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Acronyms and Abbreviations

%R percent recovery
µg/m³ microgram(s) per cubic meter
µm micron(s)
Boeing The Boeing Company
CAAQS California Ambient Air Quality Standards
CARB California Air Resource Board
CAS Chemical Abstracts Service
CFR Code of Federal Regulations
COC chain-of-custody
COPC contaminant of potential concern
dᵋ percent difference
DOE U.S. Department of Energy
DQI data quality indicator
DQO data quality objective
DTSC State of California Department of Toxic Substances Control
EDD electronic data deliverable
EPA U.S. Environmental Protection Agency
FTL field team leader
GC gas chromatography
HASP health and safety plan
HSM health and safety manager
ID identification number
IDL instrument detection limit
LCS laboratory control Sample
LPM liter(s) per minute
MDL method detection limit
MEK 2-Butanone
MIBK 4-Methyl-2-pentanone
MS mass spectrometry
MS matrix spike
MSD matrix spike duplicate
MQO measurement quality objective
NAA North American Aviation
NAAQS National Ambient Air Quality Standards
NASA National Aeronautics and Space Administration
NIST National Institute of Standards and Technology
PAH polycyclic aromatic hydrocarbon
PCB polychlorinated biphenyl
PM project manager
PM₁₀ particulate matter less than 10 microns in aerodynamic diameter
PPE personal protective equipment
QA quality assurance
QAM quality assurance manual
QAPP quality assurance project plan
QC quality control
RL reporting limit
RP responsible party
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPD</td>
<td>relative percent difference</td>
</tr>
<tr>
<td>SCAQMD</td>
<td>South Coast Air Quality Management District</td>
</tr>
<tr>
<td>SOP</td>
<td>standard operating procedure</td>
</tr>
<tr>
<td>SSC</td>
<td>site safety coordinator</td>
</tr>
<tr>
<td>SSFL</td>
<td>Santa Susana Field Laboratory</td>
</tr>
<tr>
<td>USAF</td>
<td>U.S. Air Force</td>
</tr>
<tr>
<td>VCAPCD</td>
<td>Ventura County Air Pollution Control District</td>
</tr>
<tr>
<td>VOC</td>
<td>volatile organic compound</td>
</tr>
</tbody>
</table>
Baseline Air Monitoring Work Plan

Introduction and Objectives

The Boeing Company (Boeing), the National Aeronautics and Space Administration (NASA), and the U.S. Department of Energy (DOE), also known as the responsible parties (RPs), are proposing this Baseline Air Monitoring program for the Santa Susana Field Laboratory (SSFL) site located in Ventura County, California. The plan is based on a request by the California Department of Toxic Substances and Control (DTSC). The RPs are proposing to monitor air quality at several locations along the boundary of SSFL, to include particulates and volatile organic compounds (VOCs), and to continue monitoring for radionuclides.

Objective

The objective of the Baseline Air Monitoring program is to evaluate baseline (that is, pre-project) conditions and provide a basis for determining the magnitude of deviation from those baseline conditions resulting from onsite remediation activities (project) at SSFL. The proposed monitoring strategy would occur in several phases. Baseline Monitoring, the first phase, would be followed later by program evaluation to determine a strategy for routine monitoring. This Work Plan outlines the proposed strategy for the Baseline Monitoring phase. The duration of the Baseline Monitoring phase will be 1 calendar year. The goals of the Baseline Monitoring program do not include ongoing (long-term) characterization of air quality at the boundary of SSFL or developing a risk-based approach to evaluating air quality.

The Baseline Monitoring phase is intended to evaluate air monitoring logistics, parameters, methods, and data gaps. Upon completion of the 1-year baseline monitoring phase, results will be evaluated, which could possibly lead to recommendations for a reduced set of target compounds, adjustments in sampling locations, and sampling frequency and monitoring methods most useful for monitoring spatial and temporal variability of air quality as soil remediation moves ahead at SSFL.

Local Data Summary

Local ambient particulate matter less than 10 microns in aerodynamic diameter (PM$_{10}$) data from monitors operated by the South Coast Air Quality Management District (SCAQMD) and the Ventura County Air Pollution Control District (VCAPCD) were evaluated in order to identify existing monitoring stations that could be used to obtain a representative approximation of the background PM$_{10}$ concentrations in the region around SSFL. Data availability and distance from SSFL were considered as the primary drivers for the selection of monitoring sites to use for the local data summary.

The California Air Resources Board (CARB) online iADAM system (2015) was used in order to obtain the annual average PM$_{10}$ concentrations as calculated according to the California Ambient Air Quality Standards (CAAQS) for the selected ambient monitoring stations. The CAAQS annual average PM$_{10}$ concentration standard is 20 micrograms per cubic meter ($\mu$g/m$^3$) and the 24-hour average PM$_{10}$ concentration standard is 50 $\mu$g/m$^3$. The monitoring stations evaluated, county where these monitoring stations are located, the approximate distance from SSFL, and the annual average ambient PM$_{10}$ concentrations for the past 5 years are presented in Table 1. The average annual concentration for the selected monitoring stations also are presented for each year, individually over the 5-year period, and collectively over the 5-year period. In general, the average 5-year annual PM$_{10}$ concentration for the representative area exceeds the CAAQS annual standard of 20 $\mu$g/m$^3$ with a calculated annual average concentration of 21.8 $\mu$g/m$^3$. 
TABLE 1
Santa Susana Field Laboratory Area CAAQS Representative Average Annual PM$_{10}$ Concentrations
Baseline Air Monitoring Work Plan, SSFL, Ventura County, California

<table>
<thead>
<tr>
<th>Monitor Location</th>
<th>County</th>
<th>Distance to SSFL (miles)</th>
<th>2010 (µg/m$^3$)</th>
<th>2011 (µg/m$^3$)</th>
<th>2012 (µg/m$^3$)</th>
<th>2013 (µg/m$^3$)</th>
<th>2014 (µg/m$^3$)</th>
<th>5 Year Average (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA - North Main Street</td>
<td>Los Angeles</td>
<td>42</td>
<td>NA</td>
<td>28.7</td>
<td>30.0</td>
<td>35.3</td>
<td>30.2</td>
<td>31.1</td>
</tr>
<tr>
<td>LAX - Westchester Parkway</td>
<td>Los Angeles</td>
<td>45</td>
<td>NA</td>
<td>21.4</td>
<td>19.6</td>
<td>NA</td>
<td>21.9</td>
<td>21.0</td>
</tr>
<tr>
<td>Santa Clarita</td>
<td>Los Angeles</td>
<td>26</td>
<td>20.0</td>
<td>21.7</td>
<td>22.2</td>
<td>20.6</td>
<td>24.3</td>
<td>22.3</td>
</tr>
<tr>
<td>El Rio-Rio Mesa School</td>
<td>Ventura</td>
<td>27</td>
<td>21.7</td>
<td>NA</td>
<td>22.1</td>
<td>21.0</td>
<td>NA</td>
<td>15.5</td>
</tr>
<tr>
<td>Ojai-Ojai Avenue</td>
<td>Ventura</td>
<td>39</td>
<td>15.1</td>
<td>15.9</td>
<td>21.0</td>
<td>24.3</td>
<td>NA</td>
<td>15.5</td>
</tr>
<tr>
<td>Simi Valley - Cochran Street</td>
<td>Ventura</td>
<td>3</td>
<td>18.8</td>
<td>19.6</td>
<td>19.5</td>
<td>22.5</td>
<td>NA</td>
<td>20.1</td>
</tr>
</tbody>
</table>

Average 18.9 21.6 22.5 25.7 24.7 21.8

Notes:
µg/m$^3$ = microgram(s) per cubic meter

CAAQS = California Ambient Air Quality Standards
NA = Not Available

Data obtained from the California Air Resources Board iADAM System: http://www.arb.ca.gov/adam/index.html.

Monitoring Approach
Baseline Monitoring
This Work Plan outlines the approach for the Baseline Monitoring phase. Previous environmental studies conducted at SSFL suggest that potential airborne contaminants associated with remedial activities could include PM, radionuclides, inorganic compounds, and organic compounds. Metal compounds of concern are not volatile and are in solid phase if they are present in soil. Organic compounds of concern (polycyclic aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], and dioxins) that may be in soil are non-volatile or semivolatile, and will predominately remain adsorbed onto soil particles if disturbed at ambient temperatures. VOCs present in the subsurface may volatize and may not remain adsorbed onto soil particles during disturbance of the existing soil cover.

Monitoring of airborne particulates will provide a rapid and appropriate assessment of the potential release of these compounds to the environment via the air transport pathway. Particulate matter in air (PM$_{10}$) can be monitored with sufficient frequency and at sufficient locations to reflect the potential magnitude, frequency, and locations of concentrations of other analytes. With this approach, monitoring of PM$_{10}$ becomes an effective surrogate for monitoring soil-bound compounds of concern. In addition to PM$_{10}$, the Baseline Monitoring program will include sampling for VOCs and radionuclides.

The overall goal of the Baseline Monitoring is to characterize pre-project levels of VOCs, PM$_{10}$, and radionuclides with respect to prevailing wind directions and speeds (vectors), which also would be in effect during remediation (project) activities. The prevailing wind vectors exhibit the classic diurnal pattern for southern California during most of the year, that is, daytime onshore flow generally from the northwest and nighttime offshore (drainage) flow generally from the southeast. The main exception to this pattern are Santa Ana conditions where strong offshore flow from the east and northeast can persist for several days until the inland high-pressure system that drives such winds diminishes and the onshore flow returns. The air monitoring locations (approximate) shown on Figure 1 have been located to address the predominant flow at SSFL.
Monitoring Locations

Figure 1 shows the proposed air monitoring locations for the Baseline Air Monitoring program. These locations were selected based on the areas to be remediated, with consideration of winds in the area, topographic features, and accessibility. The air monitoring sites were selected based on guidance obtained from the U.S. Environmental Protection Agency’s (EPA) Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Monitoring Program (EPA, 2013) and Meteorological Monitoring Guidance for Regulatory Modeling Applications (EPA, 2000). Sites were evaluated per 40 Code of Federal Regulations (CFR) 58 Appendix E – Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring.

Monitoring Methods and Frequency

The proposed duration of the Baseline Monitoring period is 1 calendar year.

PM$_{10}$

The proposed monitoring method for PM$_{10}$ is the continuous beta attenuation monitor, the MetOne EBAM. The EBAM allows for remote operation and operation off the power grid and provides high quality, semi-continuous data.

The EBAM units will be equipped with optional wind speed and direction sensors in order to correlate hourly PM$_{10}$ measurement data against wind vector data. This will assist with understanding the spatial relationships of remediation activities to any downwind impacts that may be recorded by the instruments. Just as important, however, wind vector data could be used to show that a detected impact may come from other sources unrelated to remediation at SSFL, such as fugitive dust generated by offsite construction or maintenance activities.

PM$_{10}$ concentration data can be collected via the EBAM on a continuous (hourly) basis for the duration of the Baseline Monitoring period. Twenty-four-hour concentrations will be calculated from the hourly concentrations for comparison to the National Ambient Air Quality Standards (NAAQS).

VOCs

The EPA Toxic Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) (EPA, 1999) is proposed for the collection and analysis of VOCs. Twenty-four-hour time integrated samples will be collected into Summa canisters via a flow controller and sent to an offsite laboratory for analysis. Method TO-15 has an extensive analyte list, which will be reviewed and refined so that it will be limited to those chemicals of concern that are known to be present at SSFL based on remedial field investigations conducted over several years and have been identified for cleanup by the RPs; thus, only defined analytes will be included in any future estimation of risks. For the Baseline Monitoring period, it is proposed that TO-15 samples be collected bi-weekly, for a total of 26 sampling events during the Baseline Monitoring period.

Radionuclides

Radionuclides will be monitored in a subset of the locations (such as Area IV and near the Area I Burn Pit) using the same methods currently employed by DOE for onsite monitoring. During the Baseline Air Monitoring program, ambient air sampling for radionuclides will be performed continuously at SSFL with three air samplers operating on 7-day sampling cycles with a weekly sample volume of about 50 cubic meters each. Airborne particulate radioactivity will be collected on glass fiber (Type A/E) filters that will be changed weekly. After a minimum 120-hour holding time to allow the decay of short-lived radon and thoron daughters, the samples will be simultaneously counted for gross alpha and beta activity with a low-background, thin-window, gas-flow proportional-counting system continually purged with P-10 argon/methane counting gas over a preset time interval.
Meteorology

Meteorological data will be collected from the onsite meteorological tower for the following parameters: wind speed, wind direction, ambient temperature, precipitation, barometric pressure, relative humidity, and solar radiation. These data will provide onsite continuous determination of upwind/downwind conditions, relative to potential emissions sources and the fenceline.

Micro-meteorological data are proposed to be collected in conjunction with the PM10 data. Local wind speed and direction data interfaced with the EBAM will enable data collection to be representative of each area being sampled. As described above, the EBAM units will be equipped with optional wind speed and direction sensors in order to correlate hourly PM10 measurement data against wind vector data.

Reporting

Data will be provided on a quarterly basis to DTSC within 45 days after the end of the reporting quarter. Quarterly reports will include a summary of PM10 and VOC data, results from any field QA checks performed on the monitor, as well as any performance audit results for further determination of data validity.

Schedule

Upon approval of the Work Plan, the Baseline Monitoring phase will proceed according to the following estimated schedule:

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration</th>
<th>Cumulative Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Receive RFP</td>
<td></td>
<td>NTP</td>
</tr>
<tr>
<td>2. Contract</td>
<td>45 days</td>
<td>45 days</td>
</tr>
<tr>
<td>3. Order equipment</td>
<td>5 days</td>
<td>50 days</td>
</tr>
<tr>
<td>4. Receive equipment</td>
<td>60 days</td>
<td>110 days</td>
</tr>
<tr>
<td>5. Install equipment</td>
<td>25 days</td>
<td>135 days</td>
</tr>
<tr>
<td>6. Internal Equipment audit</td>
<td>10 days</td>
<td>145 days</td>
</tr>
<tr>
<td>7. Equipment Tuning and Evaluation</td>
<td>60 days</td>
<td>205 days</td>
</tr>
<tr>
<td>8. Commence Baseline operation</td>
<td>0 days</td>
<td>205 days</td>
</tr>
</tbody>
</table>

Notes:
NTP = Notice to Proceed

Quality Assurance Project Plan

Appendix A to this document, the Quality Assurance Project Plan (QAPP), has been developed following guidance outlined in the EPA Guidance for Quality Assurance Project Plans (EPA, 2002) and the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Monitoring Program (EPA, 2013). The quality assurance/quality control (QA/QC) procedures outlined in the QAPP will be implemented to ensure that data collected are of high quality and can be used for project decisions.

References


Air Monitoring Locations
Santa Susana Field Laboratory
Ventura County, California

Notes:
- Sage Ranch location is contingent on approval from the property owner (Mountains Recreation Conservation Authority).

Aerial Image - 2012 USDA 1 meter
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APPENDIX A
Quality Assurance Project Plan

A  Project Management
A1  Title and Approval Sheet

Santa Susana Field Laboratory Air Monitoring
Quality Assurance Project Plan

APPROVED:

______________________________________________________________________  
Project Manager                      Date

______________________________________________________________________  
Quality Manager                      Date
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A2 Distribution List

This QAPP was developed to document the type and quality of data needed for environmental decisions, and to describe the methods for collecting, generating, and assessing the data for baseline monitoring at SSFL.

All the organizations designated to receive copies of the QAPP, and any planned future revisions are included below. This list, together with the document control information, will help ensure that all key personnel in the implementation of the QAPP have up-to-date copies of the plan.

- Quality Assurance Manager
- NASA SSFL Project Manager
- DOE SSFL Project Manager
- Boeing SSFL Project Manager

A3 Project Task and Organization

A project team will be assembled. Project personnel will be identified selected based on their qualifications and relevant experience. All personnel will have been trained by the appropriate parties to relevant standards prior to conducting work on the project. Project roles and responsibilities are outlined in Table 1.

<table>
<thead>
<tr>
<th>Position</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager (PM)</td>
<td>Each RP will have a designated PM who is responsible for management of all phases of the project.</td>
</tr>
<tr>
<td>QA Officer</td>
<td>The designated QA officer will be responsible for overall conformance with the QAPP.</td>
</tr>
<tr>
<td>Health and Safety Manager (HSM)</td>
<td>The project will have an HSM who is responsible for overall health and safety needs including audits, clearing staff to work, and developing health and safety plans (HASPs).</td>
</tr>
<tr>
<td>Field Team Leader (FTL)/Site Safety Coordinator (SSC)</td>
<td>The FTL/SSC will supervise and direct the daily activities of each field team as appropriate.</td>
</tr>
<tr>
<td>Field Team Members</td>
<td>Field Team Members will ensure that field activities are conducted in accordance with approved standard operating procedures (SOPs) and work plans.</td>
</tr>
<tr>
<td>Subcontractors</td>
<td>Each RP’s prime contractor has the overall responsibility for conformance to the quality requirements of the project. However, it is the responsibility of each subcontractor to plan, manage, complete all quality requirements, and accomplish the activities in accordance with the subcontract requirements.</td>
</tr>
<tr>
<td>Analytical Laboratory</td>
<td>The laboratory will perform analysis of VOCs, following associated laboratory SOPs and QA/QC procedures.</td>
</tr>
</tbody>
</table>

A4 Problem Definition and Background

Definition

Developing a baseline set of air monitoring data will be useful in identifying potential air quality impacts during remedial actions.

Site Location and History

SSFL is located on approximately 2,850 acres in the Simi Hills in Ventura County, California. The Simi Hills are bordered on the east by the San Fernando Valley and to the north by Simi Valley. SSFL is divided into four administrative areas – Area I, Area II, Area III, and Area IV – and two “undeveloped areas.” Areas I, III, and IV and the undeveloped areas are owned and operated by Boeing. Area II, consisting of 409.5 acres, along with
41.7 acres in Area I, are owned by the U.S. Government and used by NASA. The DOE has long held a lease on land in Area IV. The locations history began in the 1950s when the North American Aviation (NAA) acquired parts of the area for rocket testing. In the years since the 1950s, the United States Air Force (USAF), Boeing, Rockwell, and NASA have conducted research, development, and testing operations primarily relating to rocket engines at the site (NASA, 2015).

In 1953, the Atomics International Division of North American Aviation acquired Area IV for nuclear energy research activities. Nuclear research was conducted from 1955 to 1988. Non-nuclear energy research occurred within Area IV until about 2000 (CDM, 2015).

### A5 Project and Task Descriptions

The project scope consists of a site-wide air monitoring program to assess the baseline air quality at SSFL prior to demolition and remediation activities. Contaminants of potential concern (COPCs) that are proposed for the baseline monitoring phase include VOCs, PM$_{10}$, and radionuclides.

#### PM$_{10}$

Air samples for PM$_{10}$ will be collected on a continuous basis at 12 locations, as shown on Figure 1 of the Air Monitoring Work Plan, and averaged over a 24-hour basis. The continuous particulate instruments record an hourly average of concentration in units of mg/m$^3$. The hourly averages will be used to calculate a 24-hour average. For reporting purposes, particulate concentrations will be reported in µg/m$^3$. The data management section of this document describes the data validation requirements and the criteria for calculating the 24-hour averages.

#### VOCs

Air samples for VOCs will be collected bi-weekly at the same 12 locations, according to EPA method TO-15 for VOCs, and averaged over a 24-hour basis. The TO-15 analyte list shown in Table 3 will be reviewed and refined so that it will be limited to those chemicals of concern that are known to be present at SSFL based on remedial field investigation activities conducted over several years and have been identified for cleanup by the RPs.

Tables 2 and 3 list the compounds and estimated reporting limits (RL) for PM$_{10}$ and VOCs.

#### TABLE 2

**PM$_{10}$ Reporting Limit**

*Quality Assurance Project Plan, SSFL, Ventura County, California*

<table>
<thead>
<tr>
<th>Compound Name</th>
<th>Reporting Limit µg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{10}$</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Note: Reporting limits are based on a sampling rate of 16.7 liters per minute (LPM) for 24 hours  
CAS = Chemical Abstracts Service

#### TABLE 3

**TO-15 CAS Numbers and Reporting Limits**

*Quality Assurance Project Plan, SSFL, Ventura County, California*

<table>
<thead>
<tr>
<th>Compound Name</th>
<th>CAS Number</th>
<th>Reporting Limit µg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,1-Trichloroethane</td>
<td>71-55-6</td>
<td>2.77</td>
</tr>
<tr>
<td>1,1,2,2-Tetrachloroethane</td>
<td>79-34-5</td>
<td>3.49</td>
</tr>
<tr>
<td>1,1,2-Trichloro-1,2,2-trifluoroethane</td>
<td>76-13-1</td>
<td>3.90</td>
</tr>
</tbody>
</table>
### TABLE 3  
**TO-15 CAS Numbers and Reporting Limits**  
*Quality Assurance Project Plan, SSFL, Ventura County, California*

<table>
<thead>
<tr>
<th>Compound Name</th>
<th>CAS Number</th>
<th>Reporting Limit µg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,2-Trichloroethane</td>
<td>79-00-5</td>
<td>2.77</td>
</tr>
<tr>
<td>1,1-Dichloroethane</td>
<td>75-34-3</td>
<td>2.06</td>
</tr>
<tr>
<td>1,1-Dichloroethene</td>
<td>75-35-4</td>
<td>2.02</td>
</tr>
<tr>
<td>1,2,4-Trichlorobenzene</td>
<td>120-82-1</td>
<td>3.77</td>
</tr>
<tr>
<td>1,2,4-Trimethylbenzene</td>
<td>95-63-6</td>
<td>2.50</td>
</tr>
<tr>
<td>1,2-Dibromoethane (EDB)</td>
<td>106-93-4</td>
<td>3.91</td>
</tr>
<tr>
<td>1,2-Dichloro-1,1,2,2-tetrafluoroethane</td>
<td>76-14-2</td>
<td>3.56</td>
</tr>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>95-50-1</td>
<td>3.06</td>
</tr>
<tr>
<td>1,2-Dichloroethane</td>
<td>107-06-2</td>
<td>2.06</td>
</tr>
<tr>
<td>1,2-Dichloropropane</td>
<td>78-87-5</td>
<td>2.35</td>
</tr>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>108-67-8</td>
<td>2.50</td>
</tr>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>1.13</td>
</tr>
<tr>
<td>1,3-Dichlorobenzene</td>
<td>541-73-1</td>
<td>3.06</td>
</tr>
<tr>
<td>1,4-Dichlorobenzene</td>
<td>106-46-7</td>
<td>3.06</td>
</tr>
<tr>
<td>1,4-Dioxane</td>
<td>123-91-1</td>
<td>1.83</td>
</tr>
<tr>
<td>2-Butanone (MEK)</td>
<td>78-93-3</td>
<td>1.50</td>
</tr>
<tr>
<td>2-Hexanone</td>
<td>591-78-6</td>
<td>2.08</td>
</tr>
<tr>
<td>4-Ethyltoluene</td>
<td>622-96-8</td>
<td>2.50</td>
</tr>
<tr>
<td>4-Methyl-2-pentanone (MIBK)</td>
<td>108-10-1</td>
<td>2.08</td>
</tr>
<tr>
<td>Acrolein</td>
<td>107-02-8</td>
<td>1.17</td>
</tr>
<tr>
<td>Acrylonitrile</td>
<td>107-13-1</td>
<td>1.10</td>
</tr>
<tr>
<td>Benzene</td>
<td>71-43-2</td>
<td>1.62</td>
</tr>
<tr>
<td>Benzyl chloride</td>
<td>100-44-7</td>
<td>2.63</td>
</tr>
<tr>
<td>bis(2-Chloroethyl)ether</td>
<td>111-44-4</td>
<td>2.97</td>
</tr>
<tr>
<td>bis(2-Chloroisopropyl)ether</td>
<td>108-60-1</td>
<td>3.56</td>
</tr>
<tr>
<td>Bromodichloromethane</td>
<td>75-27-4</td>
<td>3.41</td>
</tr>
<tr>
<td>Bromoform</td>
<td>75-25-2</td>
<td>5.26</td>
</tr>
<tr>
<td>Bromomethane</td>
<td>74-83-9</td>
<td>1.97</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>75-15-0</td>
<td>1.58</td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>56-23-5</td>
<td>3.20</td>
</tr>
<tr>
<td>Chloroethane</td>
<td>75-00-3</td>
<td>1.34</td>
</tr>
<tr>
<td>Chloroform</td>
<td>67-66-3</td>
<td>2.48</td>
</tr>
<tr>
<td>Chloromethane</td>
<td>74-87-3</td>
<td>1.05</td>
</tr>
<tr>
<td>cis-1,2-Dichloroethene</td>
<td>156-59-2</td>
<td>2.02</td>
</tr>
<tr>
<td>cis-1,3-Dichloropropene</td>
<td>10061-01-5</td>
<td>2.31</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>110-82-7</td>
<td>1.75</td>
</tr>
<tr>
<td>Dibromochloromethane</td>
<td>124-48-1</td>
<td>4.33</td>
</tr>
<tr>
<td>Dichlorodifluoromethane</td>
<td>75-71-8</td>
<td>2.51</td>
</tr>
<tr>
<td>Ethyl Acetate</td>
<td>141-78-6</td>
<td>1.83</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>100-41-4</td>
<td>2.21</td>
</tr>
<tr>
<td>Compound Name</td>
<td>CAS Number</td>
<td>Reporting Limit $\mu g/m^3$</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Heptane</td>
<td>142-82-5</td>
<td>2.08</td>
</tr>
<tr>
<td>Hexachlorobutadiene</td>
<td>87-68-3</td>
<td>5.36</td>
</tr>
<tr>
<td>Isopropanol</td>
<td>67-63-0</td>
<td>1.25</td>
</tr>
<tr>
<td>Isopropylbenzene</td>
<td>98-82-8</td>
<td>2.50</td>
</tr>
<tr>
<td>m,p-Xylene</td>
<td>108-38-3/1</td>
<td>4.42</td>
</tr>
<tr>
<td>Methyl tert-butyl ether (MTBE)</td>
<td>1634-04-4</td>
<td>1.83</td>
</tr>
<tr>
<td>Methylene chloride</td>
<td>75-09-2</td>
<td>1.77</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>91-20-3</td>
<td>2.67</td>
</tr>
<tr>
<td>n-Butylbenzene</td>
<td>104-51-8</td>
<td>2.79</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>110-54-3</td>
<td>1.79</td>
</tr>
<tr>
<td>n-Octane</td>
<td>111-65-9</td>
<td>2.38</td>
</tr>
<tr>
<td>n-Propylbenzene</td>
<td>103-65-1</td>
<td>2.50</td>
</tr>
<tr>
<td>o-Xylene</td>
<td>95-47-6</td>
<td>2.21</td>
</tr>
<tr>
<td>p-Isopropyltoluene</td>
<td>99-87-6</td>
<td>2.79</td>
</tr>
<tr>
<td>sec-Butylbenzene</td>
<td>135-98-8</td>
<td>2.79</td>
</tr>
<tr>
<td>Styrene</td>
<td>100-42-5</td>
<td>2.17</td>
</tr>
<tr>
<td>Tetrachloroethene (PCE)</td>
<td>127-18-4</td>
<td>3.45</td>
</tr>
<tr>
<td>Tetrahydrofuran</td>
<td>109-99-9</td>
<td>1.50</td>
</tr>
<tr>
<td>Toluene</td>
<td>108-88-3</td>
<td>1.92</td>
</tr>
<tr>
<td>trans-1,2-Dichloroethene</td>
<td>156-60-5</td>
<td>2.02</td>
</tr>
<tr>
<td>trans-1,3-Dichloropropene</td>
<td>10061-02-6</td>
<td>2.31</td>
</tr>
<tr>
<td>Trichloroethene (TCE)</td>
<td>79-01-6</td>
<td>2.73</td>
</tr>
<tr>
<td>Trichlorofluoromethane</td>
<td>75-69-4</td>
<td>2.86</td>
</tr>
<tr>
<td>Vinyl acetate</td>
<td>108-05-4</td>
<td>1.79</td>
</tr>
<tr>
<td>Vinyl Chloride</td>
<td>75-01-4</td>
<td>1.30</td>
</tr>
<tr>
<td>Xylenes, Total</td>
<td>1330-20-7</td>
<td>6.63</td>
</tr>
</tbody>
</table>

Table 4 outlines the VOC and PM$_{10}$ sampling methodologies. Table 5 lists the proposed site locations.

### TABLE 4

**Air Sampling Methodologies**

*Quality Assurance Project Plan, SSFL, Ventura County, California*

<table>
<thead>
<tr>
<th>Method</th>
<th>Parameters</th>
<th>Field Locations</th>
<th>Duplicate (per event)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-15</td>
<td>VOCs</td>
<td>12 (286)</td>
<td>2 (26)</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>Particulate</td>
<td>12</td>
<td>-</td>
</tr>
</tbody>
</table>

**Notes:**
- Yearly samples in parenthesis.
- PM$_{10}$ = particulate matter less than 10 microns in aerodynamic diameter
- VOC = volatile organic compound
**TABLE 5**

**Boeing, NASA and DOE Monitoring Site Locations**

*Quality Assurance Project Plan, SSFL, Ventura County, California*

<table>
<thead>
<tr>
<th>Site</th>
<th>Parameters</th>
<th>Operator</th>
<th>Location Description</th>
<th>Sampling Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boeing 1: Sage Ranch</td>
<td>VOC, PM$_{10}$</td>
<td>Boeing</td>
<td>500 meters NNW of the Boeing Office Trailer</td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>Boeing 2: RD-120</td>
<td>VOC, PM$_{10}$</td>
<td>Boeing</td>
<td>RD-120 Well, 800 meters SSE of Main Gate</td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>Boeing 3: Bowl Test Stands</td>
<td>VOC, PM$_{10}$</td>
<td>Boeing</td>
<td>500 meters ESE of Bowl Test Stands</td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>Boeing 4: Cell Antennas</td>
<td>VOC, PM$_{10}$</td>
<td>Boeing</td>
<td>400 meters S of CTL3</td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>Boeing 5: Outfall 1</td>
<td>RAD, VOC, PM$_{10}$</td>
<td>Boeing</td>
<td>1000 meters S of Area I Burn Pit</td>
<td>Weekly, Bi-Weekly, Daily</td>
</tr>
<tr>
<td>Boeing 6: Southern</td>
<td>VOC, PM$_{10}$</td>
<td>Boeing</td>
<td></td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>Undeveloped Land</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NASA 1: North of Trailer</td>
<td>VOC, PM$_{10}$</td>
<td>NASA</td>
<td>North of Monitoring Well</td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>NASA 2: Helipad</td>
<td>VOC, PM$_{10}$</td>
<td>NASA</td>
<td>NW Corner of Parking lot</td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>NASA 3: Pride Rock</td>
<td>VOC, PM$_{10}$</td>
<td>NASA</td>
<td></td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>NASA 4: Pill Box</td>
<td>VOC, PM$_{10}$</td>
<td>NASA</td>
<td>Top of Ridge</td>
<td>Bi-Weekly, Daily</td>
</tr>
<tr>
<td>DOE-1:</td>
<td>RAD, VOC, PM$_{10}$</td>
<td>DOE</td>
<td></td>
<td>Weekly, Bi-Weekly, Daily</td>
</tr>
<tr>
<td>DOE-2:</td>
<td>RAD, VOC, PM$_{10}$</td>
<td>DOE</td>
<td></td>
<td>Weekly, Bi-Weekly, Daily</td>
</tr>
</tbody>
</table>

**Radionuclides**

Air samples for radionuclides will be collected according to existing DOE procedures summarized below at the DOE and Boeing sampling locations shown in Table 5.

During the Baseline Air Monitoring program, ambient air sampling for radionuclides will be performed continuously at SSFL with three air samplers operating on 7-day sampling cycles with a weekly sample volume of approximately 50 cubic meters each. Airborne particulate radioactivity will be collected on glass fiber (Type A/E) filters that will be changed weekly. After a minimum 120-hour holding time to allow the decay of short-lived radon and thoron daughters, the samples will be simultaneously counted for gross alpha and beta activity with a low-background, thin-window, gas-flow proportional-counting system continually purged with P-10 argon/methane counting gas over a preset time interval.

Counting system efficiencies will be determined routinely with Technetium-99 (Tc-99) and Thorium-230 (Th-230) standard sources. The activities of the standard sources are traceable to the National Institute of Standards and Technology (NIST). Filter samples for each ambient air sampling location will be combined annually and analyzed for isotopic-specific activity. It should be noted that these measurements determine only the long-lived particulate radioactivity in the air and, therefore, do not show naturally-occurring radon gas (Rn-222) and most of its progeny. However, naturally-occurring polonium-210 is a long-lived progeny and is detected by these analyses.
A6  Quality Objectives and Criteria

Data Quality Objectives

The Data Quality Objectives (DQO) process used for this project follows EPA guidance and uses the seven-step DQO development process described in Table 6. The DQOs provide a basis for the investigation activities to be performed, and ensure that data collected during the investigation will be of sufficient and adequate quality for their intended use.

<table>
<thead>
<tr>
<th>TABLE 6</th>
<th>Data Quality Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality Assurance Project Plan, SSFL, Ventura County, California</strong></td>
<td></td>
</tr>
</tbody>
</table>

| Step 1: State the Problem | Future activities at SSFL during implementation of demolition and remedial measures could potentially impact air quality. Air sampling will be performed prior to site remedial activities over a 1-year period to identify and document baseline conditions as outlined in this plan. |
| Step 2: Identify the Goals of the Study | Monitor concentrations of selected VOCs, particulate matter, and radionuclides in air at selected locations to identify the range of concentrations under current (baseline conditions) based on 24-hour average concentrations, collected daily for particulates and bi-weekly for VOCs, and weekly for radionuclides using existing DOE methodology summarized herein such that future concentrations resulting from onsite remediation activities at SSFL can be evaluated in comparison to baseline concentrations at a later date. |
| Step 3: Identify Information Inputs | Previous environmental studies conducted at SSFL suggest that potential airborne contaminants associated with remedial activities could include particulate matter, radionuclides, inorganic compounds, and organic compounds. Soil movement activities at SSFL have the potential to release soil bound organic compounds (PAHs, PCBs, and dioxins) as well as metals into the air if those compounds are present in soil. Metal compounds of concern are not volatile and are in solid phase if they are present in soil. Organic compounds of concern such as PAHs, PCBs, and dioxins that may be in soil are non-volatile or semivolatile, and will predominately remain adsorbed onto soil particles if disturbed at ambient temperatures. VOCs present in the subsurface have the potential for release to ambient air during disturbance of the existing soil cover. |

Because potential emissions of all COPCs are directly related to soil derived emissions resulting from soil movement activities, monitoring of airborne particulates will provide a rapid and appropriate assessment of the potential release of these compounds to the environment via the air transport pathway. PM$_{10}$ can be monitored with sufficient frequency and at sufficient locations to reflect the potential magnitude, frequency, and locations of concentrations of other released analytes. In addition to PM$_{10}$, the baseline monitoring program will include collection of VOCs and radionuclides to determine the spatial distribution and concentrations of these compounds prior to remedial activities. |

COPC monitoring will be conducted by incorporating EPA, CARB, and DOE guidelines as appropriate based on the COPC. |
| Step 4: Define the Boundaries of the Study | Spatial: 12 air monitoring locations have been identified based on the presence of geographic features and prevailing wind direction (see Figure 1 of the Air Monitoring Work Plan). |

Temporal: 24-hour sampling will be performed for VOCs, conducted bi-weekly for a 1-year period (26 sampling events). Daily 24-hour averages will be collected for PM$_{10}$ over the period of 1 year. Radionuclide samples will be collected on a weekly basis for one year. |

Sampling will be performed at the 12 monitoring locations identified on Figure 1 of the Air Monitoring Work Plan for VOCs and particulate matter. |

Sampling for radionuclides will be conducted according to the existing DOE locations and schedule and near the Boeing Area I Burn Pit following the 1 year schedule described. |
| Step 5: Develop the Analytic Approach | One year of baseline data will be collected to define the range of concentrations of COPCs in air prior to implementation of remedial measures and demolition activities based on 24-hour average concentrations. Data that meet the Measurement Quality Objectives stated in Table 7 and the quality control acceptance criteria stated in Section B of this QAPP will be included in the range of baseline concentrations. |
TABLE 6  
Data Quality Objectives  
Quality Assurance Project Plan, SSFL, Ventura County, California

<table>
<thead>
<tr>
<th>Step 6: Specify Performance or Acceptance Criteria</th>
<th>Random or systematic errors may be introduced during monitoring, data reduction, and data reporting. The QC measures set forth in this document serve to minimize these errors. Each member of the field team must follow the same procedures to minimize field errors. For baseline condition determination, data validation will be conducted according to established EPA and/or DOE protocols for COPCs. If necessary, additional data collection confidence levels, performance, and acceptance criteria will be developed to establish representative baseline conditions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 7: Develop the Plan for Obtaining Data</td>
<td>Twenty-four-hour samples will be collected bi-weekly over 1 year at 12 sampling locations for analysis for selected VOCs. Twenty-four-hour samples will be collected daily over 1 year at the same monitoring locations for particulate matter. Samples for radionuclides will be collected according to the current DOE plan and schedule. Boeing radiological air monitoring near the Area I Burn Pit will follow DOE’s sampling approach but will conform to the 1-year schedule described above. Collected data will be evaluated using established EPA and or CARB guidelines.</td>
</tr>
</tbody>
</table>

Data Quality Indicators

Controlling and assessing data quality to achieve the DQOs requires incorporation of appropriate Data Quality Indicators (DQIs). DQIs relevant to this project include:

**Bias.** Bias assess whether there is a systematic deviation from the true concentration being reported. It is defined by EPA as the systematic or persistent distortion of a measurement process that causes error in one direction. Bias will be determined by estimating positive and negative deviation from the true value as a percentage of the true value.

**Precision.** Precision is defined by the EPA as a measure of mutual agreement among individual measurements of the same property usually under prescribed, similar conditions. This is the random component of error. Precision is estimated by various statistical techniques using some derivation of the standard deviation.

For the PM$_{10}$ measurements, precision and bias will be calculated following the *Guideline on the Meaning and the Use of Precision and Bias Data Required by 40 CFR Part 58 Appendix A* (EPA, 2007).

For each single point check, the percent difference (d$_i$) will be calculated as follows:

**EQUATION 1**  
Percent Difference (Measured and Audited Values)  

\[
d_i = \frac{\text{meas} - \text{audit}}{\text{audit}} \times 100
\]

**Where:**

- meas = the concentration indicated by the monitoring organization’s instrument
- audit = the audit concentration of the standard used in the QC check being measured

The precision estimator used to assess the one-point QC checks for PM$_{10}$ is the coefficient of variation upper bound and is calculated using Equation 2.

**EQUATION 2**  
Coefficient of Variation  

\[
CV = \sqrt{n \sum_{i=1}^{n} d_i^2 - \left( \sum_{i=1}^{n} d_i \right)^2 \over n(n-1)} \cdot \sqrt{n-1 \over X_{01,n-1}^2}
\]
Where:

\( n \) = the number of samples
\( d \) = the value calculated from Equation 1 for each sample
\( X^2_{0.01,n-1} \) = the value of the Chi squared distribution with a probability of error of .01 for n-1 degrees of freedom

Bias is estimated using Equation 3.

**EQUATION 3**
**Bias Calculation**

\[
|bias| = AB + t_{0.95,n-1} \times \frac{AS}{\sqrt{n}}
\]

Where:

\( n \) = number of single-point checks being aggregated
\( t_{0.95,n-1} \) = the 95th quantile of a t-distribution with n-1 degrees of freedom
\( AB \) = mean of absolute values of all the \( d \)s
\( AS \) = standard deviation of the absolute values of the \( d \)s.

Validation of bias using the one-point QC checks are calculated using the following equations.

**EQUATION 4**
**Mean (\( d_j \))**

\[
d_j = \frac{1}{n} \sum_{i=1}^{n} d_i
\]

**EQUATION 5**
**Standard Deviation (\( S_j \))**

\[
S_j = \sqrt{\frac{1}{n-1} \left[ \sum_{i=1}^{n} d_i^2 - \frac{1}{n} \left( \sum_{i=1}^{n} d_i \right)^2 \right]}
\]

**EQUATION 6**
**Upper 95 Percent Probability Limit**

\( d_j + 1.96 \times S_j \)

Where:

\( d_j \) = mean
\( S_j \) = standard deviation

**EQUATION 7**
**Lower 95 Percent Probability Limit**

\( d_j - 1.96 \times S_j \)

Where:

\( d_j \) = mean
\( S_j \) = standard deviation

**Laboratory Precision.** Laboratory Precision is a measure of reproducibility of analytical results. It can be defined as the degree of mutual agreement among individual measurements obtained under similar
conditions. Total precision is a function of the variability associated with both sampling and analysis. Precision will be evaluated as the relative percent difference (RPD) between duplicate samples, laboratory control sample (LCS), and LCS duplicate results.

The RPD will be calculated using the following equation:

\[ RPD = \left( \frac{|S - D|}{(S + D)/2} \right) \times 100 \]

Where:
- \( S \) = First sample value (original value)
- \( D \) = Second sample value (duplicate value)

**Representativeness.** Representativeness is a measure of the degree to which data accurately and precisely represents a characteristic of geography, parameter variations at a sampling point, a process or environmental condition. Representativeness depends on sampling and analytical variability and the variability of environmental media at the site. Representativeness is a qualitative “measure” of data quality.

The goal of achieving representative data starts with a properly designed and executed sampling program that carefully considers the overall DQOs for the project. Proper location controls and sample handling are critical to obtaining representative samples.

The goal of achieving representative data in the laboratory is measured by assessing accuracy and precision. A laboratory will provide representative data when proper analytical procedures are followed and holding times are met. In addition, laboratories must demonstrate that its staff is qualified to perform the analyses, is certified and is proficient with the analytical methods being employed.

**Completeness.** Completeness is defined as the percentage of usable data obtained during the event and its acceptance criteria are project-specific. The data completeness of VOC laboratory analyses results will be assessed for compliance with the amount of data required for decision making. Complete data are those deemed valid.

The completeness of the data set is calculated using the following equation:

\[ % \text{Completeness} = \left( \frac{\text{Valid data obtained}}{\text{Total data planned}} \right) \times 100 \]

The data completeness goal for PM10 is 80% per quarter. To comprise one valid calendar day, 18 of 24 hours of data must be valid. If any of the monitor’s counts within a block of data is incomplete or flagged, the internal instrument logger flags the data as invalid. These flagged data are then reviewed and determined valid or invalidated during the validation task.

The completeness for the quarter is calculated using the following equation:

\[ % \text{Completeness} = \left( \frac{\text{Number of valid days}}{\text{Number of possible days}} \right) \times 100 \]

**Measurement Quality Objectives**

Measurement quality objectives (MQOs) are identified to control and assess various elements of a data collection activity and provide the metric used to assess the DQIs above. Table 7 summarizes the MQOs for this project.
## Measurement Quality Objectives

### Quality Assurance Project Plan, SSFL, Ventura County, California

<table>
<thead>
<tr>
<th>Method</th>
<th>MQO Parameter</th>
<th>Requirement</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-15 (bi-weekly)</td>
<td>Precision</td>
<td>Duplicate or collocated samples (10%)</td>
<td>&lt;15% RPD</td>
</tr>
<tr>
<td></td>
<td>Completeness</td>
<td>Valid samples collected</td>
<td>&gt;85% (*)</td>
</tr>
<tr>
<td>PM$_{10}$ (daily)</td>
<td>Flow Rate Accuracy</td>
<td>Indicated flow rate compared to primary flow standard</td>
<td>±7%</td>
</tr>
<tr>
<td></td>
<td>Completeness</td>
<td>Valid samples collected</td>
<td>&gt;80% (***)</td>
</tr>
<tr>
<td>Radionuclides (weekly)</td>
<td>Flow Rate Accuracy</td>
<td>Indicated flow rate compared to primary flow standard</td>
<td>±10%</td>
</tr>
<tr>
<td></td>
<td>Completeness</td>
<td>Valid samples collected</td>
<td>&gt;80% (***)</td>
</tr>
</tbody>
</table>

**Notes:**

* Completeness is defined as >85% as specified in the National Air Toxics Trends Station Model Quality Assurance Project Plan.
** Calculated on a quarterly basis.

RPD = relative percent difference

### A7 Training

Project team members will be chosen with the necessary experience and technical skills to perform required project tasks. All personnel engaged in field activities will have completed a site-specific safety training orientation. All subcontracted project personnel will read the project-specific HASP. Documentation will be maintained to demonstrate that all requirements of the plan are followed.

All subcontracted laboratories and lower-tiered subcontracted laboratories participating in analytical services will be certified by the National Environmental Laboratory Accreditation Program. The laboratory managers will be responsible for ensuring all personnel have been properly trained and are qualified to perform their assigned tasks.

### A9 Documentation and Records

#### Field Data

Field sampling activities will be recorded in field logbooks. Field logbook entries will be described with as much detail as possible so that reviewers can reconstruct a particular situation without reliance on field personnel memory. Modifications to field sampling protocols must be documented in the field logbook.

The field logbooks to be used will be bound field survey books or notebooks. Logbooks will be assigned to the field crew, but stored in a secure location when not in use. Project-specific document numbers will identify each logbook, the title page of which will contain the following:

- Name of the person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Project end date

At the beginning of each entry, the date, start time, weather, names of all sampling team members present and the signature of the person making the entry will be documented. Specific information and observations
will be recorded in the field notebook during all field investigation activities. The information to be documented includes the following:

- Names of all field team members present and the level of PPE
- Names of site visitors, field sampling or investigation team personnel, and the nature of their visit
- Equipment model and calibration information (if applicable)
- Sample locations, identification, analyses to be performed, method of collection, odor, visual descriptions, date, and time of collection
- All field data recorded
- Miscellaneous observations regarding other nearby site activities and equipment problems/troubleshooting measures

All entries will be made in ink, and no erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed. Any blank or unused portions of a page will be crossed out with a single diagonal line and initialed by the field personnel. Blank pages will be noted as being intentionally blank in the same manner.

Samples will be collected following the sampling procedures as documented in the method. Sample collection equipment will be identified, along with the time of sampling, sample description and number of containers used. Unique sample identification numbers (IDs) will be assigned to each sample and will be noted in the field logbook.

Field data calculations, transfers and interpretations will be reviewed for accuracy by the FTL. The FTL will also review field documentation, data reduction, and accuracy of data entries into the data log. The data logs and documents will be checked for the following:

- General completeness
- Readability
- Use of appropriate procedures
- Whether modifications to sampling procedures are clearly stated
- Appropriate instrument calibration and maintenance records
- QA/QC Results
- Reasonability of data collected
- Correctness of sample locations
- Correctness of reporting units, calculations, and interpretations

Field personnel will provide comprehensive documentation of all aspects of field sampling, field analysis, and sample chain-of-custodies. This documentation constitutes a record that allows for the reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the fieldwork will be retained in the project file.

**Laboratory Data Reporting**

Data reduction will be done manually or using appropriate application software. Quantitation procedures specified for each method will be followed. Typical calculations for analyses are based on regression analyses of calibration curves. Regression analysis is used to fit a curve through calibration standard data. Sample concentrations are calculated using the resulting regression equations. If data are reduced manually, the documentation must include the formulas used. Any application software used for data reduction must have been previously verified by the laboratory for accuracy. Documentation of the software’s verification must be maintained on file in the laboratory. All documentation of data reduction must allow re-creation of the calculations.
Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. Raw data will be stored electronically and is not reported for this project. Laboratory data entered will be sufficient to document information used to arrive at reported values.

All data will undergo at least two levels of QC review at the laboratory before release. The analyst performing the tests initially will review 100 percent of the data. After the analyst’s review has been completed, 100 percent of the data will be reviewed independently by a senior analyst, dedicated QA staff, or by the section supervisor for accuracy, compliance with calibration and QC requirements, holding time compliance, and for completeness. Analyte identification and quantitation must be verified. Calibration and QC results will be compared with the applicable control limits. Reporting limits should be reviewed to make sure they meet the project objectives. Results of multiple dilutions should be reviewed for consistency. Any discrepancies must be resolved and corrected. Laboratory qualifiers will be applied when there are nonconformances that potentially could affect data usability. These qualifiers must be properly defined as part of the deliverables. All issues relevant to the quality of the data must be addressed in a case narrative. A copy of the data package will be filed in the project file. Mailed data packages, along with applicable electronic data deliverables (EDDs), will be sealed in an appropriate shipping container with a custody seal and logged on a document mailing log.

Electronic data storage will be used when possible. All electronic data will be maintained in a manner that prevents inadvertent loss, corruption, and inappropriate alteration. Electronic data will be accessible and retrievable for a period of 10 years after project completion by the laboratory.

Raw data will be examined to assess compliance with QC guidelines. In addition, samples and laboratory blanks will be checked for possible contamination or interferences. Chromatograms and concentrations will be checked to ensure that sample results are within the calibration range; if necessary, dilutions will be performed as defined by the initial calibration range.

Deviations from guidelines will call for corrective action. Deviations determined to be caused by factors outside the laboratory’s control, such as matrix interference, will be noted with an explanation in the report narrative. Calculations will be checked and the report reviewed for errors and oversights. The hard copy and electronic laboratory reports for samples and analyses will contain the information necessary to perform data evaluation.

**Electronic Analytical Record Format**

Concurrently with the submittal of the hard copy deliverables, the laboratory will deliver electronic data in either LabSpec7, EQuIS IV, or EQuIS V format. There shall be no discrepancies between the hard copy reports and the electronic reports.

**Project Record Maintenance and Storage**

Project records will be stored and maintained in accordance with the project’s data management plan, that is, per Section 4.9 of the 2007 Consent Order.
B Measurement and Data Acquisition

B1 Sampling Design

Scheduled Project Activities

Sampling locations have been selected based on the prevailing wind direction, topography, security, and accessibility. These locations are intended to be representative of the air quality surrounding the site. Samples will be collected at 12 sampling locations.

Samples for VOCs will be collected bi-weekly and PM$_{10}$ samples will be collected daily for 1 year.

Samples for radionuclides will be conducted according to existing DOE procedures weekly for 1 year.

Sampling Locations

Sampling locations and monitors have been sited according to 40 CFR Part 58 Appendix E, to the maximum extent possible. Siting guidelines include placing the instrument a significant distance from obstacles, such as trees or buildings, paved surfaces, large bodies of water or other obstacles that could influence the airflow and measurements at the station. Proposed air sample locations for PM$_{10}$ and VOCs are presented in Figure 1 of the Air Monitoring Work Plan.

Radionuclides will continue to be sampled according to existing DOE procedures at two sites plus the addition of a third site near the Boeing Area I Burn Pit.

B2 Sampling Methods

Sample Preparation

Sample preparation is an essential component of sample collection. The following functions are required for sample preparation:

TO-15 – Cleaning, testing, verifications, and storage of SUMMA canisters on a bi-weekly basis.

PM$_{10}$ – As the EBAM systems are continuous monitors, each hourly sample is conducted entirely as an automated process and then integrated for a 24-hour composite sample.

Radionuclides – Will continue to be sampled according to DOE procedures on a weekly basis.

Field Corrective Action

Corrective action measures will be taken in the field to ensure the data quality objectives are attained. Some potential problems and corrective actions are listed in Table 8.

<table>
<thead>
<tr>
<th>Method</th>
<th>Item</th>
<th>Problem</th>
<th>Action</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{10}$</td>
<td>Flow Rate Verification</td>
<td>Out of Specification (±7% transfer standard)</td>
<td>• Perform leak test</td>
<td>• Document on field data sheet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Recalibrate flow</td>
<td>• Notify field manager</td>
</tr>
<tr>
<td>TO-15</td>
<td>Leak Test</td>
<td>Canisters not under vacuum</td>
<td>• Replace canister</td>
<td>• Document on field data sheet</td>
</tr>
</tbody>
</table>
TABLE 8
Field Corrective Action
Quality Assurance Project Plan, SSFL, Ventura County, California

<table>
<thead>
<tr>
<th>Method</th>
<th>Item</th>
<th>Problem</th>
<th>Action</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-15</td>
<td>Flow Rate Verification</td>
<td>Sampling at too slow a rate (final canister vacuum &gt;10”Hg)</td>
<td>• Extend sampling time</td>
<td>• Document on field data sheet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sampling at too high a rate (final canister vacuum projected to be 0”Hg)</td>
<td>• Stop sampling early</td>
<td>• Document on field data sheet</td>
</tr>
<tr>
<td>Radionuclides</td>
<td>Flow Rate Verification</td>
<td>Sample flow rate outside ±10% criterion</td>
<td>• Action items will continue to conform with existing DOE procedures</td>
<td>• Action items will continue to conform with existing DOE procedures</td>
</tr>
</tbody>
</table>

Sample Handling, Preservation and Holding Time

**PM$_{10}$** – Sampling will be conducted using an E-BAM calculating real-time data and there are no sample handling requirements.

**TO-15** – Canister samples will be shipped at ambient temperature and analyzed within 30 days of collection. There are no sample preservation requirements.

**Radionuclides** – Samples will continue to be collected according to existing DOE procedures. After a minimum 120-hour holding time to allow the decay of short-lived radon and thoron daughters, the samples will be simultaneously counted for gross alpha and beta activity.

Sample Collection

**PM$_{10}$** – Particulate matter less than 10 µm in size will be collected from air using a Beta Attenuation Monitor (BAM) with a MetOne E-BAM sampler with a PM$_{10}$ inlet. The E-BAM automatically measures and records particulate concentration with built-in data logging. It uses the principle of beta ray attenuation to provide a simple determination of mass concentration. A small $^{14}\text{C}$ (<60µCi) element emits a constant source of high-energy electrons, also known as beta particles. These beta particles are efficiently detected by an ultra-sensitive scintillation counter placed nearby. An external pump pulls a measured amount of air through a filter tape. The filter tape, impregnated with ambient dust, is placed between the source and the detector, thereby causing the attenuation of the measured beta-particle signal. The degree of attenuation of the beta-particle signal is used to determine the mass concentration of particulate matter on the filter tape and hence the volumetric concentration of particulate matter in ambient air. Refer to the E-BAM Particulate Monitor Operation Manual for more information.

Particulate matter will be collected at a flow rate of approximately 16.7 LPM for a 24-hour period. Hourly electronic sample data will be analyzed to determine 24-hour averages. Air will be sampled at approximately 2 meters above the ground surface below the sampler.

**TO-15** – Air samples will be collected for speciated VOCs in evacuated 6-liter Summa canisters over a 24-hour period through a pre-set flow controller at approximately 4 cc per minute. The canister inlet will be placed approximately 2 meters above ground level. Canisters and flow controllers will be provided, cleaned, and certified by the contracted laboratory before shipping to the field. Vacuum in the canister will be measured before and after sampling to ensure proper function. The canisters will be sent to the contracted laboratory for analysis by TO-15.

**Radionuclides** – Samples will continue to be collected according to existing DOE procedures. During the Baseline program, ambient air sampling for radionuclides will be performed continuously at SSFL with three air samplers operating on 7-day sampling cycles with a weekly sample volume of about 50 cubic meters.
each. Airborne particulate radioactivity will be collected on glass fiber (Type A/E) filters that will be changed weekly.

**B3 Sample Handling and Custody**

**Sample Chain-of-Custody**

Sample custody procedures include the use of field logbooks, sample labels, custody seals and chain-of-custody (COC) forms. Each person involved with sample handling will be familiar with COC procedures prior to the start of field operations. The COC form must accompany the samples during transportation from the field to the laboratory. A sample is considered to be in one’s custody under the following circumstances:

- It is in one’s actual possession.
- It is in one’s view, after being in one’s physical possession.
- It was in one’s physical possession and that person locks it up to prevent tampering.
- It is in a designated and identified secure area.
- Proper sample handling, shipment, and maintenance of a COC are key components of the quality system designed to obtain data that can be used to make project decisions. It is important that all sample handling protocols and COC requirements be followed completely, accurately and consistently.

- A properly completed COC form will accompany samples to the laboratory. The unique sample IDs and descriptive identification information (site location, date, time, etc.) will be listed on the COC form. When transferring possession of samples, the individuals relinquishing and receiving them will sign, date, and note the time on the COC form. At a minimum, the chain of custody form must include the following:
  - Site name
  - Project manager name, telephone number, and fax number
  - Unique sample identification
  - Date and time of sample collection
  - Source of sample (including name, sample type, and matrix)
  - Number of containers
  - Analyses required
  - Name of sampler
  - Custody transfer signatures and dates and times of sample transfer
  - Bill of lading or transporter tracking number (if applicable)
  - Turnaround time
  - Laboratory name, address, and contact information
  - Any special instructions

- When samples are relinquished to the shipping company for transport, the shipping bill tracking number will be recorded on the COC form. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact. The COC record identifying the contents will accompany all shipments. The original record will accompany the shipment, with field copies being retained by the sampler. Upon receipt of field samples, the analytical laboratory representative will sign the COC to accept custody of the samples and will then properly store them to await analysis.

- Erroneous entries on chain-of-custody records will be corrected by drawing a single line through the error and entering the corrected information. The person performing the correction will date and initial each change made on the chain of custody form.
### B4 Analytical and Continuous Monitoring Methods

After the samples have been properly collected and documented, they will be submitted to the selected laboratory subcontracted for analysis. Samples will be analyzed in accordance with this QAPP and the specified method. The target analytes and the required reporting limits have been specified in Tables 3 and 4 in Section A6. A summary of the analytical methods is presented below.

**PM$_{10}$** – Particulate matter less than 10 µm in size are collected from air using a MetOne E-BAM. The E-BAM conducts air sampling and air particulate concentration calculations over the course of one hour and records the concentration of PM$_{10}$ in µg/m$^3$ on an hourly basis. Periodically, but no less than monthly the hourly data will be collected electronically from the E-BAM, analyzed for completeness and used to calculate 24-hour average concentrations.

**TO-15** – VOC analysis is performed by removing an aliquot of air from the Summa canister into a pre-concentrator. The pre-concentrator removes bulk fixed gases and water vapor from the sample. The VOCs are then cryofocused before injection into a gas chromatograph (GC). The compounds are eluted from the GC column into the mass spectrometer (MS). Dilution may be performed by varying the aliquot size to get all analytes within the working range of the instrument.

**Radionuclides** – Samples will continue to be analyzed according to existing DOE procedures. After a minimum 120-hour holding time to allow the decay of short-lived radon and thoron daughters, the samples will be simultaneously counted for gross alpha and beta activity with a low-background, thin-window, gas-flow proportional-counting system continually purged with P-10 argon/methane counting gas over a preset time interval. Filter samples for each ambient air sampling location will be combined annually and analyzed for isotopic-specific activity. It should be noted that these measurements determine only the long-lived particulate radioactivity in the air and, therefore, do not show naturally-occurring radon gas (Rn-222) and most of its progeny. However, naturally-occurring polonium-210 is a long-lived progeny and is detected by these analyses.

### B5 Quality Control

QC is the overall system of technical activities that measures the attributes and performance of a process. QC activities are used to ensure that measurement uncertainty is maintained within acceptance criteria for the attainment of the DQOs.

**Field QC Procedures**

E-BAM QC activities will consist of automatic system operations, manufacturers recommended maintenance, and monthly flow-rate verifications.

The monthly flow check is performed before any instrument adjustment is made. The resulting data from the checks are used to measure precision. The flow of the E-BAM is compared to a NIST traceable volumetric flow calibration device. If the instrument’s flow differs from the calibration standard by more than 7 percent, the instrument will be adjusted.

**Radionuclides** – QA activities will continue to conform to existing DOE procedures. Counting system efficiencies will be determined routinely with Technetium-99 (Tc-99) and Thorium-230 (Th-230) standard sources. The activities of the standard sources are traceable to the NIST. The following elements of quality control are used for the SSFL program:

- **Reagent Quality** – Certified grade counting gas is used
- **Laboratory Ventilation** – Room air supply is controlled to minimize temperature variance and dust incursion
- **Laboratory Contamination** – Periodic laboratory surveys for fixed and removable surface contamination are performed; areas are cleaned routinely and decontaminated when necessary
• Control Charts – Background and reference source control charts for counting equipment are maintained to evaluate stability and response characteristics
• Calibration Standards – Counting standard radioactivity values are traceable to NIST primary standards
• Co-location of State Department of Health thermoluminescent dosimeters

Laboratory QC Procedures
Day-to-day quality control is implemented through the use of various check samples or instruments that are used for comparison. The analytical laboratory will have a QC program to assess the reliability and validity of the analyses being performed. The purpose and creation of QC samples are discussed and summarized below. Laboratory QC checks indicate the state of control that prevailed at the time of sample analysis. QC checks that involve field samples, such as matrix, surrogate spikes, and field duplicates, also indicate the presence of matrix effects. Field-originated blanks provide a way to monitor for potential contamination to which field samples are subjected. This QAPP specifies requirements for method blanks, laboratory control samples (LCS), surrogate spikes, and laboratory duplicates that laboratories participating in the data collection effort must follow.

All QC will be in accordance with method specifications including, but not limited to the following:
• Flow-rate verifications
• Leak checks
• Method blanks
• Hold time
• Initial calibrations
• Continuing calibrations
• Second source check samples
• Instrument tuning
• LCS
• Surrogate spikes
• Internal standards
• Retention time window studies

A laboratory QC batch is defined as a method blank, LCS, and a sample duplicate, depending on the method, and 20 or fewer environmental samples of similar matrix that are extracted or analyzed together. For GC/MS analyses, the number of environmental samples allowed in the laboratory QC batch is defined by the remaining time in the method-prescribed tune period divided by the analytical run time, up to 20 samples. Each preparation or analytical batch will be identified in such a way as to be able to associate environmental samples with the appropriate laboratory QC samples.

Required QC checks, minimum frequencies, acceptance criteria, corrective actions, and validation flagging criteria are included in Table 9. Results detected between the reporting limit and detection limit will be reported with a “J” qualifier. Non-detected parameters will be reported as the reporting limit with a “U” qualifier.

TABLE 9
Quality Control Checks for VOCs in Vapors with TO-15
Quality Assurance Project Plan, SSFL, Ventura County, California

<table>
<thead>
<tr>
<th>QC Check</th>
<th>Frequency</th>
<th>Data Quality Indicator</th>
<th>Criteria</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Calibration</td>
<td>Initially and if continuing</td>
<td>Accuracy</td>
<td>RSD ≤30%, r ≥0.995, r² ≥0.990 (linear regression or quadratic)</td>
<td>May repeat one point (if analyzing 5 levels) or two points (if analyzing 6 levels). Inspect the system for problems and perform required</td>
</tr>
<tr>
<td>(ICAL)-minimum of five levels or six if</td>
<td>calibration no</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 9
Quality Control Checks for VOCs in Vapors with TO-15

*Quality Assurance Project Plan, SSFL, Ventura County, California*

<table>
<thead>
<tr>
<th>QC Check</th>
<th>Frequency</th>
<th>Data Quality Indicator</th>
<th>Criteria</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>utilizing a quadratic determination</td>
<td>longer meets criteria</td>
<td></td>
<td></td>
<td>maintenance. Repeat initial calibration. Problem must be corrected. Samples may not be analyzed until there is a valid ICAL.</td>
</tr>
<tr>
<td>Initial Calibration Verification (ICV)</td>
<td>Following every ICAL</td>
<td>Accuracy</td>
<td>%Difference ±30% from expected concentration</td>
<td>Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration. Problem must be corrected. Samples may not be analyzed until there is a valid ICV.</td>
</tr>
<tr>
<td>Continuing Calibration Verification (CCV)</td>
<td>Initial run of batch, every 24 hours</td>
<td>Accuracy</td>
<td>%Difference (%D) ±30% from expected concentration</td>
<td>Reanalyze CCV. Identify and correct problem; reanalyze or where appropriate qualify the data. Repeat initial calibration if CCV corrective action is unsuccessful.</td>
</tr>
<tr>
<td>Method Blank</td>
<td>One per batch of samples (a batch cannot exceed 20 samples)</td>
<td>Contamination/Bias</td>
<td>No target analytes detected &gt; QL</td>
<td>Re-prep and reanalyze batch.</td>
</tr>
<tr>
<td>Surrogate spike</td>
<td>Every standard, sample, method blank, and LCS</td>
<td>Accuracy</td>
<td>All surrogates in samples, method blank, and LCS within 70-130% recovery</td>
<td>Re-analyze. If still unacceptable, flag all associated data in the analytical batch.</td>
</tr>
<tr>
<td>Laboratory Replicate</td>
<td>One per batch of samples</td>
<td>Precision</td>
<td>≤25%RPD</td>
<td>Re-prep and reanalyze batch.</td>
</tr>
<tr>
<td>Laboratory Control Sample (LCS)</td>
<td>One per batch of samples</td>
<td>Accuracy</td>
<td>70-130%R</td>
<td>Re-prep and reanalyze batch.</td>
</tr>
<tr>
<td>Holding Time</td>
<td>N/A</td>
<td>Representative ness</td>
<td>30 days</td>
<td>Contact client and qualify data.</td>
</tr>
</tbody>
</table>

#### Laboratory Quality Control Analyses/Parameters

QC samples will be collected to determine the accuracy and precision of the analytical results. The QC sample frequencies are as stated in this section. All sampling activities will be conducted in accordance with the HASP, and all sample handling procedures will be performed in accordance to those specified in this QAPP.

**Laboratory Quality Control Analyses/Parameters Originated by the Laboratory**

**Method Blank.** Blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential sources within the laboratory. A method blank is an analyte-free matrix that is processed through the entire sample preparation and analytical procedures along with the samples in the batch. There will be at least one method blank per preparation or analytical batch. If a target analyte is found at a concentration in excess of that allowed then corrective action must be performed to identify and eliminate the contamination source. No analytical data may be corrected for the concentration found in the blank.
**Laboratory Control Sample.** The LCS will consist of an analyte-free matrix such as high purity nitrogen or sorbent tubes spiked with known amounts of analytes that come from the same or different source than that used for calibration standards. All target analytes will be spiked into the LCS. If LCS results are outside the specified control limits, corrective action must be taken, including sample repreparation and reanalysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results of all LCSs must be reported. Any LCS recovery outside QC limits affects the accuracy for the entire batch and requires corrective action.

**Surrogates.** Surrogates are organic analytes that behave similarly to the analytes of interest, but are not expected to occur naturally in the samples. They are spiked into the standards, and into the samples and QC samples prior to sample preparation. Recoveries of surrogates are used as an indicator of accuracy, method performance, and extraction efficiency. If surrogate recoveries are outside the specified control limits, corrective action must be taken, including sample re-preparation and/or reanalysis, if appropriate.

**Internal Standards.** Some methods require using internal standards to compensate for losses during injection or purging, or losses because of viscosity. Internal standards are compounds that have similar properties as the analytes of interest, but are not expected to occur naturally in the samples. A measured amount of the internal standard is added to the standards, and to the samples and QC samples following preparation. When the internal standard results are outside the control limits, corrective action must be taken, including sample reanalysis, if appropriate.

**Laboratory Replicate (Duplicate).** A sample duplicate selected by the laboratory is called a laboratory replicate or duplicate. It is subjected to the same preparation and analytical procedures as the native sample. The RPD between the results of the native sample and laboratory sample duplicate measures the precision of sample results. The data collected may also yield information regarding whether the sample matrix is homogenous or heterogeneous.

**Retention Time Windows.** Retention time windows for gas and liquid chromatographic analyses must be established by replicate injections of the calibration standard over multiple days as described in SW-846 8000B, analytical method or appropriate laboratory SOP. The absolute retention time of the calibration verification standard at the start of each analytical sequence will be used as the centerline of the window. In order for an analyte to be reported as positive, its elution time must be within the retention time window.

**Holding Time.** The holding time requirements specified in this QAPP must be met. For methods requiring both sample preparation and analysis, the preparation holding time will be calculated from the time of sampling to the completion of preparation. The analysis holding time will be calculated from the time of completion of preparation to the time of completion of the analysis, including any required dilutions, confirmation analysis and reanalysis. For methods requiring analysis only, the holding time is calculated from the time of sampling to completion of the analysis, including any required dilutions, confirmation analysis, and reanalysis. For this project, it should be noted that samples of each material were collected from the field and are stored in the laboratory. When subsamples are collected of this material, holding times apply from the new time of collection to preparation or analysis, as appropriate. For this project and samples of such high concentration, holding time exceedances, if encountered, are expected to have very little effect on data quality.

**Sample Dilutions.** Dilution of a sample results in elevated RLs and high dilution factors are expected for this project with samples of such high concentrations. When dilutions are necessary because of high concentrations of target or non-target analytes, lesser dilutions should also be reported, if possible, to fully characterize the sample for each analyte. For samples of such high concentration, it is expected that lesser dilutions will not be possible. The level of the lesser dilution should be such that it will provide the lowest possible RLs without having a lasting deleterious effect on the analytical instrumentation.
When a sample exhibits characteristics of matrix interference that are identified through analytical 
measurement or visual observation, appropriate cleanup procedure(s) must be proven ineffective or 
inappropriate, prior to proceeding with dilution and analysis.

**Manual Integration.** The laboratory is required to provide all analysts performing methods that rely on 
interpretation of chromatographic data with training on appropriate software or manual integration 
practices. The laboratory also will make every effort to minimize the use of manual integration of data. If the 
need arises to use manual integration to correct a software auto-integration error, the manual integration 
will be clearly identified in the instrument data. Before and after enlargements of the region of the 
chromatogram where the manual integration was performed, will be provided on an appropriate scale that 
allows an independent reviewer to evaluate the need and quality of the manual integration. The analyst also 
will document the reason for the manual integration on the chromatogram along with their date and initials. 
The laboratory manager or designee will approve the manual integration by dating and initialing the 
chromatogram.

**B6 Instrument Equipment Testing, Inspection and Maintenance**

**Testing**

Field sampling equipment will be similar to instruments described in the Toxic Organic Compendia. Prior to 
field deployment, the field team will assemble and run the samplers in a laboratory setting. The field 
operators will perform external and internal leak checks and temperature, pressure and flow rate 
verification as required by the sampling method. If any of these checks are out of specification, the field 
technicians will perform corrective action.

**Inspection**

All equipment used to conduct sampling will be inspected in the field according to the manufacturer’s 
recommendations as noted in the instrument manuals. If inspection suggests that instruments are out of 
specification, the field technicians will perform corrective action.

**Maintenance**

A preventative maintenance program consists of positive actions aimed toward preventing failure of 
monitoring and analytical systems. The overall objective of a routine preventive maintenance program is to 
increase measurement system reliability and provide complete data acquisition. Preventive maintenance 
schedules for each monitoring and laboratory instrument will be in accordance with the manufacturer’s 
recommendations as noted in the instrument manuals. Only qualified personnel will service instruments and 
equipment. All maintenance actions, scheduled or unscheduled will be documented in the appropriate 
logbook or data sheet.

Whenever practical, field and analytical equipment should be maintained under a service contract. Such 
contracts allow for preventative system maintenance and repair on an “as-needed” basis. The laboratory 
should have sufficient trained staff to allow for the day-to-day maintenance of equipment. All laboratory 
instruments will be maintained in accordance with manufacturer’s specifications and within the 
requirements of the laboratory quality assurance manual (QAM). All maintenance activities are required to 
be documented in the logbooks to provide a history of maintenance records.

If field equipment becomes out of specifications and or unusable, additional instrumentation will be 
purchased or rented such that the required sampling will continue to occur.

**B7 Instrument Calibration and Frequency**

**Field Instruments**

The E-BAM has a built-in mass membrane calibrator. The membrane is automatically moved into the beta 
particle pathway to determine the “mass” of the membrane each hour or when the filter tape advances. 
Each membrane has a factory-verified mass, and that value is stored in the E-BAM. When the hourly 
membrane calibration is made, the computed value is compared to the stored factory value to determine
proper operation. The membrane must be withdrawn for normal measurements. Should the instrument fail to perform to specification, an error flag is logged in memory, and data collected subsequently are flagged. The data coordinator then invalidates data that have been flagged during data review. Failure of this test will result in further troubleshooting, such as cleaning of the instrument or other procedures based on consultation with the manufacturer.

Zero testing of blank filter paper is performed at the beginning and end of each sample period (in this case, hourly) to ensure the stability of the measurement system. Zero testing is based on the ability of the E-BAM to hold a constant output when measuring blank filter paper. If the difference between the two values exceeds the factory preset limit of ±2 percent, a data error message is logged in the error log and the digital data value is flagged.

Field Verification and Calibration of Flow System. Flow verification of the E-BAMs are conducted every month by the site operator. The flow verification or check is performed before any instrument adjustment is made. The resulting data from the checks is used to measure precision. The flow of the E-BAM is compared to a primary flow meter. If the results of the flow check do not fall within the project’s warning threshold of ±2 percent then the instrument is adjusted and rechecked. The EPA criteria of ±4 percent is used for data validation.

If the instrument flow checks fall outside the 4 percent criteria, data from the date of the failed flow check back to the last successful flow check are qualified as invalid by the data coordinator.

The BAM-1020 instruments used for this monitoring program are equipped with a volumetric flow meter. Volumetric flow measures the volume of flow in actual ambient conditions. Volumetric flow check and calibration requires a reference volumetric flow meter. A NIST traceable volumetric flow calibration kit will be used to perform flow checks and calibrations. This flow meter is a primary standard and no calibration is necessary. However, as part of the QA requirements of this project, the flow standard is factory certified once every year.

Laboratory Instruments
The instrument calibration procedures are described in the internal laboratory SOPs. Records of calibrations will be filed and maintained by the laboratory. These records will be subject to QA audit. All standards used for the calibration of equipment will be traceable, directly or indirectly, to the NIST. All standards received will be logged into standard receipt logs maintained by the individual analytical groups. Each group maintains a standards log that tracks the preparation of standards used for calibration and QC purposes.

B8 Inspection/Acceptance for Supplies and Consumables
All purchased or rented supplies and consumables will be inspected to assure that the quality and function will adhere to the standards necessary to meet all project objectives. Documented inspection and acceptance criteria are necessary to ensure consistency of supplies.

PM Filter Tape
Quartz microfiber filters tapes are used by the E-BAMs to determine mass loading. Filter tape ready for field use will be stored and maintained according to manufactures specifications prior to use. Filter material may be brittle and subject to shearing and breakage. Laboratory and field personnel must be aware of these characteristics and handle sample filter tape with care.

Canisters
Canisters will be inspected for damage and will not be used if there is visible damage. The vacuum of the canister will verified that it is between 28 and 30 inches Hg. Canisters will not be used if the initial vacuum is less than 28 inches Hg because that canister may have leaked during shipment.
Radionuclides
Radionuclide supplies and materials will continue to conform to existing DOE procedures and specifications such as glass fiber (Type A/E) filters, P-10 argon/methane counting gas, and the Technetium-99 (Tc-99) and Thorium-230 (Th-230) standard sources.

B9 Non-direct Measurements
Data required for project implementation and decision making that are not obtained from direct measurements include historical records, chemical and physical properties, geographic information, meteorological information and external databases. These data will be obtained from nationally and/or internationally recognized sources such as:

- ASTM International
- California Air Resource Board
- International Organization for Standardization
- NIST
- EPA
- United States Geological Survey
- U.S. Weather Service

B10 Data Management
Data management entails storing, handling, accessing, and securing analytical data associated with sampling and analytical data for the project. The following sections describe the project’s data management process.

Archiving
Hard copy and electronic versions will be archived in project files and on electronic archives for the duration of the project, 5 years or as specified in contractual agreements.

Data Flow and Transfer
The data flow from the laboratory and field to the project staff and data users will be sufficiently documented to ensure that data are properly tracked, reviewed and validated for use.

Record Keeping
In addition to the data management procedures outlined in Section A9 for analytical data, the laboratory will ensure that it maintains electronic and hard copy records sufficient to recreate each analytical event. The minimum records the laboratory will keep contain the following:

- Chemical analysis raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports
- Analytical chemistry laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples
- Radiological records generally cover the following processes: field sample collection and laboratory identification coding; sample preparation method; radioactivity measurement (counting) of samples, instrument backgrounds, and analytical blanks; and data reduction and verification.
- Radiological quality control records for laboratory counting systems include the results of measurements of radioactive check sources, calibration sources, backgrounds, and blanks as well as a complete record of all maintenance and service.

Record Preservation
Records shall be maintained pursuant to the requirements included in the 2007 Consent Order (Section 4.9 “Record Retention”)
C Assessment and Oversite

C1 Assessment and Response Actions

An assessment is defined as an evaluation process used to measure the performance or effectiveness of the quality system. The results of quality assurance assessments indicate whether the control efforts are adequate or need to be improved. Documentation of all quality assurance and quality control efforts implemented during the data collection, analysis, and reporting phases is important to data users, who can then consider the impact of these control efforts on the data quality.

Field and laboratory audits will be performed on an as-needed and or according to the EPA’s Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II-Ambient Air Quality Monitoring Program (EPA, 2013) to evaluate the quality system. The purposes of the audits are as follows:

- Confirm appropriate documents are properly completed and are kept current and orderly
- Ensure measurement systems are accurate
- Identify nonconformance or deficiencies and to initiate necessary corrective actions
- Verify that field and laboratory QA procedures called for in this QAPP are properly followed and executed

The QA Manager is responsible for ensuring conformance with the QAPP. The FTL is responsible for ensuring conformance with field QA/QC requirements. Activities selected for audit will be evaluated against specified requirements, which will include an evaluation of the method, procedures and instructions. Documents and records will be examined as necessary to evaluate whether the QA program is effective and properly implemented. Reports and recommendations must be prepared on all audits and submitted to the QA manager for retention in the project files. Radionuclide sampling activities and data review will continue to conform to existing DOE procedures and standards.

Field Audits

Planning, scheduling and conducting QA audits and surveillance are required to verify on site sampling activities are being performed efficiently in conformance with approved plans; standards, federal, and state regulatory requirements; sound scientific practices; and contractual requirements. Planned and scheduled audits may be performed to verify compliance with aspects of the QA program and to evaluate the effectiveness of the QA program. Audits include an objective examination of work areas, activities, processes, review of documents and records, interviews with project personnel and review of plans and standards.

Field documentation (for example, chain of custody forms, field daily sheets, logbooks) will be reviewed as generated by the FTL or designee for accuracy, completeness, and compliance with QAPP requirements. The FTL will audit field sampling procedures periodically for compliance with QAPP procedures. The auditor will check for the following:

- Sampling protocols are being followed.
- Samples are placed in proper containers.
- Samples are stored and transported properly.
- Field documentation is completed.

Field Corrective Action. Any project team member may initiate a field corrective action process. The corrective action process consists of identifying a problem, acting to eliminate the problem, monitoring the effectiveness of the corrective action, verifying that the problem has been eliminated and documenting the corrective action.

Corrective actions include correcting chain of custody forms; problems associated with sample collection, packaging, shipping, field record keeping; or additional training in sampling and analysis. Additional
approaches may include resampling or evaluating and amending sampling procedures. The team member in charge of field operations (FTL) will summarize the problem, establish possible causes, and designate the person responsible for a corrective action. The FTL will verify that the initial action has been taken and whether it appears to be effective. The FTL will additionally follow up to verify that the problem has been resolved.

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformances or suspected deficiencies to the FTL. The FTL will be responsible for assessing suspected problems in consultation with the QA manager and the PM as to whether the situation affects data quality. If it is concluded that the situation warrants a reportable nonconformance requiring corrective action, a nonconformance report will be initiated by the FTL.

The FTL will be responsible for ensuring that corrective action for non-conformances are initiated by the following:

- Evaluating all reported nonconformances
- Controlling additional work on nonconforming items
- Selecting disposition or action to be taken
- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Ensuring nonconformance reports are included in the final documentation in the project files

**Laboratory Audits**

The laboratory QA manager may conduct internal system audits. An internal audit is a qualitative evaluation of all components of the laboratory QC measurement system. The audit serves to determine if all measurement systems are being used appropriately. The system audits are conducted to evaluate the following:

- Sample handling procedures
- Calibration procedures
- Analytical procedures
- QC results
- Safety procedures
- Record keeping procedures
- Timeliness of analysis and reporting

In addition, laboratories are subject to external audits. The focus of these audits is to assess general laboratory practices and conformance to the QAPP. Laboratory audits may be performed prior to the start of analyses for this project and at any time during the course of the project as deemed necessary.

The laboratory QA manager will review internal laboratory performance and will evaluate laboratory precision and accuracy by comparing results of duplicate samples, QC samples, spikes and blanks. When a beyond-control limit situation is encountered, the laboratory manager or other client services will check analytical results prior to distribution.

**Laboratory Corrective Action.** Corrective actions may be required for two classes of problems: analytical/equipment problems and noncompliance problems. Analytical/equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis or data review.

For noncompliance problems, a corrective action program will be developed and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the proper project member. If the problem is analytical in nature, information on these problems will be communicated to the laboratory QA manager and the QA manager, who will in turn direct information to proper project members. Implementation of corrective action will be confirmed through similar channels.
Implementation of all corrective actions will be documented. No staff member will initiate corrective action without prior communication of action needing correction and proposed corrective action through the proper channels. If corrective actions are insufficient, the PM or the QA manager may issue a stop work order.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event. Laboratory personnel are alerted that corrective actions may be necessary if the following occurs:

- QC data are outside the warning or acceptable windows for precision and accuracy
- Blanks contain target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- Unusual changes in detection limits occur
- Inquiries concerning data quality are received
- Deficiencies are detected by the laboratory QA manager during internal or external audits or from results of performance evaluation samples

Corrective action procedures are often handled at the bench level by the analyst, who reviews preparation or extraction procedures for possible errors, checks instrument calibrations, spike and calibration mixes, and instrument sensitivity. If problems persist or cannot be identified, matters are referred to the laboratory supervisor, laboratory PM, and/or laboratory QA manager for further investigation. Once resolved, full documentation of the corrective action procedures is filed with the laboratory QA manager after approval by CH2M HILL. Corrective action may include the following:

- Resampling and analyzing
- Evaluating and amending sampling procedures
- Evaluating and amending analytical procedures
- Accepting data and acknowledging the level of uncertainty
- Reanalyzing the samples, if sample or extract volume is adequate and holding time criteria permits

If resampling is deemed necessary due to laboratory problems, the PM must identify the appropriate approach, including cost recovery from the laboratory, for the additional sampling effort.

**Particulate Matter Verification Audits**

One audit will be conducted by the QA Officer to ensure compliance with this QAPP within 30 days of station installation. An independent observer should be present for the audit, preferably the routine operator of the sampling equipment. This practice not only contributes to the integrity of the audit, but also allows the operator to offer explanations and information that will help the auditor to determine possible causes of discrepancies between audit-standard values and the sampling equipment values.

An initial equipment deployment audit will be conducted by staff that are not directly involved in day-to-day site operations, and quarterly thereafter for the duration of the monitoring program, including the end. The external audit is a quantitative evaluation of specific components of the E-BAM sampling system and serves to determine if all measurement systems are being used appropriately. Audit procedures for the E-BAM call for comparing the audit flow rate measured by the audit device to the indicated sampler flow rate. Flow rates measured in liters per minute are compared at actual conditions of temperature and pressure. Field measurements of temperature and pressure are recorded during an audit. The difference between the audit flow and the BAM indicated flow must be within ±7% to pass the audit. Audits will be performed by personnel who are not involved in the daily operation of the sites.

**Particulate Matter Verification Audits Corrective Action.** Corrective actions may be required as a result of external audits. Any nonconformances will be corrected on the spot if possible or a plan of corrective action
will be developed and implemented as necessary. Any nonconformances identified during the external audits will be reviewed for their effect on collected data and a determination regarding data validity will be made. All audit activities, corrective actions and data reviews will be documented.

**Radionuclide Verification Audits**
Radionuclide sampling activities, data collection oversight and auditing activities will continue to follow existing DOE procedures.

**Radionuclide Verification Audits Corrective Action.** Corrective actions may be required as a result of audit activity. Any nonconformances will be corrected on the spot if possible or a plan of corrective action will be developed and implemented as necessary. Any nonconformances identified during the external audits will be reviewed for their effect on collected data and a determination regarding data validity will be made. All audit activities, corrective actions and data reviews will be documented as appropriate.

**C2 Reports to Management**
Regular QA reports to management alert management of data quality problems, propose viable solutions to problems and allow for the procurement of additional resources to address those problems. Effective communication among all personnel is an integral part of the quality system. The FTL, QA Officer and project manager will communicate on a regular and scheduled basis to discuss adherence to sampling schedules and methods, delivery of data and reports and deviations from approved QA and test plans.

If audits are conducted, audit reports will be submitted to the PM to address any QA issues or proposed corrective actions to maintain QA standards. In addition, after the sample results are received from the laboratory and validated, reduced and tabulated, comprehensive data evaluation reports will be submitted documenting sampling activities on a quarterly basis.

The following reports will be prepared:

- Laboratory results report including case narrative will be prepared by the analytical lab.
- Data evaluation report will be prepared after reviewing and compiling data for quarterly time-periods.
D  Data Review, Validation, and Usability

D1  Data Review and Validation

Data review and validation are the processes by which data generated in support of a project are reviewed against the data QA/QC requirements. The data are evaluated for precision and accuracy against the analytical protocol requirements. Nonconformance or deficiencies that could affect the precision or accuracy of the reported result are identified and noted in the laboratory case narrative. The effect on the result is then considered when assessing whether the result is sufficient to achieve DQOs. Deficiencies discovered as a result of data validation and review, as well as corrective actions implemented in response, will be documented and submitted as part of project reports.

D2  Verification and Validation Methods

Personnel involved in the data verification function are the same as those generating the data. Before the data packages are released, the data preparer is responsible for review and verification of the data. These procedures include the following:

- Review E-BAM recorded data and parameters for validity.
- Review radionuclide sampling data for validity.
- Review laboratory data package for completeness. Results must be generated for samples submitted for analysis.
- Review COC records for discrepancies.
- Review for compliance with holding time and QC frequency requirements.
- Review QC sample results. Any exceedances must be documented in the case narrative. Corrective action must be taken as appropriate and may include qualifying (flagging) the data.
- Refer to Table 10 for the laboratory-flagging convention.
- Initiation of corrective actions, as necessary, based on the data review findings. If there are exceedances which have a significant effect on data usability, then their effect on the data is discussed in a report section.

TABLE 10
Flagging Conventions
Quality Assurance Project Plan, SSFL, Ventura County, California

<table>
<thead>
<tr>
<th>Qualifier</th>
<th>Definition</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>[None]</td>
<td>Detected or positive result</td>
<td>Detect status</td>
<td>Associated numeric result is the RL (not MDL or IDL, etc.). Results detected at less than the MDL, IDL, or other lowest-level of reporting may be noise and should be reported as nondetect (U-flagged at the RL).</td>
</tr>
<tr>
<td>U (unclassifiable)</td>
<td>Nondetect result</td>
<td>Detect status</td>
<td></td>
</tr>
<tr>
<td>J (organics)</td>
<td>Below reporting limit</td>
<td>Concentration Range</td>
<td>Applied to a detected result if less than the reporting limit but greater than the lowest-level of reporting.</td>
</tr>
<tr>
<td>B (inorganics)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 10

**Flagging Conventions**

*Quality Assurance Project Plan, SSFL, Ventura County, California*

<table>
<thead>
<tr>
<th>Qualifier</th>
<th>Definition</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>E (organics)</td>
<td>Exceeds calibration range</td>
<td>Concentration Range</td>
<td>Applied to a detected result if greater than the highest calibration standard. Often, this necessitates reanalysis at a dilution.</td>
</tr>
<tr>
<td>B (organics)</td>
<td>Blank contamination</td>
<td>Contamination</td>
<td>Applied to a detected result if the same compound was also detected in an associated method blank.</td>
</tr>
</tbody>
</table>

The laboratory may use these optional laboratory qualifiers without further-defining them. If different qualifiers are used for the same definitions, they must be redefined in the case narrative or on the Form 1s. If additional qualifiers are used, they must be defined in the case narrative or on the Form 1s. The following laboratory qualifiers are optional if applicable:

<table>
<thead>
<tr>
<th>Qualifier</th>
<th>Definition</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>* (inorganics)</td>
<td>Laboratory replicate or MS/MSD exceedance</td>
<td>QA/QC exceedance (precision)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Laboratory comment</td>
<td>Miscellaneous</td>
<td>Applied if there is a miscellaneous comment (the comment must be provided).</td>
</tr>
<tr>
<td>D</td>
<td>Result of a dilution</td>
<td>Concentration Range</td>
<td>Applied to a detected result if from a dilution factor greater than 1.</td>
</tr>
<tr>
<td>E (inorganics)</td>
<td>Estimated due to interference</td>
<td>Miscellaneous</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Holding time</td>
<td>QA/QC exceedance (holding times)</td>
<td>Applied if the result is associated with a holding time exceedance.</td>
</tr>
<tr>
<td>N (inorganics)</td>
<td>Spiked sample (LCS, MS, MSD) recovery outside control limits</td>
<td>QA/QC exceedance (accuracy)</td>
<td></td>
</tr>
<tr>
<td>P (organics)</td>
<td>Poor dual-column reproducibility</td>
<td>QA/QC exceedance (precision)</td>
<td>Applies only to dual-column analyses.</td>
</tr>
</tbody>
</table>

**Notes:**

IDL = Instrument Detection Limit  
LCS = Laboratory Control Sample  
MDL = Method Detection Limit  
MS = Matrix Spike  
MSD = Matrix Spike Duplicate  
QA = Quality Assurance  
QC = Quality Control  
RL = Reporting Limit

### D3 Reconciliation with DQOs

This process is intended to assess whether the data meet the planned DQOs for the project. The results are examined and an assessment is made to determine whether the data are of sufficient quality to support the DQOs. The data will be evaluated according to the data quality indicators and measurement quality objectives as stated in Section A7. If the data are sufficient to achieve project objectives, the PM will release the data and decisions may be made. If not, then corrective action may be required.
References


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