METROPOLITAN EDISON COMPANY

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January 24, 1978
GQL 0123

Mr. William H. Regan
Environmental Projects Branch 2
Division of Site Safety and Environmental Analysis
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station Unit 2 (TMI-2)
Docket Number 50-320

Enclosed please find Met-Ed's latest revision to the TMI-2 Radiological Environmental Monitoring Program (REMP).

Should you have any questions, please contact either myself, or Mr. R. A. Lengel of my staff.

Sincerely,

J. G. Herbein
Vice President
Generation

JGH:RAL:iem

cc: Mr. Jan Norris (NRC)

Enclosure: TMI-2 REMP

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RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

3.2 Specification

A radiological environmental monitoring program shall be conducted in the vicinity of the Three Mile Island Nuclear Station.

Environmental samples shall be collected and analyzed according to Table 3.2-2 at locations shown in Figures 3.2-1, 2, and described in the table on page 3.2-6.

Analytical techniques used shall be such that the detection capabilities in Table 3.2-3 are achieved.

The laboratories of the licensee and licensee's contractors which perform analyses required by these specifications shall participate in the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparisons Studies (Cross-Check) Program or equivalent program. This participation shall include all of the determinations (sample medium-radionuclide combination) that are offered by EPA and that also are included in these specifications. A summary of the results of analysis of these cross-check samples shall be included in the annual report.

A census shall be conducted annually during the growing season to determine the location of the nearest milk animal in each of the 16 meteorological sectors within a distance of 5 miles and action taken as specified below. Broad leaf vegetation sampling will be performed at the site boundary in a sector with the highest D/Q at the time of harvest, (or closest landsite location).

ACTION

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the annual report.

If the results of a determination in the EPA cross-check program (or equivalent program) are outside the specified control limits, the laboratory shall investigate the cause of the deviation and take steps to correct it. The results of this investigation and corrective action shall be included in the annual report.

If the above specified census indicates that milk animals are present at a location which yields a calculated thyroid dose greater than those previously sampled, or if the census results in changes in the location used in the radioactive effluent Technical Specifications for dose calculations, a written report shall be submitted to the Director of Operating Reactors, NRC (with a copy to the Director of the NRC Regional Office) within 30 days identifying the new location (distance and direction). Milk animal locations resulting in higher calculated doses shall be added to the surveillance program as soon as practicable.

The sampling location having the lowest calculated dose may then be dropped from the surveillance program at the end of the grazing season during which the census was conducted. Also, any location from which milk or broad leaf vegetation can no longer be obtained may be dropped from the surveillance program after notifying the NRC in writing that they are no longer obtainable at the location. The results of the milk census shall be reported in the annual report.

Reporting Requirement

A. Annual Environmental Operating Report, Part B, Radiological.

A report on the radiological environmental surveillance program for the previous calendar year shall be submitted to the Director of the NRC Regional Office (with a copy to the Director, Office of Nuclear Reactor Regulation) as a separate document by May 1 of each year. The period of the first report shall begin with the date of initial criticality. The reports shall include a summary (format) of Table 3.2-1, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, as deemed appropriate by the licensee, including a comparison with operational controls, preoperational studies (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the station operation on the environment.

The reports shall also include the following: a summary description of the radiological environmental monitoring program including sampling methods for each sample type, size and physical characteristics of each sample type, sample preparation methods, analytical methods, and measuring equipment used; a map of all sampling locations keyed to a table giving distances and directions from the site; the results of land use censuses; and the results of licensee participation in the Environmental Protection Agency's Environmental Radioactivity Laboratory Intercomparisons Studies (Crosscheck) Program.

B. Nonroutine Radiological Environmental Operating Reports

"If a confirmed[3] measured radionuclide concentration in an environmental sampling medium averaged over any quarter sampling period exceeds the reporting level given in Table 4, a written report shall be submitted to the Director of the NRC Regional Office (with a copy to the Director, Office of Nuclear Reactor Regulation) within 30 days from the end of the quarter. If it can be demonstrated that the level is not a result of plant effluents (e.g., by comparison with control station or preoperational data) a report need not be submitted, but shall be discussed in the annual report. When more than one of the radionuclides in Table 4 are detected in the medium, the reporting level shall have been exceeded if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1$$

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[3] A comfirmatory reanalysis of the original, a duplicate, or a new sample may be desirable, as appropriate. The results of the confirmatory analysis shall be completed at the earliest time consistent with the analysis, but in any case within 30 days.

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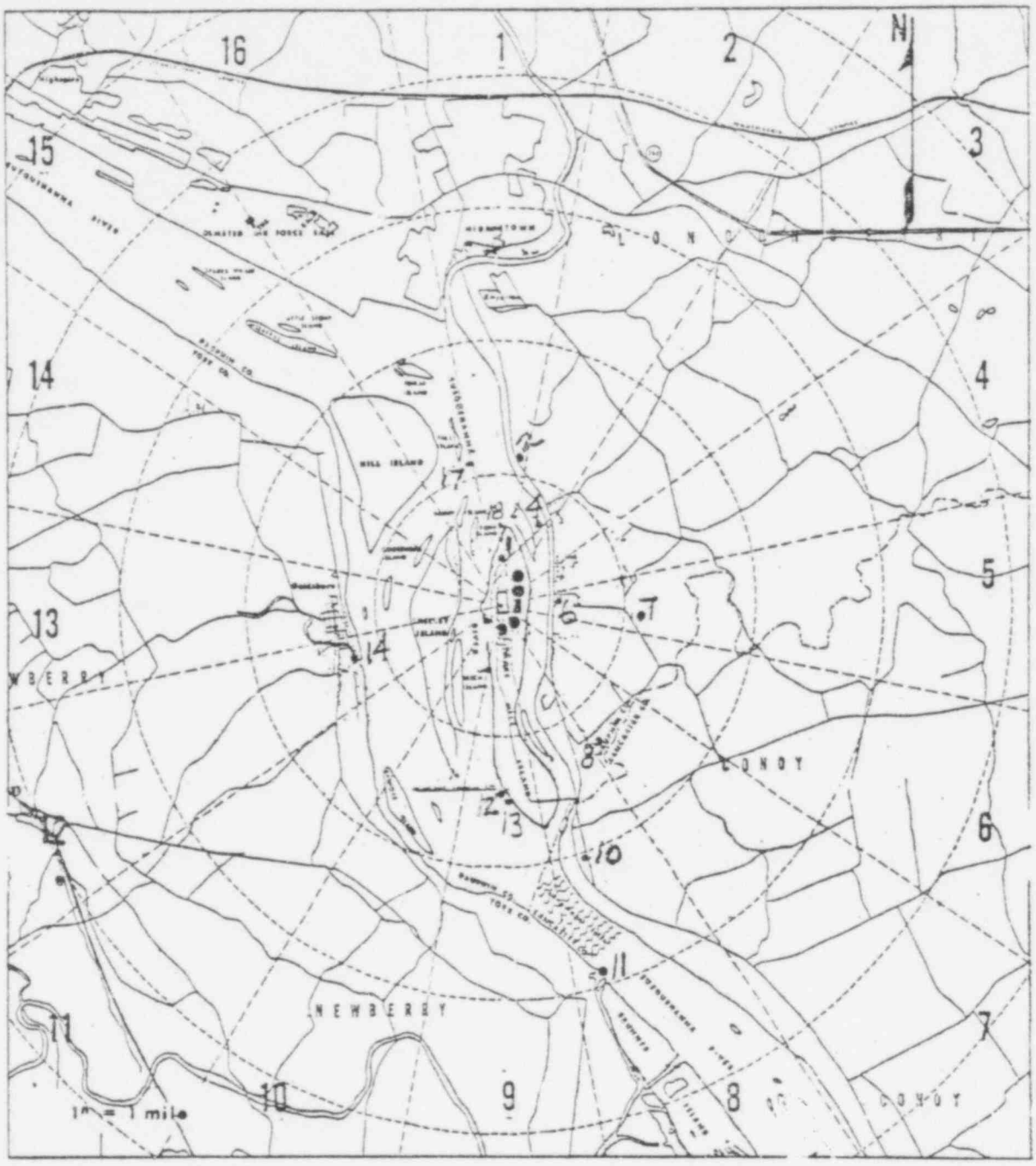

Figure 3.2-1

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations within
5 Miles of the Site

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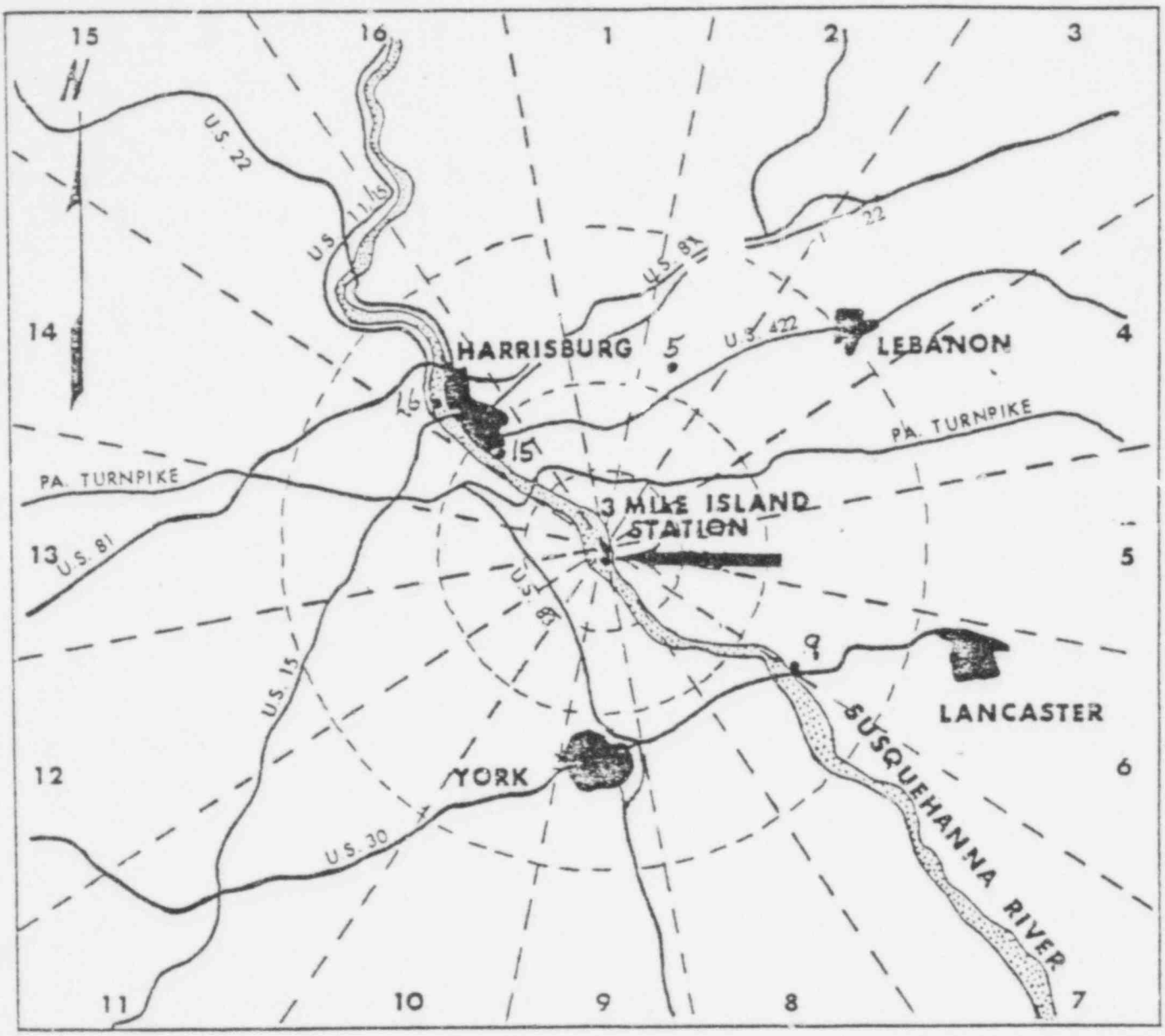

1" = APPR. 10 MILES

Figure 3.2-2

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations Greater
Than 5 Miles from the Site

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TABLE 3.2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY FORMAT EXAMPLE

Name of Facility _____ Docket No. _____

Location of Facility _____ Reporting Period _____

(County, State)

Medium or Pathway Sampled (Unit of Measurement)	Type & Total Number of Analyses Performed	Lower Limit of Detection[a] (LLD)	All Indicator Locations Mean (f)[b] Range	Location with Highest Annual Mean: Name, Distance & Direction	Location with Highest Annual Mean: Name (f)[b] Range	Control Locations Mean (f)[b] Range	Number of Nonroutine Reported Measurements
Air Particulates (pCi/m)	Gross B 416	0.003	0.08(200/312) (0.05-2.0)	Middletown 5 miles NNW	0.10(5/52) (0.08-2.0)	0/08 (8/104) (0.05-1.40)	1
	γ-Spec. 32						
	^{137}Co	0.003	0.05 (4/24) (0.03-0.13)	Smithville 2.5 miles	0.08(2/4) 0.03-0.13)	<LLD	4
	^{140}Ba	0.003	0.03 (2/24) (0.01-0.08)	Podunk 4.0 miles	0.05 (2/4) (0.01-0.08)	0.02 (2/4)	1
	^{89}Sr 40	0.002	<LLD	-	-	<LLD	0
Fish pCi/kg (wet weight)	^{90}Sr 40	0.0003	<LLD	-	-	<LLD	0
	γ-Spec. 8						
	^{137}Cs	80	<LLD	-	<LLD	90 (1/4)	0
	^{134}Cs	80	<LLD	-	<LLD	<LLD	0
	^{60}Co	80	120 (3/4) (90-200)	River Mile 35 Podunk River	See Column 4	<LLD	0

[a] See Table 3.2-3, note b.

[b] Mean and range based upon all measurements with LLD treated as positive value.

Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

[c] Note: The example data are provided for illustrative purposes only.

SAMPLE IDENTIFICATION

Met-Ed identifies samples by a three-part code. The first two letters are the power station identification code, in this case TM. The next one to three letters are for the media sampled.

AI	=	Air Iodine	FPL	=	Green Leafy Vegetables
AP	=	Air Particulates	ID	=	Immersion Dose (TLD)
AQF	=	Fish	M	=	Milk
AQS	=	Sediment	SW	=	Surface Water
			DW	=	Drinking Water

The last four symbols are a location code based on direction and distance from the site. Of the last four symbols, the first two represent each of the sixteen angular sectors of 22 1/2 degrees centered about the reactor site. Sector one is divided evenly by the north axis and the other sectors are numbered in a clockwise direction; i.e., 2 = NNE, 3 - NE, 4 = ENE, 5 = E, etc. The next digit is a letter which represents the radial distance from the plant:

S	=	On-site location	E	=	4 - 5 miles off-site
A	=	0 - 1 miles off-site	F	=	5 - 10 miles off-site
B	=	1 - 2 miles off-site	G	=	10 - 20 miles off-site
C	=	2 - 3 miles off-site	H	-	> 20 miles off-site

The last number is the station numerical designation within each sector and zone: e.g. 1, 2, ...

Location No./Code	Fig. No.	Type	Distance-Direction from Site*	Sample Types
1. 1S2	3.2-1	Indicator	0.4 mi N	AP
2. 1B1	3.2-1	Indicator	1.02 mi N	M
3. 1C1	3.2-1	Indicator	2.6 mi N	AI, AP, ID
4. 2S2	3.2-1	Indicator	0.7 mi NNE	ID
5. 2G1	3.2-2	Background	11 mi NNE	M, FPL
6. 5A1	3.2-1	Indicator	0.4 mi E	AI, AP, ID
7. 5B1	3.2-1	Indicator	1 mi E	M, FPL
8. 7B3	3.2-1	Indicator	1.6 mi SE	M, FPL
9. 7G1	3.2-2	Indicator	15 mi SE	SW, ID, DW
10. 8C1	3.2-1	Indicator	2.3 mi SSE	AI, AP, ID
11. 8C2	3.2-1	Indicator	2.8 mi SSE	SW
12. 9B2	3.2-1	Indicator	1.[illegible] mi S	AQF
13. 9B1	3.2-1	Indicator	0.7 mi S	AQS
14. 12B1	3.2-1	Indicator	1.6 mi WSW	AP, ID
15. 15F1	3.2-2	Background	8.7 mi NW	SW, DW
16. [illegible]	3.2-2	Background	15 mi NW	AI, AP, ID
17. 16B1	3.2-2	Background	1.1 mi WNW	AQF
18. 1N2	3.2-1	Background	0.7 mi N	AQS

*Site (from which all distances are measured) is defined as an imaginary point midway between the two Reactor containments.

22 [illegible]

TABLE 3.2-2

RADIOLOGICAL ENVIRONMENTAL SAMPLING

Sample Type	No. of Sample Stations (a) Indicator	Background	Type of Analysis	Collection/Analysis Frequency (a)
Air	3	1	I-131	Charcoal Cartridge-Weekly
	5	1	GB GS(1)	Particulate Weekly (b) Quarterly
Radiation TLD (f)	5	2	Gamma	Quarterly
Milk	3	1	I-131 GS Sr-90	Semi-Monthly (g) Semi-Monthly (g) If 131-Iodine > 10 pCi/l
Green Leafy Vegetables (e)	2	1	GS I-131 (h)	At harvest
Surface Water (River) (d) (3)	1	1	GS Tritium	Monthly Quarterly
Drinking Water (River) (d) (3)	1	1	GB GS Tritium I-131(h)	Monthly Monthly Quarterly Monthly
Sediment (2)	1	1	GS	Semi-Annually
Fish (2) (4)	1	1	GS	Semi-Annually

GB = Gross Beta (b)
GS = Gamma Scan (c)

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TABLE 3.2-2 NOTES

[a] The number, media, frequency and location of sampling may vary from site to site. It is recognized that, at the time it may not be possible or practical to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and submitted for acceptance. Actual locations (distance and direction) from the site shall be provided.

[b] Particulate sample filters shall be analyzed for gross beta 24 hours or more after sampling to allow for radonthoron daughter decay. If gross beta activity in air or water is greater than 10 times the mean of control sample for either medium, gamma isotopic analysis shall be performed on the individual samples.

[c] Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

[d] Composite samples will be collected with equipment (or equivalent) which is capable of collecting an aliquot at time intervals which are very short (e.g., hourly) relative to the compositing period (e.g., monthly). Background composite samples will be composited at least daily.

[e] If harvest occurs more than once a year, sampling shall be performed during each harvest.

[f] The number of TL dosimeters or chips shall be 2 or more at each location.

[g] Milk shall be collected semi-monthly during the grazing season, monthly at other times. When milk is not available, broad leaf vegetation may be substituted.

[h] The gamma scan performed on green leafy vegetables or drinking water can also suffice as the I-131 analysis as long as the I-131 sensitivity of Table 3.2-3 can be met.

RADIOLOGICAL ENVIRONMENTAL SAMPLING

(1) Composite of all samples for the quarter by location.

(2) In the event of icing or dangerous conditions on the Susquehanna River, the sampling frequency may be extended until river conditions permit sampling.

(3) River water samples will be collected weekly and composited for monthly and quarterly analyses.

(4) Sample each of two recreationally important species at each location.

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TABLE 3.2-3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

Isotope	Water (pCi/l)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross Beta	2[c]	1×10^{-2}				
^{131}I	330					
^{54}Mn	15		130			
^{59}Fe	30		260			
^{58}, ^{60}Co	15		130			
^{65}Zn	30		260			
^{95}Zr-Nb	10					
^{133}Xe	0.5[d]	7×10^{-2}		0.8[d]	25[d], e	
^{134}, ^{137}Cs	15	1×10^{-2}	130	15	80	150
^{140}Ba-La	15			15		
^{3}H(a)						

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TABLE 3.2-3 NOTES

[a]Acceptable performance criteria for thermoluminescent dosimeters will be that of Regulatory Guide 4.13, or comparable.

[b]Table 3.2-3 indicated acceptable detection capabilities for radioactive materials in environmental samples. These detection capabilities are tabulated in terms of the lower limits of detection (LLDs). The LLD is defined, for purposes of this specification, as the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 s_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per disintegration)

V is the sample size (in units of mass or volume)

2.22 is the number of disintegrations per minute per picocurie
Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide*

Δt is the elapsed time between sample collection and counting*

The value of s_b used in the calculation of the LLD for a particular measurement system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicated variance. In calculating the LLD for a radionuclide determined by gamma-ray spectrometry, the background shall include the typical contributions of other radionuclides normally present in the samples (e.g., potassium-40 in milk samples). Actual values of E, V, Y, and Δt shall be used in the calculation.

*For isotopes with $T_{\frac{1}{2}}$'s less than twice the sample analysis frequency.

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TABLE 3.2-3 NOTES (Cont'd)

[c]LLD for drinking water.

[d]LLD's for ^{131}I in water, milk and other food products correspond to one-quarter of the Appendix I (10 CFR Part 50) design objective dose-equivalent of 15 mrem/year using the assumptions given in Regulatory Guide 1.109 except for an infant consuming 330 l/yr of drinking water.

[e]LLD for leafy vegetables.

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TABLE 3.2-4

REPORTING LEVELS FOR NON-ROUTINE OPERATING REPORTS

Analysis	Reporting Level (RL)(a)				
	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/Kg, wet)	Milk (pCi/l)	Broad Leaf Vegetation (pCi/Kg, wet)
H-3	3×10^4				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-La-140	2×10^2			3×10^2	

a. averaged over any quarterly sampling period