December 28, 1990

SUBJECT: McGuire Nuclear Station
Offsite Dose Calculation Manual
Revision 31

The General Office Radiation Protection staff is transmitting to you this date, Revision 31 of the Offsite Dose Calculation Manual. As this revision only affects McGuire Nuclear Station, the approval of other station managers is not required. Please update your copy No. _____, and discard the affected pages.

REMOVE THESE PAGES	INSERT THESE PAGES
B-6 Rev. 26	B-6 Rev. 31
B-7 Rev. 26	B-7 Rev. 31
B-12 thru B-19 Rev. 26	B-12 thru B-19 Rev. 31
B-21 Rev. 26	B-21 Rev. 31
Table B5.0-1 Rev. 26	Table B5.0-1 Rev. 31
Table B5.0-2 Rev. 22	Table B5.0-2 Rev. 31

NOTE: As this letter, with its attachments, contains "LOEP" information, please insert this letter in front of the December 27, 1990 letter.

Approval Date: 12/18/90

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Approval Date: 12/17/90

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JUSTIFICATIONS FOR REVISION 31

Page B-6 Page B-7 Pages B-12 thru B-19	Updated sections using dose calculations based on 1990 Effluent Release Data (first nine months) and the 1990 Land Use Census Data.
Page B-21	Updated the dates the latest Land Use Census was performed.
Table B5.0-1	Corrected mileage error on location #170.
Table B5.0-2	Corrected typo error at location #130. Clarified description at location #159.

B2.2.1 Noble Gases

$$\sum_i (K_i [(\overline{X/Q})Q_i] < 500 \text{ mrem/yr, and}$$

$$\sum_i (L_i + 1.1\ M_i) [(\overline{X/Q})Q_i] < 3000 \text{ mrem/yr}$$

where the terms are defined below.

B2.2.2 Radioiodines, Particulates, and Others

$$\sum_i P_i [W\ Q_i] < 1500 \text{ mrem/yr}$$

where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per µCi/m³ from Table 1.2-1.

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide, in mrem/yr per µCi/m³ from Table 1.2-1.

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per µCi/m³ from Table 1.2-1 (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 µCi/m³ and for the food and ground plane pathways, in m²·(mrem/yr) per µCi/sec from Table 1.2-2. The dose factors are based on the critical individual organ and most restrictive age group (child or infant).

Q_i = The release rate of radionuclides, i, in gaseous effluent from all release points at the site, in µCi/sec.

$\overline{X/Q}$ = 7.2E-5 sec/m³. The highest calculated annual average relative concentration (dispersion parameter) for any area at or beyond the unrestricted area boundary. The location is the NNE sector @ 0.5 miles.

W = The annual average dispersion or deposition parameter for estimating the dose to an individual at a controlling location in the unrestricted area where the total inhalation, food and ground plane pathway dose is determined to be a maximum based on operational source term data, land use surveys, and NUREG-0133 guidance:

W = 2.9E-6 sec/m³, for the inhalation pathway. The location is the SE sector @ 1.0 miles.

W = 7.6E-9 meter^{-2}, for the food and gound plane pathways. The location is the SE sector @ 1.0 miles.

$Q_i = k_1 C_i f + k_2 = 4.72E+2 C_i f$

where:

C_i = the concentration radionuclide, i, in urdiluted gaseous effluent, in µCi/ml.

f = the undiluted effluent flow, in cfm

k_1 = conversion factor, 2.83E4 ml/ft^3

k_2 = conversion factor, 6E1 sec/min

B5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

The radiological environmental monitoring program shall be conducted in accordance with Technical Specification 3/4.12. The monitoring program locations and analyses are given in Tables B5.0-1 through B5.0-3 and Figure B5.0-1 Site specific characteristics make groundwater sampling unnecessary. Groundwater recharge is from Lake Norman and local precipitation. The groundwater gradient flows directly to the Catawba River; therefore, contamination of groundwater from liquid effluents is highly improbable. Additionally, two site boundary TLD locations in the NW and NNW sectors do not exist since the required locations are over water.

The laboratory performing the radiological environmental analyses shall participate in an interlaboratory comparison program which has been approved by the NRC. This program is the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparison Studies (Crosscheck) Program, our participation code is CP.

The dates of the land-use census that was used to identify the controlling receptor locations was 05/14/90 - 05/18/90.

B4.0 DOSE CALCULATIONS

B4.1 FREQUENCY OF CALCULATIONS

Dose contributions to the maximum exposed individual shall be calculated at least every 31 days, quarterly, semiannually, and annually (or as required by Technical Specifications) using the methodology in the generic information sections. This methodology shall also be used for any special reports. Dose calculations that are required for individual pre-release calculations, and/or abnormal releases shall not be calculated by using the simplified dose calculations. Station dose projections for these types and others that are known to vary from the station historical averages shall be calculated by using the methodology in the generic information sections. STATION Dose projections may be performed using simplified dose estimates.

Fuel cycle dose calculations shall be performed annually or as required by special reports. Dose contributions shall be calculated using the methodology in the appropriate generic information sections.

B4.2 DOSE MODELS FOR MAXIMUM EXPOSED INDIVIDUAL

B4.2.1 Liquid Effluents

For dose contributions from liquid radioactive releases, dose calculations based on operational source term data and NUREG-0133 guidance indicate that the maximum exposed individual would be an adult who consumed fish caught in the discharge canal and who drank water from the nearest "downstream" potable water intake. The dose from Cs-134 and Cs-137 is calculated to be 77% of that individual's total whole body dose.

B4.2.2 Gaseous Effluents

B4.2.2.1 Noble Gases

For dose contributions from exposure to beta and gamma radiation from noble gases, it is assumed that the maximum exposed individual is an adult at a controlling location in the unrestricted area where the total noble gas dose is determined to be a maximum.

B4.2.2.2 Radioiodines, Particulates, and Other Radionuclides T 1/2 >8 days

For dose contributions from radioiodines, particulates and other radionuclides; it is assumed that the maximum exposed individual is a child or infant at a controlling location in the unrestricted area where the total inhalation, food and ground plane pathway dose is determined to be a maximum based on operational source term data, land use surveys, and NUREG-0133 guidance.

B4.3 SIMPLIFIED DOSE ESTIMATE

B4.3.1 Liquid Effluents

For dose estimates, a simplified calculation based on the assumptions presented in Section B4.2.1 and operational source term data is presented below. Updated operational source term data shall be used to revise these calculations as necessary.

$$D_{WB} = 7.66E+5 \sum_{\ell=1}^{m} (F_\ell)(T_\ell)\,(C_{Cs\text{-}134} + 0.59\, C_{Cs\text{-}137})$$

where:

$7.66E+5 = 1.14E+05\ (U_{aw}/U_w + U_{af}\ BF_i)\ DF_{ait}\ (1.30)$

where:

$1.14E+05 = 10^6$pCi/µCi x 10^3ml/kg ÷ 8760 hr/yr

U_{aw} = 730 ℓ/yr, adult water consumption

D_w = 1, dilution factor from the near field area to the nearest possible potable water intake (Hunterville Water Intake).

U_{af} = 21 kg/yr, adult fish consumption

BF_i = 2.00E+03, bioaccumulation factor for Cesium (Table 3.1-1)

DF_{ait} = 1.21E-04, adult total body ingestion dose factor for Cs-134 (Table 3.1-2)

1.30 = factor derived from the assumption that 77% of adult whole body dose is contributed by Cs-134 and Cs-137 via the fish and drinking water pathway or 100% ÷ 77% = 1.30

m = number of releases

where:

$$F_\ell = \frac{f\sigma}{F + f}$$

where:

f = liquid radwaste flow, in gpm

σ = recirculation factor at equilibrium, 2.4

F = dilution flow, in gpm

where:

T_ℓ = The length of time, in hours, over which $C_{Cs\text{-}134}$, $C_{Cs\text{-}137}$, and F_ℓ are averaged. (The time period during which all releases (m) are made)

$C_{Cs\text{-}134}$ = the average concentration of Cs-134 in undiluted effluent, in µCi/ml, during the time period considered.

$C_{Cs\text{-}137}$ = the average concentration of Cs-137 in undiluted effluent, in µCi/ml, during the time period considered.

0.59 = The ratio of the adult total body ingestion dose factors for Cs-134 and Cs-137 or 7.14E-05 ÷ 1.21E-04 = 0.59

B4.3.2 Gaseous Effluents

Meteorological data is provided in Tables B4.0-1 and B4.0-2.

B4.3.2.1 Noble Gases

For dose estimates, simplified dose calculations based on the assumptions in B4.2.2.1 and operational source term data are presented below. Updated operational source term data shall be used to revise these calculations as necessary. These calculations further assume that the annual average dispersion parameter is used and that Xenon-133 contributes 72% of the gamma air dose and 82% of the beta air dose.

$$D_{\gamma} = 8.06E\text{-}10\ [\tilde{Q}]_{Xe\text{-}133} \quad (1.38)$$

$$D_{\beta} = 2.40E\text{-}09\ [\tilde{Q}]_{Xe\text{-}133} \quad (1.23)$$

where:

$\overline{X/Q}$ = 7.2E-05 sec/m³, as defined in Section B2.2.2

8.06E-10 = (3.17E-8)(353) $(\overline{X/Q})$, derived from equation presented in Section 3.1.2.1.

1.38E-09 = (3.17E-08) (1050) $(\overline{X/Q})$, derived from equation presented in Section 3.1.2.1.

$[\tilde{Q}]_{Xe\text{-}133}$ = the total Xenon-133 activity released in µCi

1.38 = factor derived from the assumption that 72% of the gamma air dose is contributed by Xe-133.

1.23 = factor derived from the assumption that 82% of the beta air dose is contributed by Xe-133.

B4.3.2.2 Radioiodines, Particulates, and Other Radionuclides with T 1/2 > 8 days

For dose estimates, simplified dose calculations based on the assumptions in B4.2.2.2 and operational source term data are presented below. Updated operational source term data shall be used to revise these calculations as necessary. These calculations further assume that the annual average dispersion/deposition parameters are used and that 91% of the dose results from Iodine-131 ingested by the maximally exposed individual via the cow milk pathway at the controlling location. The simplified dose estimate to the thyroid of an infant is:

$$D = 1.64E+4\ W\ (\tilde{Q})_{I\text{-}131} \quad (1.10)$$

where:

W = 7.6E-9 = $\overline{D/Q}$ for food and ground plane pathway, in sec/m³ from Table B4.0-2 for the controlling location (SE sector at 1.0 miles).

$(Q)_{I-131}$ = the total Iodine-131 activity released in μCi.

1.64E+4 = (3.17E-08)(R_i^C $[\overline{D/Q}]$) with the appropriate substitutions for infant-cow milk pathway factor, R_i^C $[\overline{D/Q}]$ for Iodine-131. See Section 3.1.2.2.

1.10 = factor derived from the assumption that 91% of the total inhalation, food and ground plane pathway dose to the maximally exposed individual is contributed by I-131 via the cow milk pathway.

B4.4 FUEL CYCLE CALCULATIONS

As discussed in Section 3.3.5, more than one nuclear power station site may contribute to the doses to be considered in accordance with 40CFR190. The fuel cycle dose assessments for McGuire Nuclear Station must include gaseous dose contributions from Catawba Nuclear Station, which is located approximately thirty miles SSW of McGuire. For this dose assessment, the total body and maximum organ dose contributions to the maximum exposed individual from McGuire liquid releases and the combined Catawba and McGuire gaseous releases are estimated using the following calculations:

$$D_{WB}(T) = D_{WB}(l_m) + D_{WB}(g_m) + D_{WB}(g_c)$$

$$D_{MO}(T) = D_{MO}(l_m) + D_{MO}(g_m) + D_{MO}(g_c)$$

where:

$D_{WB}(T)$ = Total estimated fuel cycle whole body dose commitment resulting from the combined liquid and gaseous effluents of Catawba and McGuire during the calendar year of interest, in mrem.

$D_{MO}(T)$ = Total estimated fuel cycle maxmium organ dose commitment resulting from the combined liquid and gaseous effluents of Catawba and McGuire during the calendar year of interest, in mrem.

B4.4.1 LIQUID EFFLUENTS

Liquid pathway dose estimates are based on values and assumptions presented in Section B4.3.1. Station operational source terms shall be used to update these simplified calculations as necessary.

B4.4.1.1 McGuire's Liquid Contributions

Based on operational history, the McGuire fuel cycle whole body dose resulting from McGuire liquid effluent releases ($D_{WB}(l_m)$) is estimated using the simplified dose calculation given below:

$$D_{WB}(l_m) = (7.66E+5)\ (F_\ell)\ (T_\ell)\ (C_{Cs-134} + 0.59\ C_{Cs-137})$$

where:

$$7.66E+5 = 1.14E+05\ (U_{aw} / D_w + U_{af}\ BF_i)\ (DF_{ait})\ (1.30)$$

where:

$1.14E+05$ = (1.0E+06 pCi/uCi x 1.0E+03 ml/kg) / (8760 hr/yr)

U_{aw} = 730 ℓ/yr, Adult water consumption

D_w = 1, dilution factor from the near field area to the nearest possible potable water intake (Huntersville Water Intake).

U_{af} = 21 kg/yr, Adult fish consumption

BF_i = 2.00E+03, Bioaccumulation factor for Cesium (Table 3.1-1)

DF_{ait} = 1.21E-04, Adult total body ingestion dose factor for Cs-134 (Table 3.1-2)

1.30 = Factor derived from the assumption that 77% of the dose is derived from Cs-134 and Cs-137 or 100% / 77% = 1.30

where:

$$F_\ell = (f)\ (\sigma) / (F + f)$$

where:

f = McGuire's average liquid radwaste flow for the calendar year of interest, in gpm

F = McGuire's average dilution flow for the calendar year of interest, in gpm

σ = 2.4, the recirculation factor at equilibrium

where:

T_ℓ = 8760 hours, the time period over which C_{Cs-134}, C_{Cs-137} and F_ℓ are averaged.

C_{Cs-134} = The average concentration of Cs-134 in McGuire's undiluted effluent, in uCi/ml, during the calendar year of interest.

C_{Cs-137} = The average concentration of Cs-137 in McGuire's undiluted effluent, in uCi/ml, during the calendar year of interest.

0.59 = The ratio of the adult total body ingestion dose factors for Cs-134 and Cs-137 or 7.14E-05 / 1.21E-04 = 0.59

Based on operational history, the McGuire fuel cycle organ dose (Adult GI-track resulting from McGuire's liquid effluent releases ($D_{MO}(1_m)$) is estimated using the simplified dose calculation given below:

$$D_{MO}(1_m) = (1.55E+06)\ (F_\ell)\ (T_\ell)\ (N_{b-95})$$

where:

$$1.55E+06 = 1.14E+05\ (U_{aw}/D_w + U_{af}\ BF_i)(DF_{ait})(1.35)$$

where:

1.14E+05 = (1.0E+06 pCi/uCi x 1.0E+03 ml/kg) / (8760 hr/yr)

U_{aw} = 730 ℓ/yr, Adult water consumption

D_w = 1, dilution factor from the near field area to the nearest possible potable water intake (Huntersville Water Intake).

U_{af} = 16 kg/yr, Adult fish consumption

BF_i = 3.0E+4, Bioaccumulation factor for Niobium (Table 3.1-1)

DF_{ait} = 2.1E-5, Adult GI-track ingestion dose factor for Niobium (Table 3.1-3)

1.35 = Factor derived from the assumption that 74% of the Teen-liver dose is contributed by Nb-95 via the fish and drinking water pathway or 100% / 74% = 1.35

where:

$$F_\ell = (f)\ (\sigma)\ /\ (F + f)$$

where:

f = McGuire's liquid radwaste flow, in gpm

F = McGuire's dilution flow, in gpm

σ = 2.4, the recirculation factor at equilibrium

where:

T_ℓ = 8760 hours, the time period of time over which Cs-134, Cs-137 and F_ℓ are averaged.

C_{Nb-95} = The average concentration of Nb-95 in McGuire's undiluted effluent, in μCi/ml, during the calendar year of interest.

B4.4.2 GASEOUS EFFLUENTS

Airborne effluent pathway dose estimates are based on the values and assumptions presented in Sections B4.3.2. and C4.3.2. Operational source term data shall be used to update these calculations as necessary.

B4.4.2.1 McGUIRE'S GASEOUS CONTRIBUTION

Based on operational history, the McGuire fuel cycle maximum whole body dose resulting from McGuire's gaseous effluent releases ($D_{WB}(g_m)$) is estimated using the simplified dose calculation given below:

$$D_{WB}(g_m) = (9.32E\text{-}06)(w)(\tilde{Q}_{Xe\text{-}133})(S_F)(1.45)$$

where:

w = 7.20E-05 = $\overline{(X/Q)}$ for the plume immersion pathway, in sec/m³, which corresponds to a location 0.5 miles NNE of the McGuire site (See Table B4.0-1)

$\tilde{Q}_{Xe\text{-}133}$ = The total Xe-133 activity released from McGuire during the calendar year of interest, in uCi.

9.32E-06 = (3.17E-08) ($K_i[\overline{X/Q}]$), with appropriate substitutions for whole body exposure in a semi-infinite cloud of Xe-133. See Section 1.2.1.

S_F = 0.7 = External radiation shielding factor for individuals.

1.45 = The factor derived from the assumption (based on historical data) that 69% of the whole body dose to the maximally exposed individual is contributed by Xe-133.

Based on operational history, the fuel cycle maximum organ dose is the Adult GI-track. For McGuire gaseous releases the organ dose ($D_{MO}(g_m)$) will be calculated for the Adult-GI Track using the simplified dose calculation given below:

$$D_{MO}(g_m) = (8.27E\text{-}05)(w)(\tilde{Q}_{H\text{-}3})\ (1.95)$$

where:

w = 1.80E-5, $\overline{X/Q}$ for the garden pathway, in sec/m³ from Table B4.0-1, for the McGuire fuel cycle maximum organ dose controlling location (E @ 0.5 miles).

$\tilde{Q}_{H\text{-}3}$ = The total H-3 activity released from McGuire during the calendar year of interest, in uCi.

8.27E-5 = (3.17E-08)($R_i^V[\overline{X/Q}]$) with appropriate substitions for the garden pathway, $R_i^V[\overline{X/Q}]$ for H-3. See Section 3.1.2.2.

1.95 = The factor derived from the conservative assumption (based on historical data) that 51% of the total inhalation, food and ground plane pathway dose to the maximally exposed individual is contributed by H-3 via the inhalation pathway.

B4.4.2.2 CATAWBA'S GASEOUS CONTRIBUTION

Based on operational history, the McGuire fuel cycle maximum whole body dose resulting from Catawba's gaseous effluent releases ($D_{WB}(g_c)$) is estimated using the simplified dose calculation given below:

$$D_{WB}(g_c) = (9.32E\text{-}06)(w)(\tilde{Q}_{Xe\text{-}133})(S_F)(1.82)$$

where:

w = 3.30E-07, $(\overline{X/Q})$ for the plume immersion pathway which corresponds to a location 5 miles NNE of the Catawba site. (See Table C4.0-1)

$\tilde{Q}_{Xe\text{-}133}$ = The total Xe-133 activity released from Catawba during the calender year of interest, in uCi.

9.32E-06 = $(3.17E\text{-}08)(K_i[\overline{X/Q}])$, with appropriate substitutions for whole body exposure in a semi-infinite cloud of Xe-133. See Section 1.2.1.

S_F = 0.7 = External radiation shielding factor for individuals.

1.82 = The factor derived from the conservative assumption (based on historical data) that 55% of the whole body dose to the maximally exposed indivdual is contributed by Xe-133 via the plume immersion pathway.

Based on operational history, the fuel cycle maximum organ dose for McGuire is the Adult GI-track. For Catawba gaseous releases the organ dose ($D_{MO}(g_c)$) will be calculated for the Adult GI track using the simplified dose calculation given below:

$$D_{MO}(g_c) = (8.27E\text{-}05)(w)(\tilde{Q}_{H\text{-}3})(2.38)$$

where:

w = 3.3E-07 = $\overline{X/Q}$ for the food and ground plane pathway in sec/m^3, for a location 5 miles NNE of the Catawba site (see Table C4.0-1).

$\tilde{Q}_{H\text{-}3}$ = The total H-3 activity released from Catawba during the calendar year of interest, in uCi.

8.27E-05 = $(3.17E\text{-}08)(R_i^V[\overline{X/Q}])$ with appropriate substitutions for the Adult-vegetable garden pathway, $R_i^V[\overline{X/Q}]$ for H-3. See Section 3.1.2.2.

TABLE B5.0-1
(1 of 1)
MCGUIRE RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(TLD LOCATIONS)

	SAMPLING LOCATION DESCRIPTION *			SAMPLING LOCATION DESCRIPTION *	
143	SITE BOUNDARY	(0.5 MILES NW)	163	4-5 MILE RADIUS	(5.0 MILES SE)
144	SITE BOUNDARY	(0.6 MILES NNE)	164	4-5 MILE RADIUS	(4.5 MILES SSE)
145	SITE BOUNDARY	(0.5 MILES NE)	165	4-5 MILE RADIUS	(5.0 MILES S)
146	SITE BOUNDARY	(0.5 MILES ENE)	166	4-5 MILE RADIUS	(5.2 MILES SSW)
147	SITE BOUNDARY	(0.5 MILES E)	167	4-5 MILE RADIUS	(4.9 MILES SW)
148	SITE BOUNDARY	(0.5 MILES ESE)	168	4-5 MILE RADIUS	(4.7 MILES WSW)
149	SITE BOUNDARY	(0.7 MILES SE)	169	4-5 MILE RADIUS	(4.4 MILES W)
150	SITE BOUNDARY	(0.5 MILES SSE)	170	4-5 MILE RADIUS	(4.5 MILES WNW)
151	SITE BOUNDARY	(0.5 MILES S)	171	4-5 MILE RADIUS	(4.5 MILES NW)
152	SITE BOUNDARY	(0.5 MILES SSW)	172	4-5 MILE RADIUS	(5.2 MILES NNW)
153	SITE BOUNDARY	(0.5 MILES SW)	173	SPECIAL INTEREST	(8.5 MILES NNW)
154	SITE BOUNDARY	(0.7 MILES WSW)	174	SPECIAL INTEREST	(8.7 MILES WNW)
155	SITE BOUNDARY	(0.7 MILES W)	175	CONTROL	(12.7 MILES WNW)
156	SITE BOUNDARY	(0.5 MILES WNW)	176	SPECIAL INTEREST	(11.0 MILES SW)
157	4-5 MILE RADIUS	(4.8 MILES N)	177	SPECIAL INTEREST	(8.6 MILES S)
158	4-5 MILE RADIUS	(4.4 MILES NNE)	178	SPECIAL INTEREST	(9.2 MILES SE)
159	4-5 MILE RADIUS	(5.0 MILES NE)	179	SPECIAL INTEREST	(10.4 MILES ESE)
160	4-5 MILE RADIUS	(4.9 MILES ENE)	180	SPECIAL INTEREST	(11.5 MILES NNE)
161	4-5 MILE RADIUS	(4.7 MILES E)	181	SPECIAL INTEREST	(6.7 MILES NE)
162	4-5 MILE RADIUS	(4.6 MILES ESE)	182	SPECIAL INTEREST	(6.0 MILES NE)
			183	SPECIAL INTEREST	(5.5 MILES S)

* All TLD samples are collected quarterly

TABLE B5.0-2
(1 of 1)
MCGUIRE RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(OTHER SAMPLING LOCATIONS)

CODE:

W - Weekly
BW - Biweekly
M - Monthly
SM - Semimonthly
Q - Quarterly
SA - Semiannually

	SAMPLING LOCATION DESCRIPTION	Control Locations	Air Radioiodines and Particulates	Surface Water	Drinking Water	Shoreline Sediment	Food Products	Fish	Milk	Broadleaf Vegatation
120	Site Boundary (0.7 mi NNE)		W							M
121	Site Boundary (0.5 mi NE)		W							
125	Site Boundary (0.5 mi SW)		W							M
128	Discharge Canal Bridge (0.4 mi ENE)			BW						
129	Discharge Canal Entrance to Lake Norman (0.6 mi ENE)					SA		SA		
130	Hwy. 73 Bridge Downstream (0.6 mi SW)			BW		SA				
131	Deleted 01/01/89									
132	Charlotte Municipal Water Supply (11.2 mi SSE)				BW					
133	Cornelius (6.2 mi NE)		W							
134	East Lincoln Junior High School (8.7 mi WNW)	X	W							M
135	Plant Marshall Intake Canal (12.0 mi N)	X		BW						
136	Mooresville Municipal Water Supply (12.5 mi NNE)	X			BW					
137	Pinnacle Access Area (12.0 mi N)	X				SA		SA		
138	Henry Cook Dairy (2.75 mi ESE)								SM	
139	William Cook Dairy (2.25 mi E)								SM	
140	Kidd Dairy-Cows (2.8 mi SSE)								SM	
141	Lynch Dairy-Cows (14.8 mi WNW)	X							SM	
142	Davidson Municipal Water Supply (7.5 mi NE)				BW					
158	4-5 Mile Radius (5.0 mi NE)									M
159	Deleted 1/1/85									
184	5 Mile Radius - Gardens (2.5 mi ENE)						M(a)			

(a) during harvest season