OFFSITE DOSE CALCULATION MANUAL

FOR

SOUTH CAROLINA ELECTRIC AND GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION

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2.0 LIQUID EFFLUENT

2.1 Liquid Effluent Monitor Setpoint Calculation

The Virgil C. Summer Nuclear Station is located on the Monticello Reservoir which provides supply and discharge for the plant circulating water. This reservoir also provides supply and discharge capacity for the Fairfield Pumped Storage Facility. The Parr Reservoir located below the pumped storage facility is formed by the Parr Dam.

There are two analyzed release pathways and sources of dilution for liquid effluents: the circulating water discharge canal and the liquid effluent line to the penstocks of the pumped storage facility. All liquid effluent pathways discharge to one of these release points. Generally speaking, very low concentrations of radioactive waste are discharged to the circulating water discharge while higher concentrations of radioactive waste are released to the penstocks of the pumped storage facility during the generation cycle.

The calculated setpoint values will be regarded as upper bounds for the actual setpoint adjustments. That is, setpoint adjustments are not required to be performed if the existing setpoint level corresponds to a lower count rate than the calculated value. Setpoints may be established at values lower than the calculated values, if desired.

Calculated monitor setpoints may be added to the ambient background count rate.

GENERAL NOTE: If no discharge is planned for a specific pathway or if the sum of the effluent concentrations of gamma emitting nuclides equals zero, the monitor setpoint should be established as close to background as practical to prevent spurious alarms and yet alarm should an inadvertent release occur.

2.1.1 Liquid Effluent Monitor Setpoint Calculation Parameters

Term		Definition*	Section of Initial Use
A	=	Penstock discharge adjustment factor which will allow the set point to be established in a convenient manner and to prevent spurious alarms. = f_t/f_{dx}	2.1.2
B	=	Steam Generator Blowdown adjustment factor which will allow the set point to be established in a convenient manner and to prevent spurious alarms. = f_d/f_{ds}	2.1.4.1
C_{ECL}	=	the effluent concentration limit (ODCM Control 1.1.2.1) implementing 10 CFR 20 for the site, in µCi/ml.	2.1.2
C_a	=	the effluent concentration of alpha emitting nuclides observed by gross alpha analysis of the monthly composite sample, in µCi/ml.	2.1.2
C_f	=	the measured concentration of Fe-55 in liquid waste as determined by analysis of the most recent available quarterly composite sample, in µCi/ml.	2.1.2
C_g	=	the effluent concentration of a gamma emitting nuclide, g, observed by gamma-ray spectroscopy of the waste sample, in µCi/ml.	2.1.2
C_i	=	the concentration of nuclide i, in µCi/ml, as determined by the analysis of the waste sample.	2.1.2
C_{ir}	=	the concentration of radionuclide i, in µCi/ml, in the Monticello Reservoir. Inclusion of this term will correct for possible long-term buildup of radioactivity due to recirculation and for the presence of activity recently released to the Monticello Reservoir by plant activities.	2.1.2
C_s	=	the concentration of Sr-89 or Sr-90 in liquid wastes as determined by analysis of the quarterly composite sample, in µCi/ml.	2.1.2
C_t	=	the measured concentration of H-3 in liquid waste as determined by analysis of the monthly composite, in µCi/ml.	2.1.2
c	=	the setpoint, in µCi/ml, of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release. This setpoint which is proportional to the volumetric flow to the effluent line and inversely proportional to the volumetric flow of the dilution stream plus the effluent stream, represents a value which, if exceeded, would result in concentrations exceeding the limits of 10 CFR 20 in the unrestricted area.	2.1.2

*All concentrations are in units of µCi/ml unless otherwise noted.

Term		Definition	Section of Initial Use
c_B	=	the monitor setpoint concentration for RM-L7, the Nuclear Blowdown Monitor Tank discharge line monitor, in µCi/ml.	2.1.2.2
c_C	=	the monitor setpoint concentration for RM-L9, the combined Liquid Waste Processing System and Nuclear Blowdown System effluent discharge line monitor, in µCi/ml.	2.1.2.3
c_D	=	the monitor setpoint concentration for RM-L11, the Condensate Demineralizer Backwash discharge line monitor, in µCi/ml.	2.1.4.2.2
c_M	=	the monitor setpoint concentration for RM-L5, the Waste Monitor Tank discharge line monitor, in µCi/ml.	2.1.2.1
c_{Sa}	=	the monitor setpoint concentration for RM-L3, the initial Steam Generator Blowdown Effluent line monitor, in µCi/ml.	2.1.4.1.1
c_{Sb}	=	the monitor setpoint concentration for RM-L10, the final Steam Generator Blowdown Effluent line monitor, in µCi/ml.	2.1.4.1.1
c_T	=	the monitor setpoint concentration for RM-L8, the Turbine Building Sump Effluent line monitor, in µCi/ml.	2.1.4.2.1
CF_D	=	the Condensate Demineralize Backwash Effluent Concentration Factor.	2.1.4.2
CF_S	=	the Steam Generator Blowdown Effluent Concentration Factor.	2.1.4.3
CF_T	=	the Turbine Building Sump Effluent Concentration Factor.	2.1.4.2
DF	=	the dilution factor, which is the ratio of the total dilution flow rate to the effluent stream flow rate(s).	2.1.2
F	=	the dilution water flow setpoint as determined prior to the release, in volume per unit time.	2.1.2
F_d	=	the flow rate of the Circulating Water System during the time of release of the Turbine Building Sump and/or the Steam Generator Blowdown, in volume per unit time.	2.1.4.1
F_{dc}	=	the dilution flow rate of the Circulating Water System used for effluent monitor setpoint calculations, based on 90 percent of expected Circulating Water System flow rate during the time of release and corrected for recirculated Monticello Reservoir activity, in volume per unit time.	2.1.4.1
F_{dp}	=	the dilution flow rate through the penstock(s) receiving the radioactive liquid release upon which the effluent monitor setpoint is based, as corrected for any recirculated radioactivity, in volume per unit time.	2.1.2
F_k	=	The near field dilution factor for C_i during release from Turbine Building sump.	2.1.4.4.1
F_t	=	the flow rate of water through the Fairfield Pumped Storage Station penstock(s) to which radioactive liquids are being discharged during the period of effluent release. This flow rate is dependent upon operational status of Fairfield Pumped Storage Station, in volume per unit time.	2.1.2
f	=	the effluent line flow setpoint as determined for the radiation monitor location, in volume per unit time.	2.1.2

Term		Definition	Section of Initial Use
f_d	=	the maximum permissible discharge flow rate for releases to the Circulating Water, in volume per unit time.	2.1.4.1
f_{db}*	=	the flow rate of the Nuclear Blowdown Monitor Tank discharge, in volume per unit time.	2.1.2
f_{dm}*	=	the flow rate of a Waste Monitor Tank discharge, in volume per unit time.	2.1.2
f_{ds}*	=	the flow rate of the Steam Generator Blowdown discharge, in volume per unit time.	2.1.4.1
f_{dx}	=	the flow rate of the tank discharge, either f_{dm} or f_{db}, in volume per unit time.	2.1.2
f_r	=	the recirculation flow rate used to mix the contents of a tank, in volume per unit time.	2.1.2
f_t	=	the maximum permissible discharge flow rate for batch releases to the penstocks, in volume per unit time.	2.1.2
ECL_i	=	ECL_g, ECL_a, ECL_s, ECL_f, and ECL_t = the limiting concentrations of the appropriate gamma emitting, alpha emitting, and strontium radionuclides, Fe-55, and tritium, respectively, from 10 CFR, Part 20, Appendix B, Table 2, Column 2.	2.1.2
SF	=	the safety factor, a conservative factor used to compensate for engineering and measurement uncertainties. SF = 0.5, corresponding to a 100 percent variation.	2.1.2
$[C_i]_{LLD}$	=	the Lower Limit of Detection (LLD) for radionuclide i in liquid waste in the Waste Monitor Tank, as determined by the analysis required in ODCM Table 1.1-4, in µCi/ml.	2.1.3
$[C_i]_M$	=	the concentration of radionuclide i in the waste contained within the Waste Monitor Tank serving as the holding facility for sampling and analysis prior to discharge, in µCi/ml.	2.1.3
$\sum_g C_g$	=	the sum of the concentrations Cg of each measured gamma emitting nuclide observed by gamma-ray spectroscopy of the waste sample, in µCi/ml.	2.1.2
$\left[\sum_g C_g\right]_B$	=	the gamma isotopic concentrations of the Nuclear Blowdown Monitor Tank as obtained from the sum of the measured concentrations determined by the analysis required in ODCM Table 1.1-4, in µCi/ml.	2.1.2

* (Conservatively this value will be either zero, if no release is to be conducted from this system, or the maximum measured capacity of the discharge pump if a release is to be conducted.)

Term		Definition	Section of Initial Use
$\left[\sum_g C_g\right]_D$	=	the gamma isotopic concentrations of the Condensate Demineralizer Backwash effluent (including solids) as obtained from the sum of the measured concentrations determined by the analysis required in ODCM Table 1.1-4, in µCi/ml.	2.1.4.2.2
$\left[\sum_g C_g\right]_M$	=	the gamma isotopic concentrations of the Waste Monitor Tank as obtained from the sum of the measured concentrations determined by the analysis required in ODCM Table 1.1-4, in µCi/ml.	2.1.2
$\left[\sum_g C_g\right]_S$	=	the gamma isotopic concentrations of the Steam Generator Blowdown as obtained from the sum of the measured concentrations determined by the analysis required in ODCM Table 1.1-4, in µCi/ml.	2.1.4.1.1
$\left[\sum_g C_g\right]_T$	=	the gamma isotopic concentrations of the Turbine Building Sump as obtained from the sum of the measured concentrations determined by the analysis required in ODCM Table 1.1-4, in µCi/ml.	2.1.4.2.1
t_r	=	the minimum time for recirculating the contents of a tank prior to sampling, in minutes.	2.1.2
V	=	the volume of liquid in a tank to be sampled, in gallons.	2.1.2
V_j	=	release volume for Turbine Building sump release permit $_j$, in gallons.	2.1.4.4.1

2.1.2 Liquid Radwaste Effluent Line Monitors

(RM-L5, RM-L7, RM-L9)

Liquid Radwaste Effluent Line Monitors provide alarm and automatic termination of release functions prior to exceeding 10 times the concentration limits specified in 10 CFR 20, Appendix B, Table 2, Column 2 at the release point to the unrestricted area. To meet this specification, the alarm/trip setpoints for liquid effluent monitors and flow measurement devices are set to assure that the following equation is satisfied:

$$10C_{ECL} \geq \frac{cf}{F+f} \qquad (1)$$

where:

C_{ECL} = the effluent concentration limit specified in 10 CFR 20 Appendix B, Table 2, Column 2. Note that Control 1.1.2.1 limits release concentrations to 10 times the Appendix B, Table 2, Column 2 values.

c = the setpoint, in µCi/ml, of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release; the setpoint, which is inversely proportional to the volumetric flow of the effluent line and proportional to the volumetric flow of the dilution stream plus the effluent stream, represents a value which, if exceeded, would result in concentrations exceeding 10 times the effluent concentrations of 10 CFR 20 in the unrestricted area.

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

f = the effluent line flow setpoint as determined at the radiation monitor location, in volume per unit time.

At the Virgil C. Summer Nuclear Station the Liquid Waste Processing System (LWPS) and the Nuclear Blowdown System (NBS) both discharge to the penstocks of the Fairfield Pumped Storage (FPS) Facility through a common line. The available dilution water flow (F_{dp}) is assumed to be 90 percent of the flow through the FPS penstock(s) to which liquid effluent is being discharged and is dependent upon operational status of the FPS Facility. The waste tank flow rates (f_{dm} and f_{db}) and the monitor setpoints (c_M, c_B and c_C) are set to meet the condition of equation (1) for a given effluent concentration, C. The three monitor setpoints are determined in accordance with the monitor system configuration for this discharge pathway. The LWPS discharges through RM-L5, which has setpoint c_M for alarm/control functions over releases from either Waste Monitor Tanks 1 or 2. The Nuclear Blowdown discharges through RM-L7, which has setpoint c_B for alarm/ control functions over releases from the Nuclear Blowdown Monitor Tank. These two release pathways merge into a common line monitored by RM-L9, which has setpoint c_C for control functions over the common effluent line. Although the piping is arranged so that simultaneous batch releases from the two systems could be practiced, <u>operational releases shall be from only one of the two batch systems at any given time</u>. The method by which their setpoints are determined is as follows:

1) The isotopic concentration for a waste tank to be released is obtained from the sum of the measured concentrations as determined by the analysis required in Table 1.1-4:

$$\sum_i C_i = \sum_g C_g + C_a + C_s + C_t + C_f \qquad (2)$$

where:

C_i = the concentration of nuclide i, in µCi/ml, as determined by the analysis of the waste sample.*

$\sum_g C_g$ = the sum of the concentrations C_g of each measured gamma emitting nuclide observed by gamma-ray spectroscopy of the waste sample, in µCi/ml.

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* Values for C_a, C_s, C_t and C_f will be based on most recent available composite sample analyses as required by Table 1.14.

C_a^* = the effluent concentration of alpha emitting nuclides observed by gross alpha analysis of the monthly composite sample, in µCi/ml.

C_s^* = the concentration of Sr-89 and Sr-90 in liquid waste as determined by analysis of the quarterly composite sample, in µCi/ml.

C_t^* = the measured concentration of H-3 in liquid waste as determined by analysis of the monthly composite sample, in µCi/ml.

C_f^* = the measured concentration of Fe55 in liquid waste as determined by analysis of the quarterly composite sample, in µCi/ml.

The C_g term will be included in the analysis of each batch; terms for alpha, strontium, Fe-55, and tritium shall be included as appropriate*. Isotopic concentrations for both the Waste Monitor Tanks (WMT) and the Nuclear Blowdown Monitor Tank (NBMT) may be calculated using equation (2).

Prior to being sampled for analysis, the contents of a tank shall be isolated and recirculated. The minimum recirculation time shall be:

$$t_r = 2V/f_r \qquad (3)$$

t_r = the minimum time for recirculating the contents of a tank prior to sampling.

V = the volume of liquid in the tank to be sampled.

f_r = the recirculation flow rate used to mix the contents of a tank.

This is done to ensure that a representative sample will be obtained. Mechanical mixers shall ensure a similar minimum turnover.

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*Based on most recent available composite sample analysis as required by Table 1.1-4.

2) Once isotopic concentrations for either Waste Monitor Tank or the Nuclear Blowdown Monitor Tank have been determined, these values are used to calculate a Dilution Factor, DF, which is the ratio of dilution flow rate to tank flow rate(s) required to assure that 10 times the limiting concentration of 10 CFR 20, Appendix B, Table 2, Column 2 are met at the point of discharge for whichever tank is having its contents discharged.

$$DF = \left[\sum_i \frac{C_i}{10\ (E\ CL)_i} \right]_x \div SF \tag{4}$$

$$DF = \left[\sum_g \frac{C_g}{10\ (E\ CL)_g} + \left[\frac{C_a}{10\ (E\ CL)_a} + \frac{C_s}{10\ (E\ CL)_s} + \frac{C_f}{10\ (E\ CL)_f} + \frac{C_t}{10\ (E\ CL)_t} \right] \right]_x \div SF \tag{5}$$

where:

$\left[\sum \frac{C_i}{10(ECL)_i} \right]_x$ = the sum of the ratios of the measured concentration of nuclide i to 10 times its limiting ECL value for the tank whose contents are being considered for release. For a WMT, X = M. For the NBMT, X = B.

ECL_i = ECL_g, ECL_a, ECL_s, ECL_f, and ECL_t, = effluent concentration limits of the appropriate gamma emitting, alpha emitting, and strontium radionuclides, Fe-55, and tritium, respectively, given in 10 CFR, Part 20, Appendix B, Table 2, Column 2.

SF = the safety factor; a conservative factor used to compensate for engineering and measurement uncertainties.

= 0.5, Corresponding to a 100 percent variation.

3) The maximum permissible discharge flow rate, f_t, may be calculated for the release of either the WMT or NBMT. First the appropriate Dilution Factor is calculated by applying equation (4), using the appropriate concentration ratio term (i.e. M or B).

Then,

$$f_t = \frac{F_{dp} + f_{dx}}{DF} \cong \frac{F_{dp}}{DF} \text{ for } F_{dp} >> f_{dx} \qquad (6)$$

where:

F_{dp} = dilution flow rate to be used in effluent monitor setpoint calculations, based on 90 percent FPS Station expected flow rate, as corrected for any recirculated radioactivity:

$$F_{dp} = (0.9)\, F_t (1 - \sum_i \frac{C_{ir}}{10\,(E\,CL)_i} \qquad (7)$$

where:

F_t = the flow rate through the Fairfield Pumped Storage Station penstock(s) to which radioactive liquids are being discharged. F_t should normally fall between 2500 and 44800 cfs.

C_{ir} = the concentration of radionuclide i, in µCi/ml, in the intake of Fairfield Pumped Storage Station (that is, in the Monticello Reservoir). Inclusion of this term will correct for possible long-term buildup of radioactivity due to recirculation and for the presence of activity recently released to the Monticello Reservoir by plant activities. For expected discharges of liquid wastes, the summation will be much less than 1.0 and can be ignored (Reference 6).

f_{dx} = the flow rate of the tank discharge, either f_{dm} or f_{db}.

f_{db} = flow rate of Nuclear Blowdown Monitor Tank discharge. (Conservatively this value will be either zero, if no release is to be conducted from this system, or the maximum measured capacity of the discharge pump if a release is to be conducted.)

f_{dm} = flow rate of Waste Monitor Tank discharge. (Conservatively this value will either be zero, if no release is to be conducted from this system, or the maximum measured capacity of the discharge pump if a release is to be conducted.)

DF = the Dilution Factor from Step 2.

If $f_t \geq f_{dx}$, the release may be made as planned and the flow rate monitor setpoints should be established as in Step 4 (below). Because F_{dp} is normally very large compared to the maximum discharge pump capacities for the Waste Monitor Tank and the Nuclear Blowdown Monitor Tank, it is extremely unlikely that $f_t < f_{dx.}$ However, if a situation should arise such that $f_t < f_{dx,}$ steps must be taken to assure that equation (1) is satisfied prior to making the release. These steps may include decreasing f_{dx} by decreasing the flow rate of f_{dm} or f_{db}, and/or increasing F_{dp}.

When new candidate flow rates are chosen, the calculations above should be repeated to verify that they combine to form an acceptable release. If they do, the establishment of flow rate monitor setpoints may proceed as follows in Step 4. If they do not, the choice of candidate flow rates must be repeated until an acceptable set is identified.

Note that if DF ≤ 1, the waste tank concentration for which the calculation is being performed includes safety factors in Step 2 and meets the instantaneous release rate limits without further dilution. Even though no dilution would be required, there will be no discharge if minimum dilution flow is not available, since the penstock minimum flow interlock will prevent discharge.

4) The dilution flow rate setpoint*, F, is established at 90 percent of the expected available dilution flow rate:

$$F = (0.9)\ F_t \qquad (8)$$

The flow rate monitor setpoint* for the effluent stream shall be set at the selected discharge pump rate (normally the maximum discharge pump rate or zero) f_{dm} or f_{db} chosen in Step 3 above.

5) The radiation monitor setpoints may now be determined based on the values of $\sum C_i$, F, and f which were specified to ensure releases are limited to 10 times the values of 10 CFR 20, Appendix B, Table 2, Column 2. The monitor response is primarily to gamma radiation, therefore, the actual setpoint is based on $\sum C_g$.

The setpoint concentration, c, is determined as follows:

$$c \leq \sum_{g} C_g X A \qquad (9)$$

A = Adjustment factor which will allow the setpoint to be established in a practical manner for convenience and to prevent spurious alarms.

$$A = f_t / f_{dx} \qquad (10)$$

If A ≥1, Calculate c and determine the maximum value for the actual monitor setpoint (cpm) from the monitor calibration graph.

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* Setpoints for flow rates are administrative limits.

If A < 1, No release may be made. Reevaluate the alternatives presented in Step 3.

NOTE: If calculated setpoint values are near actual concentrations planned for release, it may be impractical to set the monitor alarm at this value. In this case a new setpoint may be calculated following the remedial methodology presented in Step 3 for the case of $f_t < f_{dx}$.

Within the limits of the conditions stated above, the specific monitor setpoint concentrations for the three liquid radiation monitors RM-L5, RM-L7, and RM-L9 are determined as follows:

2.1.2.1 RM-L5, Waste Monitor Tank Discharge Line Monitor:

$$C_M \leq \left[\sum_g C_g \right]_M (A) \tag{11}$$

C_M is in µCi/ml

*See GENERAL NOTE under 2.1.

2.1.2.2 RM-L7, Nuclear Blowdown Monitor Tank Discharge Line Monitor:

$$C_B \leq \left[\sum_g C_g \right]_B (A) \tag{12}$$

C_B is in µCi/ml

NOTE: In no case should discharge be made directly from the Nuclear Blowdown Holdup Tank to the penstocks.

*See GENERAL NOTE under 2.1.

2.1.2.3 RM-L9, Combined Liquid Waste Processing System and Nuclear Blowdown Waste Effluent Discharge Line Monitor

The monitor setpoint concentration on the common line, c_C, should be the same as the setpoint concentration for the monitor on the active individual discharge line (i.e., c_M, or c_B as determined above):

$$C_C \leq MAX\ (C_M, C_B) \tag{13}$$

*See GENERAL NOTE under 2.1.

NOTE: In all cases, c_M, c_B, and c_c are the setpoint concentration values in µCi/ml. The actual monitor setpoints (cpm) for RM-L5, RM-L7, and RM-L9 are determined from the calibration graph for the particular monitor. Initially, the calibration curves were determined conservatively from families of response curves supplied by the monitor manufacturers. A sample is shown in Figure 2.1-1. As releases occur, a historical correlation will be prepared and placed in service when sufficient data are accumulated.

2.1.3 Liquid Radwaste Discharge Via Industrial and Sanitary Waste System (RM-L5)

In the Virgil C. Summer Nuclear Station liquid waste effluent system design, there exists a mechanism for discharging liquid wastes via the Industrial Sanitary Waste System. The sample point prior to discharge is one of the Waste Monitor Tanks. The analysis requirements are the requirements listed in Table 1.14.

C01→ 3.1.2 Station Vent Noble Gas Monitors (RM-A3 and RM-A4

For the purpose of implementation of section 1.2.1 of the ODCM, the alarm setpoint level for the station vent noble gas monitors will be calculated as follows:

S_v = count rate of the plant vent noble gas monitor (= S_{vp} for RM-A3) or the containment purge noble gas monitor (= S_{vc} for RM-A4) at the alarm setpoint level.

$\leq$ the lesser of

$$0.25 \times R_t \times D_{TB} \quad (34)$$

or

$$0.25 \times R_s \times D_{SS} \quad (35)$$

0.25 = the safety factor applied to each of the two vent noble gas monitors (plant vent and containment purge) to assure that the sum of the releases has a combined safety factor of 0.5 which allows a 100 percent margin for cumulative uncertainties of measurements.

D_{TB} = Dose rate limit to the total body of an individual

= 500 mrem/yr

R_t = count rate per mrem/yr to the total body

$$= C_v / ((\overline{X/Q})\ x\ F_v\ x\ \sum_i K_i\ X_{iv}) \quad (36)$$

Dss = Dose rate limit to the skin of the body of an individual in an unrestricted area.

= 3000 mrem/year.

Rs = count rate per mrem/yr to the skin.

$$= C_v \div [\overline{X/Q}\ x\ F_v\ x\ \sum_i (L_i + 1.1\ M_i)\ X_{iv}] \quad (37)$$

X_{iv} = the measured concentration of noble gas radionuclide i in the last grab sample analyzed for vent v, µCi/ml. (For the plant vent, grab samples are taken at least monthly. For the 6” and 36” containment purge lines, the sample is taken just prior to the release and also monthly, if the release is continuous.)

F_v = the flow rate in vent v, cc/sec. (1 cc/sec = 0.002119 cfm)

C_v = count rate, (cpm) of the monitor on station vent v corresponding to grab sample noble gas concentrations, X_{iv}, as determined from the monitor’s calibratopm curve; i.e., product of the monitor response curve slope (^{cpm}/uCi/ml) and the sum of the noble gas concentrations in the grab sample (uCi/ml). (Initial calibration curves of the type shown in Figure 2.1-1 have been determined conservatively from families of response curves supplied by the monitor manufacturers. As releases occur, a historical correlation will be prepared and placed in service when sufficient data are accumulated.)

$\overline{X/Q}$ = the highest annual average relative concentration in any sector, at the site boundary (seven year average).

= 6.3E-6 sec/m^3 in the ENE sector.

K_i = total body dose factor due to gamma emissions from isotope i (mrem/yr per μCi/m^3) from Table 3.1-1.

L_i = skin dose factor due to beta emissions from isotope i (mrem/yr per μCi/m^3) from Table 3.1-1.

1.1 = mrem skin dose per mrad air dose.

M_i = air dose factor due to gamma emissions from isotope i (mrad/yr per μCi/m^3) from Table 3.1-1.

NOTE: At plant startups when no grab sample analysis is available for the continuous releases, the Alternate Methodology of Section 3.1.4 must be used.

3.1.3 Waste Gas Decay System Monitor (RM-A10)

The permissible conditions for discharge through the waste gas decay system monitor (RM-A10) will be calculated in a manner similar to that for the plant vent noble gas monitor. In the case of the waste gas system, however, the discharge flow rate is continuously controllable by valve HCV-014 and permissible release conditions are therefore defined in terms of both flow rate and concentration. Therefore, RM-A10 is used only to insure that a representative sample was obtained.

For operational convenience, (to prevent spurious alarms due to fluctuations in background) the setpoint level will be established at 1.5 times the measured waste concentration.

The maximum permissible flow rate will be set on the same basis but include the engineering safety factor of 0.5. The RM-A10 setpoint level S_d is defined as:

$$S_d \leq 1.5c \qquad (38)$$

where:

c = count rate in CPM of the waste gas decay system monitor corresponding to the measured concentration (taken from the monitor calibration curves).

The maximum permissible waste gas flow rate f_w (cc/sec) is calculated from the maximum permissible dose rates at the site boundary according to:

$$f_w \leqq \text{the lesser of } f_t \text{ or } f_s \qquad (39)$$