Preparation and Field Use of the AreaRAE Multi-Gas Monitor

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CHANGE HISTORY (≤ LAST 5 REV-MODS)

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<tr>
<th>Rev-Mod</th>
<th>Release Date</th>
<th>Justification</th>
<th>Summary of Changes</th>
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<tr>
<td>D-1</td>
<td>03/29/2017</td>
<td>IH Request.</td>
<td>Modified Section 3.2 to address WRPS-PER-2016-2246.</td>
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<td>09/15/2016</td>
<td>Periodic Review Comment Incorporation.</td>
<td>Updated Section 3.2 Radiation and Contamination Control, Changed TFC-ESHQ-RP-MON_C-23 to TF-RC-043.</td>
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<td>C-1</td>
<td>07/28/2014</td>
<td>Safety request</td>
<td>Changed procedure from REFERENCE to ROUTINE.</td>
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<td>Periodic review comment incorporation</td>
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<td>B-3</td>
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Table 1 - Alarm Signal Summary

Attachment 1 - Main Operation Functions

Attachment 2 - Precautions and Limitations of the AreaRAE

Table 1 - Alarm Signal Summary

<table>
<thead>
<tr>
<th>Alarm Signal</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Very High</td>
</tr>
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Attachment 1 - Main Operation Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Start Scan</td>
<td>initiate scan process</td>
</tr>
<tr>
<td>Stop Scan</td>
<td>stop scan process</td>
</tr>
<tr>
<td>Record Data</td>
<td>save data to memory</td>
</tr>
</tbody>
</table>

Attachment 2 - Precautions and Limitations of the AreaRAE

<table>
<thead>
<tr>
<th>Precaution/Limitation</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Temperature Range</td>
<td>-40°C to +70°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>0% to 100%</td>
</tr>
<tr>
<td>Operational Environment</td>
<td>Indoor/Outdoor</td>
</tr>
<tr>
<td>Power Source</td>
<td>Battery</td>
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</table>

Total Pages: 30
1.0 PURPOSE AND SCOPE

1.1 Purpose

The purpose of this procedure is to ensure the proper use of the AreaRAE multi-gas monitor, model PGM - 5020 in support of field monitoring performed in accordance with TF-OPS-IHT-007 and an industrial hygiene sampling plan.

1.2 Scope

The scope includes span calibration checks of the AreaRAE used to assess five contaminants simultaneously: ammonia, volatile organic compounds, carbon monoxide, oxygen and flammable/explosive gases and vapors. The AreaRAE also has the ability to radio transmit the information to a remote PC up to two miles away.

2.0 INFORMATION

2.1 Terms and Definitions

- Duty cycle - the percentage of time within a 10 second period that the pump is running. A duty cycle of 80% or below is considered adequate for lamp cleaning purposes.
- Zero air cylinder - a gas cylinder that has “pure” air with trace organic and inorganic contaminants and is used for zeroing sensors prior to span testing.
2.2 General Information

AreaRAE specifications and operating limits:

- Concentration range:
  - CO: 0 to 500 ppm
  - O₂: 0 to 30 %
  - VOC: 0 to 2000 ppm
  - LEL: 0 to 100 %
  - NH₃: 0 to 100 ppm
- Flow rate: high mode (~ 400 - 500 ml/min)
- Instrument temperature range: - 20 to 45 C (- 4 to 113 F)
- Accuracy: ± 10 %
- T 90 sensor response time:
  - CO: 40 sec.
  - O₂: 15 sec.
  - VOC: 10 sec.
  - LEL: 30 sec.
  - NH₃: 60 sec.
- Power: up to 24 hrs. of continuous operation, 10 hrs. charge time
- Relative humidity: 0 to 100% (non-condensing) * Refer to Attachment 2
- Warm-up time: < 2 minutes
- Intrinsically safe: Class 1, Division 1, Groups A, B, C, and D; Class 2, Groups E, F, G, and Temp Code T3C.

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Equipment Safety

CAUTION - Unless in use, consideration should be given to detaching the radio antenna when handling or carrying to prevent it from being bent or broken.
3.2 Radiation and Contamination Control

3.2.1 Planned work in radiological areas must be approved by Radiological Control personnel per the Radiological Risk Screening procedure TFC-ESHQ-RP-RWP-C-01.

3.2.1.1 When performed without a formal work package or approved procedure (i.e., Level 3 or 4 work), this procedure is limited to radiological areas and work activities permitted by a low risk Radiological Work Permit (RWP).

3.2.2 Filtration requirements for air monitoring equipment.

- A radiological particulate pre-filter (1~3 micron pore size, 25 mm diameter) when monitoring in a Contamination Area (CA), High Contamination Area (HCA), or Airborne Radioactivity Area (ARA), if instrument is capable. Not required, but encouraged in posted Radiological Buffer Areas (RBA).

- The “Bacterial Air Vent” filter (manufactured by Pall – Galman Laboratory) ahead of the radiological filter when monitoring from unfiltered tank systems. This is a sealed filter that cannot be opened for radiological survey purposes, in this case, dispose of as low level radioactive material waste if needed.

- The use of parallel, sacrificial sorbent tubes or sample media, or multiple filters may be necessary depending on intended use and equipment parameters. A specific radiological Release Survey Plan (RSP) would need to address this allowance.

3.2.3 Before conducting sampling or monitoring, contact the responsible Radiological Control personnel for the facility or area to determine any specific survey or monitoring requirements.

- Pre, during, and post contamination survey requirements.

- Any applicable RSP’s for your specific equipment or task.

- Alternative survey or monitoring needs to support the radiological release survey process.
3.2 Radiation and Contamination Control (Cont.)

3.2.4 Comply with the requirements set forth by the RWP, HPT coverage, Release Survey Plan (RSP), and any other applicable procedures as determined above.

3.2.5 When exiting radiological areas where no HPT coverage was provided, inform the radiological control personnel of the use/history for the equipment being presented (e.g., only sampled air in the Contamination Area, No known history of contamination based on use, etc.) to aid them in properly evaluating the radiological release criteria needed.

3.2.6 Samples collected in a radiological area shall not be removed from the facility, transported by personnel, or submitted to an analytical laboratory until they have been evaluated by an HPT in accordance with approved procedures.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies may be needed to perform this procedure:
- “RAELink Wireless” receiver, antenna, PC loaded with “PC Remote” and “ProRAE Suite” software.

4.2 Performance Documents

The following documents may be needed to perform this procedure:
- TFC-ESHQ-RP_RWP-C-03, “ALARA Work Planning”
- TFC-ESHQ-S_IH-C-46, “Industrial Hygiene Reporting and Records Management”
- TF-OPS-IHT-007, “Using Direct Reading Instruments”
- TF-RC-043, “Perform Release Surveys for Material and Equipment”

4.3 Field Preparation

4.3.1 PERFORM a review of applicable industrial hygiene sampling plan prior to execution of this procedure.

**CAUTION**

Unless in use, consideration should be given to detaching the radio antenna when handling or carrying to prevent it from being bent or broken.

4.3.2 IF antenna is detached for transportation/moving instrument, ATTACH antenna prior to using the AreaRAE.
5.0 PROCEDURE

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.1 Operation of the AreaRAE

5.1.1 CHECK maintenance calibration date on sticker is current for the AreaRAE.

5.1.1.1 IF calibration is past due, RETURN applicable instrument to equipment custodian with a completed green tag (i.e., “IH Instrument Service Tag” (BT-6004-019) indicating its “Scheduled Maintenance Calibration”).

5.1.2 PRESS the “MODE” key to turn the monitor on.

NOTE - A battery voltage of 7.7 volts or higher indicates a full charge that should last ~ 24 hours of normal operation (i.e., without alarm conditions and backlight usage).

5.1.3 CHECK to see the battery is fully charged during the start-up phase.

5.1.4 IF battery is not fully charged, REPLACE with a fully charged one, OR ATTACH the charger until the charging light turns green.

NOTE - The display will show “ON!...”, software/firmware version # and run thru the start-up menu until the 10 second countdown timer appears.

5.1.5 CHECK for any error messages (e.g., lamp failure, sensor problems, etc.) AND TROUBLESHOOT.

5.1.6 ALLOW the monitor to warm up for a few minutes to allow residual vapors in the detector chamber to clear.

5.1.7 CHECK span gas values in the monitor correspond with the gas concentrations on the cylinders to be used for the functional (bump) test by performing the following:

5.1.7.1 PRESS AND HOLD both the [N/-] and [MODE] keys for approximately five seconds to enter into programming mode.
5.1 Operation of the AreaRAE (Cont.)

5.1.7.2 PRESS the [Y/+] key when “Calibrate Monitor?” is displayed.

5.1.7.3 PRESS the [N/-] key repeatedly until the display shows “Modify Span Gas Value?”

5.1.7.4 PRESS the [Y/+] key to display span gas values.

5.1.7.5 IF the span gas values are correct, PRESS AND HOLD the [MODE] key for approximately one second to accept the current values and return to the calibration menu.

5.1.7.6 IF the span gas values need to be modified, PERFORM the following in the order listed:

a. PRESS the [MODE] key until the number to be changed is highlighted

b. PRESS the [Y/+] or [N/-] keys to change the digit value AND

REPEAT until all span gas values are updated.

c. PRESS AND HOLD the [MODE] key for approximately one second to accept the current values

d. WHEN the display shows “save?”, PRESS the [Y/+] key to accept the change.

5.1.7.7 PRESS the [MODE] key twice to return to the normal operating mode (i.e., the current concentration screen).

5.1.8 SET alarm values per the sampling plan or Industrial Hygienist (IH) direction as follows:

5.1.8.1 PRESS AND HOLD both the [N/-] and [MODE] keys for approximately five seconds to enter into programming mode.
5.1 Operation of the AreaRAE (Cont.)

NOTE - The monitor enters the alarm limit sub-menu. In this sub-menu, the following choices will be displayed: “Change High Alarm limit?,” “Change Low Alarm limit?,” “Change STEL Alarm limit?,” and “Change Average Alarm limit?.”

5.1.8.2 PRESS the [N/-] key until the display shows “Change Alarm Limits?”, THEN

PRESS the [Y/+] key.

5.1.8.3 PRESS the [Y/+] key to select a sub-menu item to be changed, OR

PRESS the [N/-] key to move to the next item.

5.1.8.4 PRESS the [MODE] key to highlight the alarm sensor value and digit to be changed.

5.1.8.5 PRESS the [Y/+] or [N/-] keys until the desired value is set.

5.1.8.6 PRESS the [MODE] key to advance to the next digit.

5.1.8.7 PRESS AND HOLD the [MODE] key for approximately one second to exit the sub-menu.

5.1.8.8 WHEN the display shows “save?” PRESS the [Y/+] key to accept the changes.

5.1.8.9 REPEAT until all alarm limits are updated.

5.1.8.10 PRESS the [MODE] key twice to return to the normal operating mode.

5.1.9 IF sampling for reactive gases such as ammonia, SET the pump speed on “High” as follows:

5.1.9.1 PRESS AND HOLD both the [N/-] and [MODE] keys for approximately five seconds to enter into programming mode.

5.1.9.2 PRESS the [N/-] key repeatedly until “Change Monitor Setup?” is displayed, THEN

PRESS the [Y/+] key.
5.1 Operation of the AreaRAE (Cont.)

5.1.9.3 PRESS the [N/-] key repeatedly until “Change Pump Speed?” is displayed.

NOTE - “Low” is the default setting.

5.1.9.4 PRESS the [Y/+] key to display the current pump speed selection (i.e., “Pump Speed = Low?” or “Pump Speed = High?”).

5.1.9.5 PRESS the [N/-] key to change to “Pump Speed = High?” AND, WHEN “save?” appears, PRESS [Y/+] key.

OR

IF already on “Pump Speed = High?”, PRESS the [Y/+] key.

5.1.9.6 IF the initial pump speed setting was “Low,” LISTEN for the increase in pump speed to confirm the change.

5.1.9.7 PRESS the [MODE] key twice to return to normal operating mode.

NOTE - The audible and visual alarms will activate (if enabled) and “Pump” will appear in the display, indicating a successful leak test.

5.1.10 PERFORM a leak test by plugging the filter inlet with a finger.

5.1.11 IF successful, PRESS the [Y/+] key to turn off the alarm.

5.1.12 IF the leak check fails, PERFORM the following:

5.1.12.1 CHECK the filter housing AND TIGHTEN.

5.1.12.2 REPLACE the O-ring at the bottom of the filter housing.

5.1.12.3 PRIOR to use, RE-TEST the monitor.

5.1.13 IF the leak check fails again, PERFORM the following:

5.1.13.1 RETURN the monitor to the equipment custodian with a completed green tag (i.e., “IH Instrument Service Tag” (BT-5004-019) indicating “Will Not Flow Fault”).

5.1.13.2 OBTAIN another monitor.
5.1 Operation of the AreaRAE (Cont.)

5.1.13.3 GO TO Step 5.1.1 to restart.

5.1.14 PERFORM a function test of the VOC sensor with an appropriate concentration of isobutylene gas as follows:

5.1.14.1 CHECK the tag or label on the isobutylene gas cylinder to verify its shelf life has not expired.

5.1.14.2 IF the gas has expired, NOTIFY the equipment custodian, tag it with a completed green tag (i.e., “IH Instrument Service Tag” (BT-6004-019) indicating it is “Out of Service”), ACQUIRE a new cylinder of gas.

5.1.14.3 IF the gas is within its calibration period, CONTINUE with the function test.

5.1.14.4 ENSURE the gas cylinder valve is open.

NOTE The monitor will display readings of gas concentration.

5.1.14.5 ATTACH the monitor to the gas cylinder with inert tubing.

5.1.14.6 ENSURE the gas cylinder valve is OPEN.

5.1.14.7 CHECK the monitor displays readings of gas concentration.

5.1.14.8 ALLOW several minutes for readings to stabilize keeping in mind the T 90 value for the sensor AND CHECK the gas concentration reading is within tolerance levels, as indicated on the maintenance calibration sticker.

5.1.14.9 IF the concentration is not within tolerance, RETRY Step 5.1.14.8 after the current concentration reading has gone down to 0 ppm, OR

SPAN TEST the monitor in accordance with Section 5.2.
5.1 Operation of the AreaRAE (Cont.)

5.1.14.10 IF the concentration is within tolerance, ALLOW sensors to clear AND

PERFORM any additional functional (bump) tests necessary with other gases (e.g., pentane, ammonia, etc.) appropriate for the sensors installed in the monitor.

NOTE - The monitor is now ready to use. In normal operating mode, i.e., “Program” mode, the screen alternates between instantaneous readings and the sensor names approximately every three seconds. The monitor automatically returns to this screen after a period of inactivity on any other screen. Pressing the [MODE] key repeatedly from any menu eventually returns the monitor to the normal operating mode.

- The peak, minimum, short-term exposure limit (STEL), and time-weighted average (TWA) readings are cleared every time monitor is turned off.

- Readings available are: current concentration, peak reading, minimum reading, STEL, TWA, and running average. See Attachment 1 for a summary list and description of the main operating functions available.

5.1.15 PRESS the [MODE] key once until “PEAK” appears.

5.1.15.1 PRESS [Y/+] key twice to clear the peaks.

5.1.15.2 PRESS [MODE] key repeatedly until the current concentration screen appears.

5.1.16 CONDUCT monitoring in accordance with TFC-OPS-IHT-007.

5.1.17 ENABLE the data log function by performing the following:

5.1.17.1 PRESS both the [N/-] key and the [MODE] key for about 5 seconds to enter the programming mode.

5.1.17.2 PRESS the [N/-] key to scroll through the menu to the “Change Datalog?” screen AND PRESS [Y/+].

5.1.17.3 PRESS the [N/-] key until “Enable/Disable Datalog?” appears AND

PRESS the [Y/+] key.
5.1 Operation of the AreaRAE (Cont.)

NOTE - A sensor is enabled to datalog if an asterisk (*) is displayed to the right of it.

5.1.17.4 USE the combination of the [MODE] and [Y/+]/[N/-] keys to choose and enable/disable, respectively, the appropriate sensors for logging.

5.1.17.5 PRESS the [MODE] key to display the “save?” setting AND PRESS the [Y+] key to save.

NOTE - If “Automatic start/stop” vs. “Manual start/stop” datalog function is selected through the ProRAE Suite software, the monitor begins data logging as soon as the monitor is turned on.
- The following step will erase information.

5.1.17.6 PRIOR to clearing data, ENSURE it is no longer needed.

5.1.17.7 AT the “Clear all data?” option, PRESS the [Y+] key twice.

5.1.17.8 PRESS the [MODE] key twice to return to the current concentration screen.

NOTE - A small “L” in the left center of the display indicates the data logging function is enabled.

5.1.17.9 PRESS the [MODE] key repeatedly until “Start Datalog?” appears on the screen AND PRESS the [Y+] key to start data logging.

5.1.17.10 PRESS the [MODE] key three times to return to the current concentration screen.
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5.1 Operation of the AreaRAE (Cont.)

5.1.17.11 **WHEN** sampling period is complete, **REPEATEDLY PRESS** the [MODE] key until “Stop Datalog?” appears on the screen.

5.1.17.12 **PRESS** the [Y/+] key at the “Stop Datalog?” display to stop data logging.

5.1.17.13 **PRESS** the [MODE] key three times to return to the normal operation screen (the small “L” in the left center of the display should be gone).

5.1.18 **IF** the alarm (loud buzzer and red flashing light) is activated, **REFER** to Table 1 for a description of the condition identified by the monitor.

5.1.18.1 **RECORD** all data in accordance with TFC-ESHQ-S_IH-C-46.

5.1.19 **AFTER** the monitoring is complete for each sensor, **PERFORM** Step 5.1.13.3.

5.1.20 **IF** concentrations are not within tolerances, **NOTIFY** the IH.

**NOTE** - The monitor will beep once per second (if sound is activated, i.e., alarm function is turned on) during the power-down sequence with a countdown timer showing the number of remaining seconds. The message “Off!” flashes and the display will go blank.

5.1.21 **PRESS AND HOLD** the [MODE] key for five seconds to turn off the monitor.

**NOTE** - A red/orange light on the front of the instrument above “CHARGE” indicates that the battery is being charged and a green light indicates charging is complete.

5.1.22 **CONNECT** the AC adapter (plugged into the wall) to the connection port typically labeled “15VDC” on the monitor (bottom of right side or the right side) **AND**

**CHECK** that charging has started.

5.1.22.1 **CHARGE** the AreaRAE monitor for at least ten hours before the next use.

5.1.23 **PROVIDE** completed sampling forms and associated field records to the Project IH within 2 working days.
5.2 Span Testing the Monitor

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.2.1 PRESS AND HOLD both the [N/-] and [MODE] keys for approximately five seconds to enter into programming mode.

5.2.2 PRESS the [Y/+] key at “Calibrate Monitor?” display.

NOTE - When all sensors are zeroed, the display shows “Zero Cal done!”
- After zeroing is complete, the “Multiple Sensor Calibration?” screen is automatically displayed.

5.2.3 ZERO the monitor as follows:

5.2.3.1 PRESS the [Y/+] key at the “Fresh Air Calibration?” option.

5.2.3.2 IF background contaminants are suspected and with the filter housing in line, EXPOSE monitor to a clean ambient air source, such as an office or use a zero air cylinder or use a RAE zeroing tube.

5.2.4 PERFORM span test as follows:

5.2.4.1 CHECK the span gas value identified in the AreaRAE memory matches the value of the span gas cylinder being used as outlined in Step 5.1.7.

5.2.4.2 PRESS the [N/-] key until the display reads “Single Sensor Calibration?”

5.2.4.3 PRESS the [Y/+] key to span test a single gas.

5.2.4.4 PRESS the [MODE] key to cycle through the list of sensors displayed on screen. (The cursor will blink on the selected sensor.)

NOTE - With the ammonia sensor, there is a required 90 second pre-exposure time to condition the sensor for an accurate response.

5.2.4.5 IF ammonia sensor is to be spanned, EXPOSE the sensor to the gas for 90 seconds.

5.2.4.6 PRESS the [Y/+] key to select a sensor.
5.2 Span Testing the Monitor (Cont.)

NOTE - The display shows the name of the span gas to be used for the selected sensor.

5.2.4.7 WITH the filter housing in line, ATTACH span gas to the monitor using inert tubing.

5.2.4.8 WHEN the display shows “Apply Gas,” CHECK the gas cylinder valve is open.

5.2.4.9 IF the gas cylinder valve is not open, OPEN it.
NOTE - The span test should begin automatically.

5.2.4.10 IF the span test does not begin automatically, PRESS the [Y/+]
key to begin the span test.

5.2.4.11 WAIT 60 seconds until the display shows the sensor name, “cal’ed!” and the calibrated value.

NOTE - The calibrated value should be within the tolerance printed on the calibration sticker on the monitor.

5.2.4.12 IF the calibration value is not within tolerance values, TROUBLESHOOT AND REPEAT Steps 5.2.4.1 through 5.2.4.11.

5.2.4.13 IF values are still out of tolerance, REFER to the troubleshooting section of the AreaRAE Operation and Maintenance Manual.

5.2.4.14 IF troubleshooting is unsuccessful, PERFORM the following:

   a. TURN the flow of gas off AND DISCONNECT the tubing from the monitor.

   b. RETURN the monitor to the equipment custodian with a completed green tag (i.e., “IH Instrument Service Tag” (BT-6004-019) indicating “Calibration Failure”).

5.2.4.15 PRESS the [Y/+] key at the “Single Sensor Calibration?” display to perform span test on another sensor.

5.2.4.16 REPEAT Steps 5.2.4.1 through 5.2.4.15 until all sensors are span tested.
5.2 Span Testing the Monitor (Cont.)

5.2.4.17 **PRESS** the [MODE] key repeatedly until the current concentration screen appears.

5.2.4.18 **REPEAT** the function tests as outlined in Step 5.1.13.3 to check the effectiveness of the span testing.

5.2.4.19 **RECORD** all calibration data in accordance with TFC-ESHQ-S_IH-C-46.
5.3 Setting up the Monitor with the Computer

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.3.1 CONNECT the interface cable from the computer to the bottom or side of the monitor.

5.3.2 ENSURE the “ProRAE Suite” software has been installed on the computer.

5.3.3 START the “ProRAE Suite” software on the computer.

5.3.4 PRESS the [MODE] key to turn on the monitor.

5.3.5 REPEATEDLY PRESS the [MODE] key until the screen says “Communicate with PC?”

5.3.6 PRESS the [Y/+] key twice. Display says “Ready…Turn radio off!!”

5.3.7 ON the computer, PERFORM the following:

5.3.7.1 CLICK on “Communication,“

5.3.7.2 CLICK “Receive Configuration…”

5.3.7.3 CLICK “OK.”

NOTE - The current configuration of the monitor will be displayed on the computer.

5.3.8 IF the parameters require editing, PERFORM the following:

5.3.8.1 CLICK on “Edit.

5.3.8.2 CLICK “Configuration…”

5.3.8.3 MAKE the changes.

5.3.8.4 CLICK “OK.”
5.3 Setting up the Monitor with the Computer (Cont.)

5.3.9 ON the computer, **PERFORM** the following:

5.3.9.1 **CLICK** on “Communication.”

5.3.9.2 **CLICK** “Send Configuration…”

5.3.9.3 **CLICK** “OK” twice to transfer changes to the monitor.

5.3.9.4 **WHEN** display shows “You have successfully sending the configuration data to the instrument,” **CLICK** “OK.”

5.3.10 **PERFORM** the following to download data:

5.3.10.1 **CLICK** on “Communication.”

5.3.10.2 **CLICK** “Receive Data…”

5.3.10.3 **CLICK** “OK.”

**NOTE** - On the left-hand side, clicking on the “Event #” under the headings of “Text Mode”, “Graph Mode”, “STEL/TWA/AVG” or “Summary” will allow the data to be displayed in four different ways.

5.3.11 **WHEN** finished viewing the data, **CLICK** on “File” **THEN**

**CLICK** “Exit” to close the program.

5.3.12 **DECIDE** if the data is to be saved by clicking on “Yes” or “No.”

5.3.13 **IF** the data is saved, **PERFORM** the following:

5.3.13.1 **NAME** the file under “File name.”

5.3.13.2 **CHOOSE** where to save it under “Save in:”

5.3.13.3 **SELECT** “Save.”

5.3.14 **PRESS** the [MODE] key to return the AreaRAE to the monitoring mode.
5.4 Setting up the Monitor to Transmit Data

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.4.1 WITH the monitor turned off, PRESS the [Y/+] and [MODE] keys simultaneously for about 5 seconds, to place in “diagnostic mode”.

5.4.2 AFTER completion of start-up menu and “RAW” is displayed on the screen, PRESS AND HOLD the [N/-] and [MODE] keys simultaneously for about 5 seconds to enter the setup mode.

5.4.3 PRESS the [N/-] key until “Change Monitor Setup?” is displayed, THEN PRESS the [Y/+] key.

NOTE - Setting up the unit ID can also be done through the “ProRAE Suite” software.

5.4.4 AT the “Change Unit ID?” screen, PERFORM the following:

5.4.4.1 PRESS the [Y/+] key.

5.4.4.2 PRESS [MODE] OR PRESS [Y/+]/[N/-] keys to move the cursor to the correct digit to set the monitor to a number unique, for transmitting.

NOTE - If the unit ID number remains unchanged, pressing the [MODE] key will produce the display “Change Host ID?”.

5.4.5 PRESS the [MODE] key until “save?” appears THEN PRESS the [Y/+] key.

5.4.6 AT the “Change Host ID?” screen, PRESS the [Y/+] key.

5.4.7 USE the [MODE] key to move the cursor to the far right digit column, THEN

USE the [Y/+] or [N/-] key to select “1” to ensure that the host ID number is set to “1”.

[5.4] Setting up the Monitor to Transmit Data

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.4.1 WITH the monitor turned off, PRESS the [Y/+] and [MODE] keys simultaneously for about 5 seconds, to place in “diagnostic mode”.

5.4.2 AFTER completion of start-up menu and “RAW” is displayed on the screen, PRESS AND HOLD the [N/-] and [MODE] keys simultaneously for about 5 seconds to enter the setup mode.

5.4.3 PRESS the [N/-] key until “Change Monitor Setup?” is displayed, THEN PRESS the [Y/+] key.

NOTE - Setting up the unit ID can also be done through the “ProRAE Suite” software.

5.4.4 AT the “Change Unit ID?” screen, PERFORM the following:

5.4.4.1 PRESS the [Y/+] key.

5.4.4.2 PRESS [MODE] OR PRESS [Y/+]/[N/-] keys to move the cursor to the correct digit to set the monitor to a number unique, for transmitting.

NOTE - If the unit ID number remains unchanged, pressing the [MODE] key will produce the display “Change Host ID?”.

5.4.5 PRESS the [MODE] key until “save?” appears THEN PRESS the [Y/+] key.

5.4.6 AT the “Change Host ID?” screen, PRESS the [Y/+] key.

5.4.7 USE the [MODE] key to move the cursor to the far right digit column, THEN

USE the [Y/+] or [N/-] key to select “1” to ensure that the host ID number is set to “1”.

[5.4] Setting up the Monitor to Transmit Data

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.4.1 WITH the monitor turned off, PRESS the [Y/+] and [MODE] keys simultaneously for about 5 seconds, to place in “diagnostic mode”.

5.4.2 AFTER completion of start-up menu and “RAW” is displayed on the screen, PRESS AND HOLD the [N/-] and [MODE] keys simultaneously for about 5 seconds to enter the setup mode.

5.4.3 PRESS the [N/-] key until “Change Monitor Setup?” is displayed, THEN PRESS the [Y/+] key.

NOTE - Setting up the unit ID can also be done through the “ProRAE Suite” software.

5.4.4 AT the “Change Unit ID?” screen, PERFORM the following:

5.4.4.1 PRESS the [Y/+] key.

5.4.4.2 PRESS [MODE] OR PRESS [Y/+]/[N/-] keys to move the cursor to the correct digit to set the monitor to a number unique, for transmitting.

NOTE - If the unit ID number remains unchanged, pressing the [MODE] key will produce the display “Change Host ID?”.

5.4.5 PRESS the [MODE] key until “save?” appears THEN PRESS the [Y/+] key.

5.4.6 AT the “Change Host ID?” screen, PRESS the [Y/+] key.

5.4.7 USE the [MODE] key to move the cursor to the far right digit column, THEN

USE the [Y/+] or [N/-] key to select “1” to ensure that the host ID number is set to “1”.
5.4 Setting up the Monitor to Transmit Data (Cont.)

NOTE - If the host ID number remains unchanged, pressing the [MODE] key will produce the display “Change Alarm Mode?”.

5.4.8 PRESS the [MODE] key until “save?” appears, THEN

5.4.9 PRESS the [MODE] key twice until “RAW” is displayed, to exit the setup mode.

NOTE - When exiting the “diagnostic mode”, the “program mode” will appear, (i.e., current concentration screen).

5.4.10 PRESS the [Y/+] and [MODE] keys simultaneously for about 3 seconds, to exit the “diagnostic mode”.

5.4.11 PRESS the [N/-] and [MODE] keys simultaneously for about 5 seconds to enter the setup mode.

5.4.12 PRESS the [N/-] key until “Change Monitor Setup?” is displayed, THEN

5.4.13 AT the “Change Site ID?” screen, PRESS the [Y/+] key, THEN

5.4.14 PRESS [MODE] key to move the cursor to select the correct column digit.

5.4.15 PRESS [Y/+] or [N/-] keys to change the letters/numbers to the desired site name.

5.4.16 PRESS the [MODE] key twice to return to the current concentration screen.

NOTE - The red light above the “RADIO” key should turn on.

5.4.17 PRESS the “RADIO” key to activate the radio.
5.5 Setting up the "RaeLINK Wireless" to Receive Data

**NOTE** - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.5.1 **IF** possible, **PLUG** computer into an A/C outlet.

**NOTE** - The “RaeLINK Wireless” receiver is the one without the belt clip.

5.5.2 **ATTACH** the “ANTENEX” antenna to the “RAELINK Wireless” receiver.

5.5.3 **CONNECT** the “RAELINK Wireless” receiver to the PC using the 9-pin serial cable.

**NOTE** - When the receiver is turned on, a red light will appear below “CD” on the unit.

5.5.4 **USNG** the black switch next to the antenna connection, **TURN** the “RAELINK Wireless” receiver ON.

**NOTE** - “ProRAERemote” software needs to be loaded into the PC.

5.5.5 **WITH** the computer on, **CLICK** on the “ProRAERemote” icon.

5.5.6 **PRESS** the “F3” key to access the “Set up” menu.

5.5.7 **AT** the “Set up” screen under the “Host” tab, **CHOOSE** the following:

- “Master Interval (s)” - 10 to 60 seconds
- “Set as Host Controller”
- “Com 1”.

5.5.8 **SELECT** the “Unit” tab **AND**

**CHECK** all the unit ID numbers that have been set up to transmit.

5.5.9 **SELECT** the “Data” tab **AND**

**CHOOSE** “Save Every Record.”

5.5.9.1 **PRESS** “OK”.
5.5 Setting up the "RaeLINK Wireless" to Receive Data (Cont.)

5.5.10 PRESS the “F9” key to begin polling.

NOTE - A “T” will appear in the display of the monitor indicating it is sending data.
- Each monitor transmitting data will be indicated by a green light next to the unit’s number.

5.5.11 CLICK on the “Label #” under each “Unit #” AND
TYPE in the same site name entered for that monitor.

5.5.12 CLICK on the “Unit #” to view the data AND
CHOOSE “Exit” to leave the data view.
5.6 Saving Logged Data to the Computer

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.6.1 PRESS “F4” to enter “Log View” AND “F9” to stop polling.

5.6.2 SELECT the icon with the red “T” at the top of the page AND CHOOSE “Export every page on this unit”.

5.6.3 In “Save in”, CHOOSE the destination of the file to be saved.

5.6.4 NAME the file in the “File name” field AND CLICK “Save”.

5.6.5 MAKE note of where you saved the file AND ENSURE that you document its location in the “Comments” section of the Industrial Hygiene DRI database.

5.6.6 PRESS “F8” to exit the program AND THEN “YES”.
5.7 Perform AreaRAE Monitor Field Function Check

NOTE - A function check is required every shift on AreaRAE monitors set up in tank farms.

5.7.1 CONDUCT a function check for sensors enabled as described in Section 5.1, Step 5.1.13.3.

5.8 Records

5.8.1 PERFORM the following for records identified within this procedure.

5.8.1.1 RECORD the number of times the record was generated in applicable column

OR

PLACE a check mark (✓) in the N/A column.

5.8.1.2 SUBMIT the package to IH.

<table>
<thead>
<tr>
<th>Records Submittal Checklist</th>
<th>Number of times completed</th>
<th>N/A (✓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Hygiene surveys (including forms)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SEND the completed records with Records Submittal Checklist attached to the Safety and Health Program for records retention.

_________________________ / ______________________ / ________________
Signature                   Print (First and Last)                  Date
IH

The record custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
Table 1 - Alarm Signal Summary

The monitor constantly updates and monitors gas concentrations and compares them with the programmed alarm limits (time-weighted average, short-term exposure limit, and two instantaneous gas concentration alarm limit settings, low and high). When the concentration exceeds any of the preset limits, a loud buzzer and red flashing light are activated immediately. The monitor also alarms during battery, lamp, or pump failure. The alarm can be tested by pressing the [Y/+] key momentarily. The buzzer will beep once and the display and backlight will flash once to indicate that these alarm signals are functioning correctly.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Alarm Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas exceeds “High Alarm” limit</td>
<td>3 beeps/flashes per second plus sensor name on display</td>
</tr>
<tr>
<td>Gas exceeds “Low Alarm” limit</td>
<td>2 beeps/flashes per second plus sensor name on display</td>
</tr>
<tr>
<td>Gas exceeds “TWA” limit</td>
<td>1 beep/flash per second plus sensor name on display</td>
</tr>
<tr>
<td>Gas exceeds “STEL” limit</td>
<td>1 beep/flash per second plus sensor name on display</td>
</tr>
<tr>
<td>Negative drift or over range</td>
<td>3 beeps/flashes per second plus “NEG” or “OVR” name on display</td>
</tr>
<tr>
<td>Pump failure</td>
<td>3 beeps/flashes per second plus “Pump” message on display</td>
</tr>
<tr>
<td>LEL sensor off</td>
<td>3 beeps/flashes per second plus LEL sensor name and “Off” message on display</td>
</tr>
<tr>
<td>PID lamp failure</td>
<td>3 beeps/flashes per second plus “Lamp” message on display</td>
</tr>
<tr>
<td>Low battery</td>
<td>1 flash per second, 1 beep per minute plus “Bat” message on display</td>
</tr>
<tr>
<td>Memory full</td>
<td>1 flash per second plus “Mem” message on display</td>
</tr>
</tbody>
</table>

LEL = Lower Explosive Limit  
Mem = Memory  
NEG = Negative  
OVR = Over range  
PID = Photo-Ionization Detector  
STEL = Short-Term Exposure Limit  
TWA = Time-Weighted Average
Attachment 1 - Main Operation Functions

AreaRAE multi-gas monitors are used by the industrial hygiene technicians to conduct area gas and vapor sampling at tank vapor source points and in the general work area. The monitor is a programmable, one to five sensor multi-gas meter designed to provide continuous monitoring of the following gases/vapors:

- Ammonia, carbon monoxide and percent oxygen with substance specific electrochemical sensors
- Volatile organic compounds with a photo-ionization detector using a 10.6 eV lamp
- Combustible gases in the 0-100% lower flammable limit range with a catalytic bead sensor.

The AreaRAE is equipped with an integral radio transmitter that enables the monitor to transmit monitoring data to a wireless receiver connected to a remote PC. The data can be viewed on the remote PC and exported to Excel for data analysis.

Additional information, including programming and maintenance features can be found in the AreaRAE Multi-Gas Monitor Operation and Maintenance Manual.

The following information is displayed by pressing the [MODE] key to cycle from step to step.

1. The **instantaneous** reading is the actual concentration in parts per million (ppm) for toxic gases or volatile organic compound vapors, % volume for oxygen, and % of lower explosive limit (LEL) for combustible gases/vapors. The reading is updated once per second and is shown on the display.

2. The **sensor names** are displayed as: “LEL” for combustible gas sensor; “VOC” for photo-ionization detector (PID) sensor; “OXY” for oxygen sensor; “CO,” “NH₃,” etc., for up to two toxic sensors.

3. The **peak** reading is the highest reading of each gas/vapor concentration since the monitor was turned on. The reading is updated at one-second intervals and is shown on the display with the “Peak” message.

4. The **minimum** reading is the lowest reading of each gas/vapor concentration since the monitor was turned on. The reading is updated at one-second intervals and is shown on the display with the “Min” message.
Attachment 1 - Main Operation Functions (Cont.)

5. The **STEL** reading is the last 15-minute average reading of the gas/vapor concentration. The reading is updated once per minute and is shown on the display with the “STEL” message. For the first 15 minutes, “****” will be displayed. This reading applies only to VOC and toxic gases/vapors.

6. The **TWA** reading is the accumulated reading of the gas/vapor concentration divided by 8 hours since the monitor was turned on. The reading is updated once per minute and is shown on the display with the “TWA” message. This reading applies only to VOC and toxic gases/vapors.

7. The **battery voltage** reading is the current battery voltage in volts. The reading is updated once per second and is shown on the display. The shutdown voltage is also shown. A fully charged battery pack should show 7.7 volts or higher. When the battery voltage falls below 6.6 volts, a flashing “Bat” will appear as a warning message. This means there is 20-30 minutes of run time left before the monitor will turn off automatically (when the battery voltage falls below 6.4 volts).

8. The **run time** reading is the accumulated run time in hours and minutes since the monitor was turned on. The reading is updated at one-minute intervals and is shown on the display together with the current date, time, and temperature, i.e., internal temperature of the monitor.

9. The **datalog** menu shows the current datalog mode. If manual datalog mode is selected, the menu will prompt the user to turn on or off data logging. Pressing the [Y/+] key while “Start Datalog?” message is displayed turns on the data logging. Pressing the [Y/+] key while “Stop Datalog?” message is displayed turns off the data logging.

10. The monitor will display the selected **LEL** and **VOC gas name** if the combustible gas sensor and PID sensor are installed. When an LEL or VOC gas is selected, the “calculated” gas concentration, based on the built-in correction factor for that specific gas, will be displayed.

11. **Communicate with PC?** Menu display allows the user to download data from the monitor to a computer or upload configuration information from a computer to the monitor.
Attachment 2 - Precautions and Limitations of the AreaRAE

The relative humidity range is specified by the instrument manual and was clarified in correspondence with the manufacturer to be usable to 100% relative humidity levels (non-condensing) if the AreaRAE is allowed to warm up for 30 minutes in a room whose relative humidity is less than 95%. This enables the instrument to warm up and prevents condensation.

Additionally, RAE Systems technical staff also approved the compensatory measure of using a calibrated QUESTemp 32 wet bulb/globe temperature meter placed within a plastic insulated cooler so that the Industrial Hygiene Technician can note the relative humidity & temperature to determine if it is within the specification for the AreaRAE during the monitoring period. Typically, an SKC personal air sampling pump will be used to draw air through ports drilled into the cooler and be tempered by the insulated environment. Tubing from the outlet of the AreaRAE is used to then directly exhaust the air stream outside through ports in the cooler.

Condensing moisture’s effects on the photoionization detector can cause: (1) “quenching effect” – ultraviolet light is blocked by condensation from ionizing the target gas/vapor and its concentration is underestimated and (2) “current leakage effect” – associated with a dirty sensor, condensation can promote current flow and overestimate the target gas/vapor concentration.