Cooler Temperature: _____ Set-Up Date: _____ Start Time: _____
Field Recovery	Site Operator: _____ BGI Total Volume Sampled (m ³): _____ Site Location: _____ Recovery Date: _____ Recovery Time: _____ BGI Elapsed Time: _____ Status: VALID VOID (Circle one) If void, why: _____ Relinquished by: _____ Date: _____
Lab Recovery	Received by: _____ Date: _____ Filter Container #: _____ <small>(Reference BGI-100 Field Sheet)</small> Status: VALID VOID (Circle one) Cooler Temperature: _____ Stored in Freezer # 11? Yes No Freezer #11 Temperature: _____

Comments: _____

Appendix C
Laboratory Analytical Method SOPs



CONFIDENTIAL
Standard Operating Procedure
 Procedure Number: ERG-MOR-063
 Revision Number: 10
 Revision Date: February 20, 2014
 Page: 1 of 25

ENGINEERING AND SCIENCE DIVISION

TITLE: Standard Operating Procedure for the Preparation and Analysis of Hexavalent Chromium by Ion Chromatography	EFFECTIVE DATE: 2-20-2014
REFERENCES: ERG-MOR-013; ERG-MOR-033; ERG-MOR-034; ERG-MOR-042; ERG-MOR-097; CARB-039; Corporate Quality Management Plan; 40 CFR, Part 136, Appendix B; Dionex operations manual; ASTM Standard Test Method D7614	
SATELLITE FILES: LC Laboratory	
REASON FOR REVISION: Update MDLs and referenced ASTM Standard	
WRITER/EDITOR: NAME/DATE <i>Randy Zowle 2/20/14</i>	PROJECT MANAGER/TECHNICAL DIRECTOR: NAME/DATE <i>Julie C. Swift 2/20/14</i>
QUALITY ASSURANCE COORDINATOR: NAME/DATE <i>Donna Tedda 2/20/14</i>	NEXT SCHEDULED REVIEW: 1/31/2015

1.0 IDENTIFICATION AND PURPOSE

Chromium is a natural constituent of the earth's crust and present in several oxidation states. Trivalent chromium (Cr^{3+}) is naturally occurring, environmentally pervasive and a trace element in man and animals. Hexavalent chromium (Cr^{6+}) is generated anthropogenically from a number of commercial and industrial sources. Hexavalent chromium readily penetrates biological membranes and has been identified as an industrial toxic and cancer causing substance. Hexavalent chromium is a known inhalation irritant and associated with respiratory cancer and it is primarily associated with the chrome plating and anodizing process and emissions from chromate-treated cooling towers. This standard operating procedure (SOP) provides the analytical procedures for the analysis of Cr^{6+} with operation of the ion chromatograph (IC), Dionex-600.

2.0 MATRIX OR MATRICES

Hexavalent chromium has been measured in the air across the country. A procedure for sample preparation written by California Air Resources Board (CARB-039) has been

modified to the procedure listed below. The modified method was submitted and accepted as an ASTM Standard Test Method D7614 for the Determination of Total Suspended Particulate (TSP) Hexavalent Chromium in Ambient Air Analyzed by Ion Chromatography and Spectrophotometric Measurements. Sodium bicarbonate impregnated cellulose filters are exposed to ambient air using hexavalent chromium samplers designed, fabricated, and supplied by ERG (see SOP ERG-MOR-013 for sampling procedure).

3.0 METHOD DETECTION LIMIT

The method detection limit (MDL) is determined every year according to the procedure in 40 CFR, Part 136, Appendix B. A standard is spiked onto at least seven prepared filters at a concentration one to five times the estimated detection limit. These filters are extracted and analyzed according to the method outlined below. The Federal Register MDL equation is listed in Section 15.1. The method detection limit is 0.0078 ng/mL, which is 0.0036 ng/m³ (based on 21.6 m³ sample volume).

4.0 SCOPE AND APPLICATION

This procedure provides step-by-step instructions for analyzing hexavalent chromium collected on sodium bicarbonate-impregnated ashless cellulose filters exposed to ambient air.

5.0 METHOD SUMMARY

This SOP covers the determination of Cr⁶⁺ from sodium bicarbonate-impregnated ashless cellulose filters exposed to ambient air and submitted to the laboratory. The filters are extracted in a 20 mM sodium bicarbonate in deionized (DI) water solution via shaking for 45 minutes. The extract is analyzed by ion chromatography using a system comprised of a guard column, an analytical column, a post-column derivatization module, and a UV-VIS absorbance detector. In the analysis procedure, Cr⁶⁺ exists as chromate due to the near neutral pH of the eluent. After separation through the column, the Cr⁶⁺ forms a complex with the 1,5-Diphenylcarbazide (DPC) which can be detected at 530 nm. The analysis is completed using the Chromeleon® Client software version 6.50 SP4 Build 1000.

6.0 DEFINITIONS

AGP	Advanced Gradient Pump
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CD	Compact Disc
cm	centimeter(s)

Cr ⁶⁺	Hexavalent Chromium
DC	Detector/Chromatography
DI	Deionized
DIUF	Deionized Ultra Filtered
DPC	1,5-Diphenylcarbazide
DVD	Digital Versatile Disc
g	gram
HPLC	High Performance Liquid Chromatograph
IC	Ion Chromatograph
ICV	Initial Calibration Verification
ICB	Initial Calibration Blank
LPM	liter(s) per minute
L	liter(s)
LCS	Laboratory Control Samples
mL	milliliter(s)
M	molar
MB	Method Blank
MDL	Method Detection Limit
mM	millimolar
MQO	Method Quality Objectives
ng/mL	nanogram(s) per milliliter
nm	nanometer(s)
PE	Performance Evaluation
PC	Post Column
PCR	Post-Column Derivatizing Reagent
RE	Relative Error
RSD	Relative Standard Deviation
SOP	Standard Operating Procedure
SP	Single Pump
μL	microliter(s)
μm	micron(s)
UV/VIS	Ultraviolet-Visible

7.0 INTERFERENCES

Sodium carbonate, used as the stabilizing medium in the Cr⁶⁺ filters, was observed to cause interferences with the analysis. Higher concentrations of the sodium bicarbonate impregnating solution may cause flow restrictions during the ambient air sampling. The use of an impregnated filter of smaller pore size has been shown to cause definite flow restrictions during sampling.

8.0 SAFETY

- 8.1 The IC does not require venting, and elaborate safety precautions are unnecessary. Safety glasses must always be worn in the laboratory. Gloves and lab coats are required during the handling of all hazardous solutions.
- 8.2 The compressed gas cylinders must be stored and handled according to relevant safety codes outlined in the corporate health and safety manual. The cylinders must be secured to an immovable structure. They must be moved using a gas cylinder cart.
- 8.3 Calibration standards are purchased in dilute solutions from certified vendors. Standard laboratory practices for hazardous material handling should be employed for handling acids, derivatizing reagents, and neat Cr^{6+} salts when these are used for analysis.

9.0 EQUIPMENT

This SOP assumes familiarity with the operation of Dionex ion chromatographic systems. For more detailed instructions in the operation of the Dionex IC, please refer to SOP (ERG-MOR-042) and the Dionex operations manual.

- 9.1 The Dionex ICS-5000 ion chromatography system consists of an AS-DV autosampler, an SP isocratic pump with seal wash, a DC chromatography compartment housing the injection valve, 1000 uL sample loop and IC columns, a PC-10 post-column reagent delivery device, and a VWD UV/VIS absorbance detector.
- 9.2 The Dionex-600 IC consists of an AS40 autosampler with chromatography compartment, a 1.0 mL sample loop for the AS40, a GP50 advanced gradient pump (AGP) with vacuum degas option, an eluent container set with rack, an eluent degas module, a LC20 chromatography enclosure, a Rheodyne injection valve (Model 9126-038), an AD25 UV/VIS absorbance detector, and a PC10 post-column pneumatic delivery package.
- 9.3 The instrument is controlled and data is collected and processed using the Chromeleon® Client chromatography software version 6.80 running on a computer using a Microsoft Windows operating system.

10.0 MATERIALS

- 10.1 47mm ashless cellulose filters, Whatman 41 or equivalent

- 10.2 Materials required for analysis include: waste containers and a helium regulator that regulates the pressure source for the post-column derivatizing solution and degassing of the eluents. Also, the specific guard and analytical columns are listed below in Section 14.2.
- 10.3 DIUF water for preparing eluent, post-column derivatizing reagent, sodium bicarbonate solutions, and standards.
- 10.4 Class A volumetric flasks: 10 mL, 100 mL, 200 mL, 500 mL, 1 L, and 2 L.
- 10.5 Wide-mouth high density polyethylene storage bottles: 125 mL.
- 10.6 Analytical balance, capable of 100 μg sensitivity.
- 10.7 Polystyrene tubes with caps and tube rack: 14 mL.
- 10.8 Ultrasonicator, to be used for standard preparation.
- 10.9 Glove boxes supplied with a screen rack and ultra-pure nitrogen to purge while handling and drying filters. One glove box should be designated as a filter preparation only glove box.
- 10.10 Graduated cylinders: 50 mL, 100 mL, and 500 mL.
- 10.11 4 Large plastic containers for rinsing filters and filter baths.
- 10.12 Freezers.
- 10.13 Teflon[®] coated or plastic tweezers for handling filters. Tweezers are cleaned with DI Water before use.
- 10.14 Pipettes: 100 μL , 5000 μL , and 10 mL.
- 10.15 Disposable nitrile gloves.
- 10.16 Autosampler vials and caps.
- 10.17 Wrist action shaker, to be used for sample preparation.

11.0 CHEMICALS, REAGENTS, AND STANDARDS

11.1 Eluent Solution

A standard eluent solution of the following reagents is prepared in deionized water:

- 250 mM ammonium sulfate, 99.99% purity trace metals basis
- 50.9 mM ammonium hydroxide, ACS reagent grade

In a 2 L volumetric flask, dissolve 66 g of ammonium sulfate in ~1 L DI water. Sonicate ammonium sulfate and water. When mixed, add 7 mL of ammonium hydroxide. Dilute to 2 L with DI water and sonicate briefly. The solution can be used for up to 5 days, but loses strength over the course of several days.

11.2 Post-column Derivatizing Reagent (PCR)

In a 50 mL volumetric flask, dissolve 0.25 g of 1,5-diphenylcarbazide (DPC), 97% purity, in HPLC-grade methanol. Sonicate until DPC goes into solution. In a 500 mL volumetric flask add DI water, leaving room for 14 mL of 98% sulfuric acid and 50 mL of DPC solution. Add 14 mL of 98% sulfuric acid and allow the solution to cool. Add the DPC solution to the 500 mL flask. Fill to the mark with DI water. Sonicate the solution briefly. This reagent is stable for three days. To minimize waste it should be prepared in 0.5 L or 1 L quantities as needed.

11.3 Sodium Bicarbonate Impregnating Solution

In a 500 mL volumetric flask, add 5.0 g of sodium bicarbonate. Dilute to 500 mL with DI water. Sonicate to mix.

11.4 20 mM Sodium Bicarbonate Solution

In a 2 L volumetric flask, add 3.36 g of sodium bicarbonate. Dilute to 2 L with DI water. Sonicate to mix.

11.5 Primary and Secondary Stock Solutions

Two stock solutions should be prepared and/or obtained from separate sources. The primary is to be used exclusively for the calibration standards and the secondary for laboratory control samples (LCS) and calibration verification.

11.6 Working Stock Solutions

The working stock solutions are 1000 ng/mL Cr⁶⁺. Working stock solutions should be prepared for both calibration standards and laboratory control samples/calibration verification. It is important not to use the same primary stock solution for both working stock solutions.

11.6.1 Calibration Working Stock Solution: Dilute the appropriate volume of the calibration primary stock solution to 100 mL using the 20 mM sodium bicarbonate in DI water solution.

11.6.2 LCS Spike Solution (Working Stock): Dilute the appropriate volume of the laboratory control primary stock solution to 100 mL using the 20 mM sodium bicarbonate in DI water solution. The LCS Spike solution is used to spike laboratory control samples and to make the calibration verification solution.

11.7 Calibration Standards

The six calibration standards are prepared by diluting the calibration working stock solution to the concentrations specified below.

11.7.1 0.05 ng/mL Cr⁶⁺ - Dilute 10 µL of the working stock solution to 200 mL using the 20 mM sodium bicarbonate solution.

11.7.2 0.1 ng/mL Cr⁶⁺ - Dilute 10 µL of the working stock solution to 100 mL using the 20 mM sodium bicarbonate solution.

11.7.3 0.2 ng/mL Cr⁶⁺ - Dilute 20 µL of the working stock solution to 100 mL using the 20 mM sodium bicarbonate solution.

11.7.4 0.5 ng/mL Cr⁶⁺ - Dilute 50 µL of the working stock solution to 100 mL using the 20 mM sodium bicarbonate solution.

11.7.5 1.0 ng/mL Cr⁶⁺ - Dilute 100 µL of the working stock solution to 100 mL using the 20 mM sodium bicarbonate solution.

11.7.6 2.0 ng/mL Cr⁶⁺ - Dilute 200 µL of the working stock solution to 100 mL using the 20 mM sodium bicarbonate solution.

11.8 Calibration Verification Solution

As part of the quality assurance program in the evaluation of the data, a calibration verification from a secondary source at an intermediate concentration

(0.5 ng/mL) is run as a check of the precision of the instrument and calibration. An Initial Calibration Verification (ICV) is run immediately following the calibration standards and Continuing Calibration Verifications (CCV) are run after every 10 injections.

- 11.8.1 Calibration Verification Solution Preparation - Dilute 50 μ L of the LCS Spike Solution to 100 mL using the 20 mM sodium bicarbonate solution.

12.0 COLLECTION, PRESERVATION, SHIPMENT, AND STORAGE

12.1 Handling of Filters

Whenever the filter is handled, clean Teflon[®] coated or plastic tweezers are used with disposable nitrile gloves. All filter drying and spiking is completed in the laboratory nitrogen-purged glove box.

Note: For normal ambient air samples, gloves do not need to be replaced while handling filters during extraction. For high particulate loaded filters, the analyst needs to be aware of potential contamination and gloves should be replaced if needed.

12.2 Preparation of Filters

- 12.2.1 Soak filters in a 10% nitric acid (50 mL of 70% nitric acid in 450 mL DI water) bath for a minimum of 16 hours and a maximum of 24 hours. New nitric acid solution is prepared before cleaning each filter batch. About 50 filters can be soaked per half liter of solution.
- 12.2.2 Rinse filters thoroughly with DI water until the pH of filter matches the pH of the DI water (about 30 minutes).
- 12.2.3 Dry the filters completely on a screen rack in a nitrogen-purged glove box (minimum of 5 hours). The filters will become stiff after they have dried.
- 12.2.4 Soak the filters in the impregnating solution (0.12 M sodium bicarbonate in DI water) overnight. If the filters are not completely dry before placing them in the impregnating solution, the solution will become dilute and will not collect samples as efficiently.
- 12.2.5 Dry the filters completely on a screen rack in a nitrogen-purged glove box until filters start to curl (minimum of 5 hours).

12.2.6 Place dried filters into petri dishes. Place the petri dishes into small plastic freezer bags labeled with the batch number and store in a freezer until needed.

12.2.7 Analyze 10 percent of the cleaned filters. If there are any detects above the MDL, the whole batch is discarded and a new batch is prepared.

12.3 Preservation and Storage of Filters

The filters are kept in the freezer until needed in the field for sampling or used in the laboratory to prepare spikes or blanks during analysis. The filters are frozen to prevent the sodium bicarbonate from reacting with possible interfering substances present in the air.

12.4 Cleaning Filter Holders

Clean the filter holders between sample collection by placing used holder parts into a container. Fill the container with DI water and agitate the filter holders. Discard DI water and repeat two times. Fill the container with DI water and sonicate the filter holders for one hour. Air dry filter holders completely before reuse.

12.5 Shipment of the Filters

Place filters in filter holder cartridges and tighten. Place in plastic freezer bags and place this into a labeled plastic can with funnel. The filter batch number is recorded on the chain of custody, and the chain of custody is put with the plastic can into a cooler packed with silver ice packs to keep the filters frozen. The coolers are shipped to the field approximately 1-2 weeks in advance. The filters are kept in freezers in the field until the sampling event.

12.6 Sample Hold Time

Stability of samples after sampling has been tested to 21 days. Samples should be extracted and analyzed within 21 days of sampling.

13.0 CALIBRATION AND STANDARDIZATION

13.1 Prepare calibration standards at a minimum of five levels as described in Section 11.7. The initial calibration ranges from 0.05 to 2.0 ng/mL Cr⁶⁺.

13.2 Analyze each calibration standard and tabulate the area response against the concentration injected. Follow the analytical procedures described in Sections 14.2. Use the results to prepare a calibration curve.

- 13.3 Use a Least Squares Linear Regression Calculation (Chromeleon® Client chromatographic software) to calculate the correlation coefficient, slope, and intercept of the regression. A correlation coefficient of at least 0.995 is required. A relative error (RE) between the concentration calculated using the regression line and the theoretical concentration of each calibration standard of < 20% is acceptable. See equation in Section 15.4. The regression is expressed as follows:

$$y = mx + b$$

where:

y = dependent variable (response)

m = slope of regression line

b = intercept

x = independent variable (concentration)

- 13.4 The Calibration Verification solution is used to verify the calibration at the beginning and throughout the sequence. Analyze an ICV after the initial calibration and analyze a CCV after every 10 injections, and at the end of the analysis batch. The primary stock solution for the ICV and CCV must be from a different source than what is used for the calibration standards. The recovery criteria are 85-115%. If the ICV or CCV is not within 15% of the target concentration, prepare a new Calibration Verification solution and/or recalibrate the instrument.

14.0 PROCEDURE

14.1 Filter Extraction

Due to the oxidation/reduction and conversion problems of Cr^{3+} and Cr^{6+} , the extraction should be performed immediately prior to analysis. It is important that the ion chromatograph be equilibrated, calibrated and ready for analysis. Prepare one cleaned, unused filter for every 20 filter samples in an extraction batch. Unused, clean filters will also be used to prepare duplicate blank spikes for every 20 filter samples in an extraction batch. See section 16.5.

- 14.1.1 Remove the exposed filter from the petri dish, using tweezers and disposable nitrile gloves. Fold the filter, place it in a 14 mL polystyrene test tube and add 10 mL of the 20 mM sodium bicarbonate in DI water solution. Cap the tube tightly. New tweezers should be used for each filter.

- 14.1.2 Place the tubes in a test tube rack. Place the tubes into the shaker for 45 minutes.
- 14.1.3 After 45 minutes of shaking, remove the tubes and put 5 mL of the sample extract into a to a 5 mL Dionex autosampler vial. Store the remaining extract in a refrigerator until analysis of all samples are complete. Store sample extracts in the refrigerator for up to one week, then transfer extracts to a labeled plastic bag and place in the fume hood in the laboratory for disposal.

14.2 Sample analysis

The analysis time is approximately 10 minutes. The following conditions are used for analysis.

- 14.2.1 Guard Column - IonPac NG1.
- 14.2.2 Analytical Column - IonPac AS7, 4 x 250 mm.
- 14.2.3 Eluent flow rate - 1.0 mL/min (250 mM ammonium sulfate and 50.9 mM Ammonium hydroxide).
- 14.2.4 Post column Reagent flow rate - 0.3 mL/min (2 mM DPC in 10% methanol and 1 N sulfuric acid).
- 14.2.5 Detection Wavelength - 530 nm.
- 14.2.6 Sample Volume - 1000 μ L.

15.0 CALCULATIONS

The Chromeleon[®] Client chromatography software calculates sample concentrations based on the calibration values entered into the program. These values are verified by a peer reviewer after analysis, and corrections can be made before reporting.

15.1 Method Detection Limit (MDL)

The MDL is determined every year according to the procedure in 40 CFR, Part 136, Appendix B. A standard is spiked onto at least seven prepared filters at a concentration one to five times the estimated detection limit. These filters are extracted and analyzed according to the method outlined. The method detection limit is 0.0078 ng/mL, which is 0.0036 ng/m³ (based on 21.6 m³ sample volume).

The MDL is calculated as follows:

$$\text{MDL} = (t) \times (\text{SD})$$

Where:

t = Student's t value for a 99% confidence level and a standard deviation estimate with n - 1 degrees of freedom [t = 3.14 for seven replicates]

SD= standard deviation of the replicate analysis

15.2 Calculation of Stock Standard Concentration

The concentration in ng/mL is calculated below:

$$\text{Stock Concentration} = \frac{(\text{Volume Stock Added } (\mu\text{L}) \times \text{Working Standard } (\text{ng} / \text{mL}))}{\text{Total Volume } (\text{mL})} \times \frac{1(\text{mL})}{1000(\mu\text{L})}$$

15.3 Calculation of Calibration and Check Standard Concentration

The concentration in the calibration, check standard and method spike standards is calculated below:

$$\text{Cal Std Conc.} = \frac{(\text{Volume Stock Added } (\mu\text{L}) \times \text{Stock Concentration } (\text{ng} / \text{mL}))}{\text{Total Volume } (\text{mL})} \times \frac{1(\text{mL})}{1000(\mu\text{L})}$$

15.4 Calculation of Least Squares Linear Regression Calibration Curve

Use a Least Squares Linear Regression routine (using Chromeleon[®] Client chromatography software) to calculate a correlation coefficient, slope, and intercept. Use concentration as the X-term (independent variable) and response as the Y-term (dependent variable).

15.5 Calculation of the Coefficient of Correlation

The correlation coefficient, R, is the square root of R² where:

$$R^2 = \frac{\left[\sum (XY) - \frac{\sum (X)\sum (Y)}{n} \right]^2}{\left[\sum (X^2) - \frac{(\sum X)^2}{n} \right] \left[\sum (Y^2) - \frac{(\sum Y)^2}{n} \right]}$$

15.6 Calculation of the Concentration of Cr⁶⁺ in Sample

The concentration in the sample is calculated below:

$$\text{Conc. Cr}^{6+} \text{ In Sample (ng/mL)} = \frac{(\text{Sample Response} - \text{Intercept})}{\text{Slope}}$$

15.7 Calculation of ICV and CCV Percent Recovery

The ICV and CCV percent recovery is calculated below:

$$\frac{[\text{Conc. Cr}^{6+} \text{ in Std.}] \times 100}{\text{Expected Conc.}}$$

15.8 To calculate the concentration of Cr⁶⁺ in the air sampled, the volume of air sampled must be known.

$$\text{Cr}^{6+} \text{ Concentration (ng/m}^3\text{)} = \frac{\text{RA (ng/mL)} \times \text{V}_2 \text{ (mL)}}{\text{V}_1 \text{ (m}^3\text{)}}$$

where:

RA	=	Concentration of Cr ⁶⁺ in analyzed sample
V ₁	=	Volume of air sampled
V ₂	=	Total volume of sample extract

15.9 Calculation of Laboratory Control Sample Recovery

Percent recoveries of the LCS and LCS duplicates are calculated as follows. First, the concentration of Cr⁶⁺ in the LCS is calculated as described in Section 15.5. The corrected weight of Cr⁶⁺ is divided by the amount of Cr⁶⁺ spiked and multiplied by 100 as shown below:

$$\% \text{ Recovery} = \frac{(\text{Actual Concentration of Cr}^{6+} \text{ in LCS}) \times 100}{\text{Theoretical Conc. of Cr}^{6+} \text{ in LCS}}$$

15.10 Calculation of Relative Error (RE)

$$\% \text{ RE} = \frac{(\text{Theoretical Conc.} - \text{Actual Conc.}) \times 100}{\text{Theoretical Conc.}}$$

16.0 QUALITY CONTROL

The analyst must perform the quality control checks listed in Table 24-1 and meet the requirements in this section. Method Quality Objectives (MQO) and data assessment criteria are determined from the results of the quality control samples. The MQO criteria are presented in Table 24-1. A data QC review check sheet is presented in Table 24-2.

16.1 Sample Collection Quality Control

The sample acceptance criteria for the filters are given below. All samples being logged in from the field are checked for these criteria. If a sample does not meet these criteria, the sample is invalid.

- 16.1.1 Filters dropped or contaminated with any foreign matter (i.e., dirt, finger marks, ink, liquids, etc.) are invalid.
- 16.1.2 Filters with tears or pinholes which occurred before or during sampling are invalid.
- 16.1.3 Sample flow rate:
 - If the average flow rate is less than 9.0 LPM or exceeds 16 LPM the filter is invalid.
 - If the start and stop flow rates differ more than $\pm 10\%$ the filter is invalid.
- 16.1.4 Filter samples collected by samplers which operate less than 23 hours or more than 25 hours are invalid.
- 16.1.5 If a power failure occurs during a sample run which causes the stop time or sample duration requirements to be violated, the sample is invalid.

16.2 Initial Calibration

Run a calibration curve with a minimum of five points as described in Section 13.0 at the beginning of each sequence and whenever the Calibration Verification standard does not fall within 15% of the target concentration. The

initial calibration range is from 0.05 to 2.0 ng/mL of Cr⁶⁺. Calculate a correlation coefficient. If the correlation coefficient is less than 0.995 or RE is greater than 20%, identify the cause and correct it. Repeat the calibration if necessary, or prepare and reanalyze any outlying points on the calibration curve.

16.3 Initial Calibration Verification/Continuing Calibration Verification

Analyze Initial Calibration Verification (ICV) after the calibration. Analyze a Continuing Calibration Verification (CCV) after every 10 injections and at the end of the sequence to verify instrument calibration. If the calibration check response is not within 15% of expected concentration, determine the cause. The instrument may be malfunctioning, the calibration verification standard may not be valid, or the instrument may need to be recalibrated.

16.4 Initial Calibration Blank/Continuing Calibration Blank

Analyze an initial calibration blank (ICB) prepared from the 20mM sodium bicarbonate solution after the initial calibration and ICV. Analyze a continuing calibration blank (CCB) after every CCV and at the end of the sequence to verify that no contamination is occurring during the analysis. The acceptance criterion is less than or equal to the MDL.

16.5 Laboratory Control Sample (LCS)

To ensure there are no matrix effects from the filters, prepare duplicate Laboratory Control Samples for every extraction batch, up to a maximum of 20 samples per batch. Spike 10 µL of the LCS spike solution onto an unused, cleaned filter, dry the filter in the nitrogen-purged glove box, and prepare and analyze the filter with the rest of the samples. The acceptance criterion is 80-120% recovery. If the spikes are outside of these limits, check the calibration and extraction procedures. These can also be referred to as Method Spikes.

16.6 Method Blank Sample (MB)

Prepare a method blank sample with every extraction batch by extracting a blank filter with 20 mM sodium bicarbonate solution. The acceptance criterion is less than or equal to the MDL.

16.7 Replicate Analysis

Replicate analyses should be performed on all duplicate or collocated samples received by the laboratory. The replicate results should be within 20% of each other for samples greater than 5 times the MDL. If the replicate results are outside of these limits, verify that the peaks are integrated properly, that there is

no interference from other components in the sample and that the instrument is working properly, and then flag the data.

16.8 Method Detection Limit

The method detection limit (MDL) is described in Section 15.1

16.9 Retention Time

The retention time must be within 5% of the expected retention time in order for a peak to be identified as Cr^{6+} . The expected retention time is the average retention time of the calibration standards. If retention times vary by more than 10% from calibration verification sample to calibration verification sample, stop the analysis and check for an instrument problem. If the retention time changes from the beginning of the day to the end of the day, the system may be changing over the course of the day.

16.10 Performance Evaluation (PE) Samples

Performance evaluation samples should be obtained as available from independent sources and analyzed as a routine samples.

16.11 Initial Demonstration of Capability

Each analyst must demonstrate proficiency for sample preparation and analysis by generating data of acceptable accuracy and precision for four blank spikes (or MDLs). For demonstration of capability, acceptable accuracy and precision is defined as having both a %RSD equal to or lower than 20% and a percent recovery within the range of 70-130%. This demonstration is repeated whenever new staff receives training or significant changes in instrumentation are made.

16.12 Control Charts

16.12.1 Retention Time

Chart the Cr^{6+} retention time for each calibration verification standard, laboratory control sample, and sample that contains Cr^{6+} . The retention time should not vary by more than 5% of the expected retention time. The expected retention time is the average retention time of the six calibration standards. If the retention time is out of this range check the column, check the mobile phase delivery system for leaks or plugs, and make sure the sample valve is properly aligned. Retention time control charts should be created for each sequence and kept in a notebook.

16.12.2 Laboratory Control Samples

Chart the LCS concentrations. The analyzed LCS concentration should not vary by more than 20% of the expected concentration. If the LCS concentrations are outside of these limits, check the calibration and extraction procedures. LCS control charts should be created for each column used and kept in a notebook.

16.13 Field Blanks

Prepare and ship Field Blank samples at least 10 percent sample collection frequency. Extract the Field Blank sample to verify cleanliness of the filters and filter holders. The acceptance criterion is less than or equal to the MDL. If results are greater than the MDL, another Field Blank sample is submitted to the field. All data associated with that blank (samples recovered between clean blanks) are flagged.

17.0 PREVENTION

When possible, minimize the amount of chemicals used in the preparation and analysis of the Cr⁶⁺ filters to reduce waste.

18.0 DATA REVIEW AND CORRECTIVE ACTION

18.1 Data Review Documentation

Project files including at a minimum the information required in Section 22 are assembled by the performing analyst. Documentation for sample custody, preparation and analysis will be reviewed for completeness and acceptability by the Task Lead or secondary reviewer associated with the project or program requiring the analysis as described in this section.

The second review of the data is performed by the Task Lead or designated secondary reviewer using the QC review checklist (checklist) shown in Table 24-2 to confirm that quality requirements have been met. Corrections and flags are added to the data consistent with the corrective action required for each review finding. Second level reviewers must complete, initial, and date the checklist.

The completed check list is included as part of the data package. Data not meeting SOP requirements are flagged and brought to the attention of the Project Manager for resolution.

18.2 Quality Staff Review

A minimum of 10% of the data is reviewed by ERG Quality Staff. Quality staff review includes but is not limited to checks that all SOP-specified quality parameters have been met and that data reviewers have completed their review checklists. Reviews should be documented on the review form initiated in 18.1 by the primary data reviewer. Comments or issues with data identified by the Quality Staff reviewer are brought to the attention of the Project Manager for resolution. Quality Staff will use the review process as an indication of episodic or systematic quality program issues that may require improvements to the ERG laboratory quality system and or additional training for ERG staff. As an option, Quality Staff may request review of 1% of the data from this method for a project. One percent (1%) review will follow the guidance in this section.

Corrective action for Hexavalent chromium analysis data quality issues are presented in Table 24-1.

19.0 WASTE MANAGEMENT

Hazardous waste disposal is discussed in detail in SOP ERG-MOR-033.

- 19.1 The PCR waste should be placed in an appropriately labeled waste container in the fume hood in the laboratory.
- 19.2 In the laboratory there should be a satellite hazardous waste container for the hexavalent chromium working standards and instrument waste.
- 19.3 The analyst is responsible for contacting the hazardous waste contact to dispose of the waste.

20.0 MAINTENANCE

20.1 Periodic Maintenance

For regular periodic maintenance, see Dionex-600 manual, Section 4. Any maintenance performed should be recorded in the maintenance logbook in the lab.

- 20.1.1 Inspect for leaks. Wipe up any liquid spills and rinse dried reagents off with deionized water.
- 20.1.2 Replace the eluent filter when changing eluents (see Dionex-600 manual, Section 4). The pump must then be primed to remove air in the eluent line.

- 20.1.3 Rinse the PCR line and container with methanol when the instrument is not in use for more than 3 days.

21.0 SHORTHAND PROCEDURE

- 21.1 Prepare filters.
- 21.2 Send filters to site.
- 21.3 Receive filter samples.
- 21.4 Inspect filter samples.
- 21.5 Place filters in an extraction tube.
- 21.6 Add 10 mL of 20 mM Sodium Bicarbonate in DI water solution to the extraction tube.
- 21.7 Shake for 45 minutes.
- 21.8 Calibrate the IC.
- 21.9 Analyze the extracts by IC.

22.0 DOCUMENTATION AND DOCUMENT CONTROL

- 22.1 All information concerning sample preparation, standard preparation, instrument conditions, etc., must be written in the analyst's notebook or recorded in the LIMS.
- 22.2 A list of the injections must be recorded in addition to the following information: type of eluent used, system number, date of analysis, and retention time.
- 22.3 All calculations and the type of method for determining concentration must be recorded in the analyst's notebook. Any unusual problems or conditions must also be noted.
- 22.4 Record all maintenance performed on the instrument in the maintenance logbook for this particular instrument.
- 22.5 Record all sample injections, including quality control samples, performed by the instrument in the injection logbook for this particular instrument.
- 22.6 It is imperative the project documentation be updated following each sample.

22.7 Analysts will copy raw instrument and QC files to a designated corporate network shared drive at the completion of each analysis sequence or batch. Primary data reviewers will use the data on the shared network drive for their data review process. The completed data packages ready for upload into the ERG LIMS system will be retained on the network drive as the backup for this data.

All processed data are archived in the LIMS on the shared network drive. Data is periodically archived to shared server and compact disc (CD) or digital versatile disc (DVD), verified on the system where the data originated and stored for at least five years in the laboratory. An archive copy of a data package is retained for at least five years in the laboratory data storage.

23.0 REFERENCES

DX-600 Series Chromatography System, and DX-600 Chromatography System Operator's Manual, Dionex Corporation, 117171.
Advanced Gradient Pump Operators Manual, Dionex Corporation, Document No. 034463, 117171.

CARB 039, Extraction and Analysis of Hexavalent Chromium by Ion Chromatography, 1993. A summary is found at <http://www.arb.ca.gov/aaqm/sop/summary/summary.htm>.

ASTM Standard Test Method D7614 for the Determination of Total Suspended Particulate (TSP) Hexavalent Chromium in Ambient Air Analyzed by Ion Chromatography and Spectrophotometric Measurements

24.0 TABLES, DIAGRAMS, FLOWCHARTS, VALIDATION DATA



Table 24-1. Summary of Quality Control Procedures for Hexavalent Chromium Analysis

Parameter	Frequency	Acceptance Criteria	Corrective Action
Sample preparation, standard preparation, instrument conditions	Every Data Package	In Data Packet and/or notebook. Meets SOP ERG-MOR-063 criteria.	Complete documentation in the appropriate data package or notebook
All sample injections, including quality control samples	Every Data Package or injection sequence	In Data Packet and/or injection log. Meets SOP ERG-MOR-063 criteria.	Complete documentation in the appropriate data package or injection log.
Type of eluent used, system number, date of analysis, and retention time.	Every Data Package	In Data Packet and/or notebook. Meets SOP ERG-MOR-063 criteria.	Complete documentation in the appropriate data package or notebook
Calculations and method for determining standards concentration	Every Data Package or Sequence	In Data Packet and/or notebook. Meets SOP ERG-MOR-063 criteria.	Complete documentation in the appropriate data package or notebook
COCs	In Data Packet	In Data Packet	Complete documentation in the appropriate data
Initial 5-point calibration	Before every sequence	Correlation coefficient ≥ 0.995 ; RE < 20%	1) Repeat analysis of calibration standards 2) Reprepare calibration standards and reanalyze
Initial Calibration Verification (ICV)	Before every sequence, following the initial calibration	Recovery 85-115%	1) Repeat analysis of initial calibration verification standard 2) Repeat analysis of calibration standards 3) Reprepare calibration standards and reanalyze



**Table 24-1. Summary of Quality Control Procedures for Hexavalent Chromium Analysis
 (Continued)**

Parameter	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration Blank (ICB)	One per Batch, following the ICV	Analyte must be \leq MDL	1) Reanalyze 2) Reprepare blank and reanalyze 3) Correct contamination and reanalyze blank 4) Flag data of all samples in the batch
Continuing Calibration Verification (CCV)	Every 10 injections and at the end of the sequence	Recovery 85-115%	1) Repeat analysis of CCV 2) Reprepare CCV 3) Flag data bracketed by unacceptable CCV
Laboratory Control Sample (LCS)	Two per sample batch, up to 20 samples.	Recovery 80-120%	1) Reanalyze 2) Reprepare standard and reanalyze 3) Flag data of all samples since the last acceptable LCS
Method Blank (MB)	One per batch	Analyte must be \leq MDL	1) Reanalyze 2) Flag data for all samples in the batch
Replicate Analysis	Duplicate/Collocate and/or replicate samples only	RPD \leq 20% for concentrations greater than 5 x the MDL.	1) Check integration 2) Check instrument function 3) Flag samples
Continuing Calibration Blank (CCB)	After every CCV and at the end of the sequence	Analyte must be \leq MDL	1) Reanalyze 2) Reprepare blank and reanalyze. 3) Correct contamination and reanalyze blank 4) Flag data of all samples in the batch

Figure 24-1. Flowchart for Hexavalent Chromium Samples

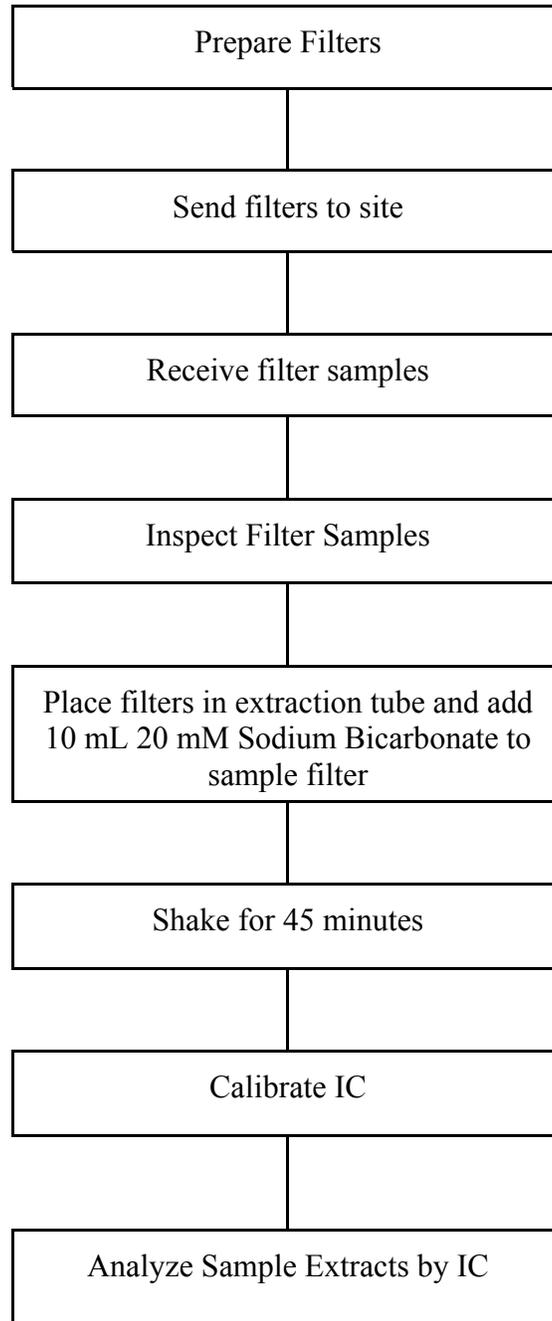




Table 24-2. Hexavalent Chromium Quality Control Review Checklist

Sequence ID: _____ Instrument: _____ Batch: _____
 Cal Curve (Method): _____ Analyst: _____ Date: _____
 10% Review Sample IDs: _____ Reviewer: _____ Date: _____
 Optional 1% Review Sample IDs: _____ Reviewer: _____ Date: _____

Parameter	Acceptance Criteria	Analyst Check (Initials and Date)	Task Lead/Data (Initials and Date)	10 % QA Review (Initials and Date)	1% Optional QA Review (Initials and Date)	Comments
All sample injections, including quality control samples	In Data Packet and/or injection log meets SOP ERG-MOR-063 criteria					
COCs included and sample volume correct	Lab receipt acknowledged. LIMS number added to COC. Sample volume correct.					
Initial 5-point calibration	Correlation coefficient ≥ 0.995 and RE <20%					
Initial Calibration Verification (ICV) following int. calibration	Recovery 85-115%					
Blanks (ICB/CCB) following ICV/CCV	Analyte must be \leq MDL					
Continuing Calibration Verification (CCV) every 10 injections and at the end of the sequence	Recovery 85-115%					



Parameter	Acceptance Criteria	Analyst Check (Initials and Date)	Task Lead/Data (Initials and Date)	10 % QA Review (Initials and Date)	1% Optional QA Review (Initials and Date)	Comments
Laboratory Control Sample one per 10 samples	Recovery 80-120%					
Method Blank one per batch	Analyte must be \leq MDL					
Replicate Analysis	RPD \leq 20% for concentrations $>$ 5 x the MDL.					
Manual Integration	Per SOP ERG-MOR-097					
Manual Check of Calculations	Manual check must agree with computer generated result					
Check Qualifiers	Check to make sure LIMS data flags are correct					

Review checklist from SOP or equivalent must be completed by primary data reviewer/TL/QA.

APPENDIX D

*STANDARD OPERATING PROCEDURE FOR
RESPONSE ACTIONS AND NOTIFICATIONS*

Appendix D to the QAPP

Standard Operating Procedures for Responses and Notifications to Action Level Exceedances Wills Wharf Office Project

*Baltimore Works Site
Baltimore, Maryland*

19 January 2016

By:
Environmental Resources Management, Inc.
Harbor Point Development LLC

For:
U.S. Environmental Protection Agency - Region III
Maryland Department of the Environment

TABLE OF CONTENTS

LIST OF ACRONYMS	III
1.0 INTRODUCTION	1
1.1 PURPOSE	2
1.2 PROJECT MANAGEMENT	2
2.0 OVERVIEW OF CONSTRUCTION AIR MONITORING	5
2.1 CONSTRUCTION MONITORING LOCATIONS	5
2.1 CONSTRUCTION MONITORING DURATION AND FREQUENCY	5
2.2 ACTION LEVELS	6
3.0 DUST CONTROL BEST MANAGEMENT PRACTICES	7
4.0 RESPONSE ACTIONS AND NOTIFICATIONS RELATED TO TOTAL PM	9
4.1 GENERAL PROVISIONS	9
4.2 AREA 1 SCENARIO NO. 1 - ACTION LEVEL EXCEEDANCE FOR TOTAL PM AT WORK ZONE MONITOR LOCATION(S)	10
4.2.1 <i>Area 1 - Response Action for Scenario No. 1</i>	10
4.2.2 <i>Notifications Under Area 1 Scenario No. 1</i>	13
4.3 SCENARIO NO. 2 - ACTION LEVEL EXCEEDANCE AT ON-SITE PERIMETER MONITOR LOCATION	14
4.3.1 <i>Response Action for Scenario No. 2</i>	14
4.3.2 <i>Notifications Under Scenario No. 2</i>	17
4.4 SCENARIO NO. 3 - CONSTANT READINGS INDICATED BY A WORK ZONE DUSTTRAK	18
4.4.1 <i>Response Action for Scenario No. 3</i>	18
4.4.2 <i>Notifications for Scenario No. 3</i>	19
4.5 SCENARIO NO. 4 - CONSTANT READINGS INDICATED BY A FIXED PERIMETER DUSTTRAK	19
4.5.1 <i>Response Action for Scenario No. 4</i>	19
4.5.2 <i>Notifications for Scenario No. 4</i>	20

4.6	SCENARIO NO. 5 - ELEVATED PERIMETER DUSTTRAK READINGS RELATED TO AMBIENT WEATHER CONDITIONS	20
4.6.1	<i>Response Action for Scenario No. 5</i>	20
4.6.2	<i>Notifications Under Scenario No. 5</i>	20
5.0	OTHER PROVISIONS RELATED TO THE BGI SAMPLERS FOR CRVI	22
5.1	VOID CRVI SAMPLE	22
5.2	HEXAVALENT CHROMIUM BTV GENERAL GUIDELINES	22
5.3	POSSIBLE CR(VI) BTV EXCEEDANCES FIXED STATION CR(VI) MONITORING	23

LIST OF FIGURES

- 1 *Construction Air Monitoring Locations*
- 2 *Area 1 - Scenario 1 for Work Zone Monitor Response Actions and Notifications to Exceedances*
- 3 *Area 1 - Scenario 2 for Fixed Perimeter Monitor Response Actions and Notifications to Exceedances*

LIST OF TABLES

- 1 *Key Personnel*

LIST OF APPENDICES

- A *Event Logs*
 - Work Zone STEL Alarm Event Log*
 - Perimeter STEL Alarm Event Log*
 - Visible Dust Release Event Log*

LIST OF ACRONYMS

BTV - Background Threshold Value

COC - Contaminant of Concern

CSSA - Cover Soil Stockpile Area

CrVI - Hexavalent Chromium

° C - Degrees Celsius

° F - Degrees Fahrenheit

DDP - Detailed Development Plan

EPA - U.S. Environmental Protection Agency

ERG - Eastern Research Group

ERS - Environmental Remediation System

HMS - Head Maintenance System

Lpm - Liters per Minute

LSC - Layered Soil Cap

M³ - Cubic Meters

MDE - Maryland Department of the Environment

mg - Milligram

MMC - Multimedia Cap

NAAQS - National Ambient Air Quality Standard

NOAA - National Oceanic and Atmospheric Association

ng - Nanogram

NWS - National Weather Service

LIST OF ACRONYMS (continued)

PAM - Perimeter Air Monitoring

PVC - Polyvinyl Chloride

RAM - Real-time Aerosol Monitor

RH - Relative Humidity

STEL - Short-Term Exposure Limit

SOP - Standard Operating Procedures

QAPP - Quality Assurance Project Plan

Total PM - Total Particulate Matter

µg - Microgram

µm - Micron

WZ - work zone

This Standard Operating Procedures (SOP) for Responses and Notifications (“the SOP”) has been prepared in support of the Detailed Development Plan (DDP) for the Wills Wharf Office Building Project (“Project”), on the former AlliedSignal Baltimore Works Site (“Site”), located in Baltimore, Maryland. The Site is located on a peninsula on the northeast shore of the Patapsco River of the Inner Harbor in the Fells Point section of Baltimore City.

Historical operations at the Site resulted in impacts to soil and groundwater from hexavalent chromium (CrVI). Honeywell International, Inc. (Honeywell), which acquired AlliedSignal, is responsible for operating and maintaining an Environmental Remediation System (ERS) that addresses the chromium impacted soil and groundwater at the Site. The ERS consists of the Multimedia Cap (MMC), Hydraulic Barrier (HB), Head Maintenance System and Outboard Embankment.

The Site consists of three Areas:

- Area 1 is the principal location of the former AlliedSignal (now Honeywell) Baltimore Works Site, which included chromium processing production and support buildings on an area that covered approximately 14 acres. ERS measures within Area 1 include but are not limited to the HB and the MMC, which is constructed inside the HB;
- Areas 2 and 3 were used for various industrial and warehousing operations, including chromate ore storage (Area 2) and brass foundry casting, oil blending and storage, coating/plastics production, lumber storage and foundry (Area 3). Areas 2 and 3 currently include the Thames Street Wharf (TSW) Office Building and its associated parking lots, where construction was completed in 2010. The ERS measures for Area 2 include a Layered Soil Cap (LSC). The ERS for Area 3 includes a soil cap. The Project will not disturb the TSW Office Building or Area 3.

The majority of the Project will occur in the western region of Area 2, south of Point Street (formerly Block Street) and west of the TSW Office Building. The construction of Wills Street as part of the Project will involve a limited area along the southeastern portion of Area 1. The Project will also include other non-designated areas that are outside of

Area 1 or Area 2 but within the Project’s limits of disturbance (LOD), which is shown in the drawings presented in the Project DDP.

1.1 PURPOSE

This SOP is intended to specify the response actions and notifications to be implemented in the event that real-time Total Particulate Matter (Total PM) monitoring during construction intrusive activities indicates an exceedance of the action level as described in the Construction Air Monitoring Plan (CAMP). For the purpose of this Plan, “intrusive activities” occur any time there is disturbance or exposure of the surface immediately below the MMC synthetic layers inside the HB in Area 1 or the upper geotextile that was constructed as part of the LSC in Area 2.

1.2 PROJECT MANAGEMENT

Harbor Point Development, LLC (HPD) is the Developer. ERM is the Developer’s environmental consultant (Developer’s Representative) responsible for implementing the air monitoring program during construction. EPA and MDE have equal regulatory authority for this project. Key project and regulatory personnel, and their contact information are summarized in Table 1. ERM notes that the Quality Assurance (QA) Manager designated in Table 1 is for the construction air monitoring program only and not for the entire construction project.

Table 1 Key Personnel

Name	Project Role	Organization	Address / E-mail / Phone
Moshood Oduwole	EPA Project Coordinator	EPA Region 3	Office of Remediation 3LC20 1650 Arch Street Philadelphia, PA 19103-2029 oduwole.moshood@epa.gov 215-814-3362
Ruth Prince	EPA Technical Lead	EPA Region 3 Alternate	Office of Technical and Administrative Support 3LC10 1650 Arch Street Philadelphia, PA 19103-2029 prince.ruth@epa.gov 215- 814-3118
Edward Dexter	MDE Project Coordinator	MDE	Solid Waste Program 1800 Washington Boulevard Suite 605 Baltimore, MD 21230-1719 ed.dexter@maryland.gov

Name	Project Role	Organization	Address / E-mail / Phone
			410-537-3315
Mark Mank	MDE Technical Lead	MDE Alternate	Solid Waste Program 1800 Washington Boulevard Suite 605 Baltimore, MD 21230-1719 mark.mank@maryland.gov 410- 537-3493
To be determined	MDE Field Inspector	MDE	Solid Waste Program 1800 Washington Boulevard Suite 605 Baltimore, MD 21230-1719 email pending 410-537-3315
Jonathan Flesher	Project Manager	HPD	1300 Thames Street, Suite 10 Baltimore, MD 21231 jflesher@beattydevelopment.com 410-332-1100
Chris French	Project Manager	Honeywell International	101 Columbia Road Morristown, NJ 07960 chris.french@honeywell.com 973-455-4131
Lenny Rafalko	ERM Technical Lead / Partner-in-Charge	ERM	75 Valley Stream Parkway Suite 200 Malvern, PA 19355 leonard.rafalko@erm.com 484-913-0428
Darren Quillen	Project Manager (PM)	ERM	180 Admiral Cochrane Drive Suite 400 Annapolis, Maryland 21401 darren.quillen@erm.com 410-972-0234
Jeff Boggs	Construction Air Quality Assurance (QA) Manager	ERM	75 Valley Stream Parkway Suite 200 Malvern, PA 19355 jeff.boggs@erm.com 443-803-8495
TBD	Field Manager (FM)	ERM	TBD
TBD	Field Engineer / Technician (FT)	ERM	TBD

Name	Project Role	Organization	Address / E-mail / Phone
TBD	Construction Contractor Project Executive	Armada Hoffler Construction Company (AHCC)	1000 Lancaster Street Suite 430 Baltimore, MD 21202
TBD	Construction Contractor Senior Project Manager (Sr. PM)	Armada Hoffler Construction Company (AHCC)	1000 Lancaster Street Suite 430 Baltimore, MD 21202

Alternate (cell phone) numbers for all key personnel will be provided to the project team members, the list of which will be posted at the Field Manager's office trailer at the site.

2.0

OVERVIEW OF CONSTRUCTION AIR MONITORING

Total PM will be monitored using DustTrak Model 8533 real-time monitors. BGI Model PQ-100 samplers will be used to collect particulate samples for potential laboratory analyses of CrVI. Detailed descriptions of the air monitoring program are detailed in the following documents:

- CAMP, 19 January 2016; and
- Air Monitoring Program Quality Assurance Project Plan Wills Wharf Office (QAPP), January 2016 (QAPP), including;
 - Field Sampling Protocol and Standard Operating Procedure (SOP) Real-time Air Sampling for Total Particulate Matter in Ambient Air, Appendix B1, 19 January 2016;
 - Field Sampling Protocol and Standard Operating Procedure Sampling of Hexavalent Chromium in Ambient Air, Appendix B2, 19 January 2016; and
 - Standard Operating Procedure for the Preparation and Analysis of Hexavalent Chromium by Ion Chromatography, Appendix C, February 2014.

2.1

CONSTRUCTION MONITORING LOCATIONS

Three fixed perimeter monitoring locations (designated as PWAM-1, PWAM-2, and PWAM-3) will be established for air monitoring of Total PM during intrusive construction activities in Area 2. Each fixed perimeter monitoring station will also include an air sampler for CrVI. Work zone monitoring for Total PM using a mobile station will also occur in Area 1 during intrusive activities as described in the CAMP. Figure 1 shows the fixed station locations.

2.1

CONSTRUCTION MONITORING DURATION AND FREQUENCY

The duration and frequency of air monitoring is as follows:

1. Total PM will be monitored at the three fixed perimeter stations (i.e., PWAM-1, PWAM-2, and PWAM-3) during intrusive activities in Area 1 or Area 2;

2. Work zone air monitoring for Total PM will be performed during intrusive activities in Area 1 under the conditions described in the CAMP;
3. Air sampling for CrVI with the BGI samplers will be performed at the fixed stations during intrusive work in Area 1.

Fixed perimeter air monitoring for Total PM will start and end prior to daily work hours beginning each work day. Collection of air samples for CrVI analyses by laboratory will occur over a 24-hour time period that overlaps with days during which intrusive activities are performed in Area 1.

ERM anticipates that the work week will be Monday through Friday, excluding holidays and weather permitting. As such, the 24-hour monitoring period will start on the Sunday evening or Monday morning prior to the start of the work week during which intrusive activities will occur and cease Friday evening after intrusive construction has ended for the week. However, this schedule may be adjusted in the future depending on actual field conditions encountered, identified efficiencies for improvements, and the construction schedule, which at times may include weekend work.

2.2 ACTION LEVELS

The Total PM action level and CrVI concentration background threshold values (BTVs) to be used for construction air monitoring were previously established for the Exelon Project ("Harbor Point Area 1, Phase 1 Development Project") and were approved by the EPA and MDE. These same BTVs (also referred to herein as "action levels" for Total PM) will be used for this Project and are as follows:

1. For Area 1, the work zone BTV for Total PM is 68 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). This BTV is applicable to the work zone mobile monitor in Area 1; or
2. The work zone BTV for Total PM will be adjusted to $118 \mu\text{g}/\text{m}^3$ under certain ambient weather conditions per the process described in Section 6 of this CAMP;
3. The perimeter BTV for Total PM is the National Ambient Air Quality Standard for PM_{10} of $150 \mu\text{g}/\text{m}^3$;
4. The CrVI BTV is 0.178 nanograms per cubic meter (ng/m^3).

Excavation surfaces during intrusive activities will be covered by geotextile or other suitable material(s) as soon as practical during the excavation sequence to limit wind-blown caused dust emissions. Other soil covering materials such as polyethylene plastic sheeting or foam spray-applied to the slopes of excavation zones may also be utilized. The bottom of the excavation zone will be further covered by installing either a clean, aggregate layer and/or mudmat, thereby allowing general construction trade workers to perform work in a clean zone.

Dust control measures as Best Management Practices (BMPs) are described in the Material Handling and Management Plan (MHMP) for the Project. These BMPs are summarized below.

1. BMP No. 1 - Limiting the size of the open area during the excavation sequence at any one time during construction to the extent practical. This will serve two purposes: 1) reduce the area of exposed soil that could be a source of windblown dust; and 2) assist with stormwater management;
2. BMP No. 2 - To the extent practicable, direct load controlled soil and debris into lined, roll-off containers or dump trucks, each with covers and eventually targeted for off-site disposal;
3. BMP No. 3 - Prior to active construction within an excavation and as soon as practical during the excavation sequence, cover the excavation surfaces and slopes with geotextile, plastic, foam or other suitable material as soon as practicable during the excavation sequence to reduce the area of exposed soil that could be a source of windblown dust. These temporary measures will be replaced during construction by installing a mudmat across the bottom and up the slopes of the excavation as shown in the drawings in the DDP to protect workers from potential contact with soil or generation of dust;
4. BMP No. 4 - Unless being disturbed for loading, unloading or shaping, cover the cover soil stockpile each day with polyethylene plastic sheeting or other suitable material, secured by sand bags as appropriate, to reduce the potential for the stockpile to be a source of windblown dust. The stockpile will be re-covered as soon as possible following loading, unloading or shaping activities, i.e., the stockpile cannot be left uncovered solely in anticipation of similar activities to be performed much

later in the day. Limit the area to be uncovered to that area required for the work (i.e., do not uncover the pile in its entirety for a specific work activity);

5. BMP No. 5 – Perform misting with potable water during potential dust generating activities. The need for misting will be determined based on field conditions and potential for dust generation;
6. BMP No. 6 – For the area inside the HB in Area 1, excavate controlled soil/debris (defined in the MHMP as materials excavated from below the geomembrane inside the HB in Area 1) and replace in an adjacent area that is also below the geomembrane. This practice will reduce the volume of controlled soil/debris that would be otherwise be direct loaded and transported off Site for disposal at a RCRA Subtitle C landfill. This BMP is acceptable under certain conditions as described in the MHMP.

Additional corrective actions that may be considered to control a dust release during intrusive activities include establishing a wind curtain by attaching fabric to a temporary fence upwind of the work zone, and by increasing the aerosolized water misting downwind of the intrusive activity.

A sufficient quantity of potable water will be maintained on the Site for dust control use. Watering equipment shall be used to minimize the potential for elevated airborne particulate concentrations and consist of wet, vacuum-sweeper trucks, water tank trucks, or other devices that are capable of applying a uniform spray of water over potential dust-generating surfaces. The use of spray-applied foam to cover an exposed soil surface may be used at locations that are difficult or impracticable to cover with construction plastic or geotextile fabric.

4.0 *RESPONSE ACTIONS AND NOTIFICATIONS RELATED TO TOTAL PM*

Response actions and notifications pertain to the project-specific Total PM action level exceedances that could occur at the fixed, perimeter air monitoring and/or mobile work zone monitoring locations. Real-time Total PM data and the STEL (“Short-Term Exposure Limit”) alarms will be monitored via the Dashboard pc/telemetry system from the fixed, perimeter and work zone monitoring locations for Total PM.

ERM’s Field Engineer/Technician (FT) and/or Field Manager (FM) are responsible for a minimum of three (3) visual inspections per day of the work zone monitoring station for potential large particulate releases during pile driving or MMC removal. These inspections will be documented daily in the field notebook. If such a release is observed, it will be documented photographically, if possible, and work will be stopped temporarily until the release has subsided and or dust suppression BMPs have been applied. If this corrective action is taken, a Visual Particulate Release Event Log will be completed (the event logs are found Appendix A).

4.1 *GENERAL PROVISIONS*

Throughout the intrusive construction air monitoring program, failure or malfunction of both the particulate DustTrak monitors and CrVI BGI samplers is always possible due to power loss, external sources of damage to the equipment, internal equipment failure, etc. To ensure continuous air monitoring operations, an adequate number of replacement monitors/samplers will be maintained securely at the Project trailer, such that multiple equipment replacements could be conducted on a daily basis.

A DustTrak monitor failure or malfunction should be immediately apparent on the Dashboard pc/telemetry system. A common malfunction occurs when a monitor reports negative concentrations, which is termed zero drift. Zero calibration and flow calibration must then be performed on that monitor to correct zero drift.

In addition to the specific scenarios identified in Sections 4.2 through 4.6, the following timeframes and actions will be followed, depending on the location of the DustTrak monitor.

1. If a work zone DustTrak monitor fails or malfunctions, intrusive construction in that work zone will shut down until the monitor is replaced or corrected and fully operational;
2. If a perimeter DustTrak monitor fails or malfunctions, it will be replaced or corrected within one hour from the first observation of malfunction. If the malfunctioning perimeter monitor is not fully operational within one hour of the documented failure, all intrusive construction upwind of the alarmed monitor will cease until the perimeter monitor is replaced and fully operational;

A complete description of the DustTrak malfunction, examination, replacement or correction will be attached to the applicable DustTrak Field Sheet.

4.2 ***AREA 1 SCENARIO NO. 1 - ACTION LEVEL EXCEEDANCE FOR TOTAL PM AT WORK ZONE MONITOR LOCATION(S)***

Scenario No. 1 addresses the situation when the STEL alarm is triggered by the mobile monitor station in Area 1, indicated by a discrete 15-minute PM average exceeding the BTV action level.

4.2.1 ***Area 1 - Response Action for Scenario No. 1***

The step by step response for Area 1 Scenario No. 1 is as follows and illustrated in Figure 2:

- Step No. 1 – Best efforts will be made to conduct Step 1 within approximately ten (10) minutes of alarm notification to ERM’s FM and/or FT. Inspect the immediate work zone area where the DustTrak monitor sounded the alarm to assess whether there is an identifiable source of dust or activity related to construction intrusive work or alternatively not related to intrusive work that may be triggering the alarm by answering the following questions:
 1. Is visible dust releasing from the specific work zone intrusive activity?
 2. Is the construction equipment (e.g., pile drivers) releasing visible smoke within range of the monitor(s)?
 3. Are there other nearby visible sources of particulate release, e.g., the cover soil stockpile, idling vehicles, etc.?

- a. If the work zone appears to be or is suspected to be the dust source, corrective action will be taken immediately to eliminate, control or manage that cause to reduce the potential for its recurrence. Additional corrective actions to control a dust release from a work zone will be implemented as appropriate, for example establish a wind curtain by attaching fabric to a temporary fence upwind of the work zone, or by increasing the aerosolized water misting downwind of the work zone. The alarming DustTrak monitor will then be observed for another 15-minute average to document that the instrument is no longer indicating a BTV action level exceedance. Under this scenario, no further action is required after a 15 minute Total PM average that does not exceed the BTV action level. An event log will be prepared.
 - b. If an alternate nearby dust source is suspected based on the answers to the questions above, that source should be temporarily eliminated (e.g., stop pile driving, turn off idling vehicle, etc.), and the 15-minute averages continued until the STEL alarm ceases. Under this scenario, no further action is required after a 15-minute Total PM average that does not exceed the BTV action level. An event log and visible dust release form, if appropriate, will be prepared.
- Step No. 2 – If Step 1 does not resolve the DustTrak alarm, inspect the DustTrak work zone instrument that sounded the alarm for possibility that the DustTrak may be malfunctioning.
 - a. If the DustTrak instrument that sounded appears to be malfunctioning as evidenced by alerts sent by the Dashboard pc/telemetry system when negative readings are recorded or loss of power occurs, shut down the associated intrusive work zone, run the Zero Cal and Flow Cal verifications and re-start the previously alarming DustTrak; and
 - b. Observe another approximate 15-minute average to document that the instrument is no longer malfunctioning. Under this scenario, no further action is required after approximately 30 minutes from the initial alarm. Resume intrusive work after notifying the agencies. An event log and visible dust release form, if appropriate, will be prepared.
 - Step No. 3 - If Step 2 does not resolve the monitor alarm, the ERM FM, in consultation with the ERM PM , MDE inspector or on-site

EPA representative, or alternate agency contacts, will check the work zone and Total PM readings of all perimeter fixed station monitors for consistency of reported Total PM concentrations:

- a. Check the Total PM level(s) at each fixed, perimeter DustTrak station, to assess the possibility that the source of the Total PM concentrations that triggered the alarm are caused by or being contributed to by conditions unrelated to intrusive construction activities. If the fixed, perimeter monitor Total PM readings are similar, then all work zone and fixed, perimeter stations will be observed for another 15-minute average to document that there is no action level exceedance or that work zone and perimeter readings are similar;
 - b. Under this scenario, no further action is required after a 15 minute Total PM average that does not exceed the BTV action level. Resume intrusive work after notifying the agencies. An event log and visible dust release form, if appropriate, will be prepared.
- Step No. 4 - If after having followed Steps No. 1 through 3, the Total PM concentration is not improving and remains at or above the alarm level:
 - a. The ERM FM, in consultation with each or a combination of the ERM FM, ERM PM, MDE inspector or on-site EPA representative or alternate Agency contacts, and the Construction Contractor's Sr. PM will **STOP** all Area 1 intrusive construction dust generating work activities that may be potentially contributing Total PM concentrations above the action level. If warranted, nearby or potentially contributing non-intrusive measures may also be stopped or adjusted after consultation with the ERM FM, ERM PM, MDE inspector or on-site EPA representative, or alternate agency contacts;
 - b. The ERM FM, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts will visually observe the efficacy of the dust control BMPs;
 - c. Submit a CrVI air sample from BGI at perimeter station downwind of the work zone. The CrVI sample samples for will be analyzed by the laboratory under a three (3) business

day turnaround (turnaround time accelerated compared to non-event conditions). Sampling and analyses will be in accordance with the QAPP and the CAMP;

- d. Resume construction activities, after notifying the agencies, once the downwind work zone mobile DustTrak monitor indicate that Total PM concentrations are below the action level for 30 continuous minutes and there are no exceedances of the action level at any of the perimeter air monitoring locations;
- e. Document the additional corrective actions taken in the work zone STEL Alarm Event Log;
- f. Record the CrVI sample analytical results as well as the Total PM results as specified in the QAPP and CAMP;
- g. An event log and visible dust release form, if appropriate, will be prepared.

4.2.2 *Notifications Under Area 1 Scenario No. 1*

The work zone STEL Alarm Event Log will be completed by the ERM FM and provide to EPA and MDE within approximately 24 hours of the event. If the work zone STEL event is resolved at Step 3, the EPA and MDE Project Coordinators (or Alternates if the Coordinators are unavailable) will be contacted on the event day. The STEL Alarm Event Log will be transmitted to the EPA and MDE Project Coordinators within approximately 24 hours of the event. If the work zone STEL event is resolved at Step 4 (Stop Work), the EPA and MDE Project Coordinators (or Alternates if the Coordinators are unavailable) will be contacted promptly by ERM if an agency representative is not already on Site and informed of the event. An event log and visible dust release form, if appropriate, will be prepared as required by Steps 1 through 4.

As part of Step 2, the ERM FM, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts, will notify (if not already having done so) the primary points of contact provided in Table 1 for the Developer and AHCC immediately following the issuance of the Stop Work order. It is expected that the ERM FM, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts, will work together with Construction Contractor's PM to resolve the on-site conditions. The ERM FM, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts, will also assess and

document the potential for upwind and/or off-site dust contribution based on the perimeter monitoring station Total PM readings.

If a work stoppage occurs, the agencies will be notified prior to resuming Area 1 intrusive work.

4.3 ***SCENARIO NO. 2 - ACTION LEVEL EXCEEDANCE AT ON-SITE PERIMETER MONITOR LOCATION***

Area 1 Scenario No. 2 addresses the situation when the STEL alarm is triggered at a fixed perimeter monitor station, indicated by a discrete 15-minute PM average exceeding the NAAQS action level. The steps below address conditions during the intrusive construction work day. If an alarm condition occurs during non-working hours when the construction site is inactive for the day or weekend, the alarm condition will be addressed following the steps below prior to commencing work the next work day. Figure 3 illustrates the response actions and notifications for Scenario 2.

4.3.1 ***Response Action for Scenario No. 2***

The step by step response for Scenario No. 2 is as follows:

- Step No. 1 - Best efforts will be made to conduct Step 1 within approximately ten (10) minutes of alarm notification to ERM's FM and/or FT. Inspect the fixed, perimeter monitor that sounded the alarm for the possibility that the DustTrak monitor may be malfunctioning, as evidenced by alerts sent by Dashboard pc/telemetry system when negative readings are recorded or loss of power occurs.
 - a. If the DustTrak instrument that sounded appears to be malfunctioning, after checking the operation and concentration readings from the other fixed, perimeter station(s) instrument operation and concentration readings for consistency of reported Total PM concentrations, run the Zero Cal and Flow Cal verifications and re-start the previously alarming DustTrak; and
 - b. Observe another 15- minute Total PM average to document that the instrument is no longer malfunctioning. Under this scenario, no further action is required after 45 minutes (three, 15 minute averages) from the initial alarm and work

interruption. An event log and visible dust release form, if appropriate, will be prepared.

- Step No. 2 – If Step 1 does not resolve the DustTrak alarm within one hour of first observation of malfunction, the work zone intrusive construction activity(ies) upwind of the monitor will be temporarily shut down.
 - a. If warranted, nearby or potentially contributing non-intrusive measures may also be stopped after consultation with each or a combination of the ERM FM, ERM PM, MDE inspector or on-site EPA representative or alternate Agency contacts, and the Construction Contractor’s Sr. PM;
 - b. The ERM FM, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts, and the construction contractor’s Sr. PM will work together to ensure that the BMP measures to control dust are in place;
 - c. The ERM FM, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts, will observe all perimeter monitor readings for Total PM concentrations for 30 continuous minutes (two, 15-minute averages). If alarm condition no longer exists, resume work after notifying the agencies. An event log and visible dust release form, if appropriate, will be prepared;
- Step No. 3 - If after following Steps No. 1 and 2, the Total PM concentration is not improving and remains at or above the alarm level:
 - a. The ERM FM, in consultation with each or a combination of the ERM FM, ERM PM, MDE inspector or on-site EPA representative or alternate Agency contacts, and the Construction Contractor’s Sr. PM will maintain the temporary shutdown of the upwind work zone intrusive work, and consider need to shut down other nearby potential dust generating activities that may be potentially contributing Total PM concentrations above the action level. If warranted, nearby or potentially contributing non-intrusive measures may also be stopped after consultation with the ERM FM, ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts and the Construction Contractor’s Sr. PM; and

- b. Check site-wide conditions for a potential Total PM source. Check the Total PM level(s) at each fixed, perimeter DustTrak station, to assess the possibility that the source of the Total PM concentrations that triggered the alarm are caused by or being contributed to by conditions unrelated to intrusive construction activities. If the fixed, perimeter monitor Total PM readings are similar, then the work zone and fixed, perimeter stations will be observed for another 15-minute average to document that there is no action level exceedance or that work zone and perimeter readings are similar. Under this scenario, no further action is required after a 15 minute Total PM average that does not exceed the BTV action level;
 - c. Document BMPs to control dust and additional corrective measures taken in an event log;
 - d. After the fixed, perimeter station DustTrak monitors indicate that the 15-minute PM averages are below the action level for 30 continuous minutes and there are no 15-minute exceedances of the action level at any of the perimeter air monitoring locations, resume construction activities after notifying the agencies;
 - h. An event log and visible dust release form, if appropriate, will be prepared.
- Step No. 4 - If after having followed Steps No. 1 through 3, the Total PM concentration is not improving and remains at or above the alarm level:
 - i. The ERM FM, in consultation with each or a combination of the ERM FM, ERM PM, MDE inspector or on-site EPA representative or alternate Agency contacts, and the Construction Contractor's Sr. PM will **STOP** all intrusive construction dust generating work activities that may be potentially contributing Total PM concentrations above the action level. If warranted, nearby or potentially contributing non-intrusive measures may also be stopped or adjusted after consultation with the ERM FM, ERM PM, MDE inspector or on-site EPA representative, or alternate agency contacts;
 - j. The ERM FM, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency

contacts will visually observe the efficacy of the dust control BMPs;

- k. Submit a CrVI air sample from BGI at perimeter station with the alarmed monitor. The CrVI sample will be analyzed by the laboratory under a three (3) business day turnaround (turnaround time accelerated compared to non-event conditions). Sampling and analyses will be in accordance with the QAPP and the CAMP;
- l. Resume construction activities once the Total PM concentration at the alarmed monitor is below the action level for 30 continuous minutes and there are no exceedances of the action level at any of the other perimeter air monitoring locations. Resume work after notifying agencies;
- m. Document the additional corrective actions taken in the work zone STEL Alarm Event Log;
- n. Record the CrVI sample analytical results as well as the Total PM results as specified in the QAPP and CAMP;
- o. An event log and visible dust release form, if appropriate, will be prepared.

4.3.2 *Notifications Under Scenario No. 2*

Under Scenario No. 2, the ERM FM, or designee, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts, will notify (if not already having done so) the primary points of contact provided in Table 1 for the Developer and AHCC immediately following the issuance of the Stop Work order.

Following resolution of the DustTrak alarm, the ERM FM, or designee, in consultation with the ERM PM, MDE inspector or on-site EPA representative, or alternate Agency contacts, will notify the primary points of contact for the Developer and Construction Contractor provided in Table 1 immediately of the resumption of work activities. The Perimeter STEL Alarm Event Log will be completed by the ERM FM and transmitted to the EPA and MDE Project Coordinators within approximately 24 hours of the event. If appropriate, a visible dust log will also be prepared and submitted to the agencies at the same time as the event log.

If a work stoppage occurs, the agencies will be notified prior to resuming Area 1 intrusive work.

4.4 ***SCENARIO NO. 3 – CONSTANT READINGS INDICATED BY A WORK ZONE DUSTTRAK***

Scenario No. 3 addresses the condition where the telemetry system or checks by office or field staff indicate that a work zone monitoring unit has indicated constant Total PM concentrations for 15 consecutive minutes. This does not apply to non-working or non-intrusive activities.

4.4.1 ***Response Action for Scenario No. 3***

The step by step response for Scenario No. 3 is as follows:

- Step No. 1 – Best efforts will be made to conduct Step 1 within approximately ten (10) minutes of alert notification to the ERM FM and ERM FT.
 - Inspect the immediate area where the DustTrak monitor sounded the alert to assess for the possibility that the DustTrak may be responding to an ambient condition or may be malfunctioning;
 - Run the Zero Cal and Flow Cal verifications and re-start the DustTrak; and
 - Observe the monitor for another 15-minute duration of consecutive readings to document that the instrument is no longer malfunctioning. No further action is required after approximately 30 minutes from the initial alarm.
- Step No. 2 – If step No. 1 does not solve the issue, replace the Dust Trak with another functioning Dust Trak. If the malfunctioning monitoring is a work zone monitor, temporarily cease the intrusive activities that the Dust Trak is monitoring until the replacement Dust Trak monitor is properly setup, calibrated and running. Once the replacement monitor is working properly, resume work after notifying the agencies.

4.4.2 *Notifications for Scenario No. 3*

Under Scenario No. 3, an alert (text/email) will be automatically sent by the Dashboard pc/telemetry system to the field personnel or from the office personal to the field personnel. The field personnel will notify the agencies by email of this occurrence and resolution in the same day as its occurrence. The field personnel shall also document this condition in the Weekly Report. An event log will not be generated.

If a work stoppage occurs, the agencies will be notified prior to resuming Area 1 intrusive work.

4.5 **SCENARIO NO. 4 - CONSTANT READINGS INDICATED BY A FIXED PERIMETER DUSTTRAK**

Scenario No. 4 addresses the condition where the Dashboard pc/telemetry system or checks by office or field staff indicate that a perimeter unit has indicated constant Total PM concentrations for 15 consecutive minutes. This does not apply to non-working or non-intrusive activities.

4.5.1 *Response Action for Scenario No. 4*

The step by step response for Scenario No. 4 is as follows:

- Step No. 1 – Best efforts will be made to conduct Step 1 within approximately ten (10) minutes of alert notification to the ERM FM and FT;
 - Inspect the immediate area upwind and downwind of where the DustTrak monitor(s) sounded the alert to assess for the possibility that the DustTrak may be responding to an ambient condition or may be malfunctioning;
 - Run the Zero Cal and Flow Cal verifications and re-start the DustTrak; and
 - Observe another 15-minute duration of consecutive readings for that Dust Trak monitor to document that the instrument is no longer malfunctioning. No further action is required after approximately 30 minutes from the initial alarm.
- Step No. 2 – If Step 1 does not resolve the DustTrak alarm within one hour of first observation of malfunction, the work zone

intrusive construction activity(ies) upwind of the monitor will be temporarily shut down.

- Replace the Dust Trak with another functioning Dust Trak. Do not resume intrusive activities until the replacement Dust Trak is properly setup, calibrated and running;
- Once the replacement monitor is working properly, resume work after notifying the agencies.

4.5.2 *Notifications for Scenario No. 4*

Under Scenario No. 4, an alert (text/email) will be automatically sent by the Greenlight system to the field personnel or from the office personal to the field personnel. The field personnel will notify the agencies by email of this occurrence and resolution on the same day as the alert. The field personnel shall also document in the Weekly Report. An event log will not be prepared.

4.6 *SCENARIO NO. 5 - ELEVATED PERIMETER DUSTTRAK READINGS RELATED TO AMBIENT WEATHER CONDITIONS*

4.6.1 *Response Action for Scenario No. 5*

The Total PM work zone dust action level for the Project may also be modified under certain documented ambient conditions, e.g. fog or high absolute humidity, when the perimeter, fixed station Total PM concentrations exceed the Work Zone dust action level. Specifically, if the average of the three (3) perimeter, fixed stations are equal to or above the Work Zone dust action level of $68 \mu\text{g}/\text{m}^3$ for three (3) consecutive 15-minute period averages, then the work zone dust action level may be increased to $118 \mu\text{g}/\text{m}^3$. Conversely, if the average of the three (3) perimeter, fixed stations are below the Work Zone dust action level of $68 \mu\text{g}/\text{m}^3$ for two (2) consecutive 15- minute period averages, then the work zone dust action level must be restored to $68 \mu\text{g}/\text{m}^3$.

4.6.2 *Notifications Under Scenario No. 5*

The ERM FM, or designee, shall notify the EPA and MDE by e-mail, providing a description of the current ambient conditions and graphically displayed data demonstrating the Total PM concentration values prior to increasing to the modified Work Zone dust action level, or reverting back to the previously established Work Zone dust action level. The “PAM Avg” value (same nomenclature as followed for the Exelon Project) is displayed

on the Dashboard pc/telemetry system *Client Menu/Live List View* page and the graph is displayed on the *Client Menu/Current Block Averages Graph View* page below the work zone and perimeter graphs. The “PAM Avg” graph will be saved as a PNG file to document the Total PM concentrations. The reviewers will document that the values were reviewed and will initial and date the time reviewed. An event log will not be prepared.

5.0 OTHER PROVISIONS RELATED TO THE BGI SAMPLERS FOR CRVI

5.1 VOID CRVI SAMPLE

A failure or malfunction of a BGI sampler will result in a voided filter from that monitoring location for that 24-hour sampling period. Obvious equipment damage will result in the replacement of the damaged BGI sampler for the next 24-hour monitoring period. Other sources of malfunction, such as unexpected power loss or sampler error messages, will be evaluated and the sampler will be thoroughly examined. If the sampler in question is to be used for the next 24-hour sampling period (after successful calibration), its operation will be monitored periodically during that 24-hour period. A complete description of the BGI sampler malfunction, examination, replacement or monitoring during the next sampling period will be attached to the applicable BGI Sampler field sheet.

5.2 HEXAVALENT CHROMIUM BTV GENERAL GUIDELINES

The Cr(VI) results from the fixed perimeter monitoring stations will be evaluated and compared to the Cr(VI) BTV of 0.178 ng/m³. Additionally, Cr(VI) perimeter results will be compared to a site-specific health-based range of values protective of Cr(VI) mutagenicity and carcinogenicity for the most sensitive age range of residents living in the area (0 – 2 years old), calculated utilizing the U.S. EPA IRIS inhalation unit risk for hexavalent chromium and the mutagenic inhalation equation (EPA Region III Regional Screening Level Table). This health-based range is 0.087 ng/m³ – 8.7 ng/m³, based on the U.S. EPA acceptable risk range for excess lifetime cancer of 1×10^{-6} – 1×10^{-4} . Based on the site-specific health-based range, the Cr(VI) BTV is equivalent to a 2×10^{-6} risk, providing a wide margin of safety.

The Cr(VI) data will be viewed as a delayed confirmation of the effectiveness of dust control at the site, since the Cr(VI) samples must be analyzed by a fixed laboratory off-site with a minimum three to five day delay between sampling and receipt of results. Real-time dust control will be accomplished by the monitoring of real-time total particulates for action level compliance.

5.3

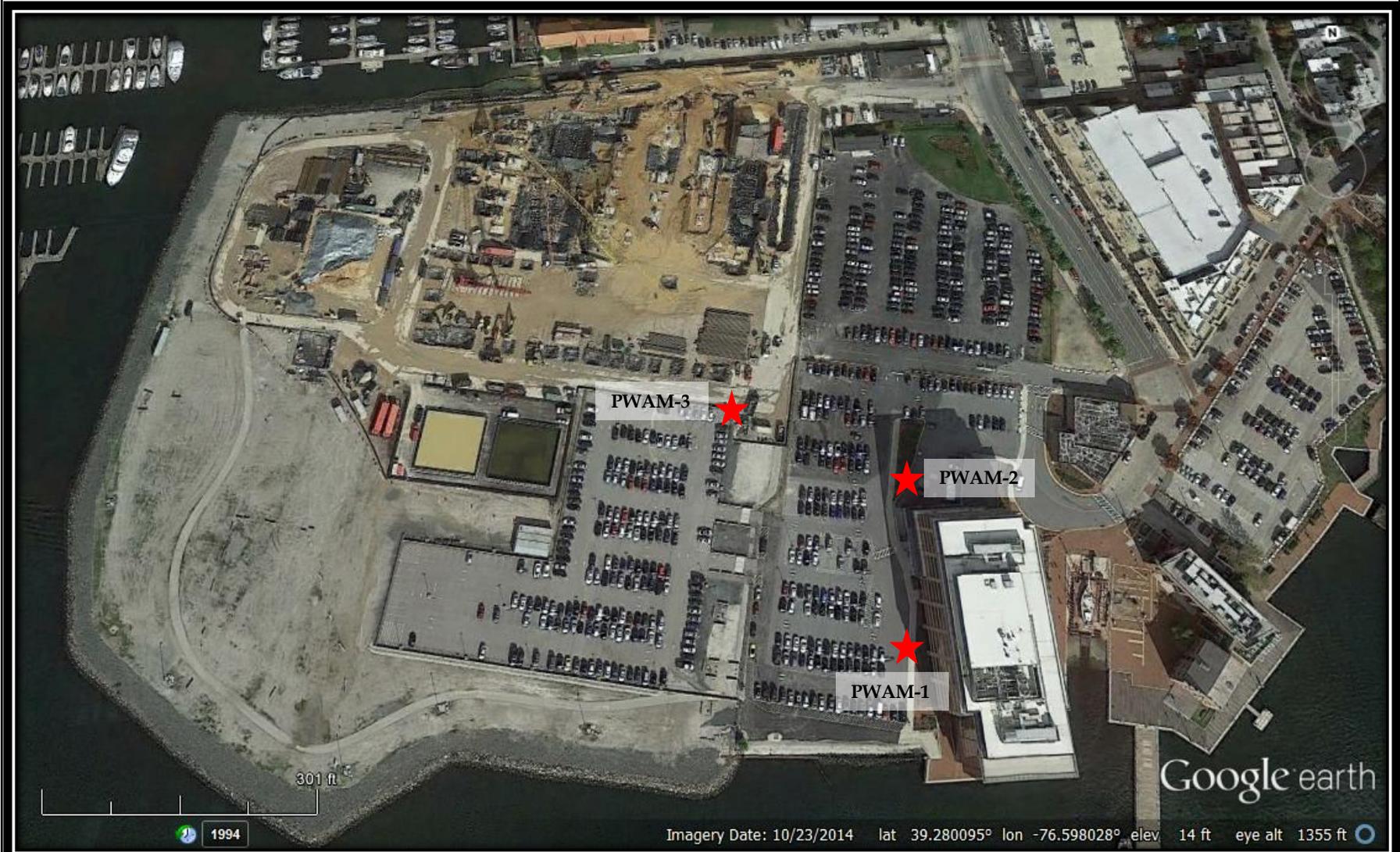
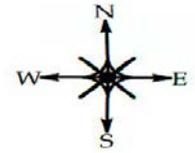
POSSIBLE CR(VI) BTV EXCEEDANCES FIXED STATION CR(VI) MONITORING

Cr(VI) BTV exceedances observed in perimeter station results will be considered an indicator if the exceedances show a consistent trend in multiple perimeter stations over multiple sampling days, or are of significant magnitude, and are elevated in comparison to the off-site station Cr(VI) results. Such an indicator will result in the employment of enhanced work zone BMPs, to include installation of wind curtains upwind of the work zone and increased aerosolized water misting downwind of the work zone. Cr(VI) sampling at the work zone may also be employed.

If perimeter Cr(VI) sample concentrations exceed the 1×10^{-5} risk level for excess lifetime cancer (0.87 ng/m³), reduction of allowable work zones per day will be employed, and other measures will be taken as directed by the Agencies, including the temporary cessation of intrusive activities that may be contributing hexavalent chromium to the environment.

FIGURES

Figure 1
Construction Perimeter Fixed Air Monitoring Locations
Wills Wharf Office Project
Baltimore, Maryland



PWAM - Perimeter Wills Air Monitor, locations are approximate.

Figure 2

Area 1 – Scenario 1

Response Actions and Notifications to Action Level Exceedances

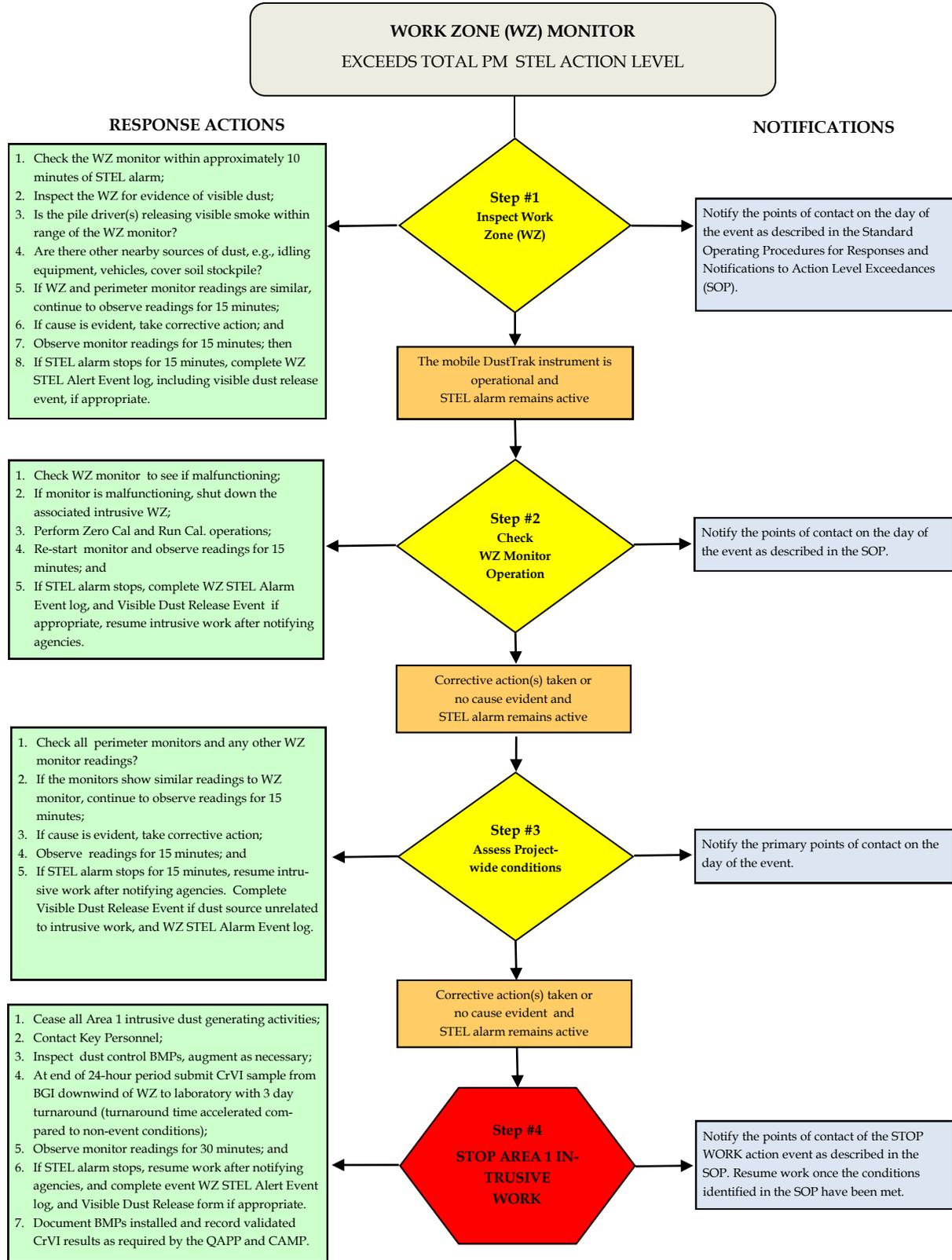
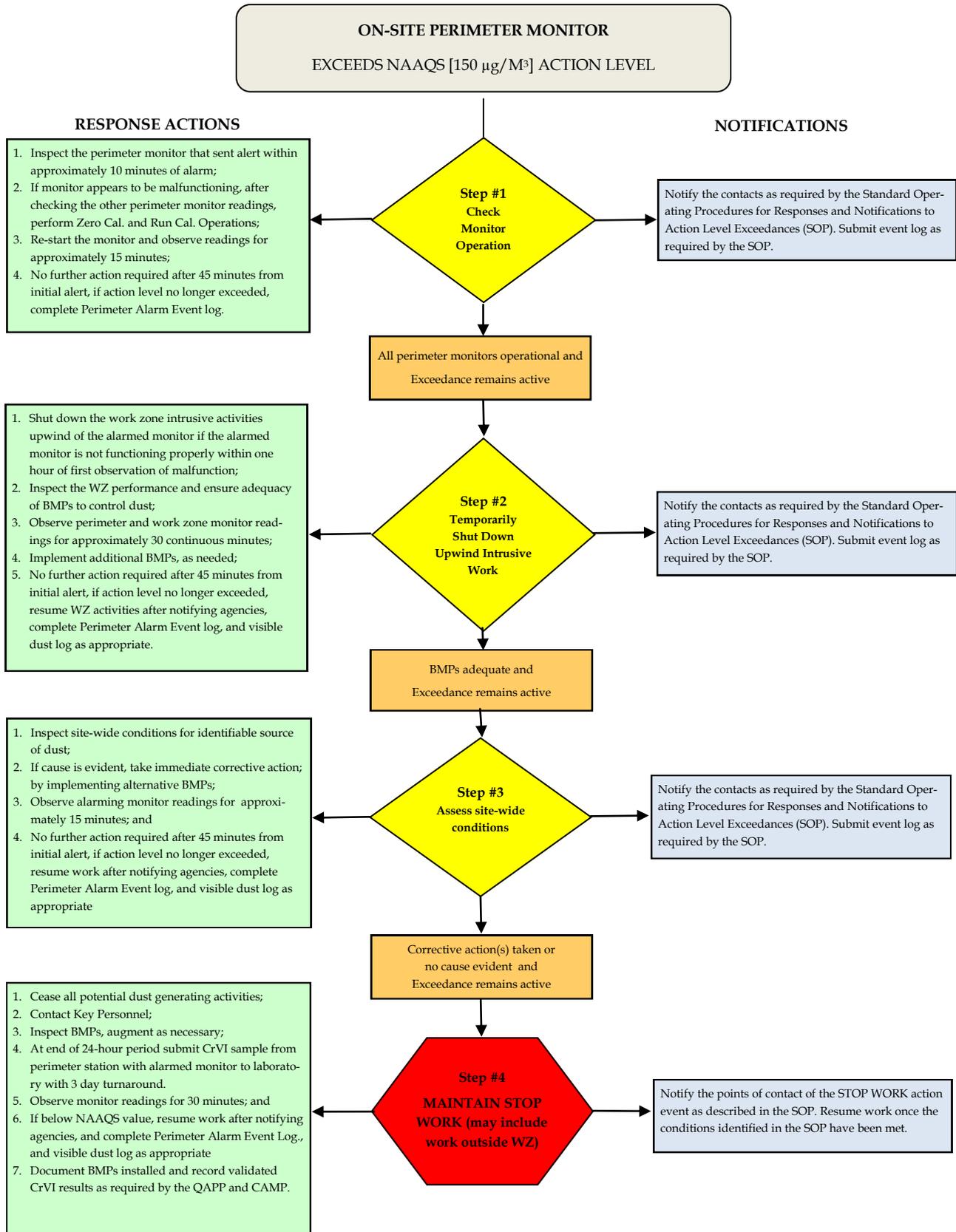


Figure 3

Area 1 - Scenario 2 Fixed Perimeter Monitor

Response Actions and Notifications to Action Level Exceedances



APPENDIX A

EVENTS LOGS

Work Zone STEL Alarm Event Log

Perimeter STEL Alarm Event Log

Visible Dust Release Event Log

CONSTRUCTION AIR MONITORING
WILLS WHARF OFFICE PROJECT
WORK ZONE STEL ALARM EVENT LOG

Date:

EVENT TIME LOG

Field Technician (Print and Sign Name)

Others Present During STEL Event? Provide Name(s)

Station ID						
First Alarm						
Initiation of alarm monitoring period and duration						
First Response Action						
Additional Response Actions						
Stop Work						
Event Resolution						
Notifications to Key Personnel						
Duration of Event						

Weather Observations (rain, dry, windy, etc.)

1. Is visible dust releasing from specific WZ intrusive activity?

2. Are there other nearby visible sources of particulate release, e.g., the cover soil stockpile, idling vehicles, etc.?

3. Has Work Zone monitor that sounded the alert been inspected?

4. Does the Work Zone monitor that sounded the alert appear to be malfunctioning?

5. Are the readings for the other Work Zone monitors reporting consistent readings?

Observations and photographs of any observed conditions that may have potential to affect STEL:

Comments regarding established BMPs:

Key Personnel

Moshood Oduwole - EPA Coordinator
Office: (215) 814-3362
Email: oduwole.moshood@epa.gov

Ruth Prince - EPA Technical Lead
Office: (215) 814-3118
Email: prince.ruth@epa.gov

Ed Dexter - MDE Coordinator
Office: (410) 537-3315
Email: ed.dexter@maryland.gov

Mark Mank - MDE Technical Lead
Office: (410) 537-3493
Email: mark.mank@maryland.gov

TBD - MDE Inspector
Office: TBD
Email: [TBD](#)

Jonathan Flesher - HPD Project Manager
Mobile: (443) 463-3937
Email: jflesher@beattydevelopment.com

Chris French - Honeywell Project Manager
Office: (973) 455-4131
Email: chris.french@honeywell.com

Lenny Rafalko - ERM Technical Lead
Mobile: (484) 913-0428
Email: leonard.rafalko@erm.com

TBD - ERM Field Manager
Mobile: TBD
Email: [TBD](#)

Jeff Boggs - QA Manager
Office: (443) 803-8495
Email: jeff.boggs@erm.com

Darren Quillen - ERM Project Manager
Office: (410) 972-0234
Email: darren.quillen@erm.com

TBD - Armada Hoffler Project Executive
Mobile: TBD
Email: [TBD](#)

TBD - Armada Hoffler Project Manager
Mobile: TBD
Email: [TBD](#)

TBD - ERM Field Technician
Mobile: TBD
Email: [TBD](#)

Recommendations for and Implemented Corrective Actions:

Were intrusive activities stopped? When? Duration (stop and start time)?

Were Key Personnel contacted? Who? When?

Indicate if DustTrak Maintenance Performed to Confirm Operation	Yes	No
Perform Zero Check before each use		
Perform Flow Verification before each use		
Clean inlet after two weeks continuous monitoring		
Replace internal filters after two weeks continuous monitoring		

Flow Verification Using BIOS Defender 510-H Performed to Confirm Operation						
Location ID	Serial ID	Start Time (24 hr clock)	Start Flow (Lpm)	End Time (24 hr clock)	End Flow (Lpm)	CrVI Samples Collected and Other Comments/Photos
PWAM-1						
PWAM-2						
PWAM-3						
MOBILE						
MOBILE						
MOBILE						
MOBILE						
MOBILE						

**CONSTRUCTION AIR MONITORING
WILLS WHARF OFFICE PROJECT
PERIMETER NAAQS ALARM EVENT LOG**

Date:

EVENT TIME LOG

Field Technician (Print and Sign Name)

Station ID							
First Alarm							
Initiation of alarm monitoring period and duration							
First Response Action							
Additional Response Actions							
Stop Work							
Event Resolution							
Notifications to Key Personnel							
Duration of Event							

Were intrusive Work Zone activities temporarily ceased? When? Duration (stop and start time)

Were Key Personnel contacted? Who? When?

Key Personnel

Moshood Oduwole - EPA Coordinator
Office: (215) 814-3362
Email: oduwole.moshood@epa.gov

Ruth Prince - EPA Technical Lead
Office: (215) 814-3118
Email: prince.ruth@epa.gov

Ed Dexter - MDE Coordinator
Office: (410) 537-3315
Email: ed.dexter@maryland.gov

Mark Mank - MDE Technical Lead
Office: (410) 537-3493
Email: mark.mank@maryland.gov

TBD - MDE Inspector
Office: TBD
Email: [TBD](#)

Jonathan Flesher - HPD Project Manager
Mobile: (443) 463-3937
Email: jflesher@beattydevelopment.com

Chris French - Honeywell Project Manager
Office: (973) 455-4131
Email: chris.french@honeywell.com

Lenny Rafalko - ERM Technical Lead
Mobile: (484) 913-0428
Email: leonard.rafalko@erm.com

TBD - ERM Field Manager
Mobile: TBD
Email: [TBD](#)

Jeff Boggs - QA Manager
Office: (443) 803-8495
Email: jeff.boggs@erm.com

Darren Quillen - Project Manager
Office: (410) 972-0234
Email: darren.quillen@erm.com

TBD - Field Technician
Mobile: TBD
Email: [TBD](#)

TBD - Armada Hoffer Project Executive
Mobile: TBD
Email: [TBD](#)

TBD - Armada Hoffer Project Manager
Mobile: TBD
Email: [TBD](#)

Others Present During Perimeter Event? Provide Name(s)

Weather Observations (rain, dry, windy, etc.)

1. Has perimeter monitor that sounded the alert been inspected?

2. Is the perimeter monitor that sounded the alert appear to be malfunctioning?

3. Are the readings for the other perimeter monitors reporting consistent readings?

Observations and photographs of any observed conditions that may have potential to affect STEL:

Comments regarding established BMPs:

CONSTRUCTION AIR MONITORING
WILLS WHARF OFFICE PROJECT
PERIMETER NAAQS ALARM EVENT LOG

Recommendations for and Implemented Corrective Actions:

Indicate if DustTrak Maintenance Performed to Confirm Operation	Yes	No
Perform Zero Check before each use		
Perform Flow Verification before each use		
Clean inlet after two weeks continuous monitoring		
Replace internal filters after two weeks continuous monitoring		

Flow Verication Using BIOS Defender 510-H Performed to Confirm Operation						
Location ID	Serial ID	Start Time (24 hr clock)	Start Flow (Lpm)	End Time (24 hr clock)	End Flow (Lpm)	CrVI Samples Collected and Other Comments/Photos
PWAM-1						
PWAM-2						
PWAM-3						
MOBILE						
MOBILE						
MOBILE						
MOBILE						
MOBILE						

**CONSTRUCTION AIR MONITORING
WILLS WHARF OFFICE PROJECT
VISUAL PARTICULATE RELEASE EVENT LOG**

Date:

EVENT TIME LOG

Field Technician (Print and Sign Name)

Nearest Station ID							
First Visible Dust Observation							
Initiation of Stop Work							
Conclusion of Stop Work							
Additional Response Actions							
Event Resolution							
Notifications to Key Personnel							
Duration of Event							

Others Present During Event? Provide Name(s)

Weather Observations (rain, dry, windy, etc.)

1. Is visible dust releasing from specific WZ intrusive activity? If YES, stop work temporarily, continue aerosolized misting operations until visible dust release terminates.

Were intrusive activities stopped? When? Duration (stop and start time)?

Were Key Personnel contacted? Who? When?

2. Is the construction equipment (e.g., pile drivers) releasing visible smoke within range of the WZ monitor(s)?

3. Are there other nearby visible sources of particulate release, e.g., the cover soil stockpile, idling vehicles, etc.?

Observations and photographs of observed conditions that may have potential to affect visible dust:

Recommendations for and Implemented Corrective Actions:

Key Personnel

Moshood Oduwole - EPA Coordinator

Office: (215) 814-3362
Email: oduwole.moshood@epa.gov

Ruth Prince - EPA Technical Lead

Office: (215) 814-3118
Email: prince.ruth@epa.gov

Ed Dexter - MDE Coordinator

Office: (410) 537-3315
Email: ed.dexter@maryland.gov

Mark Mank - MDE Technical Lead

Office: (410) 537-3493
Email: mark.mank@maryland.gov

TBD - MDE Inspector

Office: TBD
Email: [TBD](#)

Jonathan Flesher - HPD Project Manager

Mobile: (443) 463-3937
Email: jflesher@beattydevelopment.com

Chris French - Honeywell Project Manager

Office: (973) 455-4131
Email: chris.french@honeywell.com

Lenny Rafalko - ERM Technical Lead

Mobile: (484) 913-0428
Email: leonard.rafalko@erm.com

TBD – ERM Field Manager

Mobile: TBD
Email: [TBD](#)

TBD – ERM Field Technician

Mobile: TBD
Email: [TBD](#)

Jeff Boggs – QA Manager

Office: (443) 803-8495
Email: jeff.boggs@erm.com

Darren Quillen – Project Manager

Office: (410) 972-0234
Email: darren.quillen@erm.com

TBD – ERM Field Technician

Mobile: TBD
Email: [TBD](#)

Tim Hodges – Armada Hoffer Project Executive

Mobile: (410) 727-2929
Email: thodges@armadahoffer.com

Jeff Ayers – Armada Hoffer Project Manager

Mobile: (410) 727-2929
Email: jayers@armadahoffer.com