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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station
Docket Nos. 50-369 and 50-370
Annual Radiological Environmental Operating Report

Please find attached the McGuire Nuclear Station Annual Radiological Environmental Operating Report for 1999 pursuant to McGuire Technical Specification 5.6.2

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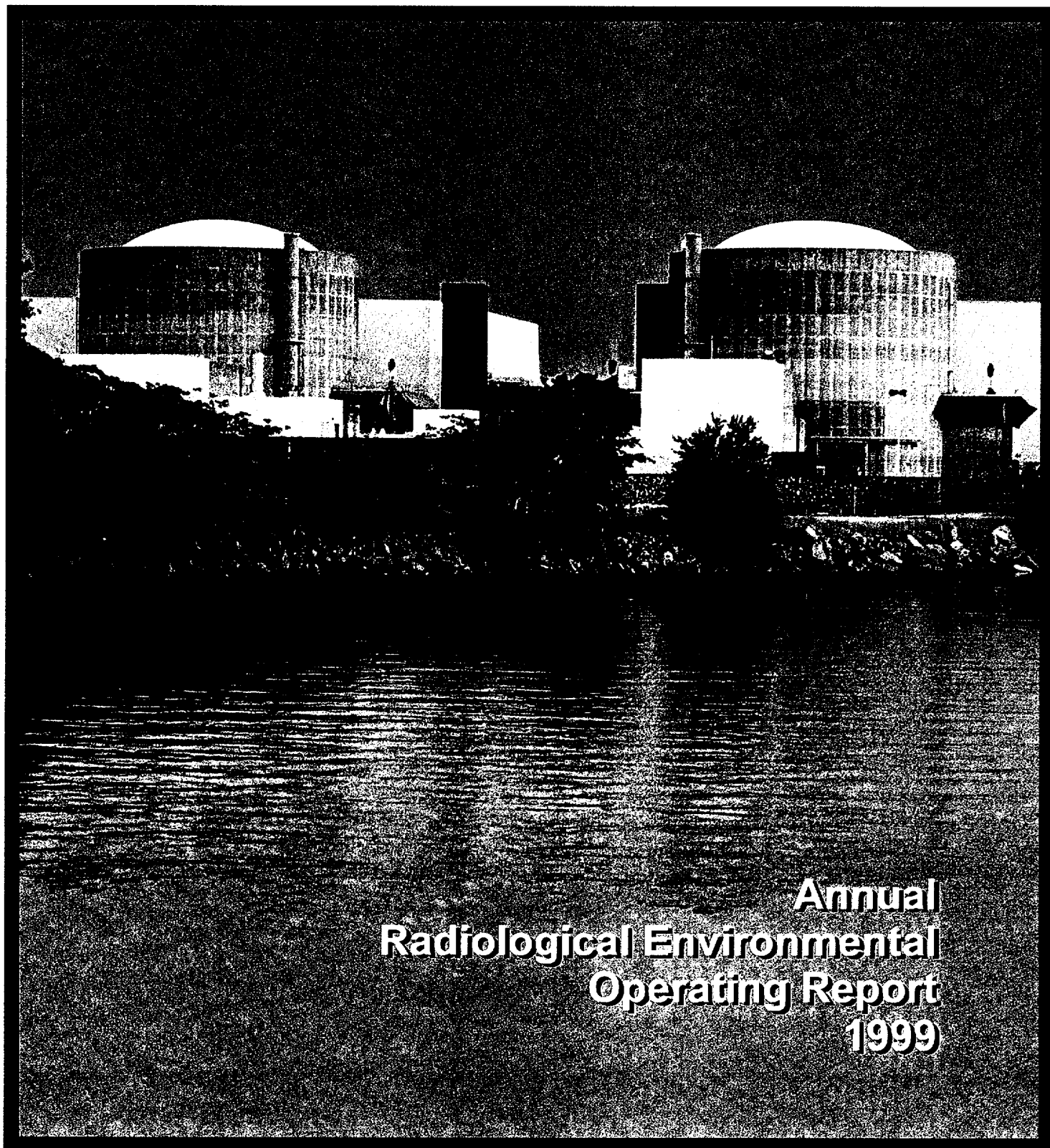
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McGuire Nuclear Station Units 1 and 2



**Annual
Radiological Environmental
Operating Report
1999**



ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

**DUKE POWER COMPANY
MCGUIRE NUCLEAR STATION
Units 1 and 2**

1999



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LIST OF ACRONYMS USED IN THIS TEXT *(in alphabetical order)*

BW	BiWeekly
C	Control
CL	Critical Level
DEHNR	Department of Environmental Health and Natural Resources
DHEC	Department of Health and Environmental Control
EPA	Environmental Protection Agency
GI-LLI	Gastrointestinal – Lower Large Intestine
LLD	Lower Limit of Detection
M	Monthly
MDA	Minimum Detectable Activity
mrem	Millirem
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
PCi/kg	Picocurie per kilogram
PCi/l	Picocurie per liter
PCi/m3	Picocurie per cubic meter
Q	Quarterly
REMP	Radiological Environmental Monitoring Program
SA	Semiannually
SLCs	Selected Licensee Commitments
SM	Semimonthly
TECH SPECS	Technical Specifications
TLD	Thermoluminescent Dosimeter
μCi/ml	Microcurie per milliliter
UFSAR	Updated Final Safety Analysis Report
W	Weekly

1.0 EXECUTIVE SUMMARY

This Annual Radiological Environmental Operating Report describes the McGuire Nuclear Station Radiological Environmental Monitoring Program (REMP), and the program results for the calendar year 1999.

Included are the identification of sampling locations, descriptions of environmental sampling and analysis procedures, comparisons of present environmental radioactivity levels and pre-operational environmental data, comparisons of doses calculated from environmental measurements and effluent data, analysis of trends in environmental radiological data as potentially affected by station operations, and a summary of environmental radiological sampling results. Quality assurance practices, sampling deviations, unavailable samples, and program changes are also discussed.

Sampling activities were conducted as prescribed by Selected Licensee Commitments (SLC's). Required analyses were performed and detection capabilities were met for all collected samples as required by SLC's. Twelve-hundred thirty-six samples were analyzed comprising 1401 test results in order to compile data for the 1999 report. Based on the annual land use census, the current number of sampling sites for McGuire Nuclear Station is sufficient.

Concentrations observed in the environment in 1999 for station related radionuclides were generally within the ranges of concentrations observed in the past. Inspection of data showed that radioactivity concentrations in surface water, drinking water, shoreline sediment and fish are higher than the activities reported for samples collected prior to the operation of the station. Measured concentrations were not higher than expected, and all positively identified measurements were within limits as specified in SLC's.

Additionally, environmental radiological monitoring data is consistent with effluents introduced into the environment by plant operations. The total body dose estimated to the maximum exposed member of the public as calculated by environmental sampling data, excluding TLD results, was $5.91\text{E-}02$ mrem for 1999. It is therefore concluded that station operations has had no significant radiological impact on the health and safety of the public or the environment.



Shoreline sediment sampling

2.0 INTRODUCTION

2.1 SITE DESCRIPTION AND SAMPLE LOCATIONS

McGuire Nuclear Station is located geographically near the center of a highly industrialized region of the Carolinas. The land is predominantly rural non-farm with a small amount of land being used to support beef cattle and farming. Recreation in the area is confined mostly to the lake and shores of Lake Norman and Mountain Island reservoir. The McGuire site is in northwestern Mecklenburg County, North Carolina, 17 miles north-northwest of Charlotte, North Carolina. The site is bounded to the west by the Catawba River channel and to the north by 32,510 acre Lake Norman. Lake Norman is impounded by Duke Power Company's Cowans Ford Dam Hydroelectric Station, which is located immediately west of the site and on the Catawba River channel. The tailwater of Cowans Ford Dam is the upper limit of Mountain Island Reservoir. Mountain Island Dam is located 15 miles downstream from the site. Lookout Shoals Hydroelectric Station is at the upper reaches of Lake Norman. Marshall Steam Station is located on the western shore of Lake Norman, approximately 16 miles upstream from the site (reference 6.3). The site exclusion radius is 2500 feet.

Tables 2.1-A and 2.1-B define the sampling and TLD locations for the McGuire Radiological Monitoring Program. Figures 2.1-1 and 2.1-2 illustrate these locations as compared to McGuire Nuclear Station.

2.2 SCOPE AND REQUIREMENTS OF THE REMP

An environmental monitoring program has been in effect at McGuire Nuclear Station since 1977, four years prior to operation of Unit 1 in 1981. The preoperational program provides data on the existing environmental radioactivity levels for the site and vicinity which may be used to determine whether increases in environmental levels are attributable to the station. The operational program provides surveillance and backup support of detailed effluent monitoring which is necessary to evaluate the significance, if any, of the contributions to the existing environmental radioactivity levels that result from station operation.

This monitoring program is based on NRC guidance as reflected in the Selected Licensee Commitments Manual, with regard to sample media, sampling locations, sampling frequency, and analytical sensitivity requirements. Indicator and control locations were established for comparison purposes to distinguish radioactivity of station origin from natural or other "man-made" environmental radioactivity. The environmental monitoring program also verifies projected and anticipated radionuclide concentrations in the environment and related exposures from releases of radionuclides from McGuire Nuclear Station. This program satisfies the requirements of Section IV.B.2 of Appendix I to 10CFR50 and provides surveillance of all appropriate critical exposure pathways to man and protects vital interests of the company, public, and state and federal agencies concerned with the environment. Reporting levels for radioactivity found in environmental samples are listed in Table 2.2-A. Table 2.2-B lists the REMP analysis and frequency schedule.

The Annual Land Use Census, required by Selected Licensee Commitments, is performed to ensure that changes in the use of areas at or beyond the site boundary are identified and that modifications to the Radiological Environmental Monitoring Program are made if required by changes in land use. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10CFR50. Results are shown in Table 3.10.

Participation in an interlaboratory comparison program as required by Selected Licensee Commitments provides for independent checks on the precision and accuracy of measurements of radioactive material in REMP sample matrices. Such checks are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10CFR50. A summary of the results obtained as part of this comparison program are in Section 5 of this annual report.

2.3 STATISTICAL AND CALCULATIONAL METHODOLOGY

2.3.1 ESTIMATION OF THE MEAN VALUE

There was one (1) basic statistical calculation performed on the raw data resulting from the environmental sample analysis program. The calculation involved the determination of the mean value for the indicator and the control samples for each sample medium. The mean is a widely used statistic. This value was used in the reduction of the data generated by the sampling and analysis of the various media in the Radiological Environmental Monitoring Program. The following equation was used to estimate the mean (reference 6.8):

$$\bar{x} = \frac{\sum_{i=1}^N x_i}{N}$$

Where:

$\bar{x}$ = estimate of the mean,

i = individual sample,

N = total number of samples with a net activity (or concentration),

x_i = net activity (or concentration) for sample i.

NOTE: "Net activity (or concentration)" is the activity (or concentration) determined to be present in the sample. No "Minimum Detectable Activity", "Lower Limit of Detection", "Less Than Level", or negative activities or concentrations are included in the calculation of the mean.

2.3.2 LOWER LEVEL OF DETECTION, MINIMUM DETECTABLE ACTIVITY, AND CRITICAL LEVEL

The Lower Level of Detection (LLD), Minimum Detectable Activity (MDA), and Critical Level (CL) are used throughout the Environmental Monitoring Program.

LLD - The LLD, as defined in the Selected Licensee Commitments Manual is the smallest concentration of radioactive material in a sample that will yield a net count, above the system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal. The LLD is an *a priori* lower limit of detection. The actual LLD is dependent upon the standard deviation of the background counting rate, the counting efficiency, the sample size (mass or volume), the radiochemical yield, and the radioactive decay of the sample between sample collection and counting. The "required" LLD's for each sample medium and selected radionuclides are given in the Selected Licensee Commitments and are listed in Table 2.2-C.

MDA - The MDA may be thought of as an "actual" LLD for a particular sample measurement remembering that the MDA is calculated using a sample background instead of a system background.

CL - The CL is defined as the net count rate which must be exceeded before a sample is considered to contain any measurable activity above the background.

2.3.3 TREND IDENTIFICATION

One of the purposes of an environmental monitoring program is to determine if there is a buildup of radionuclides in the environment due to the operation of the nuclear station. Visual inspection of tabular or graphical presentations of data (including preoperational) is used to determine if a trend exists. A decrease in a particular radionuclide's concentration in an environmental medium does not indicate that reactor operations are removing radioactivity from the environment but that reactor operations are not adding that radionuclide to the environment in quantities exceeding the preoperational level and that the normal removal processes (radioactive decay, deposition, resuspension, etc.) are influencing the concentration.

Substantial increases or decreases in the amount of a particular radionuclide's release from the nuclear plant will greatly affect the resulting environmental levels; therefore, a knowledge of the release of a radionuclide from the nuclear plant is necessary to completely interpret the trends, or lack of trends, determined from the environmental data. Some factors that may affect environmental levels of radionuclides include prevailing weather conditions (periods of drought, solar cycles or heavier than normal precipitation), construction in or around either the nuclear plant or the sampling location, and addition or deletion of other sources of radioactive materials (such as the Chernobyl accident). Some of these factors may be obvious while others are sometimes unknown. Therefore, how trends are identified will include some judgment by plant personnel.

TABLE 2.1-A
MCGUIRE RADIOLOGICAL MONITORING PROGRAM
SAMPLING LOCATIONS

Table 2.1-A Codes			
W	Weekly	SM	Semimonthly
BW	BiWeekly	Q	Quarterly
M	Monthly	SA	Semiannually
C	Control		

Site #	Location Description	Air Rad. & Part.	Surface Water	Drinking Water	Shoreline Sediment	Food Products	Fish	Milk	Broad Leaf Veg.
101	North Mecklenburg Water Supply (3.3 mi E)			BW					
119	Mt. Holly Municipal Water Supply (7.4 mi SSW)			BW					
120	Site Boundary (0.5 mi NNE)	W							M (b)
121	Site Boundary (0.5 mi NE)	W							
125	Site Boundary (0.4 mi SW)	W							M (b)
128	Discharge Canal Bridge (0.4 mi NE)		BW						
129	Discharge Canal Entrance to Lake Norman (0.5 mi ENE)				SA		SA		
130	Hwy 73 Bridge Downstream (0.5 mi SW)				SA				
131	Cowans Ford Dam (0.6 mi WNW)		BW						
132	Charlotte Municipal Water Supply (11.2 mi SSE)			BW					
133	Cornelius (6.2 mi NE)	W							
134 C	East Lincoln Jr.High School (8.8 mi WNW)	W							M (b)
135 C	Plant Marshall Intake Canal (11.9 mi N)		BW						
136 C	Mooreville Municipal Water Supply (12.7 mi NNE)			BW					
137 C	Pinnacle Access Area (12.0 mi N)				SA		SA		
138	Henry Cook Dairy (3.1 mi ESE)							SM	
139	William Cook Dairy (2.5 mi E)							SM	
140	Kidd Dairy-Cows (2.8 mi SSE)							SM	
141 C	Lynch Dairy-Cows (14.8 mi WNW)							SM	
188	5 mile radius Gardens (2.8 mi N)					M (a)			
192	Peninsula (2.8 mi NNE)	W							
193	Site Boundary (0.2 mi N)								M (b)
194	East Lincoln County Water Supply (6.7 mi NNW)			BW					
195	Fishing Access Road (0.2 mi N)	W							

(a) During Harvest Season

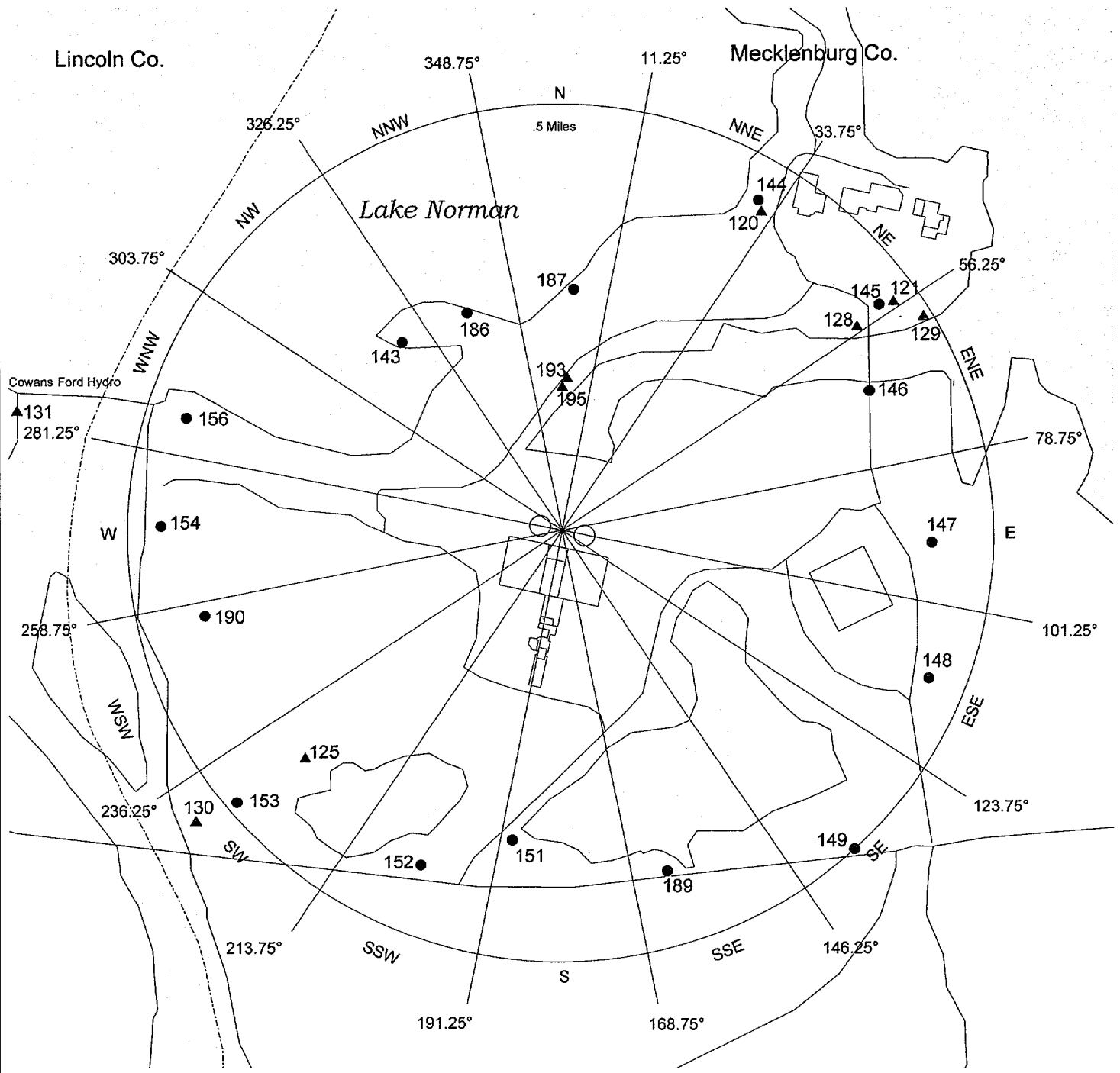
(b) When Available

TABLE 2.1-B
MCGUIRE RADIOLOGICAL MONITORING PROGRAM
SAMPLING LOCATIONS
(TLD SITES)

Site #	Location	Distance	Sector	Site #	Location	Distance	Sector
143	SITE BOUNDARY	0.3 miles	NW	167	LUCIA RIVERBEND HWY/ OLD FIREHOUSE	4.9 miles	SW
144	SITE BOUNDARY	0.5 miles	NNE	168	OLD PLANK ROAD BRIDGE	4.6 miles	WSW
145	SITE BOUNDARY	0.5 miles	NE	169	GLOVER LANE	4.0 miles	W
146	SITE BOUNDARY	0.4 miles	ENE	170	LITTLE EGYPT ROAD	4.3 miles	WNW
147	SITE BOUNDARY	0.4 miles	E	171	TRIANGLE ACE HARDWARE	4.0 miles	NW
148	SITE BOUNDARY	0.5 miles	ESE	172	WESTPORT COMMUNITY AT GOLF COURSE DRIVE	5.7 miles	NNW
149	SITE BOUNDARY	0.5 miles	SE	173 SI	KEISTLER STORE / GLENWOOD ROAD	8.4 miles	NNW
151	SITE BOUNDARY	0.4 miles	S	174 SI	EAST LINCOLN JR. HIGH SCHOOL	8.8 miles	WNW
152	SITE BOUNDARY	0.4 miles	SSW	175 C	BOGER CITY	15.5 miles	WNW
153	SITE BOUNDARY	0.5 miles	SW	176 SI	SHADOWBROOK DRIVE	11.0 miles	SW
154	SITE BOUNDARY	0.5 miles	W	177 SI	BELMARROW ROAD / COULWOOD COMMUNITY	8.8 miles	S
156	SITE BOUNDARY	0.5 miles	WNW	178 SI	FLORIDA STEEL CORPORATION	9.3 miles	SE
189	SITE BOUNDARY	0.4 miles	SSE	179 SI	PROSPERITY CHURCH ROAD	10.6 miles	ESE
190	SITE BOUNDARY	0.4 miles	WSW	180 SI	MOORESVILLE WATER TREATMENT FACILITY	12.7 miles	NNE
157	THE POINTE/MOORESVILLE	4.7 miles	N	181 SI	OLD DAVIDSON WATER TREATMENT FACILITY	7.0 miles	NE
158	BETHEL CHURCH ROAD	4.3 miles	NNE	182 SI	CORNELIUS / AIR SITE # 133	6.2 miles	NE
159	HENDERSON ROAD	5.0 miles	NE	183 SI	PUMP STATION ROAD	5.8 miles	S
160	ANCHORAGE MARINE SHOWROOM	4.9 miles	ENE	186 SI	MCGUIRE FISHING ACCESS ROAD ON PENINSULA	0.2 miles	NNW
161	SAM FURR ROAD & HWY 21	4.7 miles	E	187 SI	ENERGY EXPLORIUM / AIR SITE # 195	0.2 miles	N
162	RANSON ROAD	4.5 miles	ESE	191 SI	PENINSULA DEVELOPMENT / AIR SITE # 192	2.8 miles	NNE
163	MCCOY ROAD	4.9 miles	SE	196 SI	MCGUIRE LANDFARM FENCE	1.0 miles	S
164	HAMBRIGHT & BEATTIES FORD ROAD	4.6 miles	SSE	197 SI	MCGUIRE LANDFILL FENCE	1.1 miles	S
165	HORSESHOE BEND BEACH ROAD	5.1 miles	S	198 SI	MCGUIRE LANDFILL FENCE	1.3 miles	S
166	RIVERBEND FOSSIL STATION	5.3 miles	SSW	199 SI	MCGUIRE LANDFILL / MW-1 WELL HEAD	1.5 miles	S

C = Control
SI = Special Interest

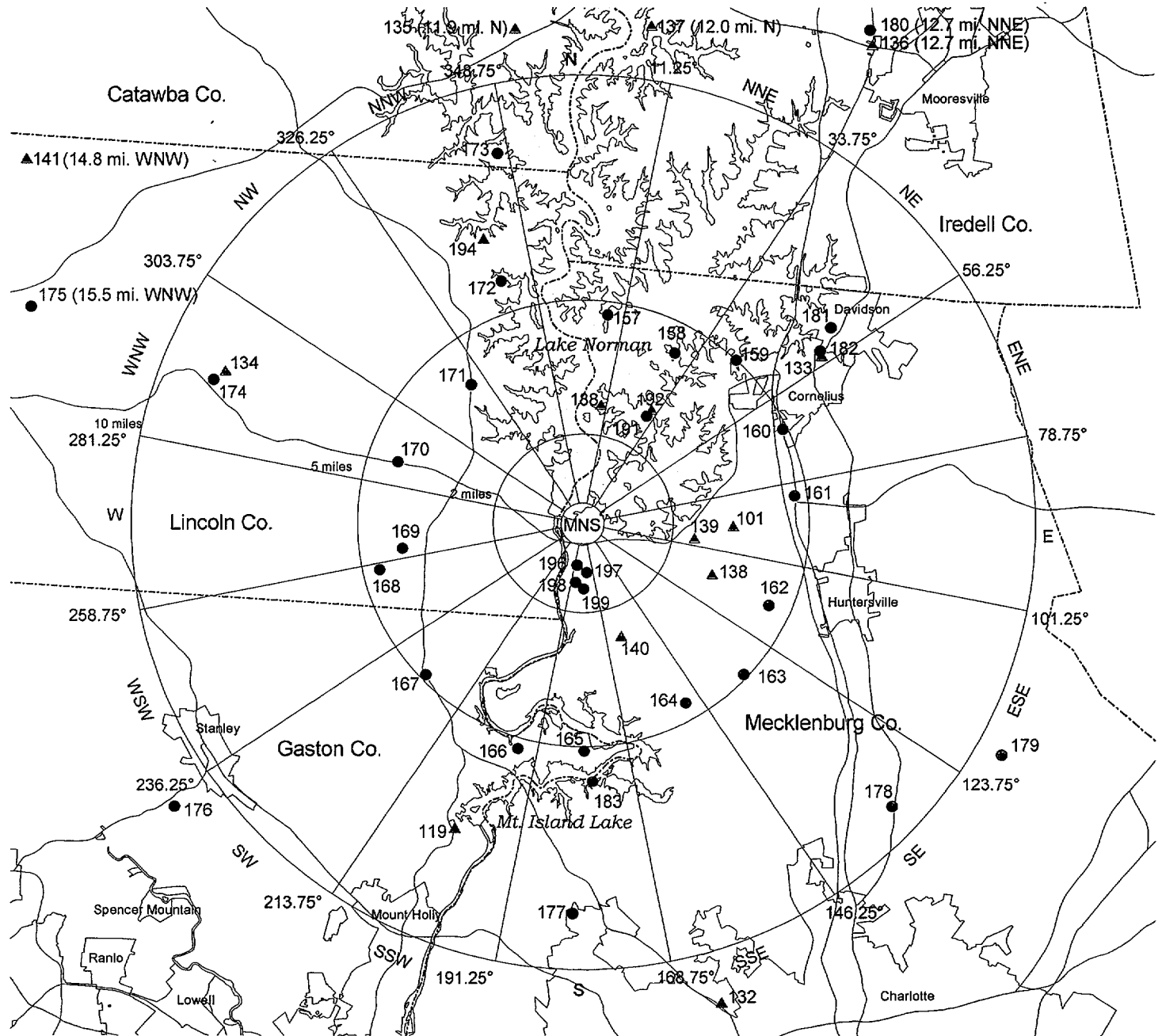
McGuire Nuclear Station Figure 2.1-1 Sampling Locations Map (Site Boundary)



- TLD Locations
- ▲ All Other Locations



McGuire Nuclear Station Figure 2.1-2 Sampling Locations Map (Ten Mile Radius)



- TLD Locations
- ▲ All Other Locations



TABLE 2.2-A

**REPORTING LEVELS FOR RADIOACTIVITY
CONCENTRATIONS IN ENVIRONMENTAL SAMPLES**

Analysis	Water (pCi/liter)	Air Particulates or Gases (pCi/m ³)	Fish (pCi/kg-wet)	Milk (pCi/liter)	BroadLeaf Vegetation (pCi/kg-wet)
H-3	20,000 ^{(a),(b)}				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	2	1		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

(a) If no drinking water pathway exists, a value of 30,000 pCi/liter may be used.

(b) H-3 Reporting level not applicable to surface water

TABLE 2.2-B
REMP ANALYSIS FREQUENCY

Sample Medium	Analysis Schedule	Gamma Isotopic	Tritium	Low Level I-131	Gross Beta	TLD
Air Radioiodine	Weekly	X				
Air Particulates	Weekly				X	
	Quarterly Composite	X				
Direct Radiation	Quarterly					X
Surface Water	Monthly Composite	X				
	Quarterly Composite		X			
Drinking Water	Monthly Composite	X			X	
	Quarterly Composite		X			
Shoreline Sediment	Semiannually	X				
Milk	Semimonthly	X		X		
Fish	Semiannually	X				
Broadleaf Vegetation	Monthly*	X				
Food Products	Monthly*	X				

* When Available

TABLE 2.2-C

MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION

Analysis	Water (pCi/liter)	Air Particulates or Gases (pCi/m ³)	Fish (pCi/kg-wet)	Milk (pCi/liter)	BroadLeaf Vegetation (pCi/kg-wet)	Sediment (pCi/kg-dry)
Gross Beta	4					
H-3	2000 ^(a)					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-Nb-95	15					
I-131	1 ^(b)	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15			15		

(a) If no drinking water pathway exists, a value of 3000 pCi/liter may be used.

(b) If no drinking water pathway exists, the LLD of gamma isotopic analysis may be used.

3.0 INTERPRETATION OF RESULTS

This section provides a summary and review of all 1999 REMP analysis results to detect and identify changes in environmental levels as a result of station operation. The radionuclides with Selected Licensee Commitments reporting levels that indicate consistent detectable activity have been historically trended from preoperation to present. Analyses from 1977 - 1978 have been excluded since these results were much higher than the other preoperational years due to outside influences such as weapons testing. The preoperational analyses from 1981 were combined with the operational analyses from the latter part of 1981 and averaged to give one concentration for each radionuclide for that year.

The highest annual mean concentration of applicable Selected Licensee Commitments radionuclides from the indicator locations for each media type was used for trending purposes. Trending was performed by comparing annual mean concentrations to historical results. Factors evaluated include the frequency of detection and the concentration in terms of the percent of the radionuclide's NRC reporting level (Table 2.2-A). All maximum percent of reporting level values were well below the 100% action level. The highest value reached during 1999 was 3.61% for drinking water tritium at the North Mecklenburg Water Treatment Facility (Location 101). Only Selected Licensee Commitments radionuclides were detected in 1999.

Changes in sample location, analytical technique, and presentation of results must be considered when reviewing for trends. Calculation of the annual mean concentrations has been performed differently over the history of the REMP. During 1979-1986, all net results (sample minus background) positive and negative, were included in the calculation of the mean. Only positive net activity results were used to calculate the mean for the other years. All negative values were replaced with a zero for calculational and graphical purposes to properly represent environmental conditions. A change in gamma spectroscopy analysis systems in 1987 ended a period when many measurements yielded detectable low-level activity for both indicator and control location samples. It is possible that the method the previous system used to estimate net activity may have been vulnerable to false-positive results.

This section includes tables and graphs containing the highest annual mean concentrations of any effluent related radionuclide detected since the change in analysis systems in 1987. Any zero concentrations used in tables or graphs represent activity measurements less than detectable levels. Only the specific radionuclides that represent the highest dose contributors or demonstrate consistent detectable activity are shown graphically.

Data presented in Sections 3.1 through 3.9 support the conclusion that there was no significant increase in radioactivity in the environment around McGuire Nuclear Station due to station operations in 1999. Similarly, there was no significant increase in ambient background radiation levels in the surrounding areas. The 1999 land use census data, shown in Section 3.10, indicates that no program changes are required as a result of the census.

3.1 AIRBORNE RADIOIODINE AND PARTICULATES

In 1999, 363 particulate and radioiodine samples were analyzed, 311 at six indicator locations and 52 at the control location. Particulate samples were analyzed weekly for gross beta. Gamma analysis was performed on 28 particulate composite samples, 24 at the six indicator locations and four at the control location. Radioiodine samples received a weekly gamma analysis.

Per Selected Licensee Commitments, if gross beta in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on individual samples. As in previous years, the location with the highest mean ($2.06\text{E-}2 \text{ pCi/m}^3$) in 1999 was less than ten times the yearly mean of the control location ($3.47\text{E-}2 \text{ pCi/m}^3$). Therefore, gamma isotopic analysis was performed quarterly on composite particulate filters. No detectable gamma emitting particulate activity has been found in environmental air samples since 1987.

No detectable I-131 activity in any environmental air radioiodine samples was found in 1999. Cs-137 was found in one environmental air radioiodine sample during 1999. However, no Cs-137 was found on the corresponding particulate filters. An investigation performed in 1990 concluded that Cs-137 activity detected only on the cartridges was not attributed by station effluents but was an active constituent of the charcoal media (reference 6.5). Therefore, the Cs-137 activity was not used to calculate doses.

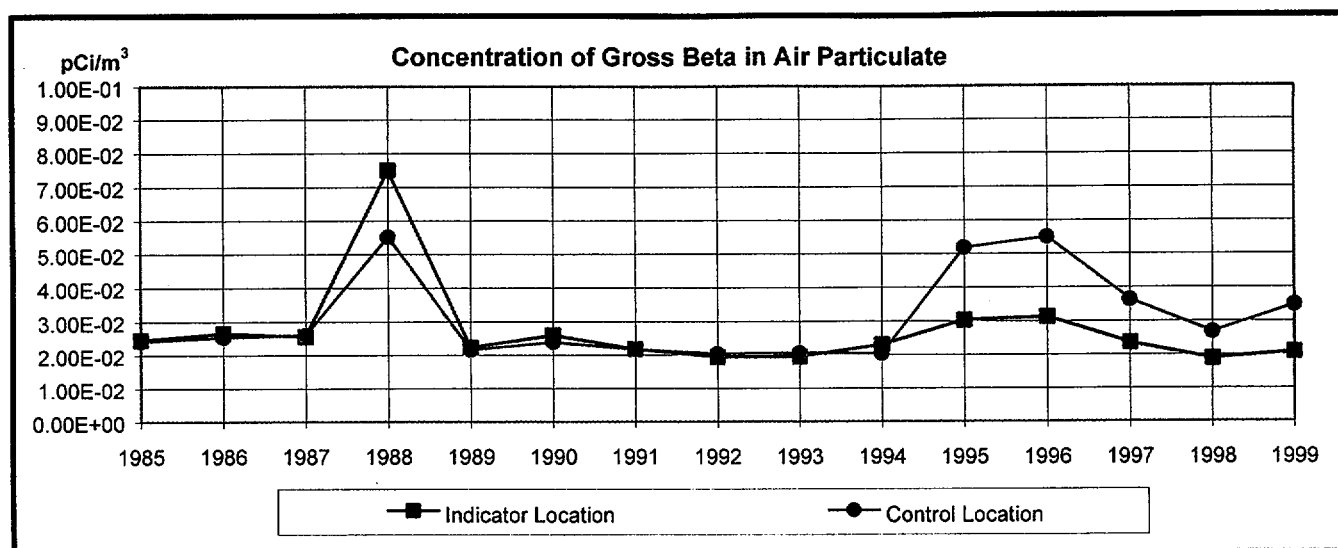
Figure 3.1 shows gross beta highest annual mean indicator and control location concentrations since 1985. There is no reporting level for gross beta. Table 3.1-A shows indicator and control location highest annual means for Cs-137 and gross beta. Since no gamma activity was detected in 1999, no reporting levels were approached.

Table 3.1-B gives indicator location highest annual means and control means since 1979 for I-131. Preoperational and ten year averages are also shown. No I-131 activity has been detected since 1989. Since no radionuclides were detected in 1999, no reporting levels were approached.



Air Sampling at McGuire Nuclear Station

Figure 3.1



There is no reporting level for Gross Beta in air particulate

Table 3.1-A Mean Concentrations of Radionuclides in Air Particulate

YEAR	Cs-137 Indicator (pCi/m ³)	Cs-137 Control (pCi/m ³)	Beta Indicator (pCi/m ³)	Beta Control (pCi/m ³)
1979*	4.40E-3	1.47E-3	**	**
1980*	6.70E-3	4.53E-3	**	**
1981*	6.16E-3	5.32E-3	**	**
1982*	3.82E-3	2.29E-3	**	**
1983*	2.93E-3	3.21E-3	**	**
1984	1.74E-3	8.29E-4	**	**
1985	1.86E-3	1.32E-3	2.44E-2	2.40E-2
1986	4.98E-3	3.03E-3	2.64E-2	2.52E-2
1987	1.07E-2	7.91E-3	2.54E-2	2.59E-2
1988	0.00E0	0.00E0	7.49E-2	5.51E-2
1989	0.00E0	0.00E0	2.22E-2	2.14E-2
1990	0.00E0	0.00E0	2.58E-2	2.37E-2
1991	0.00E0	0.00E0	2.16E-2	2.15E-2
1992	0.00E0	0.00E0	1.92E-2	2.02E-2
1993	0.00E0	0.00E0	1.93E-2	2.04E-2
1994	0.00E0	0.00E0	2.28E-2	2.02E-2
1995	0.00E0	0.00E0	3.02E-2	5.17E-2
1996	0.00E0	0.00E0	3.11E-2	5.49E-2
1997	0.00E0	0.00E0	2.34E-2	3.62E-2
1998	0.00E0	0.00E0	1.86E-2	2.66E-2
Average (1989 – 1998)	NOT APPLICABLE	NOT APPLICABLE	2.34E-2	2.97E-2
1999	0.00E0	0.00E0	2.06E-2	3.47E-2

0.00E0 = no detectable measurements

* Radioiodines and Particulates analyzed together

** Gross Beta analysis not performed

Table 3.1-B Mean Concentrations of Air Radioiodine (I-131)

Year	Indicator Location (pCi/m ³)	Control Location (pCi/m ³)
1979*	3.28E-3	1.04E-3
1980*	2.01E-3	1.10E-3
1981*	4.17E-3	6.27E-4
1982*	1.42E-3	2.48E-3
1983*	1.99E-3	2.01E-4
1984	3.17E-3	0.00E0
1985	3.15E-3	1.04E-3
1986	1.27E-2	6.10E-3
1987	1.07E-2	6.60E-3
1988	0.00E0	0.00E0
1989	2.18E-2	0.00E0
1990	0.00E0	0.00E0
1991	0.00E0	0.00E0
1992	0.00E0	0.00E0
1993	0.00E0	0.00E0
1994	0.00E0	0.00E0
1995	0.00E0	0.00E0
1996	0.00E0	0.00E0
1997	0.00E0	0.00E0
1998	0.00E0	0.00E0
1999	0.00E0	0.00E0

0.00E0 = no detectable measurements

* Radioiodines and Particulates analyzed together.

3.2 DRINKING WATER

In 1999, 61 drinking water samples were analyzed for gross beta and gamma emitting radionuclides. Forty-eight samples were from the four indicator locations and 13 from the control location. Tritium (H-3) analyses were performed on 19 composite samples, 15 at indicator locations and four at the control location.

No detectable gamma activity was found in drinking water samples in 1999 and has not been detected since 1987. Gross beta analyses indicated 2.48 pCi/l at the location with the highest annual mean and 2.17 pCi/l at the control location. Tritium was detected in 11 of the 15 indicator composite samples taken in 1999 with the highest annual mean resulting in only 2.75% of the reporting level. The dose for consumption of water was less than one mrem per year, historically and for 1999; therefore low-level iodine analysis is not required.

A new drinking water sampling location (101) was added during 1999.

Figure 3.2 shows tritium highest annual mean indicator and control location concentrations with comparisons to 10% of the reporting level. Table 3.2 gives indicator location highest annual means and control means since 1979 for tritium and gross beta. There is no reporting level for gross beta.

Figure 3.2

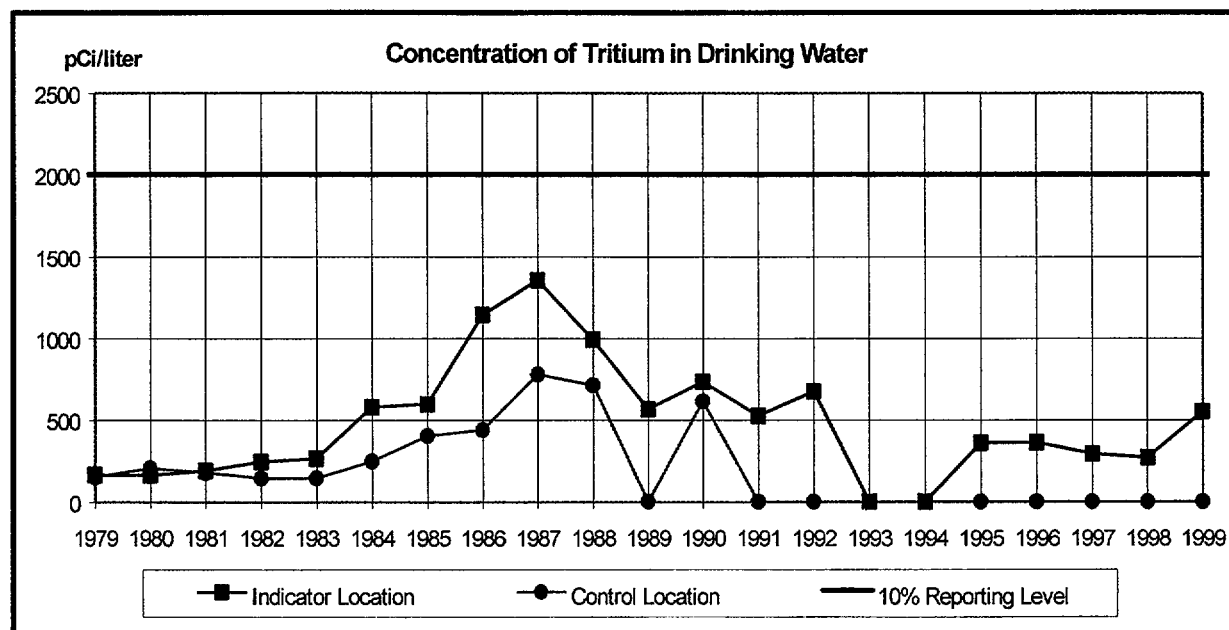


Table 3.2 Mean Concentrations of Radionuclides in Drinking Water

YEAR	Gross Beta (pCi/l)		Tritium (pCi/l)	
	Indicator Location	Control Location	Indicator Location	Control Location
1979	2.40E0	2.03E0	1.65E2	1.50E2
1980	2.34E0	1.87E0	1.63E2	2.05E2
1981	2.79E0	2.41E0	1.88E2	1.78E2
1982	2.62E0	2.43E0	2.43E2	1.45E2
1983	1.80E0	1.87E0	2.65E2	1.45E2
1984	2.78E0	1.81E0	5.77E2	2.45E2
1985	1.88E0	1.90E0	5.93E2	4.00E2
1986	2.13E0	2.15E0	1.14E3	4.37E2
1987	2.30E0	2.00E0	1.35E3	7.75E2
1988	2.00E0	2.00E0	9.92E2	7.11E2
1989	2.80E0	2.70E0	5.62E2	0.00E0
1990	3.70E0	4.30E0	7.32E2	6.11E2
1991	2.40E0	2.50E0	5.22E2	0.00E0
1992	2.00E0	1.70E0	6.73E2	0.00E0
1993	2.80E0	2.40E0	0.00E0	0.00E0
1994	2.47E0	2.90E0	0.00E0	0.00E0
1995	4.20E0	3.30E0	3.58E2	0.00E0
1996	2.75E0	2.11E0	3.60E2	0.00E0
1997	2.70E0	2.24E0	2.90E2	0.00E0
1998	2.75E0	2.33E0	2.68E2	0.00E0
1999	2.48E0	2.17E0	5.49E2	0.00E0

0.00E0 = no detectable measurements

3.3 SURFACE WATER

In 1999, 39 surface water samples were analyzed for gamma emitting radionuclides, 26 at the two indicator locations and 13 at the control location. Analyses for H-3 were performed on 12 samples, eight at indicator locations and four at the control location.

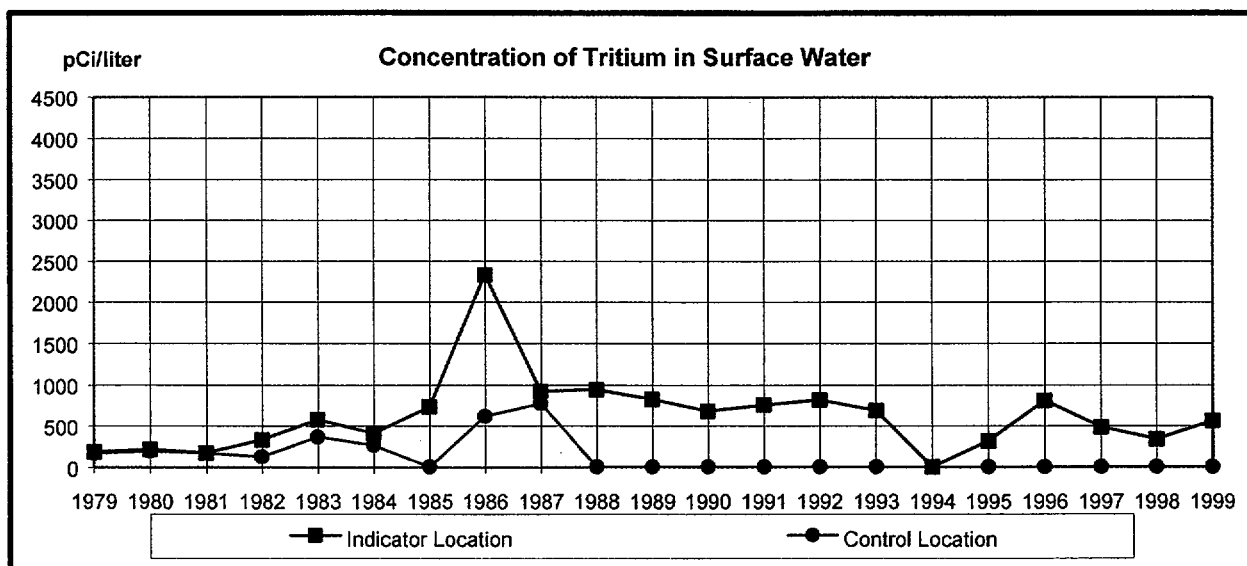
No detectable gamma activity was found in surface water samples in 1999 and has not been detected since 1988. Tritium was detected in the eight indicator composite samples taken in 1999. Tritium was not detected in any of the control location composite samples in 1999.

Figure 3.3 shows tritium highest annual mean indicator and control location concentrations. Table 3.3 gives indicator and control location highest annual means since 1979 for tritium.



Surface Water Sampling at McGuire Nuclear Station

Figure 3.3



There is no reporting level for tritium in surface water

Table 3.3 Mean Concentrations of Tritium in Surface Water

YEAR	H-3 Indicator (pCi/l)	H-3 Control (pCi/l)
1979	1.85E2	1.66E2
1980	2.13E2	1.93E2
1981	1.75E2	1.70E2
1982	3.30E2	1.23E2
1983	5.75E2	3.67E2
1984	4.10E2	2.65E2
1985	7.33E2	0.00E0
1986	2.33E3	6.13E2
1987	9.20E2	7.70E2
1988	9.40E2	0.00E0
1989	8.22E2	0.00E0
1990	6.77E2	0.00E0
1991	7.53E2	0.00E0
1992	8.13E2	0.00E0
1993	6.85E2	0.00E0
1994	0.00E0	0.00E0
1995	3.15E2	0.00E0
1996	8.08E2	0.00E0
1997	4.85E2	0.00E0
1998	3.40E2	0.00E0
1999	5.60E2	0.00E0

0.00E0 = no detectable measurements

3.4 MILK

In 1999, 104 milk samples were analyzed for low level I-131 and other gamma emitting radionuclides, 78 at the three indicator locations and 26 at the control location.

No detectable activity was found in milk samples in 1999. Cs-137 has not been detected in milk samples since 1990 and all other radionuclides have not been detected since 1987.

Table 3.4 gives indicator location highest annual means and control means since 1979 for Cs-137. Since no activity was detected in 1999, no reporting levels were approached.

Table 3.4 Mean Concentrations of Cs-137 in Milk

YEAR	Cs-137 Indicator (pCi/l)	Cs-137 Control (pCi/l)
1979	2.48E1	6.04E0
1980	1.72E1	4.13E0
1981	2.04E1	4.15E0
1982	1.21E1	5.20E0
1983	2.01E1	2.82E0
1984	1.48E1	2.56E0
1985	1.42E1	2.72E0
1986	3.74E0	3.45E0
1987	5.20E0	8.60E0
1988	3.40E0	2.90E0
1989	6.00E0	5.60E0
1990	5.30E0	2.60E0
1991	0.00E0	0.00E0
1992	0.00E0	0.00E0
1993	0.00E0	0.00E0
1994	0.00E0	0.00E0
1995	0.00E0	0.00E0
1996	0.00E0	0.00E0
1997	0.00E0	0.00E0
1998	0.00E0	0.00E0
1999	0.00E0	0.00E0

0.00E0 = no detectable measurements

3.5 BROADLEAF VEGETATION

In 1999, 28 broadleaf vegetation samples were analyzed, 21 at the three indicator locations and seven at the control location.

No detectable activity was detected in any of the vegetation samples taken in 1999.

Cs-137 was detected in 1998 in one vegetation sample. No other detectable gamma activity was found in vegetation samples in 1998 and no other radionuclides have been detected in vegetation samples since 1987. Table 3.5 gives indicator and control location highest annual means since 1979 for Cs-137.



Broadleaf Vegetation Sampling at
McGuire Nuclear Station

Table 3.5 Mean Concentrations of Cs-137 in Broadleaf Vegetation

YEAR	Cs-137 Indicator (pCi/kg)	Cs-137 Control (pCi/kg)
1979	2.19E1	1.93E1
1980	2.30E1	1.92E1
1981	3.04E1	2.02E1
1982	2.46E1	1.22E1
1983	9.07E0	7.85E0
1984	1.02E1	1.05E1
1985	8.05E0	2.37E-2
1986	4.03E1	1.27E1
1987	2.20E1	1.70E1
1988	3.90E1	3.40E1
1989	9.60E1	0.00E0
1990	4.00E1	0.00E0
1991	3.30E1	0.00E0
1992	4.90E1	0.00E0
1993	1.60E1	0.00E0
1994	0.00E0	0.00E0
1995	0.00E0	0.00E0
1996	0.00E0	0.00E0
1997	0.00E0	0.00E0
1998	0.00E0	2.69E1
1999	0.00E0	0.00E0

0.00E0 = no detectable measurements

3.6 FOOD PRODUCTS

In 1999, 12 food products (crops) samples were analyzed, all at one indicator location. There is no control location for this media.

No detectable activity has been detected in this media since 1987. Table 3.6 shows Cs-137 indicator highest annual means with preoperational data and ten year averages. Since no activity was detected in 1999, no reporting levels were approached.

Table 3.6 Mean Concentrations of Cs-137 in Food Products

YEAR	Cs-137 Indicator (pCi/kg)
1979	2.19E1
1980	2.30E1
1981	3.04E1
1982	2.46E1
1983	9.07E0
1984	8.45E0
1985	7.99E0
1986	2.15E1
1987	2.90E1
1988	0.00E0
1989	0.00E0
1990	0.00E0
1991	0.00E0
1992	0.00E0
1993	0.00E0
1994	0.00E0
1995	0.00E0
1996	0.00E0
1997	0.00E0
1998	0.00E0
1999	0.00E0

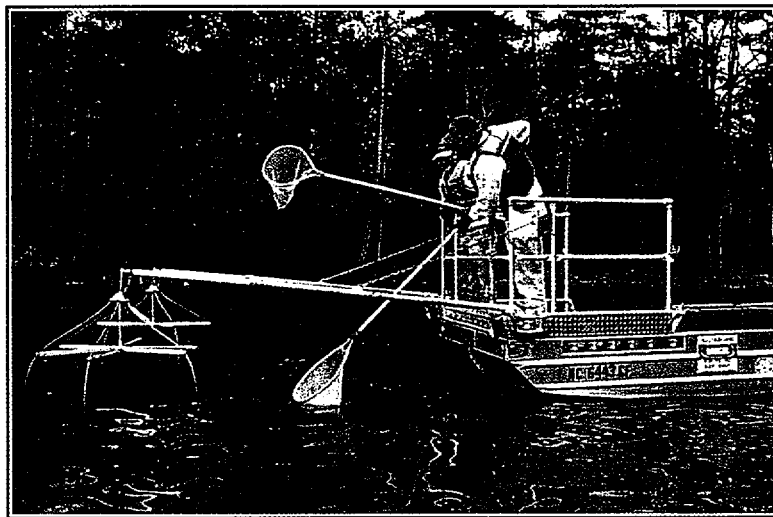
0.00E0 = no detectable measurements

3.7 FISH

In 1999, 12 fish samples were analyzed for gamma emitting radionuclides, six at the indicator location and six at the control location.

Figure 3.7-1 shows Cs-137 highest annual mean indicator and control location concentrations with comparisons to 5% of the reporting level. Figure 3.7-2 shows Co-60 highest annual mean indicator and control location concentrations also with comparisons to 5% of the reporting level. These two radionuclides represent the highest dose contributors for fish.

Table 3.7 gives indicator location highest annual means since 1980 for all radionuclides detected since the analysis change in 1988. No indicator samples were analyzed in 1979. Co-58 activity was detected in 1999 in three of the six indicator samples. Cs-137 activity was detected in 1999 in two of the six indicator samples taken and one control location sample. All other radionuclides not shown in the table have demonstrated no detectable activity since 1986. The highest annual mean for Co-58 resulted in only 0.18% of the reporting level. The highest annual mean for Cs-137 activity resulted in only 1.05% of the reporting level.



Fish Sampling at McGuire Nuclear Station

Figure 3.7-1

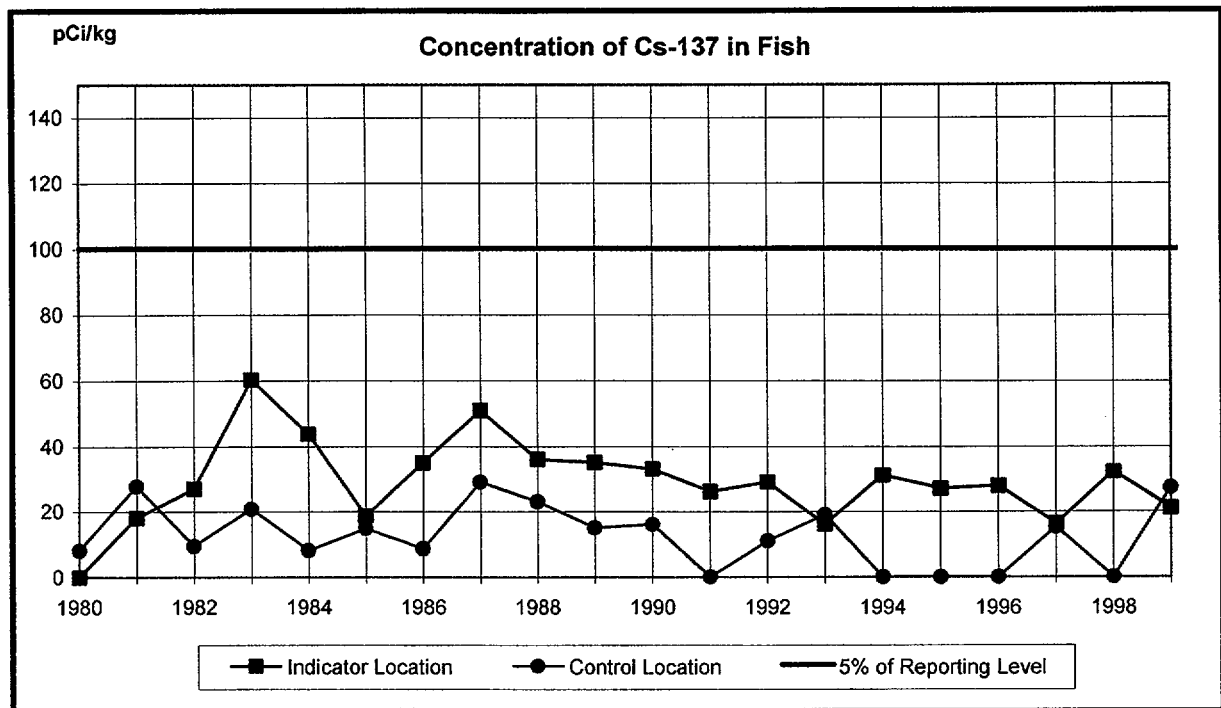


Figure 3.7-2

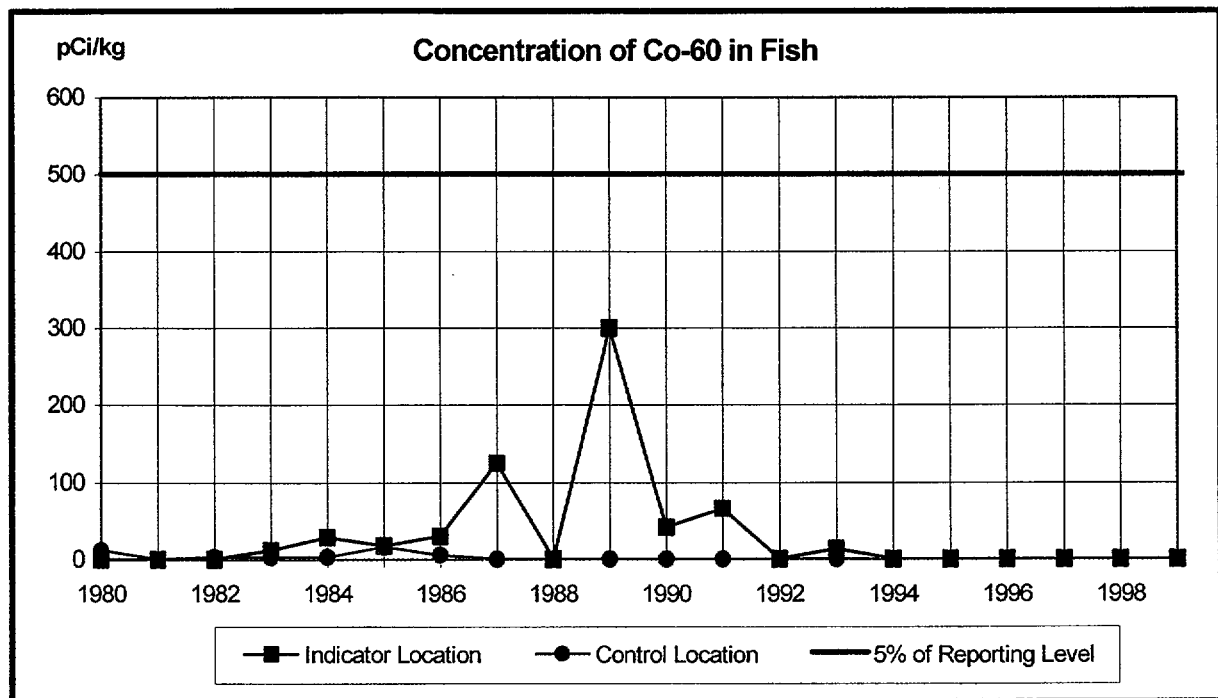


Table 3.7 Mean Concentrations of Radionuclides in Fish (pCi/kg)

YEAR	Mn-54 Indicator	Co-58 Indicator	Co-60 Indicator	Cs-134 Indicator	Cs-137 Indicator
1980	-1.97E1	8.36E0	-2.25E1	-2.70E1	-4.13E0
1981	-2.71E0	-2.98E0	-2.65E0	-1.99E0	1.80E1
1982	-3.83E0	8.16E0	-4.34E-1	-8.22E-1	2.69E1
1983	-2.60E0	2.60E1	1.11E1	-1.32E0	6.03E1
1984	3.61E0	1.45E2	2.82E1	3.11E1	4.38E1
1985	2.53E-1	7.19E0	1.72E1	-1.56E0	1.86E1
1986	1.03E0	3.17E1	2.96E1	1.67E1	3.49E1
1987	0.00E0	2.71E2	1.25E2	2.60E1	5.10E1
1988	1.20E1	7.70E1	0.00E0	2.70E1	3.60E1
1989	9.00E1	4.05E2	2.99E2	1.10E1	3.50E1
1990	0.00E0	5.60E1	4.10E1	0.00E0	3.30E1
1991	6.20E0	1.40E1	6.50E1	5.90E0	2.60E1
1992	0.00E0	0.00E0	0.00E0	0.00E0	2.90E1
1993	0.00E0	8.20E1	1.30E1	0.00E0	1.60E1
1994	0.00E0	0.00E0	0.00E0	0.00E0	3.10E1
1995	0.00E0	0.00E0	0.00E0	0.00E0	2.70E1
1996	0.00E0	0.00E0	0.00E0	0.00E0	2.78E1
1997	0.00E0	0.00E0	0.00E0	0.00E0	1.62E1
1998	0.00E0	0.00E0	0.00E0	0.00E0	3.21E1
1999	0.00E0	3.53E1	0.00E0	0.00E0	2.10E1

0.00E0 = no detectable measurements

All negative values have been replaced with zeros for calculational purposes

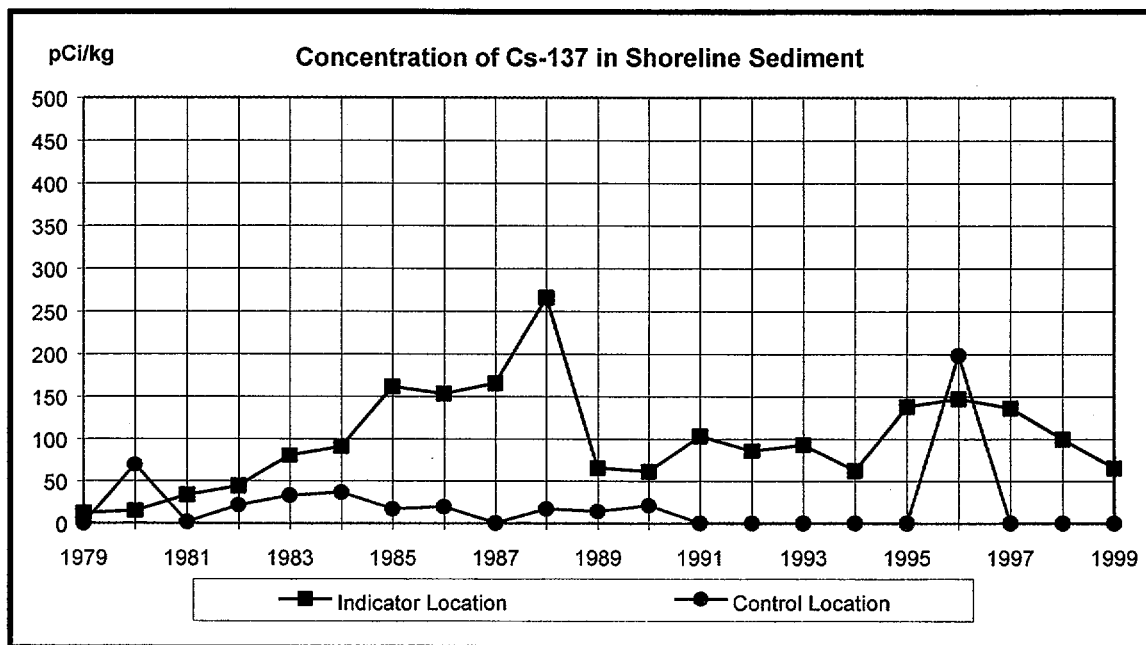
3.8 SHORELINE SEDIMENT

In 1999, six shoreline sediment samples were analyzed, four from two indicator locations and two at the control location.

Figure 3.8-1 shows Cs-137 highest annual mean indicator and control location concentrations since 1979. Figure 3.8-2 shows Co-60 highest annual mean indicator and control location concentrations since 1979. These two radionuclides represent the highest dose contributors for shoreline sediment.

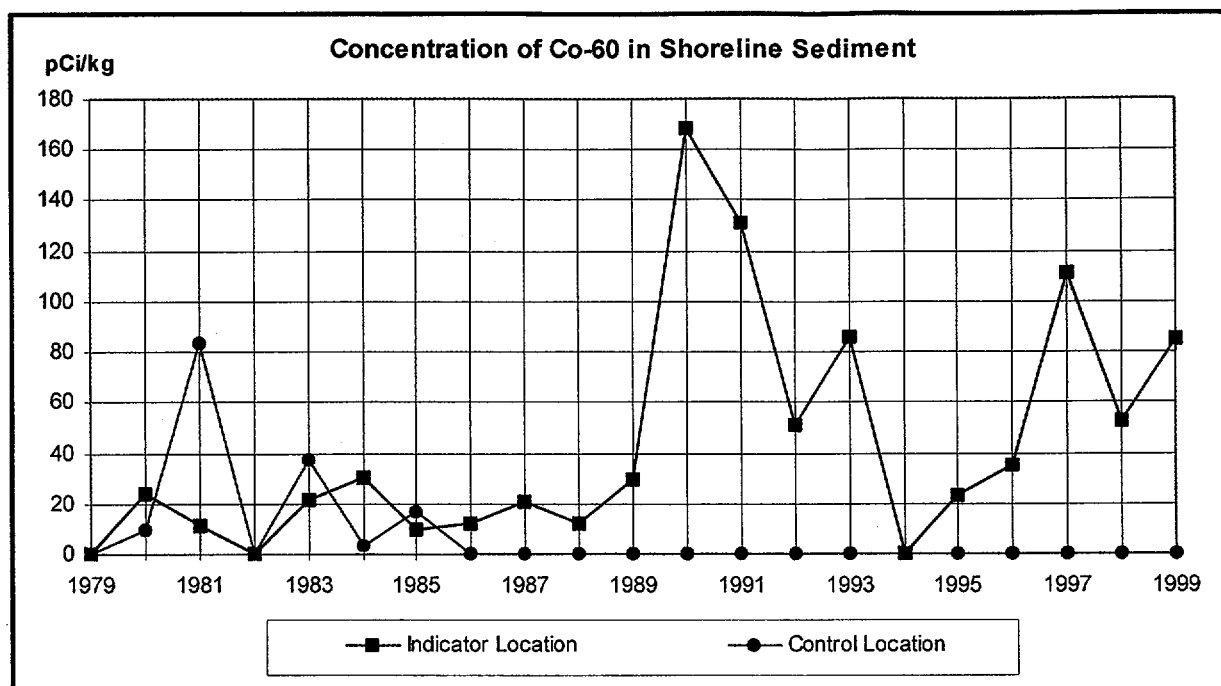
Table 3.8 gives indicator location highest annual means since 1979 for all radionuclides detected since the analysis change in 1988. There is no reporting level for shoreline sediment.

Figure 3.8-1



There is no reporting level for Cs-137 in shoreline sediment

Figure 3.8-2



There is no reporting level for Co-60 in shoreline sediment

Table 3.8 Mean Concentrations of Radionuclides in Shoreline Sediment (pCi/kg)

YEAR	Mn-54 Indicator	Co-58 Indicator	Co-60 Indicator	Cs-134 Indicator	Cs-137 Indicator
1979	-1.07E1	2.25E1	-6.50E0	0.00E0	1.20E1
1980	1.06E1	-8.74E0	2.36E1	-3.53E0	1.44E1
1981	2.13E1	1.20E1	8.21E0	3.97E1	3.36E1
1982	5.38E1	1.66E1	-1.69E0	7.67E1	4.40E1
1983	4.40E0	3.43E1	2.12E1	7.65E1	8.02E1
1984	1.19E1	7.11E1	3.04E1	3.34E1	9.13E1
1985	4.77E0	1.46E1	9.20E0	2.02E1	1.61E2
1986	1.37E1	1.02E1	1.16E1	6.35E1	1.53E2
1987	0.00E0	1.06E2	2.10E1	4.20E1	1.65E2
1988	6.50E0	9.20E1	1.20E1	9.10E0	2.66E2
1989	2.90E1	3.80E1	2.90E1	5.30E1	6.50E1
1990	3.80E1	2.70E1	1.68E2	0.00E0	6.10E1
1991	2.80E1	5.30E1	1.31E2	0.00E0	1.03E2
1992	9.40E0	0.00E0	5.10E1	9.20E0	8.60E1
1993	0.00E0	2.20E1	8.60E1	0.00E0	9.30E1
1994	4.10E1	0.00E0	0.00E0	0.00E0	8.00E1
1995	1.70E1	0.00E0	2.30E1	0.00E0	1.38E2
1996	2.90E1	1.78E1	3.50E1	0.00E0	1.47E2
1997	0.00E0	0.00E0	1.11E2	3.10E1	1.36E2
1998	0.00E0	0.00E0	5.21E1	0.00E0	9.97E1
1999	0.00E0	2.47E1	8.49E1	0.00E0	6.51E1

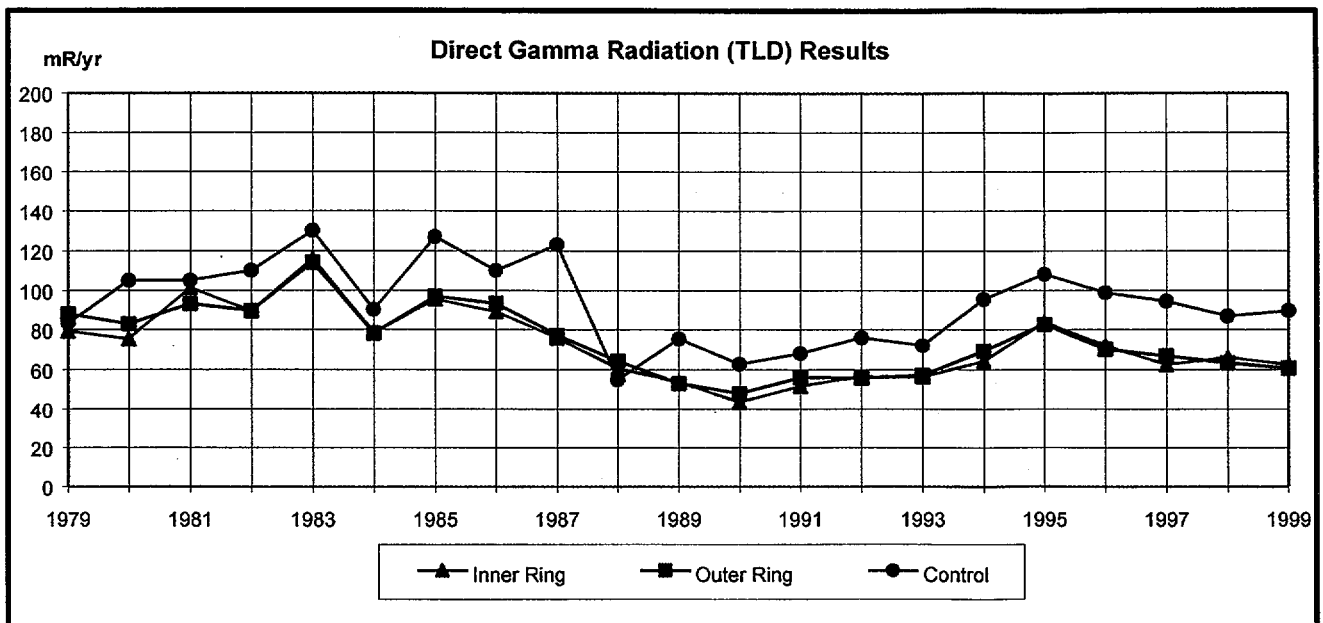
3.9 DIRECT GAMMA RADIATION

In 1999, 189 TLDs were analyzed, 185 at indicator locations, four at the control location. TLDs are collected and analyzed quarterly. The highest annual mean exposure for an indicator location was 101.1 milliroentgen. The annual mean exposure for the control location was 89.6 milliroentgen.

Figure 3.9 and Table 3.9 show TLD inner ring (site boundary), outer ring (4-5 miles), and control location annual averages in millirem per year. Preoperational data and ten year rolling averages are also given. As shown in the graph, inner and outer ring averages historically compare closely, with control data somewhat higher. Inner and outer ring averages comprise a number of data points with control averages representing only one location.

The calculated total body dose from gaseous effluents for 1999 was 4.46E-1 millirem, which is 0.72% of the average inner ring TLD values. Therefore, it can be concluded that discharges from the plant had very little impact on the measured TLD values.

Figure 3.9



There is no reporting level for Direct Radiation (TLD)

Table 3.9 Direct Gamma Radiation (TLD) Results

YEAR	Inner Ring Average (mR/yr)	Outer Ring Average (mR/yr)	Control (mR/yr)
1979	7.91E1	8.82E1	8.32E1
1980	7.54E1*	8.29E1*	1.05E2
1981	1.01E2	9.31E1	1.05E2
1982	8.95E1	8.97E1	1.10E2
1983	1.16E2	1.14E2	1.30E2
1984	7.85E1	7.83E1	9.02E1
1985	9.54E1	9.69E1	1.27E2
1986	8.91E1	9.35E1	1.10E2
1987	7.58E1	7.71E1	1.23E2
1988	6.03E1	6.42E1	5.48E1
1989	5.37E1	5.30E1	7.55E1
1990	4.34E1	4.78E1	6.25E1
1991	5.14E1	5.59E1	6.80E1
1992	5.65E1	5.55E1	7.60E1
1993	5.61E1	5.71E1	7.20E1
1994	6.40E1	6.93E1	9.55E1
1995	8.36E1	8.25E1	1.08E2
1996	7.18E1	7.02E1	9.88E1
1997	6.22E1	6.68E1	9.45E1
1998	6.59E1	6.32E1	8.69E1
Average (1989 – 1998)	6.09E1	6.21E1	8.38E1
1999	6.23E1	6.05E1	8.96E1

* Values are based on two quarters due to change in TLD locations.

NOTE: The expected background for North Carolina is 120 mrem per year (Reference 6.3).

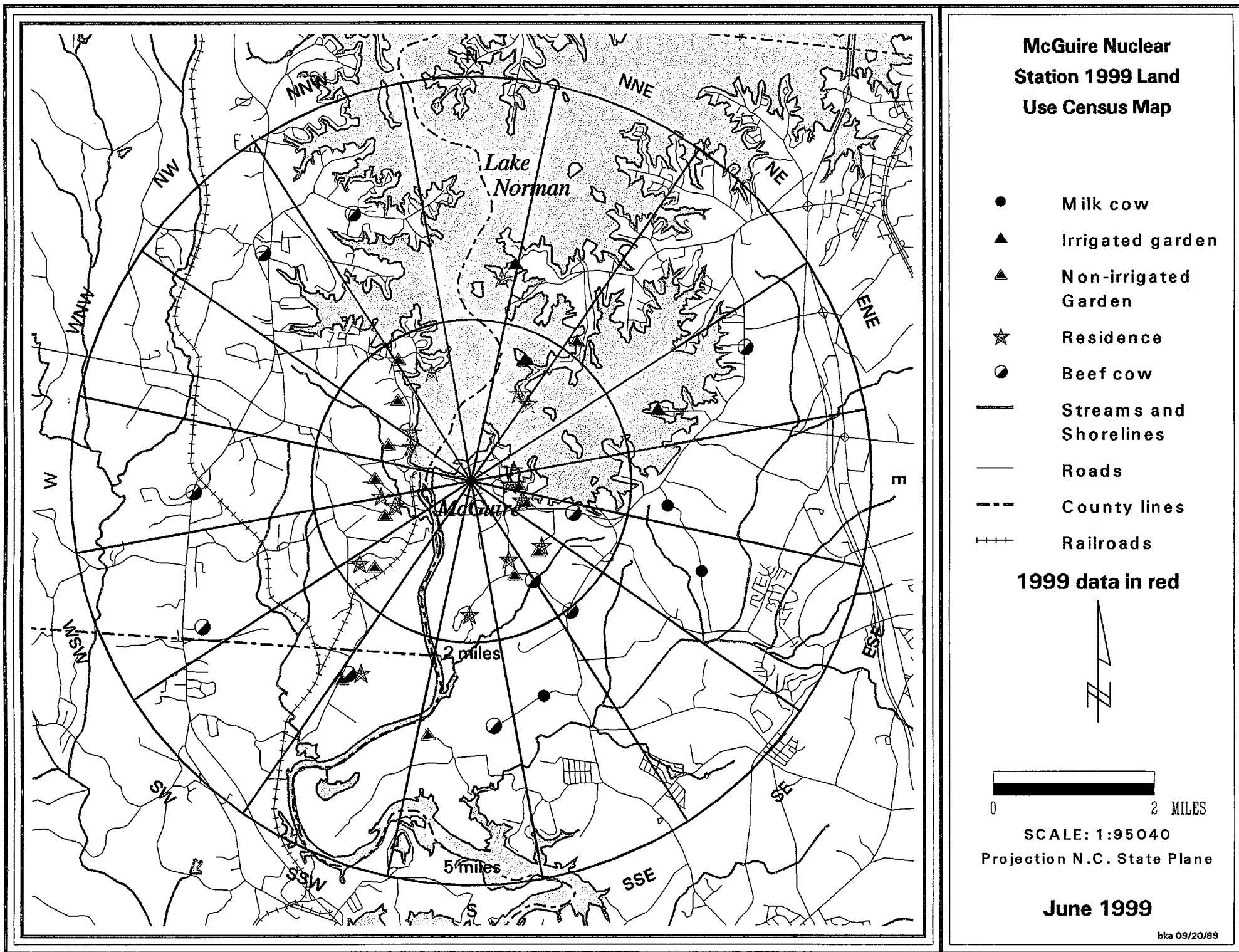
3.10 LAND USE CENSUS

The land use census was conducted June 16 - June 18, 1999 and the results are shown in Table 3.10 and Figure 3.10. During the 1999 census, no new or closer irrigated gardens were identified. The nearest residence is located in the East sector at 0.48 miles. No program changes were required as a result of the 1999 land use census.

Table 3.10 McGuire 1999 Land Use Census Results

Sector	Distance (Miles)	Sector	Distance (Miles)
N	Nearest Residence 2.50 Nearest Garden 2.79 Nearest Milk Animal - Nearest Meat Animal -	S	Nearest Residence 1.62 Nearest Garden 3.18 Nearest Milk Animal - Nearest Meat Animal (Cow) 3.01
NNE	Nearest Residence 1.29 Nearest Garden 1.64 Nearest Milk Animal - Nearest Meat Animal -	SSW	Nearest Residence 2.57 Nearest Garden 2.93 Nearest Milk Animal - Nearest Meat Animal (Cow) 2.75
NE	Nearest Residence 1.20 Nearest Garden 2.10 Nearest Milk Animal - Nearest Meat Animal -	SW	Nearest Residence 1.80 Nearest Garden 1.80 Nearest Milk Animal - Nearest Meat Animal -
ENE	Nearest Residence 0.56 Nearest Garden 2.55 Nearest Milk Animal - Nearest Meat Animal (Cow) 3.81	WSW	Nearest Residence 1.01 Nearest Garden 1.16 Nearest Milk Animal - Nearest Meat Animal (Cow) 3.97
E	Nearest Residence 0.48 Nearest Garden 0.48 Nearest Milk Animal (Cow) 2.46 Nearest Meat Animal -	W	Nearest Residence 1.16 Nearest Garden 1.22 Nearest Milk Animal - Nearest Meat Animal (Cow) 3.48
ESE	Nearest Residence 0.63 Nearest Garden 0.63 Nearest Milk Animal (Cow) 3.07 Nearest Meat Animal (Cow) 1.30	WNW	Nearest Residence 0.89 Nearest Garden 1.15 Nearest Milk Animal - Nearest Meat Animal -
SE	Nearest Residence 1.17 Nearest Garden 1.21 Nearest Milk Animal - Nearest Meat Animal (Cow) 2.02	NW	Nearest Residence 0.93 Nearest Garden 1.37 Nearest Milk Animal - Nearest Meat Animal (Cow) 3.85
SSE	Nearest Residence 1.06 Nearest Garden 1.26 Nearest Milk Animal (Cow) 2.76 Nearest Meat Animal (Cow) 1.48	NNW	Nearest Residence 1.53 Nearest Garden 1.77 Nearest Milk Animal - Nearest Meat Animal (Cow) 3.67

“-“ indicates no occurrences within the 5 mile radius



4.0 EVALUATION OF DOSE

4.1 DOSE FROM ENVIRONMENTAL MEASUREMENTS

Doses were estimated for measured concentrations of radionuclides in direct pathways to man using NRC Regulatory Guide 1.109 methodology and factors. A dose factor of zero was used when the Reg. Guide listed "NO DATA" for a factor. The highest annual mean values for each sample type and radionuclide as given in Appendix B were used after the background concentrations, as measured at the control location, had been subtracted. The maximum exposed individual doses are summarized in Tables 4.1-A and 4.1-B. Dose calculations sheets for each age and pathway that indicated environmental doses greater than zero can be found following Tables 4.1-A and 4.1-B.

4.2 ESTIMATED DOSE FROM RELEASES

Throughout the year, dose estimates were calculated based on actual 1999 liquid and gaseous effluent release data. Effluent-based dose estimates were calculated using the RETDAS computer program which employs methodology and data presented in NRC Regulatory Guide 1.109. The 1999 MNS Annual Radioactive Effluent Release Report (reference 6.6) includes calendar year dose estimates for the location with the highest individual organ dose from liquid and gaseous effluent releases. These reported doses are shown in Table 4.1-A along with the corresponding REMP-based dose estimates.

The effluent-based liquid release doses are summations of the dose contributions from the drinking water, fish, and shoreline pathways. The effluent-based gaseous release doses report noble gas exposure separately from iodine, particulate, and tritium exposure. For noble gas exposure there is no critical age group; as the maximum exposed individuals are assumed to receive the same doses, regardless of their age group. For iodine, particulate, and tritium exposure the effluent-based gaseous release doses are summations of the dose contributors from ground/plane, inhalation and vegetation pathways.

4.3 COMPARISON OF DOSES

The environmental and release data doses given in Table 4.1-A agree reasonably well. The similarity of the doses indicate that the radioactivity levels in the environment do not differ significantly from those expected based on effluent measurements and modeling of the environmental exposure pathways. This indicates that effluent program dose estimates are both valid and reasonably conservative.

In calculations based on liquid release effluent pathways, drinking water consumption was the predominant dose path based on effluent data for 1999. For 1999 environmental

samples, drinking water also was the predominant dose path. The only radionuclide detected in drinking water in 1999 was tritium. The only radionuclides detected in fish in 1999 were Cs-137 and Co-58. Tritium from surface water samples also was included in the fish pathway.

No environmental doses resulted from the gaseous pathway in 1999. Broadleaf vegetation, milk, and airborne radioiodines and particulates indicated no activity in 1999. The effluent dose for iodine, particulate, and tritium is primarily based on the vegetation pathway to the child.

The doses calculated do not exceed the 40CFR190 dose commitment limits for members of the public. Doses to members of the public attributable to the operation of MNS are being maintained well within regulatory limits.

TABLE 4.1-A

**MCGUIRE NUCLEAR STATION
1999 ENVIRONMENTAL AND EFFLUENT DOSE COMPARISON**

LIQUID RELEASE PATHWAY

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Location	Maximum Dose* (mrem)
Skin	Environmental	Teen	Shoreline Sediment	130 (0.5 mi SW)	9.10E-04
Skin	Effluent	Teen	Shoreline Sediment	0.5 mi ENE	1.12E-03
Bone	Environmental	Teen	Shoreline Sediment	130 (0.5 mi SW)	1.13E-03
Bone	Effluent	Child	Fish	0.5 mi ENE	1.38E-02
Liver	Environmental	Child	Drinking Water	101 (3.3 mi E)	5.82E-02
Liver	Effluent	Child	Drinking Water	0.5 mi ENE	7.86E-02
T. Body	Environmental	Child	Drinking Water	101 (3.3 mi E)	5.91E-02
T. Body	Effluent	Child	Drinking Water	0.5 mi ENE	6.77E-02
Thyroid	Environmental	Child	Drinking Water	101 (3.3 mi E)	5.77E-02
Thyroid	Effluent	Child	Drinking Water	0.5 mi ENE	6.53E-02
Kidney	Environmental	Child	Drinking Water	101 (3.3 mi E)	5.77E-02
Kidney	Effluent	Child	Drinking Water	0.5 mi ENE	6.94E-02
Lung	Environmental	Child	Drinking Water	101 (3.3 mi E)	5.77E-02
Lung	Effluent	Child	Drinking Water	0.5 mi ENE	6.67E-02
GI-LLI	Environmental	Child	Drinking Water	101 (3.3 mi E)	6.03E-02
GI-LLI	Effluent	Child	Drinking Water	0.5 mi ENE	6.84E-02

* Maximum dose is a summation of the fish, drinking water and shoreline sediment pathways.

GASEOUS RELEASE PATHWAY

IODINE, PARTICULATE, and TRITIUM

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Location	Maximum Dose* (mrem)
Skin	Environmental	-	-	-	0.00E+00
Skin	Effluent	All	Ground/Plane	0.5 mi E	5.87E-03
Bone	Environmental	-	-	-	0.00E+00
Bone	Effluent	All	Ground/Plane	0.5 mi E	4.99E-03
Liver	Environmental	-	-	-	0.00E+00
Liver	Effluent	Child	Vegetation	0.5 mi E	4.46E-01
T. Body	Environmental	-	-	-	0.00E+00
T. Body	Effluent	Child	Vegetation	0.5 mi E	4.46E-01
Thyroid	Environmental	-	-	-	0.00E+00
Thyroid	Effluent	Child	Vegetation	0.5 mi E	4.45E-01
Kidney	Environmental	-	-	-	0.00E+00
Kidney	Effluent	Child	Vegetation	0.5 mi E	4.45E-01
Lung	Environmental	-	-	-	0.00E+00
Lung	Effluent	Child	Vegetation	0.5 mi E	4.46E-01
GI-LLI	Environmental	-	-	-	0.00E+00
GI-LLI	Effluent	Child	Vegetation	0.5 mi E	4.46E-01

* Maximum dose is a summation of the ground/plane, inhalation, milk and vegetation pathways.

NOBLE GAS

Air Dose	Environmental or Effluent Data	Critical Age	Critical Pathway	Location	Maximum Dose (mrad)
Beta Beta	Environmental Effluent	- N/A	- Noble Gas	- 0.5 mi NNE	Not Sampled 3.10E-02
Gamma Gamma	Environmental Effluent	- N/A	- Noble Gas	- 0.5 mi NNE	Not Sampled 8.02E-02

TABLE 4.1-B*Maximum Individual Dose for 1999 based on Environmental Measurements (mrem) for McGuire Nuclear Station*

Age	Sample Medium	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Skin
Infant	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	<u>TOTAL</u>	0.00E+00	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02	0.00E+00
Child	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	5.68E-02	5.68E-02	5.68E-02	5.68E-02	5.68E-02	5.68E-02	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Broadleaf Vegetation	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Fish	0.00E+00	1.14E-03	2.05E-03	7.06E-04	7.06E-04	7.06E-04	3.26E-03	0.00E+00
	<u>Shoreline Sediment</u>	2.37E-04	2.37E-04	2.37E-04	2.37E-04	2.37E-04	2.37E-04	2.37E-04	2.78E-04
	<u>TOTAL</u>	2.37E-04	5.82E-02	5.91E-02	5.77E-02	5.77E-02	5.77E-02	6.03E-02	2.78E-04
Teen	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	2.97E-02	2.97E-02	2.97E-02	2.97E-02	2.97E-02	2.97E-02	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Broadleaf Vegetation	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Fish	0.00E+00	1.40E-03	2.12E-03	8.55E-04	8.55E-04	8.55E-04	8.42E-03	0.00E+00
	<u>Shoreline Sediment</u>	1.13E-03	1.13E-03	1.13E-03	1.13E-03	1.13E-03	1.13E-03	1.13E-03	1.33E-03
	<u>TOTAL</u>	1.13E-03	3.22E-02	3.30E-02	3.17E-02	3.17E-02	3.17E-02	3.93E-02	1.33E-03
Adult	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	4.21E-02	4.21E-02	4.21E-02	4.21E-02	4.21E-02	4.21E-02	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Broadleaf Vegetation	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Fish	0.00E+00	1.66E-03	2.35E-03	1.11E-03	1.11E-03	1.11E-03	1.23E-02	0.00E+00
	<u>Shoreline Sediment</u>	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.38E-04
	<u>TOTAL</u>	2.03E-04	4.40E-02	4.47E-02	4.34E-02	4.34E-02	4.34E-02	5.46E-02	2.38E-04

Note: Dose tables are provided for sample media displaying positive nuclide occurrence.

Radionuclide	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Water (pCi/l)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.99E-05	4.51E-06	NO DATA	4.41E-06	NO DATA	7.31E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	3.60E-06	8.98E-06	NO DATA	NO DATA	NO DATA	8.97E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	3.08E-05	5.38E-05	2.12E-05	NO DATA	NO DATA	1.59E-05	2.57E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	NO DATA	1.08E-05	2.55E-05	NO DATA	NO DATA	NO DATA	2.57E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	1.84E-05	6.31E-05	2.91E-05	NO DATA	3.06E-05	NO DATA	5.33E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	4.20E-08	1.73E-08	1.00E-08	NO DATA	1.24E-08	NO DATA	1.46E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	2.06E-07	5.02E-08	3.56E-08	NO DATA	5.41E-08	NO DATA	2.50E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	NO DATA	1.51E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	3.77E-04	7.03E-04	7.10E-05	NO DATA	1.81E-04	7.42E-05	1.91E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	5.22E-04	6.11E-04	4.33E-05	NO DATA	1.64E-04	6.64E-05	1.91E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	1.71E-04	1.71E-07	8.81E-06	NO DATA	4.06E-08	1.05E-07	4.20E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	NO DATA	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	101	549.00	0.00E+00	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02
Dose Commitment (mrem) =										0.00E+00	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02	5.58E-02

McGuire Nuclear Station
Dose from Drinking Water Pathway for 1999 Data
Maximum Exposed Child

Child Dose from Drinking Water Pathway (mrem) = Usage (l) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/l)

Usage (intake in one year) = 510 l

Radionuclide	<u>Ingestion Dose Factor</u>							<u>Highest Annual Net Mean Concentration</u>		<u>Dose (mrem)</u>						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Water (pCi/l)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.07E-05	2.85E-06	NO DATA	3.00E-06	NO DATA	8.98E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C0-60	NO DATA	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	4.21E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	NO DATA	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	101	549.00	0.00E+00	5.68E-02	5.68E-02	5.68E-02	5.68E-02	5.68E-02	5.68E-02
Dose Commitment (mrem) =										0.00E+00	5.68E-02	5.68E-02	5.68E-02	5.68E-02	5.68E-02	5.68E-02

McGuire Nuclear Station
Dose from Fish Pathway for 1999 Data
Maximum Exposed Child

Child Dose from Fish Pathway (mrem) = Usage (kg) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

H-3 Concentration in Fish = Surface Water pCi/l x Bioaccumulation Factor 0.9 pCi/kg per pCi/l = 560 pCi/l x 0.9 = 504 pCi/kg

Usage (intake in one year) = 6.9 kg

Radionuclide	<u>Ingestion Dose Factor</u>							<u>Highest Annual Net Mean Concentration</u>		<u>Dose (mrem)</u>						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Fish (pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.07E-05	2.85E-06	NO DATA	3.00E-06	NO DATA	8.98E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-05	129	35.30	0.00E+00	4.38E-04	1.34E-03	0.00E+00	0.00E+00	0.00E+00	2.56E-03
Fe-59	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C0-60	NO DATA	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	NO DATA	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	128	504.00	0.00E+00	7.06E-04	7.06E-04	7.06E-04	7.06E-04	7.06E-04	7.06E-04
Dose Commitment (mrem) =										0.00E+00	1.14E-03	2.05E-03	7.06E-04	7.06E-04	7.06E-04	3.26E-03

McGuire Nuclear Station
Dose from Shoreline Sediment Pathway for 1999 Data
Maximum Exposed Child

Shoreline Recreation = 14 hr (in one year)
Shore Width Factor = 0.3 (lake shore - location 129)
Shore Width Factor = 0.2 (river shoreline - location 130)
Sediment Surface Mass = 40 kg/m²

Child Dose from Shoreline Sediment Pathway (mrem) = Shoreline Recreation (hr) x External
Dose Factor (mrem/hr per pCi/m²) x Shore Width Factor x Sediment Surface Mass (kg/m²) x
Sediment Concentration (pCi/kg)

<u>External Dose Factor Standing on Contaminated Ground</u>			<u>Highest Annual Net Mean Concentration</u>		<u>Dose</u>	
Radionuclide	(mrem/hr per pCi/m ²)		Indicator Location	Sediment (pCi/kg)	(mrem)	
	T. Body	Skin			T. Body	Skin
Co-58	7.00E-09	8.20E-09	129	24.70	2.90E-05	3.40E-05
Co-60	1.70E-08	2.00E-08	130	84.90	1.62E-04	1.90E-04
Cs-134	1.20E-08	1.40E-08	ALL	0.00	0.00E+00	0.00E+00
Cs-137	4.20E-09	4.90E-09	129	65.10	4.59E-05	5.36E-05
Dose Commitment (mrem) =					2.37E-04	2.78E-04

McGuire Nuclear Station
Dose from Drinking Water Pathway for 1999 Data
Maximum Exposed Teen

Teen Dose from Drinking Water Pathway (mrem) = Usage (l) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/l)

Usage (intake in one year) = 510 l

Radionuclide	<u>Ingestion Dose Factor</u>							<u>Highest Annual Net Mean Concentration</u>		<u>Dose (mrem)</u>						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Water (pCi/l)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	3.24E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	NO DATA	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	101	549.00	0.00E+00	2.97E-02	2.97E-02	2.97E-02	2.97E-02	2.97E-02	2.97E-02
Dose Commitment (mrem)=										0.00E+00	2.97E-02	2.97E-02	2.97E-02	2.97E-02	2.97E-02	2.97E-02

McGuire Nuclear Station
Dose from Fish Pathway for 1999 Data
Maximum Exposed Teen

Teen Dose from Fish Pathway (mrem) = Usage (kg) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

H-3 Concentration in Fish = Surface Water pCi/l x Bioaccumulation Factor 0.9 pCi/kg per pCi/l = 560 pCi/l x 0.9 = 504 pCi/kg

Usage (intake in one year) = 16 kg

Radionuclide	<u>Ingestion Dose Factor</u>							<u>Highest Annual Net Mean Concentration</u>		<u>Dose (mrem)</u>						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location	(pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-05	129	35.30	0.00E+00	5.49E-04	1.27E-03	0.00E+00	0.00E+00	0.00E+00	7.57E-03
Fe-59	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	3.24E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	NO DATA	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	128	504.00	0.00E+00	8.55E-04	8.55E-04	8.55E-04	8.55E-04	8.55E-04	8.55E-04
Dose Commitment (mrem) =										0.00E+00	1.40E-03	2.12E-03	8.55E-04	8.55E-04	8.55E-04	8.42E-03

McGuire Nuclear Station
Dose from Shoreline Sediment Pathway for 1999 Data
Maximum Exposed Teen

Shoreline Recreation = 67 hr (in one year)
 Shore Width Factor = 0.3 (lake shore - location 129)
 Shore Width Factor = 0.2 (river shoreline - location 130)
 Sediment Surface Mass = 40 kg/m²

Teen Dose from Shoreline Sediment Pathway (mrem) = Shoreline Recreation (hr) x External
 Dose Factor (mrem/hr per pCi/m²) x Shore Width Factor x Sediment Surface Mass (kg/m²) x
 Sediment Concentration (pCi/kg)

External Dose Factor Standing on Contaminated Ground			Highest Annual Net Mean Concentration		Dose	
Radionuclide	(mrem/hr per pCi/m ²)		Indicator Location	Sediment (pCi/kg)	(mrem)	
	T. Body	Skin			T. Body	Skin
Co-58	7.00E-09	8.20E-09	129	24.70	1.39E-04	1.63E-04
Co-60	1.70E-08	2.00E-08	130	84.90	7.74E-04	9.10E-04
Cs-134	1.20E-08	1.40E-08	ALL	0.00	0.00E+00	0.00E+00
Cs-137	4.20E-09	4.90E-09	129	65.10	2.20E-04	2.56E-04
Dose Commitment (mrem) =					1.13E-03	1.33E-03

McGuire Nuclear Station
Dose from Drinking Water Pathway for 1999 Data
Maximum Exposed Adult

Adult Dose from Drinking Water Pathway (mrem) = Usage (l) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/l)

Usage (intake in one year) = 730 l

Radionuclide	<u>Ingestion Dose Factor</u>							<u>Highest Annual Net Mean Concentration</u>		<u>Dose (mrem)</u>						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Water (pCi/l)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	NO DATA	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	101	549.00	0.00E+00	4.21E-02	4.21E-02	4.21E-02	4.21E-02	4.21E-02	4.21E-02
Dose Commitment (mrem) =										0.00E+00	4.21E-02	4.21E-02	4.21E-02	4.21E-02	4.21E-02	4.21E-02

Radionuclide	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location	(pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05	129	35.30	0.00E+00	5.52E-04	1.24E-03	0.00E+00	0.00E+00	0.00E+00	1.12E-02
Fe-59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	NO DATA	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-05	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	128	504.00	0.00E+00	1.11E-03	1.11E-03	1.11E-03	1.11E-03	1.11E-03	1.11E-03
Dose Commitment (mrem) =										0.00E+00	1.66E-03	2.35E-03	1.11E-03	1.11E-03	1.11E-03	1.23E-02

McGuire Nuclear Station
Dose from Shoreline Sediment Pathway for 1999 Data
Maximum Exposed Adult

Shoreline Recreation = 12 hr (in one year)
 Shore Width Factor = 0.3 (lake shore - location 129)
 Shore Width Factor = 0.2 (river shoreline - location 130)
 Sediment Surface Mass = 40 kg/m²

Adult Dose from Shoreline Sediment Pathway (mrem) = Shoreline Recreation (hr) x External
 Dose Factor (mrem/hr per pCi/m²) x Shore Width Factor x Sediment Surface Mass (kg/m²) x
 Sediment Concentration (pCi/kg)

External Dose Factor Standing on Contaminated Ground			Highest Annual Net Mean Concentration		Dose (mrem)	
Radionuclide	(mrem/hr per pCi/m ²)		Indicator Location	Sediment (pCi/kg)	T. Body	Skin
	T. Body	Skin				
Co-58	7.00E-09	8.20E-09	129	24.70	2.49E-05	2.92E-05
Co-60	1.70E-08	2.00E-08	130	84.90	1.39E-04	1.63E-04
Cs-134	1.20E-08	1.40E-08	ALL	0.00	0.00E+00	0.00E+00
Cs-137	4.20E-09	4.90E-09	129	65.10	3.94E-05	4.59E-05
Dose Commitment (mrem) =					2.03E-04	2.38E-04

5.0 QUALITY ASSURANCE

5.1 SAMPLE COLLECTION

EnRad Laboratories, Fisheries, and Aquatic Ecology performed the environmental sample collections as specified by approved sample collection procedures.

5.2 SAMPLE ANALYSIS

EnRad Laboratories performed the environmental sample analyses as specified by approved analysis procedures. EnRad Laboratories is located in Huntersville, North Carolina, at Duke Power Company's Environmental Center.



Duke Power Company's
Environmental Center

5.3 DOSIMETRY ANALYSIS

The Radiation Dosimetry and Records group performed environmental dosimetry measurements as specified by approved dosimetry analysis procedures.

5.4 LABORATORY EQUIPMENT QUALITY ASSURANCE

5.4.1 DAILY QUALITY CONTROL

EnRad Laboratories has an internal quality assurance program which monitors each type of instrumentation for reliability and accuracy. Daily quality control checks ensure that instruments are in proper working order and these checks are used to monitor instrument performance.

5.4.2 CALIBRATION VERIFICATION

National Institute of Standards and Technology (NIST) standards that represent counting geometries are analyzed as unknowns at various frequencies ranging from weekly to annually to verify that efficiency calibrations are valid. The frequency is dependent upon instrument use and performance. Investigations are performed and documented should calibration verification data fall out of limits.

5.4.3 BATCH PROCESSING

Method quality control samples are analyzed with sample analyses that are processed in batches. These include gross beta in drinking water and all tritium analyses.

5.5 DUKE POWER INTERCOMPARISON PROGRAM

EnRad Laboratories participated in the Duke Power Nuclear Generation Department Intercomparison Program during 1999. Interlaboratory cross-check standards, including, Marinelli beakers, air filters, air cartridges, gross beta on smears, and tritium in water samples were analyzed at various times of the year by the four counting laboratories in Duke Power Company for this program. A summary of these Intercomparison Reports for 1999 is documented in Table 5.0.

5.6 DUKE POWER AUDITS

EnRad Laboratories participated in a laboratory assessment conducted by the Duke Power Corporate Radiation Protection in April, 1999. Laboratory practices and procedures were reviewed. No significant problems were identified as a result of this assessment.

5.7 U.S. NUCLEAR REGULATORY COMMISSION INSPECTIONS

The McGuire Nuclear Station Radiological Environmental Monitoring Program was audited by the NRC in 1999 [NRC Audit 9908 10/24 – 12/11/1999]. There were no findings from this audit. EnRad Laboratories was not audited by the NRC in 1999.

5.8 STATE OF NORTH CAROLINA INTERCOMPARISON PROGRAM

EnRad Laboratories routinely participates with the State of North Carolina Department of Environmental Health and Natural Resources (DEHNR) in an intercomparison program. EnRad Laboratories sends air, water, milk, vegetation, sediment, and fish samples which have been collected to the State of North Carolina Radiation Protection Section for intercomparison analysis.

5.9 TLD INTERCOMPARISON PROGRAM

Radiation Dosimetry and Records normally participates in a TLD intercomparison program with the State of North Carolina Radiation Protection section. This intercomparison was not performed during 1999. A new program with an outside laboratory was established beginning in 2000.

TABLE 5.0

DUKE POWER COMPANY INTERLABORATORY COMPARISON PROGRAM

1999 CROSS-CHECK RESULTS FOR ENRAD LABORATORIES

Cross-Check samples are normally analyzed a minimum of three times. A status of "3 Pass" indicates that all three analyses yielded results within the designated acceptance range. A status of "1 Pass" indicates that one analysis of the cross-check was performed.

Gamma in Water 3.5 liters

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
3/3/99	Q991GWSL	Cr-51	1.13 - 2.00 E5	1.51 E5	1.49 E5	3 Pass
		Mn-54	3.07 - 5.45 E4	4.09 E4	4.24 E4	3 Pass
		Fe-59	1.94 - 3.44 E4	2.59 E4	2.75 E4	3 Pass
		Co-60	3.55 - 6.30 E4	4.74 E4	4.77 E4	3 Pass
		Zn-65	3.97 - 7.04 E4	5.29 E4	5.54 E4	3 Pass
		Cs-134	2.25 - 3.98 E4	2.99 E4	2.70 E4	3 Pass
		Cs-137	4.68 - 8.29 E4	6.23 E4	5.97 E4	3 Pass
		Ce-141	4.76 - 8.45 E4	6.35 E4	6.37 E4	3 Pass
6/2/99	Q992GWR	Cr-51	2.09 - 6.73 E2	3.74 E2	4.31 E2	3 Pass
		Mn-54	0.61 - 1.08 E3	8.10 E2	8.67 E2	3 Pass
		Fe-59	0.96 - 2.44 E2	1.52 E2	1.88 E2	3 Pass
		Co-60	0.83 - 1.48 E3	1.11 E3	1.17 E3	3 Pass
		Zn-65	0.74 - 1.32 E3	9.89 E2	1.04 E3	3 Pass
		Cs-134	5.00 - 8.86 E2	6.66 E2	6.34 E2	3 Pass
		Cs-137	1.12 - 1.99 E3	1.50 E3	1.47 E3	3 Pass
		Ce-141	1.65 - 2.93 E2	2.21 E2	2.20 E2	3 Pass
8/20/99	Q993GWSL	Cr-51	0.63 - 1.11 E5	8.35 E4	8.48 E4	3 Pass
		Mn-54	3.29 - 5.84 E4	4.39 E4	4.60 E4	3 Pass
		Fe-59	2.33 - 4.13 E4	3.11 E4	3.26 E4	3 Pass
		Co-60	2.35 - 4.16 E4	3.13 E4	3.20 E4	3 Pass
		Zn-65	3.24 - 5.75 E4	4.32 E4	4.49 E4	3 Pass
		Cs-134	1.79 - 3.17 E4	2.38 E4	2.24 E4	3 Pass
		Cs-137	3.92 - 6.94 E4	5.22 E4	5.19 E4	3 Pass
		Ce-141	0.73 - 1.30 E5	9.78 E4	9.91 E4	3 Pass
12/3/99	Q994GWR	Cr-51	3.18 - 5.64 E2	4.24 E2	4.83 E2	3 Pass
		Mn-54	1.83 - 3.25 E3	2.44 E3	2.68 E3	3 Pass
		Fe-59	3.21 - 5.68 E2	4.27 E2	4.81 E2	3 Pass
		Co-60	1.59 - 2.81 E3	2.12 E3	2.23 E3	3 Pass
		Zn-65	1.69 - 3.00 E3	2.25 E3	2.42 E3	3 Pass
		Cs-134	1.14 - 2.02 E3	1.52 E3	1.41 E3	3 Pass
		Cs-137	2.73 - 4.85 E3	3.64 E3	3.69 E3	3 Pass
		Ce-141	5.49 - 9.73 E2	7.32 E2	7.64 E2	3 Pass

Gamma in Water 1.0 liter

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
3/3/99	Q991GWSL	Cr-51	1.13 - 2.00 E5	1.51 E5	1.52 E5	3 Pass
		Mn-54	3.07 - 5.45 E4	4.09 E4	4.27 E4	3 Pass
		Fe-59	1.94 - 3.44 E4	2.59 E4	2.76 E4	3 Pass
		Co-60	3.55 - 6.30 E4	4.74 E4	4.81 E4	3 Pass
		Zn-65	3.97 - 7.04 E4	5.29 E4	5.58 E4	3 Pass
		Cs-134	2.25 - 3.98 E4	2.99 E4	2.72 E4	3 Pass
		Cs-137	4.68 - 8.29 E4	6.23 E4	6.01 E4	3 Pass
		Ce-141	4.76 - 8.45 E4	6.35 E4	6.47 E4	3 Pass
6/2/99	Q992GWR	Cr-51	2.09 - 6.73 E2	3.74 E2	5.12 E2	3 Pass
		Mn-54	0.61 - 1.08 E3	8.10 E2	8.62 E2	3 Pass
		Fe-59	0.96 - 2.44 E2	1.52 E2	1.85 E2	3 Pass
		Co-60	0.83 - 1.48 E3	1.11 E3	1.20 E3	3 Pass
		Zn-65	0.74 - 1.32 E3	9.89 E2	1.09 E3	3 Pass
		Cs-134	5.00 - 8.86 E2	6.66 E2	6.09 E2	3 Pass
		Cs-137	1.12 - 1.99 E3	1.50 E3	1.49 E3	3 Pass
		Ce-141	1.65 - 2.93 E2	2.21 E2	2.28 E2	3 Pass
8/20/99	Q993GWSL	Cr-51	0.63 - 1.11 E5	8.35 E4	8.50 E4	3 Pass
		Mn-54	3.29 - 5.84 E4	4.39 E4	4.59 E4	3 Pass
		Fe-59	2.33 - 4.13 E4	3.11 E4	3.33 E4	3 Pass
		Co-60	2.35 - 4.16 E4	3.13 E4	3.22 E4	3 Pass
		Zn-65	3.24 - 5.75 E4	4.32 E4	4.54 E4	3 Pass
		Cs-134	1.79 - 3.17 E4	2.38 E4	2.12 E4	3 Pass
		Cs-137	3.92 - 6.94 E4	5.22 E4	5.07 E4	3 Pass
		Ce-141	0.73 - 1.30 E5	9.78 E4	9.80 E4	3 Pass
12/3/99	Q994GWR	Cr-51	2.12 - 8.48 E2	4.24 E2	6.16 E2	3 Pass
		Mn-54	1.83 - 3.25 E3	2.44 E3	2.59 E3	3 Pass
		Fe-59	3.21 - 5.68 E2	4.27 E2	4.47 E2	3 Pass
		Co-60	1.59 - 2.81 E3	2.12 E3	2.18 E3	3 Pass
		Zn-65	1.69 - 3.00 E3	2.25 E3	2.44 E3	3 Pass
		Cs-134	1.14 - 2.02 E3	1.52 E3	1.35 E3	3 Pass
		Cs-137	2.73 - 4.85 E3	3.64 E3	3.60 E3	3 Pass
		Ce-141	5.49 - 9.73 E2	7.32 E2	7.26 E2	3 Pass

Gamma in Water 0.5 liter

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
3/3/99	Q991GWSL	Cr-51	1.13 - 2.00 E5	1.51 E5	1.46 E5	3 Pass
		Mn-54	3.07 - 5.45 E4	4.09 E4	4.29 E4	3 Pass
		Fe-59	1.94 - 3.44 E4	2.59 E4	2.79 E4	3 Pass
		Co-60	3.55 - 6.30 E4	4.74 E4	4.76 E4	3 Pass
		Zn-65	3.97 - 7.04 E4	5.29 E4	5.68 E4	3 Pass
		Cs-134	2.25 - 3.98 E4	2.99 E4	2.60 E4	3 Pass
		Cs-137	4.68 - 8.29 E4	6.23 E4	5.94 E4	3 Pass
		Ce-141	4.76 - 8.45 E4	6.35 E4	6.29 E4	3 Pass

Gamma in Water 0.5 liter continued

6/2/99	Q992GWR	Cr-51	2.09 - 6.73 E2	3.74 E2	5.23 E2	3 Pass
		Mn-54	0.61 - 1.08 E3	8.10 E2	8.66 E2	3 Pass
		Fe-59	0.96 - 2.44 E2	1.52 E2	1.74 E2	3 Pass
		Co-60	0.83 - 1.48 E3	1.11 E3	1.16 E3	3 Pass
		Zn-65	0.74 - 1.32 E3	9.89 E2	1.06 E3	3 Pass
		Cs-134	5.00 - 8.86 E2	6.66 E2	5.71 E2	3 Pass
		Cs-137	1.12 - 1.99 E3	1.50 E3	1.43 E3	3 Pass
		Ce-141	1.65 - 2.93 E2	2.21 E2	2.47 E2	3 Pass
8/20/99	Q993GWSL	Cr-51	0.63 - 1.11 E5	8.35 E4	8.42 E4	3 Pass
		Mn-54	3.29 - 5.84 E4	4.39 E4	4.59 E4	3 Pass
		Fe-59	2.33 - 4.13 E4	3.11 E4	3.32 E4	3 Pass
		Co-60	2.35 - 4.16 E4	3.13 E4	3.21 E4	3 Pass
		Zn-65	3.24 - 5.75 E4	4.32 E4	4.61 E4	3 Pass
		Cs-134	1.79 - 3.17 E4	2.38 E4	2.09 E4	3 Pass
		Cs-137	3.92 - 6.94 E4	5.22 E4	5.05 E4	3 Pass
		Ce-141	0.73 - 1.30 E5	9.78 E4	9.73 E4	3 Pass
12/3/99	Q994GWR	Cr-51	3.18 - 5.64 E2	4.24 E2	4.36 E2	3 Pass
		Mn-54	1.83 - 3.25 E3	2.44 E3	2.55 E3	3 Pass
		Fe-59	3.21 - 5.68 E2	4.27 E2	4.82 E2	3 Pass
		Co-60	1.59 - 2.81 E3	2.12 E3	2.13 E3	3 Pass
		Zn-65	1.69 - 3.00 E3	2.25 E3	2.38 E3	3 Pass
		Cs-134	1.14 - 2.02 E3	1.52 E3	1.36 E3	3 Pass
		Cs-137	2.73 - 4.85 E3	3.64 E3	3.54 E3	3 Pass
		Ce-141	5.49 - 9.73 E2	7.32 E2	7.24 E2	3 Pass

Gamma in Filter

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/total	Reference Value pCi/total	Mean Reported Value pCi/total	Cross Check Status
6/24/99	E1802-37	Cr-51	1.91 - 3.39 E2	2.55 E2	2.47 E2	3 Pass
		Mn-54	0.75 - 1.33 E2	1.00 E2	1.15 E2	3 Pass
		Fe-59	4.28 - 7.58 E1	5.70 E1	7.73 E1	2/3 High
		Co-60	1.90 - 3.36 E2	2.53 E2	2.76 E2	3 Pass
		Zn-65	1.09 - 1.93 E2	1.45 E2	1.72 E2	3 Pass
		Cs-134	1.02 - 1.81 E2	1.36 E2	1.21 E2	3 Pass
		Cs-137	1.67 - 2.97 E2	2.23 E2	2.30 E2	3 Pass
		Ce-141	1.49 - 2.65 E2	1.99 E2	2.04 E2	3 Pass

Iodine in Water

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
1/29/99	Q991LIW1	I-131	1.71 - 3.04 E1	2.28 E1	2.36 E1	3 Pass
1/29/99	Q991LIW2	I-131	0.69 - 1.22 E1	9.17 E0	9.49 E0	3 Pass
1/29/99	Q991LIW3	I-131	0.60 - 1.06 E2	7.95 E1	8.52 E1	3 Pass

Iodine in Milk

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
3/15/99	Q991LIM1	I-131	2.17 - 3.84 E1	2.89 E1	3.05 E1	3 Pass
3/15/99	Q991LIM2	I-131	0.00 - 0.00 E0	0.00 E0	0.00 E0	3 Pass
3/15/99	Q991LIM3	I-131	0.65 - 1.15 E2	8.63 E1	8.40 E1	3 Pass
6/10/99	Q992LIM-1	I-131	0.00 - 0.00 E0	0.00 E0	0.00 E0	3 Pass
6/10/99	Q992LIM-2	I-131	0.72 - 1.27 E3	9.53 E2	9.17 E2	3 Pass
6/10/99	Q992LIM-3	I-131	0.80 - 3.19 E0	1.60 E0	2.15 E0	3 Pass
8/31/99	Q993LIM-1	I-131	0.00 - 0.00 E0	0.00 E0	0.00 E0	3 Pass
8/31/99	Q993LIM-2	I-131	1.88 - 3.33 E1	2.50 E1	2.35 E1	3 Pass
8/31/99	Q993LIM-3	I-131	5.41 - 9.59 E1	7.21 E1	7.03 E1	3 Pass

Iodine Cartridge

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/total	Reference Value pCi/total	Mean Reported Value pCi/total	Cross Check Status
6/24/99	E1803-37	I-131	0.57 - 1.01 E2	7.60 E1	7.79 E1	3 Pass

Beta in Water

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
3/18/99	E1676-37	Beta	1.51 - 2.67 E2	2.01 E2	1.88 E2	1 Pass
9/23/99	E1879-37	Beta	2.03 - 3.60 E2	2.71 E2	1.98 E2	2/3 Low

Beta Smear

Reference Date	Sample I.D.	Nuclide	Acceptance Range uCi/total	Reference Value uCi/total	Mean Reported Value uCi/total	Cross Check Status
5/14/99	A12034-37	Beta	4.58 - 8.11 E-3	6.10 E-3	5.99 E-3	3 Pass
5/14/99	A12043-04	Beta	4.02 - 7.13 E-3	5.36 E-3	5.50 E-3	4 Pass

Tritium in Water

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
3/3/99	Q991TWSL	H-3	3.99 - 7.08 E4	5.32 E4	5.42 E4	3 Pass
6/2/99	Q992TWR-1	H-3	2.63 - 4.66 E2	3.50 E2	4.02 E2	3 Pass
6/2/99	Q992TWR-2	H-3	4.42 - 7.83 E3	5.89 E3	5.68 E3	3 Pass
6/2/99	Q992TWR-3	H-3	0.75 - 1.33 E3	9.96 E2	9.48 E2	3 Pass
8/20/99	Q993TWSL	H-3	0.69 - 1.22 E5	9.17 E4	8.40 E4	3 Pass
12/1/99	Q994TWR1	H-3	0.63 - 1.11 E4	8.34 E3	7.63 E3	3 Pass
12/1/99	Q994TWR2	H-3	0.96 - 1.70 E3	1.28 E3	1.52 E3	3 Pass
12/1/99	Q994TWR3	H-3	2.63 - 4.66 E2	3.50 E2	3.95 E2	3 Pass

6.0 REFERENCES

- 6.1 McGuire Selected License Commitments
- 6.2 McGuire Technical Specifications
- 6.3 McGuire Updated Final Safety Analysis Report
- 6.4 Duke Power Company McGuire Offsite Dose Calculation Manual
- 6.5 McGuire Annual Radiological Environmental Operating Report 1979 - 1998
- 6.6 McGuire Annual Radioactive Effluent Release Report 1999
- 6.7 Probability and Statistics in Engineering and Management Science, Hines and Montgomery, 1969, pages 287-293.
- 6.8 Practical Statistics for the Physical Sciences, Havilcek and Crain, 1988, pages 83-93.
- 6.9 Nuclear Regulatory Commission Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purposes of Evaluating Compliance with 10CFR50, Appendix I.
- 6.10 EnRad Laboratories Operating Procedures
- 6.11 RETDAS, Radiological Effluent Tracking and Dose Assessment Software, Vertechs Version 3.5.0, Duke Power Revision # 3.0

APPENDIX A

ENVIRONMENTAL SAMPLING
&
ANALYSIS PROCEDURES

APPENDIX A

ENVIRONMENTAL SAMPLING AND ANALYSIS PROCEDURES

Adherence to established procedures for sampling and analysis of all environmental media at McGuire Nuclear Station was required to ensure compliance with Station Selected Licensee Commitments. Analytical procedures were employed to ensure that Selected Licensee Commitments detection capabilities were achieved.

Environmental sampling and analyses were performed by EnRad Laboratories, Dosimetry and Records, and Fisheries and Aquatic Ecology.

Section A.1 of this appendix describes the environmental sampling frequencies and analysis procedures by media type.

I. CHANGE OF SAMPLING PROCEDURES

Drinking water indicator location 101 was added to the program effective 4/6/1999.

In the environmental program, the air deposition parameters (D/Q) are used to determine air, broadleaf vegetation and milk sampling locations. McGuire's sectors with the three highest values did not change in 1999.

II. DESCRIPTION OF ANALYSIS PROCEDURES

Gamma spectroscopy analyses are performed using high purity germanium gamma detectors and Canberra analytical software. Designated sample volumes are transferred to appropriate counting geometries and analyzed by gamma spectroscopy. Perishable samples such as fish and broadleaf vegetation are ground to achieve a homogeneous mixture. Soils and sediments are dried, sifted to remove foreign objects (rocks, clams, glass, etc.) then transferred to appropriate counting geometry. Ten percent of samples receiving gamma analysis are analyzed as duplicate analyses.

Low-level iodine analyses are performed by passing a designated sample aliquot through an ion exchange resin to remove and concentrate any iodine in the aqueous sample (milk). The resin is then dried and transferred to appropriate counting geometry and analyzed by gamma spectroscopy.

Tritium analyses are performed quarterly by using low-level environmental liquid scintillation analysis technique on a Packard 2550 liquid scintillation system. Tritium

samples are batch processed with a tritium spike to verify instrument performance and sample preparation technique are acceptable.

Gross beta analysis is performed by concentrating a designated aliquot of sample precipitate and analyzing by gas-flow proportional counters. Samples are batch processed with a spike sample to verify instrument performance and a blank to ensure sample contamination has not occurred.

III. CHANGE OF ANALYSIS PROCEDURES

No analysis procedures were changed during 1999.

IV. SAMPLING AND ANALYSIS PROCEDURES

A.1 AIRBORNE PARTICULATE AND RADIOIODINE

Airborne particulate and radioiodine samples at each of seven locations were composited continuously by means of continuous air samplers. Air particulates were collected on a particulate filter and radioiodines were collected in a charcoal cartridge situated behind the filter in the sampler. The samplers are designed to operate at a constant flow rate (in order to compensate for any filter loading) and are set to sample approximately 2 cubic feet per minute. Filters and cartridges were collected weekly. A weekly gross beta analysis was performed on each filter and a weekly gamma analysis was performed on each charcoal cartridge. Filters were segregated by location and a quarterly gamma analysis was performed on the filter composite. The filter and charcoal cartridge were analyzed independently. The continuous composite samples were collected from the locations listed below.

Location 120	=	Site Boundary (0.5 mi. NNE)
Location 121	=	Site Boundary (0.5 mi. NE)
Location 125	=	Site Boundary (0.4 mi. SW)
Location 133	=	Cornelius, NC (6.2 mi. NE)
Location 134	=	East Lincoln Junior High School (8.8 mi. WNW)
Location 192	=	Peninsula development (2.8 mi. NNE)
Location 195	=	Fishing Access Road (0.2 mi. N)

A.2 DRINKING WATER

Biweekly composite samples were collected. A gross beta and gamma analysis was performed on monthly composites. Tritium analysis was performed on the quarterly composites. The composites were collected biweekly from the locations listed below.

Location 101	=	North Mecklenburg Water Supply (3.3 mi E)
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Location 119	=	Mt. Holly Municipal Water Supply (7.4 mi. SSW)
Location 132	=	Charlotte Municipal Water Supply (11.2 mi. SSE)
Location 136	=	Mooresville Municipal Water Supply (12.7 mi. NNE)
Location 194	=	East Lincoln Water Supply (6.7 mi. NNW)

A.3 SURFACE WATER

Biweekly composite samples were collected. A gamma analysis was performed on the monthly composites. Tritium analysis was performed on the quarterly composites sample. The composites were collected biweekly from the locations listed below.

Location 128	=	Discharge Canal Bridge (0.4 mi. NE)
Location 131	=	Cowans Ford Dam (0.6 mi. WNW)
Location 135	=	Plant Marshall Intake Canal (11.9 mi. N)

A.4 MILK

Biweekly grab samples were collected at each dairy. A gamma and low-level Iodine-131 analysis was performed on each sample. The biweekly grab samples were collected from the locations listed below.

Location 138	=	Henry Cook Dairy - COWS (3.1 mi. ESE)
Location 139	=	William Cook Dairy - COWS (2.5 mi. E)
Location 140	=	Kidd Dairy - COWS (2.8 mi. SSE)
Location 141	=	Lynch Dairy - COWS (14.8 mi. WNW)

A.5 BROADLEAF VEGETATION

Monthly samples were collected as available and a gamma analysis was performed on each sample. The samples were collected from the locations listed below.

Location 120	=	Site Boundary (0.5 mi. NNE)
Location 125	=	Site Boundary (0.4 mi. SW)
Location 134	=	East Lincoln Junior High School (8.8 mi. WNW)
Location 193	=	Site Boundary (0.2 mi. N)

A.6 FOOD PRODUCTS

Samples were collected monthly when available during the harvest season and a gamma analysis was performed on each. The samples were collected at the location listed below.

Location 188	=	Garden (2.8 mi N)
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A.7 FISH

Semiannual samples were collected and a gamma analysis was performed on the edible portions of each sample. Boney fish (i.e. Sunfish) were prepared whole minus the head and tail portions. The samples were collected from the locations listed below.

Location 129	=	Discharge Canal Entrance to Lake Norman (0.5 mi.ENE)
Location 137	=	Pinnacle Access Area (12.0 mi. N)

A.8 SHORELINE SEDIMENT

Semiannual samples were collected and a gamma analysis was performed on each following the drying and removal of rocks and clams. The samples were collected from the locations listed below.

Location 129	=	Discharge Canal Entrance to Lake Norman (0.5 mi. ENE)
Location 130	=	Highway 73 Bridge Downstream (0.5 mi. SW)
Location 137	=	Pinnacle Access Area (12.0 mi. N)

A.9 DIRECT GAMMA RADIATION (TLD)

Thermoluminescent dosimeters (TLD) were collected quarterly at forty-eight locations. A gamma exposure rate was determined for each TLD. The TLDs were placed as indicated below.

- * An inner ring of 14 TLDs at the site boundary, one in each available meteorological sector. The site boundary locations in the N and NNW sectors are over water; however, two special interest TLD's were placed in these sectors inside the site boundary in March, 1991.
- * An outer ring of 16 TLDs, one in each meteorological sector in the 6 to 8 kilometer range.
- * The remaining TLDs were placed in special interest areas such as population centers, residential areas, schools, and control locations.

TLD locations are listed in Table 2.1-B.

A.10 ANNUAL LAND USE CENSUS

An annual Land Use Census was conducted to identify within a distance of 8 kilometers (5.0 miles) from the station, the nearest location from the site boundary in each of the sixteen meteorological sectors, the following:

- * The Nearest Residence
- * The Nearest Meat Animal
- * The Nearest Garden greater than 50 square meters or 500 square feet
- * The Nearest Milk-giving Animal (cow, goat, etc.)

This census was initiated on June 16, 1999 and completed on June 18, 1999. Results are shown in Table 3.10.

APPENDIX B

**RADIOLOGICAL
ENVIRONMENTAL MONITORING
PROGRAM**

SUMMARY OF RESULTS

1999

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Air Particulate (pCi/m3)						134 (8.8 mi WNW)	
	BETA	363	1.00E-02	133	2.06E-2 (51/51)	3.47E-2 (52/52)	0
			8.37E-3 - 3.74E-2	(6.2 mi NE)	9.47E-3 - 3.60E-2	1.18E-2 - 9.36E-2	
	CS-134	28	5.00E-02		0.00 (0/4)	0.00 (0/4)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-137	28	6.00E-02		0.00 (0/4)	0.00 (0/4)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	I-131	28	7.00E-02		0.00 (0/4)	0.00 (0/4)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Air Radioiodine (pCi/m3)							
							134 (8.8 mi WNW)
CS-134	363	5.00E-02	0.00 (0/311)		0.00 (0/52)	0.00 (0/52)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-137	363	6.00E-02	0.00 (0/311)		0.00 (0/52)	7.66E-3 (1/52)	0
			0.00 - 0.00		0.00 - 0.00	7.66E-3 - 7.66E-3	
I-131	363	7.00E-02	0.00 (0/311)		0.00 (0/52)	0.00 (0/52)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Drinking Water (pCi/liter)							136 (12.7 mi NNE)
BALA-140	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
BETA	61	4	2.17 (43/48)	119	2.48 (11/13)	2.17 (10/13)	0
			0.93 - 4.84	(7.4 mi SSW)	1.07 - 4.84	0.94 - 3.94	
CO-58	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CO-60	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-134	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-137	61	18	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
FE-59	61	30	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
H-3	19	2000	381 (11/15)	101	549 (3/3)	0.00 (0/4)	0
			258 - 722	(3.29 mi E)	439 - 722	0.00 - 0.00	
I-131	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
MN-54	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
NB-95	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
ZN-65	61	30	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
ZR-95	61	15	0.00 (0/48)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Surface Water (pCi/liter)						135 (11.9 mi N)	
	BALA-140	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	CO-58	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	CO-60	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	CS-134	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	CS-137	39	18		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	FE-59	39	30		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	H-3	12	2000	128	498 (8/8)	560 (4/4)	0
				(0.4 mi NE)	304 - 807	390 - 807	
	I-131	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	MN-54	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	NB-95	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	ZN-65	39	30		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	
	ZR-95	39	15		0.00 (0/26)	0.00 (0/13)	0
					0.00 - 0.00	0.00 - 0.00	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Milk (pCi/liter)						141 (14.8 mi WNW)	
	BALA-140	104	15	0.00 (0/78)	0.00 (0/26)	0.00 (0/26)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	
	CS-134	104	15	0.00 (0/78)	0.00 (0/26)	0.00 (0/26)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	
	CS-137	104	18	0.00 (0/78)	0.00 (0/26)	0.00 (0/26)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	
	I-131	104	15	0.00 (0/78)	0.00 (0/26)	0.00 (0/26)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	
	LLI-131	104	1	0.00 (0/78)	0.00 (0/26)	0.00 (0/26)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Broadleaf Vegetation (pCi/kg-wet)						134 (8.8 mi WNW)	
	CS-134	28	60	0.00 (0/21)	0.00 (0/7)	0.00 (0/7)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	
	CS-137	28	80	0.00 (0/21)	0.00 (0/7)	0.00 (0/7)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	
	I-131	28	60	0.00 (0/21)	0.00 (0/7)	0.00 (0/7)	0
				0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Food Products (pCi/kg-wet)							No Control Location
CS-134	12	60	0.00 (0/12)		0.00 (0/12)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-137	12	80	0.00 (0/12)		0.00 (0/12)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
I-131	12	60	0.00 (0/12)		0.00 (0/12)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Fish (pCi/kg-wet)						137 (12.0 mi N)	
	CO-58	12	130	35.3 (3/6)	129	35.3 (3/6)	0.00 (0/6)
				9.75 - 67.8	(0.5 mi ENE)	9.75 - 67.8	0.00 - 0.00
	CO-60	12	130	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00
	CS-134	12	130	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00
	CS-137	12	150	21.0 (2/6)	129	21.0 (2/6)	27.2 (1/6)
				19.9 - 22.1	(0.5 mi ENE)	19.9 - 22.1	27.2 - 27.2
	FE-59	12	260	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00
	MN-54	12	130	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00
	ZN-65	12	260	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non-Routine Report Meas.	
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range		
Shoreline Sediment (pCi/kg-dry)	137 (12.0 mi N)							
	CO-58	6	0	21.1 (2/4)	129	24.7 (1/2)	0.00 (0/2)	0
				17.6 - 24.7	(0.5 mi ENE)	24.7 - 24.7	0.00 - 0.00	
	CO-60	6	0	76.9 (2/4)	130	84.9 (1/2)	0.00 (0/2)	0
				68.8 - 84.9	(0.5 mi SW)	84.9 - 84.9	0.00 - 0.00	
	CS-134	6	150	0.00 (0/4)		0.00 (0/2)	0.00 (0/2)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-137	6	180	63.0 (4/4)	129	65.1 (2/2)	0.00 (0/2)	0
			53.9 - 72.1	(0.5 mi ENE)	58.0 - 72.1	0.00 - 0.00		

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

If LLD is equal to 0.00, then the LLD is not required by Selected Licensee Commitments

Environmental Radiological Monitoring Program Summary

Facility: McGuire Nuclear Station

Docket No. 50-369,370

Location: Mecklenburg County, North Carolina

Report Period: 01-JAN-1999 to 31-DEC-1999

Medium or Pathway Sampled	Type and Total Number of	Lower Limit of Detection	All Indicator Locations	Location with Highest Annual Mean Name, Distance, Direction		Control Location	No. of Non- Routine Report Meas.
Unit of Measurement	Analyses Performed	(LLD)	Mean (Fraction) Range	Location Code	Mean (Fraction) Range	Mean (Fraction) Range	
Direct Radiation TLD (mR/standard quarter)						175 (15.5 mi WNW)	
	189	0.00E+00	15.7 (185/185)	173	25.3 (4/4)	22.4 (4/4)	0
			9.50 - 27.5	(8.4 mi NNW)	23.4 - 27.5	22.0 - 22.7	

Mean and range based upon detectable measurements only

Fraction of detectable measurements at specified locations is indicated in parentheses, (Fraction)

Zero range indicates no detectable activity measurements

APPENDIX C

**SAMPLING DEVIATIONS
&
UNAVAILABLE ANALYSES**

APPENDIX C

MCGUIRE NUCLEAR STATION SAMPLING DEVIATIONS & UNAVAILABLE ANALYSES

DEVIATION & UNAVAILABLE REASON CODES			
BF	Blown Fuse	PO	Power Outage
FZ	Sample Frozen	PS	Pump out of service / Undergoing Repair
IW	Inclement Weather	SL	Sample Loss/Lost due to Lab Accident
LC	Line Clog to Sampler	SM	Motor / Rotor Seized
OT	Other	TF	Torn Filter
PI	Power Interrupt	VN	Vandalism
PM	Preventive Maintenance		

C.1 SAMPLING DEVIATIONS

Air Particulate and Air Radioiodines

Location	Scheduled Collection Dates	Actual Collection Dates	Reason Code	Corrective Action
133	4/20 – 4/27/99	4/20 – 4/24/99	PI	Power outage to sampling equipment due to construction. Power to sampling equipment was cut by the construction crew to replace substation components.

Drinking Water

Location	Scheduled Collection Dates	Actual Collection Dates	Reason Code	Corrective Action
194	3/9 – 4/6/99	3/9 – 4/3/99	PO	Power outage to sampling equipment due to water timer failure. Work request 99006496 was initiated for repair.
132	4/6 – 5/4/99	4/20 – 5/4/99	PS	Sampling equipment failure due to solenoid malfunction. Work request 99006500 was initiated for repair. The solenoid was replaced and normal sampling was resumed.
194	4/6 – 5/4/99	4/20 – 5/4/99	PS	Sampling equipment was out of service due to timer failure. Work request 99006496 was completed and sampling was resumed following timer repair.
101	8/24 – 9/21/99	8/24 – 9/21/99	OT	Tygon tubing connecting water line to water source ruptured. Water plant personnel shut off water supply during composite period. Tubing was replaced and normal sampling resumed.

Surface Water

Location	Scheduled Collection Dates	Actual Collection Dates	Reason Code	Corrective Action
131	8/24 – 9/21/99	8/24 – 9/16/99	IW	Pump platform displaced due to high winds from hurricane Floyd creating choppy water. Work request 99018029 submitted for righting the platform in correct position. A temporary ISCO water sampler was placed into service until repair was completed and normal sampling could be resumed.

C.2 UNAVAILABLE ANALYSES

Air Particulate and Air Radioiodines

Location	Scheduled Collection Dates	Reason Code	Corrective Action
133	4/27 – 5/4/99	PI	Power to air sampler was cut by construction crew to accommodate the city of Cornelius to replace substation components. Power to sampling equipment was unavailable during the entire scheduled sampling period.

TLD

Location	Scheduled Collection Dates	Reason Code	Corrective Action
174	12/31/98 – 4/1/99	VN	TLD missing. 2 nd Quarter TLD placed in field.
163	4/1/99 – 7/1/99	VN	TLD missing. 3 rd Quarter TLD placed in field.
165	4/1/99 – 7/1/99	VN	TLD missing. 3 rd Quarter TLD placed in field.

APPENDIX D

ANALYTICAL DEVIATIONS

No analytical deviations were incurred for the
1999 Radiological Environmental Monitoring Program

APPENDIX E

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM RESULTS

This appendix includes all of the sample analysis reports generated from each sample medium for 1999. Appendix E is located separately from this report and is permanently archived at Duke Power Company's Environmental Center radiological environmental master file, located at the McGuire Nuclear Station Site in Huntersville, North Carolina.