Attachment C1

ODCM-03.01 Rev 1, Gaseous Effluents

Summary of Changes

Section/Page	Changes/Reason for change
ODCM-03.01	
3 of 23 2nd para.	Changed "In addition, prior to containment purge and venting," TO "In addition, prior to containment purging" This change was made because setpoint recalculation is required only for containment purging and to be consistent with the rest of the ODCM.
ODCM-03.01	
3 of 23 1.1.1	Changed "Reactor Building Vent Isolation Setpoint" TO "Reactor Building Vent Alarm Setpoint". This change was made because the setpoint exceedance no longer causes the Reactor Building Vent to isolate.
1st para.	Changed "Reactor Building Vent Plenum Monitor which initiates isolation of Reactor Building releases" TO "Reactor Building Vent Noble Gas Monitor". This change was made to differentiate the noble gas monitor from the plenum radiation monitor and because the isolation function has been removed from the noble gas monitor system.
ODCM-03.01	
4 of 23 1.1.1 B	Changed "For purge releases, substitute (x/q)v,the highest short term dispersion factor from Table A-12" TO "For purge releases. substitute the value obtained from Chemistry Manual procedure I.6.07 "Atmospheric Dispersion Determination" ". This change was made to more accurately predict offsite dose from containment purging by using near real time actual dispersion values.

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This section describes the procedures used by MNGP to:

A. Determine alarm point settings for gaseous effluent monitors;

B. Determine that dose rates at the site boundary from noble gases particulates and iodines remain below the limits of Tech Specs; and

C. Determine that the total dose from airborne effluents for the year is within the limits of Appendix I of 10 CFR 50[2].

The computations of this section may be done manually, by use of computer programs which implement these algorithms, and or by use of applicable MIDAS algorithms. MIDAS is a set of programs used at Monticello for the accident dose assessment. The applicable MIDAS dose evaluation routines for gaseous effluents may be utilized to perform the dose and dose rate assessments specified in this section.

1.0 MONITOR ALARM SETPOINT DETERMINATION

This procedure determines the effluent monitor alarm setpoint that indicates if the dose rate at or beyond the site boundary due to noble gas radionuclides in the gaseous effluent released from the site exceeds 500 mRem/year to the whole body or exceeds 3000 mRem/year to the skin. Accident monitors are set to limit effluent releases to a small fraction of the limits specified in 10 CFR 100. In addition this section calculates the maximum activity permitted in each off-gas storage tank.

Monitor high alarm or isolation setpoints are established in one of the following ways:

A. Monthly calculation of setpoints using the methodology of section 1.1 for noble gas nuclides in releases during the previous month.

B. Prior to each containment purge, recalculation of the setpoint using the methodology of section 1.1 based on the sample taken prior to purging.

1.1 Effluent Monitors

Monitor alarm setpoints are determined to assure compliance with Tech Specs . The setpoints indicate that the dose rate at or beyond the site boundary due to noble gas radionuclides in the gaseous effluent released from the site exceeds 500 mRem/year to the whole body or exceeds 3000 mRem/year to the skin.

Monitor alarm setpoints are calculated for the Reactor Building Vent Noble Gas monitors and the Stack Noble Gas Monitors once per month. These calculations are based on the noble gas isotopes in releases made during the previous month. The calculations are performed by the DOSGAS computer program in conjunction with Surveillance Test 0342.

In addition, prior to containment purging, the monitor setpoint for the monitor release point is recalculated. This calculation is performed by the DWCAL computer program in conjunction with Surveillance Test 0362. The monitor setpoint is determined as follows:

A. If no detectable noble gas activity is found in the purge sample, the values used as the basis for the alarm point setting are from the column, "Drywell venting" in Table 3.1-1, Gaseous Source Terms.

B. If any calculated setpoint is less than the existing monitor setpoint, the setpoint is reduced to the new value.

C. If the calculated setpoint is greater than the existing monitor setpoint, the setpoint may remain at the lower value or be increased to the new value.

D. The setpoint during purging may not be increased above the setpoint determined for continuous releases, however.

Except for containment inerting and deinerting, all containment purging and venting is done via the standby gas treatment system and plant stack. Containment inerting and deinerting releases are made via the Reactor Building vent. The small amount of containment atmosphere released by the containment sampling system on a continuous basis is not considered a venting operation.

1.1.1 Reactor Building Vent Alarm Setpoint

The following method applies to gaseous releases via the Reactor Building vent when determining the high-high alarm setpoint for the Reactor Building Vent Noble Gas Monitor. This method is applied to both continuous releases and batch releases (containment inerting and deinerting).

A. Determine the "mix" (noble gas radionuclides and composition) of the gaseous effluent.

1. Determine the gaseous source terms that are representative of the "mix" of the gaseous effluent. Gaseous source terms are the total curies of each noble gas released during the previous month

or a representative analysis of the gaseous effluent. Table 3.1-1 source terms may be used if the Reactor Building releases for the previous month were below the lower limits of detection (LLD), or, in the case of inerting and deinerting releases, no detectable activity was found in the grab sample taken prior to purging.

2. Determine S_i, the fraction of the total radioactivity in the gaseous effluent comprised by noble gas radionuclide "i", for each individual noble gas radionuclide in the gaseous effluent.

$$S_i = \frac{A_i}{\sum_i A_i} \qquad 3.1\text{-}1$$

where

A_i = The radioactivity of noble gas radionuclide "i" in the gaseous effluent.

B. Determine Q_t, the maximum acceptable total release rate of all noble gas radionuclides in the gaseous effluent (μCi/Sec), based upon the whole body exposure limit (500 mRem/yr).

$$Q_t = \frac{500}{(\chi/Q)_v \sum_i K_i S_i} \qquad 3.1\text{-}2$$

where

$(\chi/Q)_v$ = The highest calculated annual average relative concentration of effluents released via the Reactor Building vent for any area at or beyond the site boundary for all sectors (Sec/m^3) from Table A-3. For purge releases, substitute the value obtained from Chemistry Manual Procedure I.6.07, "Atmospheric Dispersion Determination".

K_i The total whole body dose factor due to gamma emissions from noble gas radionuclide "i" (mRem/year/μCi/m^3) from Table 3.1-2.

C. Determine Q_t based upon the skin exposure limit (3000 mRem/yr).

$$Q_t = \frac{3000}{(\chi/Q)_v \sum_i (L_i + 1.1\ M_i)\ S_i} \qquad 3.1\text{-}3$$

where

$L_i + 1.1M_i$ = the total skin dose factor due to emissions from noble gas radionuclide "i" (mRem/year/µCi/m^3) from Table 3.1-2, ODCM-13.03.

D. Determine HHSP (the monitor high-high alarm setpoint above background (net µCi/Sec)).

<u>NOTE</u>: Use the <u>lower</u> of the Q_t values obtained in Sections 1.1.1.B and 1.1.1.C.

$$HHSP = 0.50\ Q_t \qquad 3.1\text{-}4$$

0.50 = Fraction of the total radioactivity from the site via the monitored release point to ensure that the site boundary limit is not exceeded due to simultaneous releases from several release points.

1.1.2 Stack Isolation Setpoint

The following method applies to gaseous releases via the Stack when determining the high-high alarm setpoint for the Stack Gas Monitor which initiates isolation of Stack releases. The method is applied to both continuous releases and batch releases (containment purges). Mechanical vacuum pump releases (relatively insignificant) will be controlled using the continuous setpoint.

A. Determine the "mix" (noble gases and composition) of the gaseous effluent.

1. Determine the gaseous source terms that are representative of the "mix" of the gaseous effluent. Gaseous source terms are the total curies of each noble gas released during the previous month or a representative analysis of the gaseous effluent. Table 3.1-1 source terms may be used if the Stack releases for the previous month were below the lower limits of detection (LLD).

2. Determine S_i, the fraction of the total radioactivity in the gaseous effluent comprised by noble gas radionuclide "i", for each individual noble gas radionuclide in the gaseous effluent.

$$S_i = \frac{A_i}{\sum_i A_i} \qquad 3.1\text{-}5$$

where

A_i = The radioactivity of noble gas radionuclide "i" in the gaseous effluent.

B. Determine Q_t, the maximum acceptable total release rate of all noble gas radionuclides in the gaseous effluent (µCi/Sec), based upon the whole body exposure limit (500 mRem/yr).

$$Q_t = \frac{500}{\sum_i V_i S_i} \qquad 3.1\text{-}6$$

<u>NOTE</u>: **For short-term batch releases (equal to or less than 500 hrs/yr) via drywell purging, substitute v_i for V_i in Equation 3.1-6.**

where

V_i = The constant for long-term releases (greater than 500 hr/yr) for noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume (mRem/year/µCi/Sec) from Table 3.1-2.

v_i = The constant for short-term releases (equal to or less than 500 hr/yr) for noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume (mRem/yr/µCi/Sec) from Table 3.1-2.

C. Determine Q_t based upon the skin exposure limit (3000 mRem/yr).

$$Q_t = \frac{3000}{\Sigma_i (L_i (X/Q)_s + 1.1B_i) S_i} \qquad 3.1\text{-}7$$

NOTE: For short-term batch releases (equal to or less than 500 hours per year) via drywell purging, use the short-term $(\chi/q)_s$ value and substitute b_i for B_i in Equation 3.1-7.

where

$L_i(\chi/Q)_s + 1.1B_i$ The total skin dose constant for long-term releases (greater than 500 hours per year) due to emissions from noble gas radionuclide "i", Table 3.1-2, mRem/year/µCi/Sec;

$L_i(\chi/q)_s + 1.1b_i$ The total skin dose constant for short-term releases (less than or equal to 500 hours per year) due to emissions from noble gas radionuclide "i", Table 3.1.2, mRem/year/µCi/Sec.

D. Determine HHSP (the monitor high-high alarm setpoint above background (µCi/Sec).

NOTE: Use the lower of the Q_t values obtained in sections 1.1.2.B and 1.1.2.c.

$$HHSP = 0.50\ Q_t \qquad 3.1\text{-}8$$

0.50 = Fraction of the total radioactivity from the site via the monitored release point to ensure that the site boundary limit is not exceeded due to simultaneous releases from several release points.

1.2 Accident Monitors

The gross radioactivity in noble gases removed from the main condenser by means of steam jet air ejectors as measured prior to entering the treatment, adsorption, and delay systems ***SHALL*** be limited by an alarm setpoint for the Off-Gas Monitor.

This procedure determines the monitor alarm setpoint that indicates if the potential body accident dose to an individual at or beyond the site boundary due to noble gas radionuclides in the gaseous effluent released from the site exceeds a small fraction of the limits specified in 10 CFR 100 in the event this effluent, including the radioactivity accumulated in the treatment system, is inadvertently discharged directly to the environment without treatment. This calculation is performed by the OFF-GAS computer program on a routine or an as needed basis. Off-gas flow is automatically terminated when this setpoint is reached.

1.2.1 Maximum Release Rate

Determine Q_t, the maximum acceptable total release rate in µCi/Sec of all noble gas radionuclides in the gaseous effluent at the Off-gas Monitor after a 5-minute decay, based on the maximum acceptable total release rate of 2.60E5 µCi/Sec after a 30-minute decay.

A. Determine the off-gas mixture of the gaseous effluent. The off-gas mixture is the fraction of the off-gas noble gas radioactivity caused by each recoil diffusion, and equilibrium component. The off-gas mixture is determined, monthly, in conjunction with Monticello Technical Specification 4.8.B.5.c.

B. Determine Q_t based on the off-gas mixture using Table 3.1-3. This table was prepared using a variation of the NSP EBARR computer code (ODCM-09.01).

1.2.2 Maximum Concentration

Determine C_t, the maximum acceptable total radioactivity concentration of all noble gas radionuclides in the gaseous effluent (µCi/CC).

$$C_t = 2.12\text{ E-03} \frac{Q_t}{f} \qquad 3.1\text{-}9$$

where

f = The maximum acceptable effluent flowrate at the point of release (CFM);

= 85.5 CFM.

1.2.3 Monitor Reading

Determine C.R., the calculated monitor reading above background attributed to the noble gas radionuclides (mR/hr).

$$C.R. = \frac{C_t}{E} \qquad 3.1\text{-}10$$

where

E = The detection efficiency of the monitor for noble gas radionuclides represented in main condenser off-gas (µCi/CC/mR/hr) from Plant Chemistry Surveillance procedures.

1.2.4 Monitor High High Set-point

The monitor high-high alarm setpoint above background (mR/hr) should be set at or below the C.R. value.

1.3 Off-gas Storage Tank Maximum Activity

The Technical Specifications limit the maximum activity in each storage tank to less than 22,000 curies of noble gas (considered as dose equivalent Xe-133) after 12 hours of holdup. To verify that this limit is not exceeded, Table 3.1-3 is used.

The gross radioactivity of noble gases from the main condenser air ejector is determined by isotopic analysis monthly and whenever a significant increase in off-gas activity is noted. Analysis of this data is used to determine the primary mode of fission product release from the fuel (recoil, equilibrium, or diffusion) and the gross release rate. This information combined with the condenser air inleakage rate (CFM) and the air ejector monitor release rate is used to confirm that the maximum tank contents limit is not exceeded. This calculation is performed by the OFF-GAS computer program on a routine or as needed basis IAW MNGP Technical Specification 4.8.B.4.a.

Table 3.1-3 is entered with the off-gas mixture (fraction recoil, diffusion, and equilibrium rounded to one decimal place) and the air inleakage rate (in CFM determined from the last tank fill time). The resulting tank activity is multiplied by the current total release rate after a 30 minute decay (µCi/Sec) and divided by the maximum permitted air ejector release rate of 260,000 µCi/Sec. Linear interpolation of air inleakage is used.

As noted earlier, Table 3.1-3 is derived from the EBARR computer program described in ODCM-09.01. It is extremely unlikely that the maximum tank activity limit will be exceeded.

2.0 GASEOUS EFFLUENT DOSE RATE - COMPLIANCE WITH TECH SPECs (TS)

Dose rates resulting from the release of noble gases, and from radioiodines and particulates must be calculated to show compliance with Tech Specs (TS). The dose rate limits of Tech Spec (TS) are conservatively applied on an instantaneous basis at the hypothetical worst case location.

2.1 Noble Gases

The dose rate in unrestricted areas resulting from noble gas effluents is limited by Tech Spec (TS) to 500 mRem/yr to the total body and 3000 mRem/yr to the skin. The setpoint determinations discussed in the previous section are based on the dose rate calculation method presented in NUREG-0133[4]. This represents a backward solution to the limiting dose rate equations in NUREG-0133. Setting alarm trip setpoints in this manner will insure that the limits of Tech Spec (TS). are met for noble gas releases. Therefore, no routine dose rate calculations for noble gases will be needed to show compliance with this part. Routine calculations are made for dose rates from noble gas releases to show compliance with 10 CFR 50, Appendix I by performing the DOSGAS computer program.

2.2 Radioiodine and Radioactive Particulates and Other Radionuclides

The dose rate in unrestricted areas resulting from the release of radioiodines and particulates with half lives greater than 8 days is limited by Tech Spec (TS) to 1500 mRem/yr to any organ. The calculation of dose rate from radioiodines and particulates is performed for drywell purges prior to the release and weekly for all releases. This calculation is performed by the DWCAL computer program for drywell purges and 1/week by the IPART computer program for all releases, which is run in conjunction with Surveillance Test 0356. The calculations are based on the results of analyses obtained pursuant to MNGP Technical Specifications 4.8.B.1.b. To show compliance with Tech Spec (TS), Equation 3.2-1 or the MIDAS equations shown in ODCM-11.01 will be evaluated for I-131, I-133, tritium, and radioactive particulates with half lives greater than eight days.

$$\Sigma P_{i_I} \; [(\chi/Q_v)\, Q_{iv} + (\chi/Q_s)\, Q_{is}] < 1500 \text{ mRem/yr} \qquad 3.2\text{-}1$$

where

P_{i_I} = child critical organ dose parameter for radionuclide i for the inhalation pathway, mRem/yr per $\mu Ci/m^3$;

$(\chi/Q)_v$ = annual average relative concentration for long-term release from the Reactor Building vent at the critical location, Sec/m^3 (ODCM-13.06 Table A-3);

$(\chi/Q)_s$ = annual average relative concentration for long-term releases from the off-gas stack at the critical location, Sec/m^3 (Appendix A, Table A-6);

Q_{iv} = the release rate of radionuclide i from the Reactor Building vent for the week of interest, µCi/Sec;

Q_{is} = the release rate of radionuclide i from the off-gas stack for the week of interest, µCi/Sec.

The χ/Q values presented in Tables A-3 and A-6 have been calculated using the USNRC computer code "XOQDOQ."[(5)] Dose rate calculations using Equation 3.2-1 are made once per week. The source terms Q_{iv} and Q_{is} are determined from the results of analysis of weekly stack and Reactor Building particulate filters and charcoal cartridges. These source terms include all gaseous releases from MNGP. They are recorded and reported as the total dose for compliance with 10 CFR 20.

Radioiodines and particulates may be released from both the off-gas stack and the Reactor Building vent. As specified in NUREG-0133, the critical receptor location is identified based on the Reactor Building vent χ/Q.

A component of the total stack or vent source term may be due to short term releases occurring as a result of containment drywell purging. Dose rate calculations are made on this component separately to further assure compliance with Tech Spec (TS) prior to release. The calculated dose rate is used only to determine whether or not the drywell can be purged. All dose rates from drywell purges will be accounted for and reported through the weekly calculations discussed above. Release rates are determined from the results of analyses of samples from the drywell.

The term Q_{is} for the calculation of drywell purge dose rate is determined by multiplying the concentration of each nuclide in the drywell by the rate of release. Credit will be taken for the expected reduction in radionuclide concentration due to use of the standby gas treatment system. Equation 3.2-2 is used to calculate purge dose rates. Only one source term is used depending on the release point (stack or Reactor Building vent). Short term values of χ/q from the Table A-9 or Table A-12 is used in the purge dose rate calculation. the limiting dose rate limit for each purge is determined using:

$$BL = 1500 - (D_{cv} + D_{cs} - D_{dw}) \qquad 3.2\text{-}2$$

where

BL = limiting dose rate for the batch, mRem/yr;

D_{cv} = previous week's dose rate from Reactor Building continuous and batch releases, mRem/yr;

D_{cs} = previous week's dose rate from off-gas stack continuous and batch releases, mRem/yr;

D_{dw} = previous week's total dose rate from drywell purge releases, mRem/yr, for the purge release point.

Although mechanical vacuum pump releases are batch mode, they cannot be sampled prior to release. For this reason, no prerelease dose rate calculations can be made from this source. Experience has shown mechanical vacuum pump release to be well within Tech Spec (TS) limits.

2.3 Critical Receptor Identification

As stated in 5.2.1 of NUREG-0133, when the critical receptor is different for stack and vent releases, the controlling location for vent releases should be used. For this reason, the Reactor Building vent dispersion parameters are used to identify the critical receptor. The real time atmospheric dispersion factor (χ/Q) is calculated by performing the MIDAS XP computer program IAW MNGP Chemistry Procedure I.6.07. As discussed previously, weekly and batch dose rate calculations are performed for the critical boundary location. The critical boundary location is based on reactor vent long term χ/Q (Table A-3) is 0.43 miles in the SSE sector.

3.0 GASEOUS EFFLUENTS - COMPLIANCE WITH 10 CFR 50

Doses resulting from the release of noble gases, and radioiodines and particulates must be calculated to show compliance with Appendix I of 10 CFR 50. The calculations are performed monthly for all gaseous effluents. Calculations of the doses received due to the release of noble gases is performed by the DOSGAS computer program. Similarly the dose received due to the release of radioiodines and particulates is calculated by the DOSPIT computer program. These two programs are performed monthly or as required in conjunction with Surveillance Test 0342.

This section describes the methods and equations used at MNGP to perform the dose evaluation using manual methods based on historical meteorological dispersion parameters and using the MIDAS computer methods with contemporaneous meteorological dispersion parameters.

3.1 Noble Gases

The air dose in unrestricted areas at MNGP is limited to:

A. for any calendar quarter:
$D_\gamma \leq$ 5 mrad due to gamma radiation; and
$D_\beta \leq$ 10 mrad due to beta radiation; and

B. for any calendar year:
$D_\gamma \leq$ 10 mrad due to gamma radiation; and
$D_\beta \leq$ 20 mrad due to beta radiation.

Air doses may be calculated using historical meteorological data using the highest normalized concentration statistics as the best estimator of the atmospheric dispersion, or the doses may be computed using the contemporary meteorological data during the period of the release. Either method may be used and both are described below.*

3.1.1 Air Dose Based on Historical Meteorology

The limiting air dose, D, based on historical meteorology is based on the critical receptor in the unrestricted area. For air doses the critical receptor is described by the off-site location with the highest long term annual average relative concentration (χ/Q) at or beyond the restricted

area boundary. For short-term vent releases (less than 500 hours per year), the location with the highest short-term average relative concentration (χ/q) is chosen. The critical receptor is described in section 3.5.

For gamma radiation, the air dose is given by:

$$D_\gamma = 3.17 \times 10^{-8} \sum_i (M_i[(\chi/Q)_v Q_{iv} + (\chi/q)_v q_{iv}] + B_i Q_{is} + b_i q_{is}) \qquad 3.3\text{-}1$$

The historical meteorological data base is the basis for the method described in the original MNGP ODCM. With the addition of the MIDAS system to the MNGP, it is now possible to estimate doses based on contemporaneous data.

For beta radiation, the air dose is:

$$D_\beta = 3.17 \times 10^{-8} \sum_i N_i [(\chi/Q)_v Q_{iv} + (\chi/q)_v q_{iv} + (\chi/Q)_s Q_{is} + (\chi/q)_s q_{is}] \qquad 3.3\text{-}2$$

where:

M_i = The air dose factor due to gamma emission for each identified noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$; (Table 3.3-1)

N_i = the air dose factor due to beta emissions for each identified noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$; (Table 3.3-1)

$(\chi/Q)_v$ = the annual average relative concentration for areas at or beyond the site boundary for long-term Reactor Building vent releases (greater than 500 hr/yr), Sec/m^3, (ODCM-13.06, Table A-3);

$(\chi/q)_v$ = the relative concentration for areas at or beyond the site boundary for short-term Reactor Building vent releases (equal to or less than 500 hr/yr), Sec/m^3, (ODCM-13.06, Table A-12);

$(\chi/Q)_s$ = the annual average relative concentration for areas at or beyond the site boundary for long-term off-gas stack releases (greater than 500 hr/yr), Sec/m^3, (ODCM-13.06, Table A-6);

$(\chi/q)_s$ = the relative concentration for areas at or beyond the site boundary for short-term off-gas stack releases (equal to or less than 500 hr/yr), Sec/m^3 (ODCM-13.06, Table A-9);

q_{is} = the average release of the noble gas radionuclide i in gaseous effluents for short-term off-gas stack releases (equal to or less than 500 hr/yr), µCi;

q_{iv} = the average total release of the noble gas radionuclide i in gaseous effluents for short-term Reactor Building vent releases (equal to or less than 500 hr/yr), µCi;

Q_{is} = the total release of noble gas radionuclide i in gaseous releases for long-term off-gas stack releases (greater than 500 hr/yr), µCi;

Q_{iv} = the total release of noble gas radionuclide i in gaseous effluents for long-term Reactor Building vent releases (greater than 500 hr/yr), µCi;

B_i = the constant for long-term releases (greater than 500 hr/yr) for each identified noble gas radionuclide i accounting for the gamma radiation from the elevated finite plume, mrad/yr per µCi/Sec;

b_i = the constant for short-term releases (less than or equal to 500 hr/yr) for each identified noble gas radionuclide i accounting for the gamma radiation from the elevated finite plume, mrad/yr per µCi/Sec;

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

Noble gases are continuously released from the Reactor Building vent and the plant stack. These long-term releases rates are determined from the continuous noble gas monitor readings and periodic radionuclide analyses. There are infrequent containment purges from either release point. To separate the short-term release from the long term release (the continuous monitor records both), the drywell source term should be subtracted from the total source term whenever a purge

release occurs. Periodic radionuclide analysis of main condenser off-gas and radionuclide analysis of each purge prior to release are used in conjunction with the total activity measured by the monitor to quantify individual noble gas nuclides released.

Long-term and short-term χ/Q's are given in ODCM-06.01 for both the Reactor Building vent and the plant stack. Short-term χ/q's were calculated using the USNRC computer code "XOQDOQ" assuming 144 hours per year drywell purge. Values of M and N were calculated using the methodology presented in NUREG-0133 and are given in Table 3.3-1. Table 3.3-2 presents values of B_i and b_i calculated using the USNRC computer code "RABFIN." This code was also used to calculate values of V_i presented in section 1.0. Values of v_i, were calculated by multiplying V_i by the ratio of b_i to B_i. The v_i, iB_i, and b_i values of Table 3.3-2 are the maximum values for the site boundaries location. This location, 0.51 mi SSE, is different than the critical site boundary location based upon the Reactor Building vent χ/Q.

3.1.2 Air Dose Based on Contemporaneous Meteorology Using MIDAS

The air dose based on contemporaneous meteorology is performed in MIDAS [6] using the XDAIR routine. XDAIR uses the methods described under XDCALC with some parameters defined to provide the air dose computations. The XDCALC function is used to calculate atmospheric dispersion and doses according to the models prescribed in Regulatory Guides 1.109[7] and 1.111.[8] The MIDAS equations are given in ODCM-11.01.

Hourly values of χ/Q are calculated and are used to compute beta and gamma air doses. These doses are cumulated for the duration of the release. Calculations use hourly site meteorological data averages, centerline, depletion, and deposition calculations are performed.

For gamma or beta radiations the air doses are given by:

$$D_{\gamma,air} = 3.6 \times 10^{-6} \ \chi/Q \sum_{i=3}^{17} DF_i^{\gamma} Q_i , \quad \text{or}$$

$$D_{\beta,air} = 3.6 \times 10^{-6} \ \chi/Q \sum_{i=3}^{17} DF_i^{\beta} Q_i , \quad 3.3\text{-}3$$

where:

$D_{\gamma,air}$= gamma air dose, rad/hour;

$D_{\beta,air}$= beta air dose, rad/hour;

χ/Q= appropriate χ/Q for ground, mixed, or elevated release, Sec/m^3 (see ODCM-11.01);

i (3 to 17)= nuclide indices in MIDAS for noble gases;

DF^{γ}_i= the air dose factor due to gamma radiation for each identified noble gas radionuclide. in (mrad m^3)/(Ci Sec) (see Table 3.3-2);

DF^{β}_i= the air dose factor due to beta radiation for each identified noble gas radionuclide. in (mrad m^3)/(Ci Sec)(see Table 3.3-2);

Qi= release rate in uCi/Sec for each nuclide; and

3.6×10^{-6}= $\frac{\text{rad} \quad \text{Ci} \quad 3600\ \text{Sec}}{\text{mrad} \quad \mu\text{Ci} \quad \text{hour}}$

The MNGP uses both an elevated stack and building vents for releases. MIDAS uses the appropriate χ/Q for the computation depending on the source of the release. The computation of χ/Q in MIDAS for all cases is given in ODCM-11.01 under the section describing the Program XDCALC.

3.2 Radioiodine, Particulates, and Other Radionuclides

The dose, D_{aj}, to an individual from radioiodines, radioactive materials in particulate form and radionuclides other than noble gases with half lives greater than eight days in gaseous effluents released to unrestricted areas ***SHALL*** be limited to:

$D_{aj} \leq$ 7.5 mRem for any calendar quarter

$D_{aj} \leq$ 15 mRem for any calendar year

These limits apply to the receptor location where the combination of existing pathways and age groups indicates the maximum exposure. For this reason the MIDAS dose assessment algorithms should be used if available. Alternatively the infant dose at the historical highest χ/Q may be used. Both methods are described below.

3.2.1 Dose from Radioiodines and Particulates Based on Historical Meteorology

The worst case dose to an individual from I-131, tritium and radioactive particulates with half-lives greater than eight days in gaseous effluents released to unrestricted areas is determined by the following expressions:

$$D_{aj} = 3.17 \times 10^{-8} \sum_{p}\sum_{i} R_{iapj} [W_v Q_{iv} + w_v q_{iv} + W_s Q_{is} + w_s q_{is}] \qquad 3.3\text{-}4$$

where:

Q_{is} = release of radionuclide i for long-term off-gas stack releases (greater than 500 hr/yr), μCi;

Q_{iv} = release of radionuclide i for long-term Reactor Building vent releases (greater than 500 hr/yr), μCi;

q_{is} = release of radionuclide i for short-term off-gas stack purge releases (equal to or less than 500 hr/yr); μCi;

q_{iv} = release of radionuclide i for short-term Reactor Building vent purge releases (equal to or less than 500 hr/yr); μCi;

W_s = the dispersion parameter for estimating the dose to an individual at the controlling location for long-term off-gas stack releases (greater than 500 hr/yr), Sec/m^3 or m^{-2};

W_v = the dispersion parameter for estimating the dose to an individual at the controlling location for long-term Reactor Building vent releases (greater than 500 hr/yr), Sec/m^3 or m^{-2};

w_s = the dispersion parameter for estimating the dose to an individual at the controlling location for short-term off-gas stack releases (equal to or less than 500 hr/yr), Sec/m^3 or m^{-2};

w_v = the dispersion parameter for estimating the dose to an individual at the controlling location for short-term Reactor Building vent releases (equal to or less than 500 hr/yr), Sec/m^3 or m^{-2}

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

R_{iapj} = the dose factor for each identified radionuclide i, pathway p, age group a, and organ j, m^2 mRem/yr per µCi/Sec or mRem/yr per µCi/m^3.

The above equation is applied to each combination of age group and organ. Values of R_{iapj} have been calculated using the methodology given in NUREG-0133 and are given in Tables 3.3-3 through 3.3-21. The equation is applied to a controlling location which will be one of the following:

A. residence,

B. vegetable garden,

C. milk animal.

The selection of the actual receptor is discussed in section 3.3. The source terms and dispersion parameters in Equation 3.3-3 are obtained in the same manner as in section 2.0. The W values are in terms of χ/Q (Sec/m^3) for the inhalation pathways and for tritium and in terms of D/Q (m^{-2}) for all other pathways.

Appendix E contains the methodology for calculating R_{iapj} values. This method will be used to compute dose factors for nuclides not tabulated in Tables 3.3-3 through 3.3-21 if they are encountered.

3.2.2 Dose Based on Contemporaneous Meteorology Using MIDAS

The dose to individuals from I-131, tritium and radioactive particulates may be calculated using the MIDAS system algorithms. In MIDAS the Program GASPRO computes the accumulation of dose to individual receptors or to the surrounding population based on hourly meteorological data collected by MIDAS and release data from other computer programs utilizing the algorithms in this manual or other manual inputs.

Dose calculations are performed for each important nuclide for each pathway, organ, age group, distance and direction.

Radionuclide and pathway are used in GASPRO to determine the appropriate dispersion type to be used. Three types of atmospheric dispersion factors are used, χ/Q, χ/Q(depleted), and D/Q, depending on pathways and nuclide.

Hourly meteorological data is used so atmospheric conditions are contemporaneous with release.

The GASPRO calculations are based on the environmental pathways-to-man models prescribed by the NRC in Regulatory Guide 1.109. Dose factors for the individual doses (and for population doses) are based on results run-off line using the Pickard, Lowe, and Garrick (PLG) version of GASPAR. These data are tabled and used by the MIDAS routine in a look-up mode. These tables are given in MIDAS Tables 2.2.6.3-1 and 2.2.6.3-2 for Individual Dose Factors and Population Dose Factors, respectively. These tables are included in this manual in ODCM-11.01.

GASPRO calculates doses for the following pathways, organs and age groups.

Index	MIDAS Pathway
1	Plume
2	Ground Shine
3	Vegetable
4	Meat
5	Cow Milk
6	Goat Milk
7	Inhalation

Index	MIDAS Organ
1	Total Body
2	GI Tract
3	Bone
4	Liver
5	Kidney
6	Thyroid
7	Lung
8	Skin

Index	MIDAS Age Group
1	Adult
2	Teen
3	Child
4	Infant

Five types of receptors as indicated below can be located at up to 10 distances in each of the direction sectors.

Index	MIDAS Receptors
1	Residents
2	Vegetable Gardens
3	Meat Animals
4	Cows
5	Goats

The resident location is used to calculate plume shine dose, ground shine from deposited material, and inhalation dose. Normal dispersion, depleted dispersion and ingestion pathways are used as appropriate. Average χ/Q, depleted χ/Q and deposition are computed using the current hour meteorological data.

Doses are computed and accumulated hourly by direction, distance organ or receptor, age group, and pathway. A finite plume gamma dose model is used to calculate the dose from noble gases. Submersion skin dose is calculated separately from whole body dose and the total skin dose from noble gases is computed by adding the finite gamma plume dose to the submersion skin dose using the appropriate Reg. Guide 1.109 dose factors. The equations used in MIDAS for the dose computations are given in ODCM-11.01

3.3 Cumulation of Doses

Doses calculated monthly are summed for comparison with quarterly and annual limits. The monthly results are added to the doses cumulated from the other months in the quarter of interest and in the year of interest and compared to the limits given in section 3.1 and 3.2. This summation is performed by the DOSGAS and the DOSPIT computer program for doses from exposures due to noble gas, and radioiodine and particulates respectively. If these limits are exceeded, a Special Report will be submitted to the USNRC in accordance with the MNGP Technical Specifications. If twice the limits are exceeded, a Special Report showing compliance with 40 CFR 190 [9] will be submitted.

3.4 Projection of Doses

Projection of doses is not necessary. The Technical Specifications require the off-gas holdup system to be operated at all times.

3.5 Critical Receptor Identification

The critical receptors for compliance with 10 CFR 50, Appendix I will be identified. For the noble gas specification the critical location is based on the external dose pathway only. This location is the off-site location with the highest long-term Reactor Building vent χ/Q and is selected using the χ/Q values given in ODCM-13.06, Table A-4. The critical receptor location is used for showing compliance with 10 CFR 20 and remains the same unless meteorological data is re-evaluated or the site boundary changes.

The critical location for the radioiodine and particulate pathway is selected once per year. This selection follows the annual land use census performed within 5 miles of the MNGP. Each of the following locations is evaluated as a potential critical receptor before implementing the effluent technical specifications:

A. Residences in each sector.

B. Vegetable garden producing leafy green vegetables.

C. All identified milk animal locations.

The critical receptor is selected based on this evaluation.

Following the annual survey, doses are calculated using Equation 3.3-4 for all newly identified receptors and those receptors whose characteristics have changed significantly. The calculation includes appropriate information shown to exist at each location. The dispersion parameters given in this manual should be employed. The total releases reported for the previous calendar year should be used as the source term.

REFERENCES

1. Monticello Nuclear Generating Plant Technical Specifications, TS-B.2.4-Radioactive Effluents, Specification 2.4.3F Rev. 25.

2. USNRC, Title 10, Code of Federal Regulation, Part 50, "Domestic Licensing of Production and Utilization Facilities", Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents"

3. NSP - Monticello Nuclear Generating Plant, Appendix I Analysis - Supplement No. 1 - Docket No. 50-263, Table 2.1-3.

4. Boegli, J.S., et. al. Eds, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, NUREG-0133, 1978, NTIS, Springfield Va.

5. Sangendorf, J.F. and J. T. Goll, "XOQDOQ - Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations", NUREG-0324, 1977, USNRC, Washington, D.C.

6. Pickard, Lowe and Garrick, Inc., (Proprietary), "MIDAS Users Manual", Section 2.2.6, "Environmental Pathway and Dose Calculations for Liquid and Gaseous Effluents"

7. USNRC, Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I", Rev. 1, Oct. 1977, USNRC, Washington D.C.

8. USNRC, Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors", July 1977. USNRC, Washington, D.C.

9. EPA, Title 40, Code of Federal Regulations, Part 190 "Environmental Radiation Protection Standards for Nuclear Power Operations"

Attachment C2

ODCM-12.05 Rev 1, ODCM-05.01 Figures

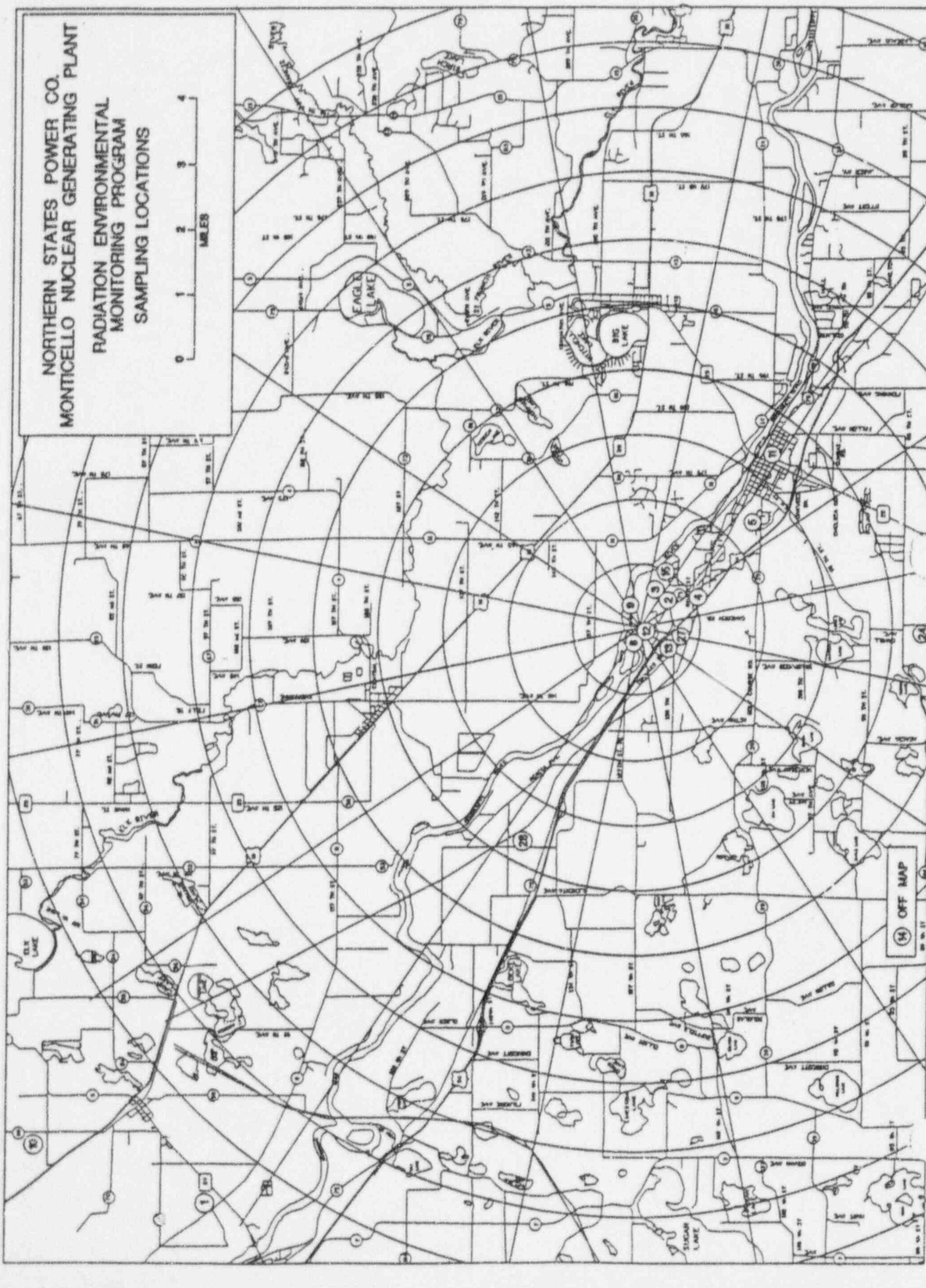
Summary of Changes

Section/Page	Changes/Reason for change
ODCM-12.05	
2 of 4	Updated the map of REMP sampling locations This change was made because the locations had changed.
ODCM-12.05	
3 of 4	Updated the map of 4-5 mile ring control and special interest TLD locations. This change was made because a TLD (05S) location had changed.

ALARA Reviewed By: K Shusirich			Date: 7/12/95
Prepared By: B Peterson			
Reviewed By: M Donner			Date: 7-28-95
OC Final Review Date: MTG #1996 8/10/95			
Approved By: W C Jepson			Date: 8/11/95
Resp Supv: S CHEM	Assoc Ref: CHEM I	SR: N	Freq: 2 yrs
Doc Type: 7030	ARMS: ODCM	Admin Initials: CH	Date: 8/24/95

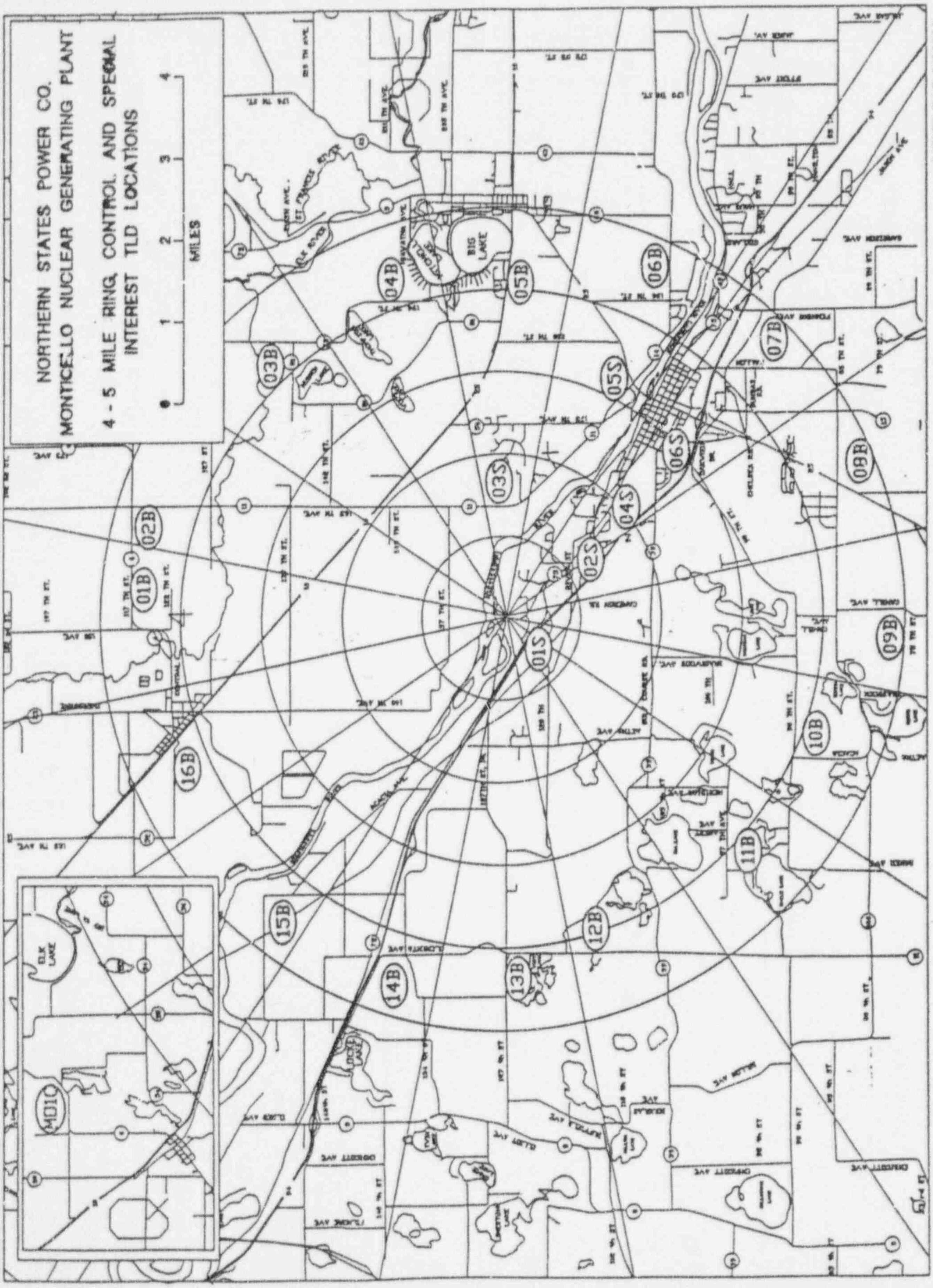
3087's Incorp #95-1202

djj



MONTI CAD M00524

djj



MONTI CAD M00522

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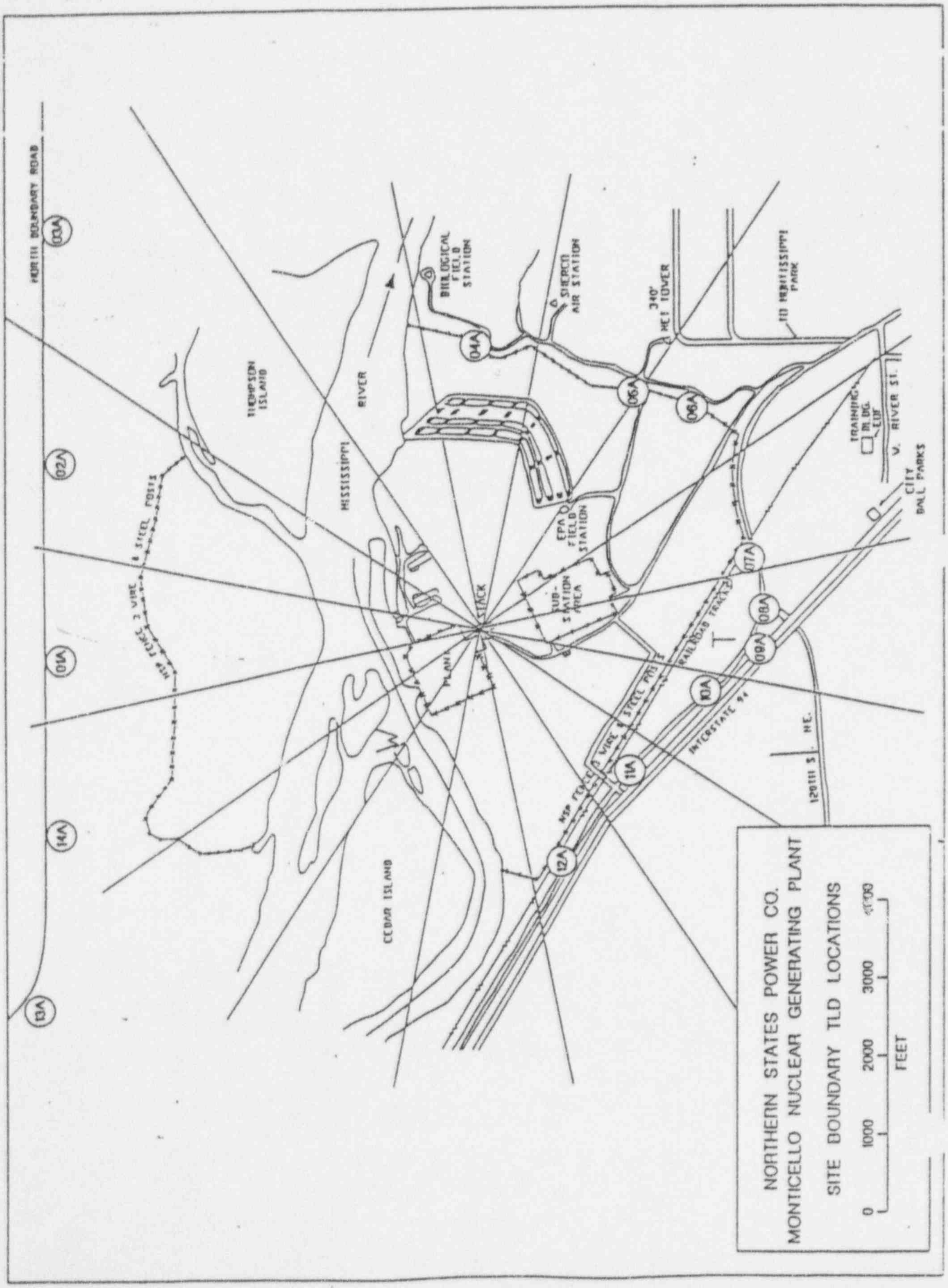

MONTI CAD M00523

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Attachment C3

ODCM-13.05 Rev 1, ODCM-05.01 Tables

<u>Summary of Changes</u>

Section/Page	Changes/Reason for change
ODCM-13.05 2 of 5, 3 of 5, 4 of 5	Changed REMP sampling location descriptions. Changed collection site names and locations. The REMP sampling location descriptions were changed in response to an NSP "Nuclear Quality Dept. " internal audit report. The sample collection site names and locations were changed to reflect land uses census results.

ALARA Reviewed By:					Date: 7/12/95	
Prepared By:						
Reviewed By:					Date: 7/28/95	
OC Final Review Date: MTG # 1996 8/10/95						
Approved By:					Date: 8/11/95	
Resp Supv: S CHEM		Assoc Ref: CHEM I		SR: N	Freq: 2 yrs	
Doc Type: 7030	ARMS: ODCM		Admin Initials:		Date: 8/24/95	

3087's Incorp #95-1201

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Title 5.1-1 Monticello Nuclear Generating Plant Radiation Environmental Monitoring Program Sampling Locations

			Location		
Type of Sample	Code	Collection Site	Distance Miles	Compass Heading	Sector
River water	M-8[c]	Upstream of plant	w/in 1000 ft upstream of plant intake		
River water	M-9	Downstream of plant	w/in 1000 ft downstream of plant discharge		
Drinking water	M-14	City of Minneapolis	36.	128	SE
Well water	M-10[c]	Goenner Farm	12.5	321	NW
Well water	M-11	City of Monticello	3.2	128	SE
Well water	M-12	Plant Well No. 1	0.2	267	W
Well water	M-13	Ernst Residence	0.6	202	SSW
Sediment-River	M-8[c]	Upstream of plant	w/in 1000 ft upstream of plant intake		
Sediment-River	M-9	Downstream of plant	w/in 1000 ft downstream of plant discharge		
Sediment-Shoreline	M-15	Montissippi Park	1.6	117	ESE
Periphyton or Macroinvertebrates	M-8[c]	Upstream of plant	w/in 1000 ft upstream of plant intake		
	M-9	Downstream of plant	w/in 1000 ft downstream of plant discharge		
Fish	M-8[c]	Upstream of plant	w/in 1000 ft upstream of plant intake		
Fish	M-9	Downstream of plant	w/in 1000 ft downstream of plant discharge		
Milk	M-10[c]	Goenner Farm	12.5	321	NW
Milk	M-24	Weinand Farm	4.8	180	S
Milk	M-28	Hoglund Farm	3.7	300	WNW

Title 5.1-1 Monticello Nuclear Generating Plant Radiation Environmental Monitoring Program Sampling Locations [continued]

Type of Sample	Code	Collection Site	Location: Distance Miles	Compass Heading	Sector
Cultivated crops (leafy green vegetables)					
	M-10[c]	a. Available Producer	>10.0	a.	a.
	M-27	Highest D/Q Garden	0.7	200	SSW
(corn)*					
(potatoes)*					
Particulates and Radioiodine					
(air)	M-1[c]	Air Station M-1	11.1	306	NW
(air)	M-2	Air Station M-2	0.8	140	SE
(air)	M-3	Air Station M-3	0.6	104	ESE
(air)	M-4	Air Station M-4	0.9	150	SSE
(air)	M-5	Air Station M-5	2.7	136	SE
Direct Radiation - (general area of the site boundary)					
(TLD)	M01A	North Boundary Rd.	0.7	353	N
(TLD)	M02A	North Boundary Rd.	0.8	23	NNE
(TLD)	M03A	North Boundary Rd.	0.1	43	NE
(TLD)	M04A	Biology Station Rd.	0.7	92	E
(TLD)	M05A	Biology Station Rd.	0.6	112	ESE
(TLD)	M06A	Biology Station Rd.	0.6	133	SE
(TLD)	M07A	County Road 75	0.5	158	SSE
(TLD)	M08A	County Road 75	0.5	183	S
(TLD)	M09A	County Road 75	0.4	203	SSW
(TLD)	M10A	County Road 75	0.3	225	SW
(TLD)	M11A	County Road 75	0.4	250	WSW

* Collected only if plant discharges radioactive effluent into the river, then only from river irrigated fields. (See Sec. 5.1)

Title 5.1-1 Monticello Nuclear Generating Plant Radiation Enviro.₍mental Monitoring Program Sampling Locations [continued]

Type of Sample	Code	Collection Site	Location		
			Distance Miles	Compass Heading	Sector
(TLD)	M12A	County Road 75	0.7	273	W
(TLD)	M13A	North Boundary Rd.	1.1	317	NW
(TLD)	M14A	North Boudnary Rd.	0.8	338	NNW
Direct Radiation - (about 4 to 5 miles distant from the plant)					
(TLD)	M01B	Sherco No. 1 Air Sta.	4.6	2	N
(TLD)	M02B	County Road 11	4.4	17	NNE
(TLD)	M03B	County Rd. 73 & 81	4.5	49	NE
(TLD)	M04B	Sherco No. 6 Air Sta.	4.2	67	ENE
(TLD)	M05B	City of Big Lake	4.4	87	E
(TLD)	M06B	County Rd 14 & 196 St	4.3	116	ESE
(TLD)	M07B	Monte Industrial Dr.	4.4	135	SE
(TLD)	M08B	Dale Larson Res.	4.6	162	SSE
(TLD)	M09B	Norbert Weinand Farm	4.7	180	S
(TLD)	M10B	John Reisewitz Farm	4.4	206	SSW
(TLD)	M11B	Clifford Vanlith Farm	4.2	225	SW
(TLD)	M12B	Lake Maria St. Park	4.4	253	WSW
(TLD)	M13B	Bridgewater Sta.	4.1	271	W
(TLD)	M14B	Richard Anderson Res.	4.5	288	WNW
(TLD)	M15B	Gary Williamson Res.	4.5	308	NW
(TLD)	M16B	Sand Plain Research Farm	4.3	338	NNW
Direct Radiation - (special interest locations)					
(TLD)	M01S	Osowski Farm Market	0.7	130	SW
(TLD)	M02S	Edgar Klucas Res.	0.7	142	SE
(TLD)	M03S	Big Oaks Park	1.3	89	E
(TLD)	M04S	Pinewood School	2.3	132	SE
(TLD)	M05S	Rivercrest Christian Academy	2.6	112	ESE

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Title 5.1-1 Monticello Nuclear Generating Plant Radiation Environmental Monitoring Program Sampling Locations [continued]

			Location		
Type of Sample	Code	Collection Site	Distance Miles	Compass Heading	Sector
(TLD)	M06S	Monte Public Works	2.7	136	SE
(TLD)	M01C	Kirchenbauer Farm	11.5	323	NW

Notes on Table 5.1-1:

"c" denotes control locations. All other locations are indicator locations.
a. Control "leafy green" vegetable will be taken in locations as available outside 10 mi. EPZ.

The letters after TLD code numbers have the following meanings:

A Locations in the general area of the site boundary;
B Locations about 4 to 5 miles distant from the plant;
S Special interest locations.