THREE MILE ISLAND NUCLEAR STATION

STATION HEALTH PHYSICS PROCEDURE 1604

ALPHA SURVEYS

Table of Effective Pages

Page	Date	Revision	Page	Date	Revision	Page	Date	Revision
1.0	01/19/76	3	26.0			51.0		
2.0	01/15/75	2	27.0			52.0		
3.0	04/06/77	6	28.0			53.0		
4.0	04/06/77	6	29.0			54.0		
5.0	01/15/75	2	30.0			55.0		
6.0	01/15/75	2	31.0			56.0		
7.0	01/15/75	2	32.0			57.0		
8.0			33.0			58.0		
9.0			34.0			59.0		
10.0			35.0			60.0		
11.0			36.0			61.0		
12.0			37.0			62.0		
13.0			38.0			63.0		
14.0			39.0			64.0		
15.0			40.0			65.0		
16.0			41.0			66.0		
17.0			42.0			67.0		
18.0			43.0			68.0		
19.0			44.0			69.0		
20.0			45.0			70.0		
21.0			46.0			71.0		
22.0			47.0			72.0		
23.0			48.0			73.0		
24.0			49.0			74.0		
25.0			50.0			75.0		

Unit 1 Staff Recommends Approval

Approval N/A Date _____

Cognizant Dept. Head

Unit 2 Staff Recommends Approval

Approval N/A Date

Cognizant Dept. Head

Unit 1 PORC Recommends Approval

J P O'Hanlon Date 4-1-77

Chairman of PORC

PORC comments of _____ included

(date)

By _____ Date _____

Unit 2 PORC Recommends Approval

J A Marshall Jr. Date 4-5-77

VICE Chairman of PORC

PORC comments of _____ included

(date)

By _____ Date _____

Approval J J Colitz, Jr. Date 4-7-77

Unit Superintendent

188 217

TMI-55-A 11-74

THREE MILE ISLAND NUCLEAR STATION

STATION HEALTH PHYSICS PROCEDURES

1604 - Alpha Surveys

1.0 PURPOSE

The purpose of this procedure is to insure that a proper method is followed in the process of conducting an alpha survey.

2.0 DISCUSSION

An alpha particle is a helium nucleus consisting of two protons and two neutrons, with a double positive charge. The alpha particle is a strongly ionizing and weakly penetrating particle. An alpha particle can be stopped by a few thin sheets of paper. The range of the alpha particle is approximately three centimeters in air.

Because of their relatively large mass and double positive charge, alpha particles lose their energy very rapidly in the medium through which they pass. The range of the alpha particle is therefore very short. Accordingly, alpha particles do not present an external radiation hazard. However, alpha emitters do present one of the greatest internal hazards when deposited throughout a vital organ. They can cause great damage because of their relatively high energies (4-9 MEV) and high specific ionization, and because their relative damage (RBE) factor to tissue is about 20 times greater than that for Beta-Gamma radiation.

Different isotopes tend to deposit in different parts of the body. ^{239}Pu deposits predominatly in the skeleton where, many years later, it may produce bone disease.

The three ways radiation may enter the body are (1) Inhalation (2) Ingestion (3) Through the skin (abrasions, cuts, punctures, etc.).

2.1 Alpha surveys provide assurance of up to date exposures, regarding radiation hazards (internal) and insure adequate precautions are appropriately outlined on RWP's.

2.2 Alpha surveys will be conducted according to the area survey schedule board in the H.P. Lab.

3.0 REFERENCES

3.1 Basic Radiological Health Book

3.2 Health Physics Handbook

3.3 PAC-4S Eberline Technical Manual

3.4 Rad Protection Manual Administrative Procedure 1003

3.5 Health Physics Procedure 1613

4.0 EQUIPMENT

4.1 PAC-4S Eberline portable alpha detector

4.2 Area survey maps (in filing cabinet in health physics lab, filed under "New Forms.")

4.3 Filter papers (in Health Physics Lab.)

4.4 Small coin envelopes

4.5 Portable air sampler

4.6 Air Filters (in Health Physics Lab.)

4.7 Stop watch (in Health Physics Lab.)

4.8 Wide Beta II/P.C.C.-IIT

4.9 Alpha Scintillation

5.0 OPERATING INSTRUCTIONS

5.1 Portable Alpha Survey: Survey the specified area with the PAC-4S, portable alpha detector. Before entering an area, check to see that the instrument is in operating condition. The PAC-4S has three positions on the switch, OFF, ON and

BATTERY check. When the switch is at the Battery position, the black needle should read in the green area. If it does not, change batteries per the PAC-4S Technical Manual. Release the switch and it returns to the ON position.

5.1.1 The probe on the PAC-4S, which is a ZnS(Ag) activated scintillation detector, should be held one quarter inch from the object being surveyed. Touching the object would give better results; but there is a chance of contaminating the probe or damaging it by puncturing the detector face.

5.1.2 The PAC-4S reads out in counts per minute (CPM) representing the total 2π emission rate from either a one inch diameter ^{239}Pu source or 59 cm^2 of a uniformly distributed ^{239}Pu source. To determine the DPM value, use the following formula: $DPM = \frac{CPM}{Eff.}$. The efficiency of the PAC-4S is 28%, so if an area were surveyed and counts per minute were found to be 44, to obtain the DPM value, put the 44 CPM into the formula as $DPM = \frac{44}{.28} = 157$ DPM. To calculate the DPM value for 100 cm^2 of area, multiply the resulting number by 100/59 or 1.7.

Rule of Thumb formula to use for calculation of DPM/100cm^2 is as follows:

$$DPM/100cm^2 = CPM_4(6.07)$$

where $6.07 = \frac{1.7(DPM/100cm^2 Factor)}{.28(Efficiency)}$

5.1.3 The surface contamination limits are:

Contaminated Area: >100 DPM/100cm^2 alpha;

Clean Area: <100 DPM/100cm^2 alpha

(Ref: Radiation Protection Manual)

5.1.4 Mark all readings obtained on a survey map (See Figure 1604-1)

5.2 Swipe or Smear Survey: To do a swipe or smear survey, number the small envelopes to correspond with the survey points.

5.2.1 Hold the smear papers with a gloved finger and wipe over an area of 100 cm^2 (i.e. a 4 inch square).

5.2.2 Place smear papers in numbered envelopes.

5.2.3 Mark smear numbers on survey map corresponding to points of survey (Figure 1604-2).

5.2.4 After the smears are obtained, they are counted in an appropriate alpha counting instrument.

5.2.5 Calculate the disintegrations per minute (DPM) by using the following formula:

$$DPM = \frac{\text{counts per minute (less background)}}{\text{Efficiency}}$$

Background as per H.P.P. #1703

Efficiency as per H.P.P. #1706

5.2.6 The latest background and efficiency for the alpha counting instrument are recorded in the H.P. Lab.

5.2.7 If the activity in counts per minute on the smears (CPM minus background) is less than the value computed by using the following formula $2\sqrt{\underset{(cpm)}{\text{Background}}} + \underset{(cpm)}{\text{Background}}$ then there is no detectable loose surface contamination present.

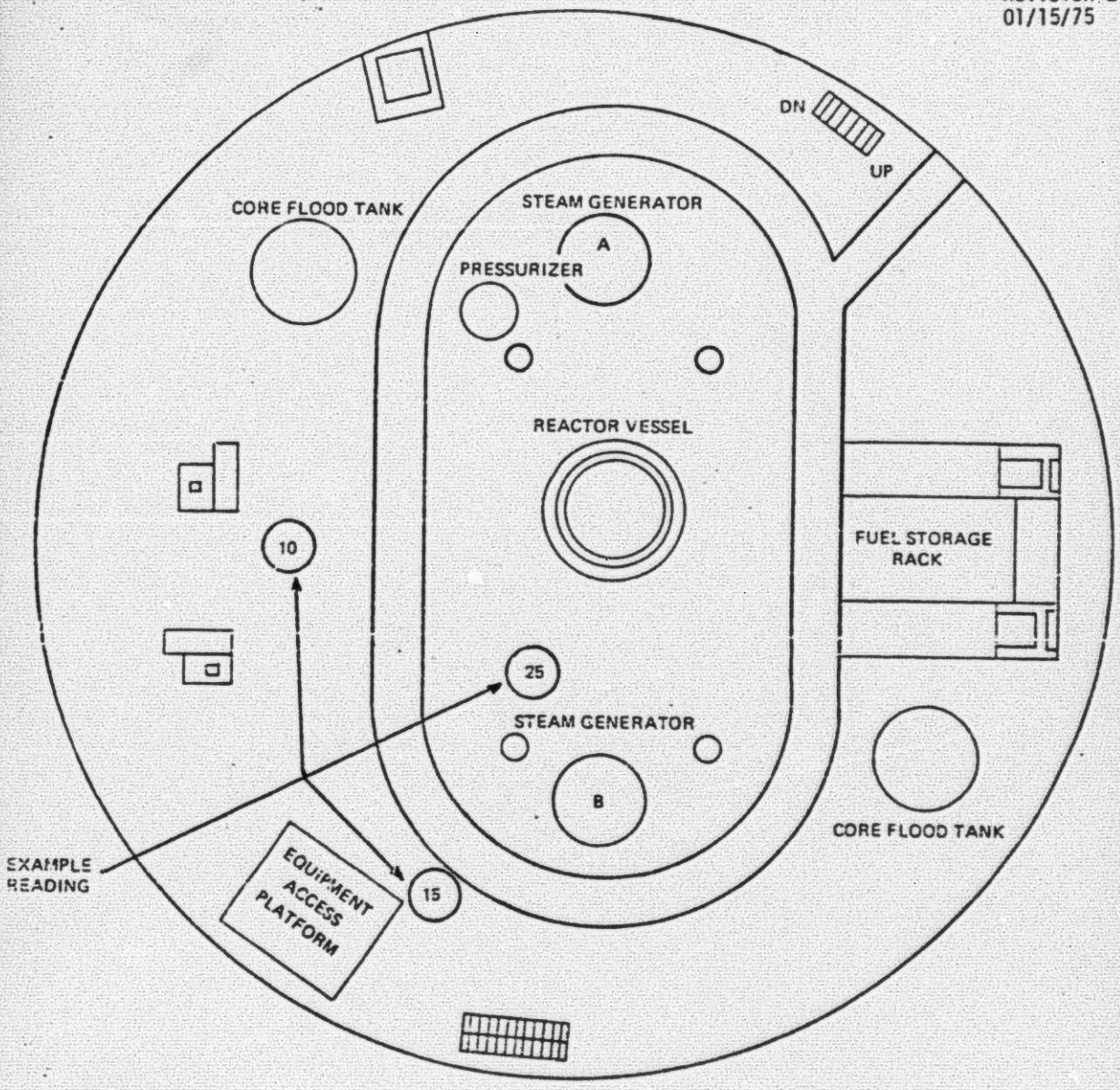
5.2.8 Record all data on Form 1609-1 (attached).

5.2.9 Return completed form to the H.P. Foreman for review and approval.

5.3 Air Sampling

NOTE: Refer to H.P.P. 1605 "Portable Air Sampling for Radioactive Particulate.

Revision 2
01/15/75



ELEV. 308' -0"

DATE _____

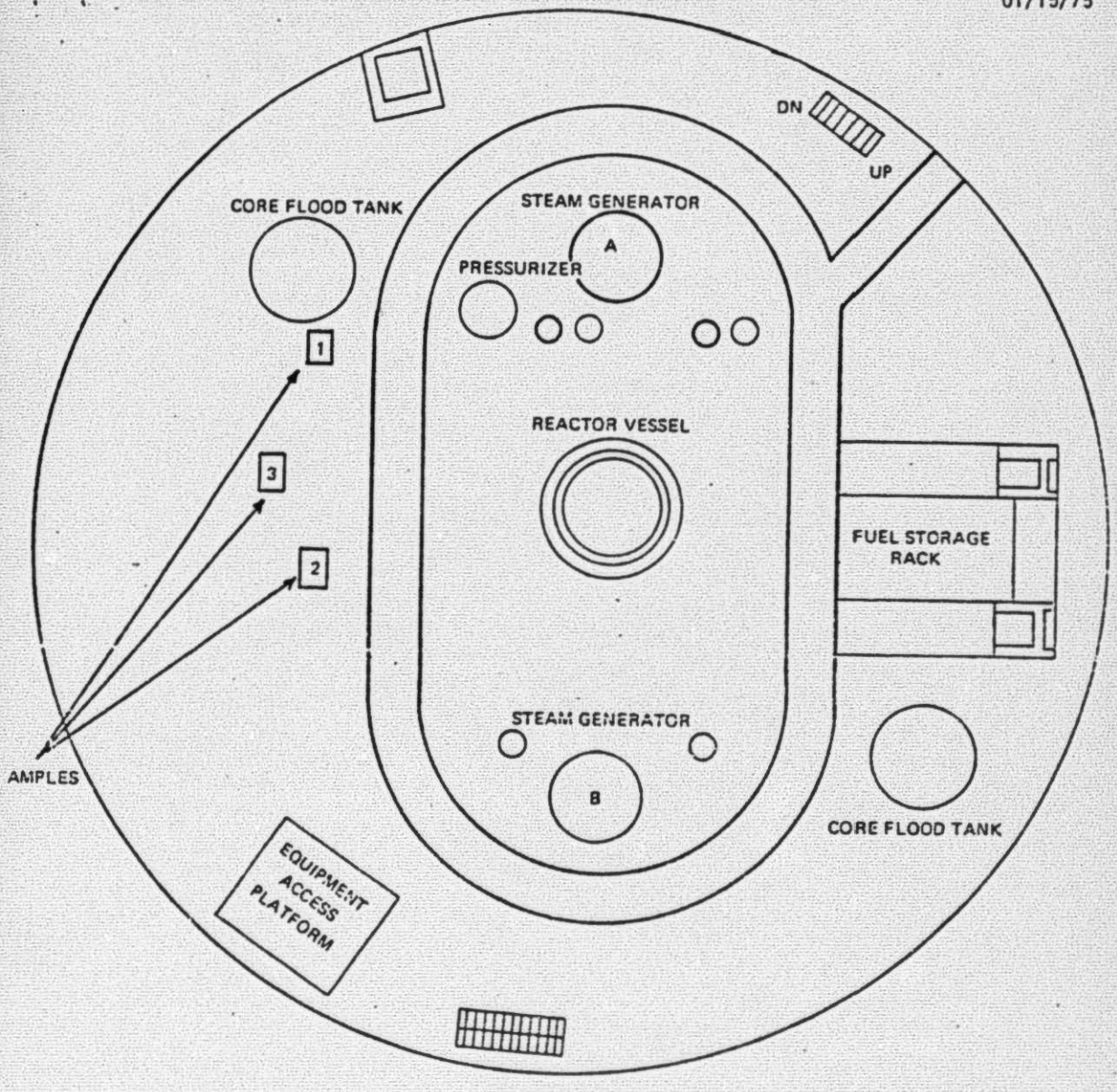
TIME _____

INSTRUMENT 188 223

TECHNICIAN _____

ALPHA READINGS IN DPM

Figure 1604.1



DATE_____

TIME_____ 188 224

INSTRUMENT_____

TECHNICIAN_____

Figure 1604-2

TMI DOCUMENTS

DOCUMENT NO: TM-073

COPY MADE ON 5/4/79 OF DOCUMENT PROVIDED BY METROPOLITAN EDISON COMPANY.

Wilda R. Mullinix, NRC