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Ms. Bobbi Coleman  
South Carolina Department of Health and Environmental Control (SCDHEC)  
Assessment Section, UST Management Division  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

Subject: *Startup Plan for Surface Water Protection Measures - Revision 2*  
**Lewis Drive Remediation**  
Plantation Pipe Line Company  
Belton, South Carolina  
Site ID #18693, "Kinder Morgan Belton Pipeline Release"



Dear Ms. Coleman,

On behalf of Plantation Pipe Line Company (Plantation), CH2M HILL Engineers, Inc. (CH2M) has prepared this revision to the *Startup Plan for Surface Water Protection Measures* submitted on February 10, 2017. This document describes the proposed injection and monitoring sequence to safely and effectively initiate operation of the recently constructed biosparging system at the site. The proposed initial flow rates are biosparging rates to limit volatilization of hydrocarbons. Air injection is planned to be gradually increased over time to optimize system performance. Monitoring will be conducted to evaluate system performance and will take various forms, including visual observations, field measurements, and analytical results.

## Air Monitoring

As detailed in the attached Air Monitoring Plan, two fixed air monitoring stations will be established at Brown's Creek and Cupboard Creek in order to monitor for and identify indications of potential vapor problems that may occur due to operation of the biosparging system. Mobile ambient air monitoring will also be performed in select areas along Brown's Creek and Cupboard Creek at and down-gradient of biosparging wells.

## Water Table and Product Monitoring

Potential mounding of the water table will be monitored, in part, by four continuous water level data loggers (In Situ Rugged TROLL 100) installed in MW-12 and MW-15 near Brown's Creek, at MW-20 near Cupboard Creek, and MW-02. Baseline gauging using an oil-water interface probe will be performed before startup (to establish baseline conditions). Then gauging will be performed daily during Week 1 of the injection and weekly for the remainder of Month 1, as detailed in **Table 1** below. Dissolved oxygen (DO) will be measured at the end of Month 1 with an optical DO probe.

**Table 1. Water Table and Product Monitoring Schedule**  
*Lewis Drive Remediation Site*

Location	Baseline	Twice/Day on Day 1	Daily for Week 1	Weekly for Month 1	End of Month 1
<i>Cupboard Creek</i>					
MW-19	WL	WL	WL	WL	WL, DO
MW-20*	WL	WL	WL	WL	WL, DO
MW-29	WL	WL	WL	WL	WL, DO
TW-67	WL	WL	WL	WL	WL, DO
TW-73	WL	WL	WL	WL	WL, DO
<i>Brown's Creek</i>					
MW-12*	WL	WL	WL	WL	WL, DO
MW-12B	WL	--	--	--	WL, DO
MW-15*	WL	WL	WL	WL	WL, DO
MW-15B	WL	--	--	--	WL, DO
MW-25	WL	WL	WL	WL	WL, DO
MW-25B	WL	--	--	--	WL, DO
MW-28	WL	WL	WL	WL	WL, DO
MW-35	WL	WL	WL**	WL	WL, DO
MW-39	WL	WL	WL**	WL	WL, DO
MW-41	WL	WL	WL**	WL	WL, DO
TW-59	WL	WL	WL	WL	WL, DO
TW-60	WL	WL	WL	WL	WL, DO
TW-66	WL	WL	WL	WL	WL, DO

**Notes:**

-- indicates that this does not apply.

WL = water level and product gauging

DO = dissolved oxygen

\* Monitoring wells MW-02, MW-12, MW-15, and MW-20 will have dedicated loggers (TROLL 100) for continuous water level logging.

\*\* Monitoring wells MW-35, MW-39, and MW-41 will be gauged daily for 2 weeks, after which the gauging frequency will be reevaluated.

## Analytical Monitoring of Groundwater

Groundwater samples will be collected weekly during startup from the 24 monitoring wells listed in **Table 2** below. These locations are also depicted on **Figure 1**. Per approval from SCDHEC, samples will be collected using no-purge HydraSleeve samplers. However, if there is not sufficient depth of water column in the well for HydraSleeve sampling (16 inches of water column is typically required), the groundwater must be sampled using low-flow purge sampling. Samples will be analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary butyl ether (MTBE), 1,2-dichloroethane (1,2-DCA), and naphthalene by Environmental Protection Agency (EPA) Methods 8011 and 8260B. Samples will be collected in accordance with a revised Quality Assurance Project Plan (QAPP) to be submitted to SCDHEC under separate cover.

**Table 2. Analytical Groundwater Monitoring Schedule**  
*Lewis Drive Remediation Site*

Brown's Creek Monitoring Wells		Cupboard Creek monitoring wells	
MW-12	MW-34 (to be installed)	MW-19	MW-26
MW-12B	MW-35	MW-20	MW-26B
MW-15	MW-38	MW-21	MW-29
MW-15B	MW-39	MW-23	MW-45
MW-25	MW-40	MW-23B	MW-45B
MW-25B	MW-41	MW-17	
MW-28	MW-42	MW-17B	

## Analytical Monitoring of Surface Water

Surface water samples will be collected from all surface water sampling locations at the site weekly during startup. Samples will be collected in accordance with the QAPP and analyzed for BTEX and naphthalene by EPA Method 8260B.

## Startup Sequence

The proposed sequence for startup operations is as follows:

### Week 1

- The sparging system operator-in-charge (OIC) will initiate one of the two Sullair compressors and open valves in manifold legs for the two stream bubblers and for the 45 vertical sparging wells. Low flow rates of 1 standard cubic foot per minute (scfm) per sparge well/surface water aerator have been selected to build up the assimilative capacity of the vadose zone and to minimize water table mounding and vapor generation. The stream aerators will run 24/7. A pulsing sequence in the vertical sparge well network of 6 hours per injection row will be used to treat from "outside-in", i.e., inject for 6 hours into the most downgradient injection row at Brown's Creek/Cupboard Creek, then inject for 6 hours into the next upgradient row, then inject for 6 hours into the most upgradient row, and then re-initiate the cycle.
- Surface water will be monitored daily for potential disturbances from aerators. If any sustained disturbance beyond bubbling of air (e.g., increased turbidity) is observed, the OIC will reduce the flow rate and should disturbances continue, ultimately cease injections.
- Ambient air monitoring will be performed daily with a handheld photoionization detector (PID), in particular the areas around MW-19, MW-40, and MW-09, and also the City of Belton water branch line valve to the former residence at 112 Lewis Drive.
- Product recovery will continue on a twice per week basis.
- Fixed air monitoring station data will be logged continually and downloaded twice per week. Fixed air monitoring station data will be evaluated per the attached Air Monitoring Plan.
- Daily water table monitoring will be performed as described above and detailed in **Table 1**.
- Data from TROLLs will be downloaded at the end of Week 1.
- Groundwater and surface water samples will be collected once in Week 1 as described above and detailed in Table 2.

- Visual inspections will be performed weekly for evidence of a petroleum sheen on surface waters, odors in the area, and/or distressed vegetation or biota on all areas of the site, including along Brown's Creek and Cupboard Creek. If any of these are detected which have not been previously reported, the consultant project manager will be notified immediately by phone. A description of the observation, the time it occurred, its location, and any response actions taken will be included in regular reports to SCDHEC according to the reporting schedule described below.

## Week 2

- Starting week 2, the OIC of the system will increase flows from 1 to 2 scfm for each vertical sparging well and surface water aerator, maintaining the same pulsing schedule in the vertical sparge wells as before (assuming no adverse conditions were observed) and continuing to run the aerators 24/7.
- Surface water and ambient air monitoring will be performed daily as above. Fixed air monitoring station data will continue to be downloaded twice weekly.
- Water table and product monitoring will be performed once weekly as described above and detailed in **Table 1**.
- Data from TROLLs will be downloaded at the end of Week 2.
- Groundwater and surface water samples will be collected once in Week 2 as described above and detailed in Table 2.
- Visual inspections will be performed weekly as described above.

## Week 3

- Week 3 will essentially be a repeat of Week 2. The injection flow rate in the vertical sparging wells and surface water aerators will increase to 3 scfm each, and CH2M will continue to monitor surface water, groundwater, and ambient air. and conduct visual inspections as described for Weeks 1 and 2.

## Week 4

- Week 4 will be the same as previous weeks, with the addition of enhanced monitoring for influence from the system. The injection sequence will increase to 4 scfm for each vertical sparging well and surface water aerator, and CH2M will continue to monitor surface water, groundwater, and ambient air and conduct visual inspections as described for Weeks 1 and 2..
- Finally, after completion of the first month, staff will measure DO with an optical probe in select wells to assess the effects of sparging. These measurements will be conducted while the system remains operational to better assess the potential zone of influence.

# Reporting

Data transmittals consisting of field data sheets (including observations out of the norm), lab reports (including chains of custody), summary tables, and figures will be provided to SCDHEC on a weekly basis as soon as analytical data are received and evaluated. Data transmittals will be by e-mail and followed up by hardcopy.

If you have any further questions or concerns, please call me at 919-760-1777, Mr. Scott Powell/CH2M at 678-530-4457, or Mr. Jerry Aycock/Plantation at 770-751-4165.

Regards,  
CH2M HILL Engineers, Inc.



William M. Waldron, P.E.  
Senior Project Manager

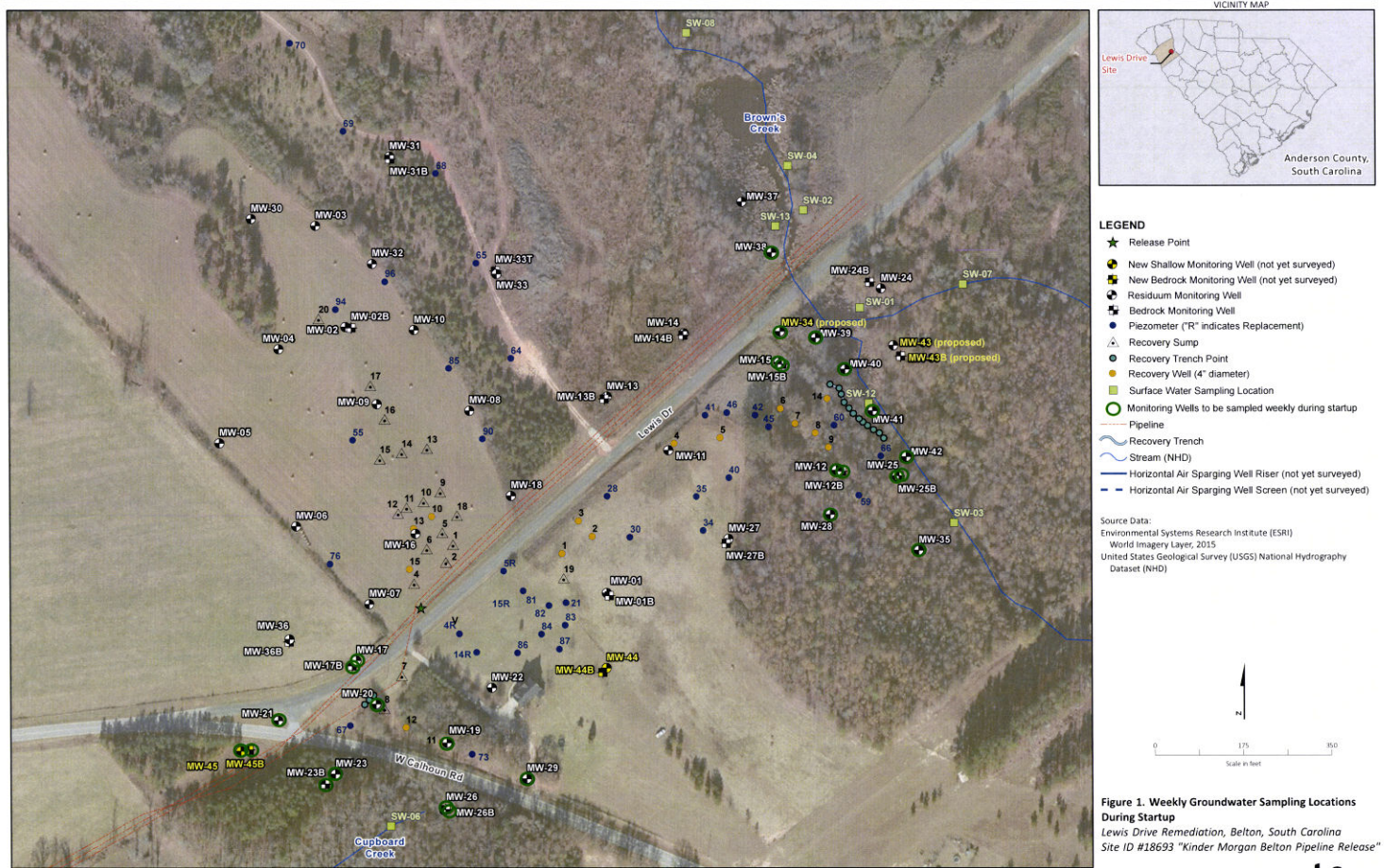
Enclosures:

Figure 1 – Weekly Groundwater Sampling Locations During Startup  
Air Monitoring Plan

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File

Figure

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**Figure 1. Weekly Groundwater Sampling Locations During Startup**  
 Lewis Drive Remediation, Belton, South Carolina  
 Site ID #18693 "Kinder Morgan Belton Pipeline Release"

# Attachment – Air Monitoring Plan



# Air Monitoring Plan

## Lewis Drive Remediation, Belton, South Carolina

This Plan presents the Vapor Monitoring Plan for the Lewis Drive site (The Site) in Belton, South Carolina. The plan was prepared on behalf of Plantation Pipe Line Company (Plantation) by CH2M Engineers, Inc. (CH2M).

## Background

On December 8, 2014 a gasoline release was discovered from Plantation's 26-inch product pipeline near Lewis Drive in Belton, South Carolina. Plantation performed initial response actions from December 8, 2014 through February 2, 2015. An Interim Corrective Action Plan (CAP) was submitted to SCDHEC on March 5, 2015 and a Site Assessment Report was submitted to DHEC on September 9, 2015. A site wide CAP was submitted to SCDHEC on September 1, 2016.

A biosparging remedial system was constructed at the Site to treat the gasoline release. System construction is nearly complete. System shakedown and startup is scheduled for February 2017.

## Air Monitoring Plan

Air monitoring will be performed to identify indications of vapor problems that are due to operation of the biosparging system. The goal is to show that startup and operation of the biosparging system is being performed in a manner that does not adversely affect nearby receptors by producing excessive vapors. Excessive vapors would be considered 5 parts per million (ppm) VOCs on the perimeter of the site area or in the vicinity of any of the roads running through the site.

Monitoring for vapors generated by biosparging will be performed through use of fixed air monitoring stations and mobile ambient air monitoring. Descriptions of these two air monitoring techniques and the schedule for air monitoring using each technique are provided in the following sections.

### Fixed Air Monitoring Stations

Two fixed air monitoring stations will be established at the site. One air monitoring station will be established immediately above biosparging wells at Brown's Creek and a second station will be established immediately above biosparging wells at Cupboard Creek. The locations of these two proposed air monitoring stations are shown on **Figure 1**.

Each air monitoring stations will consist of a MiniRae photoionization detector (PID) and explosive atmosphere meter in a Pelican Case enclosure. A cut sheet for the MiniRae is attached. The MiniRae PID measures volatile organic compounds (VOCs) and hydrogen sulfide in air at concentrations from 0 to 15,000 ppm. The PID will be programmed to log VOC concentration at 10 minute intervals. Although the PID can capture more than 59 months of data when logging at 10-minute intervals, the data will be downloaded at routine intervals and reviewed.

The PID will be placed in a Pelican Case for protection from elements and weather. The Pelican Case will be attached to a tree or other fixed object at an elevation between 3 and 6 feet above ground surface (the breathing zone).

Prior to deployment each PID will be turned on, allowed to reach ambient operating temperature, and then calibrated in accordance with manufacturer's instructions. Canisters of 1 ppm hydrogen sulfide and 10 ppm isobutylene calibration gas will be used to calibrate the PID to achieve measurement confidence in the range of 0.1 to 0.5 ppm. A calibration log will be maintained for each instrument.

The MiniRae nominal battery life is between 12 and 16 hours. MiniRaes deployed in fixed air monitoring stations will be connected to a marine battery, which extends the operational period to one week.

Fixed air monitoring stations will be deployed and operating for a minimum of 96 hours prior to operating the biosparging system. Logged data will be downloaded at the following frequencies:

- Daily during the first week of biosparging system operation,
- Three times per week during the second and third weeks of biosparging system operation
- Twice per week during the fourth week of biosparging system operation

If air monitoring results indicate that startup and operation of the biosparging system is being performed in a manner that does not adversely affect nearby receptors by producing vapors or odors, then the fixed air monitoring stations will be demobilized after a month of data collection.

## Mobile Ambient Air Monitoring

Mobile ambient air monitoring will be performed in select areas along Brown's Creek and Cupboard Creek at and down-gradient of biosparging wells. These areas are identified on **Figure 1**.

Mobile ambient air monitoring will consist of a person walking through the area looking for indications of biosparging causing vapors to emanate at ground surface, for hydrocarbon sheens on surface water, and for odors. The person will use a PID to monitor for VOCs at the following locations:

- Surface water sampling locations (SW-03, SW-06, SW-12)
- Where the creek passes under Lewis Drive
- General area of the 45 vertical biosparge wells

At each location, a reading will be taken once the PID readout has stabilized, or after 3 minutes, whichever is sooner. Ambient air monitoring results will be maintained in a logbook or on data sheets. Ambient air monitoring will be performed for a minimum of 96 hours prior to operating the biosparging system. After startup of the biosparging system, the frequency of ambient air monitoring will be:

- Daily during the first week of biosparging system operation
- Three times per week until one week after the maximum desired air flow has been achieved in the biosparging system (anticipated to be a month after startup)
- Monthly for the second and third months of biosparging system operation
- Quarterly thereafter when the biosparging system is operating

The frequency of air monitoring will reset if there are major changes to biosparging system operation, or after a prolonged period (e.g. more than two months) when the system is not operated.

## Air Monitoring Reporting

Results of air monitoring will be provided to SCDHEC in data submittals weekly for the first month, monthly for the next two months, and quarterly thereafter. Data submittals will consist of a brief narrative addressing the monitoring period, type of data collected, map with sampling station locations, and tables of results. Quarterly reports will provide a discussion of the results and recommendations for warranted changes to the monitoring plan.

Data submittals will be provided at the following frequency:

- Weekly emails during the first month of air monitoring (followed up by hardcopy submittal)
- Monthly emails during the second and third months of air monitoring (followed up by hardcopy submittal)

Quarterly reports will be provided to SCDHEC within one month following the end of the air monitoring period covered by the report.

## Response to Detections

The response to detections of VOCs or hydrogen sulfide in air will depend on the nature, magnitude, and relative location of the detection.

If VOCs are detected by air monitoring at locations above biosparging wells will be responded to by shutting off or decreasing the air flow rate to wells. Supplemental air monitoring results at the same location will be reviewed to verify that the reduced air flow to biosparging wells eliminates the VOC detections.

If VOCs are detected at locations away from biosparging wells, observations will be made to search for indications of air discharges at ground surface or other sources of the VOCs. The specific response to these potential VOC sources will be developed based on conditions encountered in the field.



# MiniRAE 3000

Portable Handheld VOC Monitor



The MiniRAE 3000 is a comprehensive handheld VOC (Volatile Organic Compound) monitor that uses a third-generation patented PID technology to accurately measure more ionizable chemicals than any other device on the market. It provides full-range measurement from 0 to 15,000 ppm of VOCs.

The MiniRAE 3000 has a built-in wireless modem that allows real-time data connectivity with the ProRAE Guardian command center located up to 2 miles (3 km) away through a Bluetooth connection to a RAELink 3\* portable modem or optionally via Mesh Network.

## KEY FEATURES

- Third-generation patented PID technology
- VOC detection range from 0 to 15,000 ppm
- 3-second response time
- Humidity compensation with built-in humidity and temperature sensors
- Six-month datalogging
- Real-time wireless built-in – Bluetooth (and optional RAELink3 portable modem) or Mesh Network support
- Large graphic display with integrated flashlight
- Multi-language support with 10 languages encoded
- IP- 67 waterproof design

## APPLICATIONS

- Oil and Gas
- HazMat
- Industrial Safety
- Civil Defense
- Environmental and Indoor Air Quality

- Highly accurate VOC measurements
- Patented PID sensor
- Low maintenance—easy access to lamp and sensor
- Low cost of ownership
- 3-year 10.6eV lamp warranty



Workers can quickly measure VOCs and wirelessly transmit data via Bluetooth or optional Mesh radio.

\*RAELink 3 modem is sold separately.



# MiniRAE 3000

Portable Handheld VOC Monitor



## SPECIFICATIONS

### Instrument Specifications

Size	10" L x 3.0" W x 2.5" H (25.5 cm x 7.6 cm x 6.4 cm)
Weight	26 oz (738 g)
Sensors	Photoionization sensor with standard 10.6 eV or optional 9.8 eV or 11.7 eV lamp
Battery	<ul style="list-style-type: none"> <li>Rechargeable, external field-replaceable Lithium-Ion battery pack</li> <li>Alkaline battery adapter</li> </ul>
Running time	16 hours of operation (12 hours with alkaline battery adapter)
Display Graphic	4 lines, 28 x 43 mm, with LED backlight for enhanced display readability
Keypad	1 operation and 2 programming keys, 1 flashlight on/off
Direct Readout	Instantaneous reading <ul style="list-style-type: none"> <li>VOCs as ppm by volume (mg/m<sup>3</sup>)</li> <li>High values</li> <li>STEL and TWA</li> <li>Battery and shutdown voltage</li> <li>Date, time, temperature</li> </ul>
Alarms	95dB at 12" (30 cm) buzzer and flashing red LED to indicate exceeded preset limits <ul style="list-style-type: none"> <li>High: 3 beeps and flashes per second</li> <li>Low: 2 beeps and flashes per second</li> <li>STEL and TWA: 1 beep and flash per second</li> <li>Alarms latching with manual override or automatic reset</li> <li>Additional diagnostic alarm and display message for low battery and pump stall</li> </ul>
EMC/RFI	Compliant with EMC directive (2004/108/EC) EMI and ESD test: 100MHz to 1GHz 30V/m, no alarm Contact: ±4kV Air: ±8kV, no alarm
IP Rating	<ul style="list-style-type: none"> <li>IP-67 unit off and without flexible probe</li> <li>IP-65 unit running</li> </ul>
Datalogging	Standard 6 months at one-minute intervals
Calibration	Two-point or three-point calibration for zero and span. Calibration memory for 8 calibration gases, alarm limits, span values and calibration dates
Sampling Pump	<ul style="list-style-type: none"> <li>Internal, integrated flow rate at 500 cc/mn</li> <li>Sample from 100' (30m) horizontally or vertically</li> </ul>
Low Flow Alarm	Auto pump shutoff at low-flow condition
Communication & Data Download	<ul style="list-style-type: none"> <li>Download data and upload instrument set-up from PC through charging cradle or optional Bluetooth™</li> <li>Wireless data transmission through built-in RF modem</li> </ul>
Wireless Network	Mesh RAE Systems Dedicated Wireless Network
Wireless Range (Typical)	EchoView Host: LOS > 660 ft (200 m) ProRAE Guardian & RAEMesh Reader: LOS > 660 ft (200 m) ProRAE Guardian & RAELink3 Mesh: LOS > 330 ft (100 m)
Safety Certifications	<b>US and Canada:</b> CSA, Classified as Intrinsically Safe for use in Class I, Division 1 Groups A, B, C, D <b>Europe:</b> ATEX II 2G EEx ia IIC T4
Temperature	-4° to 122° F (-20° to 50° C)
Humidity	0% to 95% relative humidity (non-condensing)

<sup>1</sup> Contact RAE Systems for country-specific wireless approvals and certificates. Specifications are subject to change.

Attachments	Durable bright yellow rubber boot
Warranty	3 years for 10.6 eV lamp, 1 year for pump, battery, sensor and instrument
Wireless Frequency	ISM license-free band. IEEE 802.15.4 Sub 1GHz
Wireless Approvals	FCC Part 15, CE R&TTE, Others <sup>1</sup>
Radio Module	Supports Bluetooth or RM900

### Sensor Specifications

Gas Monitor	Range	Resolution	Response Time T90
VOCs	0 to 999.9 ppm	0.1 ppm	< 3 s
	1,000 to 15,000 ppm	1 ppm	< 3 s

### MONITOR ONLY INCLUDES:

- MiniRAE 3000 Monitor, Model PGM-7320
- Wireless communication module built in, as specified
- Datalogging with ProRAE Studio II Package
- Charging/download adapter
- RAE UV lamp, as specified
- Flex-I-Probe™
- External filter
- Rubber boot
- Alkaline battery adapter
- Lamp-cleaning kit
- Tool kit
- Operation CD-ROM
- Operation and Maintenance manual
- Soft leather case

### OPTIONAL CALIBRATION KIT ADDS:

- 100 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

### OPTIONAL GUARANTEED COST-OF-OWNERSHIP PROGRAM:

- 4-year repair and replacement guarantee
- Annual maintenance service

#### CORPORATE HEADQUARTERS

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