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Revision 2
1607
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THREE MILE ISLAND NUCLEAR STATION
STATION HEALTH PHYSICS PROCEDURE 1607
AIR SAMPLING FOR RADIOACTIVE GAS

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Unit 1 Staff Recommends Approval

Approval N/A Date ________
Cognizant Dept. Head

Unit 2 Staff Recommends Approval

Approval N/A Date ________
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Unit 1 PORC Recommends Approval

J P O'Hanlon Date 1-2-76
Chairman of PORC

PORC comments of ——— included
(date)

By ———— Date ———

Unit 2 PORC Recommends Approval

Norman Williams Date 1/5/76
Vice Chairman of PORC

PORC comments of ——— included
(date)

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By ———— Date ———

Approval N/A Date N/A
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Approval J P Miller / J J Colitz Date 1/10/76 1-19-76
Station Superintendent/
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Revision 2
01/19/76

THREE MILE ISLAND NUCLEAR STATION
STATION HEALTH PHYSICS PROCEDURES
1607 - Air Sampling for Radioactive Gas

1.0 PURPOSE

The purpose of this procedure is to outline the steps to be taken for Air Sampling for Radioactive Gas.

2.0 DISCUSSION

2.1 Radioactive Gas Samples will be collected and analyzed for Beta and Gamma activities.

2.2 For the Beta, an A-100 Gas Chamber will be used.

2.3 For the Gamma, a 5 cc. glass vial, or a Marinelli Beaker with petcocks will be used.

3.0 REFERENCES

3.1 W. B. Johnson Catalog (Section-Lab. Equipment)

3.2 PCP 1958

3.3 HPP 1740

4.0 EQUIPMENT

4.1 Glass Sampling Flask (Marinelli Beaker)

4.2 A-100 Gas Chamber

4.3 Geli Detector/Multi-channel Analyzer System

4.4 GM Instrument

4.5 Pump or Hand Aspirator

4.6 Tygon Tubing

4.7 Aluminum Flask (Marinelli Beaker)

4.8 5cc. Glass Vial with Rubber Insert

4.9 Syringe

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5.0 OPERATING INSTRUCTIONS

5.1 Gamma Analysis of Radioactive Gas (Glass Marinelli Beaker)

5.1.1 The Marinelli Beaker is filled with demineralized water so that all the air in the beaker has been displaced.

5.1.2 Connect the gas-inlet side of the Marinelli Beaker to the line or area from which the sample is to be taken.

5.1.3 Open the water-outlet petcock.

5.1.4 Open the gas-inlet petcock allowing the gas to be drawn in.

5.1.5 Close both petcocks when all the water has been removed.

5.1.6 The sample will then be taken to the lab and analyzed on the Multi-channel Analyzer/Geli Detector System as per P.C.P. 1958.

5.1.7 Forward completed date to Radiation Pretection Supervision for review and approval.

5.2 Gamma Analysis of Radioactive Gas (Aluminum Marinelli Beaker)

5.2.1 An Aluminum Marinelli Beaker will be connected in the line or in the area to be sampled.

5.2.2 Connect a pump to a stopcock of the Marinelli Beaker.

5.2.3 Start the pump and transfer at least three (3) times the volume of the beaker ($\sim 2 \times 10^4$cc.) through the Marinelli.

5.2.4 After making sure the petcock on either side of the Aluminum Marinelli Beaker is closed, remove the beaker and return it to the Count Room for analysis on the Multi-channel Analyzer/Geli Detector System as per P.C.P. 1958.

5.2.5 Forward completed data to Radiation Protection Supervision for review and approval.

5.3 Gamma Analysis of High Level Radioactive Gas (5cc Glass Vial)

5.3.1 When gamma analysis with a Marinelli Beaker yields a dead time of greater than 20% on the Geli Detector/Multi-channel System, a sample must be taken and counted using a 5cc. glass vial.

5.3.2 Using the 5cc. glass vial, take a syringe and place a slight vacuum on the glass vial. (evacuate approximately 15 cc. of air from the vial).

5.3.3 Proceed to the sample point and using the syringe, take a 5 cc. sample and inject into the vial.

5.3.4 Take the sample to the count room and analyze on the Geli Detector/Multi-channel System as per P.C.P. 1958.

5.3.5 Forward completed data to Radiation Protection Supervision for review and approval.

5.4 Beta Analysis of Radioactive Gas

5.4.1 The A-100 Gas Chamber will be placed in the line or in the area to be sampled.

5.4.2 Either a pump or a hand aspirator will be used to transfer a 100 cc sample of gas to the chamber.

5.4.3 After making sure the petcock on either side of the A-100 is closed, remove and return to the Health Physics lab for analysis.

5.4.4 Connect an appropriate counting instrument to the A-100 chamber and count for 5 minutes.

5.4.5 The Activity will be determined using the following formula:

$$\frac{\text{CC/Min.}}{(\text{Volume})(\text{Efficiency})(2.22 \times 10^6)} = \mu\text{Ci/cc}$$

CC/Min. = corrected counts per minute. Counts per minute minus background.

Efficiency: efficiency for GM counter

$2.22 \times 10^6$ = disintegrations per minute per microcurie.

5.4.6 If the corrected counts per minute is less than the minimum detectable count rate, the activity is reported as less than MDA.

NOTE: The formula for MDCR is as follows:

$$\text{MDCR} = 3\sqrt{\frac{\text{BKG CPM}}{\text{Time BKG Count}}}$$

5.4.7 Forward completed data to Radiation Protection Supervision for review and approval.

Example for Beta Calculations:

A gas sample is counted for 5 minutes on the GM counter. The total counts are 225, the efficiency for the GM is 20% and the background 12.5 cpm. Determine the activity.

Volume of sample = 100 cc.

$$\frac{225 \text{ counts}}{5 \text{ minutes}} = 45 \text{ cpm}$$

45 cpm minus 12.5 cpm bkg 32.5 cc/min

$$\frac{32.5}{(100)(.20)(2.22 \times 10^6)} = 7.32 \times 10^{-7} \ \mu\text{Ci/cc}$$

Example of the use of MDCR

A gas sample is counted for 5 minutes on the GM Counter. The total counts are 85; efficiency for the GM is 20% and the background is 12.5 cpm with a background counting time of 4 minutes. Determine the activity.

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$$\frac{85}{5} - 12.5 = 4.5 \text{ cc/min}$$

$$\text{MDCR} \quad 3\sqrt{\frac{12.5 \text{ cpm}}{4 \text{ min.}}} = 5.3 \text{ cpm}$$

The corrected counts per minute, 4.5 cpm, of the sample is less than the minimum detectable count rate, 5.3 cpm; therefore the MDCR is used in the formula to determine µCi/cc (MDA):

$$\text{MDA} = \frac{5.3}{(100)(.20)(2.22 \times 10^6)} = <1.2 \times 10^{-7} \ \mu\text{Ci/cc}$$

TMI DOCUMENTS

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