CARB OIL & GAS REGULATION

[TITLE 17, CALIFORNIA CODE OF REGULATIONS, § 95668]

STORAGE MONITORING PLAN

ALISO CANYON NATURAL GAS STORAGE FACILITY

SOUTHERN CALIFORNIA GAS COMPANY

555 WEST 5TH STREET

LOS ANGELES, CA 90013

PREPARED BY:

STORAGE DATA MANAGEMENT – STORAGE FACILITIES & COMPLIANCE SYSTEMS

JULY 2024

***Note** – This Monitoring Plan is based on the October 2017 interpretation and the April 2024 amendments of the regulation requirements and is subject to revision. When anticipated regulation revisions are released or substantive CARB or associated EPA documents are released (e.g., guidance or clarifications), activity and monitoring data requirements should be reviewed.*

Southern California Gas CARB Monitoring Plan Revision History

New Document Number	Revised By	Revision Date	Approved By	Approval Date	Description of Primary Revisions
2	SCG	08/03/18			Additional information provided per AQMD and ARB requests
3	SCG	10/22/18			Additional information provided per AQMD and ARB requests
4	SCG	07/01/24			Additional information per CARB approvals and amendments to the Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities

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LIST OF SYMBOLS, ACRONYMS, AND ABBREVIATIONS

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BCF	Billion Cubic Feet
CalGEM	California Geologic Energy Management Division
CARB	California Air Resources Board
CCR	California Code of Regulations
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LEL	Lower Explosive Limit
O&G	Oil & Gas
OGI	Optical Gas Imaging
PID	Photo Ionization Detector
ppb	Parts Per Billion
ppm	Parts Per Million
ppmv	Parts Per Million by Volume
SCAQMD	South Coast Air Quality Management District
SoCalGas	Southern California Gas Company
SOP	Standard Operating Procedures

1.0 INTRODUCTION

Title 17, California Code of Regulations (CCR), sections 95665-95677 and associated appendices cover Subarticle 13: Greenhouse Gas Emission standards for Crude Oil and Natural Gas Facilities (CARB Oil & Gas Regulation). Natural gas underground storage facilities are addressed in the CARB Oil & Gas Regulation, including monitoring, reporting, and recordkeeping provisions for covered facilities that involve the implementation of processes, procedures, and equipment. These provisions are described in:

- § 95668 "Standards",
- § 95669 "Leak Detection and Repair",
- § 95672 "Record Keeping Requirements",
- § 95673 "Reporting Requirements",
- Appendix A "Record Keeping and Reporting Form".

Owners or operators of existing natural gas underground storage facilities subject to the CARB Oil & Gas Regulation are required to submit an updated monitoring plan to CARB for approval and implement the plan within 180 days of CARB approval.[1] This monitoring plan has been prepared for Southern California Gas Company's (SoCalGas) Aliso Canyon natural gas underground storage facility (Aliso Canyon) to comply with the requirements of the CARB Oil & Gas Regulation described above and in accordance with the requirements of § 95668(h)(4) of the Regulation.

This monitoring plan was initially developed per the CARB Oil & Gas Regulation effective on October 1, 2017. The most recent revision to the CARB Oil & Gas Regulation became effective on April 1, 2024. This monitoring plan has been updated and applies for monitoring and reporting of the Aliso Canyon facility beginning in 2018 and reflects the monitoring updates applied in 2024.

1.1 REGULATORY BACKGROUND

The facility shall comply with the requirements and procedures for monitoring, quality assurance, recordkeeping, verification, and reporting identified in each applicable subpart of the CARB Oil & Gas Regulation.

As noted above, the following sections are applicable to the Aliso Canyon storage facility.

§ 95668 "Standards". This section sets forth standards that shall be met by all affected facilities, as defined in § 95666 of the Regulation, which are primarily the development of this monitoring plan, as required by subsection § 95668(h), *Natural Gas Underground Storage Facility Monitoring Requirements*. This monitoring plan addresses the three key areas required including: (1) continuous ambient air monitoring, (2) wellhead daily or continuous leak screening, and (3) well blowout procedures.

§ 95669 "Leak Detection and Repair". This section applies to most components found at the facilities and cites procedures and timetables for repairing any gas leaks detected. Facility-specific leak detection and repair plans are provided in separate internal company Standard Operating Procedures (SOPs) and will have been developed by July 1, 2024.

§ 95672 "Record Keeping Requirements" & § 95673 "Reporting Requirements". These sections present recordkeeping and reporting requirements to demonstrate compliance with the CARB Oil & Gas Regulation, as necessary. Specifically, § 95672(a)(15) through § 95672(a)(22) of the Regulation cite the record retention periods and recordkeeping forms can be found in Appendix A of the CARB O&G Regulation required by the monitoring plan.

[1] § 95668(h) of the CARB Oil & Gas Regulation

This plan focuses on the requirements detailed in Table 1-1 below.

Table 1-1. Monitoring Requirements for Natural Gas Storage Facilities

Regulation Section	Monitoring Requirement	Plan Section	At Page
§ 95668(h)(4)(A)	Upwind/Downwind Continuous Monitoring for Ambient Methane	2.0	7
§ 95668(h)(4)(A)(1)	At least one upwind sensor and one downwind sensor	2.1 Appendix A	7 14
§ 95668(h)(4)(A)(1)(a)	Measure methane at minimum 250 ppb accuracy	2.1	7
§ 95668(h)(4)(A)(1)(b)	Monitors calibrated at least annually; defective instrumentation repaired or replaced within 14 calendar days	2.1	7
§ 95668(h)(4)(A)(2)	Meteorological conditions (ambient temperature, ambient pressure, relative humidity, wind speed and wind direction) continuously recorded	2.1	7
§ 95668(h)(4)(A)(3)	Store at least 24 months of continuous instrument data and able to generate periodic reports	2.4.1	9
§ 95668(h)(4)(A)(4)	Alarm system audible and visible continuously in facility control rooms	2.1	8
§ 95668(h)(4)(A)(5)	All data shall be made available upon request of the CARB Executive Officer and reported annually per §95673	2.4.2	10
§ 95668(h)(4)(A)(6)	Baseline monitoring conditions established using 12 months of continuous data	2.1	7
§ 95668(h)(4)(A)(7)	Alarm triggered any time the downwind sensors detect reading greater or equal to four (4) times baseline or sensor failure	2.1	8
§ 95668(h)(4)(A)(8)	Operator to confirm alarm conditions and notify CARB, CalGEM, and the local air district within 24 hours of the downwind sensor(s) detecting a reading that is greater than or equal to four (4) times the downwind sensor(s) baseline	2.4.2	10
§ 95668(h)(4)(A)(10)	Records of any time the monitoring system is inactivated, including an explanation of the reason for the system being inactivated. Records when the system is reactivated.	2.4.1	9
§ 95668(h)(4)(B)	Daily or continuous leak screening at each injection/withdrawal wellhead	3.0	11
§ 95668(h)(4)(B)(1)	Daily leak screening using Method 21 or optical gas imaging	3.1.2	12
§ 95668(h)(4)(B)(1)(a)	Delay of inspections and associated reporting to the CARB Executive Officer if wildlife is present on a component and work must be halted or postponed within a certain distance of the wildlife	3.1.2 3.2	12 12
§ 95668(h)(4)(B)(2)	Continuous leak screening using automated instruments and a monitoring system; alarm system audible and visible in facility control rooms	3.1.1	11
§ 95668(h)(4)(B)(2)(a)	Alarm triggered if leak is detected above 50,000 ppmv THC or above 10,000 ppmv THC if the 10,000 ppmv leaks persists for more than five (5) continuous calendar days	3.1.1	11
§ 95668(h)(4)(B)(2)(b)	Alarm triggered in the event of a sensor failure	3.1.1	11
§ 95668(h)(4)(B)(2)(c)	Store 2 years of continuous monitoring data	3.2	12
§ 95668(h)(4)(B)(2)(d)	Sensors and alarms tested quarterly; defective instrumentation repaired or replaced within 14 calendar days from the date of the discovery of a malfunction	3.1.1	11

§ 95668(h)(4)(B)(2)(e)	Sensors calibrated at least annually; defective instrumentation repaired or replaced within 14 calendar days from the date of the discovery of a malfunction	3.1.1	11
§ 95668(h)(4)(B)(2)(f)	Maintain and make available upon request by the CARB Executive Officer records of monitoring system data, calibration, and alarm system testing	3.2	12
§ 95668(h)(4)(B)(2)(g)	Records of any time the monitoring system is inactivated, including an explanation of the reason for the system being inactivated. Records when the system is reactivated.	3.2	12
§ 95668(h)(4)(B)(3)	Leaks tested by US EPA Reference Method 21 within 24 hours.	3.1.1 3.1.2	11 12
§ 95668(h)(4)(B)(3)(a)	Delay of inspections and associated reporting to the CARB Executive Officer if wildlife is present on a component and work must be halted or postponed within a certain distance of the wildlife	3.1.1 3.2	11 12
§ 95668(h)(4)(B)(4)	Leaks must be repaired within repair timeframes as specified in §95669	3.1.1 3.1.2	11 12
§ 95668(h)(4)(B)(6)	Leaks above 50,000 ppmv THC or above 10,000 ppmv THC for longer than five (5) continuous calendar days to be confirmed; CARB, CalGEM, and the local air district notified within 24 hours	3.2	12
§ 95668(h)(4)(B)(7)	Initial and final leak concentration measurement records, as specified in Appendix A Table A5, maintained, and made available to the CARB Executive Officer upon request	3.2	12
§ 95668(h)(4)(B)(8)	Results of initial and final leak concentrations reported as specified in §95673	3.2	12
§ 95668(h)(4)(C)	Optical gas imaging of leak at injection/withdrawal head assembly in the event of a blowout	4.0	13
§ 95668(h)(4)(C)(1)	OGI performed by a technician qualified in basic thermal science, OGI camera operation and safety, and OGI inspections training	4.1	13
§ 95668(h)(4)(C)(2)	OGI video footage of leak recorded a minimum of 10 minutes every four (4) hours throughout the course of the blowout incident	4.2	13
§ 95668(h)(4)(C)(3)	OGI video footage of leak will be made available upon request by the CARB Executive Officer	4.2	13
§ 95668(h)(4)(C)(4)	OGI video footage of leak will be posted on public web site throughout blowout	4.2	13

1.2 FACILITY DESCRIPTION

This monitoring plan is applicable to the Aliso Canyon facility located in South Coast Air Quality Management District (SCAQMD) at 12801 Tampa Ave., Northridge, CA 91326.

The Aliso Canyon facility historically has a design working capacity of 86 BCF. The facility sits on the southern slope of the Santa Susana Mountains on a total area of approximately 3600 acres. The terrain is mountainous with equipment on surrounding crests and valleys.

The main plant is located north of the main entrance and features a compressor station housing five reciprocating compressors and three electric driven centrifugal compressors. The main plant also houses a two-track dehydration system. To the west of the main plant is a tank farm. The facility also contains a second two-track dehydration plant to the north of the main plant and a third smaller dehydration plant out in the east field area. In addition, there are two gathering plants located northeast and northwest of the main plant.

A map showing the facility location is in Figure 1.

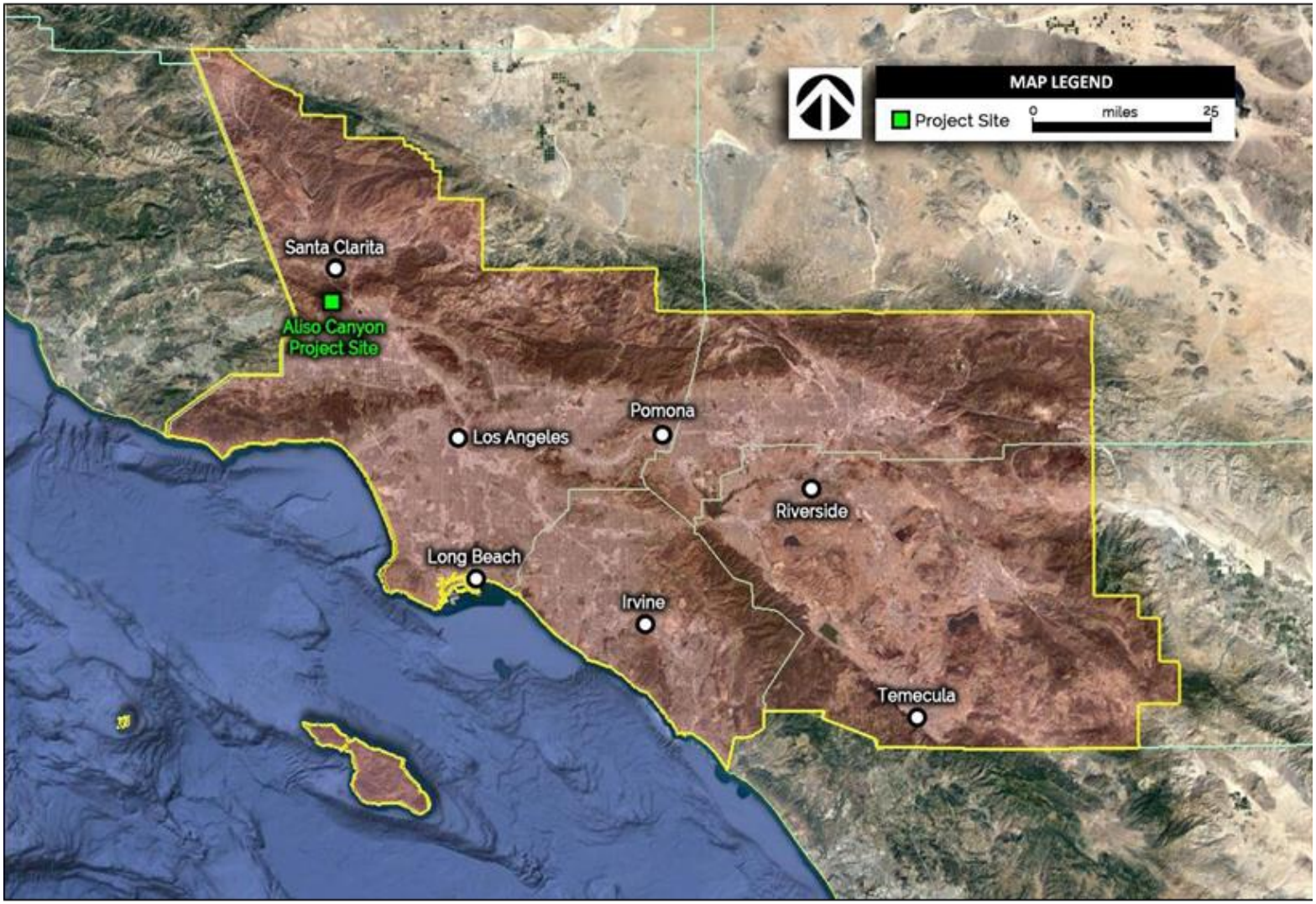


Figure 1. Aliso Canyon Facility Location Map

2.0 CONTINUOUS AMBIENT AIR MONITORING

Requirements for calculating and reporting natural gas underground storage facility ambient air monitoring are addressed in § 95668(h)(4)(A) of the CARB Oil & Gas Regulation.

2.1 SUMMARY OF AMBIENT AIR MONITORING TECHNOLOGIES AND OPERATION

The ambient air monitoring system consists of three (3) stationary ambient air monitors placed downwind, two (2) stationary ambient air monitors placed upwind of the facility, and four (4) meteorological stations.[2] The locations of the monitors are presented in Appendix A1. Monitor placement was chosen to meet the requirements of § 95668(h)(4)(A). Monitor site selection guidance presented in 40 CFR Part 58, Appendices A & E and EPA's Meteorological Monitoring Guidance for Regulatory Modeling Applications was utilized. EPA's Quality Assurance Handbook for Air Pollution Measurement Systems: Volume II: Ambient Air Quality Monitoring Program and Volume IV: Meteorological Measurements Versions 2.0 were also referenced. The sites were selected based on existing, site-specific meteorological data, suitability of terrain, and distance from obstruction to ensure that representative data are collected. Availability of power and accessibility to the sites were also considerations in choosing the location of the monitors.

As required by § 95668(h)(4)(A)(1)(b) of the CARB Oil & Gas Regulation, SoCalGas calibrates the ambient air monitors at least once annually. SoCalGas shall repair or replace any defective ambient air monitors within 14 calendar days from the date of calibration or discovery of a malfunction. SoCalGas shall seek a delay of repair from the CARB Executive Officer, if applicable.

As required by the CARB Oil & Gas Regulation, the ambient air monitors are capable of continuously measuring a methane concentration of 250 ppb accuracy or better. For both upwind and downwind locations, SoCalGas utilizes the Los Gatos Research (LGR) closed-path, point sensor laser-based ambient monitors. The LGR closed-path system was selected based on its high-speed performance, highly accurate measurements, low power requirements and ability to withstand a wide range of weather conditions. Specifications for the LGR monitors are shown in Appendix B1.[3]

As required by § 95668(h)(4)(A)(2) of the Regulation, the ambient monitoring system includes four (4) meteorological stations instrumented for continuous measurement and recording of ambient temperature, ambient pressure, relative humidity, wind speed, and wind direction. The Porter station is the designated meteorological station to comply with the Regulation. Meteorological sensors are sited at a distance beyond the influence of obstructions such as buildings and trees. Specifications for the meteorological instrumentation are included in Appendix B3.

Baseline ambient methane concentrations were determined once ambient monitoring instrumentation had been fully commissioned and data had been collected for over a 12-month period.[4] As required by § 95668(h)(4)(A)(6), SoCalGas has established baseline monitoring conditions for the facility, submitted baseline concentrations to the CARB Executive Officer, and received approval utilizing the 98-th percentile of 12-month continuous 1-hour measurements. The baseline monitoring conditions are presented in Table 2-1.

SoCalGas shall utilize the continuous 1-hour average baseline calculations for any modifications to baseline conditions. The 1-hour average modifications for both the upwind ambient monitors and downwind ambient

[2] § 95668(h)(4)(A)(1) and § 95668(h)(4)(A)(2) of the CARB Oil & Gas Regulation.
[3] The LGR-ICOS S-GPC-918 Analyzer product ID number has been changed to the ABB ICOS GLA131-GPC product ID.
[4] Any requests for modifications to baseline conditions will be submitted to CARB for approval. Requests for modification to baseline conditions shall be approved in full or in part, or disapproved in full or in part, by CARB within three (3) months from the date of requested modifications. Modifications to baseline conditions may be reevaluated every 12 months for changes in local conditions and shall be approved by CARB.

monitors will be computed in accordance with QA Handbook for Air Pollution Measurement Systems: Volume II: Ambient Air Quality Monitoring Program Table 6-4. To be considered valid, each hour of continuous measurement must consist of at least 45 minutes of valid data. Valid hourly measurements will be used to calculate the baseline. Hourly data which includes periods of calibration, maintenance, or quality-assurance activities which result in less than 45 valid minutes in an hour will be considered an invalid hour.

Table 2-1. Established Baseline Monitoring Conditions for Aliso Canyon

Ambient Monitor	Baseline (ppm)
MM1 (Downwind Monitor 1)	2.15
MM2 (Upwind Monitor 1)	2.04
MM3 (Upwind Monitor 2)	2.07
MM4 (Downwind Monitor 2)	2.22
MM5 (Downwind Monitor 3)	2.25

All ambient air monitors showing average methane concentrations of four (4) times the baseline or greater for an hour or showing a sensor failure, triggers an alarm that is visible and audible in the facility and remote operating rooms. The alarm time interval, a 1-hour block average, with the measurement time resolution per minute, was established, based on data collected over a 12-month period.

Alarms are investigated and confirmed per internal company Standard Operating Procedures (SOP).

The alarms are tested during the annual ambient air monitor calibration process per internal company SOPs. The test is conducted by introducing a high concentration of methane gas to the monitor to trigger an alarm. Once the alarm has been verified, the monitor calibration process will proceed.

2.2 SUPPORTING WIND DATA

Wind roses used in the initial monitor placement review were generated using meteorological data from local established stations. Potential upwind and downwind monitoring locations were determined based on these wind roses.

There are currently four (4) operational meteorological stations at the facility. The location of the established meteorological stations for Aliso Canyon are presented in Table 2-2. The height of the tower is 10 meters.

Table 2-2. Established Meteorological Stations near Aliso Canyon

Station	Coordinates
Main Plant	34°18'27.76"N, 118°33'5.67"W
MA 5	34°18'18.29"N, 118°32'21.09"W
Porter	34°19'8.56"N, 118°33'17.29"W
Sesnon	34°19'12.38"N, 118°33'54.04"W

Wind roses based on annual data from the four active meteorological stations listed in Table 2-2 are shown on the map in Appendix A1. Seasonal wind roses for each active meteorological station are also included in Appendix A8. As shown in these figures, the wind at Aliso Canyon has nearly equal wind flow distribution out of the south and north along the canyons. The seasonal wind roses show flows during the spring and summer are predominately out of the south while winter wind patterns show flows out of the north.

2.3 AMBIENT AIR MONITOR PLACEMENT

Upwind and downwind ambient monitor location maps for the facility are presented in Appendix A1. The monitor locations were suitable for establishing baseline background concentrations and adequately characterize the facility emissions for purposes of this Regulation.

At Aliso Canyon, there exists two upwind monitors and three downwind monitors. The upwind monitors (MM-2 and MM-3) sit at the top of the canyon near the back gate of the facility close to the existing Porter and Sesnon meteorological stations. The three downwind monitors (MM-1, MM-4, and MM-5) currently exist at the bottom of the canyon valleys. The location of the eastern downwind monitor (MM-5) is east of the main gate and near the intersection of Kilfinan Street and Ormskirk Avenue. The central downwind monitor (MM-4) is by the main gate and should capture any emissions from the main plant, tank farm and dehydration #2 process equipment. The location of the western downwind monitor (MM-1) is west along the fence line from the main gate near the intersection of Mason Avenue and Ridgeline Road and would capture any emissions from the western portion of the field and the Sesnon gathering plant.

All monitor placement and siting comply with requirements found in 40 CFR Part 58, Appendix E. The sites are characterized as microscale type monitoring stations according to spatial scale definitions found in 40 CFR Part 58, Appendix D. As such, the inlet probes should be placed between two and seven meters above ground level. The sample inlets are located inside a rain cap approximately 4.0 meters above ground level above the influence of the monitoring structure's roofline.

2.4 SUMMARY OF DATA HANDLING

2.4.1 DATA VALIDATION AND STORAGE

The ambient air monitors connect to an existing enterprise software system (OSIsoft PI), which can store at least five years of records and two years of continual data, with required data points including ambient temperature, ambient pressure, relative humidity, wind speed, wind direction and methane concentration. Data is monitored and validated per internal company SOPs.

The LGR analyzers include health metrics that monitor all parameters in real time. Sensors are calibrated by a qualified technician at least annually. Calibration records are kept on file for at least five years and shall be provided to CARB upon request.

Pursuant to § 95668(h)(4)(A)(3) of the Regulation, the ambient air monitoring system (including the meteorological station) is configured to store at least 24 months of continuous data with the capability to generate hourly, daily, weekly, monthly, and annual reports.

SoCalGas maintains records of any time the ambient air monitoring system is inactivated with an explanation of the reason for the system being inactivated. Inactivation periods include power failures, sensor failures, communication faults, etc. SoCalGas also maintains records of when the system is reactivated.

2.4.2 DATA REPORTING

If the downwind sensor(s) detects an average reading that is greater than or equal to four (4) times the downwind sensor(s) baseline or greater for an hour, SoCalGas will notify CARB, CalGEM, and SCAQMD within 24 hours as required in § 95673(a)(8) and § 95668(h)(4)(A)(8) of the Regulation. The explanation for the alarm condition will be provided. A planned maintenance activity that is within the facility's control and triggers the four times downwind baseline methane alarm is not considered by CARB to be a reportable event that requires notification to CARB, CalGEM, and SCAQMD. An alarm triggered by a 3rd party emission is considered a reportable event, as required in § 95668(h)(4)(A)(8), and SoCalGas will send an email notification with an explanation that the leak was caused by a 3rd party emission (e.g. no localized leak discovered after an alarm investigation was conducted, etc.).

As required in § 95673(a)(11), an annual report is generated and submitted to CARB summarizing the meteorological data gathered by the weather stations and the methane concentration data gathered by the upwind and downwind monitoring sensors.

All data collected by the monitoring system, including calibration and alarm system testing records, will be made available to the CARB Executive Officer upon request.

3.0 INJECTION/WITHDRAWAL WELL MONITORING

Requirements related to natural gas underground storage injection/withdrawal well monitoring are addressed in § 95668(h)(4)(B) of the Regulation.

3.1 SUMMARY OF MONITORING TECHNOLOGIES AND METHODOLOGY

The injection/withdrawal well monitoring system shall consist of either daily well inspections or continuous methane monitors placed at each well site in accordance with the Regulation. As discussed, below, SoCalGas has installed continuous methane monitors at all wellheads and the use of these monitors will be the primary method of complying with these requirements. However, during equipment installation, breakdown, or repair, SoCalGas will conduct daily wellhead screening, as described below, to promote continued compliance with the Regulation. While wells are undergoing rig work, neither continuous monitoring via LEL (lower explosive limit) monitors nor daily monitoring via portable methane detectors are required.[5] Wells no longer need continuous monitoring once the well is abandoned per CalGEM requirements, cementing to the surface is completed, and the rig has left the site location.

3.1.1 CONTINUOUS LEAK SCREENING

Each wellhead shall have two (2) UE Vanguard continuous LEL gas detectors that measure total hydrocarbons in units of parts per million volume (ppmv) calibrated as methane placed within a distance that will satisfy acceptable monitoring of the wellhead and attached pipeline.[6] The LEL sensors are connected to OSIsoft PI and provide continual data. SoCalGas has implemented a system weather hold when humidity reaches 95% and above and resumes monitoring after humidity reduces below 95% for a duration of one hour. Specifications for the LEL sensors are included in Appendix B2. An audible and visible alarm in the facility and remote operating rooms alert operations staff if the LEL sensor detects any of the following conditions:

- The sensor reads a methane concentration above 50,000 ppmv,
- The sensor reads a methane concentration above 10,000 ppmv that persists for more than five (5) continuous calendar days, or
- A sensor failure is detected.

For each alarm, a 10-foot radius of the alarming sensor will be inspected, and the leak quantified in accordance with US EPA Reference Method 21 within 24 hours of initial leak detection. Leaks will be repaired and re-inspected per US EPA Reference Method 21 in accordance with the timetables laid out in § 95669, *Leak Detection and Repair*. The Method 21 instruments currently utilized are the DPIR Heath Consultants Detecto Pak Infrared and TVA Thermo Scientific Toxic Vapor Analyzer 1000 A/B. Instrument specifications are provided in internal company SOPs.

If wildlife is found to be within a certain distance of the area of inspection, SoCalGas will report a delay of inspection to the CARB Executive Officer to halt or postpone work and comply with state and federal wildlife regulations.

The LEL sensors are tested quarterly by the SoCalGas maintenance group. In addition, all sensors are calibrated, at least, annually. If a sensor fails to pass the quarterly test, or is found to be defective during calibration, it shall be repaired or replaced within 14 calendar days from the date of the discovery of a malfunction.

[5] The well is effectively out of service and rig workers are monitoring well conditions apart from the CARB program; safety restrictions prevent any direct access to the well during this time.
[6] These LEL sensors are non-dedicated and may monitor more than one wellhead when it satisfies the acceptable monitoring criteria.

3.1.2 DAILY SCREENING

As discussed above, daily leak screening is conducted during times when the continuous monitoring system is not available. If required, daily leak screening will be conducted by a qualified technician per internal company SOPs. Any methane concentrations detected during daily screening will be quantified using US EPA Reference Method 21 within 24 hours. Leaks will be repaired and re-inspected per Method 21 in accordance with the timetables laid out in § 95669, *Leak Detection and Repair*. The Method 21 instruments that will be used are discussed in Section 3.1.1 and internal company SOPs. If wildlife is found to be within a certain distance of the area of inspection, SoCalGas will report a delay of inspection to the CARB Executive Officer to halt or postpone work and comply with state and federal wildlife regulations.

3.2 SUMMARY OF DATA RECORDING AND REPORTING

The daily well screening technicians shall generate a daily report in accordance with internal company Standard Operating Procedures (SOPs).

The continuous LEL monitors are linked to an OSIsoft PI system and record continual data in accordance with SoCalGas internal company SOPs. SoCalGas has configured the system to store 24 months of continual data.

As required in § 95668(h)(4)(B)(6) and § 95673(a)(7), in the event a methane concentration is detected above 50,000 ppmv total hydrocarbons or a methane concentration is detected above 10,000 ppmv total hydrocarbons that persists for more than five (5) continuous calendar days, SoCalGas will notify CARB, CalGEM, and SCAQMD within 24 hours of the alarm trigger.

Pursuant to § 95673(a)(13), all leaks detected by the monitoring system and verified by EPA Method 21 excluding PID instruments will be recorded in § 95669, *Leak Detection and Repair*, program logs. The initial and final leak concentration measurements for leaks identified during daily screening or by the continuous system, if any, will be reported to CARB and SCAQMD quarterly. Reports are submitted via email within 30 days of the end of each calendar quarter. A planned maintenance activity that is within the facility's control and triggers a methane alarm is not considered by CARB to be a reportable event that requires notification to CARB, CalGEM, and SCAQMD. An alarm triggered by a 3rd party emission is considered a reportable event, as required in § 95668(h)(4)(B)(6), and SoCalGas will send an email notification with an explanation that the leak was caused by a 3rd party emission (e.g. no localized leak discovered after an alarm investigation was conducted, etc.).

Pursuant to § 95668(h)(4)(B)(1)(a) and § 95668(h)(4)(B)(3)(a), SoCalGas will report any delays of inspection due to complying with wildlife regulations within 24 hours of discovering wildlife present on a component. The notification shall include a description of the type of wildlife and identification of the regulations requiring work to be halted. A follow-up notification will be sent to the CARB Executive Officer within 24 hours of the inspection resuming once the reason for the delay is resolved.

All records generated, including monitoring data, calibration records, and alarm records will be made available to the CARB Executive Officer upon request. SoCalGas will keep records of any time the monitoring system is inactivated, including an explanation of the reason for the system being inactivated and maintain records of system reactivation per § 95668(h)(4)(B)(2)(g).

4.0 WELL BLOWOUT MONITORING

Well blowout monitoring and reporting are addressed in § 95668(h)(4)(C) of the Regulation.

4.1 SUMMARY OF MONITORING TECHNOLOGIES AND METHODOLOGY

A blowout is defined in the CARB O&G regulation as: ""Blowout" means the uncontrolled flow of gas, liquids, or solids (or a mixture thereof) from a well onto the surface."

If a well blowout is identified per SoCalGas internal company SOPs, well blowout monitoring shall commence within 24 hours, which is in alignment with the timeline for CalGEM to publicly post information related to blowouts per SB 887.

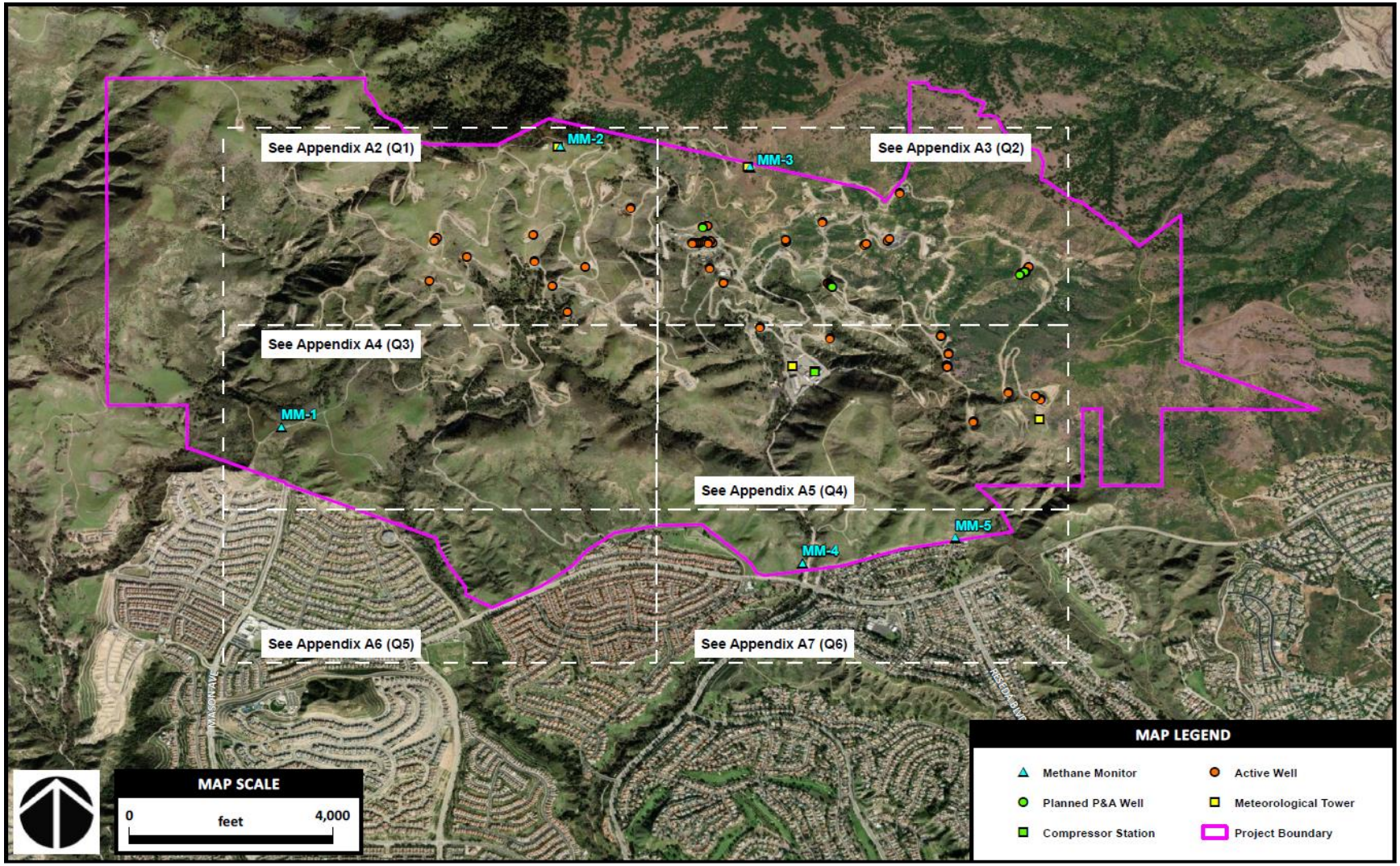
The well blowout incident shall be monitored by a technician with a certification or training in basic thermal science, OGI camera operation and safety, and OGI inspections (e.g. OGI certification or equivalent) training. Instrumentation specifications for OGI cameras are provided in Appendix B4.

4.2 SUMMARY OF DATA COLLECTION, RECORDKEEPING, AND REPORTING REQUIREMENTS

Unless an alternative approach or time frame is approved by CARB as part of a specific blowout response plan, within 48 hours of detecting a blowout, a qualified technician, as mentioned above, will set up optical gas imaging and record at least 10 minutes of footage every four (4) hours throughout the course of the blowout incident. The OGI footage will be posted on a publicly available SoCalGas maintained site as required by § 95668(h)(4)(C)(4) within 24 hours of recording. The OGI footage will be provided to the CARB Executive Officer upon request for posting on a CARB maintained internet web site as required by § 95668(h)(4)(C)(3).

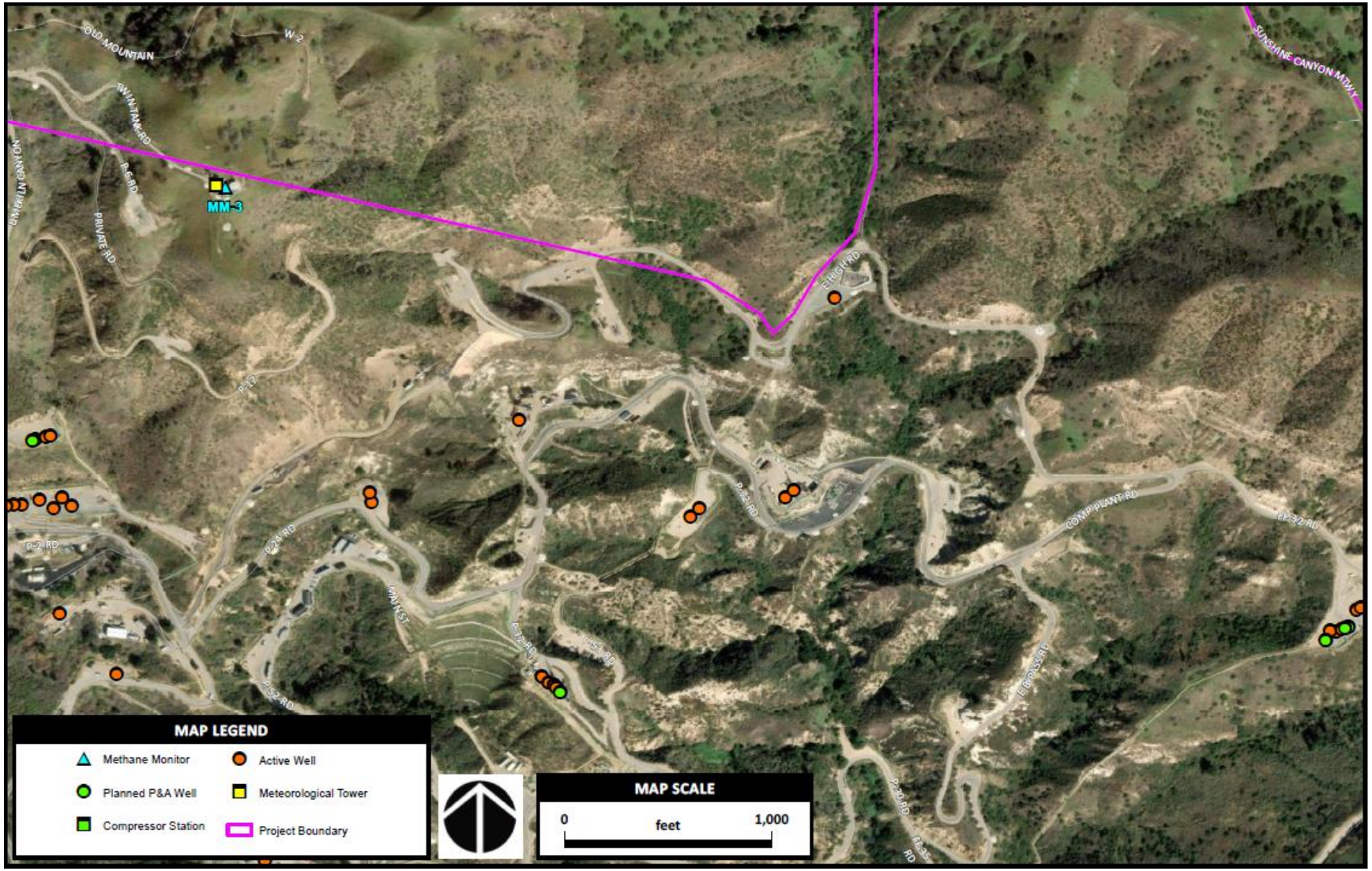
APPENDIX A: ALISO CANYON AMBIENT MONITOR LOCATIONS

APPENDIX A1: AMBIENT MONITOR LOCATIONS



APPENDIX A2: AMBIENT MONITOR LOCATIONS (Q1)

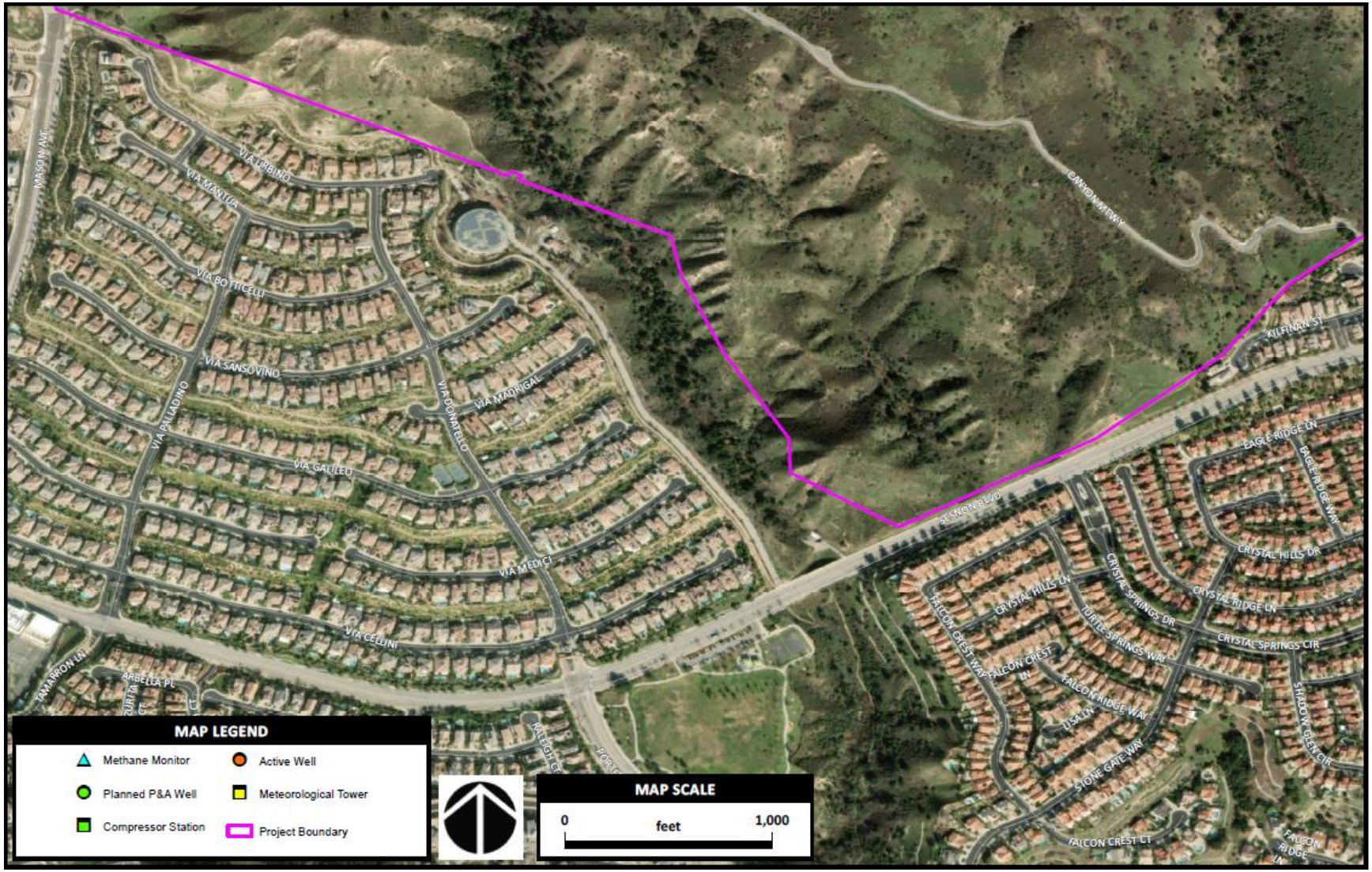
APPENDIX A3: AMBIENT MONITOR LOCATIONS (Q2)



APPENDIX A4: AMBIENT MONITOR LOCATIONS (Q3)

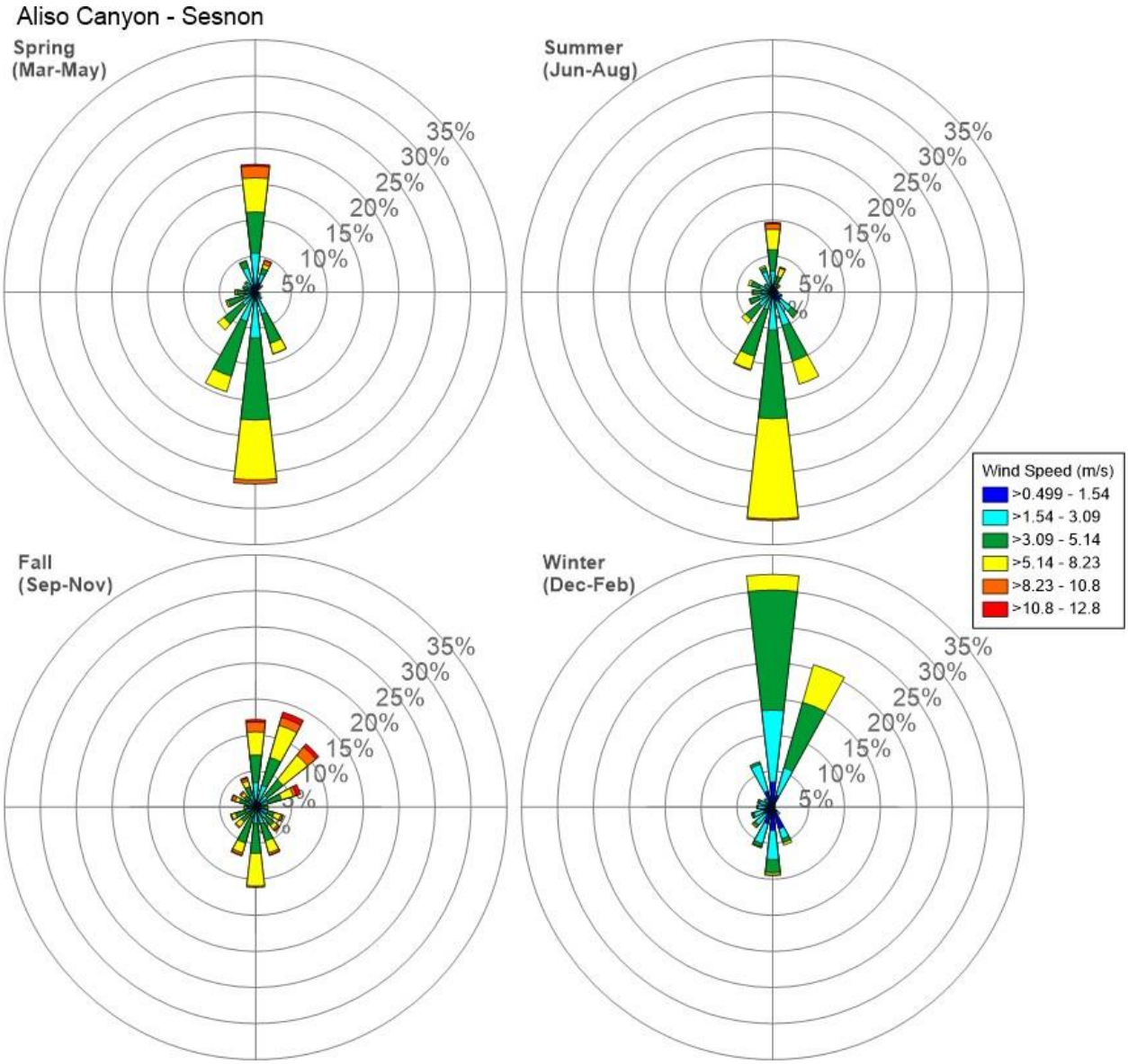
APPENDIX A5: AMBIENT MONITOR LOCATIONS (Q4)

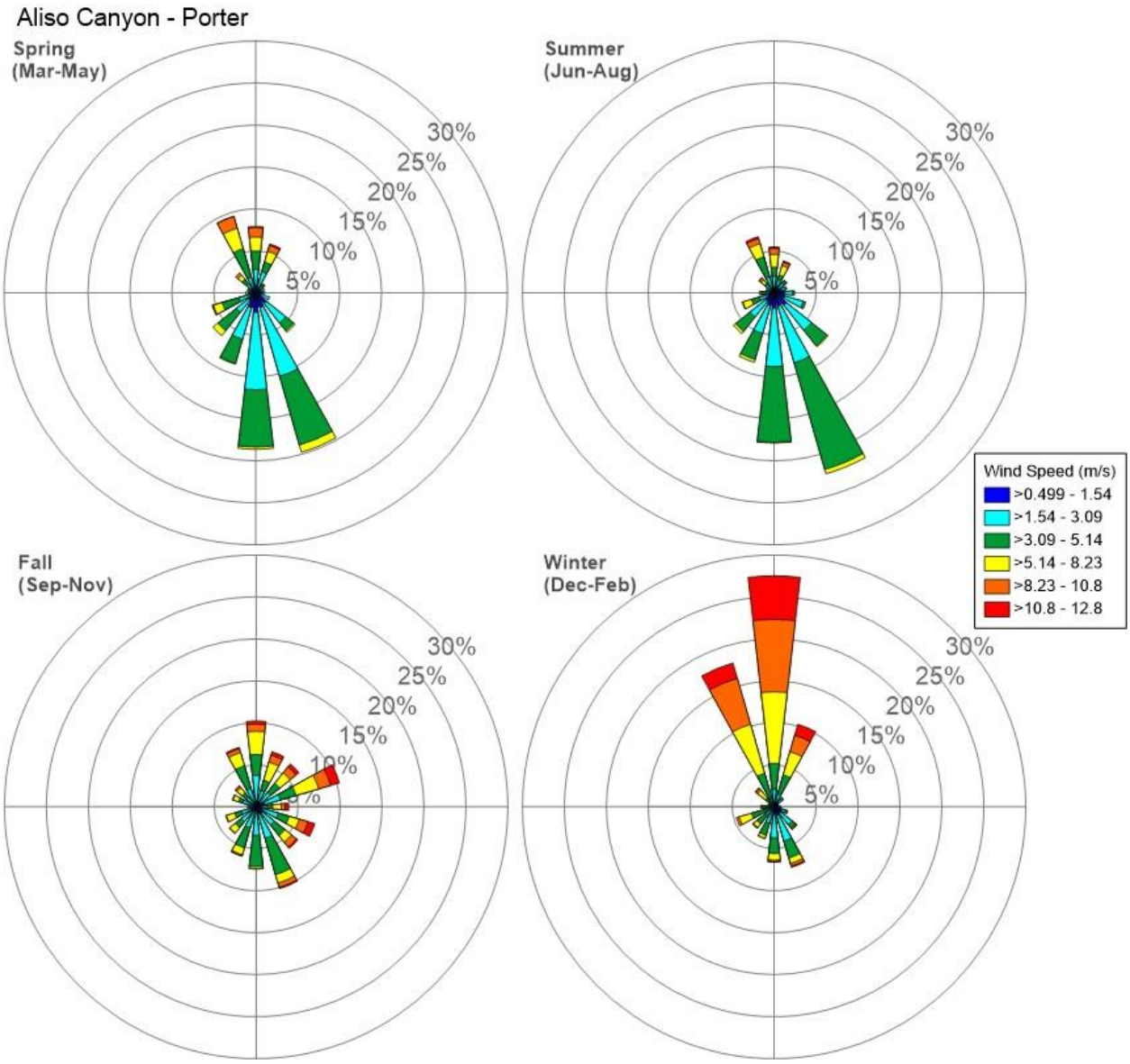
APPENDIX A6: AMBIENT MONITOR LOCATIONS (Q5)

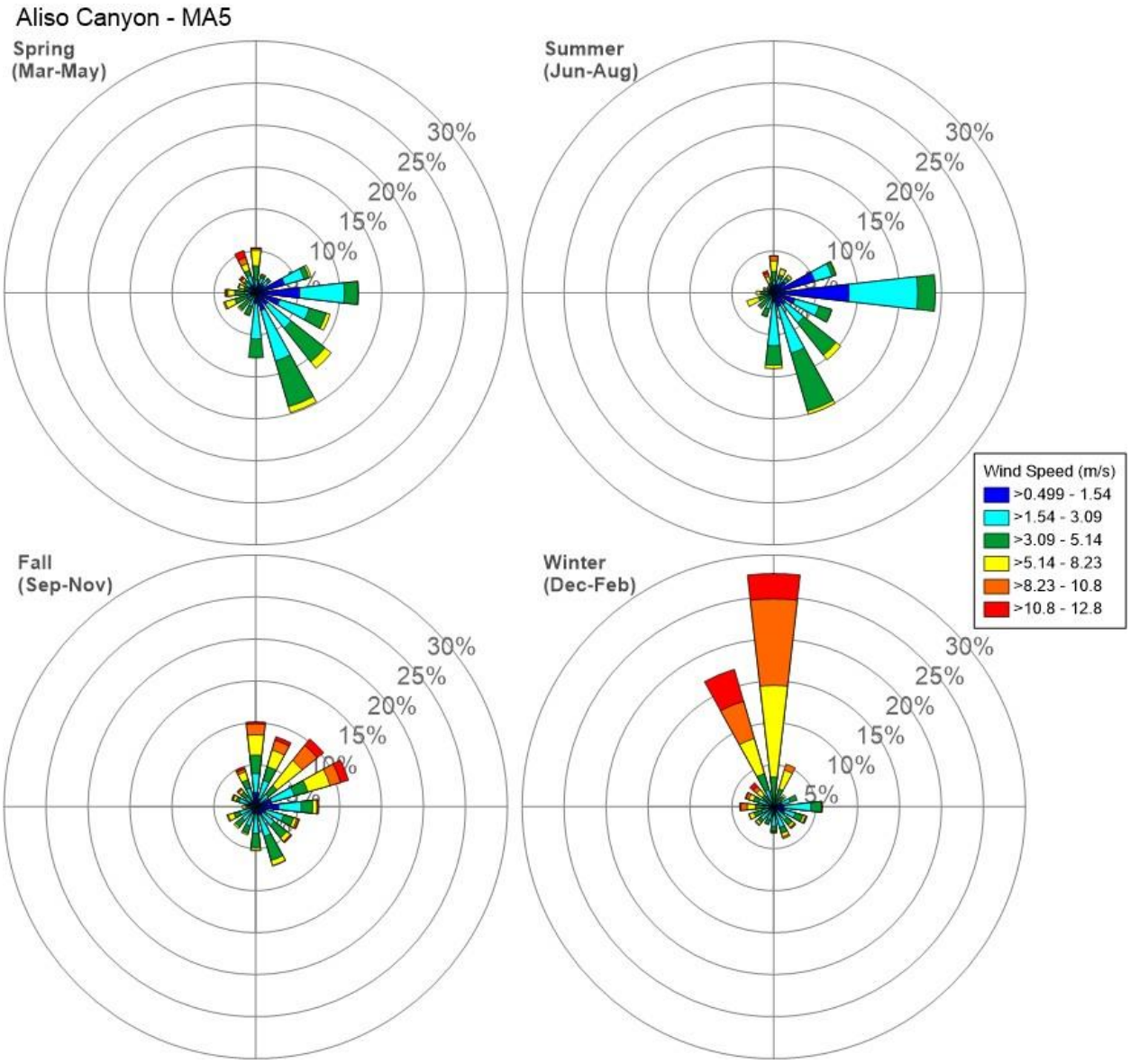


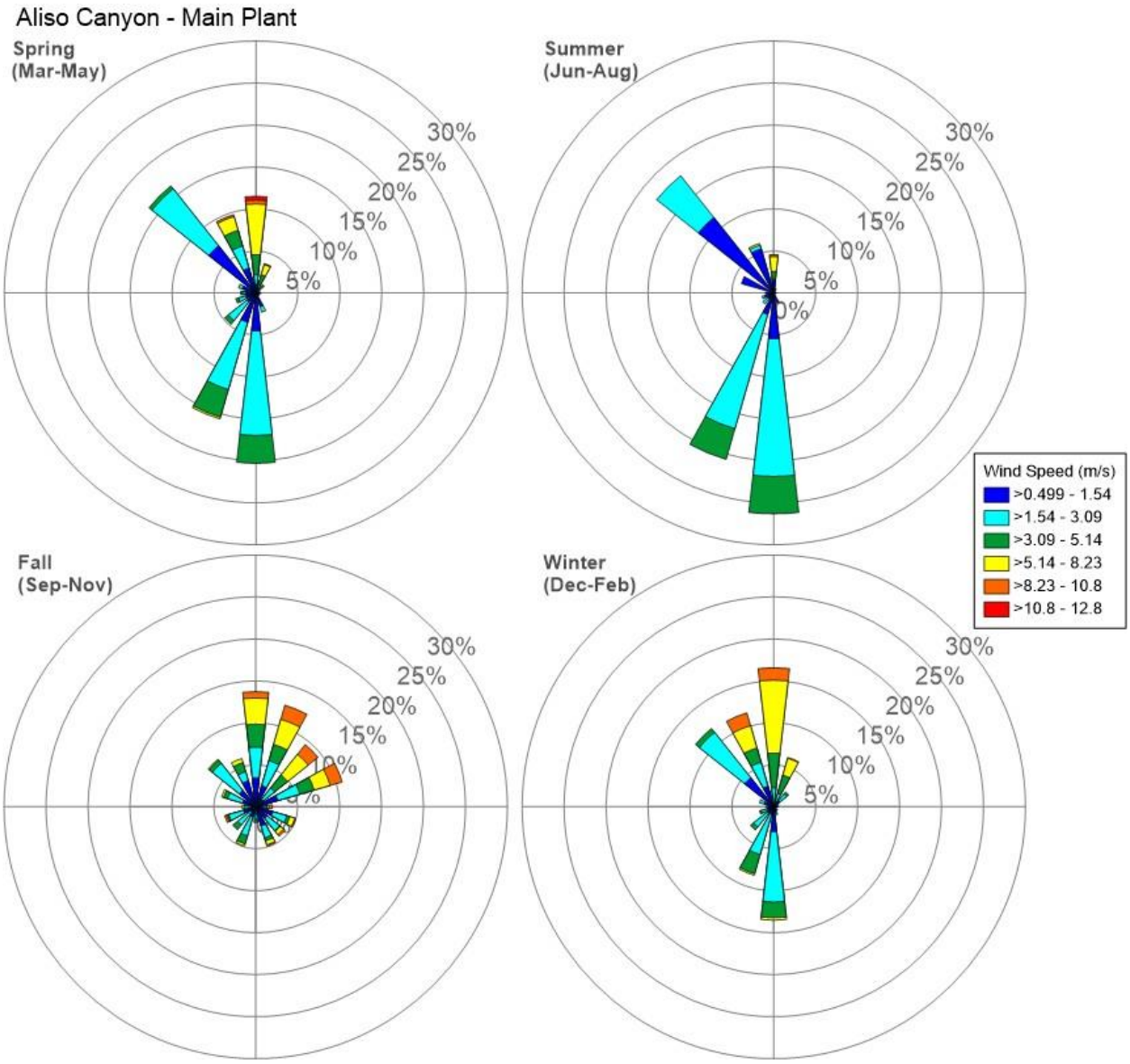
APPENDIX A7: AMBIENT MONITOR LOCATIONS (Q6)

APPENDIX A8: SEASONAL WINDROSES




Aliso Canyon - Porter
Spring
(Mar-May)
Summer
(Jun-Aug)
Fall
(Sep-Nov)
Winter
(Dec-Feb)
30%
25%
20%
15%
10%
5%
Wind Speed (m/s)
>0.499 - 1.54
>1.54 - 3.09
>3.09 - 5.14
>5.14 - 8.23
>8.23 - 10.8
>10.8 - 12.8


Aliso Canyon - MA5
Spring
(Mar-May)
Summer
(Jun-Aug)
Fall
(Sep-Nov)
Winter
(Dec-Feb)
30%
25%
20%
15%
10%
5%
Wind Speed (m/s)
>0.499 - 1.54
>1.54 - 3.09
>3.09 - 5.14
>5.14 - 8.23
>8.23 - 10.8
>10.8 - 12.8


Aliso Canyon - Main Plant
Spring
(Mar-May)
Summer
(Jun-Aug)
Fall
(Sep-Nov)
Winter
(Dec-Feb)
30%
25%
20%
15%
10%
5%
Wind Speed (m/s)
>0.499 - 1.54
>1.54 - 3.09
>3.09 - 5.14
>5.14 - 8.23
>8.23 - 10.8
>10.8 - 12.8

APPENDIX B: MONITORING TECHNOLOGY SPECIFICATIONS

Below are technical specifications for the various proposed instrumentation. Note that equivalent equipment models may be used if they are found to be a better fit for monitoring needs.

B1: LOS GATOS RESEARCH (LGR) CLOSED PATH LASER BASED MONITOR – CONTINUOUS AMBIENT AIR MONITORING TO MEASURE UPWIND AND DOWNWIND CONCENTRATIONS OF METHANE

ABB MEASUREMENT & ANALYTICS | DATA SHEET

LGR-ICOS™ M-GGA-918 and M-GPC-918
Microportable Greenhouse Gas Analyzers

Sensitive, fast and compact analyzers for measurement of CH_4, CO_2 and H_2O

Measurement made easy

LGR-ICOS™ 918 Series - Microportable analyzers

Features and benefits

- Lightweight: less than 5.5 kg (12 pounds) with battery (included)
- Continuous measurements
- Data reported every second with high sensitivity
- Ideal for soil flux studies and field measurements of greenhouse gases
- Extremely wide linear range, CH_4 range up to 4% flammability limit (optional)
- No cross interferences
- Operates directly on DC power
- Fast gas flow response time (3 second, 1/e)
- Records data within 20 seconds after power on
- Multiple data outputs and internet connectivity
- Recirculating capabilities (inlet/outlet)

Overview

The ABB LGR-ICOS gas analyzers build on the heritage and extensive track record of Los Gatos Research analyzers, using patented Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS) technology, the latest evolution in tunable diode laser absorption spectroscopy.

ABB's new microportable gas analyzers (M-GGA-918 and M-GPC-918) report measurements of methane, carbon dioxide and water vapor simultaneously in a package that is compact, crushproof and travels anywhere. Small enough to be hand-carried (even on-board aircraft) and requiring less than 35 watts, the M-GGA-918 and M-GPC-918 offers opportunities to measure greenhouse gases anywhere.

As with all LGR-ICOS analyzers, the M-GGA-918 and M-GPC-918 are fast and simple to use which makes them ideal for field studies, compliance monitoring, air quality studies and soil flux studies, and wherever sensitive measurements of greenhouse gases are needed.

… Overview

The M-GGA-918 and M-GPC-918 begin recording data within 20 seconds after power on so users do not have to wait for a long warm-up period for the system to thermally equilibrate.

ABB's patented OA-ICOS technology, a fourth-generation cavity enhanced absorption technique, has many advantages over older, conventional and delicate cavity ringdown spectroscopy and direct absorption techniques. LGR-ICOS analyzers are easier to operate and more robust, thus providing users with higher performance and reliability at lower operating costs.

The M-GGA-918 and M-GPC-918 analyzers have an internal computer that can store data practically indefinitely on an SD card and send real time data to a tablet, smartphone or other WiFi device. The analyzer includes control and analysis software.

Accessories, Maintenance & Options

ACC-MICRO-KIT	**Accessory kit for microportable** Includes shoulder strap and collapsible wand
ACC-MICRO-AC	**AC Power adapter for microportable**
ACC-MICRO-B	**Spare battery for microportable 918 Series** 99.4Wh
ACC-MICRO-BC	**Dockstation battery charger for microportable 918 Series**
ACC-WIFI-iPad	**Wireless User Interface - Apple iPad with WiFi router** Provides full instrument control and provides touch-screen video display, keyboard and mouse.
ACC-WIFI-Android	**Wireless User Interface - Samsung Galaxy Tab S3 with WiFi router** provides full instrument control and provides touch-screen video display, keyboard and mouse.
MTN-MICRO2	**Maintenance kit for microportable 918 Series**
MTN-CLEAN-M	**Mirror cleaning kit for microportable**
OPT-EXTENDED-CH4	**Extended range for CH4 measurement** Extends normal 0-100 ppm range to 0-5% (M-GGA-918) Extends normal 0-100 ppm range to 0-500 ppm (M-GPC-918)
MIU-8	**Multiport Inlet Unit 8 channels -** External hardware (includes 8 solenoid valves) and internal software package which enables fully integrated, programmable selection from up to 8 separate sources.

Ordering information

- LGR-ICOS™ M-GGA-918
- LGR-ICOS™ M-GPC-918

Specifications

Precision (1σ, 1 sec / 10 sec / 100 sec):
CH_4: 1 ppb /0.4 ppb / 0.2 ppb
CO_2: 0.4 ppm / 0.2 ppm / 0.1 ppm [M-GGA-918]
CO_2: 4 ppm / 2 ppm / 1 ppm [M-GPC-918]
H_2O: 200 ppm / 60 ppm / 30 ppm

Measurement ranges (meets all specifications):
CH_4: 0 – 100 ppm (standard range)
CH_4: 0 – 5% (extended range) [M-GGA-918]
CH_4: 0 – 500 ppm (extended range) [M-GPC-918]
CO_2: 0 – 20000 ppm
H_2O: 0 – 30000 ppm

Sampling conditions:
Sample temperature: -40 – 50 °C
Operating temperature: 5 – 45 °C
Ambient humidity: 0 - 98% relative humidity non-condensing

Flow time response:
3 second (1/e)

Data measurement rate:
0.01 – 10 Hz (user selectable)

Data outputs:
WiFi, Ethernet, USB, MIU connection (8 ports), Serial(RS-232)

Power requirements:
10-30 VDC or 110/240 VAC
35 watts [M-GGA-918]
27 watts [M-GPC-918]
120W Power supply/charger included
99.9Wh internal battery included, 3 hours (M-GGA-918) autonomy, 4 hours (M-GPC-918) autonomy

Dimensions:
12cm H x 34 cm W x 29.5 cm D
6 in. H × 13.4 in. W × 11.6 in. D

Weight:
4.8 kg (10.5 pounds) without internal battery
5.4 kg (11.9 pounds) with internal battery

DS/LGR-ICOS/MGGA-EN Rev. D 03.2019

B2: UNITED ELECTRONICS VANGUARD HYDROCARBON LEL DETECTOR – CONTINUOUS LEAK SCREENING AT EACH INJECTION/WITHDRAWAL WELLHEAD

UE VANGUARD

VANGUARD

CAPABILITY OVERVIEW

Interoperability

- Seamless integration with existing *Wireless*HART networks and asset management systems

Wireless Capability

- *WirelessHART*® communication *7.2*
- IEC 62591 compatible
- Integrated HART terminals
- Adjustable update rate

Long Lifespan

- 5 years battery life*
- Battery pack is field replaceable in hazardous location areas

*FLEX*mount™ Bracket

- Mounting bracket for pipe or wall mount
- Facilitates easy installation and replacement of unit

Heavy Duty Design

- Class I, Div. 1&2 for hazardous areas
- Explosion-proof & intrinsically safe

Easy Calibration and Use

- Configure, calibrate, and test onsite with the touch of a button
- 128x64 pixel graphic display showing gas concentration, network connection, and battery status

*FLEX*sense™ Sensor

- Automatically configures toxic or combustible gas sensor for readings in ppm or %LEL
- Sensor is field replaceable in hazardous location areas

*Based on an 8 second update rate. 5 years battery warranty valid upon battery warranty registration.

WirelessHART® is a registered trademark of Field Comm Group. *FLEX*sense™ is a trademark of United Electric Controls Co.

2 www.ueonline.com/vanguard TCD50-B-04

VANGUARD UE

VANGUARD

SPECIFICATIONS

Sensor

	Methane (CH_4)	Hydrogen Sulfide (H_2S)	Carbon Monoxide (CO)
Storage Temperature:	72°F (22°C) recommended		
Storage Life:	3 years in sealed package	1 year in sealed package	6 months in sealed package
Expected Operational Life[1]:	5 Years	2 Years	2 Years
Operating Temperature:	-40°F (-40°C) to 149°F (65°C)	-40°F (-40°C) to 149°F (65°C)	-40°F (-40°C) to 131°F (55°C)
Types:	Nondispersive infrared	Electrochemical	Electrochemical
Measurement Range:	0 to 100 %LEL	0 to 100 ppm	0 to 500 ppm
Resolution:	1% LEL	1 ppm	1 ppm
Accuracy[2]:	±2% LEL or ±5% of indication, whichever is greater	±2 ppm or ±5% of indication, whichever is greater	±5 ppm or ±5% of indication, whichever is greater
Response Time (T90)[3]:	30 Seconds	<30 Seconds	<30 Seconds
Stabilization Time:	2 Minutes	<1 Minute	<1 Minute

Note: Sensors are interchangeable & self-configurable with the transmitter base. Sensor allows for one-handed sensor installation in hazardous area without declassifying the area

Battery

Batteries: Battery pack contains two Lithium battery cells
Operating Voltage: 7.2 V
Life: 5 years based on an 8 second update rate

[1]Expected operational life varies with environmental conditions and gas exposure
[2]At standard conditions: 68°F (20°C) and 1.0 atm. Accuracy may vary with frequency, accuracy of calibration, and environmental conditions (e.g., barometric pressure, temperature and humidity).
[3]Excludes latency due to radio burst rate.

VANGUARD

Specifications Cont.

Base Transmitter

Operating Temperature:	-40°F (-40°C) to 149°F (65°C)
Operating Humidity:	0% to 98% RH recommended
Material:	Aluminum alloy (maximum copper content at 0.25%) with powder polyester paint; 316 stainless steel; nickel-plated brass; tempered glass
Ingress Protection:	Type 4X (enclosure only)
Display:	Viewable area is 2.25"W x1.25"H (57.2mm x 31.8mm) Graphical LCD display
Display Language:	English
Memory:	Programming and data are protected by a non-volatile EEPROM
Antenna:	2.4 GHz, Hazardous Area Antenna
Mounting:	*FLEX*mount™ Options
Weight:	7.84 lbs (Base) 9.61 lbs (Base with Sensor and Battery)

Output and Access

Communication Protocol:	*WirelessHART*® HART 7.2; EDDL file available at www.ueonline.com/vanguard	
Process Variables:	Primary Variable (PV):	Methane (CH_4) concentration in %LEL Hydrogen Sulfide (H_2S) concentration in ppm Carbon Monoxide (CO) concentration in ppm
	Secondary Variable (SV):	Temperature (°C); Not available for Methane sensor
	Tertiary Variable (TV):	Days since calibration (days)
	Quaternary Variable(QV):	Battery voltage (volts)
Programming Access:	Vanguard Configurator, HART hand-held communicator, or via HART modem, connected to HART terminals located in rear battery compartment or via remote access (e.g., asset management software)	
Calibration/Bump Test Access:	Via external button on transmitter base	

B3: MAXIMET STATION FOR AMBIENT TEMPERATURE, RELATIVE HUMIDITY, AMBIENT PRESSURE, WIND SPEED, AND WIND DIRECTION – METEOROLOGICAL DATA TO SUPPORT METHANE MONITORING

MaxiMet

GMX500 Compact Weather Station

GILL

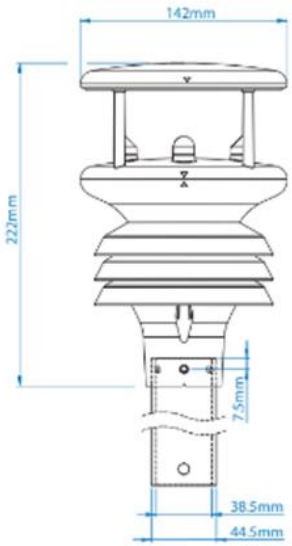
The MaxiMet range of compact weather stations is designed and manufactured by Gill Instruments. MaxiMet products use reliable, high quality instruments to provide accurate meteorological information in a wide variety of applications.

GMX500 Features

Temperature, humidity, pressure. A combined instrument mounted inside three double louvered, naturally aspirated radiation shields with no moving parts. The results are high performance across each measurement over long periods of time.

Wind. Wind speed and direction measurements are provided via an ultrasonic sensor and the addition of an electronic compass provides apparent wind measurements. Average speed and direction together with WMO averages and gust data is also provided. Add GPS (optional) to provide true wind and other features.

TEMP, HUMIDITY & PRESSURE	WIND	GPS (OPTION)	PARAMETERS
• Air Pressure / Temperature • Relative / Absolute humidity • Naturally aspirated UV stable radiation shield • Protection against wind-blown precipitation/dust	• Wind speed & direction • Apparent and true wind (with GPS) • WMO wind averages and gust • Compass	• Height above sea level *m* • Sunrise/sunset • Position of the sun • Twilight • Solar Noon • MSL pressure	• Temperature *°C / °F / °K* • Relative humidity *% Rh* • Barometric pressure *hPa, mbar, mm Hg, In Hg* • Wet bulb temperature *°C / °F / °K* • Absolute humidity *g/m³* • Air density *kg/m3* • Wind speed *m/s, km/hr, mph, kts, ft/min* • Wind direction ° • Wind chill *°C / °F / °K* • True/apparent wind • Angle of Tilt • Outputs *RS232, 422, 485 (ASCII), SDI-12, NMEA, MODBUS, Analogue (option)*



All MaxiMet Models Feature

- Quality Measurements
- Lightweight and Robust
- Low Power Mode
- Free of Charge Software
- Gill Proven Reliability
- Compact Integrated Design
- Real Time Output
- Easy Installation
- Gill Customer Support
- 2 Year Warranty

MaxiMet

GMX500 Compact Weather Station

Applications

- Building and Industrial Controls
- Authorities
- Transport
- Coastal
- Agricultural
- Safety
- Educational
- Commercial
- Energy

WIND SPEED	
Range	0.01 m/s to 60 m/s
Accuracy	± 3% to 40 m/s, ± 5% to 60 m/s
Resolution m/s	0.01
Starting Threshold	0.01 m/s
Sampling Rate	1 Hz
Units	m/s, km/hr, mph, kts, ft/min

WIND DIRECTION	
Range	0-360°
Accuracy	± 3° to 40 m/s ± 5° to 60 m/s
Resolution	1°
Starting Threshold	0.05 m/s
Sampling Rate	1 Hz
Units	Degrees

TEMPERATURE	
Range	-40°C to +70°C
Resolution	0.1
Accuracy	± 0.3°C @ 20°C
Sampling Rate	1 Hz
Units	°C, °F, °K

HUMIDITY	
Range	0-100%
Resolution	1%
Accuracy	± 2% @ 20°C (10%-90% RH)
Sampling Rate	1 Hz
Units	% Rh, g/m³

DEW POINT	
Range	-40°C to +70°C
Resolution	0.1
Accuracy	± 0.3°C @ 20°C
Units	°C, °F, °K
Sampling Rate	1 Hz

PRESSURE	
Range	300 to 1100 hpa
Resolution	0.1 hPa
Accuracy	± 0.5 hPa @ 25°C
Sampling Rate	1 Hz
Units	hPa, mbar, mmHg, inHg

OUTPUTS	
Output rate	1/s, 1/min, 1/hr
Digital Comms Modes	Serial RS232, RS422, RS485, SDI-12, NMEA, MODBUS, ASCII
Analogue Outputs	Available via separate optional device

POWER	
Power Supply	5 to 30 Vdc
Power (Nominal) 12 Vdc	25 mA continuous high mode. 0.7 mA eco-power mode (1 hour polled)

ENVIRONMENTAL CONDITIONS	
IP Rating	66
Operational Temperature Range:	-35°C to +70°C
EMC Standard:	BS EN 61326-2-1:2013 FCC, CFR Title 47, Part 15, Subpart B, Class A digital device
CE Marking	YES
RoHS compliant	YES
Weight	0.7 Kg
Origin	UK

Specifications may be subject to change without prior notice

GILL

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Lymington, Hampshire SO41 9EG
United Kingdom

Tel: +44 (0) 1590 613 500

contact@gillinstruments.com

gillinstruments.com

1957-008 iss 9

B4: FLIR OPTICAL GAS IMAGING CAMERA – DAILY LEAK SCREENING AT EACH INJECTION/ WITHDRAWAL WELLHEAD

FLIR GF300/GF320

Infrared Camera for Methane and VOC Detection

The FLIR GF300/GF320 is a revolutionary infrared camera capable of detecting Methane and Volatile Organic Compound (VOC) fugitive emissions from the production, transportation, and use of oil and natural gas. This camera can scan large areas and visualize potential gas leaks in real-time, so you can check thousands of components over the course of one survey. Designed with the user in mind, the GF300/GF320 is lightweight, offers both a viewfinder and LCD monitor, and has direct access to controls. Embedded GPS data helps in identifying the precise location of faults and leaks, for faster repairs.

Visualize Gas Emissions in Real-time

The FLIR GF300/GF320 is unbeatable at detecting gas emissions, with a High Sensitivity Mode that lets you visualize even the smallest leaks in real-time. Use this visual verification to pinpoint the exact source of the emissions and begin repairs immediately. In addition, the GF320 is capable of measuring temperatures up to 350 °C with ±1 °C accuracy, allowing you to note temperature differentials and improve gas plume detection.

Increase Worker Safety

Surveys performed with GF300/GF320 cameras are nine-times faster than those performed with gas sniffers. They're also safer: optical gas imaging does not require close contact with components in order to detect gas. This reduces the risk of exposure to invisible and potentially harmful chemicals. In addition, the camera can scan areas of interest that are difficult to reach using conventional methods. The ergonomic design, with a bright LCD and articulated viewfinder, takes the strain out of a full day of surveys.

Stop Leaks, Save Money, Help the Environment

By fixing gas leaks, you can save your company thousands in lost gas and lost profits, while at the same time improving regulatory compliance and protecting the environment. The FLIR GF300/GF320 complies with all current regulations for Optical Gas Imaging (OGI). See our website for a full listing.

The GF300/GF320 detects the following gases:

Methanol	Methane	Benzene	Ethane	Propylene
Ethanol	Pentane	1-Pentene	Isoprene	Butane
Ethylbenzene	MEK	Toluene	Propane	Octane
Heptane	MIBK	Xylene	Ethylene	Hexane

www.flir.com

FLIR | The World's Sixth Sense™

Specifications

Model	GF300 / GF320
Detector Type	FLIR Indium Antimonide (InSb)
Spectral Range	3.2 – 3.4 µm
Resolution	320 x 240 pixels
Detector Pitch	30 µm
NETD/Thermal Sensitivity	<15 mK @ +30°C (+86°F)
Sensor Cooling	Stirling Microcooler (FLIR MC-3)
Electronics / Imaging	
Image Modes	IR Image, visual image, high sensitivity mode (HSM)
Frame Rate (Full Window)	60 Hz
Dynamic Range	14-bit
Video Recording / Streaming	Real-time non-radiometric recording: MPEG4/H.264 (up to 60 min./clip) to memory card Real-time non-radiometric streaming: RTP/MPEG4
Visual Video	MPEG4 (25 min./clip) to memory card
Visual Image	3.2 MP from integrated visible camera
GPS	Location data stored with every image
Camera Control	Remote camera control via USB
Measurement	
Standard Temperature Range	–20°C to +350°C (–4°F to +662°F)
Accuracy*	±1°C (±1.8°F) for temperature range (0°C, to +100°C, +32°F to +212°F) or ±2% of reading for temperature range (>+100°C, >+212°F)
Optics	
Camera f/number	f/1.5
Available Fixed Lenses	14.5° (38 mm), 24° (23 mm)
Focus	Automatic (one touch) or manual (electric or on the lens)
Image Presentation	
On-Camera Display	Built-in widescreen, 4.3 in. LCD, 800 x 480 pixels
Automatic Gain Control	Continuous/manual, linear, histogram
Image Analysis*	10 spotmeters, 5 boxes with max./min./average, profile, delta temperatures, emissivity & measurement corrections
Color palettes	Iron, Gray, Rainbow, Arctic, Lava, Rainbow HC
Zoom	1-8x continuous, digital zoom
General	
Operating Temperature Range	–20°C to +50°C (–4°F to +122°F)
Storage Temperature Range	–30°C to +60°C (–22°F to +140°F)
Encapsulation	IP 54 (IEC 60529)
Bump / Vibration	25 g (IEC 60068-2-27) / 2 g (IEC 60068-2-6)
Power	AC adapter 90-260 VAC, 50/60 Hz or 12 V from a vehicle
Battery System	Rechargeable Li-ion battery
Weight w/ Battery & Lens	1.94 kg (4.27 lbs)
Size (L x W x H) w/ Lens	305 x 169 x 161 mm
Mounting	Standard, 1/4"-20

* GF320 model only

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