Version 2.0
June 7, 2022

CALIFORNIA
AIR RESOURCES BOARD

Draft

Study of Neighborhood Air near Petroleum Sources (SNAPS) Community Air Monitoring Plan *for* Communities Surrounding the Inglewood Oil Field

Prepared by
California Air Resources Board
Monitoring and Laboratory Division

Contents

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Acronyms

ASTM	American Society for Testing and Materials
BTX	Benzene, Toluene, and Xylenes
CAP	Community Advisory Panel
CARB	California Air Resources Board
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CODAS	CARB Online Data Acquisition System
CSD	Community Standards District
DNPH	2,4-Dinitrophenylhydrazine
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
GC	Gas Chromatography
GPS	Global Positioning System
HPLC	High Performance Liquid Chromatography
HRA	Health Risk Assessment
H_2S	Hydrogen Sulfide
IOF	Inglewood Oil Field
IR	Infrared
LAX	Los Angeles International Airport
MEMS	Micro-Electromechanic System
MLD	Monitoring and Laboratory Division
MS	Mass Spectrometry
NIST	National Institute for Standards and Technology
NO	Nitrogen Monoxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	Polycyclic Aromatic Hydrocarbons
PID	Photoionization Detector
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter with an Aerodynamic Diameter ≤2.5 micrometers
ppb	Part Per Billion
ppm	Part Per Million
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Program Plan

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SNAPS	Study of Neighborhood Air Near Petroleum Sources
SOP	Standard Operating Procedure
AQMD	Air Quality Management District
TACs	Toxic Air Contaminants
VOCs	Volatile Organic Compounds
UV/VIS	Ultraviolet/Visible

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CARB staff are looking for feedback on the Draft SNAPS Inglewood Oil Field Communities Air Monitoring Plan through July 31, 2022. Please submit feedback by July 31, 2022 via email or phone at (279) 208-7749.

1. Inglewood Oil Field Community Partnerships

The Inglewood Oil Field (IOF) and the communities that surround it are located in Los Angeles County. These communities (IOF communities) are in a unique urban environment in terms of air pollution sources. In addition to typical urban air pollution sources, such as on-road vehicles, these communities are near IOF, one of the largest contiguous urban oil fields in the United States and a source of domestic oil and natural gas.[1]

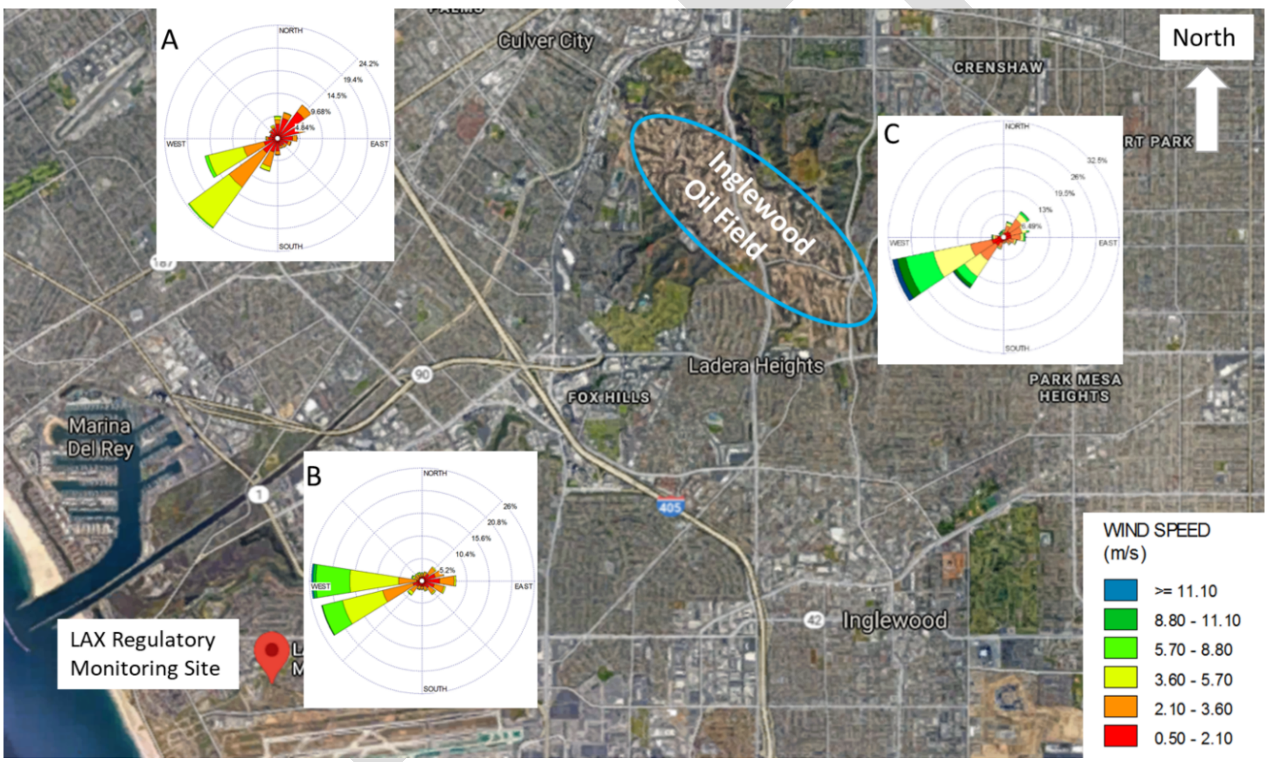

Figure 1: Map of the Inglewood Oil Field and nearby areas (Google Map). Wind data shown here was collected at the Santa Monica Airport (Inset A), Los Angeles International Airport (Inset B) and on the IOF (Inset C). Data shown in wind rose plots of A and B are the 5-year average from 2012 to 2016. The plots were prepared by the South Coast Air Quality Management District (AQMD).[2] The data for the wind rose plot on the IOF (inset C) are the 5-year average from 2015 to 2019.[3] The nearby regulatory monitoring station is located at 7201 W Westchester Parkway, Los Angeles CA 90045, operated by South Coast AQMD.

[1] https://inglewoodoilfield.com
[2] http://www.aqmd.gov/home/air-quality/meteorological-data/data-for-aermod
[3] https://planning.lacounty.gov/assets/upl/project/bh_health-risk-assessment-report.pdf

Substantial actions have been taken to understand the air quality in IOF communities. The Baldwin Hills Community Standards District (CSD)[4] was adopted in 2008 to implement provisions to minimize the impact of activities on the IOF on communities nearby, including air quality impacts. As part of the CSD, a Community Advisory Panel (CAP) was established to help foster communication with and ensure community input to the County of Los Angeles Department of Regional Planning and IOF operators. In addition, studies, such as a human health risk assessment (HRA) study[3] and an air quality monitoring study[5], have been carried out to understand the effects of emissions from the IOF on air quality in nearby communities. However, questions remain regarding potential health impacts and sources of air pollution in these communities.

California Air Resources Board (CARB) selected the IOF communities as a monitoring location under CARB's Study of Neighborhood Air near Petroleum Sources (SNAPS). CARB conducted two sets of public workshops near the IOF communities to introduce the SNAPS program, to understand community air quality concerns, and to gain feedback on proposed sites to locate SNAPS air monitoring equipment. In addition, CARB participated in numerous CAP meetings, mostly providing status reports as CARB prepares to implement this monitoring plan.

2. Purpose for Air Monitoring

Through air monitoring efforts and subsequent analysis, the SNAPS program aims to improve our understanding of air quality, potential health impacts of atmospheric pollutants, and sources of these pollutants within communities near oil and gas production activities. To achieve these goals, CARB staff conduct limited-term, intensive air pollutant monitoring in communities near oil and gas production operations. SNAPS air monitoring measures criteria air pollutants, volatile organic compounds (VOCs), metals, toxic air contaminants (TACs), and supplemental parameters such as meteorological conditions.

3. Scope of Actions

CARB selected the IOF communities for SNAPS air monitoring. All communities selected for SNAPS follow a selection process consisting of three stages: 1) identification, 2) evaluation, and 3) prioritization.[6] The selection of these communities was based on close proximity to petroleum activities, public recommendations, results

[4] https://planning.lacounty.gov/baldwinhills/csd
[5] https://planning.lacounty.gov/assets/upl/project/bh_air-quality-study.pdf
[6] https://ww2.arb.ca.gov/sites/default/files/2018-06/SNAPS%20Community%20Selection%20Overview%206-18-18.pdf

of previous exploratory studies[5], and lack of comprehensive information on the types and concentrations of air pollutants impacting the air quality in IOF communities.

During the monitoring period, CARB staff will share the status of SNAPS monitoring and preliminary results with community members through community meetings and newsletters. Preliminary data generated by on-line measurements (excluding VOCs and metals which require additional data processing) will be published and updated hourly on the SNAPS data website (the link will be shared at the start of SNAPS monitoring). VOC and metal data will be released along with the final report (Please see Section 14 of this monitoring plan). An example of the SNAPS data display for on-line measurements can be seen using the link (https://ww2.arb.ca.gov/our-work/programs/study-neighborhood-air-near-petroleum-sources/snaps-data-display). If pollutant concentrations found within the communities are above the Office of Environment Health Hazard Assessment (OEHHA)'s acute reference exposure levels, CARB will attempt to locate the source and notify the responsible facility, business, or utility. This information will be shared with community members and South Coast AQMD.

At the completion of monitoring, CARB will prepare a final report to summarize study findings and recommend future actions as indicated by monitoring results. The draft of the final report will be released for public comment. SNAPS findings will be shared with community members and other interested stakeholders.

4. Air Monitoring Objectives

CARB staff will use stationary monitoring, supplemented by mobile monitoring, to characterize air quality in IOF communities. Intensive air monitoring is expected to occur for a period of 12 months at two stationary sites representative of local conditions near the IOF (outlined in Section 8 of this monitoring plan).

Air monitoring under SNAPS focuses on pollutants categorized as toxic air contaminants and criteria air pollutants. Meteorological data will also be collected throughout the duration of monitoring. SNAPS monitoring equipment is capable of measuring the pollutants listed in Appendix A.

Below are examples of air pollutants measured in the SNAPS program:

- particulate matter with an aerodynamic diameter ≤ 2.5 micrometers ($PM_{2.5}$)
- gaseous criteria pollutants subject to National Ambient Air Quality Standards (nitrogen dioxide, ozone and carbon monoxide)
- VOCs, including hydrocarbons and oxygenated VOCs, etc.
- polycyclic aromatic hydrocarbons (PAHs)
- metals

- black carbon (BC)
- methane (CH_4)
- hydrogen sulfide (H_2S)

CARB staff will conduct mobile monitoring in IOF communities periodically in addition to stationary monitoring. The mobile monitoring platform measures a subset of analytes monitored by the stationary monitoring trailers, such as methane, ethane, nitrogen oxides, hydrogen sulfide, ozone, black carbon, and BTX (benzene, toluene, and xylenes). The number and classes of analytes measured by mobile monitoring are limited by availability of fast-response monitors and the footprint of the mobile platform.

The objective of mobile monitoring is to examine the spatial distribution of air pollutants by comparing the observed pollutant concentrations by mobile monitoring at various sites across the communities with those measured at stationary monitoring sites. CARB staff plan to conduct two weeks of mobile monitoring per quarter throughout the monitoring period in IOF communities; however, the actual mobile monitoring schedule will be subject to the availability of resources. The mobile monitoring sites are proposed in Section 8 of this monitoring plan.

5. Roles and Responsibilities

The Monitoring and Laboratory Division (MLD) of CARB has the primary responsibility to conduct air monitoring and perform preliminary data analysis. MLD staff are fully trained on the proper use of all instrumentation and analytical tools described within this plan. The responsibility for maintaining the stationary monitoring site will be split between staff in the Community Air Monitoring Branch's Advanced Monitoring Techniques Section based in Sacramento and Community Air Monitoring South based in Riverside. MLD also assists the Industrial Strategy Division (ISD) with the preparation of final reports and works with ISD on community engagement and communicating SNAPS findings.

ISD has primary responsibilities of project management tasks which include outreach and engagement efforts with the community and other stakeholders, coordination of monitoring site selection, preparation of final reports, and communication of SNAPS results with community members and other stakeholders. A full description of CARB's staff's roles and responsibilities can be found within the SNAPS Quality Assurance Program Plan (QAPP).[7]

[7] https://ww2.arb.ca.gov/resources/documents/quality-assurance-project-plan-study-neighborhood-air-near-petroleum-sources

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The Office of Environment Health Hazard Assessment (OEHHA) conducts a health risk assessment using the data collected during SNAPS monitoring and prepares a health risk assessment report, which will be incorporated into the SNAPS final report. OEHHA is also responsible for communicating the results of SNAPS health risk assessments to community members and other stakeholders.

6. Data Quality Objectives

Data quality attributes are unique to the equipment and methodologies used for sampling, detection, and quantification of air pollutants. A full description of all pollutant data quality objectives can be found in the SNAPS standard operating procedures (SOPs). A brief description of SNAPS's data quality objectives is provided here.

In general, gaseous air pollutant monitors and analyzers, including gas chromatography - flame ionization detector - mass spectrometry (GC-FID-MS), will be assessed for their bias and drift through the use of zero and span audits (at typical ambient concentrations or the highest concentrations of the chosen concentration ranges). Flow audits will be used for all PM instruments and samplers for discrete samples to verify proper instrument operation and sampling performance.

Tables 1-3 summarize expected data quality objectives (DQO) for each pollutant under the SNAPS program. It should be noted that data quality objectives are subject to change based on real-world performance and analytical objectives. In addition to the DQOs listed in Tables 1 and 2, field blanks for discrete samples will also be collected. Information regarding blanks may be found in each method's respective SOP.[8]

[8] https://ww2.arb.ca.gov/resources/documents/study-neighborhood-air-near-petroleum-sources-snaps-monitoring-documents

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Table 1. DQOs for field on-site measurements

Analyte	DQO (Bias)	Quality Check Schedule	Proposed Acceptance Criteria	Reference
Ozone	Zero/Span	Biweekly[2]	Zero < 5 ppb; Span drift <7.1% of the calibration point	EPA QA Handbook
Nitrogen oxides	Zero/Span	Biweekly	< ± 5.1 ppb; Span drift < ± 10.1 % of calibration point	EPA QA Handbook
Hydrogen sulfide	Zero/Span	Biweekly	Zero < 5.1 ppb; Span drift <10.1% of the calibration point	EPA QA Handbook
Methane, carbon monoxide, carbon dioxide	One-point standard check	Monthly	CH4< ±3 ppb; CO <±50 ppb; CO2 <± 0.5 ppm	Instrument Specifications
Speciated VOCs (hydrocarbons)[1]	One-point standard check	Daily	Less than 20% from the calibration point	CAMB SOP 258
$PM_{2.5}$	Flow audit	Biweekly	Less than 4% of the set flowrate	AQSB SOP 400
Black carbon	Flow audit	Monthly	Less than 10% of the set flowrate	CAMB SOP 401
Metals[1]	Daily energy calibration and upscale check	Daily	Less than 10% from the set point	CAMB SOP 450

Note: (1) Individual analytes in VOCs and metals are provided in Appendix A: Table A1. On-site Measurements. (2) “Biweekly” refers to “14 days”

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Table 2. DQOs for collection of discrete samples.

Analyte	DQO (Bias)	Quality Check Schedule	Proposed Acceptance Criteria	Reference
PAHs(1)	Flow audit	Monthly	10% of the set flowrate	TO-13
Carbonyls(1)	Flow audit	Semiannual	5% of the set flowrate	CAMB SOP 850
Metals(1)	Flow audit	Semiannual	5% of the set flowrate	CAMB SOP 850
Sulfur containing compounds(1)	Flow audit	Semiannual	5% of the set flowrate	CAMB SOP 850
Hydrocarbons, oxygenated & halogenated compounds(1)	Flow audit	Semiannual	5% of the set flowrate	CAMB SOP 850

Note: (1) Individual analytes are provided in Appendix A: **Table A2.** Discrete Samples

Table 3. Mobile monitoring DQOs

Analyte	Instrument Bias Limit (%)	Data Completeness (%)
Methane	15	80
Hydrogen sulfide	15	80
Ozone	20	80
Nitrogen oxides	20	80
Ethane & methane	20	80
BTX	20	80
VOC (grab samples)	20	N/A
Black carbon	20	80

7. Monitoring Methods and Equipment

Proposed target analytes (Appendix A) are directly measured by a suite of instruments in the field (on-site measurements) or collected for laboratory chemical analysis using samplers (discrete samples). Additional information on these methods may be found in the SNAPS QAPP.[7]

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Stationary Air Monitoring

Stationary monitoring is anticipated to occur at two locations within the IOF communities (see Section 8) for a period of 12 months using two climate-controlled trailers equipped with a suite of on-line instruments to provide continuous, high-time resolution measurements of criteria air pollutants and TACs. Samplers to collect discrete samples will also be deployed at each stationary monitoring site. In addition, meteorological data (e.g. wind speed and direction) will also be collected at the monitoring sites using RM Young 81000 ultrasonic anemometers.

Table 4 lists the analytes and instruments/methods used by SNAPS to measure proposed analytes. The concentrations of analytes measured on site are reported as hourly averages. The concentrations of analytes determined from discrete samples are reported as 24-hour averages.

Mobile Monitoring

Mobile monitoring is conducted using a vehicle (Toyota Highlander Hybrid) outfitted with equipment to measure CH_4, H_2S, O_3, NO_x, BTX, a global positioning system (GPS), meteorological data (temperature, relative humidity, wind speed and direction), and a camera to record the vehicle's location and surroundings (Table 5). All real time data are collected using a data logger which synchronizes data from the GPS and instruments into a central file that can be used for data analysis. The mobile monitoring vehicle is also capable of collecting VOC grab samples for more comprehensive chemical analyses (beyond BTX) as needed.

CARB intends to utilize mobile monitoring to complement and supplement the measurements made by the stationary trailers. CARB staff will start with monitoring sites identified in the 2019 Baldwin Hills HRA[3] and prioritize sites by their estimated cancer risk. The mobile platform will visit these sites and conduct measurements for at least one hour at each site. Detailed description of these sites is provided in Section 8-Monitoring Sites of this monitoring plan.

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Table 4. Summary of measurements conducted at stationary sites
(**Site 1**="Marycrest Manor Site" and **Site 2** = "Sentinel Peak Site" on IOF)

Analyte	Analyzer/Sampling Media	Measurement Method	Measurement/ Sampling Frequency	Reporting Interval	Site 1	Site 2
Hydrogen sulfide	Teledyne T101	Ultraviolet(UV) fluorescence	Continuous	Hourly	×	×
Ozone	Teledyne T400	UV absorption	Continuous	Hourly	×	×
Methane, carbon monoxide, carbon dioxide	Picarro G2401	Cavity ring down spectroscopy (CRDS)	Continuous	Hourly	×	×
Nitric oxide, nitrogen dioxide, nitrogen oxides	Ecophysics nCLD855	Chemiluminescence	Continuous	Hourly	×	×
Speciated hydrocarbon VOCs(1)	Thermo trace 1300 GC-FID & ISQ 7000 MS coupled with a Markes AirServer-Unity system	GC-FID-MS	Continuous	Hourly	×	×
$PM_{2.5}$	MetOne BAM 1020	Beta-ray attenuation	Continuous	Hourly	×	×
Black carbon	Magee AE33	Optical absorption	Continuous	Hourly	×	×
Metals in $PM_{2.5}$ (1)	SailBri Cooper Xact 625i	XRF	Continuous	Hourly		x
Carbonyls(2)	2,4-Dinitrophenyl hydrazine (DNPH) cartridge	Ultra high performance liquid chromatography (HPLC)- UV/visible(VIS) absorption	One sample every six days (1-in-6)[3]	24-hour average	x	x
Halogenated, oxygenated and hydrocarbon VOCs(2)	SUMMA canister	GC-MS	1-in-6	24-hour average	x	x
Sulfur containing compounds (2)	Silonite canister	GC-chemiluminescence	1-in-6 (or one sample every 12 days, 1-in-12)[4]	24-hour average	x	x

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Analyte	Analyzer/Sampling Media	Measurement Method	Measurement/ Sampling Frequency	Reporting Interval	Site 1	Site 2
PAHs(2)	Quartz filter, Polyurenthane foam (PUF) and XAD-2 resin	GC-MS	1-in-6 (or 1-in-12)	24-hour average	x	x
Metals in total suspended particles(2)	Teflon filter	XRF	1-in-6	24-hour average	x	x
Hexavalent chromium in total suspended particles	Cellulose filter	Ion chromatography	2 samples per quarter	24-hour average	x	x

Note: (1) Individual analytes in VOCs and metals are provided in Appendix A: Table A1. On-site Measurements.
(2) Individual analytes for these measurements are provided in Appendix A: **Table A2.** Discrete Samples.
(3) The sampling dates follow the EPA's 1-in-6 or 1-in-12 sampling schedule.
(4) The sampling schedule for sulfur containing compounds and PAHs depends on the available resources.

Table 5. Summary of Mobile Monitoring Measurements

Analyte	Analyzer	Measurement Method	Frequency	Reporting Interval
Methane, hydrogen sulfide	Picarro G2204	CRDS	Continuous	5 sec
BTX	Omniscent OMNI-2100	Micro-electromechanic system (MEMS)-GC	15-40 minutes	15-40 minutes
VOCs (grab samples)	GC-MS	MLD058	As necessary	Per sample
Methane, ethane	Aeris MIRA Pico	Mid-infrared (IR) laser	Continuous	1 second
Black carbon	Aethlabs MA350 and Magee AE33	Light absorption	Continuous	1 second
Ozone	2B Technologies POM	UV absorption	Continuous	2 second

8. Monitoring Sites

Several communities surround the IOF in Los Angeles County, CA, including but not limited to Baldwin Hills, Culver City, Ladera Heights, Village Green, and View Park-Windsor Hills. Meteorological measurements from nearby monitoring sites show that the prevailing wind is from the west-southwest as shown by the wind roses in Figures 1 and 2. A variety of sources including IOF, vehicles on nearby roads, and residential combustion may impact local air quality.

Monitoring sites are selected based on their ability to represent the overall impacts of pollution sources within and around the communities while considering operational logistics, such as site access, electricity and space for the stationary monitoring trailer and associated accessories. A detailed description of the process of site selection[9] and responses to comments[10] from communities are provided on the SNAPS website.

Primary Stationary Sites

SNAPS stationary monitoring will take place at two sites using two mobile trailers outfitted with equipment listed in Table 4. The first site is located at Marycrest Manor (34°00'00.9"N 118°22'56.1"W - Google Maps), a skilled nursing facility in Culver City. The second site is located within IOF, but it is at the boundary of the oil field and adjacent to a community park (Sentinel Peak Site, 34°00'18.0"N 118°21'51.0"W - Google Maps).

Stationary Site 1: Marycrest Manor Site

Marycrest Manor is a skilled nursing facility located west of the IOF, approximately 1500 feet from the nearest active oil well. This site is located typically upwind of IOF as the prevailing wind direction is from the west and southwest. Staff anticipates that samples captured at this location may include pollutants from non-IOF related sources. Site 1 can also serve as the downwind site, potentially capturing pollutants from IOF, when the wind direction shifts to an east-northeasterly direction, a relatively common occurrence (Figure 2). Combined with measurements at the Sentinel Peak Site (Stationary Site 2), the impacts of oil field activities and other sources on air quality will be characterized.

Stationary Site 2: Sentinel Peak Site

This site is on the eastern edge of IOF within the boundary fence surrounding the oil field. This site is typically downwind of the oil field under the prevailing wind from the

[9] https://ww2.arb.ca.gov/sites/default/files/2020-10/SNAPS_Baldwin_Hills_Site_Selection_Response_Document_English.pdf

[10] https://ww2.arb.ca.gov/sites/default/files/2020-10/SNAPS_Baldwin_Hills_Site_Selection_Response_Document_English.pdf

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west and southwest, and is downwind of the residential area when the wind direction shifts from the west to the east. This site is likely able to capture the pollutants from both the oil field and the residential areas. In addition, this site is in close proximity to the east monitoring site for the 2015 Baldwin Hills Air Quality Study conducted by Sonoma Technology, Inc[11]. Deploying the SNAPS trailer to this site also offers a potential data comparison for BC, VOCs, and metals and provides insights into air quality over time.

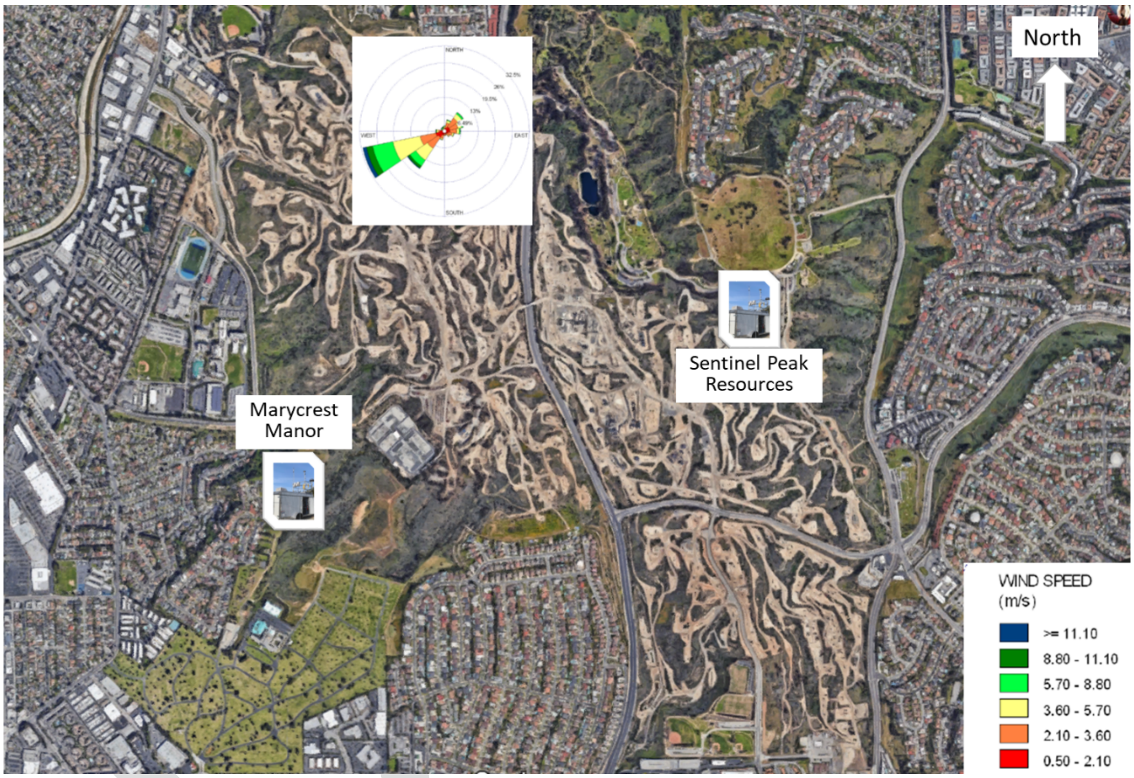

Figure 2. Map of two stationary monitoring sites. The wind rose plot shows the 5-year average of wind data collected in IOF during 2015-2019[12].

Mobile Monitoring Sites

Figure 3 shows the sites at which CARB staff will conduct mobile monitoring. The full characterization of every street within the area surrounding the IOF is beyond the current capabilities of the SNAPS program. However, CARB staff will work to balance the communities' priorities with current mobile monitoring resource availability and capabilities to collect data to best inform the monitoring objective. Due to the sampling frequency of the portable GC, mobile monitoring for VOCs will be carried

[11] https://planning.lacounty.gov/assets/upl/project/bh_air-quality-study.pdf
[12] https://planning.lacounty.gov/assets/upl/project/bh_health-risk-assessment-report.pdf

out by parking the mobile platform for approximately an hour at each site to produce a short-term snapshot of concentrations at the site. It is important to note that mobile monitoring data is a snapshot in time, and that a single measurement is not representative of long-term trends or persistent pollutant concentrations.

CARB staff expect to conduct mobile monitoring 2 weeks per quarter, with an average of 6 hours per day and at least 3 days per week of monitoring. CARB staff will collect data at various times of the day and different days of the week to explore temporal trends in areas around the community. This sampling frequency is subject to change based on logistical resources, availability of staff, and initial results of stationary monitoring. All changes will be presented to the public through an amended monitoring plan and the SNAPS newsletters.

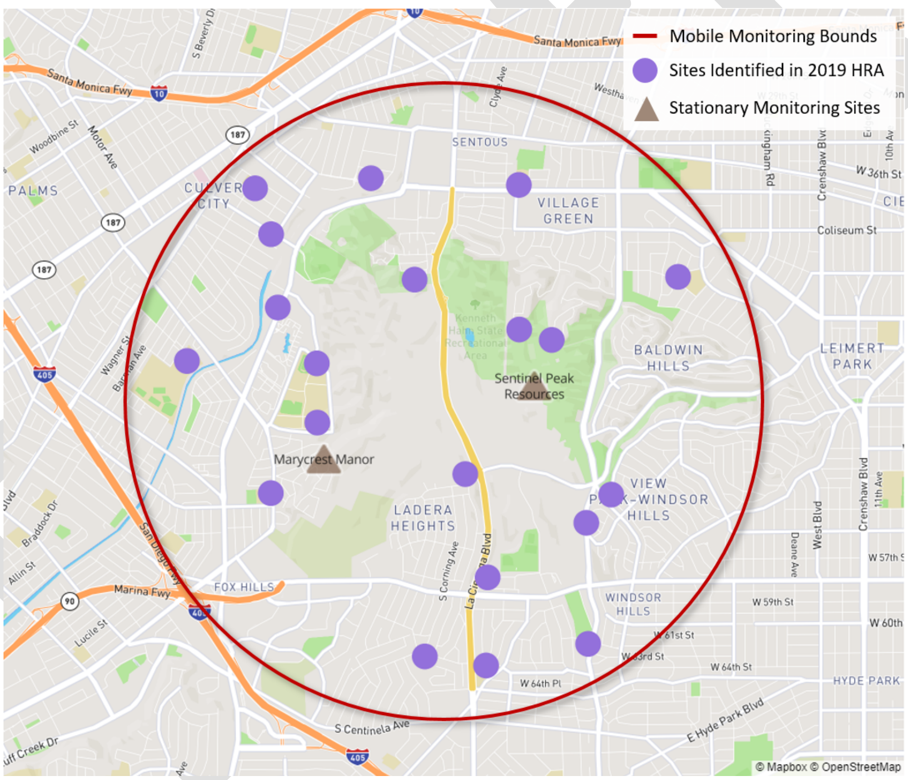

Figure 3: Mobile monitoring area including community receptors from the 2019 Inglewood HRA along with CARB stationary monitoring sites

9. Quality Assurance and Quality Control (QA/QC)

CARB staff will perform standard calibrations, flow rate checks, and preventative maintenance to ensure data quality. Here we provide a brief description of QA/QC procedures. Expanded information can be found within the SNAPS QAPP and SOPs for each instrument.

Calibration

All instruments will be calibrated at the beginning and end of field monitoring campaigns. Most of the standards (e.g., VOC standards) used here have the National Institute of Standards and Technology (NIST) traceability. Instruments will also be calibrated as needed during the field campaign to improve data quality based on quality control checks. Calibrations will be conducted for both response and/or sampling flowrate on an instrument-to-instrument basis. Routine one-point standard checks/audits will be performed to evaluate the proposed initial data quality objectives listed in Table 1.

Quality Control Checks

1) The trailer temperature will be checked daily automatically through the data acquisition system. If the temperature is out of the operating temperature range of 15 ~ 30°C for a period of more than 1 hour, CARB staff will investigate whether this is caused by the ambient temperature or the air conditioning unit.
2) All data produced by on-site instrumentation will be reviewed daily. Any outliers or abnormal diurnal trends will be investigated and corrective actions will be performed as necessary to address anomalous data. Please see the Data Management section of this monitoring plan for more information.
3) The response of the thermal desorption GC-FID-MS will be checked using zero air and VOC standards. If the response of the zero air and/or VOC standards do not meet established acceptance criteria for two consecutive days, the instrument will be diagnosed, repaired, and a new calibration will be conducted.
4) The response of the gas monitors (H_2S, NO_x and O_3) will be checked using zero air and gas standards on a biweekly schedule (Table 1). CH_4 and CO monitor responses will be checked monthly (Table 1). If the zero/span response does not meet established acceptance criteria, corrective actions will be performed and/or the instrument will be recalibrated.
5) The sampling tape for on-site particle instruments will be checked biweekly. Filter tapes will be replaced as necessary.
6) Cylinder pressures for GC, helium and nitrogen, will be checked during each site visit. The water level of the hydrogen generator for GC will also be checked during each site visit.
7) The sampling flow rate, temperature, and pressure of instruments measuring the mass of atmospheric $PM_{2.5}$ will be checked biweekly. The equipment measuring BC will be checked monthly. If the audited sampling flow rate does not meet established acceptance criteria, the instrument will be diagnosed and corrected. Following the diagnosis, calibrations will be performed.

Maintenance

1) For gas monitors measuring CO, CH_4, H_2S, NO_x and O_3, the in-line filter, used to remove airborne particles, will be changed bi-weekly.
2) For instruments measuring the mass of $PM_{2.5}$ and BC, both the cyclone and sampling head will be cleaned monthly.

Discrete Sample Handling

Unused sample media and collected samples will be stored and transported to and from the MLD laboratory and contracted laboratory following the SOPs for each sample type.

Mobile monitoring

All instruments in the mobile monitoring vehicle will be calibrated prior to monitoring in the community and will undergo routine quality control checks as outlined in instrument SOPs. Quality control checks will be logged to track instrument performance. Data will not be collected for instruments that malfunction during active mobile monitoring and cannot be returned to proper operation.

10. Data Management

The data management plan for the SNAPS program outlines methods and procedures for data acquisition, automatic quality control, automatic data review, and data security. A brief description of the SNAPS data management protocol is provided here. Detailed information is provided in the SNAPS QAPP.

Data Acquisition

SNAPS acquires data from on-site continuous air monitoring instruments, discrete samples (using canisters, cartridge, filters and PUFs), and mobile monitoring. All data is eventually stored on the CARB Snowflake Data Cloud.

- Continuous air monitoring is carried out using instruments capable of automatic sampling and quantification, such as analyzers for criteria gaseous pollutants and our continuous GC for VOCs. Most of this data, except for GC data, will be automatically uploaded for data reviewing and reporting. GC data (e.g., chromatograms) will be uploaded to Snowflake post collection, where it will be downloaded, analyzed, and reported by our staff chemist using state of the art GC analysis software and methods in the CARB's Sacramento office.
- Discrete samples are sent for off-site laboratory analysis using both internal and external laboratories. Laboratory results will be combined later for further data review and analysis.
- Mobile monitoring data will be collected through an in-house developed data acquisition platform (CARB Online data acquisition system, CODAS). Concentration measurements will be collected, along with additional

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parameters including the instrument name, date and time measurements were made, units of measurement, and metadata that can be used to assess if the instruments are operating correctly. GPS coordinates and meteorology data will be collected to provide context for the monitoring data.

Data Auto Quality Control

Auto quality control primarily focuses on instrument operational states, such as manufacturer specified operational conditions and nightly drift checks. Any automatically flagged data gives the operator the opportunity to review data more closely before publication. For instance, if the instrument's box temperature exceeds the manufacturer specified maximum allowable temperature range, the system will automatically flag the data as questionable requiring operator review before release.

Automatically assigned data flags will not preclude an operator or manager from reviewing and marking data as valid later. All changes to data flagging states will be recorded into the data chain of custody for future inspection.

Manual Data Review

Manual data review involves the staff review of monitoring data for anomalous behavior that may or may not be reflected by diagnostic parameters or automated QC checks. The operator may examine the diurnal profiles of pollutants (typical fluctuations in concentrations throughout the day), time series, and shifts in wind direction to ensure that the instrument appears to be functioning nominally.

All data will include three levels of technical review. The first level of data review includes review of percent from true calibration, review of instrument diagnostic data, verification of all automatic quality control flags, review of minute-based data, and review of hourly continuous data by parameter. The second level of data review includes review of quality control documents, maintenance check sheets, hourly data for reviewed 1-minute data, and data completeness. Additionally, the second level review ensures that all QC practices were performed to meet data quality objectives for each pollutant or parameter. A third level of review will be conducted by CARB staff to further evaluate the data quality by examining the diurnal profiles and seasonal variations and compare the time series with concurrent measurements performed at other monitoring sites in the same region. A full description of the data verification and validation process can be found in the SNAPS QAPP.

Data Storage and Security

Data logger security will follow due diligence by using a firewall, updating public facing applications, running antivirus, periodic log review, and external inspection by information technology security. All data transmittal will be encrypted in transit.

Data cloud privacy is safeguarded by requiring account access privileges to access data storage and any associated data acquisition systems. All data stored in Snowflake uses AES-256 strong encryption at rest and periodically re-keyed for enhanced security. Staff specific access to all data is maintained using data access and role-based access controls. Data backup is provided using Snowflake Continuous Data Protection, Time Travel, and Fail-Safe.

11. Work Plan for Field Measurements

Field measurements are proposed to begin in 2022. The start date is highly dependent upon operational logistics such as installation of electricity for monitoring instruments. The duration of field measurements is planned for one year.

Figure 4 outlines the work plan during the monitoring. Staff will adhere to established SOPs (https://ww2.arb.ca.gov/resources/documents/study-neighborhood-air-near-petroleum-sources-snaps-monitoring-documents) to carry out field tasks. All quality control activities will be logged into appropriate logbooks. Continuous measurements will be made 24 hours per day (except for the period of QA/QC) while discrete samples will be collected on a 1-in-6 day or 1-in-12 day sampling schedule depending on available resources and local air quality. These activities are repeated periodically for each instrument during the 1-year of monitoring.

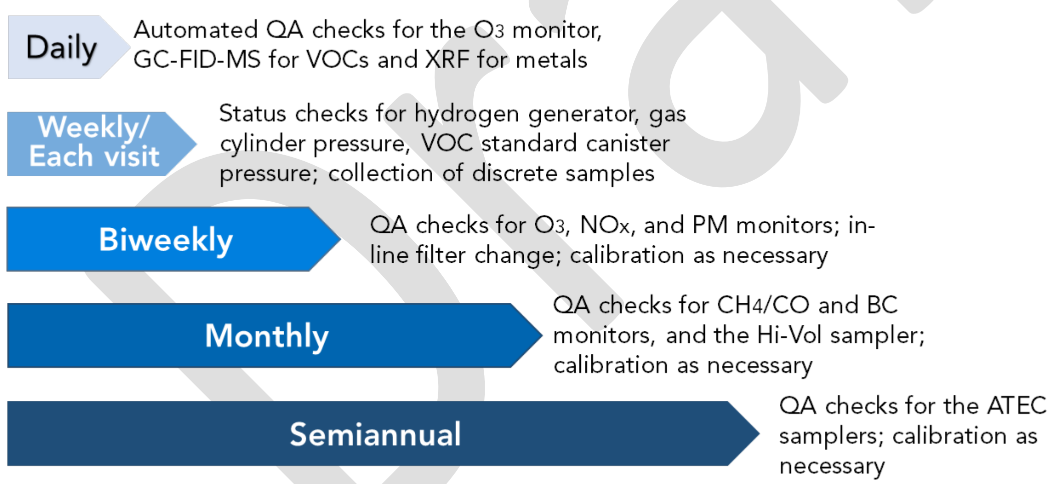

Figure 4. Outline of work plan.

12. Evaluating Effectiveness

Data will be analyzed on an ongoing basis to ensure that data quality objectives are met and data is of sufficient quality and quantity to meet all applicable requirements. Collected data must be of appropriate quality to conduct health risk assessments and source apportionment. CARB staff will meet monthly with CARB management to discuss data capture status, completeness, validity, representativeness, and any programmatic issues. Operational factors affecting program objectives will be quickly identified and corrective actions will be implemented to ensure the collection of an accurate, complete, and useful dataset.

13. Data Analysis and Interpretation

All collected data will be subject to three levels of data verification and validation described in Section 10 of this monitoring plan. Once reviewed, the data will be passed to the corresponding staff for follow-up data analysis.

CARB staff will analyze measurement data to characterize air quality in the community. Air pollutant time series, diurnal patterns, and time-averaged concentrations will be evaluated. These data will be compared with regional air quality data in Los Angeles County, such as the data produced by air monitoring stations located at the LAX and the downtown Los Angeles.

OEHHA will use collected data to perform in-depth health risk assessments.

An external contractor will utilize measurement data to perform source apportionment analysis to identify the major VOC source categories impacting air quality in the IOF communities.

14. Communication of Results

Collected data will be summarized and shared by CARB and OEHHA staff via several methods, including publishing near real-time data on-line, providing interim updates at community meetings and via newsletters, and publishing a final report.

All collected data will be categorized into two Tiers for data publishing (Table 6). Tier I data is from real-time and near real-time air quality measurements. Tier I data will be reported as hourly concentrations and as estimated Air Quality Index (AQI) values for ozone and $PM_{2.5}$. Pollutant concentrations will be compared to relevant health standards and regional pollutant concentrations, where appropriate, to provide context. Tier II data, including auto GC measurements and data acquired from discrete samples, will be included in the final report.

CARB staff will hold public meetings during the monitoring to provide updates regarding the monitoring status, to report preliminary results, and to share a mutual dialogue with the community on how the data can be best analyzed and communicated.

CARB and OEHHA staff will prepare a final report to summarize all findings. The proposed timeline to have the draft final report released for public comments is 12 months after the completion of the field measurements. All validated data for the duration of the monitoring will be available once public comments are addressed and posted with the finalized report.

Table 6. Data availability schedule

Measurement	Pollutants	Proposed Timeline to Public Posting of Data
Tier I data	CH_4, H_2S, O_3, CO, NO_2, NO, $PM_{2.5}$, BC	Hourly[(1)]
Tier II data	Toxic air contaminants (TACs), non-TAC VOCs and metals	With published report

Notes: (1) Results streamed hourly on the SNAPS project website.

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Appendix A. Analytes Proposed for SNAPS Measurements

Table A1. On-site Measurements

	Equipment for On-site Measurements							
Compound name	**GC-FID-MS**	**MetOne BAM 1020**	**SailBri Cooper Xact625i**	**Magee AE33**	**Picarro G2401**	**Teledyne T101**	**Ecophysics nCLD855**	**Teledyne T400**
$PM_{2.5}$		x						
Black carbon				x				
Carbon monoxide					x			
Methane					x			
Carbon dioxide					x			
Hydrogen Sulfide						x		
$NO/NO_2/NOx$							x	
Ozone								x
Benzene	x							
Ethylbenzene	x							
Styrene	x							
Toluene	x							
Xylene (o)	x							
Xylenes (m & p)	x							
1,2,3-Trimethylbenzene	x							
1,2,4-Trimethylbenzene	x							
1,3,5-Trimethylbenzene	x							
1-Butene	x							
1-Hexene	x							
1-Pentene	x							
2,2,4-Trimethylpentane	x							

	Equipment for On-site Measurements							
Compound name	**GC-FID-MS**	**MetOne BAM 1020**	**SailBri Cooper Xact625i**	**Magee AE33**	**Picarro G2401**	**Teledyne T101**	**Ecophysics nCLD855**	**Teledyne T400**
2,2-Dimethylbutane	x							
2,3,4-Trimethylpentane	x							
2,3-Dimethylbutane	x							
2,3-Dimethylpentane	x							
2,4-Dimethylpentane	x							
2-Ethyltoluene	x							
2-Methylheptane	x							
2-Methylhexane	x							
2-Methylpentane	x							
3-Ethyltoluene	x							
3-Methylheptane	x							
3-Methylhexane	x							
3-Methylpentane	x							
4-Ethyltoluene	x							
Acetylene	x							
Butane	x							
cis-2-Butene	x							
cis-2-Pentene	x							
Isopropylbenzene	x							
Cyclohexane	x							
Cyclopentane	x							
Decane	x							
m-Diethylbenzene	x							
p-Diethylbenzene	x							

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	Equipment for On-site Measurements							
Compound name	**GC-FID-MS**	**MetOne BAM 1020**	**SailBri Cooper Xact625i**	**Magee AE33**	**Picarro G2401**	**Teledyne T101**	**Ecophysics nCLD855**	**Teledyne T400**
Dodecane	x							
Ethane	x							
Ethene	x							
Heptane	x							
Hexane	x							
2-Methylpropane	x							
2-Methylbutane	x							
Isoprene	x							
Methylcyclohexane	x							
Methylcyclopentane	x							
Nonane	x							
Octane	x							
Pentane	x							
Propane	x							
Propylbenzene	x							
Propylene	x							
trans-2-Butene	x							
trans-2-Pentene	x							
Undecane	x							
Aluminum			x					
Silicon			x					
Phosphorus			x					
Sulfur			x					
Chlorine			x					
Potassium			x					

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	Equipment for On-site Measurements							
Compound name	**GC-FID-MS**	**MetOne BAM 1020**	**SailBri Cooper Xact625i**	**Magee AE33**	**Picarro G2401**	**Teledyne T101**	**Ecophysics nCLD855**	**Teledyne T400**
Calcium			x					
Titanium			x					
Vanadium			x					
Chromium			x					
Manganese			x					
Iron			x					
Cobalt			x					
Nickel			x					
Copper			x					
Zinc			x					
Gallium			x					
Germanium			x					
Arsenic			x					
Selenium			x					
Bromine			x					
Rubidium			x					
Strontium			x					
Yttrium			x					
Zirconium			x					
Niobium			x					
Molybdenum			x					
Palladium			x					
Silver			x					
Cadmium			x					
Indium			x					

	Equipment for On-site Measurements							
Compound name	**GC-FID-MS**	**MetOne BAM 1020**	**SailBri Cooper Xact625i**	**Magee AE33**	**Picarro G2401**	**Teledyne T101**	**Ecophysics nCLD855**	**Teledyne T400**
Tin			x					
Antimony			x					
Tellurium			x					
Iodine			x					
Cesium			x					
Barium			x					
Lanthanum			x					
Cerium			x					
Platinum			x					
Gold			x					
Mercury			x					
Thallium			x					
Lead			x					
Bismuth			x					

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Table A2. Discrete Samples

	Analytical Methods for Discrete Samples						
Compound name	**MLD058+066 or MLD072**	**MLD039**	**TO-13 SIM mode**	**TO-13 Scan mode**	**MLD034**	**MLD022**	**ASTM D5504**
Benzene	x						
Ethylbenzene	x						
Styrene	x						
Toluene	x						
Xylene (o)	x						
Xylenes (m & p)	x						
1,1,1-Trichloroethane	x						
1,3-Butadiene	x						
Acetone	x						
Acetonitrile	x						
Acrolein	x						
Acrylonitrile	x						
Bromomethane	x						
Carbon tetrachloride	x						
Chloroform	x						
cis-1,3-Dichloropropene	x						
Dichloromethane	x						
Freon 11	x						
Freon 113	x						
Freon 12	x						
Perchloroethylene	x						
trans-1,3-Dichloropropene	x						
Trichloroethylene	x						

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	Analytical Methods for Discrete Samples						
Compound name	**MLD058+066 or MLD072**	**MLD039**	**TO-13 SIM mode**	**TO-13 Scan mode**	**MLD034**	**MLD022**	**ASTM D5504**
Vinyl chloride	x						
Acetaldehyde						x	
Formaldehyde						x	
Methyl ethyl ketone						x	
Hydrogen sulfide							x
2,5-Dimethylthiophene							x
2-Ethylthiophene							x
3-Methylthiophene							x
Carbon disulfide							x
Carbonyl sulfide							x
Diethyl disulfide							x
Diethyl sulfide							x
Dimethyl disulfide							x
Dimethyl sulfide							x
Ethyl methyl sulfide							x
Ethyl mercaptan							x
Isobutyl mercaptan							x
Isopropyl mercaptan							x
Methyl mercaptan							x
n-Butyl mercaptan							x
n-Propyl mercaptan							x
tert-Butyl mercaptan							x
Tetrahydrothiophene							x
Thiophene							x
Aluminum					x		

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	Analytical Methods for Discrete Samples						
Compound name	**MLD058+066 or MLD072**	**MLD039**	**TO-13 SIM mode**	**TO-13 Scan mode**	**MLD034**	**MLD022**	**ASTM D5504**
Antimony					x		
Arsenic					x		
Barium					x		
Bromine					x		
Calcium					x		
Chlorine					x		
Chromium					x		
Cobalt					x		
Copper					x		
Iron					x		
Lead					x		
Manganese					x		
Mercury					x		
Molybdenum					x		
Nickel					x		
Phosphorus					x		
Potassium					x		
Rubidium					x		
Selenium					x		
Silicon					x		
Strontium					x		
Sulfur					x		
Tin					x		
Titanium					x		
Vanadium					x		

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	Analytical Methods for Discrete Samples						
Compound name	**MLD058+066 or MLD072**	**MLD039**	**TO-13 SIM mode**	**TO-13 Scan mode**	**MLD034**	**MLD022**	**ASTM D5504**
Yttrium					x		
Zinc					x		
2-Methylnaphthalene			x	x			
Acenaphthene			x	x			
Acenaphthylene			x	x			
Anthracene			x	x			
Benzo[a]anthracene			x	x			
Benzo[a]pyrene			x	x			
Benzo[b]fluoranthene			x	x			
Benzo[g.h,i]perylene			x	x			
Benzo[k]fluoranthene			x	x			
Chrvsene			x	x			
Dibenz[a,h]anthracene			x	x			
Fluoranthene			x	x			
Fluorene			x	x			
Indeno[1, 2,3-cd]pyrene			x	x			
Naphthalene			x	x			
Phenanthrene			x	x			
Pyrene			x	x			
Hexavalent chromium		x					
1, 3-Dichlorobenzene				x			
1,2,4-Trichlorobenzene				x			
1,2-Dichlorobenzene				x			
1,4-Dichlorobenzene				x			
2,4,5-Trichlorophenol				x			

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	Analytical Methods for Discrete Samples						
Compound name	MLD058+066 or MLD072	MLD039	TO-13 SIM mode	TO-13 Scan mode	MLD034	MLD022	ASTM D5504
2,4,6-Tribromophenol				x			
2,4,6-Trichlorophenol				x			
2,4-Dichlorophenol				x			
2,4-Dimethylphenol				x			
2,4-Dinitrophenol				x			
2,4-Dinitrotoluene				x			
2,6-Dinitrotoluene				x			
2-Chloronaphthalene				x			
2-Chlorophenol				x			
2-Fluorophenol				x			
2-Methylphenol				x			
2-Nitroaniline				x			
2-Nitrophenol				x			
3 & 4 Methylphenol				x			
3,3'-Dichlorobenzidine				x			
3-Nitroaniline				x			
4,6-Dinitro-2-methylphenol				x			
4-Bromophenyl phenyl ether				x			
4-Chloro-3-methylphenol				x			
4-Chloroaniline				x			
4-Chlorophenyl phenyl ether				x			
4-Nitroaniline				x			
4-Nitrophenol				x			
Benzoic acid				x			
Benzyl alcohol				x			

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	Analytical Methods for Discrete Samples						
Compound name	**MLD058+066 or MLD072**	**MLD039**	**TO-13 SIM mode**	**TO-13 Scan mode**	**MLD034**	**MLD022**	**ASTM D5504**
Bis (2-chloroisopropyl) ether				x			
Bis(2-chloroethoxy)methane				x			
Bis(2-chloroethyl)ether				x			
Bis(2-ethylhexyl) phthalate				x			
Butyl benzyl phthalate				x			
Dibenzofuran				x			
Diethylphthalate				x			
Dimethyl phthalate				x			
Di-n-butyl phthalate				x			
Di-n-octyl phthalate				x			
Hexachloro-1,3-cyclopentadiene				x			
Hexachlorobenzene				x			
Hexachlorobutadiene				x			
Hexachloroethane				x			
Isophorone				x			
Nitrobenzene				x			
N-Nitrosodimethylamine				x			
N-Nitrosodi-n-propylamine				x			
N-Nitrosodiphenylamine				x			
Pentachlorophenol				x			
Phenol				x			

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