National Aeronautics and Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

September 21, 2017

AS01

Mr. Mark Malinowski
SSFL Program Manager
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento CA 95824

SUBJECT: *Santa Susana Field Laboratory Baseline Air Monitoring Work Plan*

Dear Mr. Malinowski:

The National Aeronautics and Space Administration is submitting the *Final Baseline Air Monitoring Work Plan* on behalf of Department of Energy – Energy Technology and Engineering Center, The Boeing Company, and NASA for your approval. This document includes revisions addressing DTSC comments from DTSC July 20, 2017 and August 4, 2017 letters on the Final Baseline Air Monitoring Plan.

If you have any questions, please contact me at (202) 714-0496.

Sincerely,

Peter Zorba
NASA Project Director

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete.

Signature: ____________

Name: *Peter Zorba*

Title: *NASA SSFL Project Director*

Date: 21 Sept 2017

Attachment

cc: Roger Paulson/DTSC
Mark Zeller/The Boeing Company
Art Lenox/The Boeing Company
John Jones/DOE ETEC
Stephanie Jennings/DOE ETEC

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Final

Baseline Air Monitoring Work Plan Santa Susana Field Laboratory, Ventura County, California

Submitted to

California Department of Toxic Substances Control

Prepared for

National Aeronautics and Space Administration George C. Marshall Space Flight Center, The Boeing Company, and Department of Energy Energy Technology and Engineering Center

September 2017

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Contents

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Acronyms and Abbreviations

%R	percent recovery
$\mu g/m^3$	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
CCV	continuing calibration verification
CFR	*Code of Federal Regulations*
COC	chain-of-custody
COPC	chemical of potential concern
d_i	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
ICV	initial calibration verification
ID	identification number
IDL	instrument detection limit
LCS	laboratory control sample
lpm	liter(s) per minute
MDL	method detection limit
MEK	2-Butanone
mg/m3	milligram(s) per cubic meter
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
$PM_{2.5}$	particulate matter less than 2.5 microns in aerodynamic diameter
PM_{10}	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
RPD	relative percent difference
SCAQMD	South Coast Air Quality Management District
SLAMS	state or local air monitoring station
SOP	standard operating procedure
SSC	site safety coordinator
SSFL	Santa Susana Field Laboratory
USAF	U.S. Air Force
VCAPCD	Ventura County Air Pollution Control District
VOC	volatile organic compound

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 California Department of Toxic Substances and Control (DTSC) sent a letter to the RPs on July 13, 2015, directing them to prepare this plan. 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 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 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 Air 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

Monitor Location	County	Distance to SSFL (miles)	2010 (µg/m³)	2011 (µg/m³)	2012 (µg/m³)	2013 (µg/m³)	2014 (µg/m³)	5 Year Average (µg/m³)
LA - North Main Street	Los Angeles	42	NA	28.7	30.0	35.3	30.2	31.1
LAX - Westchester Parkway	Los Angeles	45	NA	21.4	19.6	NA	21.9	21.0
Santa Clarita	Los Angeles	26	20.0	NA	NA	20.6	22.1	20.9
El Rio-Rio Mesa School	Ventura	27	21.7	22.2	21.0	24.3	NA	22.3
Ojai-Ojai Avenue	Ventura	39	15.1	15.9	NA	NA	NA	15.5
Simi Valley - Cochran Street	Ventura	3	18.8	19.6	19.5	22.5	NA	20.1
		Average	18.9	21.6	22.5	25.7	24.7	21.8

Notes:
Data obtained from the California Air Resources Board iADAM System: http://www.arb.ca.gov/adam/index.html.
µg/m³ = microgram(s) per cubic meter
CAAQS = California Ambient Air Quality Standards
NA = Not Available

Monitoring Approach

Baseline Monitoring

This Work Plan outlines the approach for the baseline monitoring phase. The stations used to collect the baseline data will continue to operate during excavation and cleanup activities. Additional but not identical monitoring will occur near the excavation and cleanup activity. All data will be used to evaluate whether remedial activities are affecting air quality.

Previous environmental studies conducted at SSFL suggest that potential airborne contaminants associated with remedial activities could include PM, radionuclides, inorganic compounds, and organic compounds. Metals of concern are not volatile and are in solid phase if they are present in soil. Organic chemicals 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 chemicals of concern. Measurements of airborne particulate matter may be indicative of particulate matter originating from the local area as a result of nearby soil-disturbing activities. Chemicals of concern are soil bound with low or no volatility. Therefore, it is reasonable to expect airborne particulate matter to be a direct indicator of the contribution of local activities to airborne chemicals of concern and subsequent transport of those compounds. In addition to PM_{10}, the Baseline Air Monitoring program will include sampling for $PM_{2.5}$, VOCs, and radionuclides.

The overall goal of the baseline monitoring is to characterize pre-project levels of VOCs, PM_{10}, $PM_{2.5}$, 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. Refer to Table 5 of the Quality Assurance Project Plan (QAPP) for additional details regarding sampling locations.

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 E-BAM. The E-BAM allows for remote operation and operation off the power grid and provides high quality, semi-continuous data.

The E-BAM 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 E-BAM 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).

$PM_{2.5}$

The proposed monitoring method for $PM_{2.5}$ is the MetOne E-BAM. The $PM_{2.5}$ E-BAMs will not be equipped with wind speed and direction sensors as they are collocated with the PM_{10} E-BAMs.

$PM_{2.5}$ concentration data can be collected via the E-BAM 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 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. Samples will be collected on alternating days of the week to account for potential daily variability in nearby industrial emissions.

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, airborne particulate radioactivity samples will be collected at 35 liters per minute (lpm) on glass fiber (Type A/E) filters that will be changed twice a week. 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 onsite meteorological towers 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 PM_{10} data. Local wind speed and direction data interfaced with the PM_{10} E-BAMs will enable data collection to be representative of each area being sampled. As described above, the PM_{10} E-BAM units will be equipped with optional wind speed and direction sensors in order to correlate hourly particulate 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 meteorological, $PM_{2.5}$, PM_{10}, VOC, and radionuclide data; the results from field quality assurance (QA) checks performed on the monitor; and any performance audit results for further determination of data validity. Analysis of particulate matter is anticipated to include an evaluation of local particulate concentrations relative to background levels as indicated by the nearest state or local air monitoring station (SLAMS) sites. The comparisons will note that the nearest SLAMS sites are in Simi Valley (VCAPCD) and Reseda (SCAQMD), which are 3 miles north and 8 miles east of SSFL, respectively, and about 1,000 feet lower in elevation. Both of these sites are impacted by local vehicle traffic (road dust) and local stationary sources (e.g., industrial). These impacts affect the respective local populations. Localized concentration increases may be attributed to localized activities, with corresponding releases of chemicals of concern based on measured concentrations in soil at nearby remediation sites. A qualitative check on local wind directions will be used to verify the reasonableness for attribution of measurements to local activities.

A proposed outline of the quarterly report is presented in Appendix B.

Schedule

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

Task	Duration	Cumulative Date
1. Receive RFP	-	NTP
2. Contract	45 days	45 days
3. Order equipment	5 days	50 days
4. Receive equipment	60 days	110 days
5. Install equipment	25 days	135 days
6. Internal Equipment audit	10 days	145 days
7. Equipment Checkout[a]	60 days	205 days
8. Commence Baseline operation	0 days	205 days

[a] Verification of acceptable equipment performance and adequate power supplies.
NTP = Notice to Proceed
RFP = Request for Proposal

Quality Assurance Project Plan

Appendix A to this document, the 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

California Air Resource Board (CARB). 2015. iADAM Air Quality Data Statistics Webpage. Accessed November 10. http://www.arb.ca.gov/adam/index.html.

U.S. Environmental Protection Agency (EPA). 2000. *Meteorological Monitoring Guidance for Regulatory Modeling Applications*. EPA-454/R-99-005. February.

U.S. Environmental Protection Agency (EPA). 2002. *Guidance for Quality Assurance Project Plans*. EPA QA/G-5 (EPA 240/R-02/009). December.

U.S. Environmental Protection Agency (EPA). 2013. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Quality Monitoring Program,* EPA-454/B-13-003. May.

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Figure

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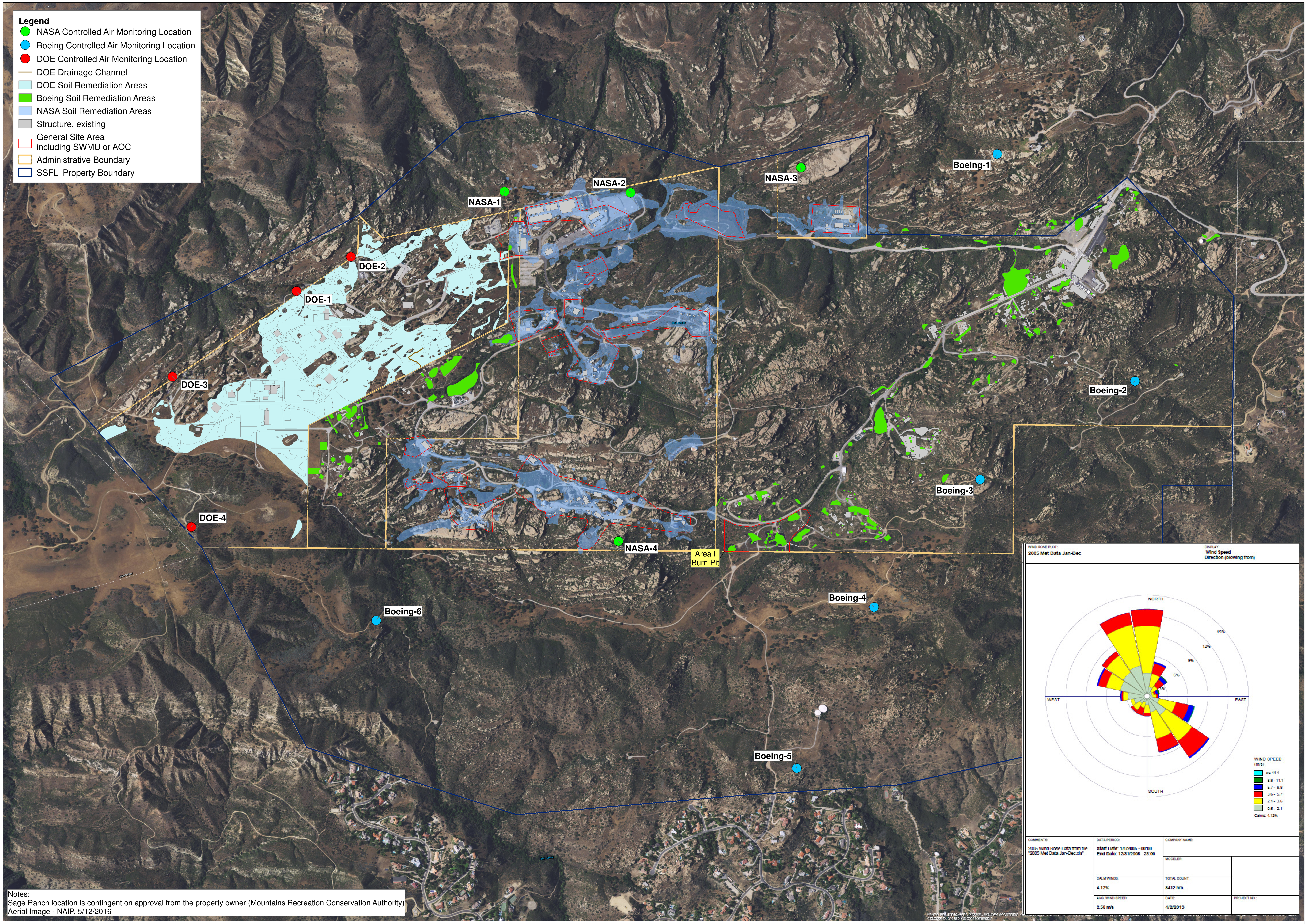

0 500 1,000 2,000 Feet

0 150 300 600 Meters

25-Aug-2017
Drawn By:
A. Cooley

Figure 1
Air Monitoring Locations
Santa Susana Field Laboratory
Ventura County, California

Map Document: O:\NASA\SSFL\maps\Air_MonitoringLocs.mxd

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Appendix A
Quality Assurance Project Plan

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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 Quality Assurance Project Plan (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 Santa Susana Field Laboratory (SSFL) in Ventura County, California.

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 (QA) Manager
- National Aeronautics and Space Administration (NASA) SSFL Project Manager
- U.S. Department of Energy (DOE) SSFL Project Manager
- The Boeing Company (Boeing) SSFL Project Manager
- State of California Department of Toxic Substances Control (DTSC)

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 1
Project Roles and Responsibilities
Quality Assurance Project Plan, SSFL, Ventura County, California

Position	Responsibilities
Project Manager (PM)	Each RP will have a designated PM who is responsible for management of all phases of the project.
QA Officer	The designated QA officer will be responsible for overall conformance with the QAPP.
Health and Safety Manager (HSM)	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).
Field Team Leader (FTL)/Site Safety Coordinator (SSC)	The FTL/SSC will supervise and direct the daily activities of each field team as appropriate.
Field Team Members	Field Team Members will ensure that field activities are conducted in accordance with this Work Plan, QAPP, and all instrument operating manuals.
Subcontractors	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.
Analytical Laboratory	The laboratory will perform analysis of volatile organic compounds (VOCs), following associated laboratory standard operating procedures (SOPs) and quality assurance/quality control (QA/QC) procedures.

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 U.S. 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. Chemicals of potential concern (COPCs) that are proposed for the baseline monitoring phase include radionuclides, $PM_{2.5}$, PM_{10}, and VOCs.

PM_{10}

Air samples for PM_{10} will be collected on a continuous basis at 14 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 milligrams per cubic meter (mg/m^3). The hourly averages will be used to calculate a 24-hour average. For reporting purposes, particulate concentrations will be reported in micrograms per cubic meter ($\mu g/m^3$). The data management section of this document describes the data validation requirements and the criteria for calculating the 24-hour averages.

$PM_{2.5}$

Air samples for $PM_{2.5}$ will be collected on a continuous basis at three locations—NASA-2, Boeing-1, and Boeing-4, 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 $\mu g/m^3$. 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 14 locations, according to U.S. Environmental Protection Agency (EPA) method TO-15 for VOCs, and collected over a 24-hour period. VOC results will be statistically reviewed throughout the monitoring period. 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. If there are consistent non-detects for specific VOCs, they may be removed from the analyte list on approval from DTSC.

Tables 2 and 3 list the compounds and estimated reporting limits (RL) for particulates and VOCs.

TABLE 2
PM_{10} and $PM_{2.5}$ Reporting Limits
Quality Assurance Project Plan, SSFL, Ventura County, California

Compound Name	Reporting Limit ($\mu g/m^3$)
PM_{10}	2.5
$PM_{2.5}$	2.5

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

Compound Name	CAS Number	Reporting Limit µg/m³
1,1,1-Trichloroethane	71-55-6	2.77
1,1,2,2-Tetrachloroethane	79-34-5	3.49
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	3.90
1,1,2-Trichloroethane	79-00-5	2.77
1,1-Dichloroethane	75-34-3	2.06
1,1-Dichloroethene	75-35-4	2.02
1,2,4-Trichlorobenzene	120-82-1	3.77
1,2,4-Trimethylbenzene	95-63-6	2.50
1,2-Dibromoethane (EDB)	106-93-4	3.91
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	3.56
1,2-Dichlorobenzene	95-50-1	3.06
1,2-Dichloroethane	107-06-2	2.06
1,2-Dichloropropane	78-87-5	2.35
1,3,5-Trimethylbenzene	108-67-8	2.50
1,3-Butadiene	106-99-0	1.13
1,3-Dichlorobenzene	541-73-1	3.06
1,4-Dichlorobenzene	106-46-7	3.06
1,4-Dioxane	123-91-1	1.83
2-Butanone (MEK)	78-93-3	1.50
2-Hexanone	591-78-6	2.08
4-Ethyltoluene	622-96-8	2.50
4-Methyl-2-pentanone (MIBK)	108-10-1	2.08
Acrolein	107-02-8	1.17
Acrylonitrile	107-13-1	1.10
Benzene	71-43-2	1.62
Benzyl chloride	100-44-7	2.63
Bromodichloromethane	75-27-4	3.41
Bromoform	75-25-2	5.26
Bromomethane	74-83-9	1.97
Carbon disulfide	75-15-0	1.58
Carbon tetrachloride	56-23-5	3.20
Chloroethane	75-00-3	1.34
Chloroform	67-66-3	2.48
Chloromethane	74-87-3	1.05
cis-1,2-Dichloroethene	156-59-2	2.02
cis-1,3-Dichloropropene	10061-01-5	2.31
Cyclohexane	110-82-7	1.75
Dibromochloromethane	124-48-1	4.33
Dichlorodifluoromethane	75-71-8	2.51

TABLE 3
TO-15 CAS Numbers and Reporting Limits
Quality Assurance Project Plan, SSFL, Ventura County, California

Compound Name	CAS Number	Reporting Limit µg/m³
Ethyl Acetate	141-78-6	1.83
Ethylbenzene	100-41-4	2.21
Heptane	142-82-5	2.08
Hexachlorobutadiene	87-68-3	5.36
Isopropanol	67-63-0	1.25
Isopropylbenzene	98-82-8	2.50
m,p-Xylene	108-38-3/1	4.42
Methyl tert-butyl ether (MTBE)	1634-04-4	1.83
Methylene chloride	75-09-2	1.77
Naphthalene	91-20-3	2.67
n-Butylbenzene	104-51-8	2.79
n-Hexane	110-54-3	1.79
n-Octane	111-65-9	2.38
n-Propylbenzene	103-65-1	2.50
o-Xylene	95-47-6	2.21
p-Isopropyltoluene	99-87-6	2.79
sec-Butylbenzene	135-98-8	2.79
Styrene	100-42-5	2.17
Tetrachloroethene (PCE)	127-18-4	3.45
Tetrahydrofuran	109-99-9	1.50
Toluene	108-88-3	1.92
trans-1,2-Dichloroethene	156-60-5	2.02
trans-1,3-Dichloropropene	10061-02-6	2.31
Trichloroethene (TCE)	79-01-6	2.73
Trichlorofluoromethane	75-69-4	2.86
Vinyl acetate	108-05-4	1.79
Vinyl Chloride	75-01-4	1.30
Xylenes, Total	1330-20-7	6.63

Table 4 outlines the VOC, particulate, and radionuclide sampling methodologies. Table 5 lists the proposed site locations. The Sage Ranch location is contingent on approval from the property owner (Mountains Recreation Conservation Authority). The selection of monitoring sites was based on several factors, including data quality objectives (DQOs), monitoring equipment configuration, site accessibility, topography, and prevailing wind direction. The stations encircle the site to provide a comprehensive network to capture potential contamination exiting the site.

TABLE 4
Air Sampling Methodologies
Quality Assurance Project Plan, SSFL, Ventura County, California

Method	Parameters	Field Locations	Duplicate (per event)
TO-15	VOCs[a]	14 (364)	2 (52)
PM_{10}	Particulate	14	-
$PM_{2.5}$	Particulate	3	-
DOE-HDBK-1216-2015, Section 6.7	Radionuclides	6 (312)	-

[a] The use of particulate filters on Summa canisters will be evaluated in consultation with the analytical laboratory
Yearly samples in parenthesis.

$PM_{2.5}$ = particulate matter less than 2.5 microns in aerodynamic diameter
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

Site	Rationale	Parameters	Operator	Location Description	Sampling Frequency
Boeing 1: Sage Ranch[a]	NE of remediation area	VOC, PM_{10} $PM_{2.5}$	Boeing	500 meters NNW of the Boeing Office Trailer	Bi-Weekly, Daily, Daily
Boeing 2: RD-120	E and SE of remediation area	VOC, PM_{10}	Boeing	RD-120 Well, 800 meters SSE of Main Gate	Bi-Weekly, Daily
Boeing 3: Bowl Test Stands	SE of remediation area	VOC, PM_{10}	Boeing	500 meters ESE of Bowl Test Stands	Bi-Weekly, Daily
Boeing 4: SE of Area I Burn Pit	SE of remediation area, proximity to Burn Pit	RAD, VOC, PM_{10}, $PM_{2.5}$	Boeing	400 meters South of CTLIII	Weekly, Bi-Weekly, Daily, Daily
Boeing 5: Antenna Station	SE of remediation area, proximity to Burn Pit	RAD, VOC, PM_{10}	Boeing	1000 meters S of Area I Burn Pit	Weekly, Bi-Weekly, Daily
Boeing 6: Southern Undeveloped Land	SW of remediation area, capture potential deposition from northerly winds	VOC, PM_{10}	Boeing		Bi-Weekly, Daily
NASA 1: North of Trailer	NW of remediation area	VOC, PM_{10}	NASA	North of Monitoring Well	Bi-Weekly, Daily
NASA 2: Helipad	N of remediation area	VOC, PM_{10}, $PM_{2.5}$	NASA	NW Corner of Parking lot	Bi-Weekly, Daily, Daily
NASA 3: Pride Rock	N of remediation area	VOC, PM_{10}	NASA		Bi-Weekly, Daily
NASA 4: Pill Box	S of remediation area, capture	VOC, PM_{10}	NASA	Top of Ridge	Bi-Weekly, Daily

TABLE 5
Boeing, NASA, and DOE Monitoring Site Locations
Quality Assurance Project Plan, SSFL, Ventura County, California

Site	Rationale	Parameters	Operator	Location Description	Sampling Frequency
	potential deposition from northerly winds				
DOE-1	NW of remediation area	RAD, VOC, PM_{10}	DOE		Weekly, Bi-Weekly, Daily
DOE-2	W of remediation area	RAD, VOC, PM_{10}	DOE		Weekly, Bi-Weekly, Daily
DOE-3	W of remediation area	RAD, VOC, PM_{10}	DOE		Weekly, Bi-Weekly, Daily
DOE-4	W of remediation area	RAD, VOC, PM_{10}	DOE		Weekly, Bi-Weekly, Daily

[a] Sage Ranch location is contingent on approval from the property owner (Mountains Recreation Conservation Authority)

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. The monitoring will follow the requirements of DOE Order 231.1B (DOE, 2011), DOE Order 458.1 (DOE, 2013) and DOE-HDBK-1216-2015, Section 6.7 (DOE, 2015). During the Baseline Air Monitoring program, airborne particulate radioactivity samples will be collected at 35 lpm on glass fiber (Type A/E) filters that will be changed twice a week. 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) or Strontium-90 (Sr-90) 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. Table 6 shows the proposed methods and analysis. Gamma spectroscopy results from the laboratory include all isotopes found. Only data that passes evaluation will be reported. Non-detects of values that do not pass screening for QA will not be reported.

TABLE 6
Radionuclide Analysis
Quality Assurance Project Plan, SSFL, Ventura County, California

Nuclide	Analysis	Method
Be-7 (natural)	Gammaspec, Gamma, Filter	DOE HASL 300, 4.5.2.3/Ga-01-R
K-40 (natural)	Gammaspec, Gamma, Filter	DOE HASL 300, 4.5.2.3/Ga-01-R
Co-60	Gammaspec, Gamma, Filter	DOE HASL 300, 4.5.2.3/Ga-01-R
Sr-90	GFPC, Sr90, filter	EPA 905.0 Modified
Cs-137	Gammaspec, Gamma, Filter	DOE HASL 300, 4.5.2.3/Ga-01-R

TABLE 6
Radionuclide Analysis
Quality Assurance Project Plan, SSFL, Ventura County, California

Nuclide	Analysis	Method
Po-210 (natural)	Alphaspec Po210, filter	DOE EML HASL-300, Po-01-RC Modified
Th-228	Alphaspec Th, Filter	DOE EML HASL-300, Th-01-RC Modified
Th-230	Alphaspec Th, Filter	DOE EML HASL-300, Th-01-RC Modified
Th-232	Alphaspec Th, Filter	DOE EML HASL-300, Th-01-RC Modified
U-234	Alphaspec U, Filter	DOE EML HASL-300, U-02-RC Modified
U-235	Alphaspec U, Filter	DOE EML HASL-300, U-02-RC Modified
U-238	Alphaspec U, Filter	DOE EML HASL-300, U-02-RC Modified
Pu-238	Alphaspec Pu, Filter	DOE EML HASL-300, Pu-11-RC Modified
Pu-239/240	Alphaspec Pu, Filter	DOE EML HASL-300, Pu-11-RC Modified
Pu-241	Liquid Scint Pu241, Filter	DOE EML HASL-300, Pu-11-RC Modified
Am-241	Alphaspec Am241, Filter	DOE EML HASL-300, Am-05-RC Modified
Ra-226[a]	Scintillation Ra226, Filter	DOE EML HASL-300, Ra-02-RC Modified
Ra-228[a]	GFPC Ra228, Filter	DOE EML HASL-300, Ra-02-RC Modified

[a] Added for Area 1 Burn Pit

A6 Quality Objectives and Criteria

Data Quality Objectives

The DQO process used for this project follows EPA guidance and uses the seven-step DQO development process described in Table 7. 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 7
Data Quality Objectives
Quality Assurance Project Plan, SSFL, Ventura County, California

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. Metals of concern are not volatile and are in solid phase if they are present in soil. Organic chemicals of concern such as PAHs, PCBs, and dioxins that may be in soil are non-volatile or semivolatile, and will

TABLE 7
Data Quality Objectives
Quality Assurance Project Plan, SSFL, Ventura County, California

	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 $PM_{2.5,}$ 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, California Air Resource Board (CARB), and DOE guidelines as appropriate based on the COPC.
Step 4: Define the Boundaries of the Study	Spatial: 14 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} and $PM_{2.5}$ over the period of 1 year. Radionuclide samples will be collected on a weekly basis for one year. Sampling will be performed at the 14 monitoring locations identified on Figure 1 of the Air Monitoring Work Plan for VOCs and particulate matter. Sampling for radionuclides will be conducted at the existing DOE locations 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 8 and the QC acceptance criteria stated in Section B of this QAPP will be included in the range of baseline concentrations.
Step 6: Specify Performance or Acceptance Criteria	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.
Step 7: Develop the Plan for Obtaining Data	Twenty-four-hour samples will be collected bi-weekly over 1 year at 14 sampling locations for analysis for selected VOCs. Twenty-four-hour samples will be collected daily over 1 year at the same monitoring locations for PM_{10}. $PM_{2.5}$ will be collected daily over 1 year at three locations. 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 according to procedures described in this Work Plan and Section D, *Data Review, Validation, and Usability*, of this QAPP, as well as the "Spatial Characterization of $PM_{2.5}$ Associated Organic Compounds - California Regional Particulate Air Quality Study (CRPAQS)" (Desert Research Institute, 2004).

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} and $PM_{2.5}$ 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} and $PM_{2.5}$ is the coefficient of variation upper bound and is calculated using Equation 2.

EQUATION 2

Coefficient of Variation

$$CV = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{n(n-1)}} \cdot \sqrt{\frac{n-1}{X^2_{01,n-1}}}$$

Where:

n = the number of samples
d = the value calculated from Equation 1 for each sample
$X^2_{01,n-1}$ = 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 a the d_is
AS = standard deviation of the absolute values of the d_is.

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)

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

EQUATION 6

Upper 95 Percent Probability Limit

$d_j + 1.96\ S_j$

Where:

d_j = mean
S_j = standard deviation

EQUATION 7

Lower 95 Percent Probability Limit

$d_j - 1.96\ S_j$

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:

$$RPD = \{(\lvert S - D \rvert)/[(S + D)/2]\} \times 100$$

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:

$$\% \text{ Completeness} = [(\text{Valid data obtained}) / (\text{Total data planned})] \times 100$$

The data completeness goal for PM_{10} and $PM_{2.5}$ is 80 percent 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:

$$\% \text{ Completeness} = [(\text{Number of valid days}) / (\text{Number of possible days})] \times 100$$

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 8 summarizes the MQOs for this project.

TABLE 8
Measurement Quality Objectives
Quality Assurance Project Plan, SSFL, Ventura County, California

Method	MQO Parameter	Requirement	Acceptance Criteria
TO-15 (bi-weekly)	Precision	Duplicate or collocated samples (10%)	<15% RPD
	Completeness	Valid samples collected	>85% ([a])
PM_{10} (daily)	Flow Rate Accuracy	Indicated flow rate compared to primary flow standard	±7%
	Completeness	Valid samples collected	> 80% ([b])
$PM_{2.5}$ (daily)	Flow Rate Accuracy	Indicated flow rate compared to primary flow standard	±7%
	Completeness	Valid samples collected	> 80% ([b])
Radionuclides (weekly)	Flow Rate Accuracy	Indicated flow rate compared to primary flow standard	±10%
	Completeness	Valid samples collected	> 80% ([b])

Notes:
[a] Completeness is defined as >85% as specified in the National Air Toxics Trends Station Model QAPP.
[b] 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.

A8 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 14 sampling locations.

Samples for VOCs will be collected bi-weekly and particulate 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}, $PM_{2.5}$ 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 four sites plus the two sites 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. Summa canisters will be batch-certified.

PM_{10} and $PM_{2.5}$ – As the E-BAM 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 DQOs are attained. Some potential problems and corrective actions are listed in Table 9.

TABLE 9
Field Corrective Action
Quality Assurance Project Plan, SSFL, Ventura County, California

Method	Item	Problem	Action	Documentation
PM_{10}	Flow Rate Verification	Out of Specification (±7% transfer standard)	• Perform leak test of E-BAM • Clean nozzle/vane • Recalibrate flow	• Document on field data sheet • Notify field manager
$PM_{2.5}$	Flow Rate Verification	Out of Specification (±7% transfer standard)	• Perform leak test of E-BAM • Clean nozzle/vane • Recalibrate flow	• Document on field data sheet • Notify field manager
TO-15	Leak Test	Canisters not under vacuum	• Replace canister	• Document on field data sheet

TABLE 9
Field Corrective Action
Quality Assurance Project Plan, SSFL, Ventura County, California

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

Sample Handling, Preservation and Holding Time

PM_{10} and $PM_{2.5}$ – 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 microns (µm) in size will be collected from air using a Beta Attenuation Monitor (BAM), the MetOne E-BAM sampler equipped 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}C (< 60 µCi) 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.

$PM_{2.5}$ – Particulate matter less than 2.5 µm in size will be collected with a MetOne E-BAM sampler equipped with a PM_{10} inlet and $PM_{2.5}$ sharp cut cyclone. 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, airborne particulate radioactivity samples will be collected at 35 lpm on glass fiber (Type A/E) filters that will be changed twice a week.

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
    - 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 2, 3, 4, and 6 in Section A5. 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 mg/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.

$PM_{2.5}$ – Particulate matter less than 2.5 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 $PM_{2.5}$ in mg/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) or Strontium-90 (Sr-90) and Thorium-

230 (Th-230) standard sources. The activities of the standard sources are traceable to the NIST. The following elements of QC 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 QC 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, 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 10. 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 10
Quality Control Checks for VOCs in Vapors with TO-15
Quality Assurance Project Plan, SSFL, Ventura County, California

QC Check	Frequency	Data Quality Indicator	Criteria	Corrective Action
Initial Calibration (ICAL)-minimum of five levels or six if utilizing a quadratic determination	Initially and if continuing calibration no longer meets criteria	Accuracy	RSD ≤30%, r ≥0.995, r2 ≥0.990 (linear regression or quadratic)	May repeat one point (if analyzing 5 levels) or two points (if analyzing 6 levels). Inspect the system for problems and perform required maintenance. Repeat initial calibration. Problem must be corrected. Samples may not be analyzed until there is a valid ICAL.
Initial Calibration Verification (ICV)	Following every ICAL	Accuracy	%Difference ±30% from expected concentration	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.
Continuing Calibration Verification (CCV)	Initial run of batch, every 24 hours	Accuracy	%Difference (%D) ±30% from expected concentration.	Reanalyze CCV. Identify and correct problem; reanalyze or where appropriate qualify the data. Repeat initial calibration if CCV corrective action is unsuccessful.
Method Blank	One per batch of samples (a batch cannot exceed 20 samples)	Contamination/ Bias	No target analytes detected > QL	Re-prep and reanalyze batch.
Surrogate spike	Every standard, sample, method blank, and LCS	Accuracy	All surrogates in samples, method blank, and LCS within 70-130% recovery	Re-analyze. If still unacceptable, flag all associated data in the analytical batch.
Laboratory Replicate	One per batch of samples	Precision	≤ 25% RPD	Re-prep and reanalyze batch.
LCS	One per batch of samples	Accuracy	70–130% R	Re-prep and reanalyze batch.
Holding Time	N/A	Representative ness	30 days	Contact client and qualify data.

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

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 ±4 percent then the instrument is adjusted and rechecked.

If the instrument flow checks fall outside the 7 percent acceptance criteria in Table 8, 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 E-BAM 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 standard 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 verify 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) or Strontium-90 (Sr-90) 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
- U.S. 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 A8 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 QA assessments indicate whether the control efforts are adequate or need to be improved. Documentation of all QA/QC 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. A minimum of one field audit will occur within the 1-year monitoring program. Laboratory audits will be performed according to the laboratory's QAPP and certification procedures. 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 E-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 11 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 11
Flagging Conventions
Quality Assurance Project Plan, SSFL, Ventura County, California

Qualifier	Definition	Type	Comment
The following laboratory qualifiers are required when applicable:			
[None]	Detected or positive result	Detect status	
U (unclassifiable)	Nondetect result	Detect status	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).
J (organics) B (inorganics)	Below reporting limit	Concentration Range	Applied to a detected result if less than the reporting limit but greater than the lowest-level of reporting.

TABLE 11
Flagging Conventions
Quality Assurance Project Plan, SSFL, Ventura County, California

Qualifier	Definition	Type	Comment
E (organics)	Exceeds calibration range	Concentration Range	Applied to a detected result if greater than the highest calibration standard. Often, this necessitates reanalysis at a dilution.
B (organics)	Blank contamination	Contamination	Applied to a detected result if the same compound was also detected in an associated method blank.
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:			
* (inorganics)	Laboratory replicate or MS/MSD exceedance	QA/QC exceedance (precision)	
C	Laboratory comment	Miscellaneous	Applied if there is a miscellaneous comment (the comment must be provided).
D	Result of a dilution	Concentration Range	Applied to a detected result if from a dilution factor greater than 1.
E (inorganics)	Estimated due to interference	Miscellaneous	
H	Holding time	QA/QC exceedance (holding times)	Applied if the result is associated with a holding time exceedance.
N (inorganics)	Spiked sample (LCS, MS, MSD) recovery outside control limits	QA/QC exceedance (accuracy)	
P (organics)	Poor dual-column reproducibility	QA/QC exceedance (precision)	Applies only to dual-column analyses.

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 A6. 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.

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Appendix B
Proposed Outline of Quarterly Report

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APPENDIX B

Proposed Outline of Quarterly Report

1.0 Introduction

2.0 Sampling Events

3.0 Data

3.1 Meteorological Data

3.2 PM_{10} Data

3.3 $PM_{2.5}$ Data

3.4 Volatile Organic Compound Data

3.5 Radionuclide Data

4.0 QA/QC Activities

4.1 Field QA/QC

4.2 Laboratory QA/QC

4.3 Audit Results

5.0 Summary

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