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U. S. Nuclear Regulatory Commission  
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BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2  
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62  
REVISIONS TO PLANT EMERGENCY PROCEDURE

Gentlemen:

In accordance with 10 CFR 50.54(q) and 10 CFR 50, Appendix E, Carolina Power & Light (CP&L) Company is submitting OPEP-03.5.5, "Environmental Monitoring and Plume Tracking," Revision 4. CP&L has evaluated this revision, in accordance with 10 CFR 50.54(q), and has determined that it does not decrease the effectiveness of the Radiological Emergency Response Plan and the Plan, as changed, continues to meet the standards of 10 CFR 50.47(b) and the requirements of 10 CFR 50, Appendix E. A summary of changes is provided in Enclosure 1. Enclosure 2 contains a copy of the revised procedure.

There are no regulatory commitments being made in this submittal. Please refer any questions regarding this submittal to Mr. Michael Alford, Supervisor - Emergency Preparedness, at (910) 457-2286.

Sincerely,

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A045

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BSEP 00-0170 / Page 2

Enclosures:

1. Summary of Changes
2. Copy of Revised Procedure

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## ENCLOSURE 1

### BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2 DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62 REVISIONS TO PLANT EMERGENCY PROCEDURE

#### Summary of Changes

OPEP-03.5.5, "Environmental Monitoring and Plume Tracking," Revision 4, effective November 8, 2000:

1. Clarified instructions for obtaining air surveys, air samples, and expanded environmental samples;
2. Revised various forms and attachments to enhance usability of the procedure;
3. Deleted references to collecting particulate or iodine activity using Geiger-Müller tube graphs; and
4. Incorporated several editorial changes.

ENCLOSURE 2

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2  
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62  
REVISIONS TO PLANT EMERGENCY PROCEDURE

Copy of Revised Procedure



PLANT OPERATING MANUAL

VOLUME XIII

PLANT EMERGENCY PROCEDURE

UNIT  
0



**0PEP-03.5.5**

***ENVIRONMENTAL MONITORING AND PLUME  
TRACKING***

REVISION 4

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## 1.0 PURPOSE

The purpose of this procedure is to define the duties and responsibilities of the Environmental Monitoring Teams and provide guidelines for activities associated with the confirmation of offsite dose projections, plume tracking, and expanded environmental monitoring.

## 2.0 REFERENCE

- 2.1 OPEP-02.6.6, Environmental Monitoring Team Leader
- 2.2 OPEP-03.1.3, Use of Communication Equipment
- 2.3 OPEP-03.7.6, Emergency Exposure Controls
- 2.4 OPEP-03.7.7, Onsite Radiological Controls
- 2.5 OPEP-04.6, Radiological Emergency Kit Inventories
- 2.6 OE&RC-3101, Radiological Effluent Monitoring Program
- 2.7 EPA-400-R-92-001, Manual of Protective Action Guidelines and Protective Actions for Nuclear Incidents, USEPA, May 1992
- 2.8 AR-00022147, Assignment: 08-01, EMT Procedural Improvements

## 3.0 DEFINITIONS/ABBREVIATIONS

EMT(L) - Environmental Monitoring Team (Leader)  
CCPM - Calculated counts per minute (Sample Activity)

## 4.0 RESPONSIBILITIES

- 4.1 The Radiological Controls Manager is responsible for providing up-to-date assessments of the areas affected by radioactivity release into the environment.
- 4.2 The Environmental Monitoring Team Leader shall provide administrative and technical direction to Environmental Monitoring Teams during environmental monitoring activities.
- 4.3 Environmental Monitoring Teams shall perform environmental monitoring activities in accordance with direction provided by the Environmental Monitoring Team Leader.

## 5.0 INSTRUCTIONS

### 5.1 Activation

- 5.1.1 When properly notified the Environmental Monitoring Team shall:
1. Report to the EOF for accountability unless otherwise directed by the Environmental Monitoring Team Leader (EMTL).
  2. Obtain a vehicle and assemble at the environmental kit location.
  3. Obtain one Environmental Monitoring Emergency Kit and perform the following:
    - Kit inventory check (Verifying Seal intact, if not complete inventory necessary for dispatch)
    - Instrument operability and source response checks
    - Report deficiencies to the EMTL.
  4. Document dosimeter and TLD information on Attachment 1, Personal Dose Tracking Form, and inform the EMTL.
  5. Establish communications with the EMTL, report readiness status, and obtain briefings to include:
    - Priorities (plume tracking, dose projection confirmation, expanded monitoring, etc.)
    - Sample types
    - Locations
    - Frequency
    - Location to deliver samples for analysis
    - Radiological and meteorological conditions

### 5.2 General Activity Guidelines

- 5.2.1 A personal TLD and dosimeter **SHALL** be worn at all times. The dosimeter is to be read at a frequency determined by the EMTL and dependent on radiation intensities.

### 5.3 Plume Tracking

**NOTE:** Plume tracking is a dynamic activity with conditions constantly changing. Meteorological and radiological conditions must be constantly evaluated to anticipate and track a plume's path.

1. Radiation readings should always be taken while in transit to desired sample locations and during plume tracking activities by placing a radiation survey instrument near the vehicle windshield or window. Readings of  $\geq 0.2$  mr/hr should be documented, with location and time, and reported to the EMTL.
2. Attempt to identify the edges and centerline of a plume by traversing the plume at right angles to the direction of plume travel. Specific direction will be provided by the EMTL.
  - Survey instrument readings of  $\geq 1$  mr/hr should establish the criteria necessary to define the edges of the plume.
  - Maximum survey readings should be the criteria used to identify the centerline of the plume.
  - Document times and specific locations of acquired data in the logbook.

#### **CAUTION**

Minimize time, to the extent possible, in the defined plume to reduce exposure (i.e., move to lower dose areas to read cartridges and filters)

- Notify the EMTL of plume tracking results.
3. At the discretion of the EMTL, return to the locations of maximum readings for air samples to determine centerline airborne activity.

## 5.4 Monitoring and Sample Collection

### CAUTION

Assume all emergency environmental samples collected are contaminated and exercise necessary precautions to prevent cross-contamination and personal contamination.

### CAUTION

Exercise care when operating electric samplers and portable generators in or around substations, water or damp areas.

### 5.4.1 Sample Labels

1. Each field sample taken shall be documented with sample labels completed and attached to the sample.
2. Complete a sample label for each sample with the following information (See Attachment 8).
  - Sample Control #
  - Sample Type
  - Origin/Location of the sample
  - Radiation reading and time of collection
  - Person taking sample

#### 5.4.1 Sample Labels

3. Air sample iodine cartridges and particulate filter sample labels should also include:
  - Sample duration (start, stop, total)
  - Sample volume
  - I-131 activity estimation

**NOTE:** The primary radiological monitoring process used for dose projection confirmation and plume tracking is a combination of area radiation surveys and air samples.

#### 5.4.2 Area Radiation Surveys

1. Area radiation surveys shall be taken initially at waist level (1 meter) to determine the presence of radioactive materials.
2. If the presence of radioactive material is indicated; open and closed window readings shall be taken at two distances from the surface:
  - Waist level ( $\approx$  1 meter); and,
  - 3" - 6" from the surface

**NOTE:** Open window measurements must be taken with the probe facing downward.

3. A minimum of two area radiation measurements shall be taken during the time air samples are being collected with the area sufficiently surveyed to ensure the measurement is representative for the location.
4. Document the survey results on Attachment 2, Dose Rate Survey Data.

### 5.4.3 Airborne Monitoring

#### CAUTION

Precautions should be taken to ensure a representative air sample is attained. Improper air sampler placement may interfere with accurate sample analysis. The sampler should be placed so as to prevent loose surface contamination from becoming airborne due to sampler exhaust or liquids coming into contact with the filter.

1. Air samples shall be collected to determine the presence and concentration of radioactive particulate and radioiodines.
2. Air samples should be taken using a 47 mm glass fiber particulate filter and a charcoal or silver zeolite cartridge.

**NOTE:** Silver zeolite cartridges should be used in place of charcoal cartridges when sampling in the presence of high noble gas concentrations.

**NOTE:** In the absence of silver zeolite cartridges, a charcoal cartridge may be used with the following caution; noble gases will be retained on the cartridge and slowly off-gas providing some indication based primarily on Rb-88.

**NOTE:** A ten minute sample provides sufficient volume to meet the  $10^{-7}$   $\mu\text{Ci/cc}$  minimum detectable limit for I-131.

3. Collect a 30 ft<sup>3</sup> air sample  $\pm$  10 %. (Any deviation in sample duration or volume must be directed by the EMTL.)
4. Record air sampler and collection information on a separate Airborne Monitoring Data (Attachment 3) sheet for each air sample collected.
5. Remove the particulate filter and iodine cartridge from the air sampler and place in separate, clean plastic bags.
  - Use forceps and/or gloves to prevent personnel or cross-contamination.

### 5.4.3 Airborne Monitoring

6. Conduct a field estimate of airborne I-131 and particulate activity by performing the following:

**NOTE:** Record all data on Attachment 3, Airborne Monitoring Data

- Locate, measure, and record background radiation levels for an area of relatively low background (using RM-14).
- Measure the initial activity (on contact readings) of the iodine cartridge (in the plastic bag) with an RM-14 by placing the probe against one flat surface of the cartridge and note the highest reading.
- Calculate the net (sample) activity by subtracting the measured background radiation from the highest measurement taken on the iodine cartridge and record data.

**NOTE:** If the activity at the second reading is within 25% of the initial measurement, it should be presumed that iodine is present, pending isotopic analysis. If the reading is not within 25% contact the EMTL.

- Obtain a second set of readings after 5 minutes of initial measurement and calculate the net (sample) activity for the filter and cartridge.
- Repeat the activity measurement process with the particulate filter.
- Plot the highest calculated sample activity (ccpm) against the calculated sample volume on Attachment 5, Iodine Activity with a Frisker, to determine the airborne concentration of radioiodines ( $\mu\text{Ci}/\text{cc}$ ) and record results.
- Plot the highest calculated sample activity (ccpm) against the calculated sample volume on Attachment 4, Particulate Activity with a Frisker, to determine the airborne concentration ( $\mu\text{Ci}/\text{cc}$ ) and record results.

### 5.4.3 Airborne Monitoring

7. Report all results to the Environmental Monitoring Team Leader.
8. Complete and attach a sample label to each of the particulate filter and iodine cartridge samples. (See Attachment 8, Sample Labels)

### 5.4.4 Collection of Soil Samples

**NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Soil samples should be obtained from an open noncultivated level area.
2. Outline a one square foot (1 ft<sup>2</sup>) area and clear away vegetation, rocks, litter, and other non-soil material.
3. Remove soil from the outlined area to a depth of two (2) inches.
4. Place the soil in a new clean container and leave open for at least five minutes to allow the sample to off-gas.
5. Obtain a radiation measurement using a survey instrument and record the data on the sample label.
6. Complete a sample label and attach to the sample.
7. Document the sample on Attachment 7, Environmental Sample Data, and report results to the EMTL.

### 5.4.5 Collection of Potable Water Samples

**NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Potable water samples should consist of at least a one-gallon sample of drinking water.

#### 5.4.5 Collection of Potable Water Samples

2. Flush all sample lines and rinse the sample container thoroughly.
3. Fill the sample container to overflowing and cap securely.
4. Obtain a radiation measurement of the sample using a survey instrument.
5. Complete a sample label and attach to the sample container.
6. Document sample data on Attachment 7, Environmental Sample Data, and report results to the EMTL.

#### 5.4.6 Collection of Surface Water Samples

**NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Surface water samples may be collected from the plant cooling water intake and discharge canal stationary automatic composite samplers. Locations are provided in E&RC-3101.
2. If the automatic composite samplers are operating, remove the collection container and fill a one-gallon sample container to overflowing and cap securely.
3. If the automatic composite samplers are not operating or a different body of water requires sampling, grab samples may be obtained by dipping a clean container into the water. A 1000 ml Tri-pour beaker with string is recommended.

**NOTE:** For snow and ice samples, to obtain an equivalent liquid sample of at least 500 mls, a 4-liter sample of snow, ice, etc. is needed.

4. Fill a one-gallon sample container with the dip samples to overflowing and cap securely.
5. Obtain a radiation measurement of the sample using a survey instrument.

#### **5.4.6 Collection of Surface Water Samples**

6. Complete a sample label and attach to the sample container.
7. Document the sample data on Attachment 7, Environmental Sample Data, and report results to the EMTL.

#### **5.4.7 Collection of Vegetation and Crop Samples**

**NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Gather a 12" x 12" bag packed full of leafy vegetables or other vegetation (no stems) as directed by the EMTL. The samples should be obtained from the top most portion of the vegetation and from an open area.
2. Place the sample in a sample container and obtain a radiation measurement with a survey instrument.
3. Do not seal the sample container for at least five minutes to allow the sample to off-gas.
4. Complete a sample label and attach to the sample container.
5. Document the sample data on Attachment 7, Environmental Sample Data, and report results to the EMTL.

#### **5.4.8 Expanded Environmental Monitoring**

1. Additional evaluation of offsite conditions is available via the collection of previously installed TLDs and stationary air sampler filters and cartridges.
2. Collect, replace, and supplement environmental TLDs as directed by the EMTL and in accordance with OE&RC-3101, which also contains the locations of the TLDs.
3. Collect filters/cartridges from the stationary air samplers as directed by the EMTL in accordance with E&RC-3101.

## **5.5 Deactivation**

5.5.1 When properly notified the Environmental Monitoring Team shall:

1. Return instruments to proper storage.
2. Inventory and reseal the Environmental Monitoring Emergency Kit(s) used during this activity per OPEP-04.6.
3. Return vehicle to designated area.

## **6.0 DIAGRAMS/ATTACHMENTS**

### **6.1 Diagrams**

None

### **6.2 Attachments**

- 6.2.1 Attachment 1, Personnel Dose Tracking Form
- 6.2.2 Attachment 2, Dose Rate Survey Data
- 6.2.3 Attachment 3, Airborne Monitoring Data
- 6.2.4 Attachment 4, Particulate Activity with a Frisker
- 6.2.5 Attachment 5, Iodine Activity With a Frisker
- 6.2.6 Attachment 6, Collection of Environmental Samples
- 6.2.7 Attachment 7, Environmental Sample Data
- 6.2.8 Attachment 8, Sample Labels



**ATTACHMENT 2**  
**Page 1 of 1**  
**Dose Rate Survey Data**

DATE \_\_\_\_\_

Page \_\_\_ of \_\_\_

LOCATION/TIME					
1 METER READING OPEN WINDOW (mr/hr)					
1 METER READING CLOSED WINDOW (mr/hr)					
6" READING OPEN WINDOW (mr/hr)					
6" READING CLOSED WINDOW (mr/hr)					
INSTRUMENT TYPE/ SERIAL #					
TECHNICIAN					

ATTACHMENT 3  
Page 1 of 1  
**Airborne Monitoring Data**

Air Sample Collection Date: \_\_\_\_\_

Air Sample Location: \_\_\_\_\_

Air Sampler Serial Number: \_\_\_\_\_ Cal Due Date: \_\_\_\_\_

Air Sample Flow Rate (ft<sup>3</sup>/min.): \_\_\_\_\_

Air Sample Start/Stop Time: \_\_\_\_\_ / \_\_\_\_\_

Air Sample Volume (ft<sup>3</sup>): \_\_\_\_\_ (flow rate x time)

**Air Particulate Filter**

**Air Cartridge**

Sample Control #: \_\_\_\_\_

Sample Control #: \_\_\_\_\_

Background (cpm)	
Initial Reading (cpm)	
5-min Reading (cpm)/ Time: _____	
Net Activity (μCi/cc) (Attach. 4)	
Survey Meter No.: _____	
Serial No.: _____	
Cal Due Date: _____	

Background (cpm)	
Initial Reading (cpm)	
5-min Reading (cpm)/ Time: _____	
Net Activity/I-131 Est. (μCi/cc) (Attach. 5)	
Survey Meter No.: _____	
Serial No.: _____	
Cal Due Date: _____	

Technician: \_\_\_\_\_

Technician: \_\_\_\_\_

Sample Control #: AA-BB-CC-DD

AA - Environmental Monitoring Team # (01, 02, 03, etc.)

BB - Sample Type

CC - Sequential sample number

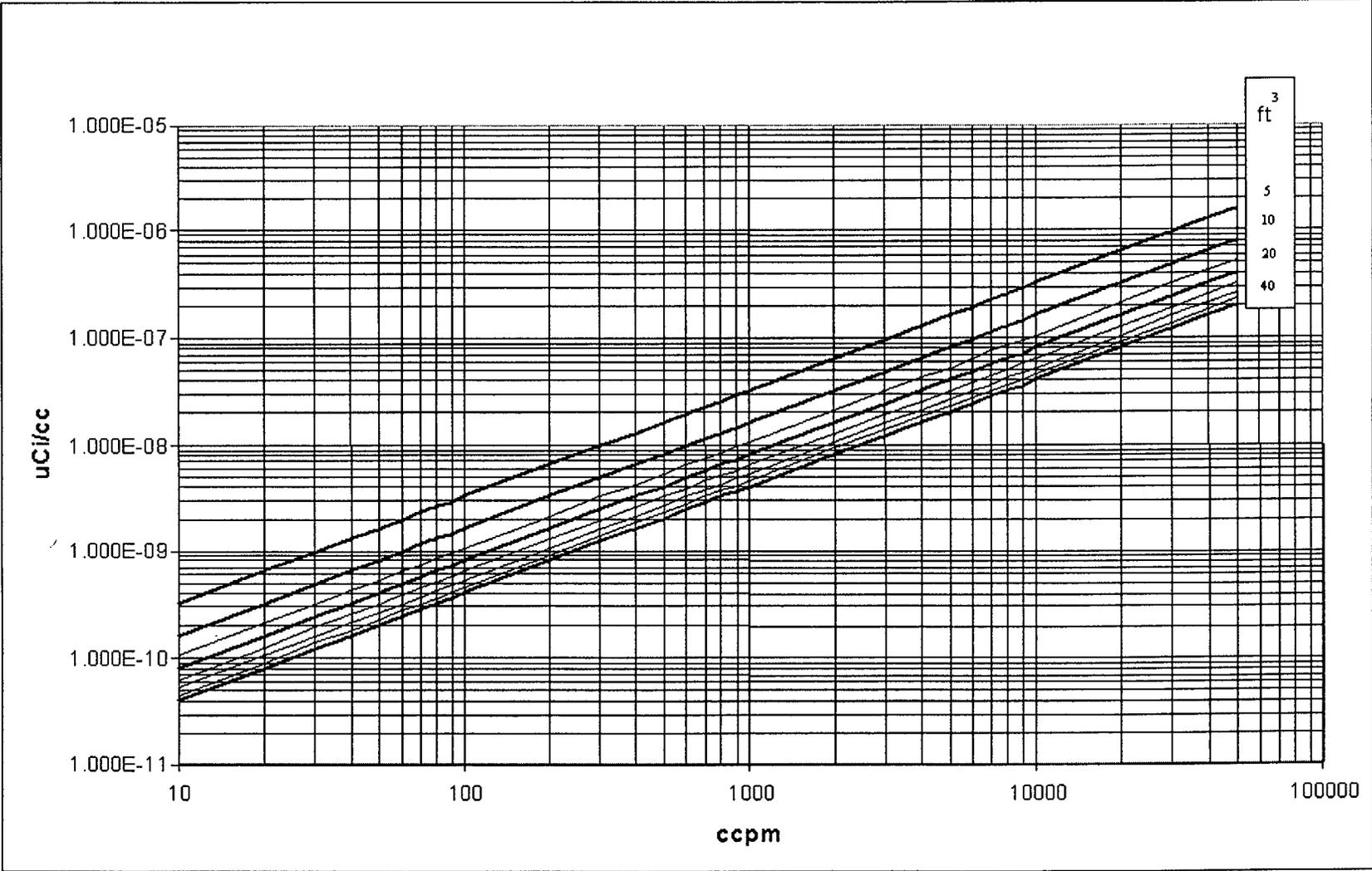
DD - Lab number

Sample Types

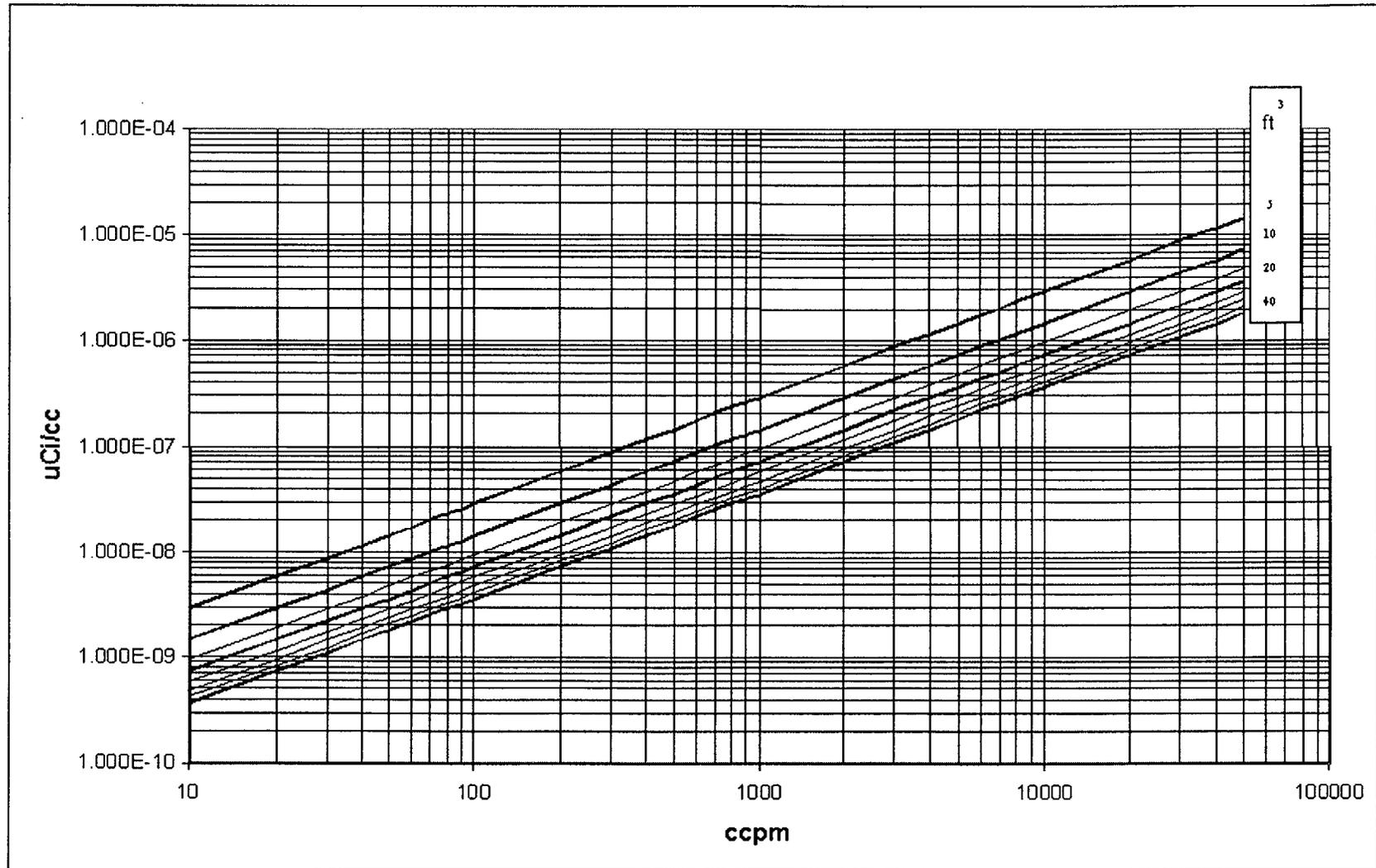
AP Air Particulate

AC Air Cartridge

ATTACHMENT 4  
Page 1 of 1  
Particulate Activity With a Frisker



ATTACHMENT 5  
Page 1 of 1  
Iodine Activity With a Frisker



ATTACHMENT 6  
Page 1 of 2  
**Collection of Environmental Samples**

SAMPLE TYPE	PRECAUTIONS	METHODS AND GUIDELINES
A. SOIL	<ol style="list-style-type: none"> <li>1. Assume <u>ALL</u> samples are contaminated and handle using techniques to prevent cross-contamination.</li> <li>2. <u>Do Not Seal</u> container of soil for at least five minutes. This will permit radon gases to off-gas.</li> </ol>	<ol style="list-style-type: none"> <li>1. When possible, select an open, level area for sampling.</li> <li>2. Clear <math>\approx 1 \text{ ft.}^2</math> area of vegetation, rocks, litter, and other nonsoil items.</li> <li>3. Mark out <math>\approx 1 \text{ ft.}^2</math> and remove soil within area to a depth of 2" (<math>\approx 5 \text{ cm}</math>).</li> <li>4. Place soil in container.</li> </ol>
B. POTABLE WATER	<ol style="list-style-type: none"> <li>1. Assume <u>ALL</u> samples are contaminated and handle using techniques to prevent cross-contamination.</li> </ol>	<ol style="list-style-type: none"> <li>1. Collect at least 1-gallon sample of drinking water.</li> <li>2. Flush sample lines and rinse sample container before filling.</li> <li>3. Fill container to overflowing and cap securely .</li> </ol>
C. SURFACE WATER	<ol style="list-style-type: none"> <li>1. Assume <u>ALL</u> samples are contaminated and handle using techniques to prevent cross-contamination.</li> </ol>	<ol style="list-style-type: none"> <li>1. Surface water samples from the plant cooling water and discharge structures may be collected from the automatic samplers.</li> <li>2. If samples are out-of-service, obtain a grab sample from boat, bridge, or shore. NOTE: More specific sampling instructions will be provided by the EMT Leader.</li> <li>3. Collect 1-gallon sample to overflowing and secure tightly.</li> </ol>
D. SNOW & ICE	<ol style="list-style-type: none"> <li>1. Assume <u>ALL</u> samples are contaminated and handle using techniques to prevent cross-contamination.</li> </ol>	<ol style="list-style-type: none"> <li>1. OBJECTIVE - Obtain the equivalent of at least 500 mls. of liquid for analysis. This will require a 4-liter sample of snow, ice, etc.</li> </ol>

ATTACHMENT 6  
Page 2 of 2  
**Collection of Environmental Samples**

SAMPLE TYPE	PRECAUTIONS	METHODS AND GUIDELINES
E. VEGETATION & CROPS	<ol style="list-style-type: none"> <li>1. Assume <u>ALL</u> samples are contaminated and handle using techniques to prevent cross-contamination.</li> <li>2. <u>Do Not Close or Seal Container</u> for at least five minutes to allow the sample to off-gas.</li> </ol>	<ol style="list-style-type: none"> <li>1. Obtain a 12" x 12" bag packed full of leafy vegetables and/or other vegetation (no stems) as directed by the EMT Leader.</li> <li>2. If milk is to be collected, collect samples of pasture grass as close to the roots as possible without including dirt in the sample.</li> <li>3. If possible, tree leaves should be sampled from topmost part of tree.</li> <li>4. Large, leafy vegetation is better than small.</li> <li>5. Ground covers should be selected from open areas.</li> </ol>
F. MILK	<ol style="list-style-type: none"> <li>1. Assume <u>ALL</u> samples are contaminated and handle using techniques to prevent cross-contamination.</li> </ol>	<ol style="list-style-type: none"> <li>1. Sampling should begin the day after an atmospheric release of radioactive material and every 2 days thereafter until levels of I-131 return to normal. NOTE: Peak Iodine (I-131) activity is expected on Day 3 following the release.</li> <li>2. If available, collect at least 1-gallon sample from a thoroughly mixed tank or from a single milk cow when available.</li> <li>3. Collect approximately 1000 grams of pasture grass and/or feed whenever milk samples are collected.</li> </ol>



ATTACHMENT 8

Page 1 of 1

Sample Labels

ENVIRONMENTAL SAMPLE LABEL

SAMPLE CONTROL # \_\_\_\_\_  
 SAMPLE TYPE \_\_\_\_\_  
 ORIGIN/LOCATION \_\_\_\_\_  
 \_\_\_\_\_  
 TAKEN BY \_\_\_\_\_ DATE/TIME \_\_\_\_\_  
 RADIATION LEVEL UPON  
 COLLECTION \_\_\_\_\_  
 TIME RECEIVED IN LAB/INITIAL \_\_\_\_\_  
 COMMENTS \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

AIR SAMPLE LABEL

SAMPLE CONTROL NUMBER \_\_\_\_\_  
 AIR SAMPLER \_\_\_\_\_ TAKEN BY \_\_\_\_\_  
 ORIGIN/LOCATION \_\_\_\_\_  
 \_\_\_\_\_  
 SAMPLE ON (DATE/TIME/INITIAL) \_\_\_\_ / \_\_\_\_ / \_\_\_\_  
 SAMPLE OFF (DATE/TIME/INITIAL) \_\_\_\_ / \_\_\_\_ / \_\_\_\_  
 TOTAL SAMPLE TIME (MIN) \_\_\_\_\_  
 FLOW (ft<sup>3</sup>min) \_\_\_\_\_ FINAL VOLUME \_\_\_\_\_ ft<sup>3</sup>  
 INITIAL RADIATION LEVEL \_\_\_\_\_ mR/HR TOTAL VOLUME \_\_\_\_\_ ft<sup>3</sup>  
 I-131 ACTIVITY ESTIMATE \_\_\_\_\_  $\mu$ Cl/cc  
 TIME RECEIVED IN LAB/INITIAL \_\_\_\_ / \_\_\_\_  
 COMMENTS \_\_\_\_\_

Sample Control # AA-BB-CC-DD

AA - Environmental Monitoring Team # (01, 02, 03, etc.)

BB - Sample Type

CC - Sequential sample number

DD - Lab number

Sample Types

AC	Air Cartridge	AP	Air Particulate	AV	Aquatic Vegetation
BO	Benthic Organisms	FC	Food Crops	FH	Fish
FO	Fodder or Feed	GW	Groundwater	MK	Milk
OY	Oysters	SD	Bottom Sediment	SH	Shrimp
SS	Soil	SW	Surface Water	TL	TLD
TV	Terrestrial Vegetation			ZO	Zooplankton

- Sample types must be very specific

• **REVISION SUMMARY**

Revision for OPEP-03.5.5,

- Corrected heading for Section 5.3.4
- Provided  $\pm 10\%$  as guidance per discussion with Chemistry staff. Deviation beyond that should be approved by EMTL to ensure ability to read info from appropriate graph.
- Revised instruction to eliminate vegetation collection weight which is not determined in field.
- Revised forms for collecting information for particulate and iodine cartridges.
- Revised guidance to measure background for instrument being used to obtain readings on cartridge.
- Revised attachment to collect instrument serial number and type for Environmental sample data.
- Provided clarification for conducting inventory check before dispatch and response check of instrumentation.
- Revised Estimated activity graphs, adding reference to AR-22147 which has new basis calculations.
- Deleted reference to collecting particulate or iodine activity using g-m tube instruments.