J. T. Collins

R BANGART

File
Eff Tech Specs 7/25/79

COMMENTS ON MET-ED LETTER 7/9/79
Sid Porter to Bon Ruscke

No comments -

Our comments on the previous 7/1/79 letter appear to have been incorporated, i.e. were the background factors taken into account, and was the 0.1 of MPC applicable before or after dilution by blowdown from the mechanical draft cooling tower -

Looks OK!
Dick B.

D. Baugart/P. Stoddart

JF 7/12

METROPOLITAN EDISON COMPANY

Review & provide comments

Subject: Minimum Detectable Activities (MDA) in Liquid Samples Compared to Maximum Permissible Concentrations (MPC) in Water for Unrestricted Areas

Location: TMI

Date: July 9, 1979

To: Ben Rusche

1. Reference is made to letter from Syd Porter, July 1, 1979, subject as above.

2. Appendix 1 reflects current MDA's and MPC's for selected gamma-emitting radionuclides in liquids. Radiochemical separations must be preformed to quantify those radionuclides which are not gamma-emitters (e.g., ^{3}H, ^{55}Fe, ^{89}Sr, $^{90}Sr^{90}Y$, etc.). There are a number of factors which affect MDA's. Some of these factors are sample volume, sample counting time, background, interference from other radionuclides in the sample, etc. These MDA's were obtained by the counting labs when interference from other radionuclides were taken into account by the computer program. The MDA's will vary from time to time even though backgrounds are normally counted at least once every eight hours during a twenty-four hour day. Appendix 2 provides guidance for the calculation of Lower Limit of Detection (LLD). The LLD for radionuclides in important pathways should not exceed 0.1 of the applicable standard.

3. The release of all liquid effluents from TMI to the environment (unrestricted area) should be as low as in reasonably achievable (10CFR20.1). Therefore, we recommend that the release rates be controlled such that the concentration at the point of release to the Susquehanna River, after considering dilution prior to release by the blowdown from the MDCT, is less than 0.1 of the MPCw, for the radionuclides.

4. Recommend that all liquid effluents to be released to the environment be analyzed by the lab having the greatest sensitivity.

Gordon McLolole Jr

Syd Porter, Jr., CHP

SP:GMb:gp
2 Enclosures

cc: J. Barton
J. Collins (NRC-NRR)
D. Hetrick
R. McGoey
Sample Coordinator

INTER-OFFICE MEMORANDUM

APPENDIX 1

July 9, 1

MDA's IN LIQUIDS AT 4.66 SIGMA

Radionuclide	(MPC)*w Unrestricted Area (microcurie/ml)	NMC Detector 2292 (1 liter sample size)	NMC Detector 1637 (1 liter sample size)	NMC Detector 1640 (1 liter sample size)	Unit 1 GeLi (3.5 liter sample size	Unit 2 GeLi (1 liter sample size)	EG&G Detector MG-1 (sample size	EG&G Det (sample size
^{131}I	3E-7	2.65E-8	3.02E-8	3.09E-8	2.97E-8	1.29E-7	2.6E-7	3
^{134}Cs	9E-6	2.76E-8	2.50E-8	3.10E-8	3.17E-8	1.09E-7	3E-7	8
^{136}Cs	6E-5	2.64E-8	2.7E-8	3.14E-8	2.98E-8	6.72E-8	3.5E-7	5
^{137}Cs	2E-5	2.75E-8	2.62E-8	3.86E-8	5.45E-8	1.45E-7	5E-7	1
^{140}Ba	2E-5	6.09E-8	7.09E-8	6.53E-8	8.61E-8	2.77E-7	7E-7	2
^{140}La	2E-5	2.59E-8	2.39E-8	2.38E-8	***	***	4E-7	9
^{131m}Xe	3E-6	1.5E-6	1.31E-6	1.19E-6	8.91E-7	2.68E-6	2E-6	:
^{133}Xe	5E-3**	8.24E-8	2.07E-7	1.3E-7	6.55E-8	2.03E-7	1.6E-6	:
^{133m}Xe	3E-6	1.67E-7	1.95E-7	1.03E-7	***	***	1.4E-6	:
^{99}Mo	4E-5	2.85E-8	2.95E-8	3.1E-8	1.31E-8	1.29E-7	5E-7	
^{58}Co	9E-5	2.36E-8	2.42E-8	2.75E-8	4.12E-8	9.26E-8	3E-7	
^{60}Co	3E-5	1.22E-8	2.53E-8	2.46E-8	4.45E-8	9.89E-8	5E-7	

Background Counting Times

NMC 2500 seconds
UNIT 1 1200 seconds
UNIT 2 2000 seconds
EGG 1000 seconds
SAI 1000 seconds

* Most conservative (MPC) w, 10CFR 20.106 and Appendix B, Table 2, Column 2

** Unit 2 ETU

*** None available for gases in liquids

Compiled by: Effluent/Environmental As

APPENDIX 2
LOWER LIMIT OF DETECTION

1. In order to standardize reporting of data for the evaluation of release of radioactive effluents from TMI, it is necessary to establish Lower Limits of Detection (LLD's) for various radionuclides being released to the environment; therefore, the following general methodology should be employed to determine LLD's. The LLD is the smallest concentration of radioactive material in a sample that will be detected with a 95% probability with only 5% of falsely concluding that a blank observation represents a "real" signal or count. The LLD is determined by the following expression:

$$LLD = \frac{4.66\ \sigma}{(3.7\ E+4)\ EVY \exp(-\lambda\Delta t)}$$

Where: LLD = the lower limit of detection (μ Ci/cc or μ Ci/ml)

σ = the standard deviation of the instrument background counting rate (CPS)

3.7 E+4 = the number of nuclear transformations per second per microcurie or 3.7 E-2 nuclear transformations per second per picocurie

E = is the counting efficiency (counts per nuclear transformation)

V = sample volume (cc or ml)

Y = is the fractional radiochemical yield (as applicable)

λ = radioactive decay constant for each radionuclide

Δt = the elapsed time between sample collection and counting

NOTE: 1. The value of the σ used in the calculation of the LLD's for a particular detector system should be based on the actual observed variance of the instrument background counting rate rather than an unverified theoretical predicted variance. In calculating the LLD for a radionuclide, the background should include typical contributions of other radionuclides normally present in the samples. Typical values of E, V, y, and Δt should be used in the calculation.

2. Since the LLD is a function of sample volume, counting efficiency, radiochemical yield, etc., the LLD may vary for different sampling and analysis procedures.

3. Whenever there is a significant change in the parameters of the measurement system, the LLD should be recalculated.

4. Backgrounds should be determined every eight hours when routinely analyzing samples.

5. For certain radionuclides with low gamma yields or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near the LLD. Under these circumstances, the LLD may be increased proportionally to the gamma yield (i.e., IE + Y/I, where I is the gamma (photon) abudance expressed as a decimal fraction), but in no case shall the LLD, as calculated in this manner for a specific radionuclide, be greater 0.1 MPC value specified in 10CFR20, Appendix B, Table II, for unrestricted areas.

6. The term not detected (ND) shall not be used. If the maximum sensitivity is 3.1 E-8 µCi/ml, then the results shall be reported as <3.01 E-8 µCi/ml.