## AIR MONITORING

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| Effective: | November 21, 2018 |
| Scheduled Review: | November 21, 2021 |
| Replaces: | 613 Gas Monitor Maintenance |
| Approved: | Fire Chief Mike Kennedy |

I.  **PURPOSE**
   The purpose of this SOP is to provide a procedure regarding air monitoring equipment operated by the Ann Arbor Fire Department.

II.  **RESPONSIBILITY**
   The Mechanics Division has ultimate responsibility for record keeping, repair, and maintenance. The Mechanics Division may delegate certain responsibilities or solicit assistance as needed.

III.  **GENERAL USAGE**
   Whenever air monitoring is required such as carbon monoxide incidents, natural gas leaks, confined space emergencies, hazardous materials incidents, overhaul phase of structure fires, or work being performed in an IDLH atmosphere, monitors are to be fresh air started and zeroed.

   All structural fires require air quality monitoring for CO and HCN after being brought "under control" and prior to SCBA required usage is lifted.

IV.  **HYDROGEN CYANIDE**
   The short-term exposure limit for hydrogen cyanide (HCN) recommended by the National Institute for Occupational Safety and Health is 4.7 ppm and is also the ceiling of exposure limit recommended by the American Conference of Industrial Hygienists. The Occupational Safety and Health Administration still uses 10 ppm as its short-term exposure limit, but the Environmental Protection Agency lists 10 ppm as creating possible adverse medical impacts in as little as 30 minutes. HCN is estimated to be 26 to 35 times more toxic than carbon monoxide.

   In order for AAFD personnel to operate without SCBA during overhaul, readings of HCN must be below **4 ppm**. Immediately Dangerous to Life and Health (IDLH) for HCN is 50 ppm.

V.  **QRAE 3**
   Each station has a QRAE 3, 4-gas air monitor with the following sensors: oxygen ($O_2$), methane ($CH_4$), hydrogen sulfide ($H_2S$), and carbon monoxide (CO).
   A.  Operation
       i.  To turn the QRAE 3 on, press and hold the [MODE] key until the audible alarm stops and then release.
       ii.  During startup, the battery, buzzer, vibration alarm, and LEDs are tested, and then the QRAE 3 performs self-testing of its other functions. When the main measurement screen appears, the QRAE 3 is ready for calibration or use.

Note: If the battery is completely empty, then the display briefly shows the message "Battery Discharged!" and the QRAE 3 shuts off. You should charge or replace the battery before turning it on again.

Note: If "Zero At Start," "Must Calibrate" or "Must Bump" is set, you will be prompted to perform the appropriate calibration before using the instrument.

B.   Zero and Fresh Air Calibration
   i.   The QRAE 3 should be zero-calibrated in clean air with 20.9% oxygen or with a cylinder of clean zero air. In Programming Mode, press [MODE] to select "Multi Zero." Press [Y/+] to select it. Then press [Y/+] to start a Fresh Air calibration for the listed sensors. All are fresh-air calibrated at once. During calibration, the screen says, "Calibrating." When done, each sensor is shown, accompanied by the word "Pass."

   ii.  The QRAE 3 shall be examined and tested during Saturday morning apparatus checks. Should any problem be noted, the company officer shall contact the Mechanics Division.
   iii. Station officers shall ensure that their station's QRAE 3 is calibrated monthly at Station 6.

C.   Turning the QRAE 3 Off
   i.   Press and hold [MODE]. A 5-second countdown to shutoff begins. Continue pressing on the key for the entire shutoff process. Otherwise, the shutoff operation is canceled and the QRAE 3 continues normal operation.
   ii.  When the countdown ends and the screen displays "Unit Off!" release your finger from the [MODE] key. The QRAE 3 is now off.

D.   Testing the Alarm
   i.   Under normal-operation mode and non-alarm conditions, the buzzer, vibration alarm, LED, and backlight can be tested anytime by pressing [Y/+] once. If any alarm does not respond, check the Alarm Settings in Programming Mode to make sure all alarms are enabled. If any alarms are enabled but are not functional, do not use the instrument

VI.   **TOXIRAE 3**
The ToxiRAE 3 carbon monoxide detector is a simple to use single gas monitor that once it is turned to the "ON" position will remain "ON" for two years or until the battery exhausts itself.  The detector should only need to be calibrated every three months.
A.   Operation
   i.   To turn the ToxiRAE 3 on, press and hold [MODE] for 3 seconds.
   ii.  The ToxiRAE 3 turns on and the display shows "On" and a battery icon that indicates the battery condition. The buzzer and LEDs are tested.
   iii. The sensor is tested. If the sensor is okay, it warms up, and there is a countdown. Note: If the sensor is depleted or does not check out satisfactorily, an error message of "E01" flashes on the display. The ToxiRAE 3 should not be used until the sensor is replaced.

(Shut off the ToxiRAE 3 by pressing and holding [MODE] until you see the countdown and the display shows "oFF.")

    iv. Once the countdown is complete, the type of sensor is displayed (for example, "CO"), "OK" is displayed below the battery icon, and the reading is also shown (for example 0 ppm). The ToxiRAE 3 is now in Normal Mode and is ready for use.

B. Turning the ToxiRAE 3 Off
    i. Press and hold [MODE]. In 2 seconds, a 5-second countdown to shutoff begins. You must hold your finger on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the ToxiRAE 3 continues normal operation.
    ii. When you see "OFF," release your finger from the [MODE] key. The ToxiRAE 3 is now off.

C. Testing the Alarms (Anytime)
    i. Under normal non-alarm conditions, the buzzer, vibration alarm, and LEDs can be tested at any time by pressing [Y/+] once.

D. Low Battery Warnings
    i. When the battery's charge is low, the battery symbol flashes once per second and "bAt" flashes once per minute.
    ii. When the battery reaches a critically low charge, the battery symbol flashes once per second and "bAt" flashes once per minute, plus the buzzer sounds once per minute.

E. Dead Battery Warning & Shutoff
    i. When the battery is dead, the buzzer sounds once per second for the last minute and then shuts off. The display shows "oFF".
    ii. Do not operate the ToxiRAE 3 again until its battery has been replaced.

F. Maintenance
    i. The ToxiRAE 3 carbon monoxide monitor should be mainly maintenance free. In the event a sensor or battery has a problem, contact the Mechanics Division.

VII. **ToxiRAE Pro**
The ToxiRAE Pro is a single gas monitor for hydrogen cyanide. It is kept on the battalion chief vehicle.
A. Operation
    i. To turn the ToxiRAE 3 on, press and hold [MODE] for 3 seconds. During startup, the battery, buzzer, vibration alarm, and LEDs are tested, and then the ToxiRAE Pro performs self-testing of its functions. When the main measurement screen appears, the ToxiRAE Pro is ready for calibration or use.
    ii. The ToxiRAE Pro's user interface consists of the display, four LED lights, an alarm buzzer, and two keys, [MODE] and [Y/+].

The LCD displays real-time reading in specified measurement units, sensor type, alarm type (when in alarm, including cal. or bump overdue), Man Down status, battery status, datalog (if on), and radio and connection quality (if available).Turning the ToxiRAE 3 Off

    iii.  Turning The ToxiRAE Pro Off, press and hold [MODE]. A 5-second countdown to shutoff begins. You must continue pressing on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the ToxiRAE Pro continues normal operation. When the countdown beeps stop and you see "Unit Off," release your finger from the [MODE] key. The ToxiRAE Pro is now off.

B. Calibration

The ToxiRAE Pro can be automatically bump tested and calibrated using the AutoRAE 2 Test and Calibration Station (refer to its User's Guide for instructions). Manually calibrate using a fixed-flow regulator (flow rate between 0.5 and 1.0 liters per minute) and the supplied special calibration adapter that covers the gas inlet:

    i.  To begin calibration, connect the zero air or calibration gas cylinder, flow regulator, and calibration adapter to the ToxiRAE Pro.

    ii.  Enter Programming Mode by pressing and holding [MODE] and [Y/+] simultaneously until the password screen appears.

    iii.  Input the 4-digit password. (The default password is "0000." If you do not know the password, highlight and select "OK.") Then follow the instructions for zero calibration and span calibration.

    iv.  Important! After a bump test or calibration, remove the calibration adapter to ensure correct readings.

C. Zero (Fresh Air) Calibration

The ToxiRAE Pro should be zero-calibrated in clean air with 20.9% oxygen. If the ambient air has impurities, a cylinder of clean zero air should be used for zero calibration. With the ToxiRAE Pro in Programming Mode and "Zero Calib" highlighted:

    i.  Press [Y/+]. "Apply zero gas…" is displayed.

    ii.  Start the flow of the zero gas, if used, and press [Y/+] to start the fresh air or zero calibration.

    iii.  The screen says, "Zeroing…" and shows the countdown.

    iv.  When done, it says, "Zero is done! Reading = X" (this reading should be 0.0 ppm or very close to it for toxic gas sensors, and 20.9% Vol. for an oxygen sensor).

    v.  "Span Calib" is highlighted.

    vi.  Shut off the flow of zero air (if used).

    vii.  Remove the calibration adapter.