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United States
Environmental Protection
Agency
Office of Radiation Programs

Eastern Environmental
Radiation Facility
1890 Federal Drive
Montgomery, AL 36109

EPA
May 1988

Radiation

EPA

Environmental Radiation Ambient Monitoring System (ERAMS) Manual

VOLUME II

Sample Collection and Procedures Guide

EPA 520/5-84-008

Environmental

Radiation

Ambient

Monitoring

System

E R A M S MANUAL

VOLUME II

SAMPLE COLLECTION AND PROCEDURES GUIDE

May 1988

U.S. Environmental Protection Agency
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FOREWORD

This document explains in detail the operation of the Environmental Radiation Ambient Monitoring System (ERAMS). It is bound in loose-leaf format so that it may be updated as necessary.

Readers are encouraged to review the information and advise the EERF of inaccuracies and suggested changes. Please send your comments or suggestions to the following address:

Chief, Monitoring and Analytical Services Branch
Eastern Environmental Radiation Facility
1890 Federal Drive
Montgomery, Alabama 36109

Charles R. Porter, Director
Eastern Environmental Radiation Facility

1 AIR PARTICULATE SAMPLING

The ERAMS air stations are operated continuously and the filters are changed twice weekly. Field estimates of gross beta radioactivity are made and routinely submitted with the filters to the Eastern Environmental Radiation Facility (EERF).

At the EERF the air filters are again analyzed for gross beta radioactivity. Filters having greater than usual radioactivity are subjected to further analysis to more precisely determine the levels of different radioactive elements and to attempt to define the possible source of the activity. In addition, quarterly composites of air filters from each location are analyzed for plutonium and uranium.

1.1 Equipment

Equipment to operate the station is provided by the EERF. New and improved equipment is provided as it becomes available. Although some of the older equipment may still be in use, it will be replaced as it becomes inoperative. Most stations are now equipped with the following items:

- blower-motor assembly in weatherproof enclosure
- sampling head (attached to blower)
- survey meter with pancake Geiger-Mueller detector
- calibration source
- Magnehelic gauge(R) (attached to weatherproof enclosure)

1.2 Supplies

Each station is supplied with the following expendable items:

- 4" diameter air filters
- glassine envelopes

- ERAMS Air and Precipitation Report forms
- franked mailing envelopes

1.3 Replacement Items

Replacement equipment and supplies are provided by the EERF on receipt of the request form illustrated in Figure 1.1. Supplies may also be requested by telephone from the Chief, Monitoring and Analytical Services Branch (MASB), at (205) 272-3402 or FTS 534-7615.

1.4 Equipment Installation

The air sampling unit used by ERAMS to collect the air particulate sample is supplied complete and ready to install as seen in Figure 1.2. The unit can be plugged into any normal 110 VAC receptacle. If a receptacle is not available and must be installed, the work should be done by a certified electrician to meet local electrical codes. The receptacle Must Be Electrically Grounded for Safety. (NOTE: Although it is not mandatory, the blower-motor assembly can be bolted to a surface to achieve maximum stability of the unit.)

1.5 Maintenance

With proper maintenance, the unit should provide years of trouble-free operation. There is little maintenance required; however, the unit should be observed daily for proper operation. Unusual noises or excessive heat may be signs of impending problems. The unit should be kept clear of excessive dust or other materials that may prevent flow of cooling air.

1.6 Sampling Schedule

Air particulate sampling equipment is operated continuously, and filters should be removed and submitted either each Monday and Thursday

Figure 1.1

ERAMS EQUIPMENT AND SUPPLY REQUEST

Air Particulate Component

Requested by: _____

Date: _____

Station: _____

Address: _____

_____

Telephone: ( ) _____

☐ Mailing Envelopes

☐ Glassine Envelopes

☐ Filters

☐ Parts (specify)

☐ Franked Mailing Labels

☐ Report Forms

☐ Equipment (specify)

Comments: _____

_____

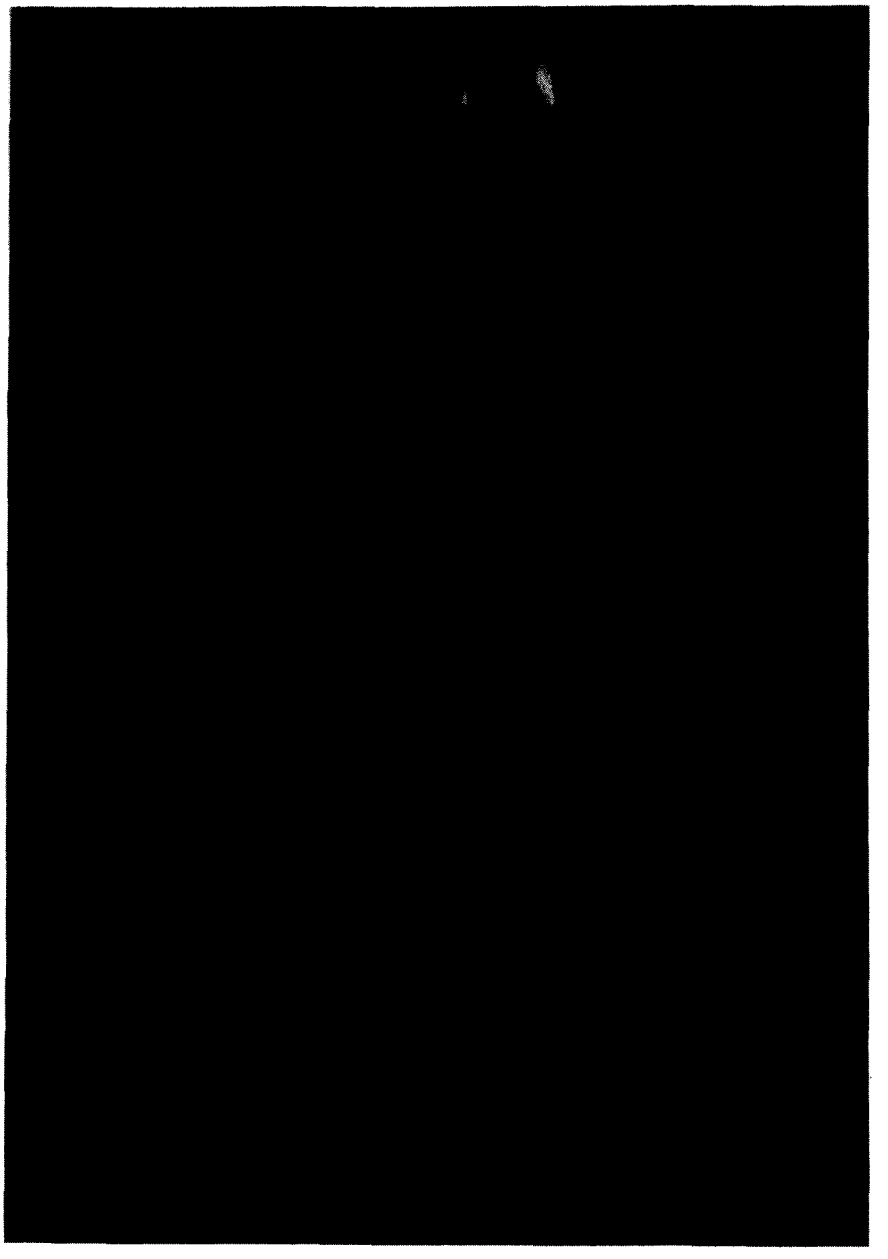
_____

Please return this form to the attention of:

Chief, Monitoring and Analytical Services Branch
Eastern Environmental Radiation Facility
1890 Federal Drive
Montgomery, Alabama 36109
(205) 272-3402; FTS 534-7615

Figure 1.2

Sampling Unit (external view)



morning or each Tuesday and Friday morning, whichever is more compatible with the station operator's normal work week.

1.7 Air Flow Measurements

Air flow measurements are made with the Magnehelic(R) gauge that is installed on the inside of the sampling unit door (Figure 1.3). The measurements are made immediately after the start and just prior to the end of the sampling period. The sampling unit must be located such that the Magnehelic(R) gauge is in an upright (vertical) position. It is necessary to connect the Tygon hose from the Magnehelic(R) gauge to the "push on" nipple on the filter head to make the reading. The connection should be made only for reading, and at all other times the tubing is removed and the nipple left open. The vacuum in the filter head is read on the Magnehelic(R) gauge in inches of water (Figure 1.4), which can be converted to air flow in cubic meters per hour.

The total air flow for the sampling period is obtained by averaging the initial and concluding air flows for the sampling period. The Magnehelic(R) readings in inches of water are converted to air flow in cubic meters per hour (CMH) using a table that is similar to Table 1.1 and/or a curve similar to Figure 1.5. A calibration table and a calibration curve are supplied with each sampling system, since calibration data are valid for only one particular head. An example calculation of total air flow, using data for sampling head 011 (see Table 1.1 and Figure 1.5), is shown below:

	Magnehelic (in. of water)	CMH
Initial reading	5.0	32.0
Final reading	4.2	29.2
Average flow rate		30.6 CMH

Figure 1.3

Sampling Unit (internal view)

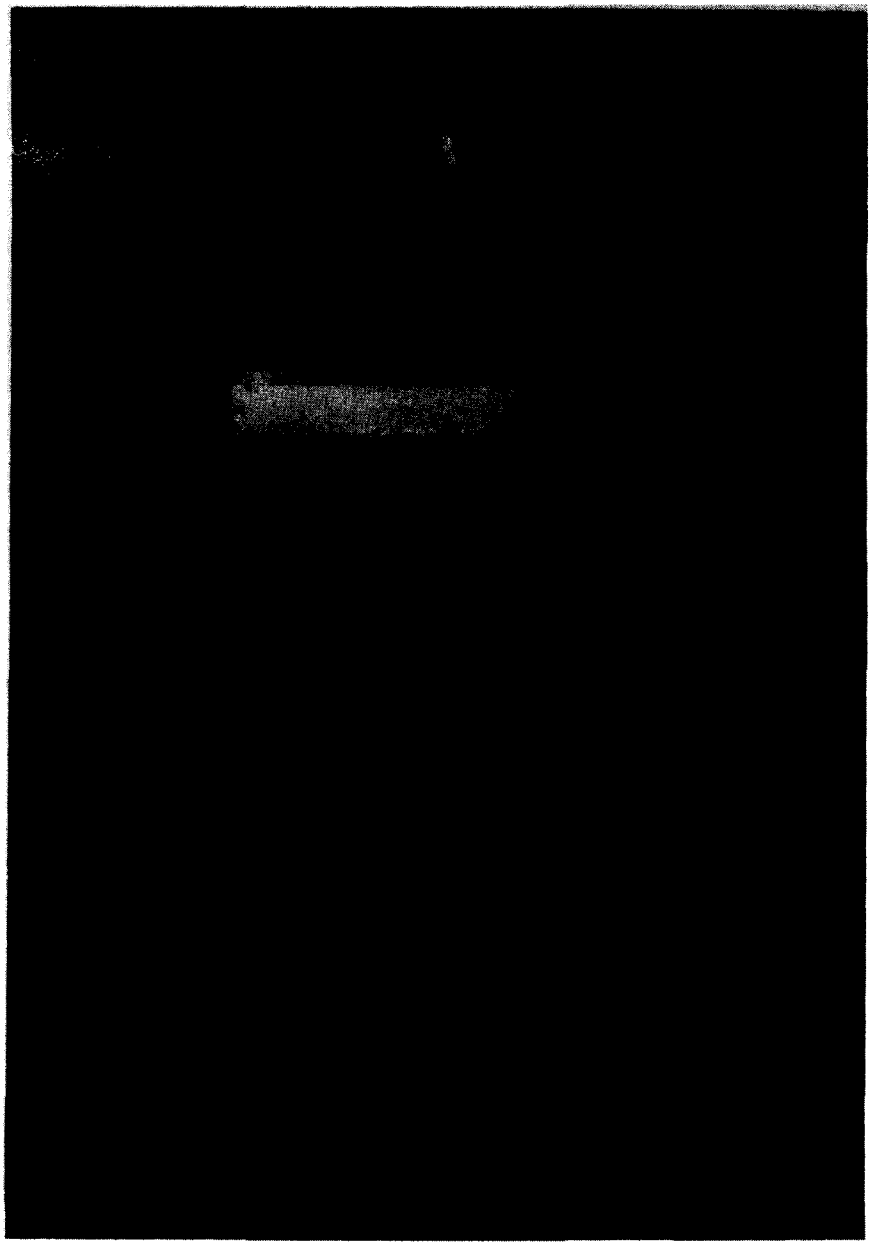


Figure 1.4

Air Flow Measurement/Magnehelic(R) Gauge

(read in inches of water)

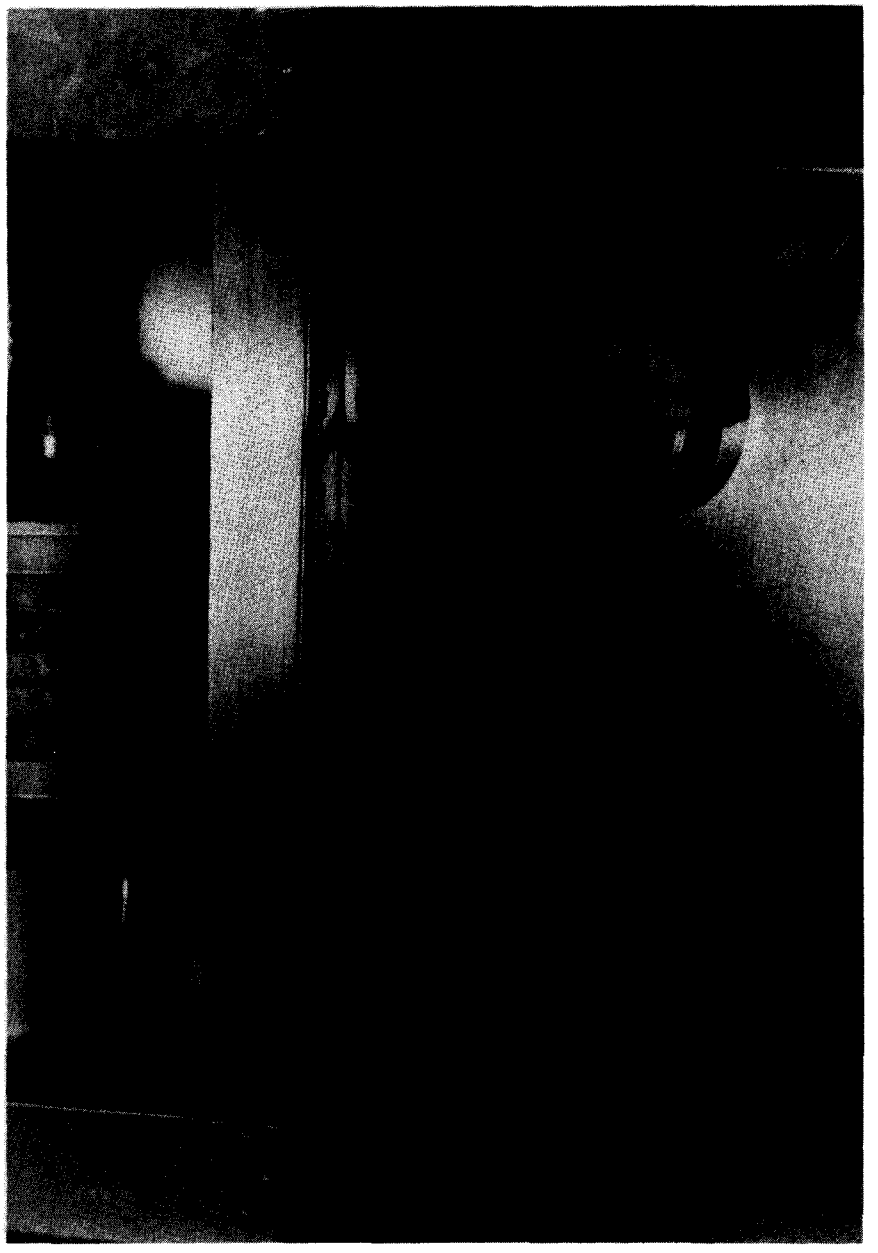


TABLE 1.1

Sample Air Flow Calibration Table

HI VOL AUDIT ORIFICE CALIBRATION DATA

****** AUDIT ORIFICE # 011 DATE 7/ 2/86 SITE

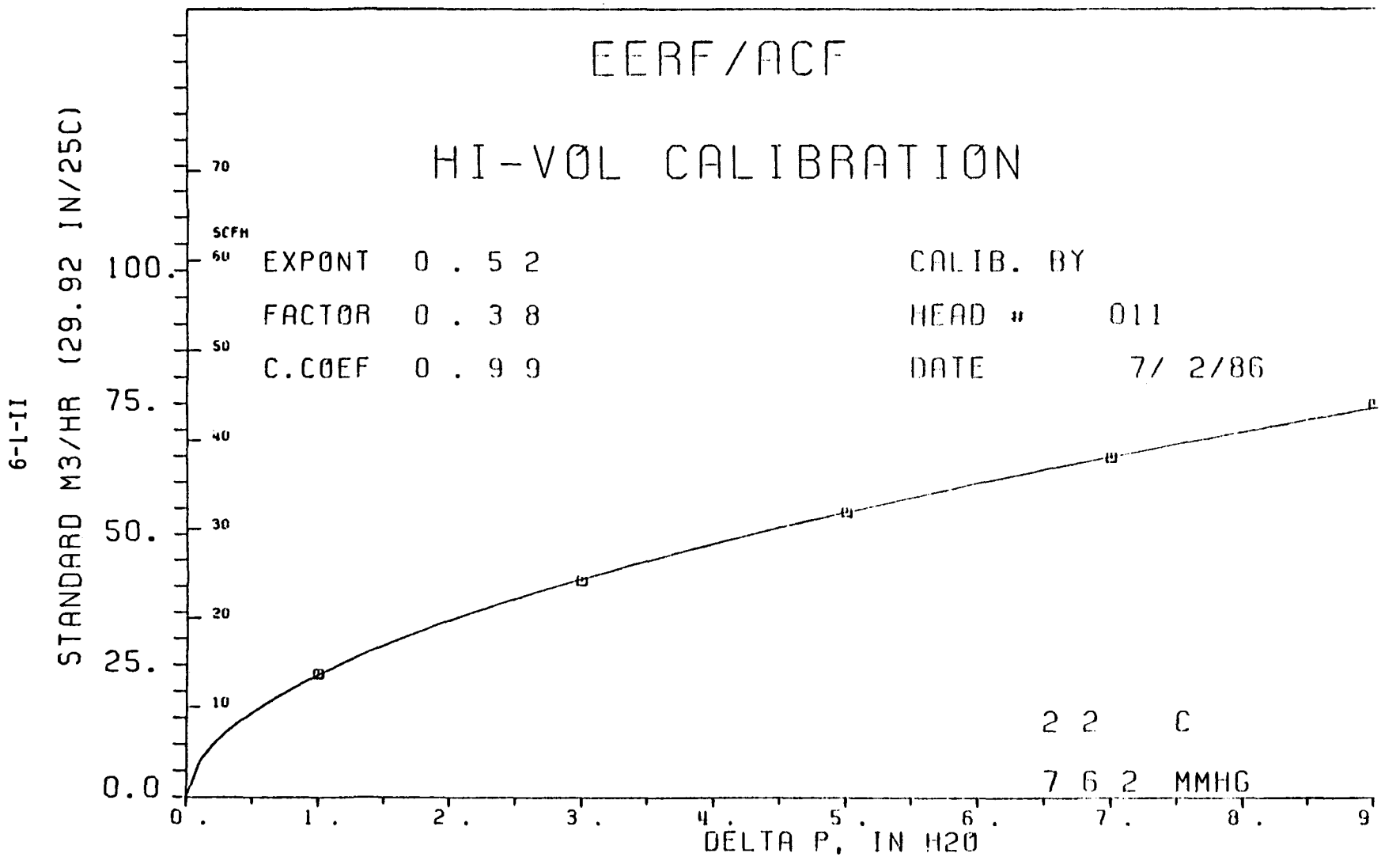
MAGN RDG	SCFM	M3/HR	MAGN RDG	SCFM	M3/HR	MAGN RDG	SCFM	M3/HR
0.1	4.021	6.833	3.5	26.457	44.956	6.9	37.910	64.416
0.2	5.806	9.865	3.6	26.855	45.633	7.0	38.200	64.909
0.3	7.197	12.230	3.7	27.248	46.300	7.1	38.488	65.399
0.4	8.383	14.244	3.8	27.636	46.959	7.2	38.774	65.886
0.5	9.435	16.032	3.9	28.019	47.610	7.3	39.059	66.369
0.6	10.392	17.658	4.0	28.397	48.253	7.4	39.341	66.849
0.7	11.276	19.161	4.1	28.771	48.888	7.5	39.622	67.326
0.8	12.103	20.565	4.2	29.141	49.516	7.6	39.901	67.800
0.9	12.882	21.890	4.3	29.507	50.138	7.7	40.179	68.272
1.0	13.622	23.147	4.4	29.868	50.752	7.8	40.454	68.740
1.1	14.328	24.346	4.5	30.226	51.360	7.9	40.728	69.206
1.2	15.004	25.495	4.6	30.580	51.962	8.0	41.001	69.669
1.3	15.654	26.599	4.7	30.931	52.557	8.1	41.272	70.129
1.4	16.281	27.665	4.8	31.278	53.147	8.2	41.541	70.586
1.5	16.887	28.695	4.9	31.621	53.731	8.3	41.808	71.041
1.6	17.475	29.693	5.0	31.962	54.309	8.4	42.075	71.493
1.7	18.045	30.662	5.1	32.299	54.882	8.5	42.339	71.943
1.8	18.600	31.605	5.2	32.633	55.450	8.6	42.603	72.390
1.9	19.141	32.524	5.3	32.964	56.012	8.7	42.864	72.835
2.0	19.668	33.420	5.4	33.292	56.570	8.8	43.125	73.278
2.1	20.183	34.295	5.5	33.617	57.123	8.9	43.384	73.718
2.2	20.687	35.151	5.6	33.940	57.671	9.0	43.641	74.155
2.3	21.180	35.989	5.7	34.260	58.214	9.1	43.898	74.591
2.4	21.663	36.810	5.8	34.577	58.753	9.2	44.153	75.024
2.5	22.137	37.615	5.9	34.892	59.288	9.3	44.406	75.455
2.6	22.602	38.405	6.0	35.204	59.818	9.4	44.659	75.884
2.7	23.058	39.181	6.1	35.513	60.344	9.5	44.910	76.311
2.8	23.507	39.943	6.2	35.821	60.866	9.6	45.160	76.735
2.9	23.948	40.693	6.3	36.126	61.385	9.7	45.408	77.158
3.0	24.382	41.430	6.4	36.428	61.899	9.8	45.656	77.578
3.1	24.810	42.156	6.5	36.729	62.410	9.9	45.902	77.997
3.2	25.230	42.872	6.6	37.027	62.917	10.0	46.147	78.413
3.3	25.645	43.576	6.7	37.323	63.420	10.1	46.391	78.828
3.4	26.054	44.271	6.8	37.618	63.920	10.2	46.634	79.240

****

M3/HR = 23.146816 * (MANOMETER READING)** 0.529898
SCFM = 13.622185 * (MANOMETER READING)** 0.529898
MANOMETER READING = MANOMETER READING IN H2O
M3/HR = CUBIC METERS /HR (25 C, 760 mm Hg)
SCFM = CUBIC FEET /MIN (25 C, 760 mm Hg)

Figure 1.5

HI-VOL CALIBRATION CURVE



To determine the total air volume moved through the filter, the average flow rate is multiplied by the sampling time in hours.

1.8 Operation of the Sampler

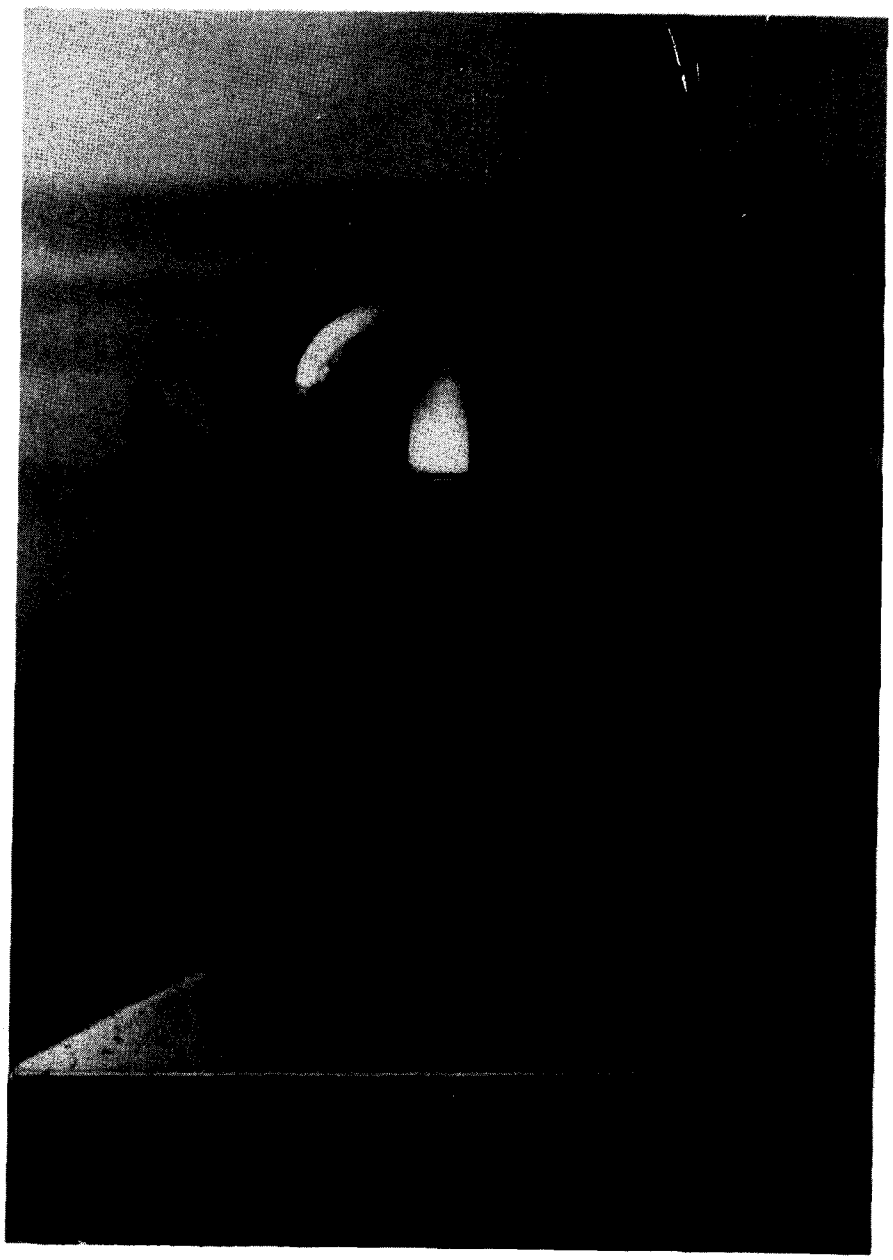
1.8.1 Initiating the Sampling Period. If the blower is operating, turn the power off using the switch on the box at the lower left side of the door opening. Allow the motor to come to a complete stop before proceeding. Remove the top of the sampling head by twisting slightly and lifting up as shown in Figure 1.6. If there is a filter in the sampling position, remove it and place a new 4" "all dust" filter in position as shown in Figure 1.7. Replace the top of the sampling head firmly into position and restart the motor with the switch. After three minutes, connect the tygon tube from the Magnehelic to the nipple on the sampling head and record the first air flow measurement in the sampling log. Disconnect the tygon tube from the sampling head.

1.8.2 Concluding the Sampling Period. Before turning the motor off, connect the Magnehelic gauge and record the final flow measurement in the sampling log. With a wax pencil or a felt tip marker write the following identifying information on a glassine envelope, as illustrated in Figure 1.8.

1. Station number, sample location, and date
   (Example: No. 408 Montgomery, AL)
2. Day and time sample collection began (month-day-hour)
   (Example: 11/17/0800)

Figure 1.6

Removal of Sampler Head



3. Day and time sample collection ended (month-day-hour)
   (Example: 11/20/0800)
4. Total air volume that has moved through filter
   (Example: 51 CMH X 72 Hours = 3672 m^3)

Turn the motor off and wait until it has stopped completely. Remove the sampling head. Using forceps and taking special care not to touch the filter surface where particulates have been deposited, remove the air filter and place it in a glassine envelope. Before mailing the glassine envelope to the Eastern Environmental Radiation Facility, it is a good idea to compare the information on the envelope with the required information as illustrated in Figure 1.7.

Figure 1.7

Filter Placement in Sampler Head

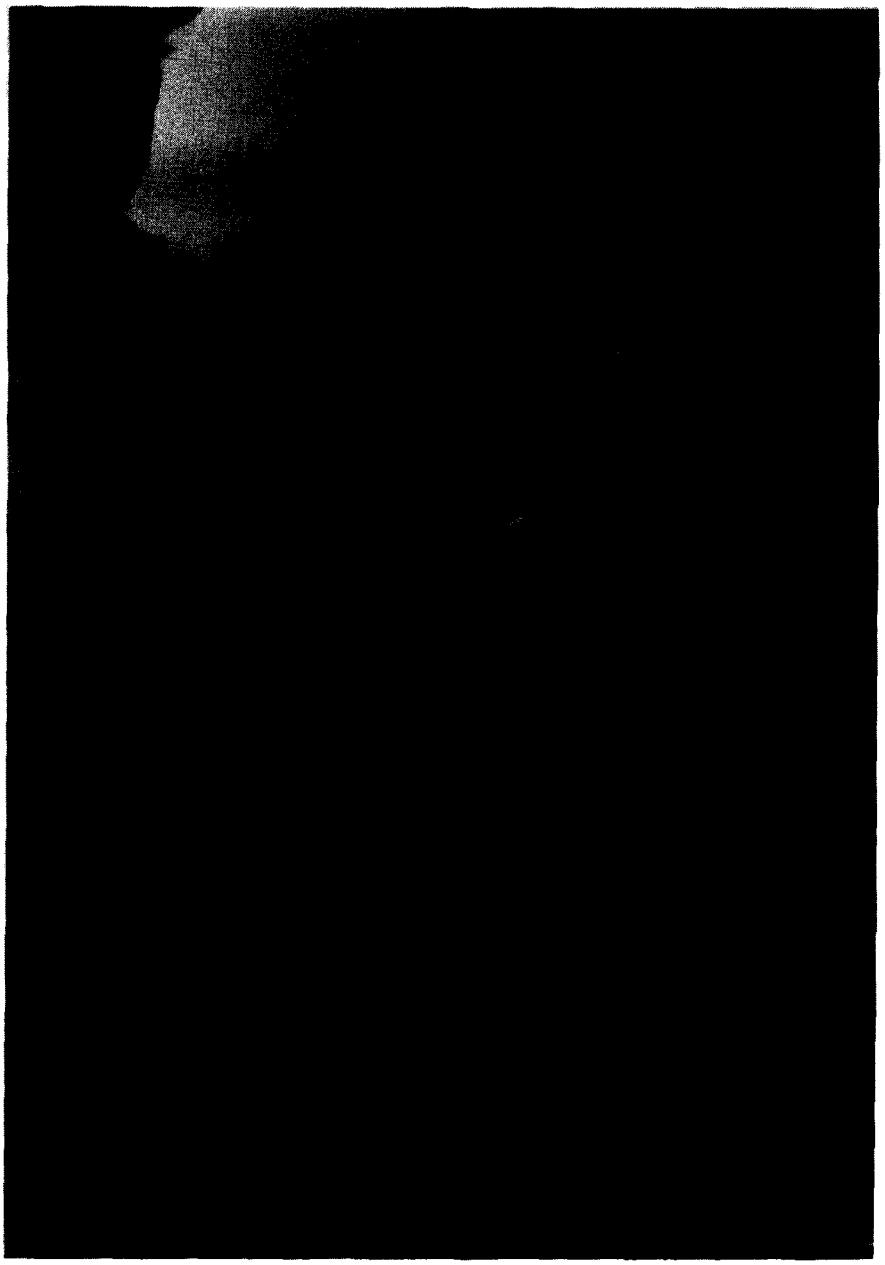
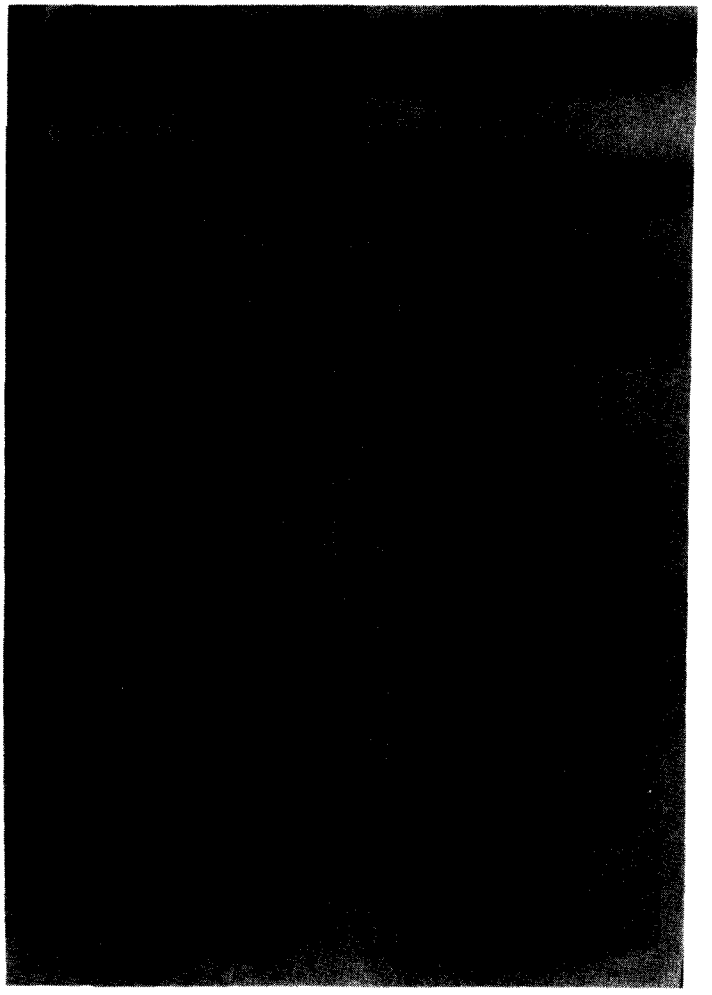


Figure 1.8

Marking of a Glassine Envelope



2 FIELD ESTIMATES

Field estimates of the quantity of radioactivity on the air filter are performed in order to provide early warnings of any large increases in airborne radioactivity. The determination requires a portable survey instrument. Although the field estimate is not highly accurate or sensitive, it does detect significantly elevated levels.

The field estimate is made using a Geiger-Mueller (GM) detector to compare radioactivity from the filter to that from a beta standard. The standard is placed in the detector and counted and then the sample is placed in the detector and another reading is taken. The ratio of the readings is used to calculate the amount of beta emitting radioactive material present on the filter, according to the following formula:

$$\text{Sample Activity (pCi)} = \frac{\text{Sample reading}}{\text{Standard reading}} \times \text{Standard Activity (pCi)}$$

The units for sample reading and standard reading may be either milliroentgen per hour (mR/hr) or counts per minute as long as both are measured in the same units. The calculated activity in picocuries is divided by the volume of air in cubic meters represented by the sample. This provides the gross activity of the sample expressed in picocuries per cubic meter (pCi/m^3).

The accuracy of field estimates depends upon the instrument being used and the nature and total amount of radioactivity present on the sample. The field estimate should be within ± 50 percent of the actual value for gross activities ranging from 10 pCi/m^3 to 400 pCi/m^3. Below 10 pCi/m^3 and above 400 pCi/m^3, the instrument response characteristics may interfere with reliable measurements.

2.1 Equipment

The EERF supplies all equipment to perform field estimates of radioactivity on filters. The equipment consists of a portable survey meter and a pancake Geiger-Mueller (G-M) detector. An appropriate standard is supplied to verify proper instrument operation and calibration.

2.1.1 Survey Meters. There are three different types of survey meters currently used by air stations for making field estimates. They are the Eberline Model E-120 and the two models of the Victoreen Thyac. The newer of these is the Eberline Model E-120. All instruments perform the same function with only minor differences in battery requirements, switching designations, and some component parts. All may be coupled to the detector that the EERF provides for making field estimates.

2.1.2 Detector Assembly. The "Pancake" G-M tube probe is the standard detector now in use; it has been issued to all stations. It consists of a 2-inch diameter, thin window (3-5 mg/cm^2), halogen quenched, pancake type G-M tube mounted in a free-standing aluminum assembly (Figure 2.1). The sample (or standard) is placed in a movable tray with the active side (side on which the particles have been deposited) up and moved under the G-M tube to be counted. Normal

operation is at 900 volts. Stations equipped with compatible scalers and high voltage supplies may use the assembly separate from the survey meter and obtain more precise results at lower activity levels.

2.1.3 Beta Calibration Standard. A beta calibration standard with an area equal to the net collecting area of the air filter is provided for checking equipment and determining beta activity during field estimates. This standard has strontium-90 and yttrium-90, in equilibrium, deposited on one side of a 3-1/2 inch diameter disc. The standard contains an exempt quantity of by-product material. However, care should be exercised to ensure its proper use and storage. When the standard is used, the measurements should be made on the side with no label. Periodic updates on the standard activity will be made in order to correct for decay. Standards will be replaced when the activity decreases to an unacceptable level.

2.2 Replacement Items

Replacement equipment and supplies are provided by the EERF on receipt of the request form illustrated in Figure 1.1 at the end of this section. Problems may also be reported by telephone to the Chief, Monitoring and Analytical Services Branch, at (205) 272-3402 or FTS 534-7615.

2.3 Maintenance

Maintenance of survey meters and detectors by station operators is limited to replacing batteries and cleaning the exterior surfaces. Erratic or higher than usual readings in an uncontaminated area may indicate accumulated fallout or other radioactive contamination on the

instrument probe. The possibility, however, is very small. If contamination is suspected, wipe the exterior surfaces of the probe and case with a dry cloth or one dampened with a mild detergent. DO NOT DISASSEMBLE THE GM TUBE HOUSING. The sample holder or planchet may be washed in soap and water as long as it is thoroughly rinsed and dried before use. Any other maintenance must be performed by personnel at the EERF.

2.4 Field Estimate Schedule

One or two field estimates are required on each air filter. The first is made about 5 hours after the filter is removed from the sampler. The five hour delay permits decay of radon daughters that may have been attached to collected particles. If the first field estimate is greater than 1.0 pCi/m^3, a second field estimate is made 29 hours after the filter is removed. (Exception: If a station is in ERAMS ALERT STATUS, a filter will be mailed directly to the EERF following the 5 hour reading.)

2.5 Procedures for Making a Field Estimate

Making field estimates with either the Thyac or the Eberline instruments is basically the same, except for slight differences due to instrument features. When making a reading on either instrument, meter fluctuations should be observed for 10 seconds and visually averaged.

The Eberline E-120 has an adjustable response time that is controlled by a knob labeled "RESPONSE" on the instrument case. When making the field estimate using the E-120 this knob should be set to the most counterclockwise position to provide slowest instrument response and minimize meter fluctuations.

The Eberline E-120 is also equipped with a battery check function. When the range switch is set to the battery check position (BATT), the meter should indicate in the "BATT OK" range. If the meter does not indicate in the "BATT OK" range, replace the batteries.

Follow Steps 1-3 below for making field estimates:

STEP 1. Perform a calibration check to ensure that the instrument is functioning properly.

1. Turn the meter range switch to the X100 CPM range.
2. Place the beta calibration standard, without the glassine envelope, in the sample holder (see Figure 2.1).
3. Slide the holder and source into the counting position with the standard beneath the detector. Make sure the active side of the standard, the side without the label, is toward the detector.
4. Read the meter. If the reading is less than 8,000 CPM on the Thyac or 5,000 on the E-120, shift to the X10 range.
5. Reread the meter. If the meter is less than 800 CPM for the Thyac or less than 500 CPM for the E-120, shift to the X1 range. The lowest range (X1, X10, X100) on which the meter does not go off scale is the correct setting of the range select knob.
6. Read the CPM for the standard, visually averaging the fluctuations over a 10 second period. The reading should

fall within ± 10 percent of the value stated on the standard. For example, if the stated standard activity = 10,000 CPM, then ± 10 percent = ± 1,000 CPM. Therefore, the standard should read between 9,000 and 11,000 CPM. If the instrument does not perform within these specifications, it should be returned to the EERF for maintenance.

7. Record the calibration CPM obtained in 4, 5, or 6 above in the appropriate "Standard Gross CPM" blanks on the ERAMS Air and Precipitation Report (Figure 3.1).

STEP 2. Take a background reading.

1. Slide the sample holder and standard from the slot in the detector assembly and replace the standard with an unused air filter.
2. Set the meter range switch to the X1 position.
3. Slide the blank filter in the holder into the slot in the detector assembly.
4. Estimate the average reading by watching the needle fluctuations for 10 seconds. The reading should be in the 25-200 CPM range. If the reading is higher than 200 CPM, remove the sample holder and filter from the slot, wash the holder with soap and water, place a new filter in the holder, and slide the holder and filter into the slot. If the reading is still high, there may either be contamination or a faulty instrument. Call the EERF for assistance.

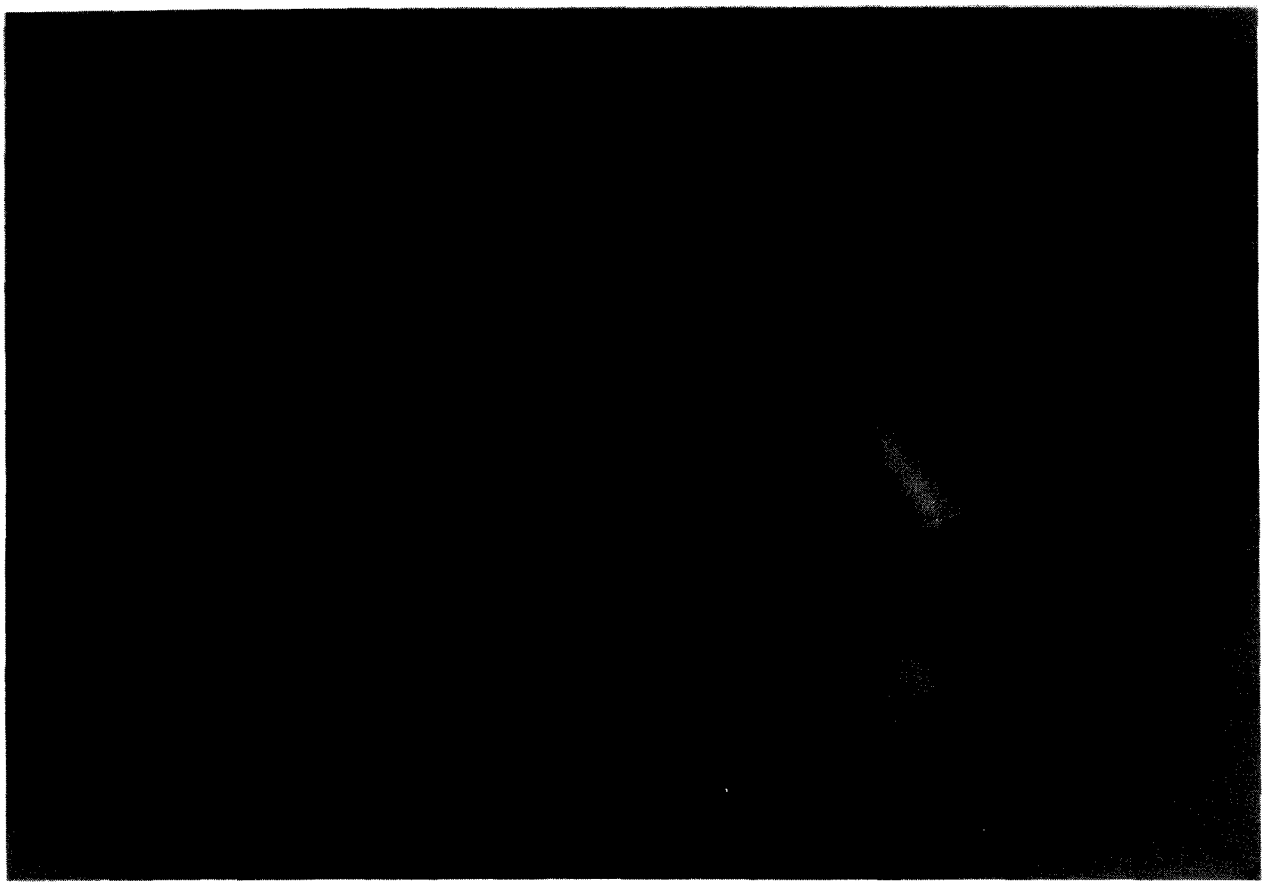
5. Record the background reading in the appropriate "Background CPM" blanks on the ERAMS Air and Precipitation Report.

STEP 3. Take the sample reading.

1. Turn the instrument range switch to the X100 position.
2. Place the filter to be evaluated in the sample holder with the deposited side toward the detector and slide the holder into the slot in the detector assembly.
3. Read the meter. If the reading is less than 8,000 CPM for the Thyac or 5,000 CPM for the E-120, turn the range switch to the X10 position.
4. Reread the meter. If the reading is less than 800 CPM for the Thyac or 500 CPM for the E-120, turn the range switch to the X1 position.
5. Reread the meter. Visually average the meter fluctuations for a 10 second period.
6. Record the reading obtained in (3), (4), or (5) above in the appropriate "Sample Gross CPM" blank on the ERAMS Air and Precipitation Report.

Figure 2.1

"Pancake" GM Tube Attached Detector



3 ROUTINE AIR REPORTS

The only routine report required of the ERAMS Station Operator is the ERAMS Air and Precipitation Report (Figure 3.1), which is submitted for each day that samples are taken. The report, together with the sample for which the data are being reported, should be placed in a pre-addressed, franked envelope and sent to the EERF as soon as all data are complete. The station number should be written on the front of the envelope under the words "Official Business." The data from the field estimate on the air sample should be written on the data sheet. Do not put data from samples collected (removed from the sampler) on two different dates on the same report sheet. It is important that the person completing the data form sign his/her name. The EERF may need to contact that person if additional information is required. NOTE: If the air precipitation samples are being submitted simultaneously, then include precipitation data on the ERAMS Air and Precipitation Report and enclose the air sample and the completed form in the precipitation shipping container (see Section 5, Precipitation Sampling, for detailed shipping instructons).

The data form will provide a duplicate copy for your files. The white original must be returned to the EERF and the yellow copy should be kept in the station operator's file.

3.1 General Instructions

Information pertaining to sample collections and data obtained from air volume calculations and field estimates are recorded on the report form following the outline given below.

1. Station Number - Print your station number in the blank provided.
2. Location - Print your station location.
3. Time Zone - Print your time zone and circle STD for standard time or DST for daylight savings time.
4. Date of Collection - Write the date of the end of sample collection.
5. Circle continuous duty.
6. Air Flow - Write the air flow rates (m^3/hour) as measured at the start and end of sample collections.
7. Duration of Sampling - Write the month, day, and hour of the start and end of sample collections.
8. Air Volume Calculations - Indicate whether or not the air volume is known and, if not, the cause. Also indicate whether or not the survey meter is working and, if not, the cause. Calculate the air volume as follows:
   a. Enter the Average Air Flow rate from step 5 [(m^3/hr at start + m^3/hr at stop)/2].
   b. Enter the Sampling Period from step 6 (elapsed time to the nearest whole hour).
   c. Calculate the Air Volume in m^3 by multiplying the average Air Flow rate by the sampling period.
9. First Field Estimate - Begin by indicating date and time of first field estimate. NOTE: The time elapsed between discontinuation of sampling and the first field estimate should be no less than 5 hours.

Next, calculate Standard Net Counts Per Minute (CPM) as described in the following sequential steps:

a. Enter the Standard Gross CPM at the time of the first field estimate.

b. Enter the Background CPM at the time of the first field estimate.

c. Subtract the background CPM from the standard CPM to give the Standard Net CPM.

Next, calculate the sample Net Counts Per Minute in the following steps:

a. Enter the Sample Gross CPM at the time of the first field estimate.

b. Enter the Background CPM at the time of the first field estimate.

c. Subtract the background CPM from the sample CPM to give the Sample Net CPM.

Now use these data to calculate the Field Estimate in the following steps:

a. Enter the Sample Net CPM.

b. Enter the Standard Activity in picocuries. (You will be provided this activity in January of each year for your standard.)

c. Enter the Air Volume in m^3 from step 8.

d. Enter the Standard Net CPM.

e. Calculate the First Field Estimate in pCi/m^3.

10. Second Field Estimate - If a second field estimate is required, it may be done using the same procedure as in 9 above, except that the second standard, background, and filter counts are to be used for the calculations.

11. Not applicable to air sampling. Leave blank. NOTE: Air and Precipitation Report Form must be signed and dated by the preparer.

3.2 Sample ERAMS Air and Precipitation Report

Figure 3.2 illustrates a completed report form based on the following information.

1. Station Number 408 located in Montgomery, Alabama, Central Standard time zone, collected an air sample beginning at 0800 November 17, 1987, and ending at 0800 November 20, 1987.
2. The sample was collected at an initial air flow rate of 52 cubic meters per hour and a terminal flow rate of 50 cubic meters per hour.
3. The first field estimate was performed at 1300 November 20, 1987, and yielded the following data: Standard (21,700 pCi) gross count was 5,500 CPM; sample gross count was 350 CPM; and the background count was 150 CPM.

Figure 3.1

ERAMS AIR AND PRECIPITATION REPORT

Eastern Environmental Radiation Facility
1890 Federal Drive, Montgomery, AL 36109
(205) 272-3402 FTS 534-7615

SAMPLE ID: RAN – _____

DATE RECEIVED: ____/____/____ (Year / Month / Day)

COMMENTS: _____

FIRST COUNT: ____/____/____ (Year / Month / Day) ____ Hour

Length (Min) _____ Gross Counts _____ System

SECOND COUNT: ____/____/____ (Year / Month / Day) ____ Hour

Length (Min) _____ Gross Counts _____ System

(Above For Use by EERF Personnel Only)

1. STATION NUMBER _____

2. LOCATION: _____

3. TIME ZONE: _____ STD/DST

4. DATE OF COLLECTION ____/____/____ (Year / Month / Day)

5. TYPE OF SAMPLING: Continuous Duty 1/3 Duty

6. AIR FLOW START _____ m³/hr: STOP _____ m³/hr:

7. DURATION OF SAMPLING

Start Time ____/____/____ (Month / Day / Hour) Stop Time ____/____/____ (Month / Day / Hour)

8. AIR VOLUME CALCULATION

_____ (Average Air Flow (m³/hr)) × _____ (Sampling Period (Hours)) × _____ (Duty Cycle (On Time / Sample Period)) = _____ (Air Volume (m³))

Is air volume known? YES NO _____ Motor Failure _____ Filter Failure

Is survey meter operable? YES NO

9. FIRST FIELD ESTIMATE (AIR)

_____ (Sample NET CPM) × _____ (Standard Activity (pCi))

_____ (Air Vol. (m³)) × _____ (Standard NET CPM)

_____ FIELD ESTIMATE (pCi/m³)

HOURS TO 1st F.E. ____/____ (Day / Hour)

STANDARD READING	SAMPLE READING
Gross _____ CPM	Gross _____ CPM
– Bkgd _____ CPM	– Bkgd _____ CPM
NET _____ CPM	NET _____ CPM

10. SECOND FIELD ESTIMATE (AIR)

_____ (Sample NET CPM) × _____ (Standard Activity (pCi))

_____ (Air Vol. (m³)) × _____ (Standard NET CPM)

_____ FIELD ESTIMATE (pCi/m³)

HOURS TO 2nd F.E. ____/____ (Day / Hour)

STANDARD READING	SAMPLE READING
Gross _____ CPM	Gross _____ CPM
– Bkgd _____ CPM	– Bkgd _____ CPM
NET _____ CPM	NET _____ CPM

11. CALCULATION OF DEPTH OF PRECIPITATION

_____ (Volume collected (liters)) / _____ (Collector Area (meters²)) = _____ (Depth of Precipitation (millimeters))

PRECIPITATION (Note type)

Snow _____ Rain _____ Other (Specify) _____

This Report Prepared By:

Date: ____/____

EERF Form 1001
Revised Sept., 1982

Figure 3.2

ERAMS AIR AND PRECIPITATION REPORT

Eastern Environmental Radiation Facility
1890 Federal Drive, Montgomery, AL 36109
(205) 272-3402 FTS 534-7615

SAMPLE ID: R A N — _____ FIRST COUNT: ___/___/___ (Year / Month / Day) ___:___ (Hour)

DATE RECEIVED: ___/___/___ (Year / Month / Day) _____ Length (Min) _____ Gross Counts _____ System

COMMENTS: _____ SECOND COUNT: ___/___/___ (Year / Month / Day) ___:___ (Hour)

_____ Length (Min) _____ Gross Counts _____ System

(Above For Use by EERF Personnel Only)

1. STATION NUMBER 408
2. LOCATION: Montgomery, AL
3. TIME ZONE: Central (STD) DST
4. DATE OF COLLECTION 87 / 11 / 20 (Year / Month / Day)

5. TYPE OF SAMPLING: (Continuous Duty) 1/3 Duty
6. AIR FLOW START 52 m³/hr: STOP 50 m³/hr:
7. DURATION OF SAMPLING
Start Time 11 / 17 / 0800 (Month / Day / Hour) Stop Time 11 / 20 / 0800 (Month / Day / Hour)

8. AIR VOLUME CALCULATION

51 (Average Air Flow (m³/hr)) × 72 (Sampling Period (Hours)) × 1 (Duty Cycle (On Time / Sample Period)) = 3672 (Air Volume (m³))

Is air volume known? (YES) NO ____ Motor Failure ____ Filter Failure

Is survey meter operable? (YES) NO

9. FIRST FIELD ESTIMATE (AIR)

300 (Sample NET CPM) × 21,700 (Standard Activity (pCi))

3672 (Air Vol (m³)) × 5450 (Standard NET CPM)

0.33 FIELD ESTIMATE (pCi/m³)

HOURS TO 1st F.E.: 20 / 1300 (Day / Hour)

	STANDARD READING	SAMPLE READING
	5500 Gross CPM	350 Gross CPM
	− 50 Bkgd CPM	− 50 Bkgd CPM
	5450 NET CPM	300 NET CPM

10. SECOND FIELD ESTIMATE (AIR)

_____ (Sample NET CPM) × _____ (Standard Activity (pCi))

_____ (Air Vol (m³)) × _____ (Standard NET CPM)

FIELD ESTIMATE (pCi/m³)

HOURS TO 2nd F.E.: ___/___ (Day / Hour)

	STANDARD READING	SAMPLE READING
	_____ Gross CPM	_____ Gross CPM
	− _____ Bkgd CPM	− _____ Bkgd CPM
	_____ NET CPM	_____ NET CPM

11. CALCULATION OF DEPTH OF PRECIPITATION

_____ (Volume collected (liters)) / _____ (Collector Area (meters²)) = _____ Depth of Precipitation (millimeters)

PRECIPITATION (Note type)

Snow _____ Rain _____ Other (Specify) _____

This Report Prepared By: Jane Doe

Date: 11, 20, 87

EERF Form 100¹
Revised Sept., 1982

4 ALERT AIR REPORTS

An alert condition within ERAMS means that the network is in a state of maximum readiness and, usually, that one or more components are operating on an increased sampling and reporting frequency. There are two types of alerts, differing primarily by the way that each originates.

4.1 Type I Alert

In a Type I Alert, a known or suspected release of radioactivity into the environment (e.g., a nuclear weapons test) has occurred. Accordingly, the EERF notifies each station operator either directly or through an EPA Regional Radiation Representative to go on alert status and to sample and report results more frequently. In the case of pasteurized milk samples, an FDA official normally requests the sample. Sampling and reporting frequencies will be stated at the beginning of an alert.

4.2 Type II Alert

In a Type II Alert, the EERF declares an alert because elevated levels of radioactivity have been detected and reported by one or more of the ERAMS stations themselves.

4.3 Reporting

Station Operators should call in reports as soon as they have completed the 5-hour field estimate. Calls should be directed to the Chief, Monitoring and Analytical Services Branch, at the EERF according to the following schedule:

Regular Duty Hours The EERF telephones are manned from 8:00 A.M. through 4:45 P.M. (central time) during weekdays, except federal holidays. If daily operation has been requested of the entire network, telephones will also be manned from 1:00 P.M. through 5:00 P.M. on weekends and holidays. During regular duty hours, use the following telephone numbers:

Commercial Number:	(205) 272-3402
FTS Number:	534-7615

Non-Duty Hours The following personnel will receive alert reports at home at the following numbers whenever the office is not manned:

Name	Telephone Number
Charles R. Phillips	(205) 277-8213
Jon A. Broadway	(205) 272-9502
Charles R. Porter	(205) 272-4714

NOTE: In alert situations the samples are to be mailed to the EERF immediately after the 5-hour field estimate. The station operators may be directed to use express mail, in which case they will be given an authorization number to pay the extra postage.

5 PRECIPITATION SAMPLING

Precipitation is collected continuously and samples are shipped to the EERF on the same schedule as air particulate samples, assuming measurable precipitation has been collected (more than 2 liters).

The precipitation collection unit is a 0.5 square meter area fiberglass collector draining into a five gallon plastic bucket that serves as a reservoir for the precipitation (Figure 5.1). In periods of extreme rainfall, the bucket may overflow. If this occurs, contact the local weather service or meteorologist to find out the millimeters rainfall for your area. In sub-zero weather, some provisions may be necessary to prevent the collected precipitation from freezing or to melt snow that accumulates in the collection pan.

Analysis of precipitation samples at the EERF includes a gamma scan, gross beta, and tritium analysis of monthly composite samples. Plutonium and uranium analyses are performed on a composite of the March, April, and May samples. Additional analyses are performed during an alert.

5.1 Equipment

Each station is provided the following items:

- precipitation collection unit
- plastic bucket

5.2 Supplies

Each station is provided the following expendable items:

- 4-liter Cubitainers(R) and lids (Cubitainer is a registered trademark of Hedwin)
- adhesive data labels

- ERAMS Air and Precipitation Report forms
- mailing cartons
- franked mailing labels

5.3 Replacement items

Equipment and/or supplies will be replaced on receipt of the request form illustrated in Figure 5.2 at the end of this section. Supplies may also be requested from the EERF by telephone. You may contact the ERAMS Supply Officer at (205) 272-3402 or FTS 534-7615.

5.4 Equipment Installation

ERAMS precipitation collection equipment will be supplied complete and ready to install. It will only be necessary to secure the unit by attaching the leg base plates to any stable surface. The unit may be modified to accommodate sloping surfaces by removing two legs and shortening them as necessary.

5.5 Sampling Schedule

Precipitation is collected continuously. Samples should be shipped to the EERF, when measurable precipitation occurs (greater than 2 liters), on the same schedule as air particulate samples, i.e., Monday/Thursday or Tuesday/Friday schedule.

5.6 Maintenance

The precipitation collection unit requires minimum maintenance. This includes a daily check for leaks or debris in the system and a monthly cleaning of the surface collection area and the inside of the bucket with a mild soap and brush or cloth. Cleaning may be required more often in some areas. NOTE: Be sure to rinse the unit at least 3 times with clean water after washing.

5.7 Sample Collections

Follow the steps listed below to collect and prepare a sample:

1. Determine the volume in the bucket by either measuring it in a graduated cylinder or reading the volume with the provided measuring stick.
2. From the bucket spigot or from the graduated cylinder, put 4 liters of water into a Cubitainer. If the bucket contains less than 4 liters, use the entire volume.
3. Screw the Cubitainer cap on tightly, seal with tape, and check for leaks.
4. Discard any remaining water. Only one 4-liter sample is required for any sampling period.
5. Complete a data label (Figure 5.3) and place it on the top of the Cubitainer.
6. Record the type of precipitation on the ERAMS Air and Precipitation Report. An equation is provided on the form to calculate depth of precipitation:
   a. Enter volume collected in liters.
   b. Enter collector area, which is 0.5 square meters.
   c. Calculate depth of precipitation in millimeters by dividing the collector area into the volume.
7. Set up an inner shipping carton (the one with the hole in the top) and place the filled Cubitainer in it. Close the top.
8. Set up an outer shipping carton, and place it in the inner carton and the ERAMS Air and Precipitation Report Form along

with the data pertaining to air particle collections and the air filter for that day. Seal with reinforced tape.

9. Place a franked mailing label, addressed to the Eastern Environmental Radiation Facility (EERF), on the outside of the outer carton and mail.

10. Include data pertaining to sample collections in the ERAMS Air and Precipitation Report form (Figure 3.1) along with data pertaining to air particulate collections for that same day.

Figure 5.1

Precipitation Collection Unit

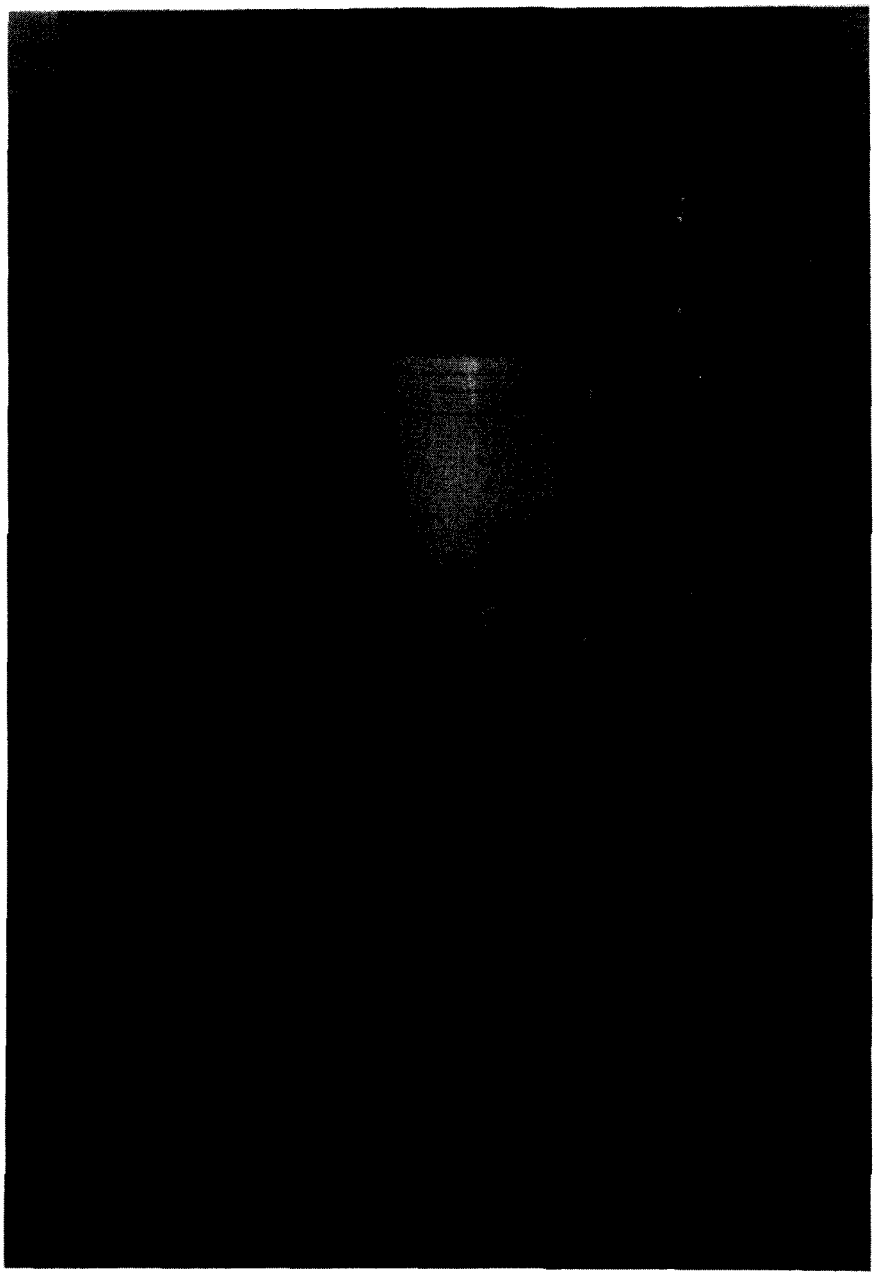


Figure 5.2

ERAMS EQUIPMENT AND SUPPLY REQUEST

Precipitation Component

Requested by: _____

Date: _____

Station: _____

Address: _____

_____

Telephone: ( ) _____

☐ Mailing Cartons

☐ Franked Mailing Labels

☐ Data Labels

☐ Cubitainers

☐ Equipment (specify)

☐ Parts (specify)

Comments: _____

_____

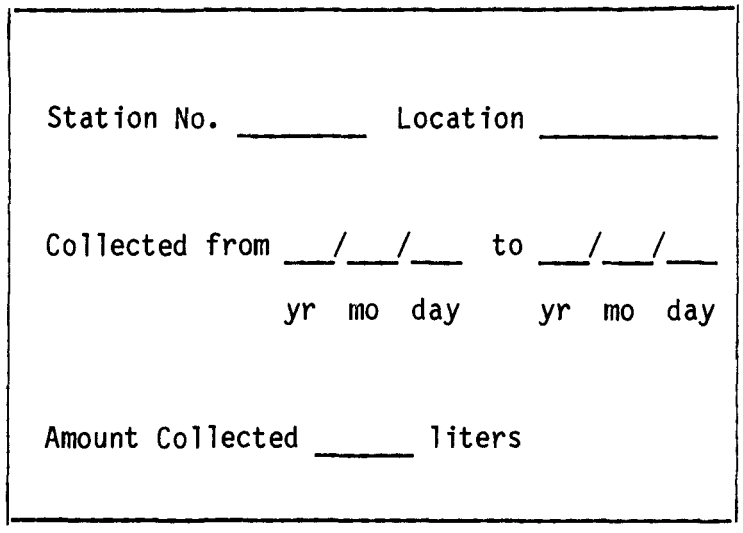
_____

Please return this form to the attention of:

Chief, Monitoring and Analytical Services Branch
Eastern Environmental Radiation Facility
1890 Federal Drive
Montgomery, Alabama 36109
(205) 272-3402; FTS 534-7615

Figure 5.3

Precipitation Data Label



6 DRINKING WATER SAMPLING

Drinking water samples are collected from finished water supplies serving major population centers. The tap sampled should be one that is known to be connected to the desired water system. The tap selected should be one which is frequently used and provides water that has had no on-site treatment such as water softeners or filters.

Analyses of drinking water samples at the EERF include tritium on each quarterly sample and a gamma scan, gross alpha, gross beta, radium, strontium, plutonium, and uranium on a yearly composite of the quarterly samples. Iodine analysis is done once a year on one sample from each location.

6.1 Supplies

Each station is provided the following expendable items.

- 4-liter Cubitainers
- Drinking Water Report forms
- mailing cartons
- franked mailing labels

6.2 Replacement Items

Supplies will be mailed to each sampling location on a quarterly basis. Additional supplies may be requested by telephoning the EERF at (205) 272-3402 or FTS 534-7615.

6.3 Sampling Schedule

Drinking water is collected quarterly in January, April, July, and October of each year. The station operator may use receipt of the quarterly collection supplies as notice to collect that quarter's sample and return it to the EERF.

6.4 Sample Collections

Follow the steps listed below to collect and prepare a sample:

1. Open a cold water tap and allow it to flow until the water reaches its coolest natural temperature (about 2 minutes).
2. Before filling, check that the 4-liter Cubitainer provided by the EERF has the correct location indicated. If not, identify your location using a waterproof felt tip marker.
3. Fill the Cubitainer directly from the tap until the water level is within 2 cm of the top.
4. Screw the Cubitainer cap on tightly, seal with tape, and check for leaks.
5. Complete the Drinking Water Report form (Figure 6.1).
6. Set up an inner shipping carton (the one with the hole in the top) and place the filled Cubitainer in it. Close the top.
7. Set up an outer shipping carton, place the inner carton and the report form in it, and seal with reinforced tape.
8. Place a franked mailing label, addressed to the Eastern Environmental Radiation Facility, on the outside of the outer carton and mail.

Figure 6.1

ERAMS DRINKING WATER REPORT

Eastern Environmental Radiation Facility
1890 Federal Drive, Montgomery, AL 36109
(205) 272-3402; FTS 534-7615

Station: _____

Tap Location: _____

_____

_____

Local Sample ID (if any): _____

Comments: _____

_____

_____

_____

_____

Quarter: Jan-Mar Apr-Jun Jul-Sep Oct-Dec Year: _____

Sample Collector: _____

Phone Number : ( ) _____

Date of Collection: _____

7.3 Replacement Items

Supplies will be mailed to each sampling location on a quarterly basis. Additional supplies may be requested by telephoning the Chief, Monitoring and Analytical Services Branch, at (205) 272-3402 or FTS 534-7615.

7.4 Sampling Schedule

Surface water is collected quarterly in January, April, July, and October of each year. The station operator may use the receipt of the quarterly collection supplies as notice to collect that quarter's sample.

7.5 Sample Collections

Follow the steps listed below to collect and prepare a sample:

1. Collect water in a clean 5-liter sampling bucket by dipping it or casting it, as necessary. Avoid getting bottom sediment in the water sample. If it is necessary to wade into the water, sample upstream of where you are standing.
2. Prior to filling, check that the Cubitainer provided by the EERF has the correct location indicated. If not, identify your location using a waterproof felt tip marker. Note that the April-June sample should be collected using a 4-liter Cubitainer. The other three quarterly samples will be collected using a 1-liter Cubitainer.
3. Insert a clean funnel in the Cubitainer and transfer the water from the sampling bucket to the container. Fill to within 2 cm of the top.
4. Screw the container cap on tightly, seal with tape, and check for leaks.

Figure 7.1

ERAMS SURFACE WATER REPORT

Eastern Environmental Radiation Facility
1890 Federal Drive, Montgomery, AL 36109
(205) 272-3402; FTS 534-7615

Station: _____

Sampling Location: _____

_____ (provide specific location on river, bay, lake, etc.)

_____

_____

Local Sample ID (if any): _____

Comments: _____

_____

_____

_____

_____

Quarter: Jan-Mar Apr-Jun Jul-Sep Oct-Dec Year: _____

Sample Collector: _____

Phone Number : ( ) _____

Date of Collection: _____

8 PASTEURIZED MILK SAMPLING

This is a cooperative program of the Environmental Protection Agency and the Food and Drug Administration. Milk is a reliable indicator of the general population's intake of radionuclides, since it is consumed fresh by a large segment of the population and it may contain several biologically important radionuclides. Primary functions of this program are to obtain representative samples of milk, to measure the radionuclide concentrations, and to determine any long-term trends.

The monthly weighted composite samples should represent greater than 80 percent of the milk consumed in each major population center sampled. Weighting and compositing of the sample is accomplished by first determining the daily volume of milk produced by each dairy plant that supplies the sample population. (Each dairy plant typically processes milk received from several dairy farms.) The volumes (or weights) for the individual dairy plants are added to yield the total milk supply for the population served. Beginning with the largest, the dairy plants which supply 80 percent of the total milk supply are selected to be sampled. Milk from these selected dairy plants is composited into the 3.5 liter sample based on the ratio of that plant's contribution to the total milk represented. An example of this procedure is presented in Section 8.4.

Monthly samples are analyzed for iodine, barium, cesium, and potassium. One sample from each location is analyzed annually in July for strontium. Also, for the first month of each of the three quarters

beginning January, April, and October, regional composite samples made up from the states within each of EPA's ten regions are analyzed for strontium.

8.1 Supplies

Each station will be supplied with the following items:

- 4-liter plastic bottles
- sample preservative
- Pasteurized Milk Report forms (Figure 8.1)
- mailing cartons
- franked mailing labels

8.2 Replacement Items

Supplies will be mailed monthly to each sample location. Additional supplies may be requested by telephoning the Chief, Monitoring and Analytical Services Branch, at (205) 272-3402 or FTS 534-7615.

8.3 Sampling Schedule

Pasteurized milk is collected monthly during the first full week of the month.

8.4 Sample Collections

Follow the steps listed below to collect and prepare a sample:

1. Determine the daily average volume of pasteurized milk produced by each dairy plant that supplies the subject population.
2. Sum each plant's production to determine the total milk supply.
3. Select the major plants whose combined milk production, when compared to total milk production, would represent at least 80 percent of the total.

4. Composite the milk collected from these plants on a weighted (ratio) basis to produce the 3.5 liter sample. Example: The subject population is supplied by six dairy plants. Each plant collects the average daily volumes of milk from the farms as shown below.

Plant	No. of Farms	Total Daily Volume
1. Smith Farms	27	40,000 gal/day
2. Jones Dairy	19	25,000
3. Milk Distributors	10	15,000
4. Jersey Incorporated	10	10,000
5. Farm Products	7	5,000
6. Happy Dairy	3	5,000
TOTAL PRODUCTION		100,000 gal/day

Knowing that the pasteurized milk sample should represent at least 80 percent of the milk produced, we find that the combined volumes of plants 1, 2, and 3 represent 80,000 gal/day out of 100,000 gal/day total production or 80 percent of total production. It will not be necessary to sample and include plants 4 through 6 when compositing the sample.

Each plant's contribution is calculated by multiplying the ratio of that plant's production to the total production by the 3.5 liters needed to make up the sample.

Plant	Ratio	Desired Milk Sample Volume		Contribution to Sample
No. 1	$\frac{40{,}000 \text{ gal/day}}{80{,}000 \text{ gal/day}}$	x 3.5 liters	=	1.75 liters (1750 ml)
No. 2	$\frac{25{,}000 \text{ gal/day}}{80{,}000 \text{ gal/day}}$	x 3.5 liters	=	1.094 liters (1094 ml)
No. 3	$\frac{15{,}000 \text{ gal/day}}{80{,}000 \text{ gal/day}}$	x 3.5 liters	=	0.656 liters (656 ml)
TOTAL SAMPLE				3.50 liters (3500 ml)

5. Add to the 4-liter shipping bottle that volume of pasteurized milk that represents each plant's weighted contribution as calculated above.
6. Add the preservative to the sample and mix well.
7. Screw the bottle cap on tightly, seal with tape, and check for leaks.
8. Complete the Pasteurized Milk Report form (Figure 8.1).
9. Place the 4-liter plastic bottle along with the report form in the mailing carton. Strap the carton closed.
10. Place a franked mailing label, addressed to the Eastern Environmental Radiation Facility, on the outside of the carton and mail.

Figure 8.1

ERAMS PASTEURIZED MILK REPORT

Eastern Environmental Radiation Facility
1890 Federal Drive
Montgomery, Alabama 36109
(205) 272-3402; FTS 534-7615

SAMPLE COLLECTION DATA

(To be returned with each sample)

1. Your sample Identification Number, if any:	4. Principal City:
2. Name and Address of Sample Collector: ☐ Check here if this is a new name or address.	5. Date Sample Produced/Collected: 6. Amount of Milk which sample represents. Specify pounds or gallons produced per day:
3. Names of Contributing Plants/ Dairies. Use additional sheets if necessary.	7. Number of Shippers contributing to sample: 8. EPA-EERF bottle number: 9. Remarks: 10. Date: 11. Signature:

1988-530-002/64688 AUGAFS,AL(882591)500