

CONTROLLED

COPY # 25

Airborne Sample Analysis

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This procedure excluded from further LI-100 reviews.

B/2



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Airborne Activity Determination

1.0 PURPOSE

- 1.1 To describe the procedure for air monitoring, air sampling and filter counting during a declared emergency at Indian Point Station.
- 1.2 To describe the process for analysis when counting is performed with other than a multi-channel analyzer or an offsite laboratory.
- 1.3 To describe operations of counting equipment normally located at the EOF.

NOTE:

This procedure is primarily used for airborne determination outside the Protected Area. Normal air sampling procedures may be used where possible to perform air sampling.

2.0 REFERENCES

- 2.1 Indian Point Energy Center Emergency Plan
- 2.2 Instruction Manual for the Eberline Model SPA-3 scintillation probe
- 2.3 Instruction Manual for the Eberline Model MS-2 Scaler
- 2.4 HP-3.701, "Radiation Protection Count Room Standard Practices."
- 2.5 HP-SQ-3.012, "Airborne Radioactivity Sampling and Analysis."
- 2.6 HP-9.031, "Operation of the Johnston Laboratories Triton Model III."
- 2.7 HP-9.032, "Operation of the Johnston Laboratories Triton Model 955B."
- 2.8 HP-9.033, "Operation of the Johnston Laboratories Triton Model 1055B."

3.0 DEFINITIONS

None



4.0 **RESPONSIBILITIES**

- 4.1 The Offsite Radiological Manager (ORM) is responsible for requesting a qualified Radiation Protection Technician to analyze air samples taken by the Field Monitoring teams. This is normally performed at the EOF.
- A. Normally samples are counted by teams in the field and retained for further analysis at a later time.
 - B. Air samples may be sent to the Units counting rooms or an offsite location for analysis. In this case existing procedures will be used at the counting location.
- 4.2 The Radiation Protection Technician assigned to count air samples for the EOF is responsible for counting samples and documenting results in accordance with this procedure. Any Radiation Protection Technicians who may be assigned as Field Monitors may analyze samples either in the field or at the EOF.
- 4.3 Some Sections of this procedure will be utilized by Field Team members to sample and count air samples.



5.0 DETAILS

5.1 Verify Instrument Operability

- A. Verify instrument has a current calibration sticker valid for the SPA-3 probe (Calibration is performed every 6 months, sticker is located on top of instrument).
- B. Verify the high voltage setting matches value listed on the calibration sticker.
- C. Ensure probe is set up (and shielding if necessary) as shown in Attachments 9.2 and 9.3 of this procedure. The sample tray shall be on the middle shelf.
- D. Perform initial background and response check:

Note:

The calibration sticker gives the acceptable source check range in Counts per Minute (cpm).

1. The response check using the Ba-133 source should have the threshold set on "3.56" and a window setting of "0.89." **WHEN** response check is completed, **THEN** adjust threshold setting to "3.64" (which is the I-131 peak) and the window setting to "0.91."
2. Perform a 2-minute background and 2-minute source check. record on Form EP-15.
3. **IF** instrument calibration is beyond 6 months **THEN**
 - a. Determine the source Decay Factor from Attachment 9.1, Barium-133 Source Decay Curve. Example: If it has been 9 months since last calibration the Decay Factor would be ~.86
 - b. Multiply the Decay Factor times the Max and Min CPM reading listed on the calibration sticker to determine appropriate counts per minute range, which would still be acceptable.
4. Record results on Response Check For Radioactive Airborne Concentration (Form EP-15) or Air Sample Log.
5. Repeat background and source checks:
 - a. If there is a suspected change in radiological conditions near counting station



OR

- b. On a daily basis

5.2 Air Sampling:

- A. Place particulate filter in the first inlet filter holder (farthest from the pump with the rough side of the filter out).
- B. Place charcoal or silver zeolite cartridge in the second inlet filter holder (closest to the pump), as appropriate:

NOTE

~~Holders for the Charcoal or Silver Zeolite Cartridge are different in size. Be sure to use the correct holder. Humidity may affect the silver zeolite cartridge. Use sealed cartridge during an activation.~~

1. IF available THEN use silver zeolite cartridges when:

- ◆ The beta field survey indicates GREATER THAN 50 mRad/hr

OR

- ◆ The indicated radioiodine activity on a charcoal filter is GREATER THAN 10^{-8} $\mu\text{Ci/cc}$.

2. Align the arrow on the cartridge in the direction of airflow through the holder.

- C. Record the following on Form EP-16, Determination of Radioactive Airborne Concentration: (Field Teams use Form 31)

- ◆ Sample ID number
- ◆ Sampler type/manufacturer
- ◆ Starting air flow indication in LPM
- ◆ Date/Time

D. Run the air sampler for ten (10) minutes. The air samplers are calibrated at 1 cubic foot per minute therefore the sample volume is 10 cubic feet. (1 Cubic foot = 28.32 Liters). No adjustment of the flow rate is necessary.

E. Record the ending sample time on Daily Air Sample Log or Form 31 (or equivalent form).

F. IF reusing charcoal filter THEN purge cartridges for 30 seconds. Placing cartridge back in an air sampler and running it in a known clean area will purge filter of noble gases.

G. Remove the filters from their respective holders:



1. Use gloves when handling samples taken in the radioactive plume.
2. Replace with new filters.
3. **WHEN** a second sample is required, **THEN** restart pump.

H. Operate the AMS-4

NOTE

AMS-4 **SHALL** be started during EOF activation

1. Initial AMS-4 Start Up

- **OPEN** filter-housing cover, remove any existing filter media **AND** install a new charcoal filter paper (#508 Carbon Impreg). The "lined" side should face down.
- **CLOSE** and latch the filter housing cover.
- **PLUG** the AMS-4 in and turn on SW1 (power) and SW2 (pump) switches located in the back of the monitor

NOTE

IF beeping continues, **THEN** readjust filter paper and restart.

- **AFTER** the AMS-4 has gone through the initial self test cycle (approximately 5 minutes), **THEN** **VERIFY** the "READY" light is on **AND** activity is displayed.
- **PRESS** "2" on the keypad **AND** **VERIFY** that indicated flow rate is near the posted reference flow rate for charcoal filter. A low flow rate may indicate a flow blockage **OR** loaded filter paper.
- **PRESS** "1" on keypad to display airborne concentration. Negative numbers indicate the current activity is less than the historical data.

2. Normal AMS-4 Operation

NOTE

This instrument is calibrated to monitor gas and particles.



- CHECK periodically the AMS-4 flow rate by pressing "2" on the keypad. IF desired return to activity monitoring by pressing "1" on the keypad.
- IF the flow rate approaches 28320 cm³/min OR the "MIN FLOW FAIL" alarm activates THEN CHANGE the filter paper as per Section 3.
- IF the AMS-4 "DAC HOUR ALARM DETECTED" alarm activates THEN NOTIFY the ORM. The alarm set point is 60 DAC-hrs, which is equivalent to 150 mRem.
- IF the "FILTER DOOR, OPEN OUT OF SERVICE" alarm activates THEN VERIFY that the filter housing is closed and latched.
- IF the gamma background in the area changes substantially THEN GO to Section 4 to set the Gamma Factor.
- WHEN finished monitoring with the AMS-4 THEN turn off SW1 (power), SW2 (pump).

3. Changing AMS-4 Filter Paper

- TURN SW2 (pump) OFF
- WHEN the audible alarm activates THEN PRESS "ALARM ACK".
- OPEN the filter housing cover AND WHEN the audible alarm activates PRESS "ALARM ACK".
- REMOVE any existing filter media AND install a new charcoal filter paper (#508 Carbon Impreg). The "lined" side should face down.
- CLOSE and latch the filter housing cover.
- TURN on SW2 (pump) switch.



- **WHEN** the audible alarm activates **THEN** PRESS "ALARM ACK".
- PRESS "2" on the keypad **AND** verify that indicated flow rate is near the posted reference flow rate for charcoal filter. The low flow rate alarm set point is 28320 cm³/min. A low flow rate may indicate a flow blockage **OR** loaded filter paper.
- **RETURN** to Section H.2 for normal operations.

4. Gamma Factor Set

- **VERIFY** "READY" light is on. The AMS-4 front panel will **NOT** respond as expected if an alarm condition exists.
- PRESS "MENU"
- **AT** the prompt "password" type in "8435" **THEN** press "ENTER"
- PRESS "_" button until "Calibrate" appears in display.
- PRESS "ENTER"
- **WHEN** "Calibration Mode Halts Normal Operation" displays **THEN** press "ENTER"
- **WAIT** until both Beta **AND** BKG counts are greater than 400 counts **THEN** observe "Factor= XX.XXX" (where XX.XXX is a number) on display **AND** press "ENTER".
- PRESS "ENTER" to accept and update Gamma Factor value.
- PRESS "MENU" key twice.

NOTE

WHEN "READY" light appears **AND** airborne concentrations appears on top line of display **THEN** go to Section 2 for normal operation. (IF the flow rate appears **THEN** press "1" to display activity).



b. Periodically check readings of AMS-4 and ensure proper instrument operation.

1. IF there is a release THEN monitor the AMS-4 to identify any increase in the radiological levels in the EOF.

2. Follow directions in Section 1.2.C of this checklist to maintain AMS-4 operations.

5.3 Sample Count Using the MS-2/SPA-3:

- A. Enclose the cartridge (e.g., in plastic wrap).
- B. Place the enclosed sample in the detector shield on the shelf closest to the detector.

C. Set the controls on the MS-2 as follows:

1. POWER switch - "ON"
2. CPM RANGE switch - appropriate multiplier setting to register expected sample count rate
3. COUNTING TIME IN MINUTES control - set to desired counting time (normally one minute)
4. Window IN/OUT switch - "IN"
5. TEST switch - "OFF"
6. TIMED/STOP/MAN. switch - "TIMED"
7. WINDOW, THRESHOLD AND HV ADJUST dials - set to values posted on the instrument.

D. Momentarily depress the RESET-START push-button.

1. Set to count the sample for ten (10) minutes. **WHEN** the sample has finished counting, **THEN** record the digital display value on Form 16.

2. Use Form 16 to calculate the sample activity using the appropriate correction factor, using the following formula: Record results on Form 16.

- ◆ EFF - Efficiency (as given on the instrument or as directed by ORM or Radiation Protection Supervisor).
- ◆ CCF - Charcoal Correction Factor (.95 or as directed by ORM or Radiation Protection Supervisor).

$$uCi/cc = \frac{(SampleCPM - BkgdCPM) \times (1E - 9)}{2.2 \times EFF \times Volume(L) \times CCF}$$



$$\text{Volume(L)} = (28.32(\frac{L}{ft^3}))X(\text{Volume}(ft^3))$$

- E. Remove the cartridge from the detector chamber and store or dispose as appropriate.
- F. Do a one-minute background verification count to verify it has not changed and the counter is not contaminated. **IF** contaminated, **THEN** take appropriate measures to decontaminate.
- G. Insert new filter.
- 5.4 Sample Count Using the E-140N OR RM-14/HP-210 or equivalent: This count is normally performed by one for the Field Team Members.
- A. Connect the HP-210 detector, using the coaxial cable, to the terminal on the instrument marked "detector" or "probe".
- B. **IF** using the RM-14 on AC, **THEN** do the following:
1. Connect it to a 120 VAC supply using the power cord, which connects at the back of the instrument chassis.
 2. Place the rotary switch in the X10 position.
 3. Operate the toggle "Test on" switch at the chassis rear **AND** check that the indication on the meter is **APPROXIMATELY** 3600 CPM (\pm 10%).
 4. Turn the toggle switch off.
 5. Record data on Form EP-16. (Field Teams use Form 31)
- C. **IF** using the instrument on battery, **THEN** check the battery condition by placing the rotary switch in "Batt" position **AND** record data on Form EP-16 (Field Teams use Form 31).
- D. Energize the instrument by turning the five position rotary switch from "off" to one of the three counting ranges: X1, X10, or X100.



- E. Place the detector on the sample holder (SH-4, -4a or equivalent) and check the background.
1. Record the background CPM on DETERMINATION OF RADIOACTIVE AIRBORNE CONCENTRATION (FORM EP-16). Field Teams use Form 31.
 2. Use lead-bricks as shielding to reduce the background CPM to read on the X1 scale (if possible).
- F. Check the operability of the counter:
1. Place the detector in contact with the Ba-133 check source (located in the kit next to the meter).
 2. Read source CPM above background AND record result on appropriate HP survey form.
 3. Compare to count rate range labeled on the source. If not within the acceptable range use another meter.
- G. Place particulate filters to be counted, one at a time, rough side up in the counting chamber.
- H. Read sample CPM and record results on DETERMINATION OF RADIOACTIVE AIRBORNE CONCENTRATION (FORM EP-16). Field Teams use Form 31.
- I. If necessary, calculate the filter activity as follows:

$$\mu\text{Ci/cc} = \frac{(\text{SampleCPM} - \text{BkgdCPM}) \times (1.5\text{E} - 10)}{\text{Volume(Cu.Ft.)}}$$

Above calculation based upon:

$$EFF(\text{Efficiency}) = 0.1$$

NOTE:

Should sample holders be unavailable, the filters may be counted by placing the detectors within half inch of the filter.

- J. To count the iodine filter cartridges in the sample holders, modify the holders as follows:
1. IF using the SH-4, THEN do the following:
 - a. Remove the sample holder slide.



- b. Place the charcoal cartridge (lip up) or the silver zeolite cartridge (face up) in the cavity created by removing the sample holder slide.
- c. Place the detector on the cartridge.
- d. Determine the count rate.

2. IF using the SH-4a, THEN pull out the slide.

- a. Remove the insert.
- b. Push the slide back in.
- c. Place the charcoal cartridge (lip up) or the silver zeolite cartridge (face up) in the cavity created by removing the sample holder slide.
- d. Place the detector on the cartridge.
- e. Determine the count rate. Field Teams record on Form 31.

K. Calculate the cartridge activity as follows:

$$uCi/cc = \frac{(SampleCPM - BkgdCPM) \times (4.6E - 9)}{Volume(Cu.Ft.)}$$

Above calculation based upon use of an

EFF (Efficiency) = 0.0034 and

CCF (Charcoal Correction Factor) = 0.95

L. Perform background and source checks:

1. APPROXIMATELY every hour:
OR
2. As specified by the ORM (frequency may be adjusted, either more or less often, in consideration of current radiological conditions)

5.5 Label filters:

- A. Use a label, tag or grease pencil.
- B. Identify filters with the following information:
 - ◆ Date
 - ◆ Time
 - ◆ Volume
 - ◆ Location



5.6 Save filters for later isotopic determination.

- A. Place in an appropriate container or bag. Work practices are to prevent any cross contamination of the samples.
- B. Determine appropriate storage location and save for future analysis.

5.7 Use of the Triton Monitor Model 955B

1. Set "RANGE" switch to "ZERO".
2. Verify filter holder contains a clean filter element.
3. Connect power cord to 115 VAC.
4. PRESS, THEN release the "POWER" push-button AND verify push-button illuminates.
5. Allow ten minutes for warm up.
6. Set "MODE" switch to "GAMMA" or "TRITIUM".
7. Zero the CRM using the "ZERO ADJUST" control.
8. Set "RANGE" switch to desired position AND allow one minute for stabilization.
9. Turn "ALARM" switch to INTERNAL. IF the alarm sounds, THEN press the "RESET" button. The alarm CANNOT be secured UNTIL activity drops BELOW preset Count Rate Meter (CRM) level and the reset button is depressed.
10. Check operation of alarm AND set alarm pointer (on the CRM) to the desired alarm level with the alarm "SET" knob. IF alarm check fails, THEN place unit out of service.
11. Secure alarm system by turning the "ALARM" switch to "OFF".
12. Check gamma background levels and gas background ("Tritium" mode and pump "off"):
 - a. IF unit has been in operation, THEN allow 15 – 20 minutes for gases in detection chamber to decay off BEFORE recording background reading.
 - b. Record background readings and post near instrument.
13. IF "TRITIUM" mode was selected in Step 5.2.6, THEN start air pump by pressing the "PUMP" push-button. Flow should be set at 8 – 10 Lpm.



14. **IF** "GAMMA" mode was selected, **THEN** leave pump "OFF." Once the proper "RANGE" switch setting has been selected, the instrument is ready to operate.

NOTE:

500 $\mu\text{Ci}/\text{m}^3$ increase above background is equivalent to 1×10^{-4} $\mu\text{Ci}/\text{cc}$ for noble gases.

15. Read the gamma radiation level directly from the CRM. For noble gases, the CRM readings should **ONLY** be used as an indication of a change in activity levels.

5.8 Use of Model 1055B:

1. Set range switch to "ZERO".
2. Verify filter holder contains a clean filter element.
3. Connect power cord to 115 VAC **OR** operate on the battery. Check battery **AND** recharge it as necessary.
4. **PRESS, THEN** release the "POWER" push-button **AND** verify push-button illuminates.
5. Allow ten minutes for warm up.
6. Set mode switch to "GAMMA" or "TRITIUM".
7. Zero CRM using "ZERO ADJUST" control.
8. Set range switch to the desired position **AND** allow one minute for stabilization.
9. Turn "ALARM" switch to "ON". **IF** the alarm sounds, **THEN PRESS** the "RESET" button. The alarm **CANNOT** be secured **UNTIL** activity drops **BELOW** preset CRM level and the reset button is depressed.
10. Check operation of alarm **AND** set the alarm to desired alarm level with the alarm "SET" knob. **IF** the alarm check fails, **THEN** place unit out of service.
11. Secure alarm system by turning the "ALARM" switch to "OFF".
12. Check gamma background levels and gas background ("Tritium" Mode and pump "off"):
 - a. **IF** unit has been in operation, **THEN** allow 15 – 20 minutes for gases in detection chamber to decay off **BEFORE** recording background reading.



- b. Record background readings and post near instrument.
13. IF "TRITIUM" mode selected in Step 5.8.6, THEN start air pump by pressing the "PUMP" push-button.
14. IF "GAMMA" mode selected, THEN leave pump "OFF." Once the proper range setting has been selected, the instrument is ready to operate.

NOTE:

500 $\mu\text{Ci}/\text{m}^3$ increase above background is equivalent to 1×10^{-4} $\mu\text{Ci}/\text{cc}$ for noble gases.

15. Read the gamma radiation level directly from the CRM. For noble gases, the CRM readings should ONLY be used as an indication of a change in activity levels.

5.9 Use of Model 111:

3. Set the front panel controls, as follows, BEFORE turning instrument "ON" OR plugging instrument into the 115 VAC:
 - a. ALARM OFF-ON-RESET switch to "OFF"
 - b. FUNCTION switch to "Zero" position
 - c. PUMP switch "OFF" (down)
 - d. POWER switch "OFF" (down)
 - e. OFFSET control to "OFF" (fully CCW)
 - f. ZERO control to fully CCW position
4. Verify filter holder (located on top) contains a clean filter element.
5. Plug instrument into a 115 VAC outlet. Red light will indicate EITHER "on charge" OR "full charge" for the battery.
6. Move POWER switch to the "ON" position.
7. Verify FUNCTION switch on "ZERO," THEN turn the zero control SLOWLY CW UNTIL the zero bar is indicating on scale at zero.
8. Move FUNCTION switch to the "calibrate" position. The display should indicate 30 (29-31). The zero control affects this value. IF the calibration reading is NOT 30 (29-31) THEN recheck the zero.



9. Move FUNCTION switch to the desired range (use lowest range possible). Scale marking for the selected range will automatically be displayed.
10. Set alarm level to a value HIGHER THAN the background reading for the scale selected as follows:
 - a. Move the "OFF-ON-RESET" switch to the "ON" position. A separate black bar will be displayed on the scale and indicates the alarm value.

NOTES:

The audible alarm may be reset by moving the audible reset switch to the right. This is of use when the $\mu\text{Ci}/\text{m}^3$ indication is ABOVE the alarm level.

When the $\mu\text{Ci}/\text{m}^3$ indication falls BELOW the alarm level, the alarm reset switch will reset the alarm and the instrument will be ready to alarm again if the $\mu\text{Ci}/\text{m}^3$ indication rises above the alarm level.

- b. To change alarm level, PRESS the ALARM SET switch to the "up" or "down" position AND hold it there UNTIL the black bar reaches the desired value.
11. Start sample pump by moving PUMP switch to the "ON" position.

NOTE:

500 $\mu\text{Ci}/\text{m}^3$ increase above background is equivalent to 1×10^{-4} $\mu\text{Ci}/\text{cc}$ for noble gases.

12. For noble gases, the scale readings should ONLY be used as an indication of a change in activity levels.

5.10 Record Retention

Turn in all completed FORMS to the ORM.



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IPEC
EMERGENCY PLAN
IMPLEMENTING
PROCEDURES

NON-QUALITY RELATED
PROCEDURE

REFERENCE USE

IP-EP-330

Revision 5

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6.0 INTERFACES

6.1 IP-EP-320, Field Team Monitoring

6.2 IP-EP-250, Emergency Operations Facility

6.3 Memorandum IPI-91MAC-240, Chaubard to LaVera, July 1, 1991

7.0 RECORDS

All Logs, Completed Forms and other records generated during an actual emergency shall be considered quality records and maintained for the life of the plant.

8.0 REQUIREMENTS AND COMMITMENTS

None

9.0 ATTACHMENTS

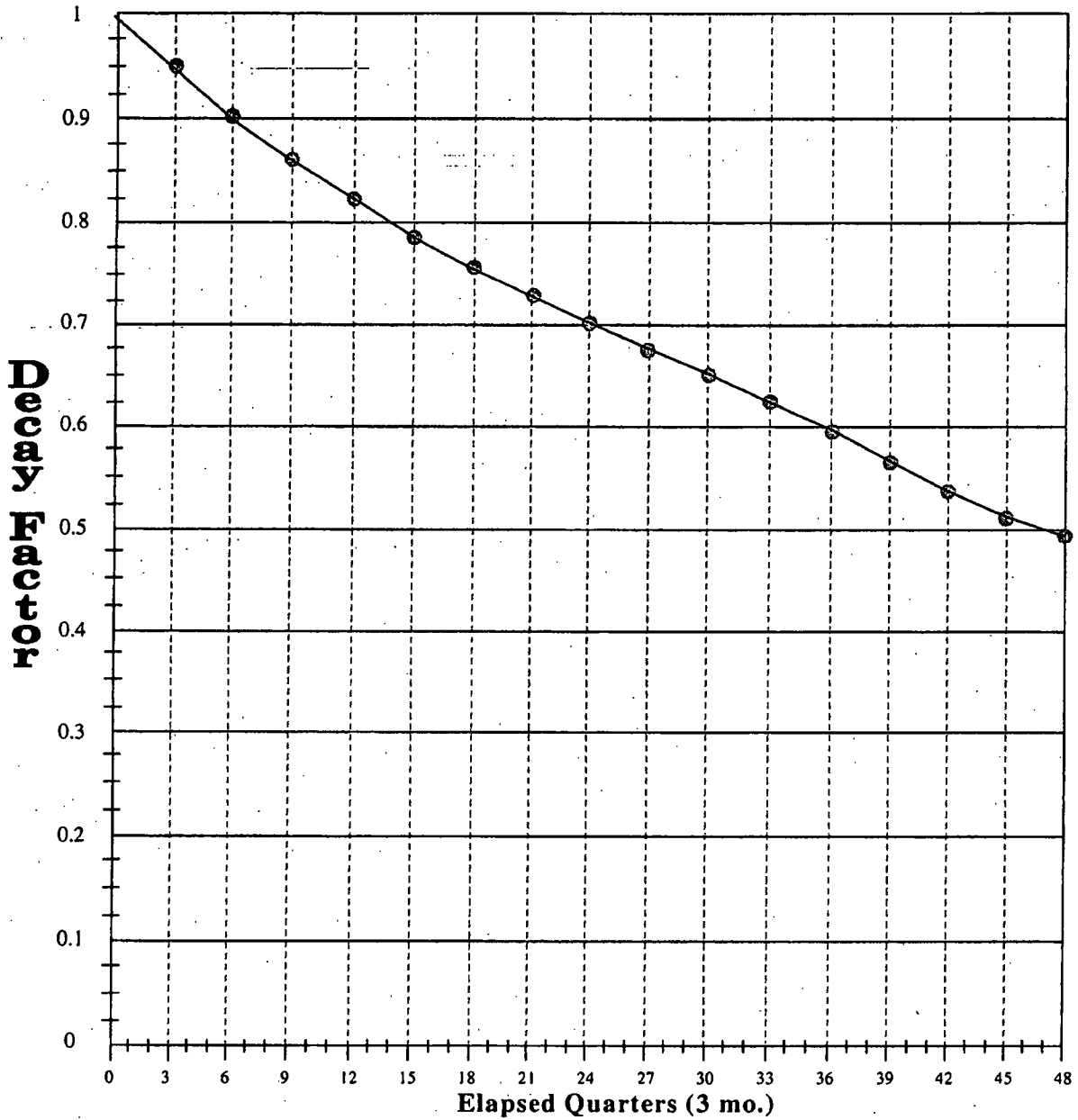
9.1 Barium-133 Source Decay Curve

9.2 SPA-3 Detector/Sample Holder Setup

9.3 Use of Lead Bricks to Shield Detector



ATTACHMENT 9.1
Barium-133 Source Decay Curve
Sheet 1 of 1

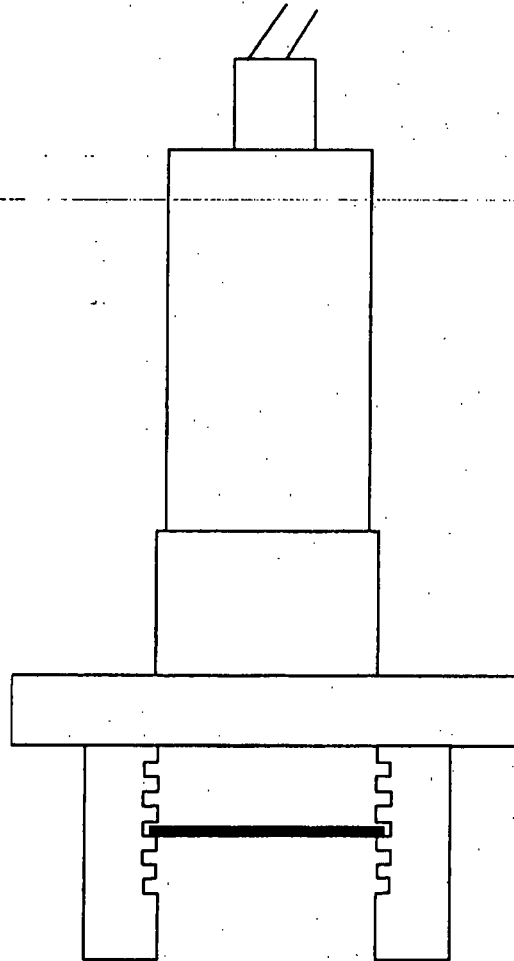




ATTACHMENT 9.2

Sheet 1 of 1

SPA-3 DETECTOR/SAMPLE HOLDER SETUP



Place Sample Tray in middle position.

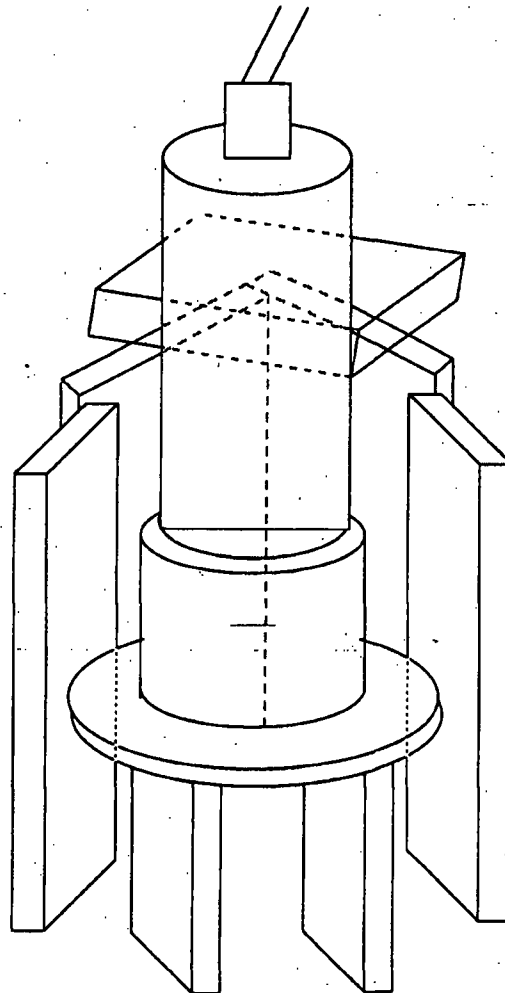


ATTACHMENT 9.3
Sheet 1 of 1

USE OF LEAD BRICKS TO SHIELD DETECTOR

NOTE

Detectors are normally placed in lead pig. If lead bricks must be used, bricks must be obtained from radiological personnel within the Protected Area.



Use 6-7 blocks to construct the wall

Use 3-4 blocks to construct the roof

Place Blocks on all side of detector