ANALYTICS, INC. • 1094 HEMPHILL AVE., N.W. • ATLANTA, GA. 30318 • (404) 876-0933 .

Exempt Quanity

CERTIFICATE OF CALIBRATION

STANDARD RADIONUCLIDE SOURCE

15882-50

Sr-90 + Y-90 44.5mm FILTER ON 47mm ALUMINUM DISK

This standard radionuclide source was prepared using an aliquot of 0.21162 grams measured gravimetrically from a master radionuclide solution standard. The master radionuclide solution standard was calibrated by the NATIONAL BUREAU OF STANDARDS and reported as test number 227944.

ISOTOPE	Sr-90 + Y-90
ACTIVITY (DPS)	3644
CALIBRATION DATE	9-1-84
PERCENT ERROR	5
PREPARED BY	E. W. Workman

MASTER COPY

E. W. Workman
Laboratory Manager

SOURCE COVERING 0.5 mg/cm2.
NR-330802

A/1

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Exempt Quanity

CERTIFICATE OF CALIBRATION

STANDARD RADIONUCLIDE SOURCE

15869-50

Sr-90 + Y-90 44.5mm FILTER ON 47mm ALUMINUM DISK

This standard radionuclide source was prepared using an aliquot of 0.20044 grams measured gravimetrically from a master radionuclide solution standard. The master radionuclide solution standard was calibrated by the NATIONAL BUREAU OF STANDARDS and reported as test number 227944.

ISOTOPE	Sr-90 + Y-90
ACTIVITY (DPS)	368.1
CALIBRATION DATE	9-1-84
PERCENT ERROR	5
PREPARED BY	E. W. Workman

MASTER COPY

E. W. Workman
Laboratory Manager

SOURCE COVERING 0.5 mg/cm2.
NR-331349

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HP 84-084

CERTIFICATE OF CALIBRATION

STANDARD RADIONUCLIDE SOURCE

15874-50

Sr-90 + Y-90 44.5mm FILTER ON 47mm ALUMINUM DISK

This standard radionuclide source was prepared using an aliquot of 0.16814 grams measured gravimetrically from a master radionuclide solution standard. The master radionuclide solution standard was calibrated by the NATIONAL BUREAU OF STANDARDS and reported as test number 227944.

ISOTOPE	Sr-90 + Y-90
ACTIVITY (DPS)	113200
CALIBRATION DATE	9-1-84
PERCENT ERROR	5
PREPARED BY	E. W. Workman

MASTER COPY

E. W. Workman
Laboratory Manager

SOURCE COVERING 0.5 mg/cm2.
NR-331349

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HP 84-082

CERTIFICATE OF CALIBRATION

STANDARD RADIONUCLIDE SOURCE

15872-50

Sr-90 + Y-90 44.5mm FILTER ON 47mm ALUMINUM DISK

This standard radionuclide source was prepared using an aliquot of 0.06526 grams measured gravimetrically from a master radionuclide solution standard. The master radionuclide solution standard was calibrated by the NATIONAL BUREAU OF STANDARDS and reported as test number 227944.

ISOTOPE	Sr-90 + Y-90
ACTIVITY (DPS)	12330
CALIBRATION DATE	9-1-84
PERCENT ERROR	5
PREPARED BY	E. W. Workman

MASTER COPY

E. W. Workman
Laboratory Manager

SOURCE COVERING 0.5 mg/cm2.
NR-331349

CERTIFICATE OF RADIOACTIVITY CALIBRATION

HP84-078

Isotope: Cs 137 Half-Life: 30.174 ± 0.034 Y

Source No.: F-872

Was assayed as containing: 10.78 μCi

MASTER COPY

As of: 8-1-84

METHOD OF CALIBRATION:

( ) The source was assayed on a 3" x 3" NaI (Tl) crystal in conjunction with a single-channel analyzer, using the MeV peak (a value of gamma rays per decay was used in the calculations), against standard No. , in the same geometrical arrangement.

( ) The source was assayed in an internal proportional/large area, low background counter against standard No.

( ) The source was assayed by alpha spectrometry on a surface barrier detector in conjunction with a single-channel analyzer, against standard No. in the same geometrical arrangement.

( ) The source was prepared from a weighed aliquot of a solution whose activity in uCi/gm was determined by the method indicated above.

(✓) THE SOURCE WAS ASSAYED ON A HIGH PURITY GERMANIUM DETECTOR IN CONJUNCTION WITH MCA, USING 0.662 MEV, AGAINST CS-137 STD # 19082-4, IN THE SAME GEOMETRICAL ARRANGEMENT.

ERROR CALCULATION:

a) Uncertainty due to systematic errors:
1. In assay of standard: ± 2.1 %
2. In weighing(s): ± %

b) Uncertainty due to random errors:
Precision of source count, e_1; standard count e_2 and background count e_3:
$= \pm t \sqrt{e_1^2 + e_2^2 + e_3^2} = \pm$ 1.1 %

c) Total uncertainty:
TU = a + b = ± 3.2 %

NOTES

IPL participates in a NBS measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NBS certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)

(✓) The total uncertainty is calculated at the 99 % confidence level.
( ) This calibration is directly/indirectly based on NBS Standard Reference Material No.

[signature]
Quality Control

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone St., Burbank, California 91504

CERTIFICATE OF RADIOACTIVITY CALIBRATION

Isotope: Cs 137 Half-Life: 30.174 ± 0.034 Y

Source No.: F - 873

Was assayed as containing: 1.150 µCi

As of: 8-1-84

MASTER COPY

METHOD OF CALIBRATION:

( ) The source was assayed on a 3" x 3" NaI (Tl) crystal in conjunction with a single-channel analyzer, using the MeV peak (a value of gamma rays per decay was used in the calculations), against standard No. , in the same geometrical arrangement.

( ) The source was assayed in an internal proportional/large area, low background counter against standard No.

( ) The source was assayed by alpha spectrometry on a surface barrier detector in conjunction with a single-channel analyzer, against standard No. in the same geometrical arrangement.

( ) The source was prepared from a weighed aliquot of a solution whose activity in uCi/gm was determined by the method indicated above.

(✓) THE SOURCE WAS ASSAYED ON A HIGH PURITY GERMANIUM DETECTOR IN CONJUNCTION WITH MCA, USING 0.662 MEV, AGAINST Cs-137 STD # 19038-4, IN THE SAME GEOMETRICAL ARRANGEMENT

ERROR CALCULATION:

a) Uncertainty due to systematic errors:
1. In assay of standard: ± 2.1 %
2. In weighing(s): ± %

b) Uncertainty due to random errors:
Precision of source count, e_1; standard count e_2 and background count e_3:
$= \pm t \sqrt{e_1^2 + e_2^2 + e_3^2} = \pm$ 1.4 %

c) Total uncertainty:
TU = a + b = ± 3.5 %

NOTES

IPL participates in a NBS measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NBS certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)

(✓) The total uncertainty is calculated at the 99 % confidence level.

( ) This calibration is directly/indirectly based on NBS Standard Reference Material No.

[signature]

Quality Control

ISOTOPE PRODUCTS LABORATORIES

1800 No. Keystone St., Burbank, California 91504

CERTIFICATE OF RADIOACTIVITY CALIBRATION

84-064

Isotope: Cs-137 Half-Life: 30.174 ±0.034 Y

Source No.: F-757

Was assayed as containing: 10.55 mCi

MASTER COPY

As of: 7-1-84

METHOD OF CALIBRATION:

( ) The source was assayed on a 3" x 3" NaI (Tl) crystal in conjunction with a single-channel analyzer, using the MeV peak (a value of gamma rays per decay was used in the calculations), against standard No. , in the same geometrical arrangement.

( ) The source was assayed in an internal proportional/large area, low background counter against standard No.

( ) The source was assayed by alpha spectrometry on a surface barrier detector in conjunction with a single-channel analyzer, against standard No. in the same geometrical arrangement.

( ) The source was prepared from a weighed aliquot of a solution whose activity in uCi/gm was determined by the method indicated above.

(x) The source was assayed in a Nuclear Associates deluxe Isotope Calibrator Model #34-056, against Cs-137 STD# 47484

ERROR CALCULATION:

a) Uncertainty due to systematic errors:
1. In assay of standard: ± %
2. In weighing(s): ± %

b) Uncertainty due to random errors:
Precision of source count, e_1; standard count e_2 and background count e_3:
$= \pm t \sqrt{e_1^2 + e_2^2 + e_3^2} = \pm$ %

c) Total uncertainty:
TU = a + b = ± 5.0 %

NOTES

IPL participates in a NBS measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NBS certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)

(x) The total uncertainty is calculated at the 95 % confidence level.
( ) This calibration is directly/indirectly based on NBS Standard Reference Material No.

[signature]
Quality Control

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone St., Burbank, California 91504

CERTIFICATE OF RADIOACTIVITY CALIBRATION

84-065

Isotope: Cs-137 Half-Life: 30.174 ± 0.034 Y

Source No.: F-756

Was assayed as containing: 1.124 mCi

As of: 7-1-84

MASTER COPY

METHOD OF CALIBRATION:

( ) The source was assayed on a 3" x 3" NaI (Tl) crystal in conjunction with a single-channel analyzer, using the MeV peak (a value of gamma rays per decay was used in the calculations), against standard No. , in the same geometrical arrangement.

( ) The source was assayed in an internal proportional/large area, low background counter against standard No.

( ) The source was assayed by alpha spectrometry on a surface barrier detector in conjunction with a single-channel analyzer, against standard No. in the same geometrical arrangement.

( ) The source was prepared from a weighed aliquot of a solution whose activity in uCi/gm was determined by the method indicated above.

(x) The source was assayed in a Nuclear Associates deluxe Isotope Calibrator Model #34-056, against Cs-137 STD# 47484

ERROR CALCULATION:

a) Uncertainty due to systematic errors:
1. In assay of standard: ± %
2. In weighing(s): ± %

b) Uncertainty due to random errors:
Precision of source count, e_1; standard count e_2 and background count e_3:

$= \pm t \sqrt{e_1^2 + e_2^2 + e_3^2} = \pm$ %

c) Total uncertainty:
TU = a + b = ± 5.0 %

NOTES

IPL participates in a NBS measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NBS certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)

(x) The total uncertainty is calculated at the 95 % confidence level.
( ) This calibration is directly/indirectly based on NBS Standard Reference Material No.

Vasana Libhart
Quality Control

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone St., Burbank, California 91504

CERTIFICATE OF RADIOACTIVITY CALIBRATION

84-062

Isotope: Cs-137

Half-Life: 30.174 ± 0.034 y

Source No.: F-755

Was assayed as containing: 0.101 mCi

MASTER COPY

As of: 7-1-84

METHOD OF CALIBRATION:

( ) The source was assayed on a 3" x 3" NaI (Tl) crystal in conjunction with a single-channel analyzer, using the MeV peak (a value of gamma rays per decay was used in the calculations), against standard No. , in the same geometrical arrangement.

( ) The source was assayed in an internal proportional/large area, low background counter against standard No.

( ) The source was assayed by alpha spectrometry on a surface barrier detector in conjunction with a single-channel analyzer, against standard No. in the same geometrical arrangement.

( ) The source was prepared from a weighed aliquot of a solution whose activity in uCi/gm was determined by the method indicated above.

(x) The source was assayed in a Nuclear Associates deluxe Isotope Calibrator Model #34-056, against Cs-137 STD# 4-4-84

ERROR CALCULATION:

a) Uncertainty due to systematic errors:
1. In assay of standard: ± %
2. In weighing(s): ± %

b) Uncertainty due to random errors:
Precision of source count, e_1; standard count e_2 and background count e_3:
$= \pm t \sqrt{e_1^2 + e_2^2 + e_3^2} = \pm$ %

c) Total uncertainty:
TU = a + b = ± 5.0 %

NOTES

IPL participates in a NBS measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NBS certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)

(x) The total uncertainty is calculated at the 95 % confidence level.
( ) This calibration is directly/indirectly based on NBS Standard Reference Material No.

Vasana [signature]
Quality Control

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone St., Burbank, California 91504

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HP 84-107

CERTIFICATE OF CALIBRATION

STANDARD RADIONUCLIDE SOURCE

15969-50

Cd-109 POINT SOURCE

This standard radionuclide source was prepared using an aliquot measured gravimetrically from a liquid radionuclide source which had been previously calibrated by comparison with National Burea of Standards traceable radionuclide solution standards. ANALYTI maintains traceability through a Measurements Assurance Program with the National Bureau of Standards.

Calibration and spectral purity checks were performed using a Germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

Source Prepared by: RCMcF

R. C. McFarland
Production Manager

COPY

ISOTOPE	GAMMA ENERGY (keV)	HALF-LIFE	BRANCHING RATIO (fraction)	ACTIVITY (dps)	ERROR (%)	ASSAY DATE
Cd-109	88	463.9 d	0.0373	2082400	5	10-17-84

PO NUMBER NR-341473
Q.A. APPROVED RMcFarland 10-18-84

Used as a Transfer Source (M.R.N.G. (l'

Channel 01

Unit 1 - Count Rate Instruments

REFERENCES

1. Plant Operations Manual (POM) Procedures for operating the following instruments:

   a. Ludlum 177
   b. Eberline RM - 14
   c. Eberline E - 140N

2. Manufacturer's Technical Manuals for the instruments listed above.

PROGRAM OBJECTIVES

The Trainee shall complete the following objectives for each count rate instrument:

1. Perform all operational checks
2. Correctly set-up instrument for use
3. Describe the function of all controls
4. Obtain a correct instrument reading for any meter indicator position and range control setting
5. Describe instrument batteries and battery maintenance
6. Name and describe the probes which are approved for use
7. Perform a proper frisk
8. Demonstrate proper instrument operation for all applications
9. Specify the assumed efficiency of detectors used
10. Describe any differences that exist between the count rate instruments regarding the following:

    a) I/O connectors
    b) Alarm indicators
    c) Test functions
    d) Quick charge capability

11. Specify two approved uses for count rate instruments equipped with pancake GM detectors at Fermi 2
12. Explain GM blocking or saturation as it applies to pancake detectors
13. State what maintenance will void the calibration

A/2

Health Physics Equipment - Operation

Unit 2 - Dose Rate Instrument

REFERENCES

1. Plant Operations Manual (POM) procedures for operating the following instruments:

   a. Eberline E-520
   b. Eberline RO-2 series
   c. Eberline RO-7
   d. Eberline 6112 Teletector
   e. Ludlum 12S
   f. Ludlum 12
   g. Victoreen 440
   h. Dositec PR-7
   i. Dositec Dosipole
   j. Xetex 501A A.R.M

2. Manufacturer's Technical Manuals for the instruments listed above

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for each dose rate instrument:

1. Perform all operational checks

2. Describe the function of each control

3. Demonstrate how to change the batteries. State the type and number of batteries required

4. Read the instrument correctly for any meter indicator position and range control setting

5. State all instrument ranges from memory

6. Describe the detectors used

7. Describe and demonstrate proper instrument usage, including directional characteristics and sensitivity for detection/measurement of beta, gamma and neutron radiation

8. State which instruments are approved beta dose rate measuring or detecting devices and demonstrate their use as such

9. Describe the recommended use of each instrument, including any advantages or disadvantages

10. State what maintenance will void the calibration

Health Physics Equipment - Operation

Unit 3 - Air Samplers

REFERENCES

1. Plant Operations Manual (POM) procedures for operating the following equipment:

   a. RADeCO HD28/HD29

   b. RADeCO H809 Series

   c. Lapel Air Samplers

2. Manufacturer's Technical Manuals for the equipment listed above

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for each air sampler:

1. Describe the function and operation of all controls
2. Demonstrate proper set-up and operational checks as applicable for particulate and iodine samples
3. Describe the capabilities for particulate and iodine samples
4. State the applicable advantages and disadvantages
5. Describe any precautions or limitations for use
6. Describe as applicable how flow rate is controlled/maintained
7. State what maintenance will void the calibration
8. Demonstrate proper operation

Health Physics Equipment - Operation

Unit 4 - Counters/Scalers

REFERENCES

1. Plant Operations Manual (POM) procedures for operating the following equipment:

   a. Ludlum 2200
   b. Eberline SAM-2
   c. Eberline BC-4

2. Manufacturer's Technical Manuals for the equipment listed above

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for each counter/scaler:

1. Describe the function of each control
2. Perform all operational and daily checks, including background, source checks and QC charts
3. As applicable, demonstrate how to change the batteries and state the type and number of batteries needed
4. State the uses of the instrument, including compatible detectors and any advantages or disadvantages
5. Describe the required actions if the instrument is suspected to be contaminated
6. State what maintenance will void the calibration
7. Demonstrate proper operation

Unit 5 - Airborne Monitors

REFERENCES

1. Plant Operations Manual (POM) procedures for operating the following equipment:

   a. Eberline AMS-3
   b. Eberline PING-3 Special
   c. Ludlum 377

2. Manufacturer's Technical Manuals for the equipment listed above

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for each airborne monitor:

1. Briefly describe the theory of operation
2. Identify detector types
3. Perform all operational checks
4. Describe the function of all controls
5. Demonstrate the ability to interpret all printouts, charts and displays
6. Describe the alarms and alarm setpoints
7. State any prerequisites or precautions and limitations to operation
8. Demonstrate the ability to change filters
9. Demonstrate the ability to change chart paper
10. State what maintenance will void the calibration
11. Demonstrate proper operation

Health Physics Equipment - Operation

Unit 6 - Digital Alarming Dosimeters

REFERENCES

1. Plant Operations Manual (POM) procedures for operating the following dosimeters:

    a. Xetex Teledose
    b. Xetex 415B

2. Manufacturer's Technical Manuals for the dosimeters listed above

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for each digital alarming dosimeters:

1. Describe the function of all controls

2. State the purpose

3. Perform all operational checks

4. Describe the capabilities, including readout and alarm

5. Describe the detectors employed

6. Describe the differences between the two types of digital alarming dosimeters

7. Describe how to change batteries

8. Describe the proper location for wearing

9. State what maintenance will void the calibration

10. Demonstrate proper usage

Unit 7 - Gamma Spectroscopy System

REFERENCES

1. Plant Operations Manual (POM) procedure for operating the ND-6685 Gamma Spectroscopy System

2. Manufacturer's Technical Manual for the ND-6685 Gamma Spectroscopy System

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the ND-6685 Gamma Spectroscopy System:

1. Identify the types of detectors used with the system

2. Briefly explain the theory of operation of the multi-channel analyzer

3. Identify the different types of shelf geometries and their uses

4. Demonstrate proper system sign-on and sign-off

5. Describe the purpose of all items on the main menu

6. Demonstrate the ability to properly operate all the items listed on the main menu for each detector

7. Demonstrate proper operation of system printers

8. Describe the system configuration, including terminals, detectors and printers

9. Explain how each sample is prepared prior to placement on the detector

10. Explain how to refill the system liquid nitrogen dewar

11. State what maintenance will void the calibration

Unit 8 - Nuclear Data Whole Body Counter

REFERENCES

1. Plant Operations Manual (POM) procedure for operating the Nuclear Data 6600 Whole Body Counting System

2. Manufacturer's Technical Manual for the Nuclear Data 6600 Whole Body Counting System

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the Nuclear Data 6600 Whole Body Counting System

1. Identify and describe the operation and characteristics of the detectors used with this system
2. Briefly explain the operation of the multi-channel analyzer
3. Describe jobstreams on the WTMENU listing
4. Properly sign on and off the system
5. Successfully operate all of the items listed on the AUTO. WTMENU jobstream
6. Terminate jobstreams
7. Recognize problems within jobstreams as they arise
8. Reboot the system
9. Print various bioassay forms
10. State what maintenance will void the calibration

Health Physics Equipment - Operation

Unit 9 - Helgeson Whole Body Counter

REFERENCES

1. Plant Operations Manual (POM) procedure for operating the Helgeson Whole Body Counter
2. Manufacturer's Technical Manual for the Helgeson Whole Body Counter

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the Helgeson Whole Body Counts:

1. Perform all operational checks including Daily Gain Check
2. Demonstrate System Startup and Shutdown
3. Perform personnel whole body counting
4. Properly interpret the computer report
5. State what maintenance will void the calibration

Health Physics Equipment - Operation

Unit 10 - Manual TLD Reader

REFERENCES

1. Plant Operations Manual (POM) procedure for operating the Panasonic UD-702E Manual TLD Reader

2. Manufacturer's Technical Manual for the Panasonic UD-702E Manual TLD Reader

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the Panasonic UD-702E Manual TLD Reader:

1. Identify the types of TLD's used at Fermi 2 and briefly describe their theory of operation

2. Briefly explain the theory of operation of the Panasonic UD-702E Manual TLD Reader

3. Describe the function of all controls on the Manual TLD reader

4. Demonstrate proper measurement of reader sensitivity and state the acceptance criteria

5. Successfully operate the Panasonic UD-702E Manual TLD Reader with all types of Panasonic TLD's

6. State what maintenance will void the calibration

Health Physics Equipment - Operation

Unit 11 - Automatic TLD Reader

REFERENCES

1. Plant Operations Manual (POM) procedure for operating the Panasonic Model UD-710A Automatic TLD Reader

2. Manufacturer's Technical Manual for the Panasonic UD-710A Automatic TLD Reader

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the Panasonic UD-710A Automatic TLD Reader:

1. Identify the types of TLD's used at Fermi 2

2. Briefly describe the theory of operation of all types of TLD's used at Fermi 2

3. Briefly explain the operation of the Panasonic UD-710A Automatic TLD Reader

4. Successfully operate the Panasonic UD-710A Automatic TLD Reader with all types of Panasonic TLD's used at Fermi 2

5. Successfully establish a data link between the Hewlett Packard 1000 computer and the Panasonic UD-710A Automatic TLD Reader

6. Successfully generate batch correction factors using a hand-held calculator and with the Hewlett Packard 1000 computer

7. Successfully calculate reportable dose from a personnel monitoring TLD using a hand-held calculator and the Hewlett Packard 1000 computer

8. Successfully estimate the dose on a TLD during an emergency situation

9. Demonstrate a clear understanding of the origins and proper use of each correction factor used to calculate reportable dose

10. Demonstrate the ability to understand and use the available options found on the TLD processing software

11. State what maintenance will void the calibration

Health Physics Equipment - Operation

Unit 12 - Respirator Fit Test Booth

REFERENCES

1. Plant Operations Manual (POM) procedure for operating the Dynatech respirator fit test booth

2. Manufacturer's Technical Manual for the Dynatech respirator fit test booth

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the Dynatech respirator fit test booth:

1. Describe the basic aerosol theory associated with quantitative fit testing

2. Describe basic fit testing practices

3. Describe and demonstrate the operation of the Dynatech Model FE259H-2 and FE792 aerosol generation and detection system

4. Describe and demonstrate familiarity with the MSA and Scott respiratory devices used for fit testing

5. State the intent and demonstrate the use of the photograph identification equipment

6. Describe and demonstrate the processing of test subject through the respirator fit testing process

7. Describe the record keeping requirements associated with respirator fit testing

8. Interpret fit test strip chart results and determine pass/fail respirator fit factors

9. Describe the overall operation of the respirator fit testing equipment including all of the housekeeping requirements associated with the equipment

HEALTH PHYSICS EQUIPMENT - OPERATION

UNIT 13 - PORTAL MONITORS/BODY FRISKERS

REFERENCES

1. Plant Operations Manual (POM) Procedures for operating the following instruments;

    a. IRT PRM 110/PRM 120

    b. Eberline PCM-1a

2. Manufacturer's Technical Manuals for the instruments listed above.

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the portal monitors:

1. Identify the type of detector used in the system

2. Identify the types of radiation detected by the system

3. Perform all operational checks

4. Perform system parameter checks

5. State the required actions in the event of an alarm

6. State what maintenance will void the calibration

Unit 14 - Automatic Planchet Changer

REFERENCES

1. Plant Operations Manual (POM) Procedure for operating the Tennelec Automatic Plantchet Changer (APC)

2. Manufacturer's Technical Manual for the Tennelec APC

PROGRAM OBJECTIVES

The trainee shall complete the following objectives for the Tennelec APC:

1. Identify type of detector used in the system

2. Identify the types of radiation detected by the system

3. Perform system operational checks

4. Operate the counting system for all the group plates

5. Prepare a sample for counting

6. Identify a power failure causing a system clear

7. State the actions required to recover from a loss of power

8. State what maintenance will void the calibration

REFERENCES

1. Plant Operations Manual (POM) Procedure General QC for Health Physics Measuring and Test Equipment

2. Enrico Fermi 2 Job Instructional Training Units (JIT) for:

   a. Health Physics Instrument Issue Assignment

   b. Health Physics Instrumentation Computer Filing System

PROGRAM OBJECTIVES

The trainee shall complete the following objectives.

1. Describe the difference between Health Physics Measuring Equipment and Health Physics Test Equipment.

2. State the HP M&TE Calibration frequencies.

3. Describe the forms of HP M&TE Tagging.

4. Describe the purpose of maintaining a HP M&TE file.

5. Describe the HP Testing Equipment Use Log.

6. Describe the HP M&TE Tracking System including the following:

   a. Temporary Issue

   b. Permanent Assignment

   c. Use of the computer tracking system.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 01 - Count Rate Instruments

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the following instruments:

   a. Ludlum 177
   b. Eberline RM-14
   c. Eberline E-140N

2. Manufacturer's Technical Manuals for the instruments listed above.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for each count rate instrument listed above:

1. Properly log out test equipment for calibration.

2. Calibrate each count rate instrument in accordance with the reference material.

3. Properly document results.

A/3

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 02 - Dose Rate Instrument

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the following instruments:

   a. Eberline E-520
   b. Eberline RO-2 series
   c. Eberline RO-7 series
   d. Eberline 6112 Teletector
   e. Ludlum 12S
   f. Ludlum 12
   g. Victoreen 440
   h. Dositec PR-7
   i. Dositec DP-2
   j. Xetex 501A A.R.M.

2. Manufacturer's Technical Manuals for the instruments listed above.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for each of the dose rate instruments listed above:

1. Properly log out test equipment for calibration.

2. Calibrate each dose rate instrument in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 03 - Air Samplers

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the following equipment:

   a. RAD e CO HD 28/HD 29
   b. RAD e CO H809 series
   c. Lapel Air Samplers

2. Manufacturer's Technical Manuals for the equipment listed above.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for each of the air samplers listed above:

1. Properly log out test equipment for calibration.

2. Calibrate each air sampler in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 04 - Counter/Scalers

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the following equipment:

   a. Ludlum 2200
   b. Eberline SAM-2
   c. Eberline BC-4

2. Manufacturer's Technical Manuals for the equipment listed above.

PROGRAM OBJECTIVES

successful completion of this unit requires the trainee to complete the following objectives for each of the counter/scalers listed above:

1. Properly log out test equipment for calibration.

2. Calibrate each counter/scaler in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 05 - Airborne Monitors

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instruction Training (JIT) material for calibrating the following equipment:

   a. Eberline AMS-3
   b. Eberline PING-3 special
   c. Ludlum 377

2. Manufacturer's Technical Manuals for the equipment listed above.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for each of the airborne monitors listed above:

1. Properly log out test equipment for calibration.

2. Calibrate each airborne monitor in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 06 - Dosimeters

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the following dosimeters.

   a. Direct Reading Dosimeters (DRD)
   b. Xetex Teledose
   c. Xetex 415B
   d. Thermoluminescent Dosimeters (TLD)

2. Manufacturer's Technical Manuals for the dosimeters listed above.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for each dosimeter listed above:

1. Perform initial receipt testing of dosimeters (such as visual inspection, driff test, as applicable).

2. Properly log out test equipment - for calibration.

3. Calibrate each dosimeter in accordance with the reference material.

4. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 07 - Gamma Spectroscopy System

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the ND-6685 Gamma Spectroscopy System.
2. Manufacturer's Technical Manual for the ND-6685 Gamma Spectroscopy System.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for the ND-6685 Gamma Spectroscopy System:

1. Properly log out test equipment for calibration.
2. Calibrate the ND-6685 Gamma Spectroscopy System in accordance with the reference material.
3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 08 - Nuclear Data Whole Body Counter

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the Nuclear Data 6600 Whole Body Counting System.

2. Manufacturer's Technical Manual for the Nuclear Data 6600 Whole Body Counting System.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for the Nuclear Data 6600 Whole Body Counting System:

1. Properly log out test equipment for calibration.

2. Calibrate the Nuclear Data 6600 Whole Body Counting System in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 09 Helgeson Whole Body Counter

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the Helgeson Whole Body Counter.

2. Manufacturer's Technical Manual for the Helgeson Whole Body Counter.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for the Helgeson Whole Body Counter:

1. Properly log out test equipment for calibration.

2. Calibrate the Helgeson Whole Body Counter in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 10 - Manual TLD Reader

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the Panasonic VD-702 E Manual TLD Reader.

2. Manufacturer's Technical Manual for the Panasonic UD-702 E Manual TLD Reader.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for the Panasonic UD-702 E Manual TLD Reader:

1. Properly log out test equipment for calibration.

2. Calibrate the Panasonic UD-702 E Manual TLD Reader in accordance with the reference material.

3. Properly document results.

FHEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 11 - Automatic TLD Reader

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the Panasonic UD 710 A Automatic TLD Reader.

2. Manufacturer's Technical Manual for the Panasonic UD-710 A Automatic TLD Reader.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for the Panasonic UD-710 A Automatic TLD Reader:

1. Properly log out test equipment for calibration.

2. Calibrate the Panasonic UD-710A Automatic TLD Reader in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 12 - Portal Monitors/Body Friskers

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the following equipment:

   a. IRT PRM 110/PRM 120
   b. Eberline PCM - 1a

2. Manufacturer's Technical Manuals for the equipment listed above.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for the portal monitors and body frisker listed above.

1. Properly log out test equipment for calibration.

2. Calibrate the IRT PRM 110/PRM 120 and the Eberline PCM-1a in accordance with the reference material.

3. Properly document results.

HEALTH PHYSICS EQUIPMENT - CALIBRATION

Unit 13 - Automatic Planchet Changer

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibrating the Tennelec Automatic Planchet Changer (APC).

2. Manufacturer's Technical Manual for the Tennelec APC.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives for the Tennelec APC.

1. Properly log out test equipment for calibration.

2. Calibrate the Tennelec APC in accordance with the reference material.

3. Properly document results.

HEATLH PHYSICS EQUIPMENT - CALIBRATION

Unit 14 - Calibration Sources

REFERENCES

1. Plant Operations Manual (POM) procedures and Job Instructional Training (JIT) material for calibration sources.

PROGRAM OBJECTIVES

Successful completion of this unit requires the trainee to complete the following objectives:

1. Properly log out test equipment for calibration.

2. Develop Verification & Decay Charts for calibration sources.

3. Perform calibration source verification.

4. Operate source calibrator.

5. Properly document results.

TABLE 4.3.7.11-1 (Continued)

TABLE NOTATIONS

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm/trip setpoint.

2. Circuit failure.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm setpoint.

2. Circuit failure.

3. Instrument indicates a downscale failure.

4. Instrument controls not set in operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using National Bureau of Standards traceable sources. These standards shall permit calibrating the system over the range of energy and measurement expected during normal operation and anticipated operational occurrences. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration or are National Bureau of Standards traceable shall be used.

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

(5) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm setpoint.

2. Circuit failure.

3. Instrument indicates a downscale failure.

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.7.12 The radioactive gaseous effluent monitoring instrumentation channels shown in Table 3.3.7.12-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 3.11.2.1 are not exceeded. The alarm/trip setpoints of these channels, with the exception of the offgas monitoring system, shall be determined and adjusted in accordance with the methodology and parameters in the ODCM.

APPLICABILITY: As shown in Table 3.3.7.12-1

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above Specification, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel inoperable.

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3.7.12-1. Restore the inoperable instrumentation to OPERABLE status within the time specified in the ACTION or, pursuant to Specification 6.9.1.8, explain in the next Semiannual Radioactive Effluent Release Report why the inoperability was not corrected within the time specified.

c. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.7.12 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 4.3.7.12-1.

TABLE 3.3.7.12-1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. REACTOR BUILDING EXHAUST PLENUM EFFLUENT MONITORING SYSTEM			
a. Noble Gas Activity Monitor - Providing Alarm	1	*	121
b. Iodine Sampler	1	*	122
c. Particulate Sampler	1	*	122
d. Sampler Flow Rate Monitor	1	*	123
2. OFFGAS MONITORING SYSTEM (At the 2.2 minute delay piping)			
a. Hydrogen Monitor	1	**	124
b. Noble Gas Activity Monitor	1	***	126
3. STANDBY GAS TREATMENT SYSTEM			
a. Noble Gas Activity Monitor - Providing Alarm	1	#	125
b. Iodine Sampler	1	#	122
c. Particulate Sampler	1	#	122
d. Effluent System Flow Rate Monitor	1	#	123
e. Sampler Flow Rate Monitor	1	#	123

TABLE 3.3.7.12 1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
4. TURBINE BLDG. VENTILATION MONITORING SYSTEM			
a. Noble Gas Activity Monitor	1	*	121
b. Iodine Sampler	1	*	122
c. Particulate Sampler	1	*	122
d. Sampler Flow Rate Monitor	1	*	123
5. SERVICE BUILDING VENTILATION MONITORING SYSTEM			
a. Noble Gas Activity Monitor	1	*	121
b. Iodine Sampler	1	*	122
c. Particulate Sampler	1	*	122
d. Sampler Flow Rate Monitor	1	*	123

TABLE 3.3.7.12-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
6. RADWASTE BUILDING VENTILATION MONITORING SYSTEM			
a. Noble Gas Activity Monitor	1	*	121
b. Iodine Sampler	1	*	122
c. Particulate Sampler	1	*	122
d. Sampler Flow Rate Monitor	1	*	123
7. ONSITE STORAGE BUILDING VENTILATION EXHAUST RADIATION MONITOR			
a. Noble Gas Activity Monitor	1	*	121
b. Iodine Sampler	1	*	122
c. Particulate Sampler	1	*	122
d. Sampler Flow Rate Monitor	1	*	123

TABLE 3.3.7.12-1 (Continued)

TABLE NOTATIONS

* At all times.

** During main condenser offgas treatment system operation.

***During operation of the main condenser air ejector.

\# During operation of the standby gas treatment system.

ACTION STATEMENTS

ACTION 121 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 8 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 122 - With the number of channnels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that within 8 hours samples are continuously collected with auxiliary sampling equipment as required in Table 4.11.2.1.2-1.

ACTION 123 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours.

ACTION 124 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, operation of main condenser offgas treatment system may continue for up to 30 days provided grab samples are collected at least once per 4 hours and analyzed within the following 4 hours.

ACTION 125 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 4 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 126 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, releases via this pathway to the environment may continue for up to 7 days provided that:

a. The offgas system is not bypassed, and

b. The reactor building exhaust plenum noble gas effluent (downstream) monitor is OPERABLE;

Otherwise, be in at least HOT STANDBY within 12 hours.

TABLE 4.3.7.12-1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
1. REACTOR BUILDING EXHAUST PLENUM					
a. Noble Gas Activity Monitor - Providing Alarm	D	M	R(2)	Q(1)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
2. OFFGAS MONITORING SYSTEM (At the 2.2 minute delay piping)					
a. Hydrogen Monitor	D	N.A.	Q(3)	M	**
b. Noble Gas Activity Monitor	D	M	R(2)	Q(1)	***
3. STANDBY GAS TREATMENT MONITORING SYSTEM					
a. Noble Gas Activity Monitor	D	M	R(2)	Q(1)	#
b. Iodine Sampler	W	N.A.	N.A.	N.A.	#
c. Particulate Sampler	W	N.A.	N.A.	N.A.	#
d. Sampler Flow Rate Monitor	D	N.A.	R	Q	#

TABLE 4.3.7.12-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
4. TURBINE BLDG. VENTILATION MONITORING SYSTEM					
a. Noble Gas Activity Monitor	D	M	R(2)	Q(4)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
5. SERVICE BUILDING VENTILATION MONITORING SYSTEM					
a. Noble Gas Activity Monitor	D	M	R(2)	Q(4)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 4.3.7.12-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
6. RADWASTE BUILDING VENTILATION MONITORING SYSTEM					
a. Noble Gas Activity Monitor	D	M	R(2)	Q(4)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
7. ONSITE STORAGE BUILDING VENTILATION EXHAUST RADIATION MONITOR					
a. Noble Gas Activity Monitor	D	M	R(2)	Q(1)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 4.3.7.12-1 (Continued)

TABLE NOTATIONS

* At all times.

** During main condenser offgas treatment system operation.

*** During operation of the main condenser air ejector.

\# During operation of the standby gas treatment system.

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm setpoint.
2. Circuit failure.
3. Instrument indicates a downscale failure.
4. Instrument controls not set in operate mode (alarm or type).

(2) The initial CHANNEL CALIBRATION shall be performed using National Bureau of Standards traceable sources. These standards shall permit calibrating the system over the range of energy and measurement expected during normal operation and anticipated operational occurrences. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration or are National Bureau of Standards traceable shall be used.

(3) The CHANNEL CALIBRATION shall include the use of standard gas samples containing a nominal:

1. One volume percent hydrogen, balance nitrogen, and
2. Four volume percent hydrogen, balance nitrogen.

(4) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation occurs on high level and that control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm setpoints.
2. Circuit failure.
3. Instrument indicates a downscale failure.
4. Instrument controls not set in the operate mode (alarm or type).

ACCESS CONTROL

for

OBJECTIVE:

Have the ability to stop or prevent initiation of a job, evolution, test or work activity that can result in a VIOLATION of Radiological Protection Standard or Procedures.

ENVIRONMENT/IMPACT

1. Perception/understanding of effective positive control over personnel access to the RCA and how important it is to ensure compliance.

2. Maintaining personnel exposures under Administrative and/or Federal limits is currently passive therefore does not lend itself to exposure control (i.e. ALARA).

3. The ability to provide Radiological protection for individuals from Radiation Exposure is optimized and not compromised.

4. The potential exist for the imposition of Regulatory and/or Civil penalties against Deco for failure to comply.

RESOLUTION OF PROCESS

1. Clarify Administrative procedures to provide direction to all personnel concerning requirements for entry into the RCA.

2. Define and implement the requirements forHigh Rad Key Control.

3. Institute a positive control over specific RWP issuance by Health Physics.

4. Provide a Health Physics Control Point separate from counting room to ensure maximum interaction with the Health Physics staff.

5. Provide positive control over access/egress to and from RCA by Health Physics.

ACTIONS:

1. Develop an Access Control Procedure (12.000.xx).

   a) Requirements for access

   b) Requirements for High Rad Key Control

      i Responsibility for keys (HP)

      ii Management authorization for key issuance

      iii Action for emergency approval

A/5

c) Dosimetry and/or Health Physics requirements for High Rad entry

d) Management participation in the prevention of over-exposures.

2. Institute Positive RWP Control

   a) Revise RWP Procedure

      i initiate worker "check out/in" of Specific RWP's

      ii Develop "continuous coverage/RWP Deviation" worksheet

      iii Clarify Specific RWP requirements

      iiii Clearly define and "Emergency Situation" and notifications

      iiiii Implement a Radiological Survey Tracking Sheet

   b) Provide RWP Status Board (Track)

      i Provide currently working RWP status on a real time basis.

      ii Increases the interaction with H.P. by workers requesting RWP's from the Control Point.

      iii Expedite RWP issuance by the H.P. staff

3. Update Training

   a) Videotape providing awareness, referencing programmatic changes

   b) Update Radworker to reflect program improvements

4. Improve Hardware

   a) Provide a larger Access Control Point separate from the count room.

      i Provides a means to issue/return DRD's, Dose cards, (Later TLD's)

      ii Provides for rapid exposure information (i.e. computer terminals) iii Provides a communication medium to ensure RCA access is necessary

iiii Reduces congestion at the Health Physics counting room

iiiii Provides positive control by Health Physics over access/egress to and from the RCA

REFERENCES:

10 CFR 19
10 CFR 20
INPO Guidelines
Summary of RadCon Violation 82-85

gives equation to compute
... this procedure

07813-190

4.4 HD6685 counting system or equivalent

4.5 Sample filter envelope(s)

4.6 Tennelec Automatic Planchet Counting System or equivalent

5.0 Precautions and Limitations

5.1 Filter media used for particulates shall have a collection efficiency of at least 98% for 0.3 micron particles.

5.2 Charcoal cartridges used for samples shall have a collection efficiency of approximately 95% for elemental and organic iodine at the flow-rate used.

5.3 Exercise caution when operating an air sampler in contaminated areas to prevent contaminating the exterior of the sample pump.

5.4 Exercise caution when operating an air sampler near contaminated components to prevent pump exhaust from creating airborne activity.

5.5 Do not operate an air sampler in an explosive environment.

5.6 Silver zeolite iodine collection cartridges are used only for iodine sampling in areas of high noble gas concentrations, emergency sampling, or as requested by Health Physics Supervision.

5.7 Avoid contaminating the outside of the sample envelope.

5.8 If sample activity causes the HD6685 detector dead time to exceed 10%, adjust sample geometry to maintain less than 10% dead time.

6.0 Prerequisites

None

7.0 Sampling

7.1 Particulate/Iodine Sample

7.1.1 Select air sampling equipment as conditions require. High volume samplers use 4" heads; low volume samplers use 2" heads.

7.1.2 Install the particulate filter and/or iodine cartridge in the air sampler. Ensure sample media is centered on the sample head.

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NOTE 1: Ensure particulate filters are installed with the "Fuzzy" collection side facing outwards.

NOTE 2: Ensure iodine cartridges are installed with the cartridge arrow oriented in the direction of air flow.

7.1.3 Nature of the job will dictate either general area or breathing zone air samples.

NOTE 1: General area samples should be taken approximately 3 feet from the floor.

NOTE 2: Breathing zone samples should be drawn as close to the worker's FACE as possible without interfering with work.

7.1.4 Turn air sample pump <u>ON</u> and record start time/date on sample envelope.

7.1.5 Run sample long enough to obtain a minimum volume of:

25 ft^3 - Particulate
5 ft^3 - Iodine

NOTE: When using an iodine cartridge, the flow rate shall not exceed 2 cfm.

7.1.6 Turn air sampler <u>OFF</u> and record end time/date on sample envelope.

7.1.7 Carefully place sample in the sample envelope and ensure the envelope is filled out completely.

7.1.8 Submit the sample as soon as possible to the counting room for analysis.

7.2 Noble Gas Sampling

7.2.1 Obtain a noble gas sample beaker and remove the cover.

7.2.2 Hold the beaker by the bottom lip and raise it overhead.

7.2.3 Swing the beaker in a circular motion at about one revolution per second for at least two seconds.

NOTE: Other sampling methods may be authorized by Health Physics Supervision.

7.2.4 Promptly replace cover on the beaker.

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7.2.5 Ensure the sample beaker is labeled with the date, time and location.

7.2.6 Submit sample as soon as possible to the counting room for analysis.

8.0 <u>Analysis</u>

8.1 Analysis of Iodine Cartridges

8.1.1 Complete the Counting Room Air Sample Index (Attachment 1) and assign the sample the next consecutive I.D. number.

NOTE 1: <u>Sample Time</u> should indicate the time the sample pump was turned off.

NOTE 2: <u>Sample Type</u> should denote Part/Iodine.

NOTE 3: <u>Location</u> indicates a general category (area) in which the results be filed in the logbook (e.g., 2nd floor Reactor Bldg., Turbine Operating floor, etc.)

8.1.2 Fill out the Air Sample Log (Attachment 2) with the information from the sample envelope.

NOTE: The "Remarks" section should indicate the specific location of the sample.

8.1.3 Prepare the sample for counting by wrapping with plastic film and placing on the appropriate detector geometry.

NOTE 1: All iodine cartridges must be counted on the ND-6685 counting system.

NOTE 2: Iodine and particulate samples may be counted simultaneously as per Reference 3.9.

NOTE 3: Iodine cartridges should be oriented so the cartridge arrow points away from the detector.

8.1.4 Obtain the isotopic analysis results and record the MPC ratio for iodines on Attachment 2 as % MPC for iodines. Discard the cartridge if no further analysis is desired.

8.2 Analysis of Noble Gas Samples

8.2.1 Complete the Counting Room Air Sample Index (Attachment 1) and assign the sample the next consecutive I.D. number.

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NOTE 1: Sample Type should denote Marinelli.

NOTE 2: Location indicates a general category (area) in which the results be filed in the logbook (e.g., 2nd floor Reactor Bldg., Turbine Operating floor, etc.)

8.2.2 Complete the Air Sample Log (Attachment 2) with the information from the Marinelli label.

NOTE: The "Remarks" section should indicate the specific locati[illegible] of the sample.

8.2.3 Place the Marinelli bre[illegible]ker on the detector and count in accordance with Reference 3.9.

8.2.4 Record analysis results on Attachment 2 as % MPC.

8.3 Analysis of Particulate Filters

8.3.1 Complete the counting room air sample index (Attachment 1) and assign the sample the next consecutive I.D. number.

NOTE 1: Sample Time should indicate the time the sample pump was turned off.

NOTE 2: Sample Type should denote either particulate, Iodine or Part./Iodine.

NOTE 3: Location indicates a general category (area) in which the results will be filed in the logbook (e.g., 2nd floor Reactor Bldg., Turbine Operating Floor, etc.)

8.3.2 Complete the Air Sample Log (Attachment 2) with the information from the sample envelope.

NOTE: The "Remarks" section should indicate the specific location of the sample.

8.3.3 Frisk and prepare sample for counting.

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NOTE 1: If gross counts from frisker exceed 5,000 cpm, do not count in Automatic Planchet Changer (APC) or BC-4.

NOTE 2: 4 inch filters must be cut down to 2 inches prior to counting

8.3.4 Count sample on appropriate counting instrument.

NOTE 1: If desired, proceed immediately to step 8.3.9 for an isotopic count.

NOTE 2: Some samples should be counted for Alpha particulate activity as directed by Health Physics Supervision.

8.3.5 Record gross counts on Attachment 2.

8.3.6 Calculate the sample concentration using either the Nuclear Data Computer Program, Tennelec Computer Program, or one of the following formulas.

1. If the sample volume is measured in liters:

$$\text{concentration (uCi/ml)} = \frac{(\text{net cpm})(4.55E\text{-}10\ \text{uCi}\cdot\text{L/dpm}\cdot\text{ml})}{(\text{counter efficiency})(\text{filter fraction})(\text{volume in liters})}$$

$$\text{Net cpm} = [(\text{gross counts})\div(\text{count time})] - [\text{background}]$$

Filter Fraction = (.25) if using a 4" filter
(1) if using a 2" filter

$$\text{Volume} = (\text{sample time})(\text{sample flow rate})$$

$$4.55E\text{-}10\ \text{uCi}\cdot\text{L/dpm}\cdot\text{ml} = \frac{1\ \text{Ci}}{2.22E^{12}\text{dpm}} \times \frac{1E^{6}\text{uCi}}{\text{Ci}} \times \frac{1\ \text{Liter}}{1E^{3}\text{ml}} \times \frac{1}{\text{Collection Efficiency (.99)}}$$

2. If the sample volume is measured in cubic feet:

$$\text{concentration (uCi/ml)} = \frac{(\text{Net cpm})(1.61E\text{-}11\ \text{uCi ft}^3/\text{dpm ml})}{(\text{counter efficiency})(\text{filter fraction})(\text{volume in ft}^3)}$$

$$\text{Net cpm} = [(\text{gross counts})\div(\text{count time})] - [\text{background}]$$

Filter Fraction = (.25) if using a 4" filter
(1) if using a 2" filter

$$\text{Volume} = (\text{sample time})(\text{sample flow rate})$$

$$1.61E\text{-}11\ \text{uCi}\cdot\text{ft}^3/\text{dpm}\cdot\text{ml} = \frac{1\ \text{Ci}}{2.22E^{12}\text{dpm}} \times \frac{1E^{6}\ \text{uCi}}{\text{Ci}} \times \frac{1\ \text{Liter}}{1E^{3}\text{ml}} \times \frac{1}{.99} \times \frac{1\ \text{ft}^3}{28.317\ \text{Liter}}$$

NOTE: If one of the above manual calculation formulas is used, insure that the formula, with values, is recorded in the remarks of ATT. 2.

8.3.7 Record the concentration from Step 8.3.6 on Attachment 2.

8.3.8 Determine the MPC for an unidentified mixture.

1. Unless instructed otherwise by Health Physics Supervision use an MPC value of 3 x 10^{-9} uCi/ml, which is based on the assumption that alpha emitters and Sr-90, I-129, Pb-210, Ac-227, Ra-228, Pa-230 Pu-241, and Bk-249 are not present. If there is any doubt as to whether this assumption is valid, consult Health Physics Supervision. 16

NOTE: For purposes of this assumption, a radionuclide may be considered as not present if (a) the ratio of the concentration of that radionuclide in the mixture to the unrestricted area MPC for that radionuclide, as stated in 10CFR20, Appendix B, Table II, does not exceed 1/10, and (b) the sum of such ratios for all the radionuclides considered as not present in the mixture will not exceed 1/4.

8.3.9 If the concentration exceeds 7.5E-10 uCi/ml (25% of the unidentified MPC 3E-9 uCi/ml), perform an isotopic analysis of the filter activity in accordance with Reference 3.9.

NOTE: If an isotopic analysis is performed, insure that the air sample number is recorded on the analysis coversheet.

8.3.10 Total the MPC ratios for particulate, iodine and noble gas. Record each total as % MPC on Attachment 2.

8.3.11 If the sample was taken to determine personnel respiratory requirements, immediately notify the technician who took the sample of the results.

8.3.12 If the combined MPC ratio for particulates and iodine equals or exceeds 25%, the sampled area should be considered an airborne area and MPC-hour tracking initiated, in accordance with 9.2 or 9.3.

8.3.13 Properly dispose of the sample if no further analysis is required.

9.0 MPC Calculations

9.1 Rapid Air Sample Activity Estimation

NOTE 1: This section shall be used only as a preliminary method for determining respiratory protection and shall be backed up by other analytical methods as described in this procedure.

NOTE 2: This section applies only for 47mm particulate filters.

9.1.1 Estimate sample activity by measuring the filter net count rate using a frisker (assume 10% efficiency).

9.1.2 Follow instructions on Attachment 3 to yield activity.

9.2 Assessing MPC-Hours From Isotopic Analysis

9.2.1 Obtain the total MPC ratio from the last page of the analysis printout.

9.2.2 Reference the Nuclide Summary Report on the printout and subtract any noble gas or iodine isotopes from the total MPC ratio; the remaining ratio is the MPC ratio for particulates. | 6

9.2.3 If the air sample was taken for the evaluation of respiratory protection requirements, assign the appropriate protection factor for the device from the following table.

Respirator Type	Protection Factor
Air Purifying	50
Supplied Air Line	2,000
Self Contained Breathing Apparatus (SCBA)	10,000
Supplied Air Hood	2,000
*Powered Air Purifying Respirator (PAPR)	1,000/50

*NOTE 1: 1,000 may be used only when motor is operating. Otherwise, use 50.

NOTE 2: No protection factor is applied to airborne radioactivity exposure incurred from radioiodines when using Air Purifying Respirators.

9.2.4 Perform the following calculation:

$$\text{Corrected Particulate MPC Ratio} = \frac{\text{MPC ratio for Particulates (9.2.2)}}{\text{Protection Factor (9.2.3)}}$$ 16

9.2.5 Add the total from 9.2.4 to the iodine MPC ratio (if any) from 9.2.2 to yield the total corrected MPC Ratio.

NOTE: If a supplied air respirator is used, credit may be taken for the protection factor when determining the Iodine MPC Ratio.

9.2.6 Calculate MPC-Hours:

MPC-Hours = Total corrected MPC Ratio (9.2.5) x Stay Time (in hours)

9.2.7 Record MPC-Hours on Attachment 4 if the total corrected MPC ratio from 9.2.5 equals or exceeds 25%.

NOTE 1: If an individual's exposure exceeds 2 MPC-Hours in one day, notify Health Physics Supervision.

NOTE 2: If an individual's seven day rolling week exposure exceeds 10 MPC-Hours, notify Health Physics Supervision.

9.2.8 Photocopy Attachment 4 and forward original for data input and review. Retain the photocopy at the main control point.

9.3 Assessing MPC Hours From Gross Activity Levels

9.3.1 If isotopic analysis is not available, then MPC hours can be assessed, based on gross activity levels.

NOTE: Estimation of MPC hours on the basis of gross activity levels should only be used as a last resort, since, in general, this will provide a significant overestimate.

9.3.2 Particulates

1. Unless instructed otherwise by Health Physics Supervision use an MPC of $3X10^{-9}$ uCi/ml, which is based on the assumption that alpha emitters and

07313-120

Sr-90, I-129, Pb-210, Ac-227, Ra-228, Pa-230, Pu-241, and Bk-249 are not present. If there is any doubt as to whether this assumption is valid, consult Health Physics Supervision.

NOTE: For purposes of this assumption, a radionuclide may be considered as not present if (a) the ratio of the concentration of that radionuclide in the mixture to the unrestricted area MPC for that radionuclide, as stated in 10CFR20, Appendix B, Table II, does not exceed 1/10, and (b) the sum of such ratios for all the radionuclides considered as not present in the mixture will not exceed 1/4.

2 Calculate the particulate MPC ratio, using the formula:

Particulate MPC Ratio = C/MPC,

where the concentration, C, is from 8.3.6 and the MPC is from 9.3.2.1.

9.3.3 If respiratory protection is worn, calculate the Corrected Particulate MPC ratio, which is the Particulate MPC Ratio divided by the protection factor, where the protection factor is that determined in 9.2.3.

9.3.4 Add the Corrected Particulate MPC ratio from 9.3.3 (or the Particulate MPC Ratio, if no respiratory protection is worn) to the iodine MPC ratio (if any) from 9.2.5, to obtain the total corrected MPC ratio.

9.3.5 Calculate MPC hours as in 9.2.6.

9.3.6 Record MPC hours on Attachment 4, if the total corrected MPC ratio from 9.3.4 equals or exceeds 0.25.

07313-120

NOTE 1: If an individual's exposure exceeds 2 MPC hours in one day, notify Health Physics Supervision.

NOTE 2: If an individual's seven day rolling week exposure exceeds 10 MPC hours, notify Health Physics Supervision.

10.0 Records

10.1 Handle all records generated by this procedure in accordance with Reference 3.5.

11.0 Posting Requirements

11.1 Dependent on air sample results, area posting should be updated in accordance with Reference 3.4.

12.0 Acceptance Criteria

None

AIR SAMPLE INDEX

SAMPLE I.D.	DATE	TIME	SAMPLE TYPE	LOCATION

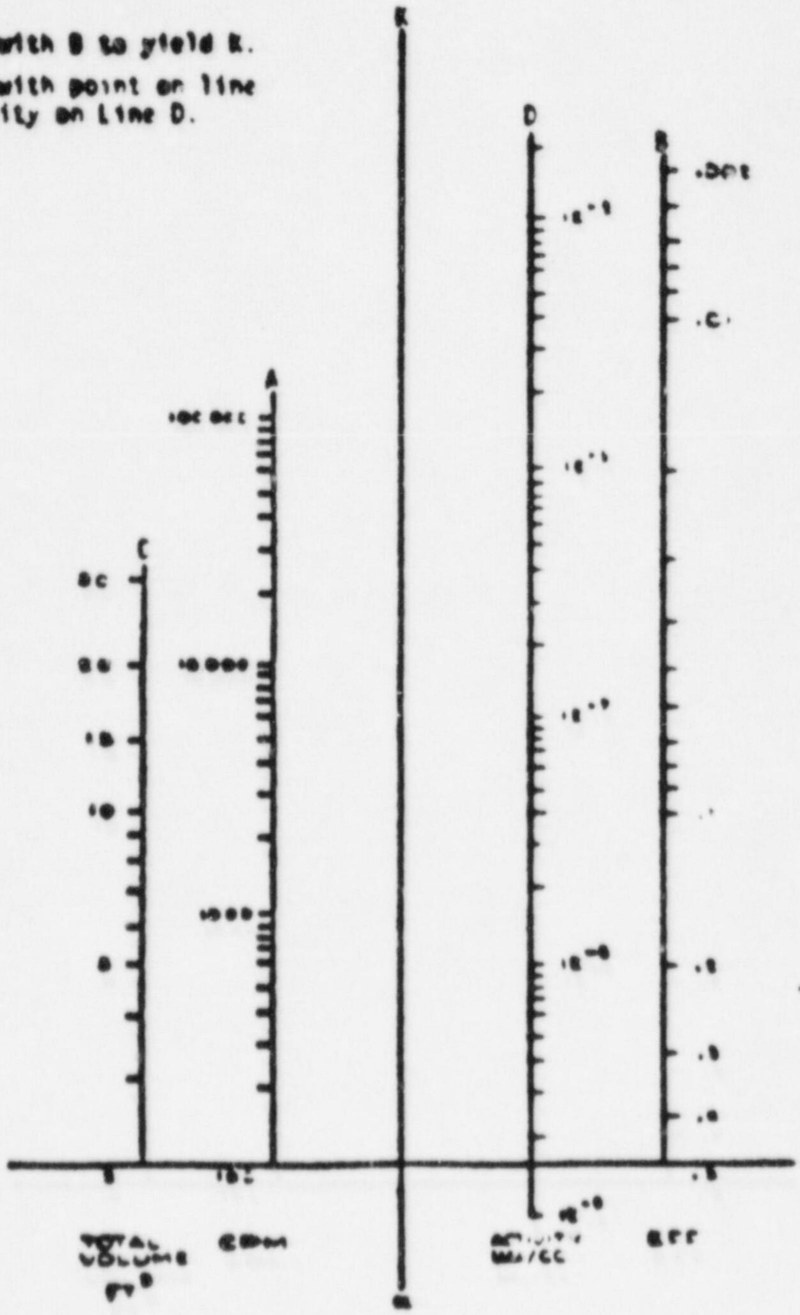
Date ____________ AIR SAMPLE LOG Location ____________

SAMPLE I.D.	SAMPLE DATE	TIME ON	TIME OFF	SAMPLERS NAME	TEST S/N	GROSS COUNTS B -	uCi/ml B -	COUNTER	INITIAL	MPC RATIO	REMARKS

SAMPLE

RAPID AIR PARTICULATE ACTIVITY ESTIMATION NOMOGRAPH

Match Line A with B to yield K.
Match Line C with point on line to find activity on Line D.



AIRBORNE/MPC LOGSHEET

NAME	EMP	AIRBORNE AREA	TIME IN	TIME OUT	SAMPLE I.D.	MPC RATIO	MPC HOURS

SAMPLE

END

OBJECTIVES

[illegible]

[illegible]

Thp38 --1. Define Maximum Permissible Body Burden (MPBB)

2. Define Maximum Permissible Concentration (MPC) and compare occupational with nonoccupational MPC's.

3. Relate MPC to MPBB.

4. Given the appropriate concentrations and MPC's for a mixture of radionuclides, conclude whether the mixture is within MPC.

5. According to 10CFR20, state whether the internal and external doses are summed when computing an individual's quarterly limit.

6. Identify and define the effective dose equivalent.

7. Define Annual Limit on Intake (ALI)

8. Define Derived Air Concentration (DAC)

Internal Dosim... Pt 4

Press -NEXT-

ICRP - 2 (1959), ICRP 9 (1965

ICRP - 26 (1977) + ICRP 30 (1978

[illegible] in refer[illegible]

Section ... 10-CFR-20 — Whol Section

in Pt 20 requirement referenced

A17

8 -- 9. Identify the elements in the equation:
$D = (\tilde{A} / M) \Delta$.

10. Given the formula $\tilde{A} = 1.443\ A_0 T_{1/2eff}$, compute the cumulative activity for a given radionuclide.

11. Given cumulative activity and the appropriate S factor, compute the integral dose for a particular internally deposited radionuclide.

-BACK- (available)   Press -NEXT-

03590-206

TRAINING PROGRAM DESCRIPTION

Title: Health Physics Technicians

Organization Unit: Nuclear Production - Rad Chem

Job Titles Included:

Sr. Health Physics Technician
Health Physics Technician
Health Physics Technician - Associate
Health Physics Technician - Assistant

Client Approval/Date 10-6-83

Training Approval/Date 10/10/83

Q.A. Approval/Date 10/11/83

Revision Number 1

Delivery Interval: (12 months)
Continuous Training Cycle:
(12 months unless otherwise noted)

COURSE NAME	FILE NUMBER	
Position Required Courses:		
Generic Systems and Procedures (WRS 3)	500 03 07 00	N.A.
Radiation Protection Theory	600 03 09 00	N.A.
Respiratory Protection	600 05 09 00	
Personnel Protective Procedures	500 06 04 00	
Radiation Worker	600 05 08 00	
Health Physics Equipment	600 04 01 00	24 months
Health Physics Applications	600 04 15 00	24 months
Health Physics Administrative Procedures	600 06 03 00	
Plant Administrative Procedures for Rad Chem	600 06 05 00	
Fermi 2 Orientation	550 05 02 00	
Mitigating Core Damage - Rad Chem	600 08 17 00	N.A.
Task Required Courses:		
Quality Assurance Awareness	600 06 16 00	

Optional Supplementary Training:

03590-226

TRAINING PROGRAM DESCRIPTION

Title: Health Physics Technicians

Job Titles Included:

- Sr. Health Physics Technician
- Health Physics Technician
- Health Physics Technician - Associate
- Health Physics Technician - Assistant

Organizational Unit: Prod-Radchem

Client Approval Date: 8-2-84, 8/3/84

Training Approval Date: 7/24/84

NQA Approval/Date: 8/15/84

Revision Number: 2

Course Name	File Number	Delivery Interval: 12 months Continuous Training Cycle: 12 months unless otherwise noted
Position Required Courses:		
Generic Systems and Procedures	03 07 00	N.A.
Radiation Protection Theory	01 09 00	N.A.
Mitigating Core Damage - Rad Chem	08 17 00	N.A.
Training Program Description 101		
Task Required Courses:		
Health Physics Equipment	04 01 00	24 months
Health Physics Application	04 15 00	24 months

1/85

Optional Supplementary Training:

NT/R296/5.52
072084

721

TRAINING PROGRAM DESCRIPTION

Title: Health Physics Technicians		Organizational Unit	Prod-Radchem
Job Titles Included:		Client Approval Date	1/14/85
Sr. Health Physics Technician		Training Approval Date	10/10/85
Health Physics Technician			
Health Physics Technician - Associate		NOA Approval/Date	11/16/85
Health Physics Technician - Assistant			
		Revision Number	3

Course Name	File Number	Delivery Interval: 12 months Continuous Training Cycle: 12 months unless otherwise noted
Position Required Courses:		
Generic Systems and Procedures	03 07 00	N.A.
Radiation Protection Theory	01 09 00	N.A.
Mitigating Core Damage - Rad Chem	08 17 00	N.A.
Training Program Description 101		
Training Program Description 651		
Task Required Courses:		
Health Physics Equipment	04 01 00	24 months
Health Physics Application	04 15 00	24 months
Optional Supplementary Training:		
Radwaste Rules and Regulations	06 31 00	24 months
ND6600 Computer Systems	07 23 00	N.A.
Health Physics Plant Systems	07 21 00	N.A.

TRAINING PROGRAM DESCRIPTION

Title: Health Physics Technicians

Organizational Unit Prod-Radchem

Job Titles Included:

Sr. Health Physics Technician
Health Physics Technician
Health Physics Technician - Associate
Health Physics Technician - Assistant

Client Approval Date [signature] 6/…/85

Training Approval Date [signature] 6-17-85

NQA Approval/Date [signature] 12-18-85

Revision Number 4

Course Name	File Number	Delivery Interval: 12 months Continuous Training Cycle: 12 months unless otherwise noted
Position Required Courses:		
Generic Systems and Procedures	03 07 00	N.A.
Radiation Protection Theory	01 09 00	N.A.
Mitigating Core Damage	08 01 00	N.A.
Training Program Description 101		
Training Program Description 651		
Task Required Courses:		
Health Physics Equipment	04 01 00	24 months
Health Physics Application	04 15 00	24 months
Optional Supplementary Training:		
Radwaste Rules and Regulations	06 31 00	24 months
ND6600 Computer Systems	07 23 00	N.A.
Health Physics Plant Systems	07 21 00	N.A.
Health Physics Update	02 10 00	N.A.
ALARA	03 26 00	N.A.
Rad Chem Counting Statistics	01 35 00	N.A.

7/85
to
4/86

TRAINING PROGRAM DESCRIPTION

Title: Health Physics Technicians

Organizational Unit: Production - RadChem

Job Titles Included:

- Senior Health Physics Technician
- Health Physics Technician
- Health Physics Technician - Associate
- Health Physics Technician - Assistant

Client Approval/Date: [signature] 14/14/86

Training Approval/Date: R. W. [signature] 14-11-86

NQA Approval/Date: [signature] 14-15-86

Revision Number: 5

Delivery Interval: 12 months
Continuous Training Cycle: 12 months unless otherwise noted

Course Name	File Number	Continuous Training Cycle
Position Required Courses:		
Fermi 2 Orientation	05-02-01-00	
Health Physics Theory	04-40-00-00	N.A.
Systems - RadChem	03-15-00-04	N.A.
Mitigating Core Damage	08-01-00-00	N.A.
Training Program Description 651		
Task Required Courses:		
Radiation Worker	05-08-00-00	
Respiratory Protection	05-09-00-00	
Behavior Reliability	05-01-00-00	N.A.
Personnel Protective Procedures	06-04-00-00	
Health Physics Equipment - Operation	04-39-00-00	24 months
Health Physics Application	04-15-00-00	24 months
Optional Supplementary Training:		
Procedure Compliance	06-33-00-00	N.A.
QA Awareness	06-16-00-00	
ALARA	08-26-00-00	
Basic Mathematics	01-38-00-00	
HP Plant Systems	07-21-00-00	
HP Update	02-10-00-00	
ND 6600 Computer System	07-23-00-00	
RadChem Counting Statistics	01-35-00-00	
Radwaste Rules and Regulations	06-31-00-00	
Technical Specifications	08-04-00-00	

current

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-16/84-01(DRMSP); 50-341/84-05(DRMSP)

Docket No. 50-16; 50-341 Licenses No. DPR-9; CPPR-87

Licensee: Detroit Edison Company
2000 Second Avenue
Detroit, MI 48226

Facility Name: Enrico Fermi Nuclear Power Station, Units 1 and 2

Inspection At: Fermi Site, Monroe, MI

Inspection Conducted: March 5-9, 1984

Inspectors: L. J. Hueter — 4-3-84 Date

N. A. Nicholson — 4/3/84 Date

Approved By: L. R. Greger, Chief
Facilities Radiation Protection
Section — 4/3/84 Date

Inspection Summary

Inspection on March 5-9, 1984 (Report No. 50-16/84-01[DRMSP]; 50-341/84-05[DRMSP])
Areas Inspected: Routine, announced inspection of preoperational radiation protection program for Unit 2. The inspection included organization, staffing, training, radiation protection procedures, facilities, instruments, equipment, status of certain NUREG-0737 items, status of certain preoperational systems, demonstrations and tests, IE Bulletins and Circulars, and open items. The inspection involved 90 inspector-hours onsite by two NRC inspectors.
Results: No items of noncompliance or deviations were identified.

A/9

16pp

DETAILS

1. Persons Contacted

B. Beal, Startup Test Engineer
C. Benoit, I&C Specialist
J. Bobba, General Supervisor - Radwaste
*R. Boyles, Startup Assurance - Startup
*L. Bregni, Nuclear Engineer - Licensing
R. DeWolf, Chemical Technician
*R. Eberhardt, General Supervisor - Chemistry
*R. Hite, Supervisor - Dosimetry
*P. Lavely, Corporate Health Physicist
*J. Leman, Radiation Protection/Chemical Engineer
*R. Lenart, Superintendent - Nuclear Production
W. Lipton, General Supervisor - Health Physics
P. Lovallo, Associate Engineer
M. Mitchell, Startup Test Engineer
G. Montgomery, Startup Test Engineer
*T. Nicholson, Startup Engineer
*J. Nyquist, Assistant Superintendent - Nuclear Production
S. O'Hern, Senior Health Physics Technician
*G. Overbeck, Assistant Superintendent - Startup
U. Peterson, Startup Test Engineer
R. Rateick, Principal Engineer, Operating Experience Review Group
*R. Salmon, Lead Startup Test Engineer - I&C
F. Sonderoth, Task Force Member
A. Wegele, Senior Engineer - Licensing
T. Williams, Chemical Engineer
L. Wooden, Systems Engineer

*W. McArthur, Health Physicist - KLM Consultant
*T. Minton, General Electric Site Operations Manager

*P. Byron, NRC Senior Resident Inspector
M. Parker, NRC Resident Inspector

*Denotes those present at the exit meeting.

2. General

The preoperational inspection, which began about 8:00 a.m. on March 5, 1984, was conducted to examine the preoperational radiation protection program, radwaste systems, certain systems demonstrations and tests, open items, Bulletins and Circulars, and progress made on certain NUREG-0737 items.

3. Licensee Action on Previous Inspection Findings

(Closed) Violation (016/83-01-01): Failure of procedures to meet technical specification requirements in that the surveillance, operating, and reporting procedures permitted a minimum cover gas pressure on the primary system below the minimum pressure specified in the technical specifications. The

The licensee tentatively plans to use eleven IRT portal monitors, seven of which are installed at the following locations: two at the primary access in the security building; three at the secondary access in warehouse B; one at the health physics control point; and one at the chemistry laboratory. Four additional portal monitors have been proposed including two for the control room, one for an alternate control point, and a spare unit at the health physics control point. The portal monitor in the laboratory is operable and in use and the portal monitor at the control point is operable but not in general use. The licensee intends to have all eleven units (with the possible exception of the alternate control point) operational and in use before fuel load. Frisking with a hand held probe is intended to be used as an alternate if needed.

The licensee has all 47 General Electric area monitors installed, calibrated, and preoperationally tested. All area monitors utilize Geiger-Mueller tube detectors. A converter produces a direct current output signal proportional in magnitude to the logarithm of the rate at which ionizing events are occurring within the tube. A transistorized current amplifier functions to maintain the converter output signal at the full scale value if the detector is over-ranged. Each monitor covers a four decade range which varies depending on the location of the monitor. The ranges vary from 1E-2 mR per hour on the low end to 1E+6 mR per hour on the upper end. Some of the monitors are provided with small strontium-90 "bug" sources to provide a low level radiation flux sufficient to cause channel indication and thereby provide verification of channel operability. In the reactor control room, logarithmic scale meters and alarms are provided for each monitor and four twelve-point recorders are provided for recording and trending purposes. In addition, twenty-seven of the area monitors have local meters and actuate a local horn or light beacon on an alarm condition.

After installation, each area monitor was calibrated at five different levels of radiation representing at least one point in each decade of the instrument range. Calibrations were performed using an NBS traceable cesium-137 source calibrator. The acceptance criteria used for the logarithmic readings for each radiation level was ± 7.5 percent of equivalent linear full scale reading. No problems were identified in review of the calibration procedures and calibration data. Preoperational testing of the area monitors is discussed in Section 9.

Items remaining ~~to be completed in this area include~~ installation of four additional portal monitors and establishment of a program for operability and use of these and other portal monitors; completion of the personnel decontamination and equipment decontamination facilities; and equipping the respiratory equipment cleaning, maintenance, and storage facility. (Open Item 50-341/84-05-03)

electrical hook up of machines & furnishings

7. Process and Radwaste Effluent Monitors

The licensee has about 23 process and radwaste effluent monitors, many of which have multiple detectors. These monitors use Geiger-Mueller, ion chamber, beta scintillation, and gamma scintillation detectors provided by General Electric, Gulf (General Atomics), and Eberline Instruments.

Solomon

installed - 1 not oper. don't have power yet
2 outside CR both not operable yet
1 op 0 " access point
2 op 2 security access 5
3 op 3 alternate security one being repaired faulty power supply;
1 op 1 chem lab

The licensee plans to use iodine and particulate detectors as trending devices only, as reflected in the proposed technical specifications.

None of the process and radwaste effluent monitors have been source calibrated or preoperationally tested by the licensee to date. Electronic calibrations are in progress and source calibrations are expected to begin in about three weeks. Source calibration procedures have been written and approved for all monitors except the Eberline SPING units.

The licensee has two types of liquid monitors - General Electric and General Atomics. Both types have sodium iodide detectors which are located in a recessed area of a liquid chamber for monitoring gamma radiation. For both types of monitors, the licensee has spare liquid chambers identical to those in the monitors. The licensee plans to fill the spare chambers with varying concentrations of cesium-137 solutions for calibration of the liquid monitors. The licensee plans to use solid sources at the same time for use in subsequent source calibration/linearity checks. The licensee also plans to perform liquid source calibrations at different power levels during startup. Liquid calibrations will be repeated at an interval which will be defined in the licensee's procedures.

For the gas monitors which use beta scintillation detectors (low range gas monitors on Eberline SPING units and low range gas monitors in General Atomic units), the licensee plans to calibrate the detectors initially with different concentrations of krypton-85 gas using a calibration test loop assembly and a krypton-85 gas source. At the same time as the krypton-85 calibration, the licensee plans to cross calibrate solid sources for subsequent source calibration/linearity checks. The licensee plans to perform gas calibrations with plant generated gases at different power levels during startup. Gas calibrations will be repeated at an interval which will be defined in the licensee's procedures.

For the gas monitors which use Geiger-Mueller tube detectors (mid and high range gas monitors on Eberline SPING units), the licensee has indicated plans to calibrate the detectors initially with different concentrations of krypton-85 gas (highest concentration limited by safe handling considerations). At the same time as the krypton-85 calibration, the licensee plans to cross calibrate solid sources for subsequent source calibration/linearity checks. The licensee plans to perform gas calibrations with plant generated gases at different power levels during startup. Gas calibrations will be repeated at an interval which will be defined in the licensee's procedures.

For the ion chamber detectors on the General Electric main steam radiation monitors and on the General Electric off-gas radiation monitors, the licensee originally planned to use a calibration device which would surround the detector with differing concentrations of cesium-137 solution. However, due to limited working space and the length of detector cables, the licensee is considering an alternative method utilizing a beam source calibrator.

The licensee is planning to introduce about 80 millicuries of krypton-85 in the off-gas system, just upstream of the charcoal beds, to evaluate the effectiveness of the charcoal beds in providing hold-up time for noble gases. This usage of krypton-85 does not appear to be authorized by By-product Material License No. 21-02335; this matter was discussed by phone with a licensee representative on March 19, 1984. Results of that discussion are included in the Exit Meeting Section.

Although the process and radwaste effluent monitor alarm setpoints are initially being set at about twice background, a software program is available for quantifying releases and establishing various monitor setpoints for functions such as required trips, isolation functions, and actuation of certain filter trains, etc. This program was reported to be functional pending NRR approval of the ODCM. Training in this program is about 50 percent complete and is expected to be completed for all involved personnel by early May 1984.

HEPA filters (seven) have been installed and in-place tested for efficiency for the fume hoods in the chemistry laboratory. Also, installation and in-place testing has been completed for 30 HEPA filters in the Radwaste Exhaust.

A "Q" material certification, an independent certification of quality over and above that provided by the filter vendor, has been obtained for both HEPA and charcoal filters to be used in the standby gas treatment system (SBGTS) and in the heating, ventilation, and air conditioning (HVAC) systems for the control center. These filters are onsite and will be installed and in-place tested within 30 days of fuel load, which is currently scheduled for June 30, 1984.

The licensee has no commitment date for installation and in-place testing of filters in a number of other systems, but stated that this will be accomplished as the systems are balanced and will likely be accomplished for all systems before fuel load. Most of these filters are onsite.

Items to be completed in this area include initial source calibration of process and radwaste effluent monitors; fluid (gas and liquid) calibration/linearity checks of monitors during startup; evaluation of effectiveness of off-gas system charcoal beds in providing hold-up time for noble gases; establishment of setpoints for monitors; and installation and in-place testing of HEPA and charcoal filters in various filter trains. (Open Item 50-341/84-05-04)

8. Status of Certain NUREG-0737 Items

a. NUREG-0737 II.B.2 - Plant Shielding

This area was briefly reviewed. The licensee has submitted a work request to replace a concrete block wall with poured concrete at the northwest end of the turbine building. Completion of this activity is designed to satisfy the only concern raised regarding this item in the July 1981 Safety Evaluation Report. Completion is scheduled for May 1984.

Detroit Edison

Date: April 9, 1984
OA-84-867

To: J. Leman
Rad Chem Engineer

From: W. E. Miller
Supervisor, Operational Assurance

Subject: Closeout of Audit No. A-OA-C-83-04

Corrective action to the three findings issued have now all been verified. Audit No. A-OA-C-83-04 is now considered closed. Copies of closed AF's # 1, 2 and 3 are provided for your information.

If you have any questions, please contact Andy Pusztai on Edison extenison 5249.

azp
WEM/AZP/rll

Attachment

CC: F. Agosti
A. DeBrango
R. Eberhardt
R. Lenart
D. Norwood
A. Pusztai
F. Schwartz
K. Shields
G. Trahey
J. Wald
T. Williamson
QA Audit File

A/10

Detroit Edison **AUDIT FINDING REPORT** PAGE 1 OF. __

1. AUDITED ORGANIZATION	2. AUDIT IDENTIFICATION	3. FINDING NO.
Nuc. Production - Chemistry	A-OA-C-83-04	1
4. AUDITOR S. L. Fox /SL Fox	5. DATE OF FINDING 2/16/83	7. DISCUSSED WITH R. Eberhardt E. Newton
6. CONTROLLING DOCUMENT, SECTION, PARAGRAPH, ETC. OQAM - Policy 2, Section 5.3		

8. REQUIREMENTS

The (QA) Program is implemented through the many administrative and work controlling procedures established by the organizations involved in plant operations and which delineate how each quality-related activity or QA function is to be performed, verified, and documented as applicable.

The QA Program prescribed by this manual shall be phased in during the pre-operational phase of the plant project and be fully implemented prior to initial fuel loading.

CONTINUED ☐

9. FINDING

The following POM Administrative procedures have not been issued in an approved form yet:

- ✓ 71.000.01 - Chemistry-General and Administrative Practices done
- ✓ 71.000.02 - Data Logging Procedures and Records Maintenance — in writing by Kathy
- ✓ 71.000.03 - Sampling and Analysis Schedule — done
- ✓ 71.000.04 - Chemistry and Quality Verification Program done

CONTINUED ☒

10. RECOMMENDED ACTION(S)

Complete the above listed procedures at the earliest possible date.

CONTINUED ☐

11. SCHEDULED INITIAL 30 DAY RESPONSE DATE	12. RESPONSIBILITY FOR CORRECTIVE ACTION
4/26/83	R. Eberhardt

13-19. EVALUATION, REMEDIAL CORRECTIVE ACTION, AND CORRECTIVE ACTION TO PREVENT RECURRENCE ARE ON PAGE 2.

20. CORRECTIVE ACTION COMPLETED

See attached memo RC-84-111 To W.E. Miller.

CONTINUED ☐

21. DATE COMPLETED	22. SUBMITTED BY
April 4, 1984	K. Shields

23. VERIFICATION ACTIONS BY QAE

Reviewed attached memo; all referenced Chemistry Administrative procedures have been approved.

CONTINUED ☐

24. IMPLEMENTATION: ACCEPTED ☒ NOT ACCEPTED ☐

[illegible] SIGNATURE BY QAE [illegible] DATE [illegible] 1, 1984

A-OA-C-83-04
Finding #1

x 71.000.05 - Regulatory Requirements and Reports - cancelled replaced by 79000.80 green 3/12
x 71.000.10 - Control of M and TE - done
x 74.000.05 - Chemical Inventory Control - green 3/5 final

Either these procedures or else new ones should also address the control of Bulk Chemicals and the control of Installed Plant Instrumentation that perform a Rad/Chem function.

1. AUDITED ORGANIZATION	2. AUDIT IDENTIFICATION	3. FINDING NO.
Nuc. Production - Chemistry	A-OA-C-83-04	1

13. EVALUATION

The procedures identified in finding no. 1 will be completed as projected in item 15 below.

CONTINUED ☐

14. REMEDIAL CORRECTIVE ACTION

14A. REMEDIAL CORRECTIVE ACTION COMPLETION DATE:

CONTINUED ☐

15. CORRECTIVE ACTION TO PREVENT RECURRENCE

a. Procedures 71.000.04, 71.000.10, were issued for review on Feb. 15, 1983. At this time OSRO Approval is projected by June 1983.

b. Procedures 74.000.05, 71.000.03, 71.000.01, 71.000.02 are drafted at this time and are expected to be approved by OSRO prior to July 1983.

c. Procedure 71.000.05 is being drafted at this time and is expected to be approved by OSRO by July 1983.

15A. CORRECTIVE ACTION TO PREVENT RECURRENCE COMPLETION DATE

7-31-83

CONTINUED ☐

16. DATE COMPLETED	17. SUBMITTED BY
4-27-83	R. Eberhardt/ R Eberhardt

18. INITIAL 30 DAY RESPONSE: ACCEPTED ☒ NOT ACCEPTED ☐

AUTHORIZED SIGNATURE BY OAE: SBJ

DATE: 5/2/83

19. EXPLANATION OF OAE NON-ACCEPTANCE OF 30 DAY REPLY

CONTINUED ☐

Corr. Act. to Finding #A-OA-C-83-04-1

Detroit Edison

Date: April 4, 1984
RC-84-111

To: W. E. Miller
Supervisor, Operational Assurance

From: K. Shields *K. Shields*
Chemist

Subject: Closure of open findings from Operational Assurance Audits A-OA-C-83-04 and A-OA-C-84-02.

Three audits relating to the Chemistry Organization and the Chemistry Administrative Program were conducted by Operational Assurance in 1983 and 1984. To date, Audit A-OA-C-83-04 has one remaining open finding which is also discussed in Audit A-OA-C-83-24. Also, Audit A-OA-C-84-02 has one open finding relating to Chemistry. The purpose of this memo is to close out these remaining items.

A) Audit A-OA-C-83-04 outlines the completion and approval of the Chemistry Administrative procedures. The status of these procedures are listed below:

Procedure	Rev.	Title	Date Approved
71.000.01	0	Chemistry-General and Administrative Practices	9/6/83
71.000.02	0	Data Logging Procedures and Records Maintenance	4/3/84
71.000.03	0	Sampling and Analysis Schedule	8/9/83
71.000.04	0	Chemistry Quality Verification Program	10/25/83
71.000.05		Regulatory Requirements and Reports (intent of procedure in contained in 79.000.50).	Cancelled
71.000.10	1	Test Equipment Calibration Process	1/24/84
74.000.05	0	Chemical Inventory Control	3/20/84
79.000.50	0	Radiological Effluents Accountability and Reporting	4/3/84

All procedures outlined in the audit finding are now complete and approved. Please close out this finding and audit report.

B) Audit A-OA-C-84-02 finding #1 outlines the completion and approval of the Chemstry Organization procedure. POM Procedure 71.000.14, Chemistry Organization was approved 3/20/84 which completes the finding.

As a result of the above procedure approvals, please close out A-OA-83-04 and A-OA-84-02-1.

cc: R. K. Eberhardt
T. L. Williamson
D. K. Norwood
R. S. Lenart
J. D. Leman

Detroit Edison **AUDIT FINDING REPORT** PAGE 1 OF ___

1. AUDITED ORGANIZATION	2. AUDIT IDENTIFICATION	3. FINDING NO.
Nuc. Production - Chemistry	A-QA-C-83-04	2
4. AUDITOR: S.L. Fox /S.L. Fox	5. DATE OF FINDING	7. DISCUSSED WITH: R. Eberhardt, K. Shields, E. Newton
6. CONTROLLING DOCUMENT, SECTION, PARAGRAPH, ETC.: OQAM-Policy 1, 4.3: SUM, section 10.3.3.2		

8. REQUIREMENTS

The OQAM states that the "responsibilities and duties of organizations performing activities affecting the safety-related functions of plant structures, systems, and components shall be clearly established and documented."

The Startup Manual, section 10.3.3.2 states that "activities (in support of Startup) performed by Nuclear Production are prescribed by procedures in the Plant Operations Manual."

CONTINUED ☐

9. FINDING

The manner in which the Nuclear Production Chemistry Department interfaces and supports the Startup Deparment is not proceduralized in the Plant Operations Manual (POM).

CONTINUED ☐

10. RECOMMENDED ACTION(S)

Develop a POM procedure which defines the Chemistry department's interfaces with the Startup organization and how the Chemistry department will support Startup on QA Level 1 analysis.

CONTINUED ☐

11. SCHEDULED INITIAL 30 DAY RESPONSE DATE	12. RESPONSIBILITY FOR CORRECTIVE ACTION
4/26/83	R. Eberhardt

13-19. EVALUATION, REMEDIAL CORRECTIVE ACTION, AND CORRECTIVE ACTION TO PREVENT RECURRENCE ARE ON PAGE 2.

20. CORRECTIVE ACTION COMPLETED

EFP-1044, guidelines for Obtaining Analytical Services was revised to incorporate the above finding. This action was completed January, 1984.

CONTINUED ☐

21. DATE COMPLETED	22. SUBMITTED BY
2/10/84	Kathleen M. Shields

23. VERIFICATION ACTIONS BY QAE

Reviewed EFP-1044, Rev 1; interviewed chemist. All details appear to be in order.

CONTINUED ☐

24. IMPLEMENTATION: ACCEPTED ☑ NOT ACCEPTED ☐

Detroit Edison

AUDIT FINDING REPORT EVALUATION AND CORRECTIVE ACTION

1. AUDITED ORGANIZATION	2. AUDIT IDENTIFICATION	3. FINDING NO.
Nuc. Production - Chemistry	A-OA-C-83-04	2

13. EVALUATION

The manner in which Nuclear Production Chemistry interfaces with Startup is not formalized at this time.

CONTINUED ☐

14. REMEDIAL CORRECTIVE ACTION

14A. REMEDIAL CORRECTIVE ACTION COMPLETION DATE:

CONTINUED ☐

. CORRECTIVE ACTION TO PREVENT RECURRENCE

A Radchem Plant Order will be drafted instructing Chemistry personnel on support of the Startup organization on QA Level 1 analysis and the degree of accuracy required for the analysis.

15A. CORRECTIVE ACTION TO PREVENT RECURRENCE COMPLETION DATE

7-1-83

CONTINUED ☐

16. DATE COMPLETED	17. SUBMITTED BY
4-27-83	R. Eberhardt/ R Eberhardt

18. INITIAL 30 DAY RESPONSE: ACCEPTED ☒ NOT ACCEPTED ☐

AUTHORIZED SIGNATURE BY OAE: SP Fox

DATE: 5/2/82

19. EXPLANATION OF OAE NON-ACCEPTANCE OF 30 DAY REPLY

N/a

CONTINUED ☐

Detroit Edison **AUDIT FINDING REPORT** PAGE 1 OF ___

1. AUDITED ORGANIZATION	2. AUDIT IDENTIFICATION	3. FINDING NO.
Nuc. Production - Chemistry	A-QA-C-83-04	2
4. AUDITOR: S.L. Fox /S.L. Fox	5. DATE OF FINDING	7. DISCUSSED WITH: R. Eberhardt, K. Shields, E. Newton
6. CONTROLLING DOCUMENT, SECTION, PARAGRAPH, ETC.: OQAM-Policy 1, 4.3: SUM, section 10.3.3.2		

8. REQUIREMENTS

The OQAM states that the "responsibilities and duties of organizations performing activities affecting the safety-related functions of plant structures, systems, and components shall be clearly established and documented."

The Startup Manual, section 10.3.3.2 states that "activities (in support of Startup) performed by Nuclear Production are prescribed by procedures in the Plant Operations Manual."

CONTINUED ☐

9. FINDING

The manner in which the Nuclear Production Chemistry Department interfaces and supports the Startup Deparment is not proceduralized in the Plant Operations Manual (POM).

CONTINUED ☐

10. RECOMMENDED ACTION(S)

Develop a POM procedure which defines the Chemistry department's interfaces with the Startup organization and how the Chemistry department will support Startup on QA Level 1 analysis.

CONTINUED ☐

11. SCHEDULED INITIAL 30 DAY RESPONSE DATE	12. RESPONSIBILITY FOR CORRECTIVE ACTION
4/26/83	R. Eberhardt

13-19. EVALUATION, REMEDIAL CORRECTIVE ACTION, AND CORRECTIVE ACTION TO PREVENT RECURRENCE ARE ON PAGE 2.

20. CORRECTIVE ACTION COMPLETED

EFP-1044, guidelines for Obtaining Analytical Services was revised to incorporate the above finding. This action was completed January, 1984.

CONTINUED ☐

21. DATE COMPLETED	22. SUBMITTED BY
2/10/84	Kathleen M. Shields

23. VERIFICATION ACTIONS BY OAE

Reviewed EFP-1044, Rev 1; interviewed chemist. All details appear to be in order.

CONTINUED ☐

24. IMPLEMENTATION: ACCEPTED ☑ NOT ACCEPTED ☐

Thomas [illegible] February 1?, 198?

Detroit Edison

AUDIT FINDING REPORT

1. AUDITED ORGANIZATION: Startup
2. AUDIT IDENTIFICATION: A-OA-C-83-04
3. FINDING NO.: 3
4. AUDITOR: S.L. Fox
5. DATE OF FINDING: 2/17/83
6. CONTROLLING DOCUMENT, SECTION, PARAGRAPH, ETC.: SUM 4.7.3
7. DISCUSSED WITH: J. Icard

8. REQUIREMENTS

Section 4.7.3 states requirements for measuring and test equipment.

CONTINUED ☐

9. FINDING

Section 4.7.3 does not address calibration requirements for the Chemistry Department which performs certain QA Level 1 analyses per Startup's request.

CONTINUED ☐

10. RECOMMENDED ACTION(S)

1. Revise SUM Section 4.7.3 to include Chemistry calibration requirements.
2. Have the SUM or any appropriate Startup Instruction describe the mechanism by which the Chemistry Department is notified and documents analysis results.

CONTINUED ☐

11. SCHEDULED INITIAL 30 DAY RESPONSE DATE:

12. RESPONSIBILITY FOR CORRECTIVE ACTION: T. Nickelson

13-19. EVALUATION, REMEDIAL CORRECTIVE ACTION, AND CORRECTIVE ACTION TO PREVENT RECURRENCE ARE ON PAGE 2.

20. CORRECTIVE ACTION COMPLETED

CONTINUED ☐

21. DATE COMPLETED:

22. SUBMITTED BY:

23. VERIFICATION ACTIONS BY QAE

SUM Rev 23 (9-6-83) to section 4.7.3 incorporates the change noted in Block #10

CONTINUED ☐

24. IMPLEMENTATION: ACCEPTED ☑ NOT ACCEPTED ☐

F.T. Schwartz 10/83

1. AUDITED ORGANIZATION	2. AUDIT IDENTIFICATION	3. FINDING NO.
Startup	A-OA-C-83-04	3

13. EVALUATION

1. See 'Block 14' below.
2. It is the opinion of Startup that no additional 'mechanism' is required in either the Startup Manual or Startup Instructions. Chemistry Analysis is provided using the Chemistry Departments' procedures and documented in their records and entered, if required, in our procedures (i.e., CCMF, PRET, etc).

CONTINUED ☐

14. REMEDIAL CORRECTIVE ACTION

1. Startup will revise Section 4.7.3 of the Startup Manual to state that "Measuring and Test Equipment (M&TE) used in the performance of tests will be documented and controlled by Startup or the responsible organization."

   This change will be included when Revision 23 to the Startup Manual is submitted to the TRC.
2. None required, see 13. above.

14A. REMEDIAL CORRECTIVE ACTION COMPLETION DATE:
June 30, 1983

CONTINUED ☐

15. CORRECTIVE ACTION TO PREVENT RECURRENCE

None required.

15A. CORRECTIVE ACTION TO PREVENT RECURRENCE COMPLETION DATE
N/A

CONTINUED ☐

16. DATE COMPLETED	17. SUBMITTED BY
4/21/83	[signature]

18. INITIAL 30 DAY RESPONSE: ACCEPTED ☒ NOT ACCEPTED ☐

AUTHORIZED SIGNATURE BY OAE — DATE
SR Fox 4/20/83

19. EXPLANATION OF OAE NON-ACCEPTANCE OF 30 DAY REPLY

N/A.

CONTINUED ☐

Marty

April 11, 1984

Docket No. 50-341 4-03

The Detroit Edison Company
ATTN: Mr. Donald A. Wells
Manager, Quality Assurance
200 Second Avenue
Detroit, IL 48226

Gentlemen:

Thank you for your letter of March 26, 1984, providing us your analytical results of a spiked sample the NRC sent to Detroit Edison as part of the preoperational confirmatory measurements inspection program. Comparative results for strontium analyses are presented in Table II and comparison criteria are outlined in Attachment A. Results for a spiked particulate filter, charcoal adsorbers, tritium and gamma activity in a liquid sample were provided in Table 1 in Inspection Report No. 50-341/84-03, dated March 1, 1984. Please attach Table II to this inspection report. The licensee obtained all agreements for the radionuclides identified. This closes out Open Item 50-341/83-16-08.

Your cooperation with us is appreciated.

Sincerely,

C. J. Paperiello, Chief
Emergency Preparedness and
Radiological Safety Branch

Enclosures:
1. Table II, Confirmatory Measurements Program
2. Attachment 1, Criteria for Comparing Analytical Measurements

cc w/encl.:
DMB/Document Control Desk (RIDS)
Resident Inspector, RIII
Ronald Callen, Michigan Public Service Commission
Harry H. Voight, Esq.

3PP.

OFFICE	RIII/DRMSP	RIII	RIII	RIII	RIII	RIII
SURNAME	Oestmann/mf	Slawinski	Rozak	Schumacher	~~Kowalski~~ Knop	Paperiello
DATE	4/10/84					

TABLE II

U S NUCLEAR REGULATORY COMMISSION

OFFICE OF INSPECTION AND ENFORCEMENT

CONFIRMATORY MEASUREMENTS PROGRAM
FACILITY: FERMI
FOR THE 4 QUARTER OF 1983

		------NRC-------		----LICENSEE----		---LICENSEE:NRC----		
SAMPLE	ISOTOPE	RESULT	ERROR	RESULT	ERROR	RATIO	RES	T
L SPIKED	SR-89	2.3E-04	6.0E-06	1.9E-04	2.1E-04	8.2E-01	3.8E 01	A
	SR-90	3.6E-05	1.2E-06	3.8E-05	4.1E-06	1.0E 00	3.0E 01	A

T TEST RESULTS:
A=AGREEMENT
D=DISAGREEMENT
P=POSSIBLE AGREEMENT
N=NO COMPARISON

ATTACHMENT 1

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgment limits are variable in relation to the comparison of the NRC Reference Laboratory's value to its associated one sigma uncertainty. As that ratio, referred to in this program as "Resolution", increases, the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement should be considered acceptable as the resolution decreases. The values in the ratio criteria may be rounded to fewer significant figures to maintain statistical consistency with the number of significant figures reported by the NRC Reference Laboratory, unless such rounding will result in a narrowed category of acceptance. The acceptance category reported will be the narrowest into which the ratio fits for the resolution being used.

RESOLUTION	RATIO = LICENSEE VALUE/NRC REFERENCE VALUE		
	Agreement	Possible Agreement "A"	Possible Agreeable "B"
<3	No Comparison	No Comparison	No Comparison
≥3 and <4	0.4 - 2.5	0.3 - 3.0	No Comparison
≥4 and <8	0.5 - 2.0	0.4 - 2.5	0.3 - 3.0
≥8 and <16	0.6 - 1.67	0.5 - 2.0	0.4 - 2.5
≥16 and <51	0.75 - 1.33	0.6 - 1.67	0.5 - 2.0
≥51 and <200	0.80 - 1.25	0.75 - 1.33	0.6 - 1.67
≥200	0.85 - 1.18	0.80 - 1.25	0.75 - 1.33

"A" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is greater than 250 keV.

Tritium analyses of liquid samples.

"B" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is less than 250 keV.

Sr-89 and Sr-90 determinations.

Gross beta, where samples are counted on the same date using the same reference nuclide.

Wayne H. Jens
Vice President
Nuclear Operations

Detroit Edison

2000 Second Avenue
Detroit, Michigan 48226
(313) 586-4150

March 26, 1984
EF2-66732

PRINCIPAL STAFF

Dr. M.J. Oestmann
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Dear Dr. Oestmann:

Reference: Fermi 2
NRC Docket No. 50-341

Subject: Analytical Results of Spiked Samples

The purpose of this letter is to report the analytical results of the spiked samples the NRC sent to Detroit Edison for analysis. Enclosed are the results from the tritium and gamma emitters that you compared during your last inspection in January - February, 1984, and the final analysis of the Sr-89 and Sr-90 liquid samples. As you requested, all the results are reported on the attached Sample Record Sheet. This completes Detroit Edison's action on this open item (No. 83-16-08).

If there are any questions regarding the analyses, please contact Mr. R.R. Eberhardt, (313) 586-5303.

Sincerely,

Wayne H. Jens

Attachment

cc: P.M. Byron
R.C. Knop

2pp

APR 3 1984

ID F-104 (Rev. 10-80)
Ref. IDM 0525 & RESL

UNITED STATES DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
RADIOLOGICAL AND ENVIRONMENTAL SCIENCES LABORATORY
SAMPLE RECORD SHEET

Non Routine ______
Routine X Urgent ______

Serial No. ______

Sample From: FOR FERMI-2
Collected By: OESTMANN
Date Submitted: August 15, 1983

Samples Received: K. M. Shields
Analysis Completed: 3-12-84
Notified: ______ Date: ______

Analyzed By: Shields/Nearhoof/Sorenson
Approved By: K. M. Shields KMS

Sample No.	Sample Date	Sample Hour	Sample Description	Anal. for	Inst. used	Quant. used	Date cntd.	Count time	Gross count	Bkgd.*	Net count		Result ±1σ* μCi/ml
			SPIKED LIQUID										
			SAMPLE FROM										
			RESL-ANALYZE										
			FOR H-3	H-3	LSC		10 29/83						1.65 E-2 ± 2.1 E-[illegible]
			Sr-89	Sr-89	α,β	10ml							1.89 E-4 ± 9.2 E-[illegible]
			Sr-90	Sr-90	α,β		3 8/84						3.8 E-5 ± 4.1 E-6
			GAMMA EMITTER	Co-60	ND B6B5	10ml	1 29/84						5.10 E-6 ± 2.7 E-7
				Cs-137									3.69 E-6 ± 1.9E-7
				Ce-144									5.12 E-6 ± 8.4E-7
			DECAY CORRECT										
			AS INSTRUCTED										
			To 8/16/83										

*Random uncertainties reported are 1 standard deviation, 1σ. small negative and other results ≤ 2σ are interpreted by RESL as including "zero" or as nondetected. If appropriate, estimates of possible systematic errors are reported in parentheses.

Note T.S + ODCM
are on shelf in Hall as of Jan 86
assembled by Monty

A/12

TABLE 1.2

OPERATIONAL CONDITIONS

CONDITION	MODE SWITCH POSITION	AVERAGE REACTOR COOLANT TEMPERATURE
1. POWER OPERATION	Run	Any temperature
2. STARTUP	Startup/Hot Standby	Any temperature
3. HOT SHUTDOWN	Shutdown#,***	> 200°F
4. COLD SHUTDOWN	Shutdown#,##,***	≤ 200°F
5. REFUELING*	Shutdown or Refuel**,#	≤ 140°F

#The reactor mode switch may be placed in the Run or Startup/Hot Standby position to test the switch interlock functions provided that the control rods are verified to remain fully inserted by a second licensed operator or other technically qualified member of the unit technical staff.

##The reactor mode switch may be placed in the Refuel position while a single control rod drive is being removed from the reactor pressure vessel per Specification 3.9.10.1.

*Fuel in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

**See Special Test Exceptions 3.10.1 and 3.10.3.

***The reactor mode switch may be placed in the Refuel position while a single control rod is being recoupled or withdrawn provided that the one-rod-out interlock is OPERABLE.

FIGURE 2.5-1 Gaseous Radwaste Effluent System

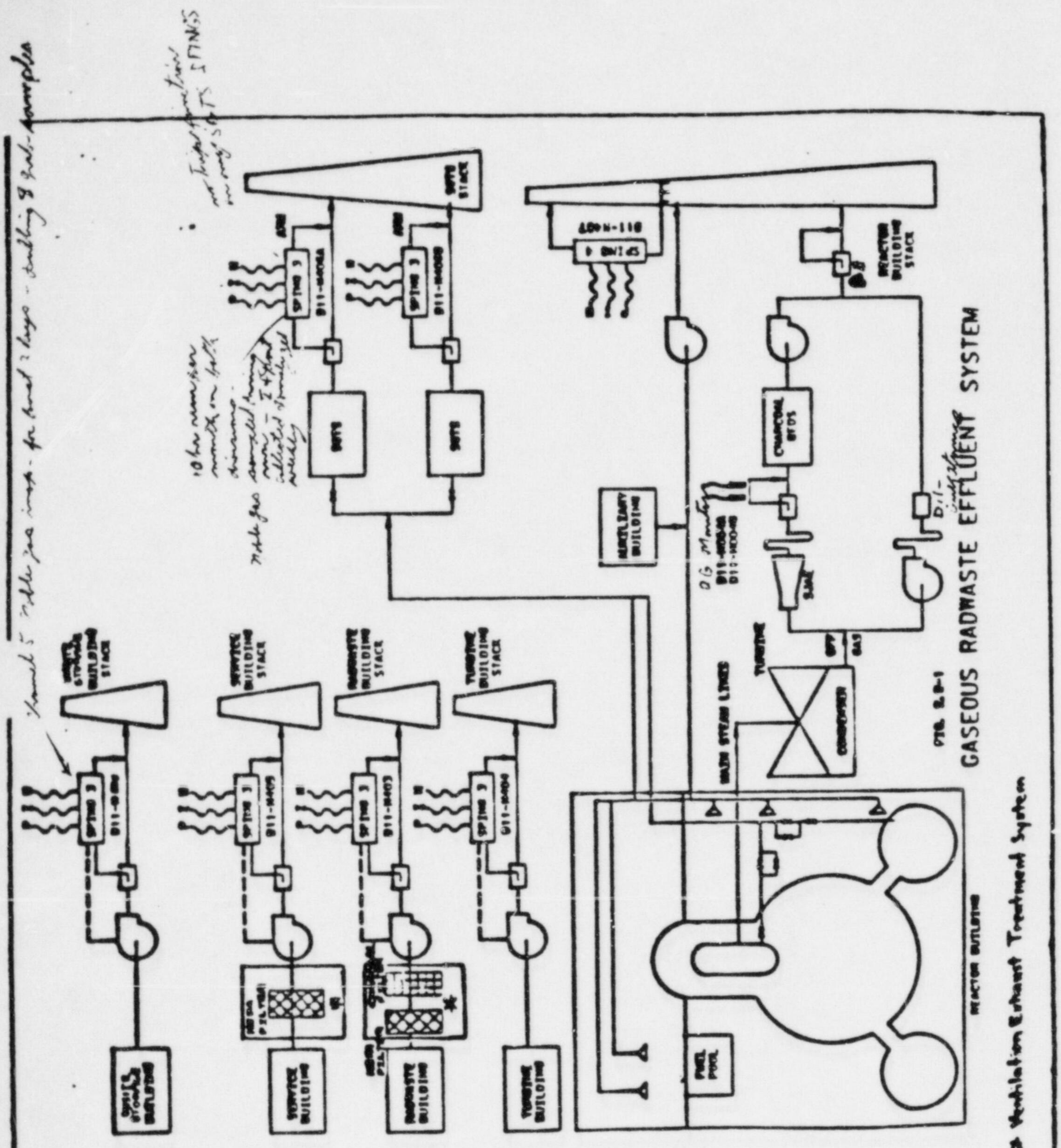
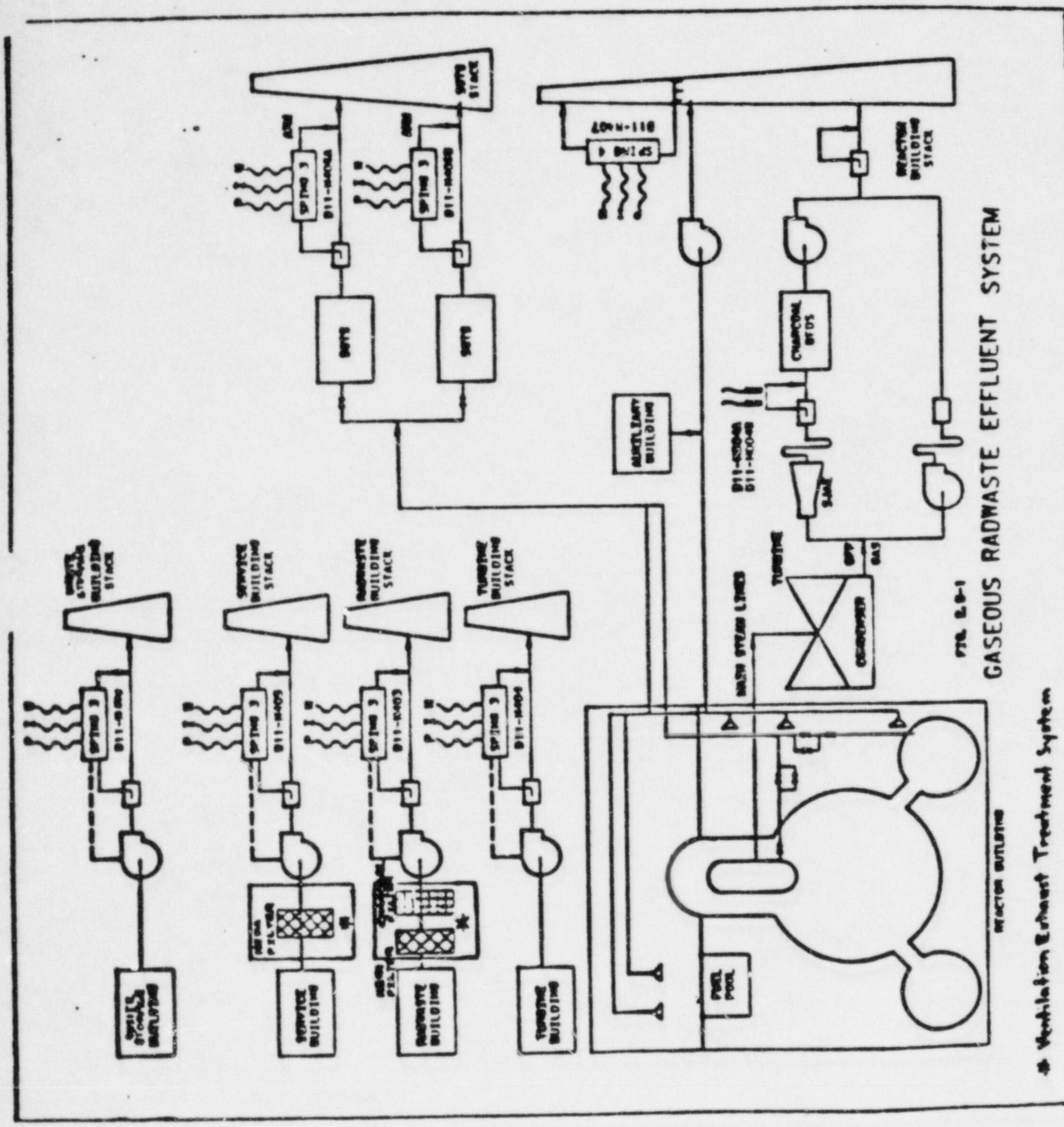


FIGURE 2.5-1 Gaseous Radwaste Effluent System



GASEOUS MONI[illegible] SUBSYSTEMS [illegible] PROCESS RADIATION MONITORING SYSTEM

PI # D11

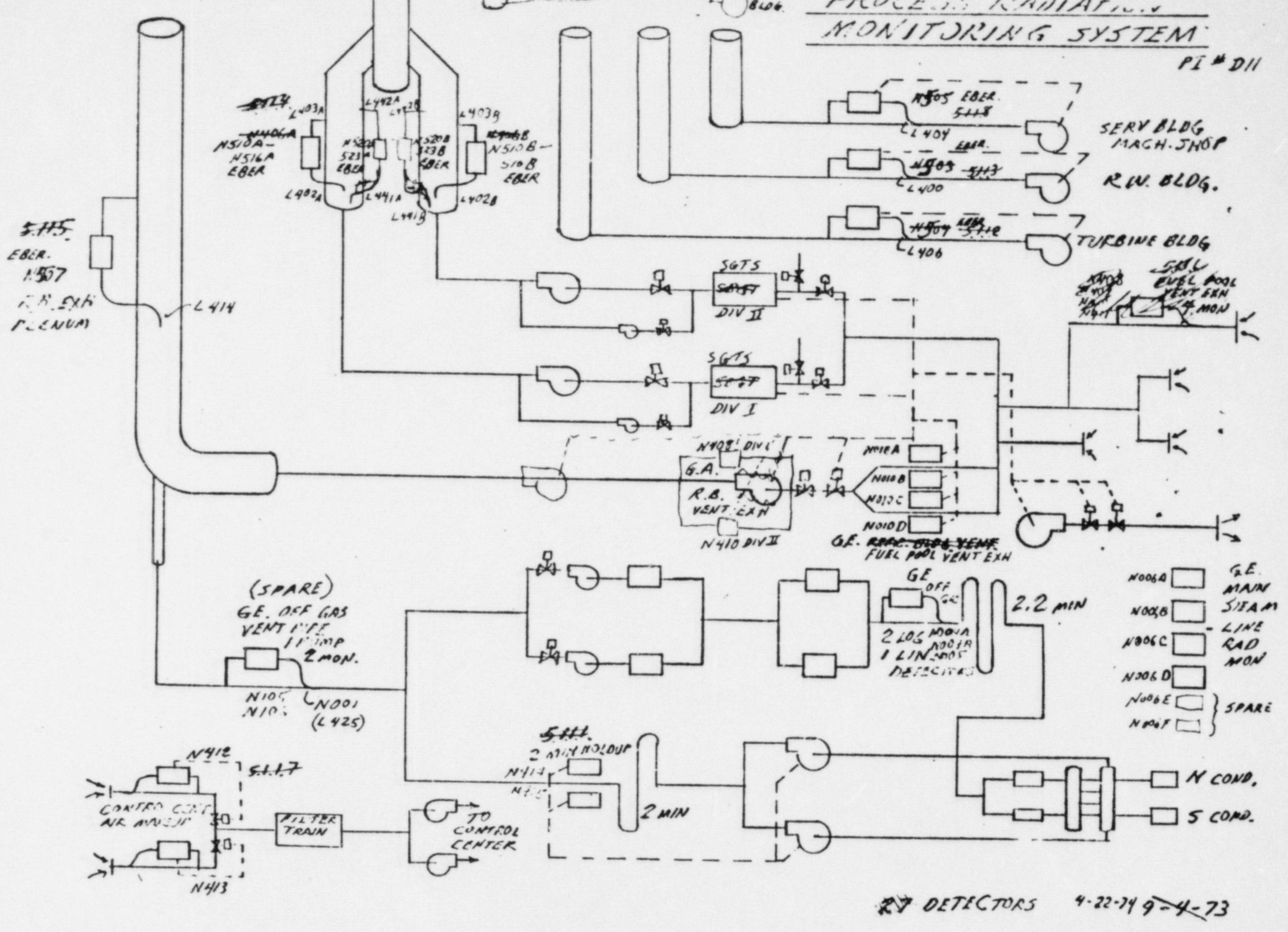
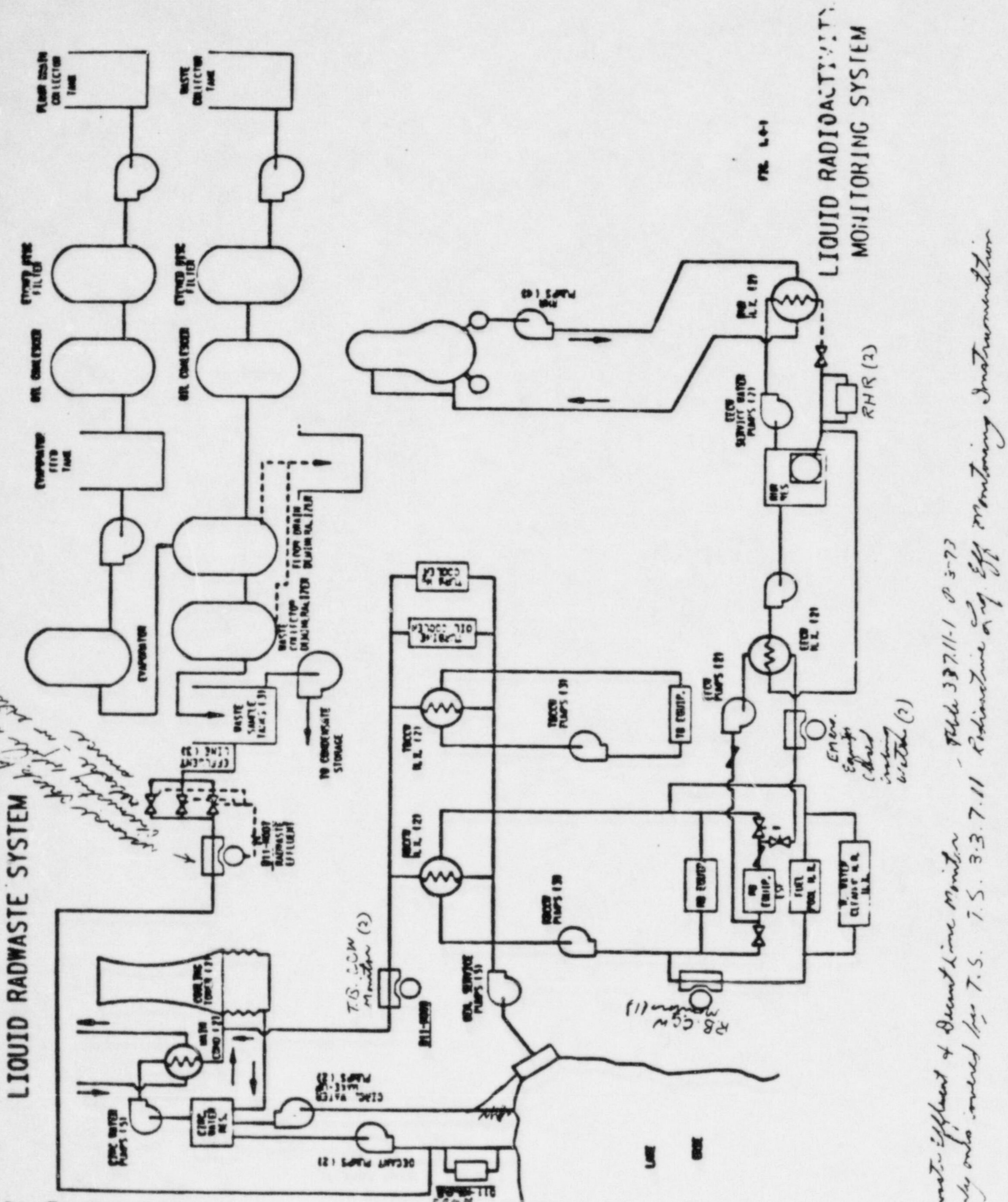


FIGURE 1.4-1 Liquid Radioactivity Monitoring System



FROM FERMI-2 ØI

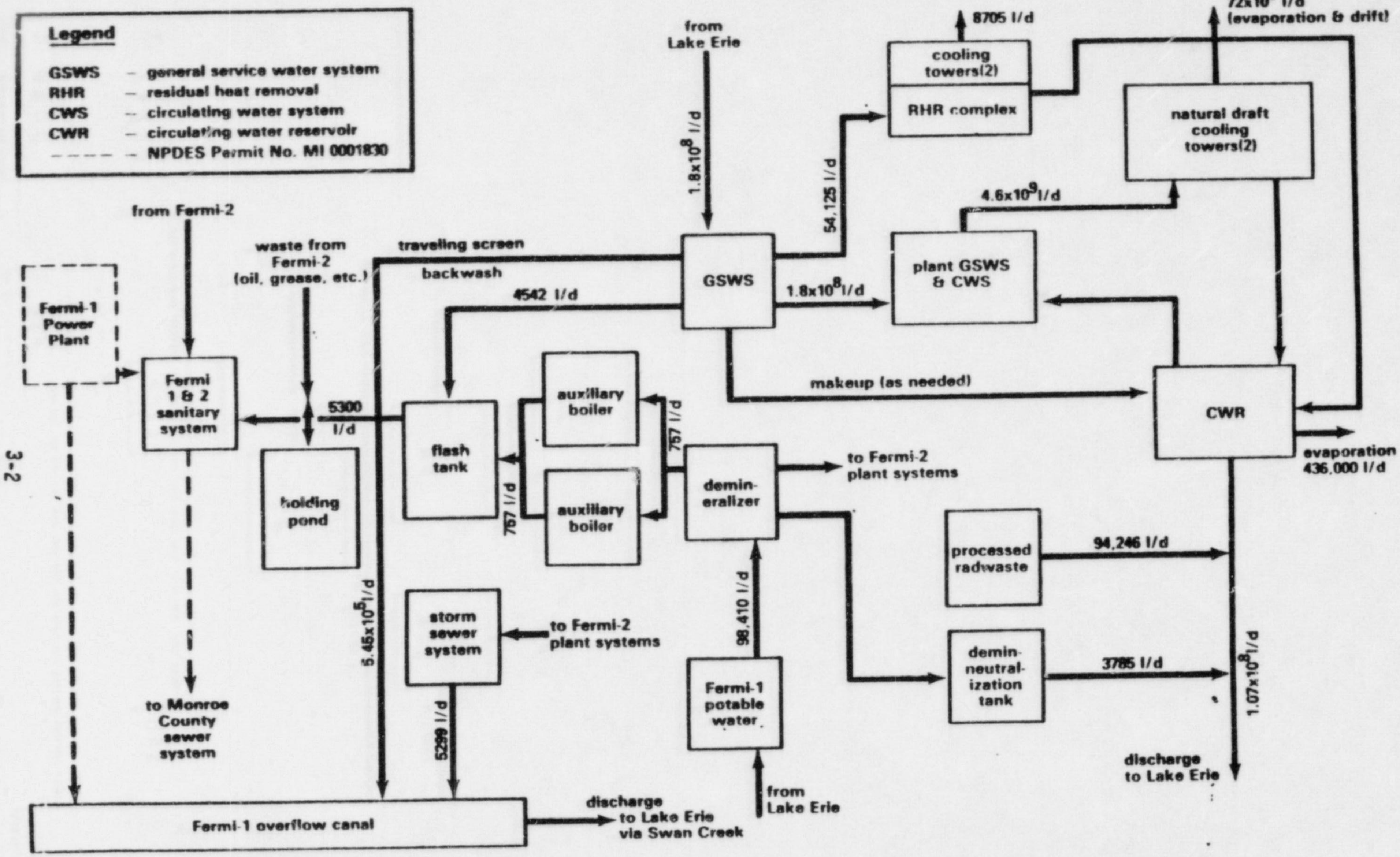
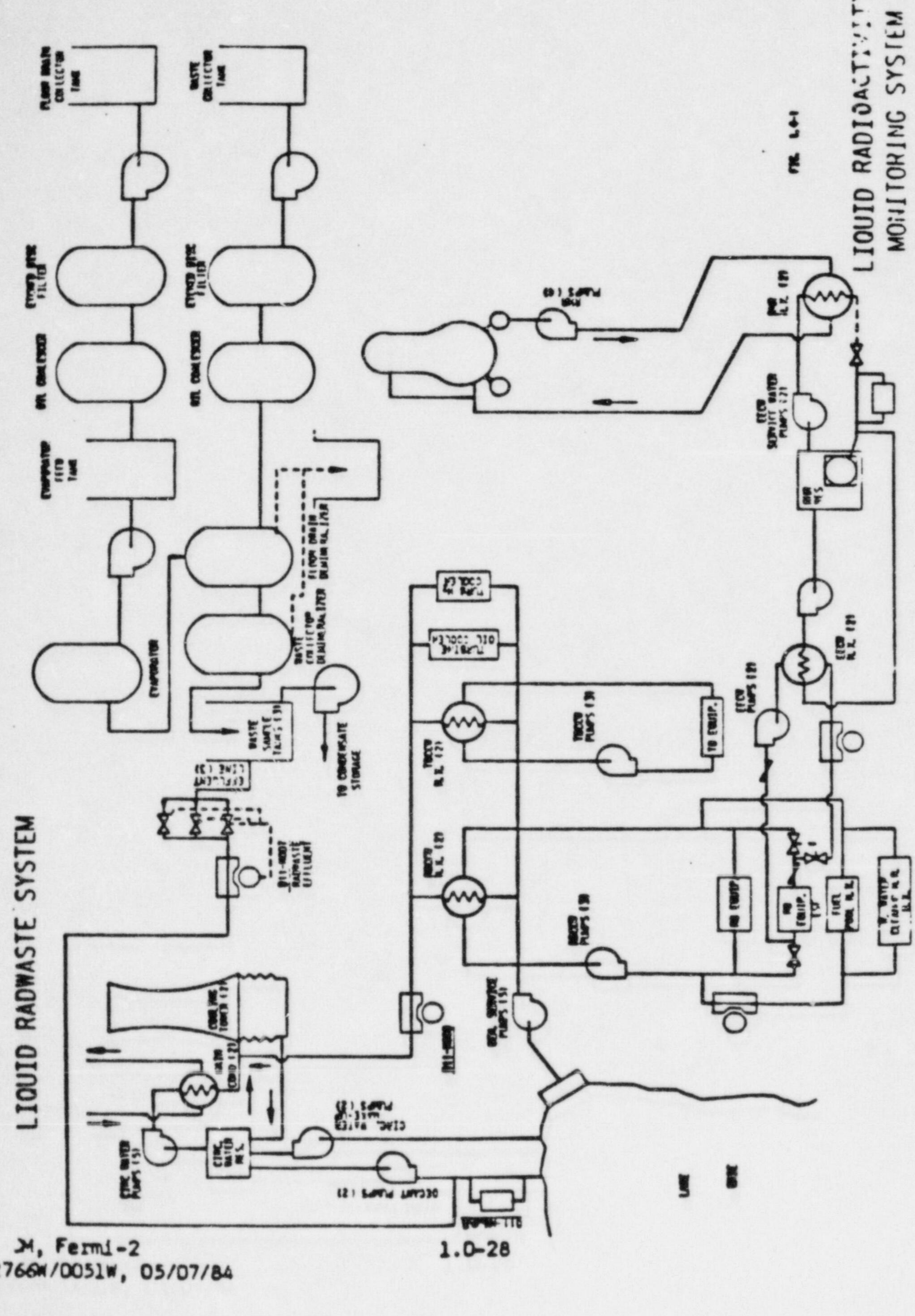


Figure 3.1 Schematic of proposed water flow daily averages (estimated)

FIGURE 1.4-1 Liquid Radioactivity Monitoring System



Wayne H. Jens
Vice President
Nuclear Operations

Detroit
Edison

Fermi 2
6400 North Dixie Highway
Newport, Michigan 48166
(313) 586-4150

August 22, 1984
EF2-72766

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood, Chief
Licensing Branch No.1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Youngblood:

Reference: Fermi 2
NRC Docket No. 50-341

Subject: Radiation Protection Manager (RPM) Qualifications

As you are aware, Edison has selected Mr. John Bobba as the new Fermi 2 Radiation Protection Manager. To document Mr. Bobba's qualifications, Edison is submitting the following information:

a) A comparison of Mr. Bobba's experience in the radiation protection field with the guidance contained in Regulatory Guide 1.8 (Attachment 1), and

b) A summary of Mr. Bobba's experience in both the naval and commercial nuclear industries (Attachment 2).

This information was previously discussed in a telephone conversation with the NRC staff reviewer (F. Skopec) on June 15, 1984. Based on the information provided, Mr. Skopec indicated that although Mr. Bobba's educational background did not completely conform with the guidance of Regulatory Guide 1.8, it appeared that his experience at commercial and naval nuclear plants did provide the desired background.

Mr. Bobba's experience will be appropriately documented in a forthcoming amendment to FSAR.

~~8408280149~~

8pp.

A113

Should you have any additional questions, please contact Mr. Keener Earle at (313) 586-4211.

Sincerely,

Wayne H. Jens

cc: Mr. P. M. Byron*
Mr. L. J. Hueter*
Mr. M. D. Lynch*
Mr. F. Skopec*
USNRC, Document Control Desk*
Washington, D.C. 20555

* With attachments

bcc: F. E. Agosti*
J. P. Bobba*
L. P. Bregni
W. F. Colbert*
O. K. Earle
W. R. Holland
R. S. Lenart*
E. Lusis
P. A. Marquardt
T. D. Phillips*
H. Tauber
G. M. Trahey
R. A. Vance
A. E. Wegele

Approval Control*
24th Floor Reading Room

O. K. Earle (Bethesda Office)*
M. S. Rager*
NRR Chron File*

* With Attachments

ATTACHMENT 1: REGULATORY GUIDE 1.8 COMPARISON

The discussion below provides a detailed comparison of Mr. John P. Bobba's qualifications with those suggested by Regulatory Guide 1.8.

The Radiation Protection Manager:*

"should be an experienced professional in applied radiation protection at nuclear facilities dealing with radiation protection problems and programs similar to those at nuclear power stations."

- As indicated below, Mr. Bobba has had significant experience in the radiation protection field at several different nuclear power stations in various modes of operation and shutdown.

"should be familiar with the design features and operations of nuclear power stations that affect the potential for exposures of persons to radiation."

- Mr. Bobba has seven years (1964-1971) of naval experience in which he dealt with the maintenance and operation of a naval (PWR) reactor during which he qualified as an Engineering Watch Supervisor and Engineering Laboratory Technician. In addition, Mr. Bobba has over four years (1971-1976) of design and systems (both primary and secondary) work with Stone and Webster Corporation. This experience has familiarized Mr. Bobba with the ALARA concerns considered in the initial design of plant systems. His operations experience with the navy and his subsequent work as an HP in operating and shutdown plants (over eight years experience) has provided him the knowledge necessary to properly implement a radiation protection program.

"should have the technical competence to establish radiation protection programs and the supervisory capability to direct the work of professionals, technicians and journeymen required to implement the radiation protection programs."

- The technical background delineated above, coupled with eight years (1976-present) of health physics (HP) experience at both operating (e.g., Connecticut Yankee) and shutdown (e.g., Calvert Cliffs, TMI, Peach Bottom) plants provide Mr. Bobba with the required background needed to establish and implement radiation protection programs. Throughout the twenty years (1964-present) Mr. Bobba has been involved in the naval and commercial nuclear industries, he has worked in numerous supervisory positions, overseeing the work of professionals, journeymen and technicians. Mr. Bobba was previously the Fermi 2 General Supervisor - Radwaste.

*The quoted passages are from the "Regulatory Position" portion of Regulatory Guide 1.8.

"should have a bachelor's degree or the equivalent in a science or engineering subject, including some formal training in radiation protection."

- Mr. Bobba has an associates degree in mechanical engineering technology. In addition, he attended naval technical schools, including the nuclear power school which involved HP courses as part of the curriculum.

"should have at least five years of professional experience in applied radiation protection. At least three years of this professional experience should be in applied radiation protection work in a nuclear facility dealing with radiological problems similar to those encountered in nuclear power stations, preferably in an actual nuclear power station."

- A summary of the work which Mr. Bobba has either supervised or been involved with is presented in Attachment 2. This summary indicates that he has spent eight years in the HP field and is qualified to develop and implement the Fermi 2 radiation Protection Program.

ATTACHMENT 2: SUMMARY OF WORK EXPERIENCES

10/82 - present	Fermi
5/82 - 9/82	Peach Bottom - provided station Health Physics coverage and station health physics supervision during RWCU HX repair, RWCU pump repair, torus modifications and other normal refueling and operational HP functions.
1/82 - 3/82	Salem Nuclear Power Station - Contractor HP Supervisor - for Aux. Bldg for Unit 1 outage and Unit 2 operation
4/81 - 12/81	Peach Bottom - provided station Health Physics coverage and Contractor HP supervision during sparger removal, recirculation pump motor replacement, torus modifications, and other normal refueling functions.
2/81 - 4/81	Nine Mile Point Unit 1 - provided project supervision and functioned as an assistant to the HP supervisor during an extensive up grading of the station Health Physics program responsible for RWP compliance auditing, contractor HP technicians, overall controlled area decontamination, torus desludging, laundry and other health physics functions normal to an operational power station.
11/80 - 2/81	Calvert Cliffs Nuclear Power Station - provided station HP coverage during a back to back two unit refueling and maintenance outage.
7/80 - 10/80	Nine Mile Point Unit 1 - provided Health Physics consulting services to Chicago Bridge and Iron during torus saddle installation. Responsibilities were to minimize the adverse impact caused by radiological procedures and insure adequate protection was afforded CBI workers. Functioned as a liaison between the station radiation protection department and CBI, implemented ALARA considerations throughout the project, supervised an ongoing cleanup/decontamination program thereby minimizing respiratory protection requirements.
7/80	Naval Reserve Active Duty - monitored submarine off-crew radiological control and chemistry training. Evaluated lecture content and instructor performance as required by Naval Reactors Branch, USN.
3/80 - 7/80	Peach Bottom Atomic Power Station - provided station HP coverage during refueling and extensive torus decontamination and structural modifications.

1/80 - 3/80	Maine Yankee Atomic Power Plant - provided station HP coverage during refueling and pipe restraint modifications.
11/79	Calvert Cliffs Nuclear Power Station - provided station HP coverage during refueling and pipe restraint modifications.
8/79 - 11/79	Yankee Rowe Atomic Power Plant - provided station HP coverage during fuel pool modifications and extensive feed system piping replacement.
7/79	Connecticut Yankee Nuclear Power Plant - provided station HP coverage during main coolant pump seal replacement during isolated loop operation.
6/79	Naval Reserve Active Duty - monitored USN radiological controls performance, conducted training seminars on civilian decontamination methods for USN radcon personnel, conducted seminars for USN medical personnel on decontamination procedures used to decontaminate people.
4/79 - 5/79	Three Mile Island - provided Project supervision and HP coverage during the initial decontamination of the Unit 2 Auxiliary and Fuel Handling building from 5R contamination levels down to 10^4 dpm contamination levels. Provided HP coverage during emergency cooling system piping modification in the fuel handling during the initial decontamination period.
3/79	Maine Yankee Power Plant - provided Project supervision and contractor HP coverage of decontamination of RHR spray building and cubicle areas.
2/79	Yankee Rowe Atomic Power Plant - provided Project supervision during decontamination of spent fuel pool.
1/79	Quad Cities Nuclear Power Station - provided Project supervision and contractor HP coverage during desludging and decontamination of Unit 1 torus.
12/78	Nine Mile Point Unit 1 - provided Project supervision during torus decontamination and desludging.
10/78	Vermont Yankee Atomic Power Plant - provided Project supervision and contractor HP coverage during decontamination of 50R reactor building floor drain system.
8/78	RG&E Ginna Nuclear Power Station - provided Project supervision and contractor HP coverage during sludge removal and decontamination of waste holdup tank.

6/78	Naval Reserve Active Duty - monitored USN radiological controls performance, coordinated overall efforts between two shipyards and USN personnel, including radiological controls during steam generator inspections and preoverhaul testing.
3/78 - 4/78	Millstone Unit 1 - provided station HP coverage of reactor drywell during refueling and extensive drywell ventilation system modification.
1/78 - 3/78	Vermont Yankee Atomic Power Station - provided contractor HP coverage during spent fuel pool rack decontamination and disposal operation.
10/77 - 12/77	Connecticut Yankee Atomic Power Plant - Provided station HP coverage and contractor shift supervision during refueling and pressurizer piping modifications.
6/77 - 9/77	James A. Fitzpatrick Nuclear Power Station - provided Project supervision and contractor HP coverage during extensive decontamination (including torus desludging).
4/77 - 5/77	Indian Point 2 - provided shift supervision and station HP coverage during extensive decontamination.
3/77	Yankee Rowe Atomic Power Plant - provided Project supervision and contractor HP coverage during spent fuel pool clean up operations.
2/77	Calvert Cliffs Nuclear Power Station - provided Project supervision and contractor HP coverage during reactor cavity decontamination.
10/76 - 12/76	James A. Fitzpatrick Nuclear Power Station - provided contractor supervision and HP coverage during decontamination procedural test on the reactor water clean up system.
5/76 - 7/76	Connecticut Yankee Power Plant - provided station HP coverage during refueling outage.
3/76	Pilgrim Nuclear Power Station
9/71 - 4/76	Stone & Webster Engineering Corporation - responsibilities consisted of system engineering on a project basis.
8/64 - 8/71	USN Nuclear Power Program - qualified Engineering Watch Supervisor and Engineering Laboratory Technician.

Education	Associate Degree, Mechanical Engineering Technology Lowell Technological Institute, Lowell, MA Miscellaneous Naval Technical Schools, including Nuclear Power School. Exceeds ANSI N18.1 and ANSI/ANS 3.1 - 1981 for qualification as a Health Physics Supervisor/Radiation Protection Engineer.

Docket No.: 50-341

MEMORANDUM FOR: Darrell G. Eisenhut, Director
Division of Licensing

THRU: Thomas M. Novak, Assistant Director
for Licensing
Division of Licensing

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

FROM: M. D. Lynch, Project Manager
Licensing Branch No. 1
Division of Licensing

SUBJECT: NRR SALP INPUT FOR FERMI-2

The NRR SALP Report for Fermi-2 for the period October 1, 1983 through September 30, 1984 is enclosed. This report is based primarily upon a survey of selected reviewers and SALP inputs which accompanied several SER Inputs.

Fermi-2 received a rating of Category 2 for this period; for the previous period of October 1, 1982 to September 30, 1983, Fermi-2 had also received a Category 2 rating. While the ratings are the same, Fermi-2 did improve its overall performance with the exception of its resolution of the fire protection issue.

M. D. Lynch, Project Manager
Licensing Branch No. 1
Division of Licensing

Enclosures:
As stated

CONCURRENCES:

DL:LB#1	DL:LB#1	AD:DL
MDLynch:es	BYoungblood	TMNovak
/ /84	/ /84	/ /84

DIST:
Docket File
PRC System
LB#1 Rdg
MRushbrook
MDLynch
TMNovak

A/1/4

Docket No.: 50-341

MEMORANDUM FOR: C. E. Norelius, Director
Division of Reactor Projects
Region III

THRU: B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

FROM: M. D. Lynch, Project Manager
Licensing Branch No. 1
Division of Licensing

SUBJECT: NRR SALP INPUT - ENRICO FERMI ATOMIC POWER PLANT, UNIT 2

Enclosed is NRR input for the November 30, 1984 SALP Board meeting for Fermi-2. As discussed in the enclosure, our evaluation was conducted according to NRR Office Letter No. 44 dated January 3, 1984 and NRC manual chapter 0516, Systematic Assessment of Licensee Performance.

M. D. Lynch, Project Manager
Licensing Branch No. 1
Division of Licensing

Enclosure:
As stated

CONCURRENCES

DL:LB#1	DL:LB#1
MDLynch:es	BJYoungblood
/ /84	/ /84

DIST:
Docket File
LB#1 Rdg
PRC System
MDLynch
MRushbrook

ENCLOSURE

Docket No. 50-341

FACILITY: Enrico Fermi Atomic Power Plant, Unit 2

LICENSEE: Detroit Edison Company

EVALUATION PERIOD: October 1, 1983 to September 30, 1984

PROJECT MANAGER: M. D. Lynch

I. INTRODUCTION

This report contains NRR's input to the SALP review for Fermi-2. The assessment of the licensee's performance was conducted according to NRR Office Letter No. 44, NRR Inputs to SALP Process, dated January 3, 1984. This Office Letter incorporates NRC Manual Chapter 0516, Systematic Assessment of Licensee Performance.

II. SUMMARY

NRC Manual Chapter 0516 specifies that each functional area evaluated will be assigned a performance category (Category 1, 2 or 3) based on a composite of a number of attributes. The performance of the Detroit Edison Company in the functional area of Licensing Activities is rated Category 2.

III. CRITERIA

The evaluation criteria used in this assessment are given in NRC Manual Chapter 0516 Appendix, Table 1, Evaluation Criteria with Attributes for Assessment of Licensee Performance.

IV. METHODOLOGY

This evaluation represents the integrated inputs of the Licensing Project Manager (LPM) and those technical reviewers who expended significant amounts of effort on Fermi-2 licensing actions during the current rating period. Using the guidelines of NRC Manual Chapter 0516, the LPM and each reviewer applied specific evaluation criteria to the relevant licensee performance attributes, as delineated in Chapter 0516, and assigned an overall rating category (1, 2 or 3) to each attribute. The reviewers included this information as part of each Safety Evaluation Report transmitted to the Division of Licensing. The LPM, after reviewing the inputs of the technical reviewers, combined this information with his own assessment of licensee performance and, using appropriate weighting factors, arrived at a composite rating for the licensee. This rating also reflects the comments of the NRR Senior Executive assigned for a short period to prepare the Integrated Licensing Schedule. A written evaluation was then prepared by the LPM and circulated to NRR management for comments, which were incorporated in the final draft.

The basis for this appraisal was the licensee's performance in support of licensing actions that were either completed or had a significant level of activity during the current rating period. These actions were amendments to the FSAR, closing open issues and responding to generic letters.

V. ASSESSMENT OF PERFORMANCE ATTRIBUTES

The licensee's performance evaluation is based on a consideration of five of the seven attributes specified in NRC Manual Chapter 0516. These are:

-- Management Involvement and Control in Assuring Quality

-- Approach to Resolution of Technical Issues from a Safety Standpoint

-- Responsiveness to NRC Initiatives

-- Staffing (including Management)

-- Training and Qualification Effectiveness

For the remaining two attributes (enforcement and reportable events), no basis exists for an NRR evaluation for the functional area of Licensing Activities.

A. MANAGEMENT INVOLVEMENT AND CONTROL IN ASSURING QUALITY

During the present rating period, the licensee's management demonstrated active participation in licensing activities and kept abreast of all current and anticipated licensing actions. The licensee's management actively participated in an effort to work closely with the NRC staff to establish integrated schedules for resolving the open issues related to the licensing of the Fermi-2 facility. In addition, the management's involvement in licensing activities usually assured a timely response to the requirements of the Commission's rules. The licensee's management usually exercised good control over its internal activities and its contractors, and maintained effective communication with the NRC staff. The management's active participation was evident in its involvement in the issues of significant safety concerns. This was illustrated in DECO's management effort to resolve almost all of the environmental qualification matters and to clarify the role of DECO management in assuring the successful implementation of its alternative approach to the Independent Safety Evaluation Group (ISEG). Additionally, DECO management has encouraged frequent meetings and telephone conferences with the NRR staff on all safety-related issues. This is one of the stronger characteristics of DECO management.

However, DECO management appeared to be not in full control of implementing the matter of fire protection for the Fermi-2 facility. Specifically, the NRR staff requirements for fire protection as published in January 1982 in Supplement No. 2 to the SER apparently were not fully implemented at the time of the on-site fire inspection in May 1984. Moreover, the placement of intervening combustibles in the relay room between the redundant divisions appears to be inconsistent with the Commission's rules on this matter. It should be noted in this regard, that there has been some confusion regarding the proper interpretation of the Commission's rules on fire protection. It is NRR's position that DECO management should have sought clarification on its own initiative if there was any doubt regarding such a vital matter. Additionally, the implementation of the NRR staff requirements regarding the control room panels as stated in SSER No. 2 was not properly executed, reflecting a lack of management involvement in this sensitive area.

On the basis of these observations, a rating of 2 is assigned to this attribute.

B. APPROACH TO RESOLUTION OF TECHNICAL ISSUES FROM A SAFETY STANDPOINT

The licensee's management and its staff have demonstrated sound technical understanding of issues involving licensing actions. Its approach to resolution of technical issues has demonstrated technical expertise in all technical areas involving licensing actions. The decisions related to licensing issues have usually exhibited conservatism in relation to significant safety matters. The licensee's frequent visits to the NRC and sound communications during the rating period assured sound technical discussions regarding resolution of safety issues. During the rating period, the licensee effectively resolved complex technical issues, including fire protection, Technical Specifications, and responses to NUREG-0737, Supplement 1 items.

On a number of occasions, when the licensee deviated from the staff guidance, the licensee has provided good technical justification for such deviations. The program for environmental qualification of equipment is a good example illustrating the soundness of the technical justifications for deviations. However, on a number of other issues relating to the safety-related instrumentation and controls and the use of unqualified coatings inside containment, the NRR staff felt obliged to provide additional guidance and seek clarification through a series of telephone conference calls and meetings. This was especially evident in the series of meetings held on June 5, July 10, September and November 2, 1984, on the matter of fire protection. (The last meeting, though outside the reporting period, is mentioned for completeness.)

Based on the above discussion, an overall rating of 2 is assigned to this category.

C. RESPONSIVENESS TO NRC INITIATIVES

The licensee has been responsive to NRC initiatives. During the rating period, it has made a significant effort to satisfy the Commission's rules, including compliance with the rules related to fire protection and environmental qualification of safety-related electrical and mechanical equipment. While there may have been differences between the NRR staff and the licensee regarding the appropriate approach to resolve technical issues as discussed in Item B above, the licensee has consistently demonstrated a high degree of responsiveness to the NRR staff's initiatives in all matters. As an example of this, the licensee made frequent visits to the NRC to discuss the forthcoming requests for staff actions prior to formal submittals. This approach has been found to be beneficial to both the staff's and licensee's efficiency in processing such actions.

Based on the above considerations, an overall rating of 1 is assigned to this attribute.

D. Enforcement

No basis exists for an NRR evaluation of this attribute.

E. REPORTABLE EVENTS

No basis exists for an NRR evaluation of this attribute.

F. STAFFING

As a result of NRR review of the licensee's shift staffing for the facility, the staff found that the licensee complied with the requirements of NRC regulations. As an example, the licensee has 40 SRO's and RO's qualified for the Fermi-2 facility, 39 of whom passed their qualifying examination on the first try. The addition of five Shift Operating Advisors (SOA) so that each shift would have an SOA experienced in operating a similar nuclear power plant, was a commendable effort by the licensee especially in light of the fact that each of the SOA's holds an SRO for the Fermi-2 facility. Furthermore, the licensee has maintained sufficient licensing staff to assure reasonably timely responses to the NRR staff requests for additional information.

Based on the above considerations, a rating of 1 is assigned to this attribute.

G. TRAINING AND QUALIFICATION EFFECTIVENESS

The licensee's training program is judged to be uniformly well-executed as evidenced by the performance of its SRO's and RO's in their licensing examinations. The same comment applies to the performance of the five SOA's who all received their Fermi-2 SRO licenses when first examined.

Based on the considerations cited above, a rating of 1 is assigned to this attribute.

VI. CONCLUSION

An overall performance rating of 2 has been assigned by the NRR SALP evaluation effort for the current rating period. It should be noted that this overall performance rating was significantly affected by the handling of the fire protection issue. Had this matter and other matters such as the use of unqualified coatings been better managed by the licensee, we might have been able to note an improvement in the licensee's overall performance.

SALP-6 10-1-84 → 6-30-85

DRAFT

This is the rewrite by ? of our SALP input (mid term)

B. Radiological Controls

The licensee is rated Category 2 in this area. This is the same rating as in the previous assessment period.

No violations were identified in this area. Management involvement, resolution of technical issues, and responsiveness to NRC issues have been satisfactory during the assessment period. Progress on open items and/or license conditions were generally addressed in a timely and acceptable manner.

The Board recommends . . .

C. Maintenance

The licensee is rated Category 2 in this area. The licensee was not rated in this area during the last assessment period.

No violations were identified in this area. Maintenance is controlled with well stated and understood programs, although the preventive maintenance (PM) program contains some weaknesses. The staff is knowledgeable and well trained. Some understaffing is evident which has resulted in a low completion rate of PM tasks. Management attention in this area appears to be weak as evidenced by the failure to evaluate or correct the low rate of completion of PM tasks.

The Board recommends the NRC inspection effort continue at normal levels with emphasis on the adequacy of the PM program.

A115

Radiological Controls

Fermi

a. Analysis

Licensee performance received a rating of 2 during the SALP 5 period which ended October 1, 1984. During the current abbreviated assessment period inspections were performed in November-December, 1984, (341/84043), ~~and~~ March 1985, (341/85017), and June 1985, to review the licensee's preparations for fuel load in the areas of radiation protection and radwaste; no violations or deviations were identified. No inspections of the confirmatory measurements or environmental monitoring programs occurred during this period.

It was determined that the licensee had satisfactorily completed activities required for a license to load fuel. However, four additional activities require completion ~~needed to be completed~~ before exceeding five percent power. These are covered by open items and/or licensee conditions. An additional item concerning operability of an interim solid radwaste system will require completion by the time of the warranty run.

Licensee progress on these remaining items has been generally satisfactory. Three of the items, involving operability of the permanent liquid radwaste system, operability of the post accident sampling system, and [illegible] ~~and installation of a collimator for the germanium detector used for post accident sample counting~~ are essentially completed and ready for ~~final~~ NRC review of preoperational procedure results. ~~Two items involving~~ heat tracing of the Standby Gas Treatment System sample lines ~~and~~ [illegible] Procedures and training for the effluent monitoring system quantification program are in progress and scheduled to be completed by

~~July 2, 1985~~ early July. The licensee ~~recently~~ has submitted a Process Control Program (PCP) covering operation of a vendor supplied interim solid radwaste processing system to NRR for approval.

The vendor system is [redacted] operational [redacted] and will be used upon NRC approval of the PCP, until completion of installation and testing of a permanent solid radwaste system.

Management involvement, resolution of technical issues, and responsiveness to NRC issues have been ~~satisfactory~~ good during this assessment period. Except for the effluent monitoring system quantification program training noted above, [redacted] licensee training has been completed. [redacted] Staffing levels and qualifications appear good.

b. <u>Conclusion</u>

The licensee is rated Category 2 in this area.

Wayne H. Jens
Vice President
Nuclear Operations

Detroit Edison

Fermi-2
6400 North Dixie Highway
Newport, Michigan 48166
(313) 586-4150

file

November 1, 1984
EF2-72006

Describes effluent system pathways (normal and post accident)

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: 1. Fermi 2
NRC Docket No. 50-341

2. Detroit Edison to NRC Letter, "Action Plan for Completing NRC Open Items Related to PRMS and PASS", EF2-70036 dated October 31, 1984.

3. USNRC Region III Inspection Report No. 50-341/84-27, dated August 10, 1984.

Subject: Clarification of Position Regarding NUREG-0737 Postaccident Sampling and Monitoring Capabilities

Dear Mr. Youngblood:

The reference (3) inspection report contains several items identified by the NRC Region III Facilities Radiation Protection Section which require clarification by Detroit Edison and your review and concurrence. These items, which relate to NUREG-0737 postaccident sampling and monitoring capabilities, are discussed in the attached Enclosures, as follows:

a. Enclosure 1: Sampling and Analysis of Plant Effluents

b. Enclosure 2: Containment High-Range Radiation Monitor

c. Enclosure 3: Postaccident Sampling Capability

Other items contained in the Inspection Report, relating to postaccident sampling and monitoring capabilities, are addressed in the referenced (3) letter submitted to NRC Region III.

~~8411060314~~

7pp.

A016

If you have any further questions please contact Mr. O. K. Earle (313) 586-4211.

Sincerely,

Enclosures

cc: Mr. P. M. Byron
Mr. C. Gill
Mr. L. Heuter
Mr. M. D. Lynch
USNRC, Document Control Desk
Washington, D. C. 20555

bcc: F. E. Agosti
R. L. Andersen
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R. A. Vance
A. E. Wegele
NOC Approval Control - ARMS Coding
O. K. Earle (Bethesda Office)
Secretary's Office
NRR Chron File

SAMPLING AND ANALYSIS OF PLANT EFFLUENTS

1. NRC COMMENT

NRC Region III made comments regarding the following items in Reference (3), relating to the sampling and analysis of plant effluents for post-accident release pathways, which should be referred to NRR for review (see Open Item 84-05-10):

(1) application of NUREG - 0737 design basis shielding source term (100 µCi/cc of gaseous radioiodine and particulates, deposited on Sampling Media, 30 minutes sampling time, average gamma energy (E) of 0.5 MeV);

(2) automatic vent fan trip function for the Reactor Building exhaust plenum monitor;

(3) demonstration of isokinetic representative sampling capabilities with regards to post-accident sampling of radioactive iodines and particulates;

(4) sample line heat tracing to accommodate post-accident gaseous effluent conditions; and

(5) empirical determination or use of sample line loss correction factors for iodines and particulates.

2. CLARIFICATION

There are five gaseous effluent release pathways at the Fermi 2 Plant which include:

(1) Radwaste Building Ventilation Exhaust;

(2) Turbine Building Ventilation Exhaust;

(3) Service Building Ventilation Exhaust;

(4) Reactor Building Exhaust Plenum; and

(5) Standby Gas Treatment System, (SGTS).

The Radwaste Building Ventilation Exhaust and the Turbine Building Ventilation Exhaust will trip and isolate on a high radiation signal, hence post-accident sampling will not be required for these pathways. See FSAR Sections 11.4.2.8.2.6, 11.4.2.8.2.7, and Detroit Edison Instrument Drawing No. 61721-2181-1 for details and design.*

The Service Building Ventilation Exhaust monitor detects activity which may occur from contaminated equipment that may be worked on in the machine shop. Post-accident source terms (design basis) can not occur for this effluent pathway. The gaseous activity in the exhaust is normally expected to be below detectable levels. In addition, a high radiation alarm will initiate a trip of the Service Building Ventilation fans and automatically close the isolation dampers, therefore, post-accident sampling will not be needed for this pathway. See FSAR Section 11.4.2.8.2.8 and Detroit Edison Instrument Drawing No. 61721-2181-1 for details and design.*

The Reactor Building Ventilation Exhaust Plenum has two process streams which discharge via this pathway, which are: (1) Off-Gas, and (2) Reactor Building Vent. The Off-Gas monitor detects activity which is attributed to fission product gasses produced in the reactor and transported in the steam through the turbine to the condenser. Since a turbine trip will occur post-accident, this process stream will not contain significant activity. See FSAR Section 11.4.2.8.2.2 and DECo Instrument Drawing No. 61721-2181-1. The reactor building vent process stream contains activity vented from the drywell and fuel pool vent (the fuel pool vent monitors are upstream of the reactor building vent monitors). Both the Reactor Building Ventilation monitors and the fuel pool vent monitors start the SGTS, close the primary containment vent valves, trip and isolate the Reactor Building Vent system, isolate the control center, and initiate emergency recirculation upon a high-high radiation alarm. Hence these effluent streams are routed to the SGTS post-accident. See FSAR Section 11.4.2.8.2.4, 11.4.2.8.2.11, DECo Instrument Drawings 61721-2181-1, and 41721-2610-17 for details and design.* Therefore, post-accident sampling is not required for the Reactor Building Ventilation Exhaust Plenum.

3. CONCLUSION

The NRC comments regarding the capability for post-accident sampling and analysis of the effluent pathways are applicable only to the SGTS for the Detroit Edison Fermi 2 Plant design.

See Fermi-2 Supplement No. 5 (NUREG-0798) dated March 1985

*Drawings are attached to cc copies of letter for information.

CONTAINMENT HIGH-RANGE RADIATION MONITOR

1. NRC COMMENT

The NRC Region III made the comment in Reference (3) regarding certification of calibration of each Containment Area High Radiation Monitor System (CAHRMS) detector in the decade of range between 10^2 R/HR and 10^3 R/HR, which should be referred to NRR for review (see Open Item 84-05-06).

2. CLARIFICATION

Detroit Edison has certified the CAHRMS for each detector at two points, 10 R/HR and 50 R/HR. The detectors were not certified at 10^3 R/HR. A type test was performed by General Atomics at ranges in excess of 10^6 R/HR. Detroit Edison has performed an in-situ source calibration for each detector, at two points, 1 R/HR and 10 R/HR. Futhermore, Detroit Edison has performed an in-situ electronic calibration for the CAHRMs using electronic signal substitution for all range decades (10^0-10^8 R/HR). These calibrations are considered by Detroit Edison to be adequate to demonstrate the capability of the CAHRMs to qualitatively indicate core damage during and following a postulated design-basis accident.

3. CONCLUSION

The above measurements should assure functional capability of the detector. An in-place test at 10^3 R/HR is not consistent with ALARA considerations. Currently Detroit Edison has no plans for a 10^3 R/HR certification and requests NRR concurrence with this position.

POSTACCIDENT SAMPLING CAPABILITY

1. NRC COMMENT

In Reference (3), NRC Region III made comments to be referred to NRR for review regarding the possible need for sample line heat tracing and determination of sample line loss correction factors for iodines and particulates for the Post Accident Sampling System (PASS) containment atmosphere sample line (see Open Item 84-05-07).

2. CLARIFICATION

Detroit Edison has noted the NRC Region III comments relating to containment atmosphere sample line heat tracing and sample line loss correction factors for iodine and particulates. The PASS provides the capability to promptly obtain reactor coolant and containment atmosphere samples, which are needed to determine the extent of core damage, during and following an accident in which there is core degradation.

The Detroit Edison procedure for determining core damage is based upon the assay of I-131 and Cs-137 in liquid samples and of noble gases in containment atmosphere samples. Quantitative assay of airborne radioactive particulates and airborne radioiodines in containment atmosphere samples is not required by procedure in order to determine the extent of core damage. The NRC staff has previously reviewed the PASS design and interim procedures, see SER, Supplement No. 2, Page 22-1 and Supplement No. 3, Page 22-3.

3. CONCLUSION

The NRC Region III concerns regarding containment atmosphere sample line heat tracing and determination of sample line loss correction factors for iodine and particulates are not considered applicable to the specific design and procedures of the Fermi 2 PASS. Detroit Edison's position is that no further modifications or evaluations are required and that the containment atmosphere sample line will be used only for obtaining noble gas samples for confirmation of liquid sample results and qualitative assessment of core damage.

Detroit Edison

Date: November 27, 1984
NENT - 84-191

To: R. L. Andersen
Nuclear Technology

From: J. M. Tozser
Nuclear Technology

Subject: Sample Line Loss Correction Factors for the SPING and AXM Sample Lines on the SGTS

A sample line loss calculation was performed for the SPING and AXM sample lines on the Standby Gas Treatment System (SGTS). Sample line losses are on the order of 10% for the total iodine plateout (excluding particulate) during normal operation. These data are summarized in the last table of the attached sample line loss calculation (Attachment 1). Based on these results a correction factor of 1.1 is recommended to be applied to the iodine sampler results.

The plateout for particulates was analyzed in "Post-Accident Sampling and Analysis at the Fermi 2 Plant," Appendix B (Attachment 2). The report concluded that sample line losses of the particulate may be neglected for both the AXM and SPING sample lines. Therefore, no correction factor is necessary for the particulate.

LBP/NT/R365/6.0
11/27/84

cc: T. L. Williamson
P. M. Harrigan

A/17

Attachment 1

SAMPLE LINE LOSS
CALCULATION

From Kabat [1], the deposition of iodine D_u per unit length of sample line is:

$$Du = \frac{V_g \times A_u \times R_u}{V_u}$$

A_u = internal surface area per unit of length (m)

R_u = residence time per unit of length (sec/m)

V_u = internal volume per unit of length (m^2)

V_g = deposition velocity constant (m/sec)

If the we let the internal radius be equal to R, then the following equations apply:

$A_u = 2\pi R$

$V_u = \pi R^2$

R_u = (sample line velocity) $^{-1} = \frac{\pi R^2}{V_f} \; \frac{60 \text{ sec}}{1 \text{ min}} \; \frac{1 \text{ liter}}{.001 \text{ m}^3}$

V_f = sample line volumetric flow rate (liters/min)

The residence time, R_u, becomes:

$$R_u = \frac{\pi R^2 (60)}{V_f (.001)}$$

The deposition equation can now be rewritten as:

$$D_u = \frac{Vg\ (2\pi R)}{\pi R^2} \quad \frac{\pi R^2(60)}{V_f(.001)} = \frac{V_g\ (2\pi R)\ (60)}{V_f\ (.001)}$$

$$= \frac{1.2 \times 10^5 \pi R V_g}{V_f}$$

R = internal radius (m)

V_g = deposition velocity constant (m/sec)

V_f = sample line volumetric flow rate (liters/min)

D_u = deposition of iodine per unit length (m^{-1})

Kabat[1] gives the fraction of iodine, D_L, deposited from the air sample at any length of L of the sampling line as follows:

$$D_L = 1 - e^{-D_u x L}$$

L = length of the sample line (m)

D_u = deposition of iodine per unit length (m^{-1})

D_L = deposition of iodine deposited (dimensionless)

Parameters for Fermi 2 sample lines characteristics on the SGTS are as follows:

	SPING SAMPLE LINES	AXM SAMPLE LINES
Material	Stainless Steel	Stainless Steel
Diameter	5/8" O.D.	3/8" O.D.
Wall Thickness	0.083 inches	0.049 inches
R	5.8293E-03 m	3.5179E-03 m
Line Length (Div I)	87'6"= 26.67 m	49'10"=15.1892 m
Line Length (Div II)	55'0"= 16.764 m	47'0" = 14.3256 m
V_f	60 liters/min	6 liters/min
Relative Humidity	97%	97%

Deposition velocity constants for the Fermi 2 sample lines will be estimated based on measured data taken from Table I of Kabat[1] for the three different forms of Iodine; (1) Elemental Iodine (I_2), (2) Hypoiodous Acid (HOI), and (3) Methyl Iodide (CH_3I). The assumed deposition velocity constants, V_g, for "non-cleaned surfaces" are as follows:

Iodine Form	V_g (m/sec)
I_2	1.6E-03
HOI	1.8E-05
CH_3I	8.0E-08

The deposition of iodine per unit length, D_u, can now be calculated. The results for the three different forms of iodine are as follows:

	SPING	AXM
D_u (I_2)	5.86E-02	3.54E-01
D_u (HOI)	6.59E-04	3.98E-03
D_u (CH_3I)	2.93E-06	1.77E-05

The fractions of iodine deposited through the entire sample line length (from the effluent stream to the sampler) for the three different forms of iodine are as follows:

	SPING		AXM	
	Div I	Div II	Div I	Div II
$D_L(I_2)$	0.790	0.626	0.995	0.994
D_L (HOI)	0.0174	0.0110	0.0586	0.0554
D_L (CH_3I)	7.81E-05	4.91E-05	2.69E-04	2.53E-04

In order to calculate the total iodine deposited in the sample lines, percentages of each of the chemical forms of iodine must be assumed. Data are available from the Monticello Nuclear Plant for the Standby Gas Treatment System. The Monticello percentages will be assumed to be typical of Standby Gas Treatment Systems. The most conservative percentages will be used from the EPRI Report [2] and are as follows:

Particulate	10.9%
I_2	8.8%
HOI	30.9%
Organic	49.4%

Since the Iodine Particulate is not of concern, (this calculation is being performed to determine correction factors for the iodine sampler, the particulates will have already been removed from the sample line.) only the three other forms of iodine will be considered. Normalizing these percentages yields the following:

I_2	9.9%
HOI	34.7%
Organic	55.4%

We will assume all the organic iodine is in the CH_3I form. The fraction of iodine deposited through the sample lines are as follows:

SPING (DIV. I)	8.4%
SPING (DIV. II)	6.6%
AXM (DIV. I)	11.9%
AXM (DIV. II)	11.8%

(1) M. T. Kabat, Deposition of Airborne Radioiodine Species on Surfaces of Metals and Plastics, Proceedings of the 17th DOE Air Cleaning Conference, 1982.

(2) EPRI NP-495, Sources of Radioiodine at Boiling Water Reactors, prepared by Science Applications, Inc., February 1978.

POST-ACCIDENT SAMPLING AND ANALYSIS AT THE FERMI-2 PLANT

Appendix B

Standard Line Loss Calculations

The calculations of this appendix follow the methods of ANSI N13.1-1969. Reference to "the standard" mean "ANSI N13.1-1969."

1. PASS line losses

   a. Conditions

   5/8" OD sample lines are 1/2" ID. This gives a line radius of r=0.635 cm, and a line cross-section of 1.267 sq. cm.

   Total line lengths are ~100 m for containment air.

   The flow rates are about 50 cc/sec during sampling, and 25 scfh during bypass.

   b. Turbulent deposition

   Using the higher flow rate, the velocity is:

   V = 25 cf/hr x 28320 cc/cf x 1 hr/3600 sec x 1/1.267 sq.cm

   = 155cm/sec

   The average Reynolds number in the tube is then:

   $$Re = D\, V \rho / \mu = (2 \times 0.635)(155)(0.0012)/(0.00018)$$

   $$= 1410$$

   At $Re \leq 2100$, flow is laminar, so turbulent losses are negligible.

   c. Gravitational settling

   As a typical particle, use one of 2 m diameter, density 2 gm/cc. The sample flow rate of 50 cc/sec is more favorable to gravitational settling, so it will be used.

   V = 50 (cc/sec) / 1.267 sq. cm = 40 cm/sec

The Cunningham slip correction may be approximated as:

$$K_m = 1 + \frac{2\ E\text{-}7\ m}{d_p} = 1 + \frac{2\ E\text{-}7}{2\ E\text{-}6} = 1.1$$

The Stokes settling velocity is then:

$$u_t = \frac{g\ d_p^2\ (\rho_p - \rho_a)\ K_m}{18 \times \mu} = 0.024\ cm/sec$$

Using the standard's equation for the distance required for 100% line loss by gravitational settling:

$$L_{100} = \frac{8\ r\ V}{3\ u_t} = \frac{8\ (.635)(155)}{3 \times 0.024} = 10900\ cm = 109\ m$$

The 50% loss distance is:

$$L_{50} = .354 \times L_{100} = 40\ m$$

Since the actual line lengths in PASS are about 100 meters, predicted gravitational losses are 50-100%.

d. Evaluate Brownian deposition at the sample flow rate of 50 cc/sec.

According Table B2 of the standard, even particles as small as 0.1 m require over 500 m to experience losses as large as 20% at this flow rate. Thus, the losses over even 100 m will be negligible.

e. Conclusion

Over lengths of ~100 m, the only significant loss mechanism is gravitational settling. However, gravitational losses are predicted to be 50 - 100%.

2. SPING line losses

a. Conditions

The same 5/8" OD lines are used, but the flow rate is a constant 60 liters per minute (LPM). Total line lengths to the various SPINGs range up to ~20 meters.

b. Turbulent deposition

Q = 60 liters per minute - 1000 cc/sec.

V = 1000 (cc/sec) / 1.267 sq. cm = 790 cm/sec

At 790 cm/sec, Re=6700, which implies turbulence.

The standard does not give equations for calculating turbulent deposition. But it does tabulate a similar case to this one: d=2 m; Re=6000; D=1 cm; Q-723 cc/sec. For this case,

If ρ=1, deposition in 20 meters is <1%.
If ρ=4, deposition in 20 meters is ~14%.

c. Gravitational settling

Using the equations and values of 1(c), with V=790, L(100)=560 meters. Thus, gravitational losses in 20 meters are insignificant.

d. Brownian deposition

Table B2 of the standard shows no significant losses of 0.1 m particles at 1000 cc/sec, over lines of hundreds of meters.

e. Conclusion

The only credible line loss mechanism in the SPING sample lines is turbulent deposition, but even these losses are conservatively predicted to be <20%. Therefore, line losses may be neglected for the SPINGs.

3. AXM grab sample pallet line losses

a. Conditions

The lines are 3/8" OD, or 1/4" ID, which gives a line radius of 0.318 cm, and a cross-section of 0.317 sq. cm. Nominal flow rate is 6 LPM=100 cc/sec. Line lengths to the grab sample pallets are less than about 15 meters. (Losses between the grab sample pallets and the monitors themselves are irrelevant.)

b. Turbulent depositon

Flow velocity V = 100 (cc/sec)/0.317 sq. cm = 315 cm/sec

This give Re=1340, which implies laminar flow. Thus, turbulent losses are insignificant.

c. Gravitational settling

Using the same equation with r=0.318 and V=315, gives L(100)=111 meters and L(50)=40 meters. Gravitional losses in 15 meters will be less than about 15%.

d. Brownian deposition

Table B2 of the standard shows no significant losses of 0.1 m particles at 100 cc/sec, over hundreds of meters.

e. Conclusion

Line losses to the AXM grab sample pallets are likely to be less than about 15%, which is acceptable.