EHSS Standard Operating Procedure			
	Subject: PPM PID Calibration Procedures RAE Systems – MiniRAE 3000 PID **EHSS SOP #012-2019**	**Sections:** All EHSS	**Distribution:** All EHSS Personnel
Issuing Authority: Rebecca Ponza, Director of EHSS **Signature:** *Rebecca J. Ponza*		**Effective:** March 1, 2019	**Supersedes:** N/A

RAE Systems MiniRAE 3000 PID Calibration Verification Procedure

I. Applicability: This Standard Operating Procedure is applicable to all Syracuse University Environmental Health and Safety Services Personnel.

II. Purpose: To provide a detailed set of calibration instructions for EHSS staff members responsible for calibration of the RAE Systems MiniRAE 3000 photo-ionization detector (PID).

III. Role of EHSS The role of EHSS is to maintain MiniRAE 3000 PID functionality by performing bimonthly calibration verifications.

IV. Definitions: Photo-ionization Detector:

- A MiniRAE 3000 PID is a type of gas detector that measures the presence of volatile organic compounds and other gases with a measurement range of 0.1 part per million (ppm) to 15,000 ppm when using a 10.6 eV lamp. Used for emergency response, industrial hygiene, indoor air quality, and chemical contamination applications.

Calibration:

- The process of configuring an instrument to provide a result for a known sample (calibration gas) within an acceptable range (+/- 5%). EHSS performs a standard two-point calibration using nitrogen (zero) gas and isobutylene (span) gas.

Bump Test (as Found Reading):

- A qualitative function check in which a known concentration of challenge gas is used to verify sensor performance. A bump test does not calibrate sensors. It is recommended that a PID should be checked using a bump test before every use if possible. If PID readings fall outside of an acceptable range for the challenge gas, the unit must be calibrated.

V. Items Needed

All items are located in Lyman Hall room 034 B & C

- ✓ RAE Systems - MiniRAE 3000 photo-ionization detectors (2).
- ✓ Calibration Gas
  - Isobutylene – 100 ppm (Span Gas) - Located in protective cases on shelving under fume hood in 034C (Figure 1). Check to make sure calibration gas has not expired by checking expiration date on cylinder label.
  - Nitrogen (Zero Gas) - Located in room Lyman 034B (Figure 1). Keep nitrogen gas cylinder on cart during testing.

  All gas cylinders, when not in use, will be stored with the valve closed, the regulator removed, and either returned to their protective case (isobutylene) or the valve protector cap securely in place (nitrogen).
- ✓ Regulators – All regulators are stored in cylinder protective cases on shelving under fume hood in 034C (Figure 1). For the isobutylene cylinder, use a 0.5 l/m regulator (marked on side).
- ✓ Calibration Binder - Located in shelving above instruments in 034C. Will need a new "PID In-House Equipment Calibration Form" (located in binder sleeve) for each instrument calibration test. An example calibration forms is attached.
- ✓ Calibration Sticker – Located in calibration binder sleeve. Place completed sticker on PID following calibration.
- ✓ Tubing – Located in cylinder protective cases on shelving under fume hood in 034C. Used to connect calibration gas cylinder regulator to the PID 6" flexible inlet probe. Please refer to the attached Diagram 1, which shows the location of the PID inlet probe.

VI. Procedures

PID Start-Up

1. Start by filling out information or checking appropriate box on a new calibration form. New forms are located in the calibration binder sleeve or attached:
   a) Date
   b) Person Calibrating
   c) Calibration Location
   d) Instrument Manufacturer: RAE Systems
   e) Instrument Name - MiniRAE 3000
   f) Model # - PGM 7320 - PPM
   g) Serial # - Located on back of instrument
   h) Calibration Gases - 100 ppm Isobutylene & Nitrogen
   i) Lamp – Noted on EHSS PID calibration sticker
2. Turn on PID (startup) by pressing and holding the "mode" key for 2 seconds. When display powers on, release the "mode" key. Please refer to the attached Diagram 1, which shows PID key locations.
3. The PID is now operating and performing self-tests. After completing tests, the instrument will operate in "basic user/hygiene" mode and display a reading in ppm.

As-Found Readings – Ambient Air and Calibration Gas (Bump Tests)

4. Once initial startup reading stabilizes, record reading on the calibration form under As-Found Reading for Ambient Air.

5. Attach regulator to nitrogen gas cylinder. Open cylinder valve. Connect PID inlet probe to the nitrogen (zero) calibration gas cylinder regulator using supplied tubing. Remember to open regulator just prior to connecting to PID inlet probe. Wait until reading on PID display stabilizes and record As-Found reading for nitrogen gas (zero gas) on calibration form. Disconnect tubing and shut off calibration gas.
6. Attach regulator to isobutylene - 100 ppm (span) gas cylinder. Connect PID inlet probe to the isobutylene – 100 ppm calibration gas cylinder using tubing and regulator. Remember to open valve on regulator just prior to connecting to PID inlet probe. Wait until reading on PID display stabilizes and record As-Found reading on calibration form for isobutylene - 100 ppm. Disconnect tubing and shut off calibration gas.

Two-Point Calibration

7. Enter "programming" mode by pressing and holding both the "mode" and "N/-" keys simultaneously for 3 seconds. You will be prompted for a password. In basic user/hygiene mode, you can skip directly to "calibration" mode by pressing (selecting) "mode" key. [If you need to enter the "programming" mode (for 3-point calibration, alarm settings, datalog settings, measurement settings and monitor setup, etc.), a password must be entered. The password is 0000. Refer to the manufacturer's user manual for further programming steps].
8. This pauses the basic user/hygiene mode and the display will show the "Calibration" mode. The calibration mode has two selections: "Zero Calib" and "Span Calib".
9. Select "Zero Calib" by pressing the "Y/+" key. The PID display will show "Apply zero gas". Connect the PID inlet probe to the nitrogen calibration gas (remember to open valve on cylinder before connection) and select "start" by pressing the "Y/+" key. The calibration process takes 30 seconds. Once done, the PID display will show "Zero is done!" and a reading. Disconnect and shut off gas. Record reading on calibration form under Calibration Reading for nitrogen (zero) gas.
10. Once zero calibration is complete, the PID display will show "Span Calib" highlighted. Select "Span Calib" by pressing the "Y/+" key. You will see a message that prompts you to "Please apply gas". Connect the PID inlet probe to the isobutylene – 100 ppm calibration gas (remember to open regulator on cylinder before connection). Once gas is detected, the instrument will display "Calibrating. "and there is a 30-second countdown. If auto-detection does not work, select "start" by pressing the "Y/+ key".
11. When span calibration is complete, a message showing "Span 1 is done" along with the reading is displayed. Record reading on calibration form under Calibration Reading for isobutylene - 100 ppm. Shut off calibration gas and disconnect from PID.
12. Once done with calibrating, press "mode" key (back) and an "updating settings…" message appears and then returns to main display.

As-Left Readings

13. Perform "As-Left Reading" for isobutylene – 100 ppm by reconnecting the isobutylene calibration gas. Write down readings on calibration form under As-Left Reading for isobutylene – 100 ppm. Shut off gas and disconnect.
14. Let meter run and perform As-Left test for ambient air.

15. If the As-Left readings are within an acceptable range of less than or equal to +/-5% for both of the calibration gases, the calibration was successful and is complete. For Isobutylene - 100 ppm the acceptable range is within 95-105 ppm and for the zero gas, it is 0-5 ppm.
16. If As-Left readings are outside of the acceptable range (more than +/- 5% of either of the calibration gases), a repeat calibration of the instrument must be performed.
17. When finished, turn off PID by pressing and holding "mode" key for 3 seconds.
18. Fill out a calibration sticker (binder sleeve) indicating date of calibration, who performed calibration, date next calibration is due, and type of lamp installed in unit. Remove old sticker and affix new sticker on instrument.
19. Check Date/Time on PID. Adjust if necessary. Consult manual if necessary.
20. Check isobutylene and nitrogen calibration gas levels to make sure enough calibration gas is left for future calibrations. Note any maintenance performed on calibration form.
21. Place calibration sheet into binder. Update binder index.
22. Make sure the nitrogen cylinder valve is closed. Remove all regulators from the gas cylinders for storage. Place isobutylene cylinder into protective case along with tubing and regulator and return to storage shelving below fume hood. Replace valve protector cap on nitrogen gas cylinder and return cylinder to 034B. Return regulator to shelving below fume hood.

Figure 1

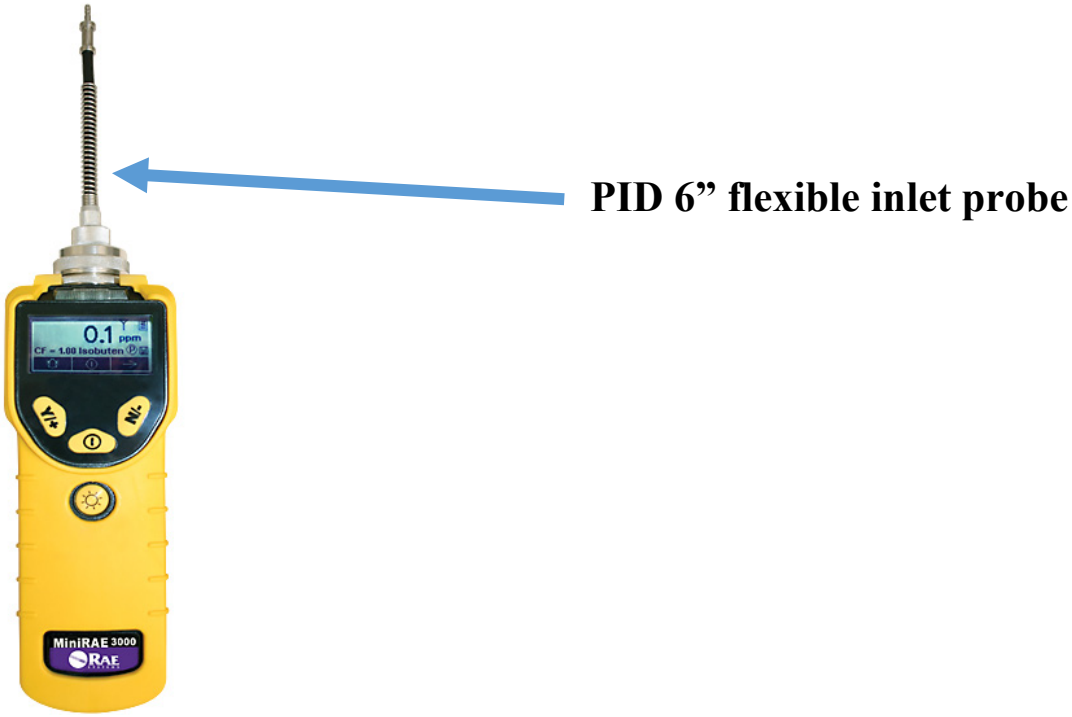
Cylinder protective cases on shelving under fume hood

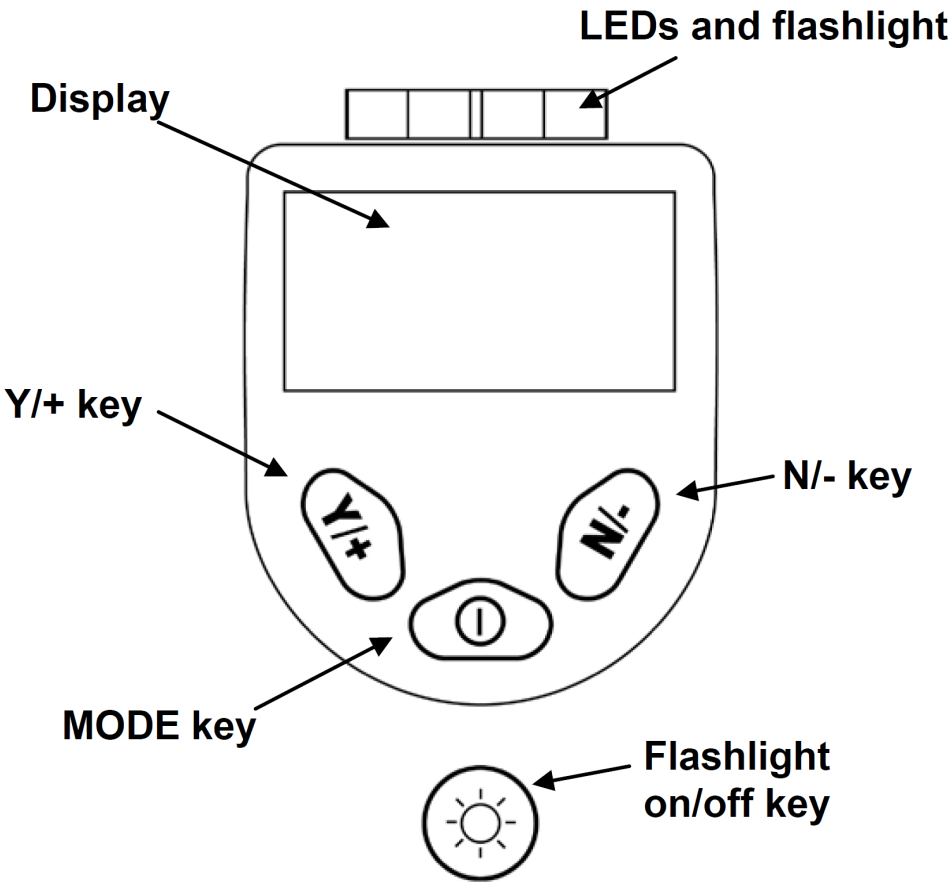
Isobutylene Gas Cylinder & Regulator

Nitrogen Gas Cylinder (Room 034B)

Nitrogen Gas Cylinder Regulator

Diagram 1


PID 6” flexible inlet probe
0.1 ppm
CF = 1.00 Isobuten
Y/+
N/-
MiniRAE 3000
RAE


LEDs and flashlight
Display
Y/+ key
N/- key
MODE key
Flashlight
on/off key

SYRACUSE UNIVERSITY
ENVIRONMENTAL HEALTH AND SAFETY SERVICES OFFICE

PID IN-HOUSE EQUIPMENT CALIBRATION FORM

Date:_____ Person Calibrating: _____

CALIBRATION LOCATION

Building: _____ Room: _____
Ambient Temperature: _____ Ambient Humidity: _____ Barometric Pressure: _____
(NWS web site for SYR)

EQUIPMENT TO BE CALIBRATED

Instrument Manufacturer: Rae Systems

Instrument Name: MiniRAE 3000 □
ppbRAE 3000 □

Model #: PGM 7320 – PPM □
PGM 7340 – PPB □

Serial #: 592-914921 □
592-914932 □
594-903960 □

Calibration Gases

Item: □ Isobutylene in air Conc.: 100 ppm Manuf.: _____ Lot/Ser.#: _____ Exp.Date: _____
Item: □ Isobutylene in air Conc.: 10 ppm Manuf.: _____ Lot/Ser.#: _____ Exp.Date: _____
Item: □ Nitrogen (Zero) Conc.: 100 % Manuf.: _____ Lot/Ser.#: _____ Exp.Date: _____
Item: _____ Conc.: _____ Manuf.: _____ Lot/Ser.#: _____ Exp.Date: _____

Lamp □ 10.6 eV □ 9.8 eV □ 11.7 eV

As-Found /Calibration/ As-Left Data Table

Calibration Gas	***I. Units***	**Calib. Std. Value**	*Calibration Standard Accuracy*	**As-Found Reading** *"Bump Test"*	**Calibration Reading**	**As-Left Reading**	***Estimated Over-all Accuracy***
Isobutylene	ppm/ppb	10 ppm/ 10,000 ppb	±				±
Isobutylene	ppm	100 ppm	±				±
Nitrogen (Zero)	ppm	0 ppm	±				±
Ambient Air	ppm	unknown			NA		

NOTE: As-Left/Calibration reading should be very close to span gas value (+/- 5 %)***. If not, recalibrate.***

If readings continue to fall outside of the 5% accuracy after several calibrations, clean lamp/sensor.

DATE/TIME: Check Date/Time. _____ Date is expressed as Month/Day/Year

_____ Time is expressed as Hours/Minutes/Seconds

CALIBRATION STICKER? __

MAINTENANCE / CLEANING PERFORMED

Action:_____

COMMENTS:_____

FOR NEXT TIME

Next Calibration Due Date:_____ How much calibration gas left? _____PSI

Supplies to Order

Item:_____ Conc.:_____ Qty.:_____ Size:_____