Offsite Dose Calculation Manual

for

Ginna Station

Rochester Gas and Electric Corporation

Revision 5, March 13, 1992

Ginna Station Offsite Dose Calculation Manual

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

I. Liquid Effluent Monitor Setpoints

The Ginna Technical Specifications, Section 3.5.5, require alarm and/or trip setpoints for radiation monitors on each liquid effluent line (reference 1). Precautions, limitations and setpoints applicable to the operation of Ginna Station liquid effluent monitors are provided in plant procedures P-9 and RD-13.1. Setpoint values are calculated to assure that alarm and trip actions occur prior to exceeding the limits of 10 CFR 20 at the release point to the unrestricted area. For added conservatism, liquid effluent release rates are administratively set so that only small fractions of the applicable 10 CFR 20 maximum permissible concentrations can be reached in the discharge canal.

The calculated alarm and trip action setpoints for each radioactive liquid effluent line monitor and flow determination must satisfy the following equation:

Equation (1): $\frac{cf}{F+f} \leq C$

Where:

C = the effluent concentration which implements the 10 CFR 20 limit for unrestricted areas, in uCi/ml.

c = the setpoint of the radioactivity monitor measuring the radioactivity concentration in the discharge line prior to dilution and subsequent release, in uCi/ml.

f = the flow as measured at the radiation monitor location, in volume per unit time, in the same units as F below.

F = the dilution water flow as determined prior to the release point, in volume per unit time.

Liquid effluent batch releases from Ginna Station are discharged through a liquid waste disposal monitor. The liquid waste stream (f) is diluted (by F) in the plant discharge canal before it enters Lake Ontario.

The limiting batch release concentration (c) corresponding to the liquid waste monitor setpoint is calculated from the above expression. Since the value of (f) is very small in comparison to (F), the expression becomes:

Equation (2): $c \leq \frac{CF}{f}$

Where:

C = the maximum permissible concentration of gross beta, gamma activity above background in the circulating water discharge at the unrestricted area boundary (1×10^{-7} uCi/ml).

F = the dilution flow assuming operation of only 1 circulating water pump (170,000 gpm).

f = the maximum waste effluent discharge rate through the designated pathway.

The limiting release concentration (c) is then converted to a setpoint count rate by use of the monitor calibration factor determined per procedure RD-13.1. The expression becomes:

Equation (2a):

$$\text{Setpoint (cpm)} = \frac{c\text{(uCi/ml)}}{\text{Cal. Factor (uCi/ml per cpm)}}$$

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<u>Example</u> (Liquid Radwaste Monitor R-18):

If one assumes, for example, that the maximum pump effluent discharge rate (f) is 30 gpm, then the limiting batch release concentration (c) would be determined as follows:

$$c\text{ (uCi/ml)} \leq \frac{1 \times 10^{-7}\text{ (uCi/ml)} \cdot 170{,}000\text{ (gpm)}}{30\text{ (gpm)}}$$

$$c \leq 5.7 \times 10^{-4}\text{ (uCi/ml)}$$

The monitor R-18 alarm and trip setpoint (in cpm) is then determined utilizing the monitor calibration factor calculated in plant procedure RD-131. Assuming a calibration factor of

$$9.5 \times 10^{-9}\ \frac{\text{(uCi/ml)}}{\text{cpm}}$$

and a limiting batch release concentration determined above the alarm and trip setpoint for monitor R-18 would be:

$$\frac{5.7 \times 10^{-4}\text{ (uCi/ml)}}{9.5 \times 10^{-9}\ \frac{\text{(uCi/ml)}}{\text{cpm}}} = 6 \times 10^{4}\text{ cpm}$$

The setpoint values for the Containment Fan Cooler Monitor (R-16), Spent Fuel Pit Heat Exchanger Service Water Monitor (R-20), Steam Generator Blowdown Monitor (R-19), the Retention Tank Monitor (R-21), and the All Volatile Treatment Waste Discharge Monitor (R-22) are calculated in a similar manner using Equation (2), substituting appropriate values of (f) and the corresponding calibration factor.

II. Gaseous Effluent Monitor Setpoints

The Ginna Technical Specifications (reference 1) require alarm and/or trip setpoints for specified radiation monitors on each noble gas effluent line. Precautions, limitations and setpoints applicable to the operation of Ginna Station gaseous effluent monitors are provided in plant procedures P-9 and RD-13.1. Setpoints are conservatively established for each ventilation noble gas monitor so that dose rates in unrestricted areas corresponding to 10 CFR Part 20 limits will not be exceeded. Setpoints shall be determined so that dose rates from releases of noble gases will comply with the Technical Specification requirements of 3.9.2.1.a(i), which stipulate that the dose rate for noble gases shall be $\leq$ 500 mrem/yr to the total body and $\leq$ 3000 mrem/yr to the skin.

The calculated alarm and trip action setpoints for each radioactive gaseous effluent monitor must satisfy the following equation:

Equation (3): $$c \leq \frac{Qiv}{f \cdot k \cdot K}$$

Where:

c = setpoint in cpm

Qiv = release rate limit by specific nuclide in uCi/sec

f = discharge flow rate in cfm

k = units conversion factor (cc/sec/cfm)

K = calibration factor (uCi/cc/cpm)

The general methodology for establishing plant ventilation monitor setpoints is based upon a vent concentration limit (in uCi/cc) derived from site specific meteorology and vent release characteristics.

Additional radiation monitor alarm and/or trip setpoints are calculated for radiation monitors measuring radioiodines, radioactive materials in particulate form and radionuclides other than noble gases. Setpoints are determined to assure that dose rates from the release of these effluents shall comply with Technical Specification 3.9.2.1.a(ii), which requires that the dose rate for all radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than 8 days shall be $\leq$ 1500 mrem/yr to any organ.

The release rate limit for noble gases shall be calculated by the following equation for total body dose:

Equation (4):

$$Q_{iv} \text{ (uCi/sec)} \leq \frac{500 \text{ (mrem/yr)}}{K_i \text{ (mrem/yr per uCi/m}^3\text{)} \cdot \overline{X/Q_v} \text{ (sec/m}^3\text{)}}$$

and by the following equation for skin doses:

Equation (5):

$$Q_{iv} \text{ (uCi/sec)} \leq \frac{3000 \text{ (mrem/yr)}}{(L_i + 1.1M_i)\text{(mrem/yr per uCi/m}^3\text{)} \cdot \overline{X/Q_v} \text{ (sec/m}^3\text{)}}$$

Where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, (in mrem/yr per uCi/m^3) from Table 2.

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide, (in mrem/yr per uCi/m^3) from Table 2.

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, (in mrad/yr per uCi/m^3) from Table 2 (unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose).

$\overline{X/Q_v}$ = The highest calculated annual average dispersion parameter for estimating the dose to the critical offsite receptor from vent release point (v) (in sec/m^3). The $\overline{X/Q_v}$ is calculated by the method described in Reg. Guide 1.111 (reference 6).

Q_{iv} = The release rate of radionuclide (i) from vent (v) which results in a dose rate of 500 mrem/yr to the whole body or 3000 mrem/yr to the skin of the critical receptor, (in uCi/sec).

Historically, xenon-133 is the principal noble gas released from all vents and is appropriate for use as the reference isotope for establishing monitor setpoints. The whole body dose will be limiting, and the Xe-133 release rate limit is calculated by substituting the appropriate values in equation (4). After the release rate limit for Xe-133 is determined for each vent, the corresponding vent concentration limits are calculated based on applicable vent flow rates. Annually-derived monitor calibration factors (uCi/cc per cpm) convert limiting vent concentrations to count rate.

Containment, Plant Vent and Air Ejector Noble Gas Monitors (Monitors R-12, R-14 and R-15)

Monitor R-12 measures noble gas activity in containment when it is isolated, or in the containment vent during purge releases. Noble gases being released via the plant vent are detected by R-14. Monitor R-15, on the air ejector, normally indicates only background noble gas activity; however it serves as one of the first indicators of primary-to-secondary leakage.[1] Additional noble gas monitoring capability for the containment, plant and air ejector vents is provided by high-range effluent monitors R-12A, R-14A and R-15A, respectively.

Noble gas monitor setpoints are conservatively set in Procedure P-9 to correspond to fractions of the applicable 10 CFR 20 maximum permissible concentrations (MPCs) for unrestricted areas. Fractions are small enough to assure the timely detection of any simultaneous discharges from multiple release points before the combined downwind site boundary concentration could exceed MPC. Additional conservatism is provided by basing these setpoints upon instantaneous downwind concentrations. Release rates during the remainder of a given year, combined with any infrequent releases at setpoint levels, are likely to result in only a very small fraction of the 10 CFR 20 annual limits.

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Example: (Plant vent monitor R-14)

Using Xe-133 as the controlling isotope for the setpoint and assuming a measured activity at 2.66E-4 uCi/cc, a ratemeter reading of 4750 cpm above background and a vent flow of 7.45 E4 cfm.

$$\text{Xe-133 efficiency} = \frac{\text{Activity}}{\text{Net Ratemeter Reading}}$$

$$\text{Xe-133 efficiency} = \frac{2.66E-4}{4750} = 5.6E-8 \ \frac{uCi/cc}{cpm}$$

$$\text{Release Rate Limit } Qiv = \frac{500 \text{ mrem/yr}}{(Ki)(X/Qv)}$$

$$Qiv = \frac{500}{(2.94E2)(2.7E-6)} = 6.3E5 \text{ uCi/sec}$$

$$\text{setpoint} = c = \frac{Qiv}{(f)(k)(K)}$$

$$c = \frac{6.3E5 \text{ (uCi/sec)}}{7.45E4 \text{ (cfm)} \cdot 472 \ \frac{cc/sec}{cfm} \cdot 5.6E{-8} \ \frac{uCi/cc}{cpm}}$$

c = 3.2E5 cpm (R-14 is set at 1/20 of this value, per Procedure P-9 or 1.6E4 cpm for normal operation).

1. NOTE: Continuous radioiodine and particulate monitoring on the air ejector is not required. Calculations and plant measurements have indicated that the iodine and particulate source terms via the air ejector compared to other airborne release pathways, are negligible. (See references 5,7, and 8)

TABLE 1

DOSE PARAMETERS FOR RADIOIODINES AND RADIOACTIVE PARTICULATE, GASEOUS EFFLUENTS*

Radio-nuclide	P_i Inhalation Pathway (mrem/yr per uCi/m^3)	P_i Food & Ground Pathways (m^2 · mrem/yr per uCi/sec)	Radio-nuclide	P_i Inhalation Pathway (mrem/yr per uCi/m^3)	P_i Food & Ground Pathways (m^2 · mrem/yr per uCi/sec)
H-3	6.5E+02	2.4E+03	Cd-115m	7.0E+04	4.8E+07
C-14	8.9E+03	1.3E+09	Sn-126	1.2E+06	1.1E+09
Cr-51	3.6E+02	1.1E+07	Sb-125	1.5E+04	1.1E+09
Mn-54	2.5E+04	1.1E+09	Te-127m	3.8E+04	7.4E+10
Fe-59	2.4E+04	7.0E+08	Te-129m	3.2E+04	1.3E+09
Co-58	1.1E+04	5.7E+08	Te-132	1.0E+03	7.2E+07
Co-60	3.2E+04	4.6E+09	Cs-134	7.0E+05	5.3E+10
Zn-65	6.3E+04	1.7E+10	Cs-136	1.3E+05	5.4E+09
Rb-86	1.9E+05	1.6E+10	Cs-137	6.1E+05	4.7E+10
Sr-89	4.0E+05	1.0E+10	Ba-140	5.6E+04	2.4E+08
Sr-90	4.1E+07	9.5E+10	Ce-141	2.2E+04	8.7E+07
Y-91	7.0E+04	1.9E+09	Ce-144	1.5E+05	6.5E+08
Zr-95	2.2E+04	3.5E+08	Np-239	2.5E+04	2.5E+06
Nb-95	1.3E+04	3.6E+08	I-131	1.5E+07	1.1E+12
Mo-99	2.6E+02	3.3E+08	I-133	3.6E+06	9.6E+09
Ru-103	1.6E+04	3.4E+10	Unidentified	4.1E+07	9.5E+10
Ru-106	1.6E+05	4.4E+11			
Ag-110m	3.3E+04	1.5E+10			

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents. These and additional dose parameters for isotopes not included in Table 1 may be calculated using the methodology described in NUREG-0133, Section 5.2.1 (reference 2).

TABLE 2

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_i (mrem/yr per uCi/m^3)	Skin Dose Factor L_i (mrem/yr per uCi/m^3)	Gamma Air Dose Factor M_i (mrad/yr per uCi/m^3)	Beta Air Dose Factor Ni (mrad/yr per uCi/m^3)
Kr-83m	7.56E-02**	----	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

* The listed dose factors are for radionuclides that may be detected in gaseous effluents. These dose factors for noble gases and daughter nuclides are taken from Table B-1 of Regulatory Guide 1.109 (reference 3). A semi-infinite cloud is assumed.

** 7.56E-02 = 7.56 x 10^{-2}.

III. Liquid Effluent Release Concentrations

Liquid batch releases are controlled individually and each batch release is authorized and based upon sample analysis and the existing dilution flow in the discharge canal. Plant procedures RD-7 and RD-8 establish the methods for sampling and analysis of each batch prior to release. A release rate limit is calculated for each batch based upon analysis, dilution flow and all procedural conditions being met before it is authorized for release. The waste effluent stream entering the discharge canal is continuously monitored and the release will be automatically terminated if the pre-selected monitor setpoint is exceeded. (See Section I)

If gross beta analysis is performed for each batch release in lieu of gamma isotopic analysis, then a weekly composite for principal gamma emitters and I-131 is performed. Additional monthly and quarterly composite analyses are to be performed as specified in Table 4.12-1 of the Ginna Technical Specifications.

The equations used to calculate activity are:

Gamma Spectrometry:

uCi/cc Act. =

$$\frac{\text{peak area counts} - \text{bkgd counts}}{(\text{Count Time})(\text{Eff})(\text{Vol})(T_{1/2}\text{ correction})(3.7\text{E}4)(\text{Branching Fraction})}$$

Gross Beta Gamma:

$$\text{uCi/cc Act.} = \frac{\text{total counts} - \text{bkgd counts}}{(\text{Count Time})(\text{Eff})(\text{Vol})(T_{1/2}\text{ correction})(3.7\text{E}4)}$$

where: count time is in seconds;

eff = counting efficiency, in $\frac{\text{counts per sec}}{\text{disintegrations per sec}}$;

vol = volume, in milliliters;

$T_{1/2}$ correction = decay correction factor, dimensionless;

3.7E4 = conversion constant, in $\frac{\text{disintegrations per sec}}{\text{uCi}}$;

Branching fraction is the fraction disintegrating by a particular decay mode, dimensionless.

IV. Liquid Effluent Dose

The dose contribution received by the maximally exposed individual from the ingestion of Lake Ontario fish and drinking water is determined using the following methodology. These calculations will assume a near field dilution factor of 1.0 in evaluating the fish pathway dose, and a dilution factor of 20 between the plant discharge and the Ontario Water District drinking water intake located 1.1 miles away (Figure 4). The dilution factor of 20 was derived from drift and dispersion studies documented in reference 4.

Dose contributions from shoreline recreation, boating and swimming have been shown to be negligible in the Appendix I dose analysis (reference 5) and do not need to be routinely evaluated. Also, there is no known human consumption of shellfish from Lake Ontario.

The dose contribution to an individual will be determined to ensure that it complies with the Technical Specification requirements of 3.9.1.2.a(i) and 3.9.1.2.a(ii). The dose or dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas shall be limited: (i) During any calendar quarter to $\leq$ 1.5 mrem to the total body and to $\leq$ 5 mrem to any organ, and, (ii) During any calendar year to $\leq$ 3 mrem to the total body and to $\leq$ 10 mrem to any organ. Offsite receptor doses will be determined for the limiting age group and organ, unless census data show that actual offsite individuals are of a less limiting age group.

The following expression is used to calculate ingestion pathway

dose contributions for the total release period $\sum_{j=1}^{m} \Delta t_j$

from all radionuclides identified in liquid effluents released to unrestricted areas:

Equation (6): $D_\tau = \sum [A_{i\tau} \sum_{j=1}^{m} \Delta t_j \, C_{ij} \, F_j]$

where:

D_τ = the cumulative dose commitment to the total body or any organ, τ, from the liquid effluents for the total time period (in mrem). $\sum_{j=1}^{m} \Delta t_j$,

Δt_j = the length of the jth time period over which C_{ij} and F_j are averaged for all liquid releases, (in hours).

C_{ij} = the average concentration of radionuclide, i, in undiluted liquid effluent during time period Δt_j from any liquid release, (in uCi/ml).

$A_{i\tau}$ = the site-related ingestion dose commitment factor to the total body or any organ τ for each identified principal gamma and beta emitter (in mrem/hr per uCi/ml). See equation (7).

F_j = the discharge canal dilution factor for C_i during any liquid effluent release. Defined as the ratio of the maximum undiluted liquid waste flow during release to the average flow from the site discharge structure to unrestricted receiving waters. The dilution factor will depend on the number of circulation pumps operating and, during icing conditions, the percentage opening of the recirculating gate. Reference curves are presented in plant procedure RD-7.

Equation (7): $A_{i\tau} = k_o \ (U_W/D_W + U_F BF_i) \ DF_i$

where:

$A_{i\tau}$ = the site-related ingestion dose commitment factor to the total body or to any organ τ for each identified principal gamma and beta emitter, (in mrem/hr per uCi/ml).

k_o = units conversion factor, $1.14 \times 10^5 = 10^6$ pCi/uCi $\times 10^3$ ml/kg $\div$ 8760 hr/yr.

U_W = a receptor person's water consumption by age group from table E-5 of Regulatory Guide 1.109 (reference 3).

D_W = Dilution factor from the near field area of the release point to potable water intake. The site specific dilution factor is 20. This factor is assumed to be 1.0 for the fish ingestion pathway.

U_F = a receptor person's fish consumption by age group from table E-5 of Regulatory Guide 1.109.

BF_i = Bioaccumulation factor for nuclide, i, (in fish pCi/kg per PCi/L), from Table A-1 of Regulatory Guide 1.109.

DF_i = Dose conversion factor for the ingestion of nuclide, i, for a receptor person in pre-selected organ, τ , (in mrem/pCi), from Tables E-11, E-12, E-13, E-14 of Regulatory Guide 1.109.

The monthly dose contribution from releases for which radionuclide concentrations are determined by periodic composite sample analysis may be approximated by assuming an average monthly concentration based on the previous monthly or quarterly composite analyses. However, in the radioactive effluent release report (submitted within 60 days of January 1 per Technical Specification 6.9.1.4) the calculated dose contributions from these radionuclides shall be based on the actual composite analyses.

<u>Example which illustrates how to compute the dose to the whole body via the fish and drinking water pathways, assuming an initial Cs-137 discharge concentration of 3.0 E-4 uCi/ml</u>:

Given the following discharge factors, where:

Δt_j = 1 hour

C_{ij} = 3.0 E-4 uCi/ml

$$F_j = \frac{20 \text{ gpm}}{170{,}000 \text{ gpm}} = 1.2 \text{ E-4}$$

D_W = 20

And, taking the following values from Regulatory Guide 1.109 which concern the receptor of interest, which we assume is the child in this case:

U_W = 510 L/year

U_F = 6.9 Kg/year

BF_i = 2000 pCi/kg per pCi/L

DF_i = 4.62 E-5 mrem/pCi

Then, the site-related ingestion dose commitment factor, $A_{i\tau}$, is calculated as follows:

$$A_{i\tau} \ \frac{\text{mrem/hr}}{\text{uCi/ml}} = K_o \, (U_W/D_W + U_F \, BF_i) \, DF_i$$

$$= 1.14 \text{ E5} \left(\frac{510}{20} + 6.9 \cdot 2000\right) 4.62 \text{ E-5}$$

$A_{i\tau}$ = 7.28 E4 mrem/hr per uCi/ml

And, the whole body dose to the child is then:

D_{τ} mrem = $(A_{i\tau})(\Delta t_j)(C_j)(F_j)$

= (7.28 E4)(1)(3.0 E-4)(1.2 E-4)

D_{τ} = 2.6E-3 mrem to the whole body from Cs-137

(The dose contribution from any other isotopes would then need to be calculated and summed.)

V. Liquid and Gaseous Radwaste Treatment and Operability

An objective of the Ginna Technical Specifications which implement the overall requirements of 10 CFR Part 50, Appendix I, is to ensure that the plant radwaste treatment equipment is used and maintained. This equipment is to be utilized to reduce radioactive discharges from nuclear plants to levels "as low as reasonably achievable" or ALARA. ALARA levels warranting equipment operability have been defined by the NRC in the form of monthly dose "trigger" values. The trigger values, which are provided below, correspond to approximately 1/48 of the annual design objective doses given by 10 CFR Part 50, Appendix I. If continued at this rate, these monthly doses would correspond to just under 1/4 of the Appendix I annual design objectives.

	Liquid Radwaste System	Gaseous Radwaste System	Ventilation Exhaust
31-day Trigger Values	0.06 mrem (w. body)	0.2 mrad (gamma air)	0.3 mrem (any organ)
	0.2 mrem (any organ)	0.4 mrad (beta air)	

Figures 1 and 2 show the components of the R.E. Ginna liquid and gaseous waste/ventilation exhaust systems. These systems are normally in routine use at the plant. Because discharges are being treated, the trigger values in the Technical Specifications may be exceeded but compliance with the stated quarterly and annual dose limits is required.

If the liquid or gaseous radwaste/ventilation exhaust systems were to be inoperable in excess of 31 days, then effluents are considered "untreated" waste. Should, over a 31-day period, the plant discharges exceed the dose trigger values in conjunction with extended inoperability of a waste treatment system, then Technical Specifications 3.9.1.3.b and 3.9.2.3.c apply. In this case, a 30-day report must be submitted to the Commission which identifies the inoperable equipment and describes appropriate corrective actions (see Technical Specifications 3.9.1.3.b and 3.9.2.3.c).

Example:

Assume a case where plant modifications were underway on the waste evaporator and demineralizer piping, and a reduction of the liquid waste volume contained in the waste holdup tank (WHUT) was needed. Assuming no other means of treatment were readily available, WHUT liquid (untreated) might be transferred to the waste condensate tanks, sampled and then discharged on a controlled basis.

In this case, assume also that a decision was made to proceed this way at the beginning of a given month, knowing that the waste evaporator and other portions of the liquid radwaste treatment system would be unavailable for the next 45 days.

<u>The following method would be used to determine the need for a 30-day report</u>:

1. Using existing plant procedures, sample the concentration contained in the WHUT (C_{ij}). Decide a sample frequency (e.g. 1/day) since the tank concentration could change.

2. Determine the permissible release rate to maintain the concentration in the discharge canal well within the applicable maximum permissible concentration (e.g. 1/100-1/10 MPC) for the mixture. (The discharge canal concentration is equal to $C_{ij} \cdot F_j$).

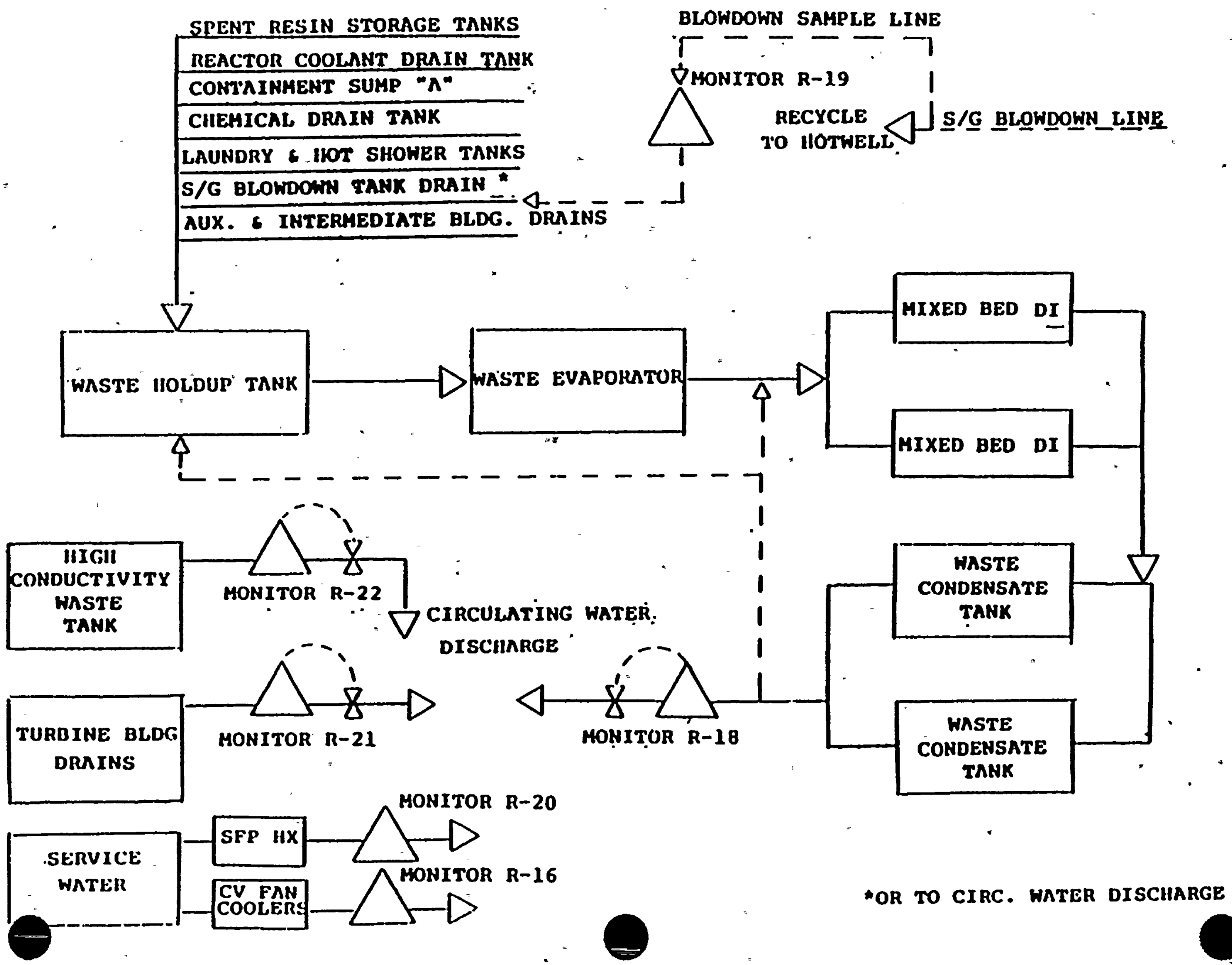
3. Calculate the incremental dose from all identified isotopes via the drinking water and fish ingestion pathways for each receptor group. The critical receptor will probably be the child. Assume the release will be continuous and that doses will be evaluated each day, corresponding to the WHUT sampling frequency. (We thus compute D using Equations 6 and 7, taking Δt_j as the duration of each release; in this case, 24 hr/day.)

4. The offsite receptor dose due to a controlled discharge of the WHUT contents is thus determined and cumulated over each daily release time interval. If the WHUT isotopic mixture and the discharge canal dilution factor, F_j, are relatively constant, then each day's dose increment should be approximately the same. One can then estimate the number of release days it will take to reach the applicable dose trigger value.

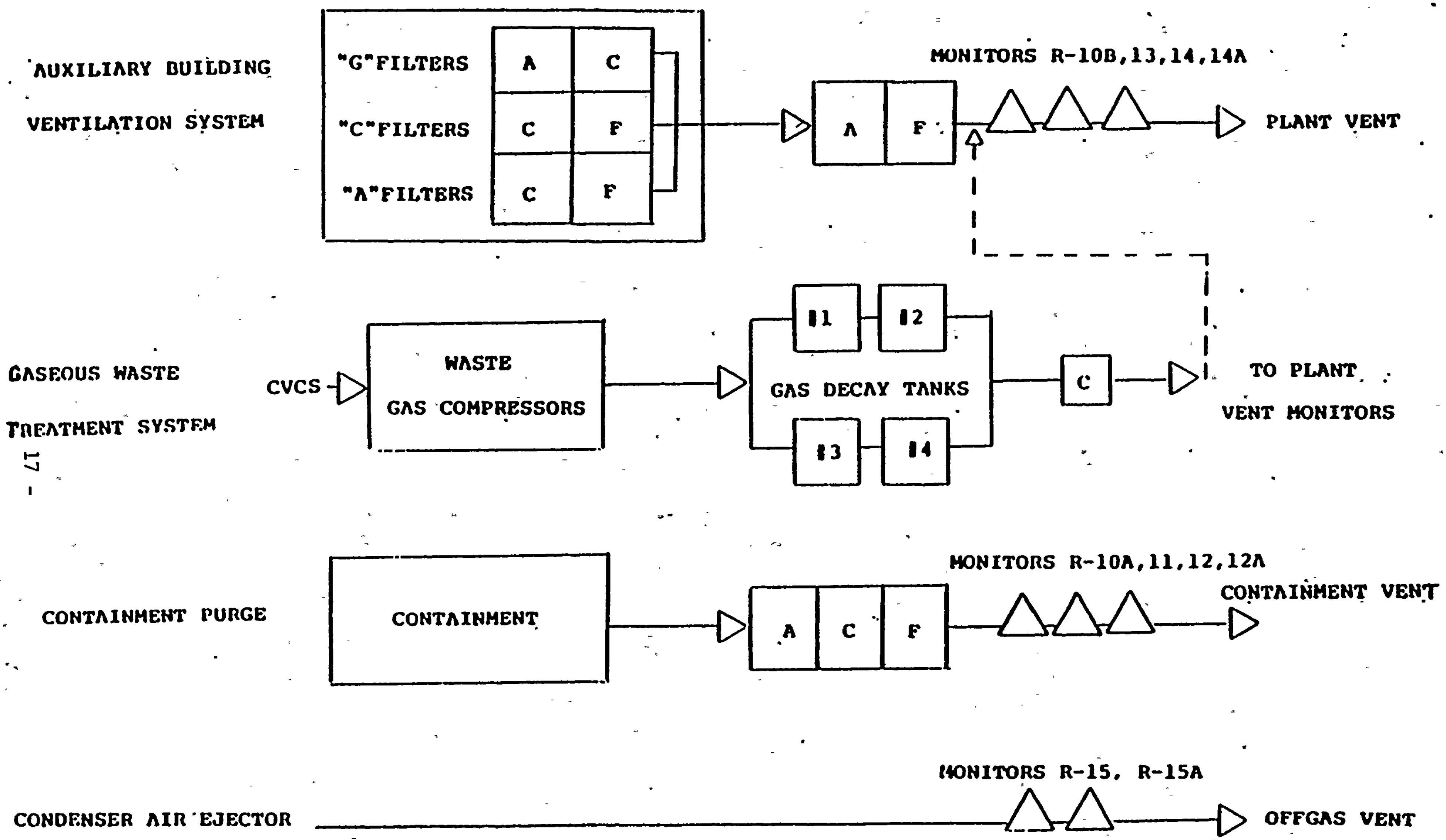
5. The 30-day reporting requirement applies if a radwaste treatment system is inoperable <u>and</u> dose trigger values are exceeded. In the example, one reporting criterion is already met, since the treatment systems will be out of service for more than 31 days. If we determine that the liquid pathway dose <u>does not</u> exceed the trigger values in 31 days or less, then a 30-day report is not required. However, if a liquid pathway dose attains a trigger level within 31 days, then a report submittal would be required.

6. In the last case, it would be prudent to avoid a situation requiring the 30-day report. First, a trigger level dose, when added to the calculated doses resulting from all other liquid release sources (e.g. high conductivity waste tank, blowdown, retention tank), may significantly impact upon the plant's "dose budget" for the calendar quarter or the calendar year. Also, more realistically, other treatment options would likely be available at the plant and could be utilized.

GINNA STATION LIQUID WASTE TREATMENT SYSTEM FIGURE 1



GINNA STATION GASEOUS WASTE TREATMENT AND VENTILATION EXHAUST SYSTEMS FIGURE 2



NOTE: A=HEPA FILTERS
C=CHARCOAL FILTERS
F=FANS

VI. Gaseous Effluent Dose Rate

Gaseous effluent monitor setpoints as described in Section II of this manual are established at concentrations which permit some margin for corrective action to be taken before exceeding offsite dose rates corresponding to 10 CFR Part 20 limitations. Plant procedures RD-1.1, RD-1.2, RD-2, RD-3, RD-5 and RD-12 establish the methods for sampling and analysis for continuous ventilation releases and for containment purge releases. Plant procedure RD-6 establishes the methods for sampling and analysis prior to gas decay tank releases. The instantaneous dose rate in unrestricted areas due to unplanned releases of airborne radioactive materials may be averaged over a 24-hour period according to Technical Specification 3.9.2.1.b. Dose rate shall be determined using the following expressions:

For noble gases:

Equation (8): $D = \sum_i [K_i \, (\overline{X/Q})_v \, Q_{iv}] \leq 500$ mrem/yr (to total body)

Equation (9): $D = \sum_i [(L_i + 1.1 \, M_i) \, (\overline{X/Q})_v \, Q_{iv}] \leq 3000$ mrem/yr

(total gamma and beta dose to the skin)

For radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases:

Equation (10): $D = \sum_i [P_i \, W_v \, Q_{iv}] \leq 1500$ mrem/yr (critical organ)

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, (in mrem/yr per uCi/m^3 from Table 2).

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide, (in mrem/yr per uCi/m^3 from Table 2).

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, (in mrad/yr per uCi/m^3 from Table 2), (unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose).

P_i = The dose parameter for radionuclides other than noble gases for the inhalation pathway, in mrem/yr per uCi/m^3 and for food and ground plane pathways, (in $m^2 \cdot$ mrem/yr per uci/sec) from Table 1. The dose factors are based on the critical individual organ and most restrictive age group.

$(\overline{X/Q})_v$ = The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary, (in sec/m^3).

W_v = The highest annual average dispersion parameter for estimating the dose to the critical receptor; (in sec/m^3 for the inhalation pathway, and in m^{-2} for the food and ground pathways).

Q_{iv} = The release rate of radionuclide i from vent (v), (in uCi/sec).

VII. Gaseous Effluent Doses

The air dose in unrestricted areas due to noble gases released in gaseous effluents from the site shall be determined using the following expressions:

During any calendar year, for gamma radiation:

Equation (11): $D_\gamma = 3.17 \times 10^{-8} \sum_i [M_i \ (\overline{X/Q})_v \ \tilde{Q}_{iv}] \leq 10$ mrad, and

During any calendar year for beta radiation:

Equation (12): $D_\beta = 3.17 \times 10^{-8} \sum_i [N_i \ (\overline{X/Q})_v \ \tilde{Q}_{iv}] \leq 20$ mrad

Where:

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, (in mrad/yr per uCi/m^3 from Table 2).

N_i = The air dose factor due to beta emissions for each identified noble gas radionuclide, (in mrad/yr per uCi/m^3 from Table 2).

$(\overline{X/Q})_v$ = For vent releases. The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary, including uninhabited areas, (in sec/m^3).

D_γ = The total gamma air dose from gaseous effluents, (in mrad).

D_β = The total beta air dose from gaseous effluents, (in mrad).

$\tilde{Q}_{iv}$ = The release of noble gas radionuclides, i, in gaseous effluents from all vents, in uCi. Releases shall be cumulative over the time period.

3.17×10^{-8} = The inverse of the number of seconds in a year.

The dose to an individual from radioiodines and radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents released from the site to unrestricted areas shall be determined using the following expression:

During any calendar year:

Equation (13): $D_I = 3.17 \times 10^{-8} \sum_i R_i \ [W_v \ \tilde{Q}_{iv}], \leq 15$ mrad

Where:

$\bar{Q}_{iv}$ = The release of radioiodines, and radioactive materials in particulate form in gaseous effluents, i, with half-lives greater than 8 days, (in uCi). Releases shall be cumulative over the desired time period as appropriate.

D_I = The total dose from radioiodines and radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents, (in mrem).

W_v = The annual average dispersion parameter for estimating the dose to an individual at the critical location; (in sec/m^3 for the inhalation pathway, and in m^{-2} for the food and ground pathways).

R_i = The dose factor for each identified radionuclide, i, (in $m^2 \cdot$ mrem/yr per uCi/sec or mrem/yr per uCi/m^3 from Table 9).

VIII. Environmental Monitor Sample Locations

Figure 3 shows the onsite* indicator sample locations for airborne particulates, radioiodine and direct radiation. Respective sample locations are specified below. Also indicated on Figure 3 is the onsite vegetable garden, as well as the placement of post-accident TLDs (locations 13-24). The onsite garden is located near the closest resident who is the maximally exposed individual.

Figure 4 gives the location of the only milk herds within 5 miles of the plant. On this map is also included the Ontario Water District intake pumping station where lake water is sampled prior to treatment.

Figure 5 shows the offsite control sample locations for airborne particulates, radioiodine and direct radiation. Sample stations 9 and 11 are situated near population centers (Webster and Williamson) located approximately 7 miles from the Ginna site.

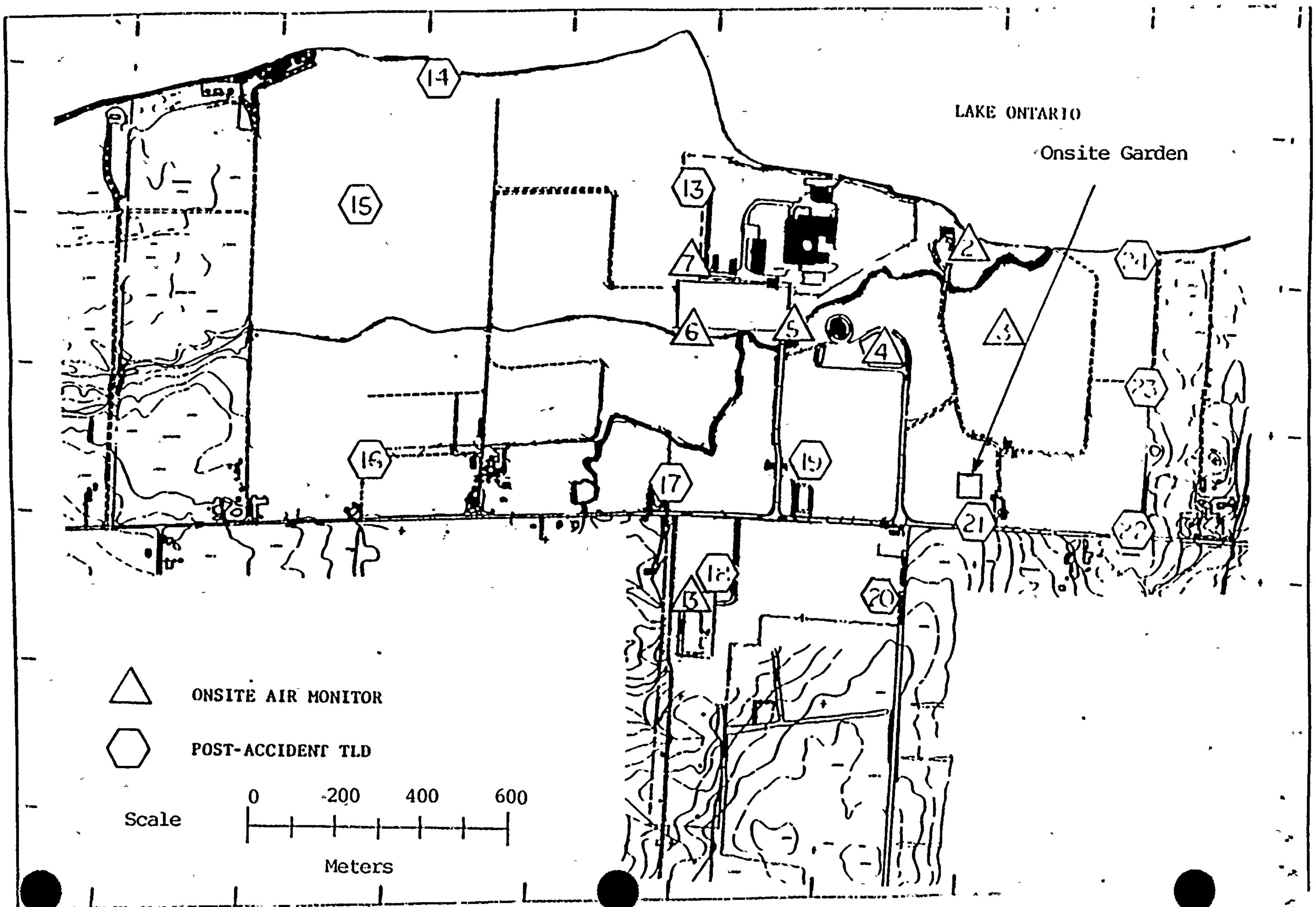
Key to Figures 3 to 5:

Type		Location	
Radioiodine:		3 onsite	#2, #4 and 7
		3 offsite	#9, #11, and #12
Particulate:		7 onsite	#2, 3, 4, 5, 6, 7 and 13
		5 offsite	#8, 9, 10, 11 and 12
Direct Radiation:			
	TLD	18 onsite	#2, 3, 4, 5, 6, 7, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 24
		10 4-5 miles	#31, 32, 33, ,34, 35, 36, 37, 38, 39 and 40
		11 > 5 miles	#8, 9, 10, 11, 12, 25, 26, 27, 28, 29 and 30
Surface Water		1 control (Russell Station)	
		1 indicator (Ginna Condenser Water Discharge)	

*Note: "Onsite" refers to the area surrounding the Ginna plant bounded by RG&E property lines. "Offsite" refers to the area beyond the immediate RG&E property.

Drinking Water	1 indicator (Ontario Water District Intake)
Milk	1 control (#4) 3 indicator (#1, 2, 3)
Fish	4 control (offshore at Russell) 4 indicator (offshore at Ginna)
Food Products	1 control 2 indicator (onsite)

FIGURE 3



LAKE ONTARIO
Onsite Garden
14
15
13
7
2
6
5
4
3
24
23
16
17
19
21
22
18
13
20
ONSITE AIR MONITOR
POST-ACCIDENT TLD
Scale
0
200
400
600
Meters

FIGURE 4

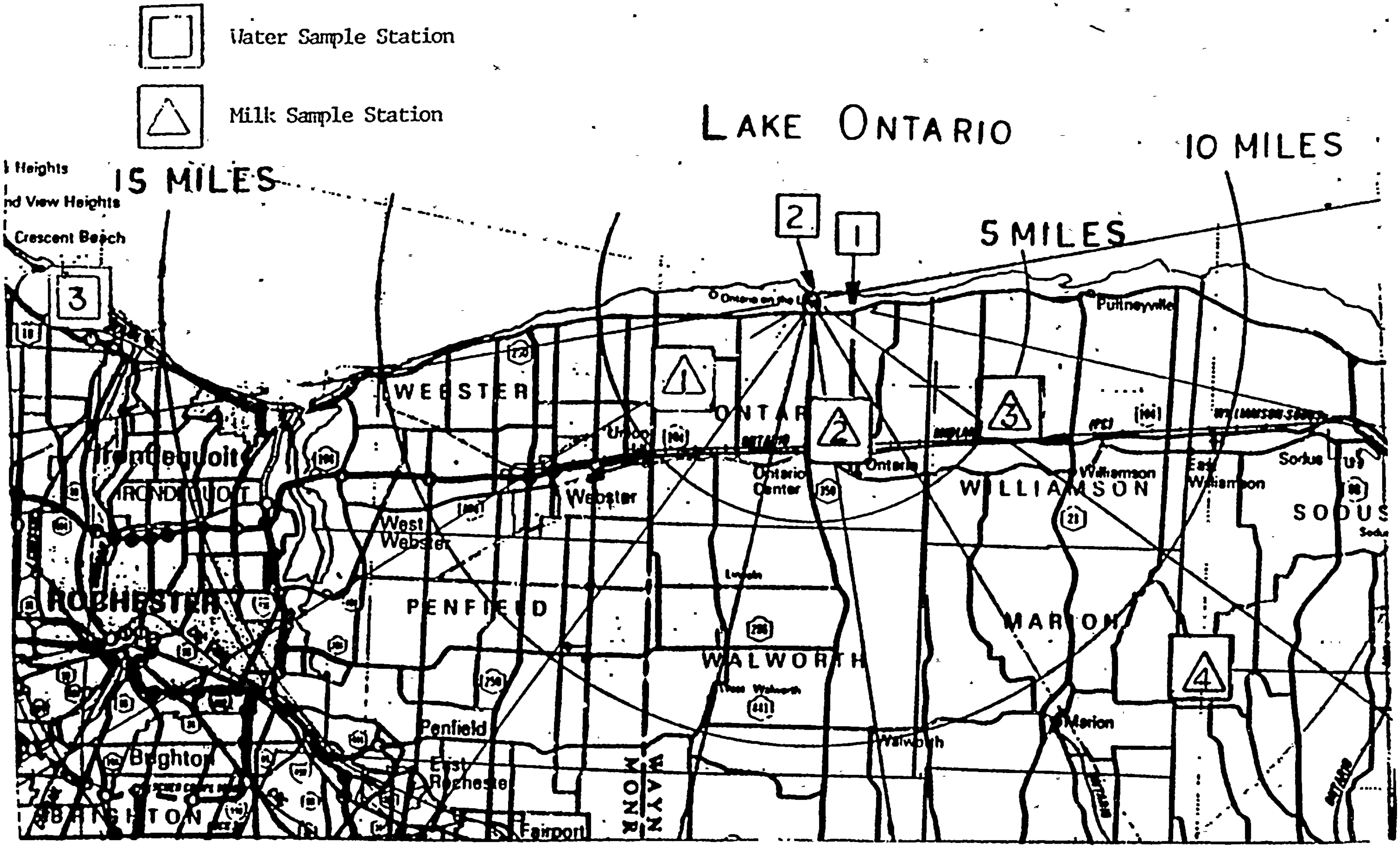
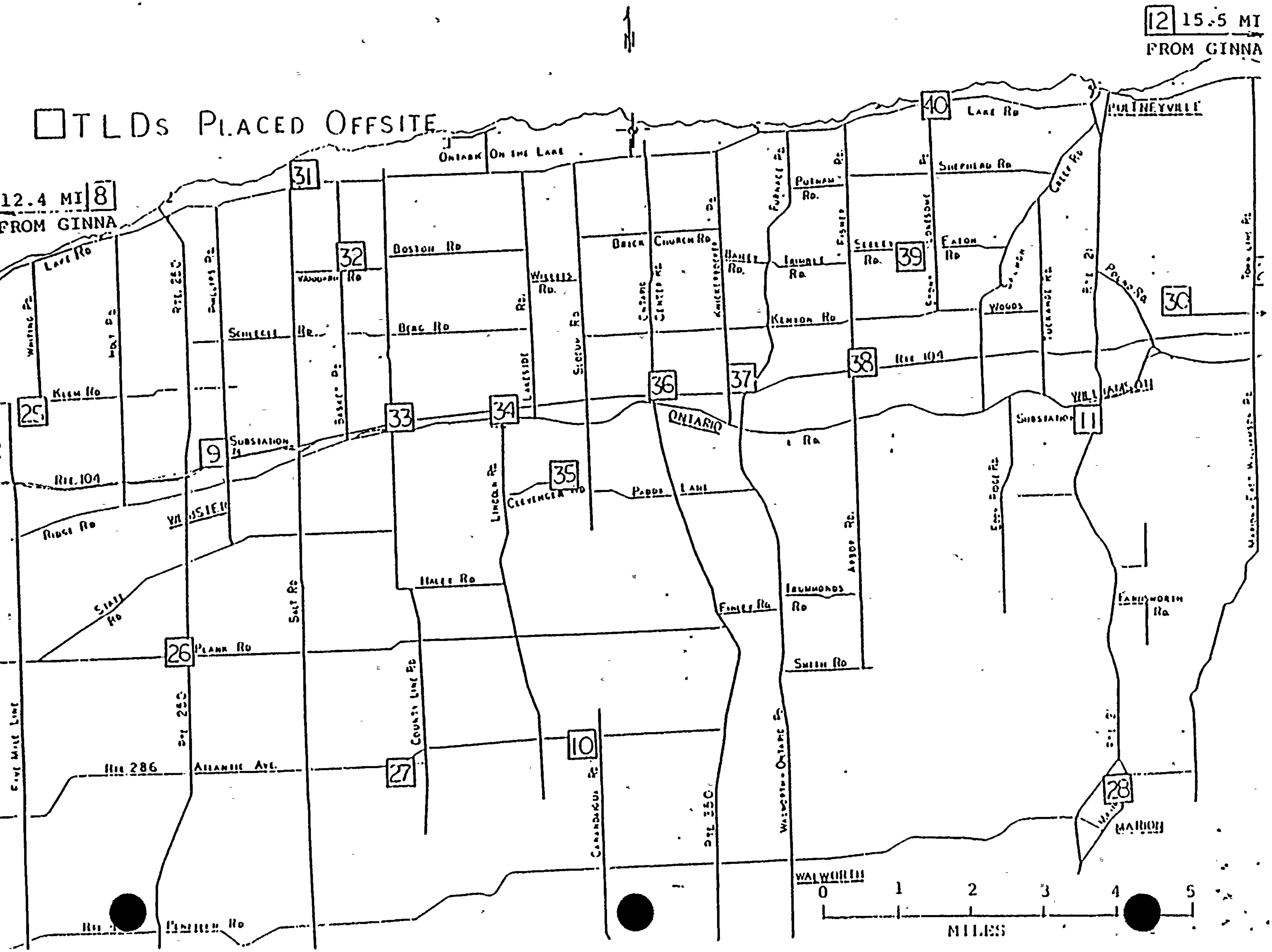
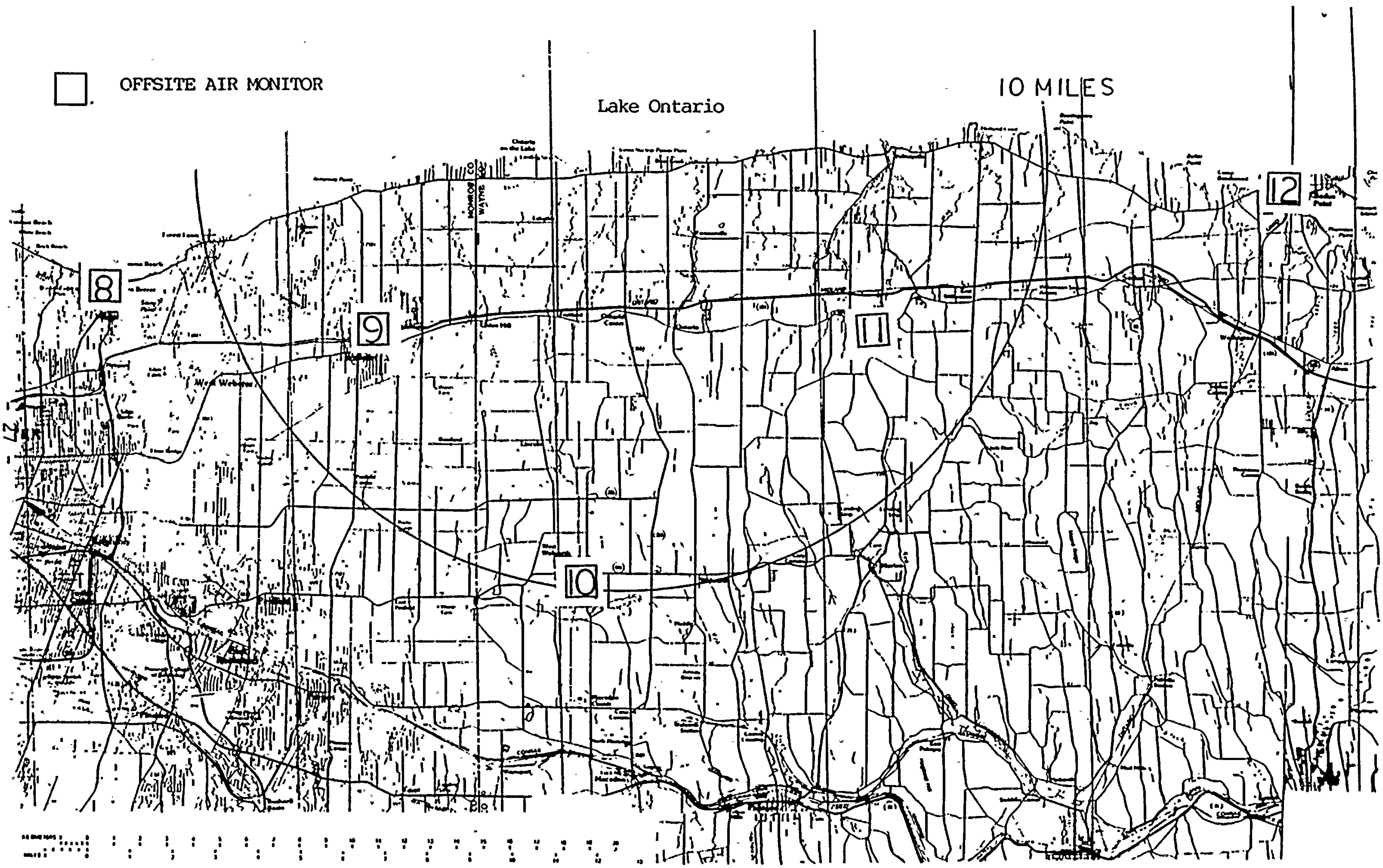

Water Sample Station
Milk Sample Station
LAKE ONTARIO
15 MILES
10 MILES
5 MILES
2
1
3
Crescent Beach
Pultneyville
WEBSTER
ONTARIO
WILLIAMSON
SODUS
Webster
West Webster
Ontario Center
Ontario
Williamson
East Williamson
Sodus
PENFIELD
MARION
WALWORTH
West Walworth
Walworth
Marion
Penfield
East Rochester
Fairport
ROCHESTER
IRONDEQUOIT
Brighton
BRIGHTON
MONROE
WAYNE

FIGURE 5



TLDs PLACED OFFSITE
12 15.5 MI FROM GINNA
12.4 MI 8 FROM GINNA
31
32
33
34
35
36
37
38
39
40
30
25
26
27
28
9
10
11
Lake Rd
Putnam Rd.
Boston Rd
Brick Church Rd
Kenyon Rd
Rte 104
Ridge Rd
Webster
Plank Rd
Rte 286
Atlantic Ave.
Ontario
Williamson
Pultneyville
Marion
Walworth
Substation
Clevenger Rd
Paddy Lane
Lincoln Rd
Salt Rd
Smith Rd
Farnsworth Rd
Five Mile Line
Salt Rd
County Line Rd
Walworth-Ontario Rd
0 1 2 3 4 5
MILES

FIGURE 6



OFFSITE AIR MONITOR
Lake Ontario
10 MILES
8
9
10
11
12
West Webster

TABLE 3

DISPERSION PARAMETER $(\overline{X/Q})$ FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

Plant Vent

Distance to the control location, in miles

Sector*	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	8.8 E-6	2.1 E-6	1.0 E-6	4.7 E-7	2.5 E-7	1.8 E-7	1.3 E-7	1.1 E-7	9.4 E-8	8.2 E-8
NNE	7.4 E-6	1.7 E-6	9.2 E-7	4.5 E-7	2.5 E-7	1.8 E-7	1.4 E-7	1.2 E-7	9.9 E-8	9.0 E-8
NE	9.7 E-6	2.3 E-6	1.2 E-6	5.9 E-7	3.2 E-7	2.3 E-7	1.8 E-7	1.5 E-7	1.2 E-7	1.1 E-7
ENE	9.2 E-6	2.2 E-6	1.1 E-6	5.0 E-7	2.6 E-7	1.8 E-7	1.4 E-7	1.2 E-7	9.8 E-8	8.7 E-8
E	1.1 E-5	2.7 E-6	1.3 E-6	5.4 E-7	2.7 E-7	1.9 E-7	1.4 E-7	1.2 E-7	9.6 E-8	8.5 E-8
ESE	8.5 E-6	2.1 E-6	1.1 E-6	4.4 E-7	2.2 E-7	1.5 E-7	1.1 E-7	9.4 E-8	7.9 E-8	6.9 E-8
SE	6.5 E-6	1.4 E-6	6.9 E-7	3.0 E-7	1.5 E-7	1.1 E-7	8.5 E-8	6.9 E-8	5.6 E-8	4.8 E-8
SSE	3.6 E-6	1.1 E-6	5.0 E-7	2.3 E-7	1.2 E-7	8.4 E-8	6.3 E-8	5.2 E-8	4.2 E-8	3.5 E-8
S	2.1 E-6	8.8 E-7	4.5 E-7	1.9 E-7	1.0 E-7	7.6 E-8	5.9 E-8	4.8 E-8	4.0 E-8	3.3 E-8
SSW	2.0 E-6	5.8 E-7	3.4 E-7	1.8 E-7	9.6 E-8	6.8 E-8	5.3 E-8	4.5 E-8	3.8 E-8	3.2 E-8
SW	2.3 E-6	5.6 E-7	3.0 E-7	1.4 E-7	7.6 E-8	5.4 E-8	4.2 E-8	3.5 E-8	2.9 E-8	2.4 E-8
WSW	2.9 E-6	7.1 E-7	5.3 E-7	1.6 E-7	9.0 E-8	6.4 E-8	4.8 E-8	3.9 E-8	3.3 E-8	2.9 E-8
W	3.3 E-6	1.0 E-6	5.1 E-7	2.4 E-7	1.3 E-7	9.6 E-8	7.2 E-8	5.9 E-8	4.9 E-8	4.3 E-8
WNW	2.7 E-6	8.9 E-7	4.7 E-7	2.3 E-7	1.2 E-7	9.0 E-8	6.9 E-8	5.8 E-8	4.8 E-8	4.2 E-8
NW	2.0 E-6	6.4 E-7	3.6 E-7	1.8 E-7	9.8 E-8	7.4 E-8	5.7 E-8	4.6 E-8	3.9 E-8	3.4 E-8
NNW	4.3 E-6	1.2 E-6	5.7 E-7	2.7 E-7	1.4 E-7	1.0 E-7	8.0 E-8	6.7 E-8	5.6 E-8	4.9 E-8

*Direction wind blows into

TABL[illegible]

DISPERSION PARAMETER $\overline{(D/Q)}$ FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

Plant Vent

Distance to the control location, in miles

Sector*	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	8.3 E-8	1.7 E-8	6.1 E-9	2.5 E-9	1.2 E-9	7.3 E-10	5.1 E-10	4.1 E-10	2.9 E-10	2.5 E-10
NNE	4.5 E-8	1.0 E-8	3.7 E-9	1.5 E-9	7.0 E-10	4.4 E-10	3.1 E-10	2.4 E-10	1.8 E-10	1.5 E-10
NE	6.5 E-8	1.5 E-8	5.4 E-9	2.2 E-9	1.0 E-9	6.5 E-10	4.5 E-10	3.6 E-10	2.6 E-10	2.2 E-10
ENE	8.3 E-8	1.8 E-8	6.4 E-9	2.6 E-9	1.2 E-9	7.5 E-10	5.3 E-10	4.1 E-10	3.1 E-10	2.6 E-10
E	1.4 E-7	2.9 E-8	1.0 E-8	4.2 E-9	1.9 E-9	1.2 E-9	8.6 E-10	6.7 E-10	4.8 E-10	4.1 E-10
ESE	1.4 E-7	3.0 E-8	1.1 E-8	4.3 E-9	1.9 E-9	1.2 E-9	8.7 E-10	6.7 E-10	5.2 E-10	4.5 E-10
SE	1.3 E-7	2.7 E-8	9.3 E-9	3.7 E-9	1.7 E-9	1.0 E-9	7.7 E-10	6.1 E-10	4.6 E-10	4.0 E-10
SSE	5.8 E-8	1.4 E-8	4.7 E-9	1.9 E-9	8.9 E-10	5.6 E-10	4.1 E-10	3.5 E-10	2.7 E-10	2.3 E-10
S	2.8 E-8	8.6 E-9	3.1 E-9	1.3 E-9	5.8 E-10	3.8 E-10	2.9 E-10	2.4 E-10	1.8 E-10	1.6 E-10
SSW	3.1 E-8	7.8 E-9	3.1 E-9	1.3 E-9	5.9 E-10	3.7 E-10	2.7 E-10	2.2 E-10	1.8 E-10	1.5 E-10
SW	4.5 E-8	1.0 E-8	3.6 E-9	1.5 E-9	6.8 E-10	4.4 E-10	3.1 E-10	2.5 E-10	1.9 E-10	1.6 E-10
WSW	5.6 E-8	1.3 E-8	4.6 E-9	1.8 E-9	8.4 E-10	5.3 E-10	3.7 E-10	2.9 E-10	2.1 E-10	1.8 E-10
W	4.2 E-8	1.0 E-8	3.9 E-9	1.6 E-9	7.4 E-10	4.7 E-10	3.3 E-10	2.6 E-10	1.9 E-10	1.6 E-10
WNW	2.2 E-8	5.9 E-9	2.4 E-9	1.0 E-9	4.7 E-10	3.0 E-10	2.1 E-10	1.7 E-10	1.3 E-10	1.0 E-10
NW	1.5 E-8	4.1 E-9	1.7 E-9	7.0 E-10	3.3 E-10	2.1 E-10	1.5 E-10	1.2 E-10	8.8 E-11	7.4 E-11
NNW	4.0 E-8	9.2 E-9	3.5 E-9	1.4 E-9	6.6 E-10	4.2 E-10	2.9 E-10	2.3 E-10	1.7 E-10	1.4 E-10

*Direction wind blows into

TABLE

DISPERSION PARAMETER $(\overline{X/Q})_{cp}$ FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

Containment Purge

Distance to the control location, in miles

Sector*	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	3.7 E-6	1.2 E-6	7.2 E-7	3.6 E-7	2.0 E-7	1.4 E-7	1.1 E-7	9.6 E-8	8.1 E-8	7.1 E-8
NNE	3.1 E-6	1.0 E-6	6.6 E-7	3.5 E-7	2.0 E-7	1.5 E-7	1.2 E-7	1.0 E-7	8.9 E-8	7.9 E-8
NE	4.1 E-6	1.4 E-6	9.0 E-7	4.7 E-7	2.7 E-7	2.0 E-7	1.6 E-7	1.3 E-7	1.1 E-7	1.0 E-7
ENE	3.9 E-6	1.3 E-6	7.7 E-7	3.9 E-7	2.1 E-7	1.5 E-7	1.2 E-7	1.0 E-7	8.5 E-8	7.5 E-8
E	4.9 E-6	1.6 E-6	8.8 E-7	4.1 E-7	2.2 E-7	1.5 E-7	1.2 E-7	1.0 E-7	8.3 E-8	7.3 E-8
ESE	4.3 E-6	1.5 E-6	9.1 E-7	3.9 E-7	2.0 E-7	1.4 E-7	1.1 E-7	8.6 E-8	7.4 E-8	6.4 E-8
SE	4.2 E-6	1.2 E-6	6.1 E-7	2.8 E-7	1.4 E-7	9.9 E-8	8.0 E-8	6.5 E-8	5.4 E-8	4.6 E-8
SSE	2.3 E-6	9.7 E-7	4.6 E-7	2.2 E-7	1.2 E-7	8.1 E-8	6.1 E-8	5.0 E-8	4.0 E-8	3.4 E-8
S	1.3 E-6	7.7 E-7	4.1 E-7	1.9 E-7	1.0 E-7	7.4 E-8	5.8 E-8	4.7 E-8	3.8 E-8	3.2 E-8
SSW	1.2 E-6	4.5 E-7	3.3 E-7	1.7 E-7	9.5 E-8	6.7 E-8	5.3 E-8	4.5 E-8	3.7 E-8	3.2 E-8
SW	1.3 E-6	4.1 E-7	2.7 E-7	1.3 E-7	7.3 E-8	5.2 E-8	4.1 E-8	3.4 E-8	2.7 E-8	2.3 E-8
WSW	1.7 E-6	5.3 E-7	3.2 E-7	1.5 E-7	8.6 E-8	6.0 E-8	4.5 E-8	3.8 E-8	3.2 E-8	2.8 E-8
W	1.7 E-6	7.2 E-7	4.4 E-7	2.1 E-7	1.2 E-7	8.6 E-8	6.6 E-8	5.5 E-8	4.6 E-8	4.0 E-8
WNW	1.2 E-6	6.0 E-7	3.9 E-7	2.0 E-7	1.1 E-7	8.2 E-8	6.3 E-8	5.3 E-8	4.5 E-8	3.9 E-8
NW	8.5 E-7	4.4 E-7	3.0 E-7	1.6 E-7	8.9 E-8	6.5 E-8	5.1 E-8	4.3 E-8	3.5 E-8	3.2 E-8
NNW	1.8 E-6	7.0 E-7	4.4 E-7	2.2 E-7	1.2 E-7	9.0 E-8	7.1 E-8	6.0 E-8	5.0 E-8	4.4 E-8

*Direction wind blows into

TABLE 6

DISPERSION PARAMETER ($\overline{D/Q}$) FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

Containment Purge

Distance to the control location, in miles

Sector*	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	4.2 E-8	1.0 E-8	4.0 E-9	1.6 E-9	7.6 E-10	4.6 E-10	3.4 E-10	2.7 E-10	1.9 E-10	1.6 E-10
NNE	2.3 E-8	6.2 E-9	2.5 E-9	1.0 E-9	4.8 E-10	2.9 E-10	2.2 E-10	1.7 E-10	1.2 E-10	1.0 E-10
NE	3.4 E-8	9.3 E-9	3.7 E-9	1.5 E-9	7.1 E-10	4.5 E-10	3.2 E-10	2.5 E-10	1.8 E-10	1.6 E-10
ENE	4.2 E-8	1.1 E-8	4.3 E-9	1.8 E-9	8.3 E-10	5.3 E-10	3.8 E-10	2.9 E-10	2.1 E-10	1.8 E-10
E	7.3 E-8	1.9 E-8	7.4 E-9	3.0 E-9	1.4 E-9	9.0 E-10	6.4 E-10	5.0 E-10	3.6 E-10	3.1 E-10
ESE	9.1 E-8	2.4 E-8	9.1 E-9	3.6 E-9	1.6 E-9	9.9 E-10	7.5 E-10	5.9 E-10	4.8 E-10	4.2 E-10
SE	1.0 E-7	2.4 E-8	8.4 E-9	3.4 E-9	1.6 E-9	9.6 E-10	7.4 E-10	5.9 E-10	4.6 E-10	4.1 E-10
SSE	4.3 E-8	1.3 E-8	4.3 E-9	1.8 E-9	8.3 E-10	5.4 E-10	4.0 E-10	3.6 E-10	2.7 E-10	2.3 E-10
S	2.1 E-8	8.1 E-9	2.9 E-9	1.7 E-9	5.5 E-10	3.7 E-10	3.0 E-10	2.5 E-10	1.9 E-10	1.6 E-10
SSW	2.1 E-8	6.9 E-9	2.9 E-9	1.2 E-9	5.7 E-10	3.6 E-10	2.7 E-10	2.2 E-10	1.8 E-10	1.5 E-10
SW	3.4 E-8	8.9 E-9	3.3 E-9	1.4 E-9	6.3 E-10	4.1 E-10	3.0 E-10	2.5 E-10	1.9 E-10	1.6 E-10
WSW	4.3 E-8	1.1 E-8	4.2 E-9	1.7 E-9	7.8 E-10	4.9 E-10	3.4 E-10	2.7 E-10	2.0 E-10	1.7 E-10
W	3.0 E-8	8.8 E-9	3.4 E-9	1.4 E-9	6.5 E-10	4.2 E-10	2.9 E-10	2.3 E-10	1.7 E-10	1.4 E-10
WNW	1.2 E-8	4.5 E-9	2.0 E-9	8.4 E-10	4.0 E-10	2.6 E-10	1.8 E-10	1.4 E-10	1.1 E-10	9.1 E-11
NW	8.8 E-9	3.2 E-9	1.4 E-9	5.9 E-10	2.8 E-10	1.8 E-10	1.3 E-10	1.0 E-10	7.6 E-11	6.5 E-11
NNW	2.2 E-8	6.4 E-9	2.6 E-9	1.1 E-9	5.0 E-10	3.3 E-10	2.3 E-10	1.8 E-10	1.4 E-10	1.1 E-10

*Direction wind blows into

TABLE 7

DISPERSION PARAMETER ($\overline{X/Q}$) FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

Ground Vent

Distance to the control location, in miles

Sector*	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	4.4 E-5	8.2 E-6	3.4 E-6	1.4 E-6	6.9 E-7	4.7 E-7	3.4 E-7	2.7 E-7	2.2 E-7	1.9 E-7
NNE	5.5 E-5	1.0 E-5	4.2 E-6	1.8 E-6	8.7 E-7	5.9 E-7	4.3 E-7	3.5 E-7	2.9 E-7	2.4 E-7
NE	6.5 E-5	1.2 E-5	5.1 E-6	2.1 E-6	1.0 E-6	6.9 E-7	5.1 E-7	4.1 E-7	3.4 E-7	2.8 E-7
ENE	4.4 E-5	8.3 E-6	3.5 E-6	1.4 E-6	6.9 E-7	4.8 E-7	3.4 E-7	2.8 E-7	2.2 E-7	1.9 E-7
E	3.7 E-5	7.1 E-6	2.9 E-6	1.2 E-6	5.7 E-7	3.7 E-7	2.8 E-7	2.2 E-7	1.8 E-7	1.5 E-7
ESE	2.6 E-5	4.8 E-6	2.0 E-6	7.8 E-7	3.8 E-7	2.5 E-7	1.8 E-7	1.5 E-7	1.1 E-7	9.9 E-8
SE	1.7 E-5	3.1 E-6	1.3 E-6	5.0 E-7	2.4 E-7	1.6 E-7	1.1 E-7	9.3 E-8	7.6 E-8	6.3 E-8
SSE	1.3 E-5	2.4 E-6	9.5 E-7	3.7 E-7	1.8 E-7	1.2 E-7	8.6 E-8	7.0 E-8	5.7 E-8	4.6 E-8
S	1.2 E-5	2.2 E-6	9.0 E-7	3.5 E-7	1.7 E-7	1.1 E-7	8.4 E-8	6.7 E-8	5.4 E-8	4.5 E-8
SSW	1.2 E-5	2.1 E-6	8.7 E-7	3.5 E-7	1.7 E-7	1.1 E-7	8.3 E-8	6.6 E-8	5.4 E-8	4.5 E-8
SW	9.7 E-6	1.7 E-6	6.8 E-7	2.7 E-7	1.3 E-7	8.7 E-8	6.3 E-8	5.1 E-8	4.1 E-8	3.4 E-8
WSW	1.4 E-5	2.4 E-6	9.9 E-7	4.0 E-7	1.9 E-7	1.3 E-7	9.3 E-8	7.6 E-8	6.3 E-8	5.2 E-8
W	2.5 E-5	4.5 E-6	1.8 E-6	7.5 E-7	3.6 E-7	2.4 E-7	1.8 E-7	1.4 E-7	1.1 E-7	9.8 E-8
WNW	2.4 E-5	4.6 E-6	1.9 E-6	7.7 E-7	3.7 E-7	2.5 E-7	1.8 E-7	1.5 E-7	1.2 E-7	9.7 E-8
NW	2.1 E-5	4.0 E-6	1.6 E-6	6.7 E-7	3.3 E-7	2.2 E-7	1.6 E-7	1.3 E-7	1.1 E-7	8.8 E-8
NNW	2.9 E-5	5.4 E-6	2.2 E-6	9.2 E-7	4.5 E-7	3.0 E-7	2.2 E-7	1.8 E-7	1.5 E-7	1.2 E-7

*Direction wind blows into

TABLE

DISPERSION PARAMETER ($\overline{D/Q}$) FOR LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

Ground Vent

Distance to the control location, in miles

Sector*	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	2.0 E-7	3.7 E-8	1.2 E-8	5.0 E-9	2.3 E-9	1.4 E-9	9.7 E-10	7.6 E-10	5.5 E-10	4.7 E-10
NNE	1.8 E-7	3.4 E-8	1.1 E-8	4.5 E-9	2.1 E-9	1.3 E-9	9.0 E-10	6.9 E-10	5.0 E-10	4.3 E-10
NE	2.5 E-7	4.5 E-8	1.5 E-8	6.1 E-9	2.8 E-9	1.7 E-9	1.1 E-9	9.2 E-10	6.9 E-10	5.8 E-10
ENE	2.1 E-7	3.9 E-8	1.3 E-8	5.3 E-9	2.4 E-9	1.5 E-9	1.0 E-9	8.0 E-10	6.0 E-10	5.0 E-10
E	2.5 E-7	4.6 E-8	1.5 E-8	6.2 E-9	2.8 E-9	1.7 E-9	1.2 E-9	9.4 E-10	7.0 E-10	5.8 E-10
ESE	2.2 E-7	4.1 E-8	1.3 E-8	5.5 E-9	2.5 E-9	1.6 E-9	1.1 E-9	8.4 E-10	6.3 E-10	5.2 E-10
SE	1.8 E-7	3.7 E-8	1.1 E-8	4.5 E-9	2.1 E-9	1.3 E-9	9.0 E-10	6.9 E-10	5.1 E-10	4.3 E-10
SSE	9.8 E-8	1.8 E-8	6.0 E-9	2.4 E-9	1.1 E-9	6.8 E-10	4.8 E-10	3.7 E-10	2.7 E-10	2.3 E-10
S	6.8 E-8	1.3 E-8	4.2 E-9	1.7 E-9	7.7 E-10	4.8 E-10	3.3 E-10	2.6 E-10	1.9 E-10	1.6 E-10
SSW	6.7 E-8	1.2 E-8	4.1 E-9	1.7 E-9	7.6 E-10	4.7 E-10	3.3 E-10	2.5 E-10	1.8 E-10	1.5 E-10
SW	7.6 E-8	1.4 E-8	4.7 E-9	1.9 E-9	8.6 E-10	5.5 E-10	3.8 E-10	2.9 E-10	2.1 E-10	1.7 E-10
WSW	9.9 E-8	1.8 E-8	6.1 E-9	1.5 E-9	1.1 E-9	6.9 E-10	4.9 E-10	3.7 E-10	2.8 E-10	2.3 E-10
W	1.1 E-7	2.0 E-8	6.7 E-9	2.7 E-9	1.2 E-9	7.5 E-10	5.4 E-10	4.1 E-10	3.0 E-10	2.5 E-10
WNW	8.9 E-8	1.6 E-8	5.4 E-9	2.2 E-9	1.0 E-9	6.3 E-10	4.3 E-10	3.3 E-10	2.5 E-10	2.1 E-10
NW	7.0 E-8	1.3 E-8	4.3 E-9	1.7 E-9	7.9 E-10	4.9 E-10	3.4 E-10	2.6 E-10	2.0 E-10	1.6 E-10
NNW	1.2 E-7	1.2 E-8	7.1 E-9	1.9 E-9	1.3 E-9	8.1 E-10	5.7 E-10	4.4 E-10	3.2 E-10	2.7 E-10

*Direction wind blows into

TABLE 9

PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES*

Radio-nuclide	Inhalation Pathway R_i (mrem/yr per uCi/m^3)	Meat Pathway R_i (m^2 · mrem/yr per uCi/sec)	Ground Plane Pathway R_i (m^2 · mrem/yr per uCi/sec)	Cow-Milk-Infant Pathway R_i (m^2 · mrem/yr per uCi/sec)	Leafy Vegetables Pathway R_i (m^2 · mrem/yr per uCi/sec)
H-3	1.12E 03	2.33E 02	0.	2.38E 03	2.47E 02
CR-51	1.70E 04	4.98E 05	5.31E 06	5.75E 06	1.63E 06
MN-54	1.57E 06	7.60E 06	1.56E 09	3.70E 07	5.38E 07
FE-59	1.27E 06	6.49E 08	3.09E 08	4.01E 08	1.10E 08
CO-58	1.10E 06	9.49E 07	4.27E 08	7.01E 07	4.55E 07
CO-60	7.06E 06	3.61E 08	2.44E 10	2.25E 08	1.54E 08
ZN-65	9.94E 05	1.05E 09	8.28E 08	1.99E 10	2.24E 08
SR-89	2.15E 06	4.89E 08	2.42E 04	1.28E 10	5.39E 09
SR-90	1.01E 08	1.01E 10	0	1.19E 10	9.85E 10
ZR-95	2.23E 06	6.09E 08	2.73E 08	8.76E 05	1.13E 08
I-131	1.62E 07	2.60E 09	1.01E 07	4.95E 11	2.08E 10
I-133	3.84E 06	6.45E 01	1.43E 06	4.62E 09	3.88E 08
CS-134	1.01E 06	1.42E 09	7.70E 09	6.37E 10	1.96E 09
CS-136	1.71E 05	5.06E 07	1.64E 08	6.61E 09	1.60E 08
CS-137	9.05E 05	1.27E 09	1.15E 10	5.75E 10	1.80E 09
BA-140	1.74E 06	5.00E 07	2.26E 07	2.75E 08	2.03E 08
CE-141	5.43E 05	1.45E 07	1.48E 07	1.43E 07	8.99E 07

* Additional dose factors for isotopes not included in Table 9 may be calculated using the methodology described in NUREG-0133, Section 5.3.1 (reference 2).

IX. Preparation of Special Report to Demonstrate Compliance with Environmental Radiation Protection Standards

Ginna Technical Specification 3.9.2.4.a requires the preparation and submittal of a Special Report to the Commission when calculated effluent release doses exceed twice the limits of Specifications 3.9.1.2.a, 3.9.2.2.a or 3.9.2.2.b. In addition, subsequent releases are to be limited so that the dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to ≤ 25 mrem to the total body or any organ (except the thyroid, which is limited to ≤ 75 mrem) for the calendar year that includes the release(s) in the Special Report. This includes the dose contributions from the calendar quarter in which the limits were exceeded and the subsequent calendar quarters within the current calendar year.

The following general guidelines are presented for preparation of the Special Report:

1) The maximally exposed real member of the public will generally be the same individual considered in the Technical Specification.

2) Dose contributions to the maximally exposed individual need only be considered to be those resulting from the Ginna plant itself. All other uranium fuel cycle facilities or operations are of sufficient distance to contribute a negligible portion of the individual's dose.

3) For determining the total dose to the maximally exposed individual from the major gaseous and liquid effluent pathways and from direct radiation, dose evaluation techniques used in preparing the Special Report may be those described in this manual or other applicable methods where appropriate.

4) The contribution from direct radiation may be estimated by effluent dispersion modelling or calculated from the results of the environmental monitoring program for direct radiation.

X. References

1. R.E. Ginna Nuclear Power Plant Unit No.1, Appendix A to Operating License No. DPR-18, Technical Specifications, Rochester Gas and Electric Corporation, Docket 50-244.

2. USNRC, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, NUREG-0133 (October, 1978).

3. USNRC, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Regulatory Guide 1.109, Revision 1 (October, 1977).

4. R.E. Ginna Nuclear Power Plant, Environmental Report, Appendix B (August, 1972).

5. R.E. Ginna Nuclear Power Plant, Calculations to Demonstrate Compliance with the Design Objectives of 10 CFR Part 50, Appendix I, Rochester Gas and Electric Corporation, (June, 1977).

6. USNRC, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, Regulatory Guide 1.111, Revision 1 (July, 1977).

7. R.E. Ginna Nuclear Power Plant, Incident Evaluation, Ginna Steam Generator Tube Failure Incident January 25, 1982, Rochester Gas and Electric Corporation, (April 12, 1982).

8. Pelletier, C.A, et. al., Sources of Radioiodine at Pressurized Water Reactors, EPRI NP-939 (November, 1978).