PHILADELPHIA ELECTRIC COMPANY

PEACH BOTTOM UNITS 2 & 3

HPA-63d CALIBRATION OF VENTILATION SYSTEMS RADIATION MONITORS

PURPOSE:

This test will demonstrate that the ventilation radiation monitor systems are operable, in calibration, have correct trip settings and perform specified annunciator functions on upscale and downscale trips.

REFERENCES:

Digital Ratemeter Manual, LFE Corporation, Bulletin 7610 - 1N1
Low Level Radiogas Sampler/Detector Manual, LFE Corporation, MQ-216
M-334
E-417
E-1674
Trapelo Drawing, D999288, M236-14
Trapello Drawing, B999274, M236-12
Technical Specification 4.8.C.5

PREREQUISITES:

1. Approval of shift supervision to perform the calibration.
2. Stable operating conditions or associated Unit shutdown.
3. This procedure assumes that the equipment has been in operation and is ready for a routine check out and calibration.

APPARATUS:

1. Cylinders of calibration gas (nominally 10^{-1}, 10^{-3}, and 10^{-5} μCi/cc of an appropriate certified standard such as Kr^{85})
2. Gas regulator with fittings to connect to gas sampler inlet.

PRECAUTIONS

The power supply high voltage is hazardous to personnel. Normal precautions should be taken when working on this equipment.

Contact plant Health-Physics for standard calibration gas and assistance before performing calibration.

THE OPERATION OF TWO CONTROL ROOM VENTILATION RADIATION ALARMS, HIGH OR LOW, INITATES INTERRUPTION OF CONTROL ROOM VENTILATION. THEREFORE, CARE SHOULD BE TAKEN NOT TO TRIP BOTH UNITS SIMULTANEOUSLY.

The following variables shuld not be exceeded: pressure greater than 3 psig or vacuum greater than 7" Hg in the gas sampler void volume to preclude damage to the sensor.

PROCEDURE:

The radiation monitoring system continuously monitors the radiation level of the air passing through the ducts. The control room monitor samples the supply air. All other monitors sample the system ventillation exhaust air.

Each unit consists of a pumping system for drawing air samples from the duct thru the gas sampler and filter holder. The gas sampler detector output is displayed on the digital rate meter as a count rate in cpm which is proportional to the concentration of gaseous activity µCi/cc in the sample. The sample to the filter holder is from an isokinetic sample line. The holder contains a filter disc for particulates and a charcoal filter or cartridge for iodines. The flow through the filters is regulated by an electro-pneumatic flow control valve located downstream from a control valve. This signal is fed to a square root extractor and then to a controller in the control room. The controller positions the flow control valve to maintain a constant flow rate. A flow alarm is also provided which will be activated by low vacuum (e.g., due to tripped sample pump). The pump discharge passes through a heat exchanger and back to the vent duct. No cooling water supply will be provided unless found to be necessary after operation.

The following components make up one system:

(1) Digital Ratememter DRM-100 (V-6)
(1) Low Level Radiogas Sampler/Detector MQ-216
(1) Roots Rotary Lobe Air Blower 1702J
(1) Fischer & Porter Electronic Differential Pressure Transmitter
(1) Fischer & Porter Electronic Square Root Extractor
(1) Fischer Controls Electro-Pneumatic Transducer
(1) Fischer Controls Diaphgram Actuator
(1) Fischer Controls Valve
(2) Fixed Filter Holders
(1) Heat Exchanger
(1) Fischer & Porter Electronic Controller
(1) Rack OAC & OBC 186
(1) Control Panel 20C10
(1) Isokinetic Nozzle

This description is applicable to the following systems

1. Control room ventilation supply __________ two sample stations
2. Unit 2 roof vent __________ two sample stations
3. Unit 3 roof vent __________ two sample stations
4. Radwaste building exhaust __________ one sample station
5. Recombiner building exhaust __________ one sample station

RADIOGAS DETECTOR

1. Set the STATISTICS switch to 10% and the HIGH ALARM to 1.0 X 10^7 cpm.
2. Verify Power on. The POWER light will be energized. The Nixie indicators will indicate any number, even multiple numbers if power had been off. Either or both the ALARM lights may be ON.
3. Turn the front panel switch to ALARM RESET. The Alarm lights will go out.
4. Turn the internal Function switch to CIRCUIT RESET. The Nixie's will all reset to 0.
5. Turn the Fuction switch to TEST and hold it in that position. Within 2 seconds, the display will change to 2.00 X 10^6.
6. Immediately turn the switch to CIRCUIT RESET. Release it. Six seconds later, the display will change to 0.00 X 10^3. 54 seconds later (1 minute after releasing) the display will read 0.00 X 10^2, and the FAILURE alarm light will indicate.
7. Set the High Alarm switches to 1.0 X 10^6. Turn the function switch to TEST. The High Alarm light will indicate.
8. Set the STATISTICS switch to 3%. Repeat Step 5 above.
9. Immediately turn the function switch to CIRCUIT RESET. Release it. Six seconds later, the display will change to 0.00 X 10^4. 54 seconds later, the display will read 0.00 X 10^3.
10. Turn the circuit reset switch to the test position and hold for five seconds. Release the switch to the OPERATE position. Six seconds later the display should indicate some random number X 10^4.
11. Reset the STATISTICS switch to 10% and repeat step 10. The display should indicate some random number X 10^3.
12. The controls may be now set to the proper operating positions. Refer to Table HPA-3.c.1.

LOW LEVEL DETECTOR CALIBRATION PROCEDURE

13. Turn the ratemeter high voltage control to 000, turn on ratemeter and ratemeter high voltage, set threshold control to 200.
14. Turn Function switch to TEST position and observe 2 X 10^6 CPM display.
15. Turn Function switch to CIRCUIT RESET position and observe 0.00 X 10^0 CPM display.
16. Energize check source and increase high voltage until ratemeter starts to count. Note cpm at discrete voltage settings.

DO NOT EXCEED 1600 VOLTS

17. Plot high voltage vs. count rate until a plateau is observed.
18. De-energize check source and plot high voltage vs. background.

DO NOT EXCEED 1600 VOLTS

19. Set high voltage at point where check source reading is on plateau and background is between 80 and 90 CPM. Lock in high voltage control.
20. Set threshold control at 600, energize check source and record ratemeter reading on data sheet HPA-3.c.1.
21. De-energize check source, set threshold control at 200. Ratemeter is now set-up for sensitivity testing.
22. Operate sample purge switch.
23. Shut off sample pump. Reset sample purge switch.
24. Close gas sampler inlet valve.
25. Verify gas sampler discharge path is open.
26. Connect standard gas cylinder to gas sampler inlet line.
27. Record background reading on digital rate meter and recorder.
28. Inject Kr^{85} at a known concentration (10^{-5} µCi/cc) into the sampler at a slow rate. Purge for 5 to 15 seconds, then close off the standard gas supply to the gas sampler by closing the valve between the gas cylinder regulator and the gas sampler inlet line. Continue this interrupted purge until the count rate has come to equilibrium (5 displays that show no change in count rate except for statistical variation). Secure the gas supply and then close the gas sampler outlet valve. Care should be taken to close the supply valve first. Do not pressurize the system. Continue to observe the ratemeter count rate and observe that there is no change in count rate (except statistical). If there is a change in count rate, equilibrium was not achieved while the gas was flowing. Repeat the interrupted flow until there is no change in five successive count rates. Record count rate on data sheet HPA-3.c.1 and establish low level calibration point on log graph paper.
29. Inject Kr^{85} at other known concentrations (e.g. nominally 10^{-3} µCi/cc and 10^{-1} µCi/cc) and repeat the procedure followed in step 28. Record the count rate on data sheet HPA-3.c.1. At least two calibration points shall be obtained.
30. Subtract the background cpm from cpm corresponding to each calibration point.
31. Plot a curve of net cpm vs µCi/cc on log log paper.
32. Purge sampler with clean air to a stable background reading.
33. Energize the Sr-90 check source. Record the reading on data sheet HPA-3.c.1. Compare the check source reading with previous check source readings. Reading shall be within $\pm$ 20% of original value corrected for decay.
34. Determine the net cpm per µCi/cc from the curve.
35. Determine the cpm corresponding to 1 X 10^{-7} µCi/cc.
36. Calculate the σ of a series of background readings as follows:

    a) operate the sample purge switch
    b) observe and record 5 to 10 background readings (each reading will be for one minute) on data sheet HPA-3.c.2.
    c) average the background readings and take the square root of this average. This is σ of the background.

37. Multiply the σ of background from step 36 by 2.56.
38. Compare this value with the cpm corresponding to 1 X 10^{-7} μCi/cc. The cpm value corresponding to 1 X 10^{-7} μCi/cc shall be greater than 2.56 σ of the background.
39. Supply copies of the calibration curve to the surveillance test supervisor and post copies in the control room.

UPSCALE AND DOWNSCALE TRIPS.

40. Turn **ANALOG OUTPUT** switch to 10^8 position (normal position is 10^4).
41. Set H.H. alarm pot to full clockwise and reset any alarms.
42. Turn TEST switch to TEST and hold. Ratemeter read out will be 2.00 X 10^6. Rotate Hi Hi alarm pot counter clockwise. The Hi Hi alarm should trip at a pot position of 7.55 ± .10. Record observations.
43. Release TEST switch and turn it to CIRCUIT RESET.
44. Turn off high voltage. Downscale alarm should trip in about 1 to 2 minutes. Record observations.
45. High and High High alarm trips may be checked by:

    a) operating the check source with the high and high high alarm settings equal to or less than the current check source reading (corrected for decay), or
    b) substituting the detector output (turn off H.V. then disconnect detector cable at drawer) for a variable pulser output (use jack in back of drawer).

46. Record observations.
47. Verify that the red and black pens on recorders track within ± 1.5% ELFS their respective indicator and trip units.

ELFS MEANS EQUIVALENT LINEAR FULL SCALE.

48. Return system to normal. Notify shift supervision.

Gas #1 is ________ concentration ________
Gas #2 is ________ concentration ________

DATA SHEET HPA-63.d.1

RADIATION MONITOR	SOURCE READING STEP 20	BACKGROUND READING CPM	COUNTRATE USING GAS #1	NET COUNTRATE GAS #1 (STEP 30)	COUNTRATE USING GAS #2	NET COUNTRATE GAS #2 (STEP 30)	SOURCE READING STEP 33	σ	2.56 X σ	FROM CURVE CPM VALVE for 1×10^{-7} μCi/cc

DATA SHEET HPA-63.d.2

Monitor ______________________

BACKGROUND	BACKGROUND	
1.	6.	Average = ________
2.	7.	$\sqrt{\text{Average}}$ = ________
3.	8.	σ = $\sqrt{\text{Average}}$
4.	9.	
5.	10.	

Monitor ______________________

BACKGROUND	BACKGROUND	
1.	6.	Average = ________
2.	7.	$\sqrt{\text{Average}}$ = ________
3.	8.	σ = $\sqrt{\text{Average}}$
4.	9.	
5.	10.	

TABLE HPA-63.d.1

	STATISTICS	RANGE SWITCH	HI ALARM THUMB WHEEL		HI HI ALARM POT SETTING		THRESHOLD
			1 unit	2 units	1 unit	2 units	
Control Room A	10%	10^6	Setpoints to be determined by HP & C and posted in the area of the vent. radiation monitors.				200
B	10%	10^6					200
Radwaste	10%	10^6					200
Recombiner	10%	10^6					200
Unit 2 Roof Vent A	10%	10^6					200
B	10%	10^6					200
Unit 3 Roof Vent A	10%	10^6					200
B	10%	10^6					200