SEMIANNUAL RADIOACTIVE EFFLUENT
RELEASE REPORT

1st and 2nd Quarters of 1985

Facility: Shoreham Nuclear Power Station, Unit 1

Licensee: Long Island Lighting Company, Inc.

The Shoreham Nuclear Power Station achieved initial criticality on February 15, 1985. However, no power ascension occurred during the 1st and 2nd quarters of 1985. LILCO received a low power license to allow testing to 5% power on July 3, 1985. This report is submitted in accordance with Technical Specification 6.9.1.7 and covers the periods from February 15, 1985, through March 31, 1985, as the first quarter and April 1, 1985, through June 30, 1985, as the second quarter.

A. SUPPLEMENTAL INFORMATION

1. Regulatory Limits

Shoreham's effluent regulatory limits are defined in Facility Operating License NPF-36, Shoreham Nuclear Power Station, Appendix A, Technical Specifications.

a) Limits for gaseous effluents and noble gases are covered by Technical Specifications 3.11.2.1 and 3.11.2.2.

b&c) Iodines and particulates with half-lifes greater than 8 days in gaseous effluents are addressed in Technical Specifications 3.11.2.3.

d) Liquid effluent limits are described in Technical Specifications 3.11.1.1 and 3.11.1.2

e) In addition, the following radionuclides for liquid effluents had typical minimum detectable activities of:

Cr-51	4.0E-7	uCi/ml
Zr-95	9.0E-8	uCi/ml
Nb-95	2.5E-8	uCi/ml
Tc-99m	3.9E-8	uCi/ml
Ba-140	1.6E-7	uCi/ml
La-140	5.6E-8	uCi/ml

The following radionuclides in gaseous effluents had typical minimum detectable activities of:

Kr-85	1.3E-6	uCi/cc
Kr-85m	4.0E-9	uCi/cc
Xe-135m	2.0E-8	uCi/cc
I-133	5.0E-13	uCi/cc
I-135	1.5E-9	uCi/cc
Ba-140	1.5E-13	uCi/cc
La-140	7.6E-14	uCi/cc

2. Maximum Permissible Concentrations

a-d) Maximum permissible concentrations are those specified in 10 CFR 20, Appendix B, Table II, Column 2. If an isotope is listed with values for SOLUBLE and INSOLUBLE states, the more conservative value is utilized. For gaseous effluents MPCs were not used. Direct calculation of dose were utilized to satisfy Technical Specifications 3.11.2.1.

3. Average Energy

No isotopes above minimum detectable activities were measured. Therefore, there is no reportable average energy for this time period.

4. Measurements and Approximations of Total Radioactivity

a-d) Samples were collected in the manner and with the frequency prescribed in Technical Specifications Surveillance Requirements 4.11.1.1.1 and 4.11.2.1.2. Samples were analyzed in accordance with Technical Specifications Tables 4.11.1.1.1-1 and 4.11.2.1.2-1 regarding both type of analysis and level of sensitivity. Most samples were analyzed by gamma spectroscopy with a Ge(Li) detector. A liquid scintillation counter was used to analyze for H3, Fe-55 and Sr-89,90. Samples analyzed for iron and strontium underwent a chemical separation prior to counting. Approved sample collection and analysis procedures were followed.

Analytical results are examined to ensure that the minimum sensitivity levels required by Technical Specifications lower limits of detection have been met. Any identifiable peaks above background are quantified.

The methods above were used for batch releases. These methods combined with gross activity measurements on process streams and total flow for these streams were used for continuous discharges.

No estimate of percent total error is provided in Tables 1A and 2A because all values were determined to be less than required lower limits of detection (LLDs). Counting LLDs reflect a two-sigma level of confidence.

5. Batch Releases

a) Liquid

	1st Quarter	2nd Quarter
1. Number of batches	30.	122.
2. Total Time (minutes)	4,563.	18,905.
3. Maximum Time (minutes)	175.	309.
4. Average Time (minutes)	152.	155.
5. Minimum Time (minutes)	92.	20.
6. Average Flow (gpm)	1.39E+05	1.51E+05

b) Gaseous - None

6. Abnormal Releases

a) Liquid - None

b) Gaseous - None

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B - GASEOUS EFFLUENTS

1st and 2nd Quarters of 1985

All samples of gaseous effluents were analyzed and determined to be at or below minimum detectable activities for all radionuclides listed in Shoreham's Technical Specifications. These MDAs were below the lower limits of detection required in Technical Specifications Table 4.11.2.1.2-1. In addition, no other radionuclides were identified. Therefore, no entries were made in Tables 1A, 1B or 1C.

TABLE 1A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (YEAR)

GASEOUS EFFLUENTS—SUMMATION OF ALL RELEASES

	Unit	Quarter	Quarter	Est. Total Error, %
A. Fission & activation gases				
1. Total release	Ci	. E	. E	. E
2. Average release rate for period	µCi/sec	. E	. E	
3. Percent of Technical specification limit	%	. E	. E	
B. Iodines				
1. Total iodine-131	Ci	. E	. E	. E
2. Average release rate for period	µCi/sec	. E	. E	
3. Percent of technical specification limit	%	. E	. E	
C. Particulates				
1. Particulates with half-lives >8 days	Ci	. E	. E	. E
2. Average release rate for period	µCi/sec	. E	. E	
3. Percent of technical specification limit	%	. E	. E	
4. Gross alpha radioactivity	Ci	. E	. E	
D. Tritium				
1. Total release	Ci	. E	. E	. E
2. Average release rate for period	µCi/sec	. E	. E	
3. Percent of technical specification limit	%	. E	. E	

TABLE 1B

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (YEAR)

GASEOUS EFFLUENTS—ELEVATED RELEASE

Nuclides Released	Unit	CONTINUOUS MODE Quarter	CONTINUOUS MODE Quarter	BATCH MODE Quarter	BATCH MODE Quarter

1. Fission gases

krypton-85	Ci	. E	. E	. E	. E
krypton-85m	Ci	. E	. E	. E	. E
krypton-87	Ci	. E	. E	. E	. E
krypton-88	Ci	. E	. E	. E	. E
xenon-133	Ci	. E	. E	. E	. E
xenon-135	Ci	. E	. E	. E	. E
xenon-135m	Ci	. E	. E	. E	. E
xenon-138	Ci	. E	. E	. E	. E
Others (specify)	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
unidentified	Ci	. E	. E	. E	. E
Total for period	Ci	. E	. E	. E	. E

2. Iodines

iodine-131	Ci	. E	. E	. E	. E
iodine-133	Ci	. E	. E	. E	. E
iodine-135	Ci	. E	. E	. E	. E
Total for period	Ci	. E	. E	. E	. E

3. Particulates

strontium-89	Ci	. E	. E	. E	. E
strontium-90	Ci	. E	. E	. E	. E
cesium-134	Ci	. E	. E	. E	. E
cesium-137	Ci	. E	. E	. E	. E
barium-lanthanum-140	Ci	. E	. E	. E	. E
Others (specify)	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
unidentified	Ci	. E	. E	. E	. E

TABLE 1C

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (YEAR)

GASEOUS EFFLUENTS—GROUND-LEVEL RELEASES

Nuclides Released	Unit	CONTINUOUS MODE Quarter	CONTINUOUS MODE Quarter	BATCH MODE Quarter	BATCH MODE Quarter

1. Fission gases

krypton-85	Ci	. E	. E	. E	. E
krypton-85m	Ci	. E	. E	. E	. E
krypton-87	Ci	. E	. E	. E	. E
krypton-88	Ci	. E	. E	. E	. E
xenon-133	Ci	. E	. E	. E	. E
xenon-135	Ci	. E	. E	. E	. E
xenon-135m	Ci	. E	. E	. E	. E
xenon-138	Ci	. E	. E	. E	. E
Others (specify)	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
unidentified	Ci	. E	. E	. E	. E
Total for period	Ci	. E	. E	. E	. E

2. Iodines

iodine-131	Ci	. E	. E	. E	. E
iodine-133	Ci	. E	. E	. E	. E
iodine-135	Ci	. E	. E	. E	. E
Total for period	Ci	. E	. E	. E	. E

3. Particulates

strontium-89	Ci	. E	. E	. E	. E
strontium-90	Ci	. E	. E	. E	. E
cesium-134	Ci	. E	. E	. E	. E
cesium-137	Ci	. E	. E	. E	. E
barium-lanthanum-140	Ci	. E	. E	. E	. E
Others (specify)	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
unidentified	Ci	. E	. E	. E	. E

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C - LIQUID EFFLUENT

1st and 2nd Quarters of 1985

All samples of liquid effluents were analyzed and determined to be at or below minimum detectable activities for all radionuclides listed in Shoreham's Technical Specifications. These MDAs were below the lower limits of detection required in Technical Specifications Table 4.11.1.1.1-1. In addition, no other radionuclides were identified. Therefore, no entries were made in Table 2B. The only entry in Table 2A pertains to waste volumes released and dilution volumes.

TABLE 2A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (YEAR)

LIQUID EFFLUENTS—SUMMATION OF ALL RELEASES

	Unit	Quarter 1st	Quarter 2nd	Est Total Error, %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	. E	. E	. E
2. Average diluted concentration during period	μCi/ml	. E	. E	
3. Percent of applicable limit	%	. E	. E	
B. Tritium				
1. Total release	Ci	. E	. E	. E
2. Average diluted concentration during period	μCi/ml	. E	. E	
3. Percent of applicable limit	%	. E	. E	
C. Dissolved and entrained gases				
1. Total release	Ci	. E	. E	. E
2. Average diluted concentration during period	μCi/ml	. E	. E	
3. Percent of applicable limit	%	. E	. E	
D. Gross alpha radioactivity				
1. Total release	Ci	. E	. E	. E
E. Volume of waste released (prior to dilution)	liters	2.08 E06	8.52E06	5.00E 00
F. Volume of dilution water used during period	liters	2.41 E09	1,08E10	1.00E01

TABLE 2B

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (YEAR)

LIQUID EFFLUENTS

		CONTINUOUS MODE		BATCH MODE	
Nuclides Released	Unit	Quarter	Quarter	Quarter	Quarter
strontium-89	Ci	. E	. E	. E	. E
strontium-90	Ci	. E	. E	. E	. E
cesium-134	Ci	. E	. E	. E	. E
cesium-137	Ci	. E	. E	. E	. E
iodine-131	Ci	. E	. E	. E	. E
cobalt-58	Ci	. E	. E	. E	. E
cobalt-60	Ci	. E	. E	. E	. E
iron-59	Ci	. E	. E	. E	. E
zinc-65	Ci	. E	. E	. E	. E
manganese-54	Ci	. E	. E	. E	. E
chromium-51	Ci	. E	. E	. E	. E
zirconium-niobium-95	Ci	. E	. E	. E	. E
molybdenum-99	Ci	. E	. E	. E	. E
technetium-99m	Ci	. E	. E	. E	. E
barium-lanthanum-140	Ci	. E	. E	. E	. E
cerium-141	Ci	. E	. E	. E	. E
Other (specify)	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
	Ci	. E	. E	. E	. E
unidentified	Ci	. E	. E	. E	. E
Total for period (above)	Ci	. E	. E	. E	. E
xenon-133	Ci	. E	. E	. E	. E
xenon-135	Ci	. E	. E	. E	. E

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D - SOLID WASTE

1st and 2nd Quarters of 1985

No shipments of solid wastes or irradiated fuel were made during the 1st and 2nd quarters of 1985.

TABLE 3

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (YEAR)

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste	Unit	6-month Period	Est. Total Error, %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	. E	
	Ci	. E	. E
b. Dry compressible waste, contaminated equip, etc.	m^3	. E	
	Ci	. E	. E
c. Irradiated components, control rods, etc.	m^3	. E	
	Ci	. E	. E
d. Other (describe)	m^3	. E	
	Ci	. E	. E

2. Estimate of major nuclide composition (by type of waste)

a. ________	%	. E
________	%	. E
________	%	. E
b. ________	%	. E
________	%	. E
________	%	. E
c. ________	%	. E
________	%	. E
________	%	. E
d. ________	%	. E
________	%	. E
________	%	. E

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
None		

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None		

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G - ODCM REVISIONS AND
REMP NON-COMPLIANCES

In accordance with Technical Specifications 6.9.1.7 which states that revisions to the ODCM shall be included in the next semi-annual radioactive effluent release report issued, the following revisions to the ODCM have been identified.

Revision 5 was issued to incorporate new setpoint calculation inputs and calibration curves. The revision was needed as a result of moving the sample point for 1D11-RE-12A&B (the main condenser air ejector radiation monitor) downstream of the air ejector glycol cooler condenser and installation of temporary detectors. The effected pages are 2.2-6, 2.2-7, 2.2-8 and figures 2.2-5 and 2.2-6.

Revision 6 was issued for the following reasons:

1. Incorporation of new setpoint calculation inputs and text description resulting from moving the sample point for 1D11-RE-12A&B to downstream of the air ejector desuperheater condenser. Effected pages are 2.2-6, 2.2-7 and 2.2-8;

2. Pages 3.3-5, 3.3-6, 3.3-8, 3.4-3, 3.4-5 and 3.5-12: The definition of Ci3, the containment drywell purge exhaust concentration of radionuclide i is changed to include description of purge events bypassing the primary containment purge filter;

3. Pages 3.3-8 and 3.5-12: The definition of Ci3, the containment drywell filter train exhaust concentration of radionuclide i, gaseous sample was changed to iodine and particulate filters to accurately describe the samples taken to derive organ doses and dose rates;

4. Table 5-5: Alternate locations for Ia1 and Ia2 were included, and;

5. Figure 5-2: Location 11C1 was added to the map.

Item 4 is a result of efforts to satisfy Technical Specifications requirements for milk sampling (Table 3.12.1-1.4.a). Milk sampling locations within the distances prescribed by this Technical Specification are acutely limited. Normal animal husbandry practices result in the seasonal loss of milk samples for approximately four months every year from locations 6B1 and 10F1. The wording of Technical Specification 3.12.1 requires that an LCO be entered whenever samples cannot be collected from the locations identified in the ODCM. Therefore, alternate locations for Ia1 (11C1) and Ia2 (8G2) were identified and sampled during the interim period. The original locations (6B1 and 10F1) are sampled preferentially because they are superior to 11C1 and 8G2 with respect to having "the highest dose potential". Therefore, the ODCM is being revised to describe a preferred and a secondary location for both Ia1 and Ia2.

The objective will be to collect milk samples at 6B1 (for Ia1) and 10F1 (for Ia2) at all times that samples are available from those locations. If samples are unavailable from 6B1 or 10F1, then 11C1 will be substituted as Ia1 and 8G2 will be substituted as Ia2 as necessary. By this change, unavailable milk samples resulting in LCO's should be limited while ensuring the integrity and intent of the environmental monitoring program.

The revised pages are appended to this section.

2.2.3.1 Initial Set Point for RE-12A,B Non-bypass Mode Operation

1. Decay the t=0 GE noble gas spectrum for off-gas system release rate prior to treatment (GE document 22A2703B Rev. 3, Table V) for 203 seconds. Scale it to the Shoreham RETS (3.11.2.7) limit of 244,000 µCi/sec at 30 minutes decay by multiplying by 2.44. Divide it by the air ejector cooler condenser maximum flow rate (3.6E+04 cc/sec) to obtain the limiting concentrations C_i (µCi/cc) of each radioisotope i.

2. Using the isotopic concentrations, C_i (µCi/cc), defined above and the effective gamma energy per disintegration, $E_{i\ell}$ (MeV/dis) calculate the specific gamma activity, $A_{i\ell}$ (MeV/cc-sec), for the i-th isotope in each of the following gamma ray energy bins: 0-0.4, 0.4-0.8, 0.8-1.3, 1.3-1.7, 1.7-2.2, 2.2-2.5, and 2.5-3.5 (MeV). Thus:

$$A_{i\ell} = K * E_{i\ell} * C_i$$

where $E_{i\ell}$ is the total gamma energy (MeV) emitted per disintegration of the i-th isotope by gamma rays belonging to the ℓ-th energy bin defined above. The factor $K = 3.7 \times 10^4$ (dis/sec/µCi) is introduced for unit conversion.

The total specific gamma activity, A_ℓ (MeV/cc-sec), for each gamma energy bin, ℓ, is calculated by summing the specific gamma activity, $A_{i\ell}$, for bin ℓ, over all isotopes.

$$A_\ell = \sum_{i=1}^{N} A_{i\ell}$$

3. Using the response curve for RE-12A,B given in Figure 2.2-5, calculate the dose rate. The generic linearity response curve for RE-12A,B is shown in Figure 2.2-6.

$$DR = \sum_{\ell=1}^{7} CF_\ell * A_\ell \qquad \text{(mrem/hr)}$$

where:

CF_ℓ (MeV) is the efficiency $\left(\frac{\text{mrem/hr}}{\text{MeV/cc-sec}}\right)$ at the ℓ-th energy group

4. The high alarm set point (see NOTE in Section 2.1.1, but note the background unit is in mrem/hr) for RE-12A,B in the non-bypass mode will be:

$$S_{12} \leq 0.8 * DR \qquad \text{(mrem/hr)}$$

2.2.3.2 Subsequent Adjustments of Set Points for RE-12A,B in Non-bypass Mode Operation

1. During operation, a gaseous sample from the monitor will be taken and analyzed for noble gases isotopic composition and concentration, C_i, (μCi/cc). The concentrations should be corrected for elapsed decay time between sampling and measurement. In addition, computed concentrations should be obtained for short lived isotopes. Before startup, C_i will be calculated as noted in Section 2.2.

2. At the time of sampling, the net dose rate reading (excluding background) of the monitor will be recorded, DR (mrem/hr).

3. The isotopic release activity concentrations, C_i, are summed and multiplied by the air ejector cooler condenser flow rate, V (cc/sec)* to obtain the noble gas release rate in μCi/sec.

4. The release rate in step 3 is normalized to the RETS Section 3.11.2.7 release limit of 2.44E+05 μCi/sec at t=30 minutes as follows:

$$F = \frac{2.44E+05}{(\sum_i C_i) * V}$$

5. From above, the high alarm set point (see NOTE in Section 2.1.1, but note the background is in mrem/hr) based on a release rate of 2.44E+05 μCi/sec at t=30 minutes can be calculated as follows:

$$S_{12} = 0.8 * F * DR \qquad \text{(mrem/hr)}$$

2.2.4 Main Condenser Air Ejector Monitor (RE-12A,B) High Alarm Set Point for Bypass Mode Operation

2.2.4.1 Initial Set Point for RE-12A,B in Bypass Mode Operation

1. Same as steps 1, 2, and 3 in Section 2.2.3.1

2. The offsite total body dose rate D_T corresponding to the above concentration is calculated as:

$$D_T = 10^{+6} * \chi/Q * V * (\sum_i DFB_i * C_i)$$

and the beta and gamma skin dose rate is calculated as :

$$D_s = 10^{+6} * \chi/Q * V * (\sum_i K_{sim} * C_i)$$

*Note: If flow rate increases, the setpoint must be recalculated. If the flow rate decreases, recalculation of setpoint is optional.

where:

D_T = predicted total body dose rate (mrem/yr)

D_s = predicted beta and gamma skin dose rate (mrem/yr)

χ/Q = annual average atmospheric dispersion factor at 366 meters NNE (6.6E-07 sec/m^3) due to releases via the station ventilation exhaust point

V = air ejector cooler condenser maximum exhaust flow rate (cc/sec) (see 2.2.3.1 Step 1)

DFB_i = total body dose rate conversion factor $(\frac{mrem/yr}{pCi/m^3})$ from Table 2.2-1

K_{sim} = skin dose rate conversion factor $(\frac{mrem/yr}{pCi/m^3})$ from Table 2.2-1

3. The normalizing factor F is chosen to be the smaller of the two (to comply with 25 percent of the RETS (3.11.2.1) dose rate limit):

$$F_T = \frac{125 \text{ mrem/yr}}{D_T}$$

$$F_S = \frac{750 \text{ mrem/yr}}{D_S}$$

F = the smaller of F_T or F_S (unitless)

4. The high alarm set point (see NOTE in Section 2.1.1, but note the background is in mrem/hr) RE-12A,B in bypass mode is set at:

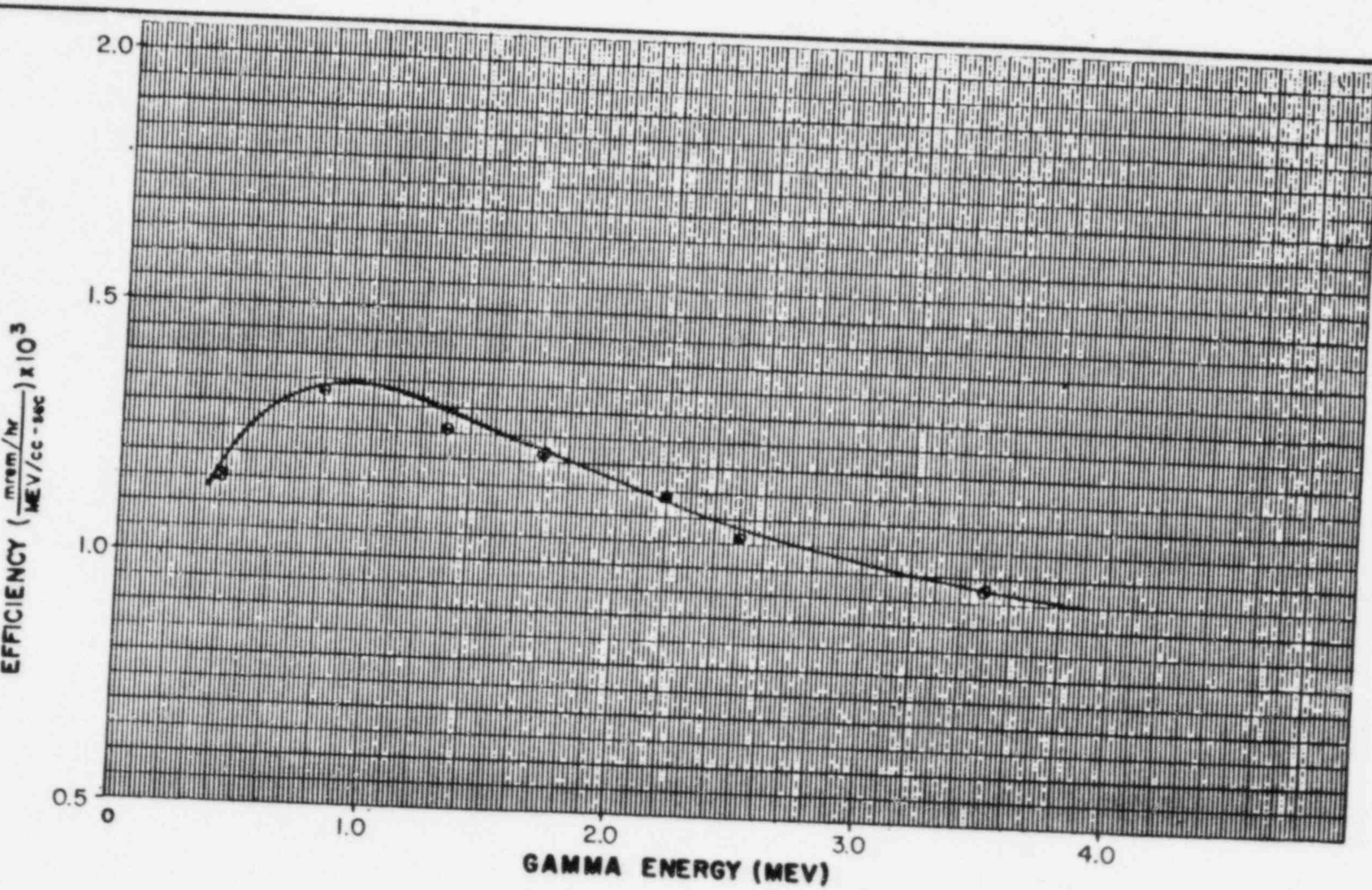
$$S_{12} \leq 0.8 * F * DR \qquad \text{(mrem/hr)}$$

2.2.4.2 Subsequent Adjustments of Set Points for RE-12A,B in Bypass Mode Operation

1. A gaseous sample from the monitor will be taken and analyzed for isotopic composition and concentration, C_i (μCi/cc)

2. At the time of sampling, the net dose rate reading, DR (mrem/hr), of the monitor will be recorded.

3. Follow procedures 2, 3, and 4 of Section 2.2.4.1 to get the high alarm set point for RE-12A,B in bypass mode.



SOURCES:

1. NED CALCULATION C-RPD-153

• GAMMA ENERGY BINS (CF_{ℓ})

FIGURE 2.2-5
DETECTORS RE-12A,B
EFFICIENCY VS. GAMMA ENERGY
SHOREHAM NUCLEAR POWER STATION-UNIT 1
OFFSITE DOSE CALCULATION MANUAL

3.3.2 Method 2: (Backup Method)

3.3.2.1 Noble Gas Total Body Dose Rate

$$DT_s = 0.7 * \chi/Q_1 * \sum_i [DFB_i *(C_{i1} * V_1 - C_{i2} * V_2 - C_{i3} * V_3)]$$
$$+ 0.7 * V_2 * \chi/Q_2 * \sum_i [DFB_i * C_{i2}]$$
$$+ 0.7 * V_3 * \chi/Q_3 * \sum_i [DFB_i * C_{i3}] \quad \text{(mrem/yr)}$$

During periods of no intermittent releases such as no main condenser air removal pump operation and no containment drywell purge the above formula reduces to the following:

$$DT_s = 0.7 * V_1 * \chi/Q_1 * \sum_i [DFB_i * C_{i1}] \quad \text{(mrem/yr)}$$

where:

DT_s = total body dose rate from all radionuclides releases (mrem/yr),

DFB_i = the total body dose rate factor due to gamma emissions for each identified noble gas radionuclide (mrem/yr per pCi/m^3) (Table 2.2-1),

C_{i1} = the station ventilation exhaust duct release concentration of radionuclide, i, (pCi/cc) (from the isotopic analyses performed on the gaseous sample taken from the station ventilation exhaust monitor),

C_{i2} = the air removal pump ventilation exhaust duct release concentration of radionuclide, i, (pCi/cc) (from the isotopic analyses performed on the gaseous sample taken from the air removal pump discharge monitor),

C_{i3} = the containment drywell purge ventilation exhaust concentration of radionuclide, i, (pCi/cc) obtained from a sample taken during a filtered release or from the containment drywell atmosphere monitor with the purge lines bypassing the primary containment purge filter (The concentration is obtained from the isotopic analyses performed on the gaseous sample taken.),

V_1 = 1.73E+08 cc/sec (3.66E+05 cfm), station ventilation exhaust duct ventilation exhaust flow rate,

V_2 = 5.70E+05 cc/sec (1200 cfm), air removal pump exhaust duct ventilation exhaust flow rate,

V_3 = 5.70E+05 cc/sec (1200 cfm), containment drywell purge ventilation exhaust flow rate,

χ/Q_1 = annual average χ/Q at 366 meters NNE due to release via the station ventilation exhaust point (6.6E-07 sec/m^3),

χ/Q_2 = short term χ/Q at 366 meters NNE due to air removal pump release via the station ventilation exhaust point (3.6E-06 sec/m^3),

χ/Q_3 = short term χ/Q at 366 meters NNE due to containment drywell purge via the station ventilation exhaust point (3.6E-06 sec/m^3).

0.70 = shielding factor that accounts for dose reduction due to shielding from residential structures.

3.3.2.2 Noble Gas Skin Dose Rate

$$DS_s = \chi/Q_1 * \sum_i [K_{si} *(C_{i1} * V_1 - C_{i2} * V_2 - C_{i3} * V_3)]$$

$$+ V_2 * \chi/Q_2 * \sum_i [K_{si} * C_{i2}] + V_3 * \chi/Q_3 * \sum_i [K_{si} * C_{i3}] \text{ (mrem/yr)}$$

During periods of no intermittent releases such as no main condenser air removal pump operation and no containment drywell purge the above formula reduces to the following:

$$DS_s = V_1 * \chi/Q_1 * \sum_i [K_{si} * C_{i1}] \quad \text{(mrem/yr)}$$

where:

DS_s = skin dose rate from all radionuclides released (mrem/yr),

K_{si} = the skin dose factor due to beta and gamma emissions for each identified noble gas radionuclide (mrem/yr per pCi/m^3) from Table 2.2-1,

C_{i1} = the station ventilation exhaust duct release concentration of radionuclide, i, (pCi/cc) (from isotopic analyses performed on the gaseous sample taken from the station ventilation exhaust monitor),

C_{i2} = the air removal pump ventilation exhaust duct release concentration of radionuclide, i, (pCi/cc) (from the isotopic analyses performed on the gaseous sample taken from the air removal pump discharge monitor),

C_{i3} = the containment drywell purge ventilation exhaust concentration of radionuclide, i, (pCi/cc) obtained from a sample taken during a filtered release or from the containment drywell atmosphere monitor with the purge lines bypassing the primary containment purge filter (The concentration is obtained from the isotopic analyses performed on the gaseous sample taken.),

V_1 = 1.73E+08 cc/sec (3.66E+05 cfm), station ventilation exhaust duct ventilation exhaust flow rate,

C_{i2} = the air removal pump ventilation exhaust duct release concentration of radionuclide, i, (μCi/cc) (from the isotopic analyses performed on the iodine and particulate filters taken from the air removal pump discharge monitor),

C_{i3} = the containment drywell purge ventilation exhaust concentration of radionuclide, i, (μCi/cc) obtained from the iodione and particulate filters during a filtered release or from the containment drywell atmosphere monitor with the purge lines bypassing the primary containment purge filter.(The concentration is obtained from the isotopic analyses performed on the iodine and particulate filters.),

V_1 = 1.70E+08 cc/sec (3.60E+05 cfm), station ventilation exhaust duct ventilation exhaust flow rate,

V_2 = 5.70E+05 cc/sec (1200 cfm), air removal pump exhaust duct ventilation exhaust flow rate,

V_3 = 5.70E+05 cc/sec (1200 cfm), containment drywell purge ventilation exhaust flow rate,

χ/Q_1 = annual average χ/Q at 2478 meters ESE due to releases via the station ventilation exhaust point (1.54E-07 sec/m^3),

χ/Q_2 = short term χ/Q at 2478 meters ESE due to condenser air removal pump release via the station ventilation exhaust point (4.22E-07 sec/m^3),

χ/Q_3 = short term χ/Q at 2478 meters ESE due to containment drywall purge via the station ventilation exhaust point (4.22E-07 sec/m^3).

3.4.2 Method 2: (Backup Method)

3.4.2.1 Noble Gas Gamma Air Dose

The general equation is:

$$D_{G_s} = 3.17E\text{-}08 * \chi/Q_1 * \sum_i [M_i * (C_{i1} V_1 t_1 - C_{i2} V_2 t_2 - C_{i3} V_3 t)]$$
$$+ 3.17E\text{-}08 * V_2 * t_2 * \chi/Q_2 * \sum_i [M_i * C_{i2}]$$
$$+ 3.17E\text{-}08 * V_3 * t_3 * \chi/Q_3 * \sum_i [M_i * C_{i3}] \quad \text{(mrad)}$$

During periods of no intermittent releases, such as no main condenser air removal pump operation and no containment drywell purge, the above formula reduces to the following:

$$D_{G_s} = 3.17E\text{-}08 * V_1 * t_1 * \chi/Q_1 * \Sigma_i [M_i * C_{i1}] \quad \text{(mrad)}$$

where:

D_G = the total gamma air dose from the releases (mrad),

3.17E-08 = the inverse of number of seconds in a year,

M_i = the air dose factor due to gamma emissions for each identified noble gas radionuclide (mrad/yr per $\mu Ci/m^3$) from Table 3.4-1,

t_1 = 7.88E+06 sec for quarterly dose calculation,
= 3.15E+07 sec for yearly dose calculation

t_2 = release period (sec) for condenser air removal pump

t_3 = release period (sec) for containment drywell purge exhaust

C_{i1} = the station ventilation exhaust duct release concentration of radionuclide, i, ($\mu Ci/cc$) (from the isotopic analyses performed on the gaseous sample taken from the station ventilation exhaust monitor),

C_{i2} = the air removal pump ventilation exhaust duct release concentration of radionuclide, i, ($\mu Ci/cc$) (from the isotopic analyses performed on the gaseous sample taken from the air removal pump discharge monitor),

C_{i3} = the containment drywell purge ventilation exhaust concentration of radionuclide, i, ($\mu Ci/cc$) obtained from a sample taken during a filtered release or from the containment drywell atmosphere monitor with the purge lines bypassing the primary containment purge filter (The concentration is obtained from the isotopic analyses performed on the gaseous sample taken.),

t_1 = 7.88E+06 sec for quarterly dose calculation,
= 3.15E+07 sec for yearly dose calculation,

t_2 = release period (sec) for condenser air removal pump,

t_3 = release period (sec) for containment drywell purge exhaust,

C_{i1} = the station ventilation exhaust duct release concentration of radionuclide, i, (μCi/cc) (from the isotopic analyses performed on the gaseous sample taken from the station ventilation exhaust monitor),

C_{i2} = the air removal pump ventilation exhaust duct release concentration of radionuclide, i, (μCi/cc) (from the isotopic analyses performed on the gaseous sample taken from the air removal pump discharge monitor),

C_{i3} = the containment drywell purge ventilation exhaust concentration of radionuclide, i, (μCi/cc) obtained from a sample taken during a filtered release or from the containment drywell atmosphere monitor with the purge lines bypassing the primary containment purge filter.(The concentration is obtained from the isotopic analyses performed on the gaseous sample taken.),

V_1 = 1.73E+08 cc/sec (3.66E+05 cfm), station ventilation exhaust duct ventilation exhaust flow rate,

V_2 = 5.70E+05 cc/sec (1200 cfm), air removal pump exhaust duct ventilation exhaust flow rate,

V_3 = 5.70E+05 cc/sec (1200 cfm), containment drywell purge ventilation exhaust flow rate,

χ/Q_1 = annual average χ/Q at 457 meters ESE due to release via the station ventilation exhaust point (8.44E-07 sec/m^3),

χ/Q_2 = short term χ/Q at 457 meters ESE due to condenser air removal pump release via the station ventilation exhaust point (1.83-06 sec/m^3), and

χ/Q_3 = short term χ/Q at 457 meters ESE due to containment drywell purge release via the station ventilation exhaust point (1.83E-06 sec/m^3).

The dose factors P_{ij}, P_{oij} are based on the critical individual organ for the child group, since this group is most restrictive.

t_1 = 7.88E+06 sec for quarterly dose calculation
= 3.15E+07 sec for yearly dose calculation,

t_2 = release period (sec) for condenser air removal pump,

t_3 = release period (sec) for containment drywell purge exhaust,

C_{i1} = the station ventilation exhaust duct release concentration of radionuclide, i, (μCi/cc) (from the isotopic analyses performed on the iodine and filter cartridge taken from the station ventilation exhaust monitor),

C_{i2} = the air removal pump ventilation exhaust duct release concentration of radionuclide, i, (μCi/cc) (from the isotopic analyses performed on the iodine and particulate filters taken from the air removal pump discharge monitor),

C_{i3} = the containment drywell purge ventilation exhaust concentration of radionuclide, i, (μCi/cc) obtained from the iodine and particulate filters during a filtered release or from the containment drywell atmosphere monitor with the purge lines bypassing the primary containment purge filter. (The concentration is obtained from the isotopic analyses performed on the iodine and particulate filters.),

V_1 = 1.73E+08 cc/sec (3.66E+05 cfm), station ventilation exhaust duct ventilation exhaust flow rate,

V_2 = 5.70E+05 cc/sec (1200 cfm), air removal pump exhaust duct ventilation exhaust flow rate,

V_3 = 5.70E+05 cc/sec (1200 cfm), containment drywell purge ventilation exhaust flow rate,

χ/Q_1 = annual average χ/Q at 2478 meters ESE due to releases via the station ventilation exhaust point (1.54E-07 sec/m^3),

χ/Q_2 = short term χ/Q at 2478 meters ESE due to condenser air removal pump release via the station ventilation exhaust point (4.22E-07 sec/m^3),

χ/Q_3 = short term χ/Q at 2478 meters ESE due to containment drywell purge via the station ventilation exhaust point (4.22E-07 sec/m^3),

D/Q_1 = annual average D/Q deposition factor at 2478 meters ESE due to releases via the station ventilation exhaust point (3.08E-09 m^{-2}),

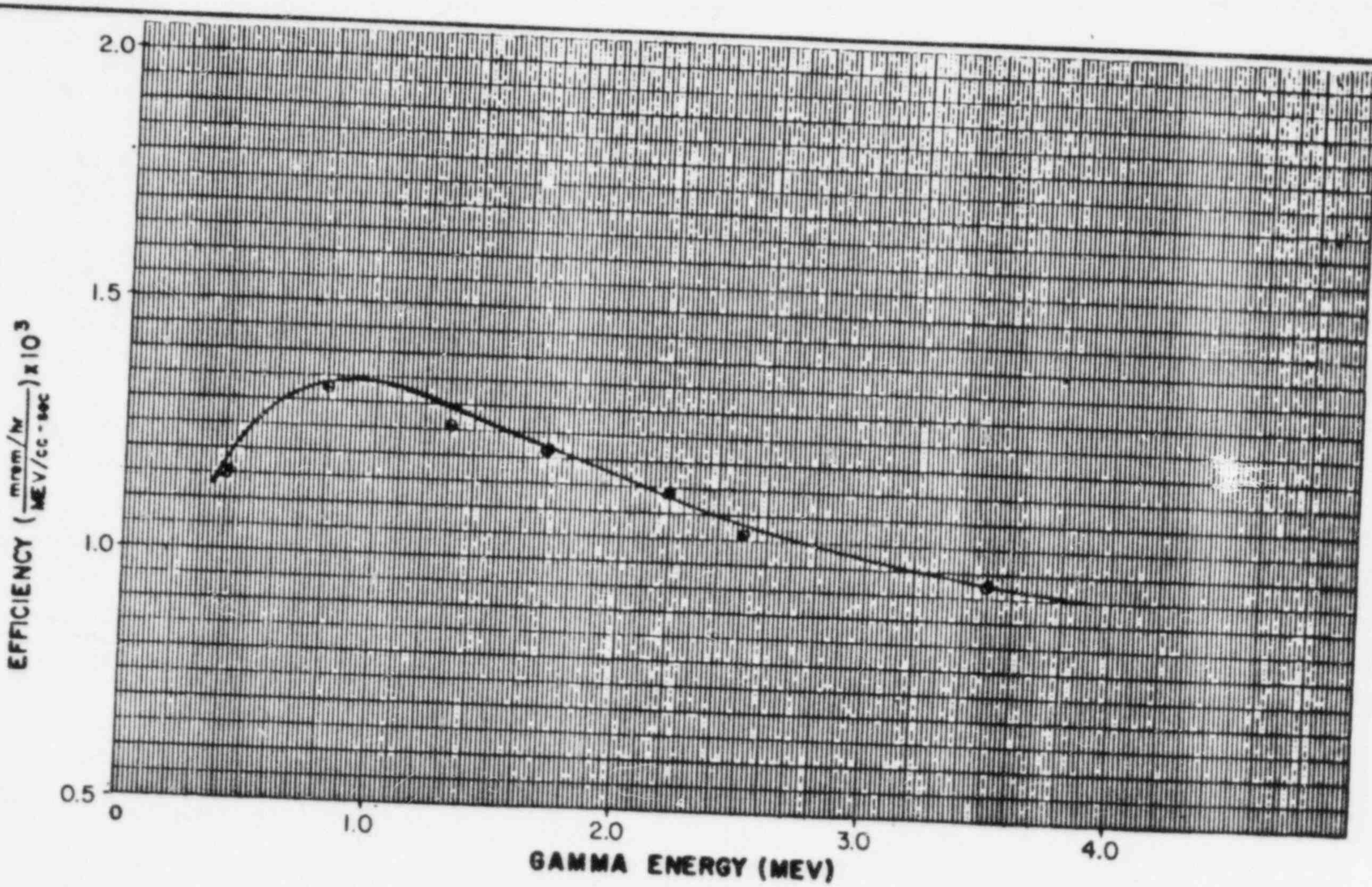
D/Q_2 = short term D/Q deposition factor at 2478 meters ESE due to condenser air removal pump releases via the station ventilation exhaust point (8.47E-09 m^{-2}),

TABLE 5-5

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP) INGESTION MONITORING STATIONS

Location NUREG-0473	Codes Shoreham REMP	Location Description
Ia1*	6B1	Goat Farm, 1.54 mi. ESE
	11C1	School (Goats), 2.4 mi. SW
Ia2*	10F1	Goat Farm, 9.2 mi. SSW
	8G2	Dairy (Cow), 10.8 mi. SSE
Ib1	3C1	Fish and Invertebrates, outfall area, 2.9 mi. NE
Ib2	14C1	Fish and Invertebrates, outfall area 2.1 mi. WNW
Ib3	13G2	Fish and Invertebrates, background, 13.3 mi. W
Ic1	8B1	Local Farm, 1.2 mi. SSE
Ic2	5C2	Local Farm, 2.8 mi. E
Ic3	12H1	Background Farm, 26 mi. WSW

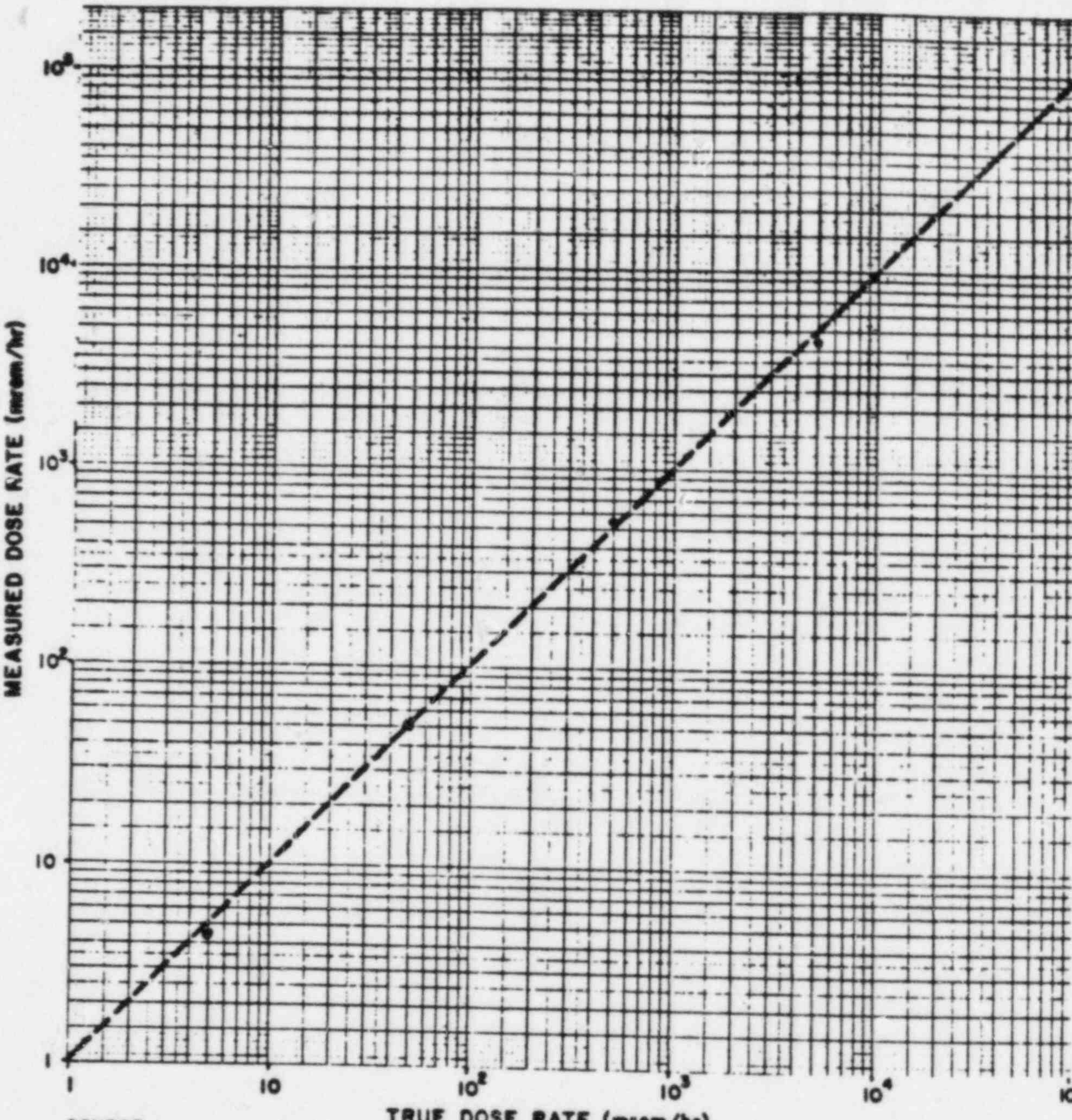
*Samples will be obtained from one of the locations listed as available. Priority will be given to the first of the two locations listed. If samples are unavailable from that location, substitution will be made from the second location listed.



SOURCES:
1. NED CALCULATION C-RPD-153

• GAMMA ENERGY BINS (CF_l)

FIGURE 2.2-5
DETECTORS RE-12A,B
EFFICIENCY VS. GAMMA ENERGY
SHOREHAM NUCLEAR POWER STATION-UNIT 1
OFFSITE DOSE CALCULATION MANUAL



SOURCE:

RAD SERVICES INC. CALIBRATION OF EBERLINE EXTERNAL PROBE RD-17A
CALIBRATION DATE 01/11/85

— — IDEAL CURVE
• ACTUAL DATA

FIGURE 2.2-6
GENERIC LINEARITY CURVE
FOR DETECTORS RE-12A,B
SHOREHAM NUCLEAR POWER STATION-UNIT 1
OFFSITE DOSE CALCULATION MANUAL

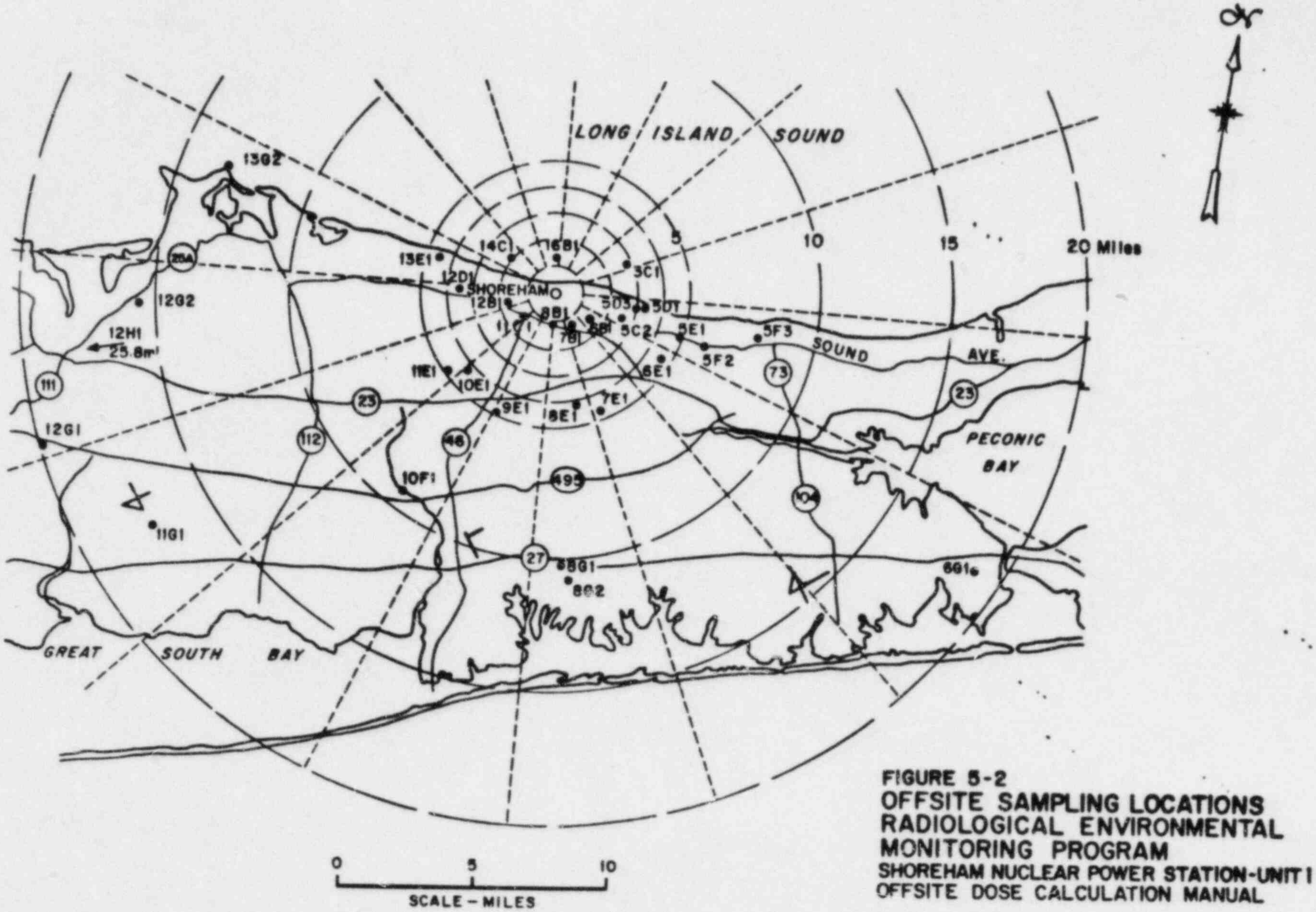


FIGURE 5-2
OFFSITE SAMPLING LOCATIONS
RADIOLOGICAL ENVIRONMENTAL
MONITORING PROGRAM
SHOREHAM NUCLEAR POWER STATION-UNIT 1
OFFSITE DOSE CALCULATION MANUAL

REVISION 6 - AUGUST 1985