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Carolinas

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May 13, 2010

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Subject: Duke Energy Carolinas, LLC
Catawba Nuclear Station, Units 1 and 2
Docket Nos. 50-413 and 50-414
2009 Annual Radiological Environmental Operating Report

Pursuant to Catawba Nuclear Station Technical Specification 5.6.2 and Selected Licensee Commitment 16.11-16, please find attached the 2009 Annual Radiological Environmental Operating Report. This report covers operation of Catawba Units 1 and 2 during the 2009 calendar year.

Any questions concerning this report should be directed to Toni Pasour at (803) 701-3566.

Sincerely,

James R. Morris

Attachment

IE25
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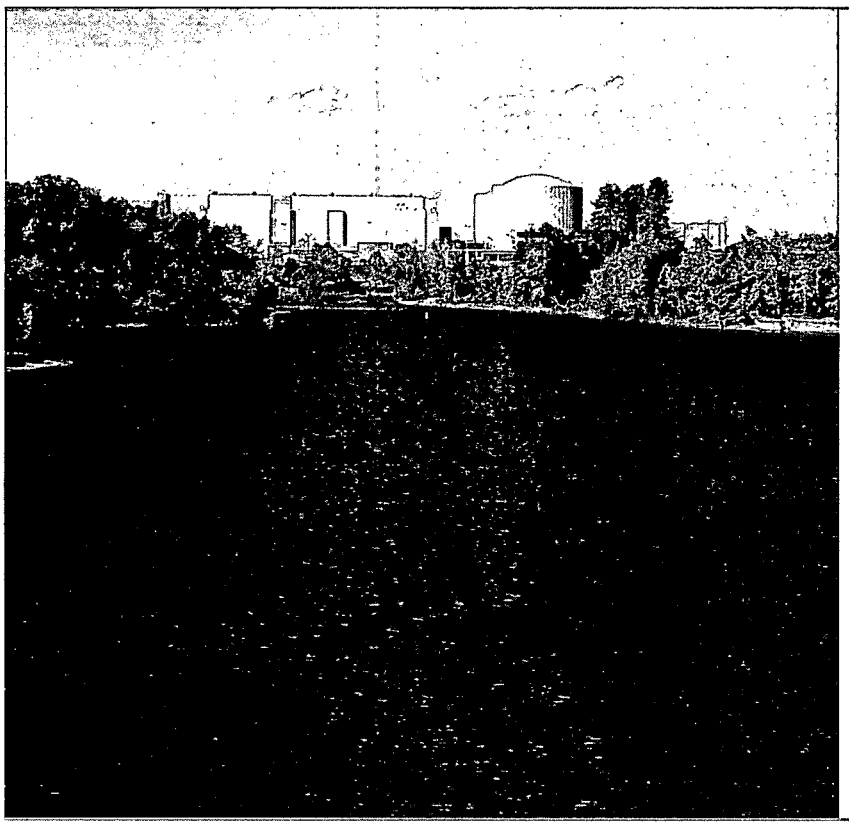
Catawba Nuclear Station
Units 1 and 2



AREOR

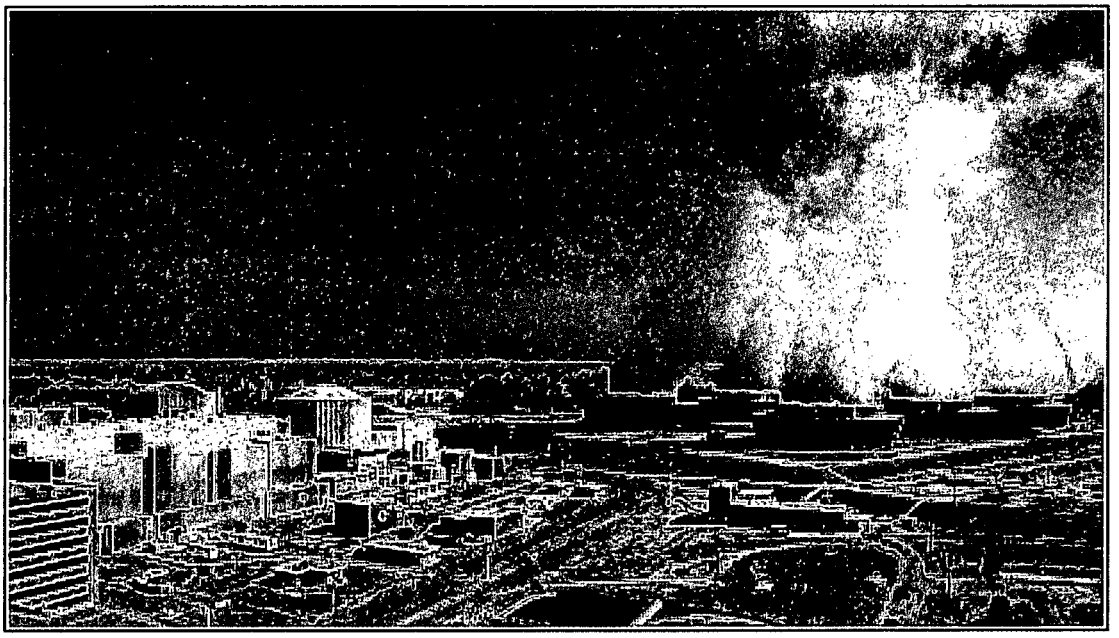
Annual
Radiological Environmental
Operating Report
2009

Duke Energy SM

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

DUKE ENERGY CORPORATION
CATAWBA NUCLEAR STATION
Units 1 and 2

2009



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

BW	BiWeekly
C	Control
CNS	Catawba Nuclear Station
DEHNR	Department of Environmental Health and Natural Resources
DHEC	Department of Health and Environmental Control
EPA	Environmental Protection Agency
ERA	Environmental Resource Associates
GI-LLI	Gastrointestinal – Lower Large Intestine
GPS	Global Positioning System
LLD	Lower Limit of Detection
M	Monthly
MDA	Minimum Detectable Activity
MOA	Memorandum of Agreement
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
PIP	Problem Investigation Process
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 Catawba Nuclear Station Radiological Environmental Monitoring Program (REMP), and the program results for the calendar year 2009.

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 (SLCs). Required analyses were performed and detection capabilities were met for all collected samples as required by SLCs. Eight-hundred eighty-eight samples were analyzed comprising 1,197 test results in order to compile data for the 2009 report. Based on the annual land use census, the current number of sampling sites for Catawba Nuclear Station is sufficient.

Concentrations observed in the environment in 2009 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 SLCs.

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 2.01E-01 mrem for 2009. It is therefore concluded that station operations has had no significant radiological impact on the health and safety of the public or the environment.

2.0 INTRODUCTION

2.1 SITE DESCRIPTION AND SAMPLE LOCATIONS

Duke Energy Corporation's Catawba Nuclear Station is a two-unit facility located on the shore of Lake Wylie in York County, South Carolina. Each of the two essentially identical units employs a pressurized water reactor nuclear steam supply system furnished by Westinghouse Electric Corporation. Each generating unit is designed to produce a net electrical output of approximately 1145 MWe. Units 1 and 2 achieved initial criticality on January 7, 1985, and May 8, 1986, respectively.

Condenser cooling is accomplished utilizing a closed system incorporating cooling towers, instead of using lake water directly. Liquid effluents are released into Lake Wylie via the station discharge canal and are not accompanied by the large additional dilution water flow associated with "once-through" condenser cooling. This design results in greater radionuclide concentrations in the discharge canal given comparable liquid effluent source terms.

Figures 2.1-1 and 2.1-2 are maps depicting the Thermoluminescent Dosimeter (TLD) monitoring locations and the sampling locations. The location numbers shown on these maps correspond to those listed in Tables 2.1-A and 2.1-B. Figure 2.1-1 comprises all sample locations within a one mile radius of CNS. Figure 2.1-2 comprises all sample locations within a 10 mile radius of CNS.

2.2 SCOPE AND REQUIREMENTS OF THE REMP

An environmental monitoring program has been in effect at Catawba Nuclear Station since 1981, four years prior to operation of Unit 1 in 1985. 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 Catawba 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 activity 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 REMP 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 3.11.

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. "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. The following equation was used to estimate the mean (reference 6.8):

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

Where:

$\overline{x}$ = estimate of the mean,
i = individual sample,
N = total number of samples with a net activity (or concentration),
χ_i = net activity (or concentration) for sample i.

2.3.2 LOWER LEVEL OF DETECTION AND MINIMUM DETECTABLE ACTIVITY

The Lower Level of Detection (LLD), and Minimum Detectable Activity (MDA) are used throughout the REMP.

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 is the net counting rate (sample after subtraction of background) that must be surpassed before a sample is considered to contain a scientifically measurable amount of a radioactive material exceeding background amounts. The MDA is calculated using a sample background and may be thought of as an "actual" LLD for a particular sample measurement.

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. 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.

Figure 2.1-1

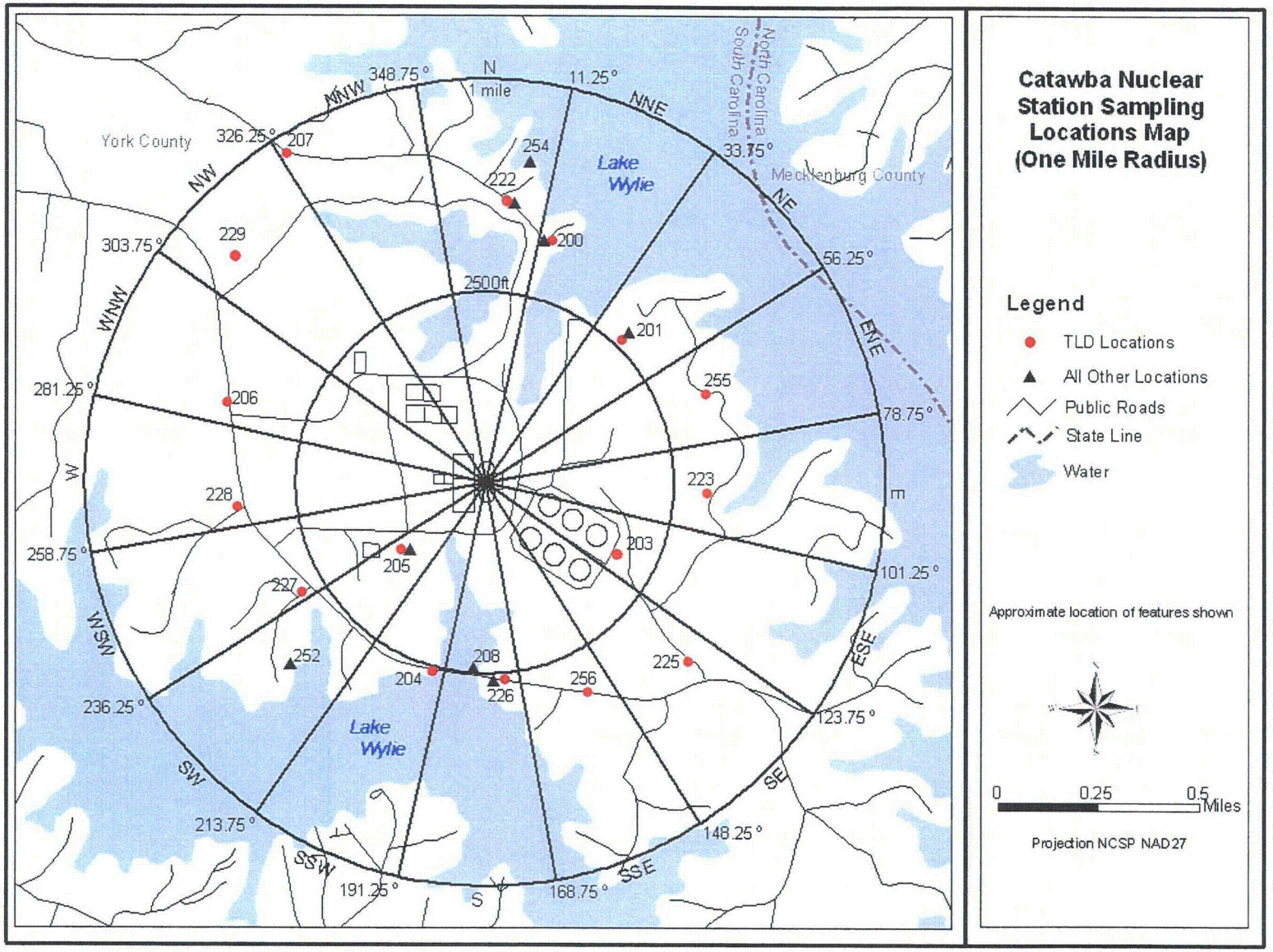
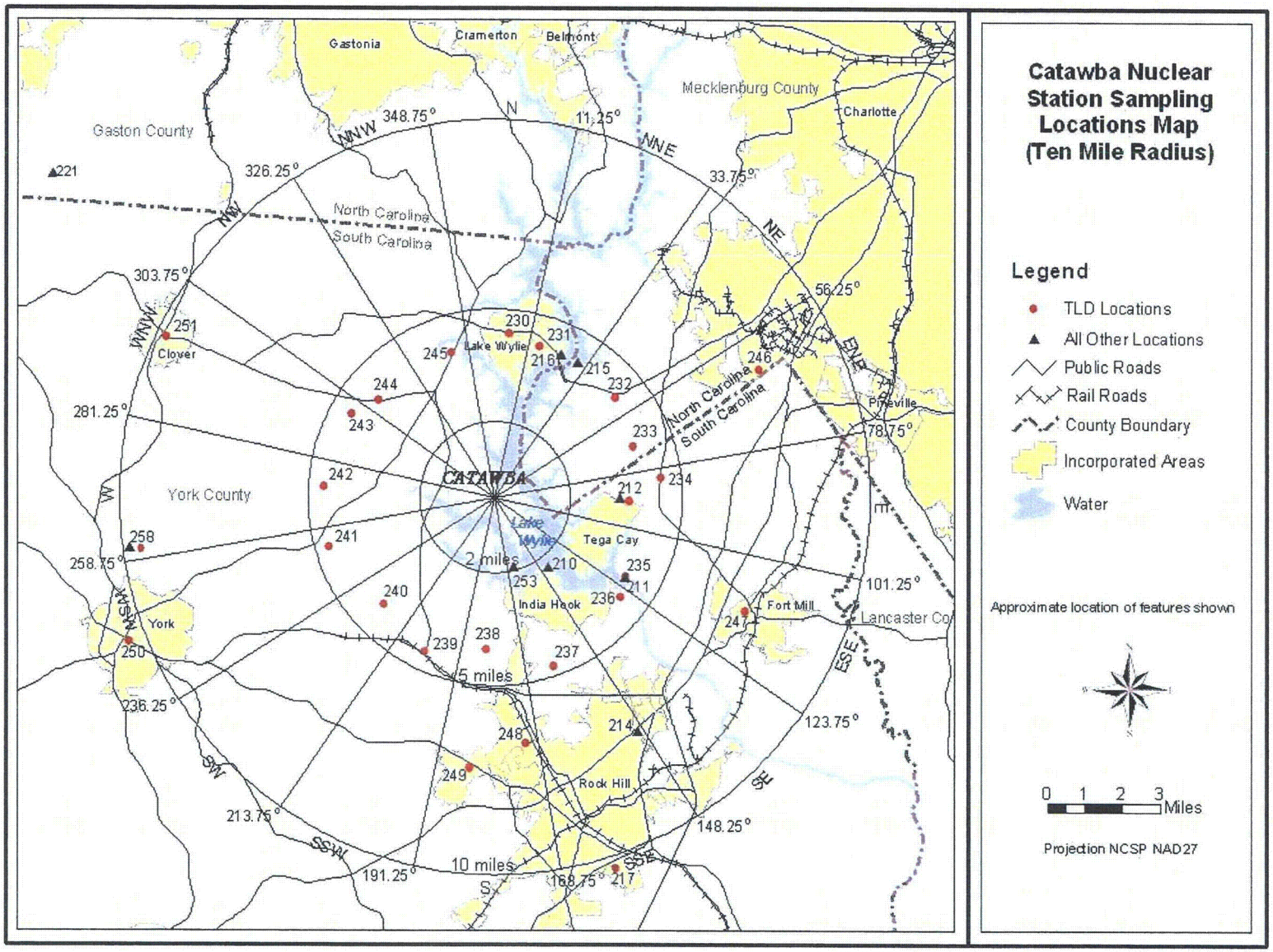

Catawba Nuclear Station Sampling Locations Map (One Mile Radius)
Legend
TLD Locations
All Other Locations
Public Roads
State Line
Water
Approximate location of features shown
0
0.25
0.5
Miles
Projection NCSP NAD27
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
348.75°
11.25°
33.75°
56.25°
78.75°
101.25°
123.75°
148.25°
168.75°
191.25°
213.75°
236.25°
258.75°
281.25°
303.75°
326.25°
1 mile
2500ft
York County
Mecklenburg County
North Carolina
South Carolina
Lake Wylie
Lake Wylie
200
201
203
204
205
206
207
208
222
223
225
226
227
228
229
252
254
255
256

Figure 2.1-2


Gastonia
Cramerton
Belmont
Mecklenburg County
Charlotte
Gaston County
North Carolina
South Carolina
Clover
York County
York
Lake Wylie
Tega Cay
India Hook
Fort Mill
Lancaster Co
Pineville
Rock Hill
CATAWBA
2 miles
5 miles
10 miles
348.75°
11.25°
33.75°
56.25°
78.75°
101.25°
123.75°
148.25°
168.75°
191.25°
213.75°
236.25°
258.75°
281.25°
303.75°
326.25°
NNW
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SW
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221
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214
248
249
217
Catawba Nuclear Station Sampling Locations Map (Ten Mile Radius)
Legend
TLD Locations
All Other Locations
Public Roads
Rail Roads
County Boundary
Incorporated Areas
Water
Approximate location of features shown
0 1 2 3 Miles
Projection NCSP NAD27

TABLE 2.1-A

CATAWBA RADIOLOGICAL MONITORING PROGRAM
SAMPLING LOCATIONS

Table 2.1-B 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 (a)	Fish	Milk	Broad Leaf Veg. (b)	Ground Water
200	Site Boundary (0.63 mi NNE)	W							M	
201	Site Boundary (0.53 mi NE)	W							M	
205	Site Boundary (0.23 mi SW)	W								
208	Discharge Canal (0.45 mi S)		M		SA		SA			
210	Ebenezer Access (2.31 mi SE)				SA					
211	Wylie Dam (4.06 mi ESE)		M							
212	Tega Cay (3.32 mi E)	W								
214	Rock Hill Water Supply (7.30 mi SSE)			M						
215 C	River Pointe - Hwy 49 (4.21 mi NNE)		M		SA					
216 C	Hwy 49 Bridge (4.19 mi NNE)						SA			
218 C	Belmont Water Supply (13.5 mi NNE)			M						
221 C	Dairy (14.5 mi NW)							SM		
222	Site Boundary (0.70 mi N)								M	
226	Site Boundary (0.48 mi S)								M	
252	Residence (0.64 mi SW)									Q
253	Irrigated Gardens (1.90 mi SSE)					M(a)				
254	Residence (0.82 mi N)									Q
258 C	Fairhope Road (9.84 mi W)	W							M	

(a) During Harvest Season
(b) When Available

* GPS data reflect approximate accuracy to within 2-5 meters. GPS field measurements were taken as close as possible to the item of interest.

TABLE 2.1-B

CATAWBA RADIOLOGICAL MONITORING PROGRAM
SAMPLING LOCATIONS

(TLD SITES)

Site #	Location*	Distance	Sector	Site #	Location*	Distance	Sector
200	SITE BOUNDARY	0.63 miles	NNE	234	WACHOVIA BANK	4.50 miles	E
201	SITE BOUNDARY	0.53 miles	NE	235	LAKE WYLIE DAM	4.07 miles	ESE
203	SITE BOUNDARY	0.38 miles	ESE	236	SC WILDLIFE FEDERATION OFFICE	4.25 miles	SE
204	SITE BOUNDARY	0.48 miles	SSW	237	TWIN LAKES ROAD AND HOMESTEAD ROAD	4.75 miles	SSE
205	SITE BOUNDARY	0.23 miles	SW	238	PENNINGTON ROAD AND WEST OAK ROAD	4.02 miles	S
206	SITE BOUNDARY	0.67 miles	WNW	239	CARTER LUMBER COMPANY	4.49 miles	SSW
207	SITE BOUNDARY	0.95 miles	NNW	240	PARAHAM ROAD	4.07 miles	SW
212 SI	TEGA CAY AIR SITE	3.32 miles	E	241	CAMPBELL ROAD	4.58 miles	WSW
217 C	ROCK HILL AIR SITE	10.3 miles	SSE	242	TRANSMISSION TOWER ON PARAHAM ROAD	4.56 miles	W
222	SITE BOUNDARY	0.71 miles	N	243	KINGSBERRY ROAD	4.39 miles	WNW
223	SITE BOUNDARY	0.57 miles	E	244	BETHEL ELEMENTARY SCHOOL	4.02 miles	NW
225	SITE BOUNDARY	0.68 miles	SE	245	CROWDERS CREEK BOAT LANDING	4.01 miles	NNW
226	SITE BOUNDARY	0.48 miles	S	246 SI	CAROWINDS GUARD HOUSE	7.87 miles	ENE
227	SITE BOUNDARY	0.52 miles	WSW	247 C	FORT MILL	7.33 miles	ESE
228	SITE BOUNDARY	0.61 miles	W	248 SI	PIEDMONT MEDICAL CENTER	6.54 miles	S
229	SITE BOUNDARY	0.84 miles	NW	249 SI	YORK COUNTY OPERATIONS CENTER	7.17 miles	S
230	RIVER HILLS COMMUNITY CHURCH	4.37 miles	N	250 SI	YORK DUKE POWER OFFICE	10.4 miles	WSW
231	RIVER HILLS FRONT ENTRANCE	4.21 miles	NNE	251 C	CLOVER	9.72 miles	WNW
232	PLEASANT HILL ROAD	4.18 miles	NE	255	SITE BOUNDARY	0.61 miles	ENE
233	ZOAR ROAD AND THOMAS DRIVE	3.95 miles	ENE	256	SITE BOUNDARY	0.58 miles	SSE
				258	FAIRHOPE ROAD	9.84 miles	W

C = Control
SI = Special Interest

* GPS data reflect approximate accuracy to within 2-5 meters. GPS field measurements were taken as close as possible to the item of interest.

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)	Food Products (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	0.9		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 Particulate	Weekly	X			X	
Direct Radiation	Quarterly					X
Surface Water	Monthly Composite	X				
	Quarterly Composite		X			
Drinking Water	Monthly Composite	X		(a)	X	
	Quarterly Composite		X			
Ground Water	Quarterly	X	X			
Shoreline Sediment	Semiannually	X				
Milk	Semimonthly	X		X		
Fish	Semiannually	X				
Broadleaf Vegetation	Monthly[b]	X				
Food Products	Monthly[b]	X				

(a) Low-level I-131 analysis will be performed if the dose calculated for the consumption of drinking water is > 1 mrem per year. An LLD of 1 pCi/liter will be required for this analysis.
(b) When Available

TABLE 2.2-C

MAXIMUM VALUES FOR THE LOWER LIMIT OF DETECTION

Analysis	Water (pCi/liter)	Air Particulates or Gases (pCi/m^3)	Fish (pCi/kg-wet)	Milk (pCi/liter)	Food Products (pCi/kg-wet)	Sediment (pCi/kg-dry)
Gross Beta	4	0.01				
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

Review of all 2009 REMP analysis results was performed to identify changes in environmental levels as a result of station operations. The following section depicts and explains the review of these results. Sample data for 2009 was compared to preoperational and historical data. Over the years of operation, analysis and collection changes have taken place that do not allow direct comparisons for some data collected from 1984 (preoperational) through 2009. Summary tables containing 2009 information required by Technical Specification Administrative Control 5.6.2 are located in Appendix B.

Evaluation for significant trends was performed for radionuclides that are listed as required within Selected Licensee Commitments 16.11-13. The radionuclides include: H-3, Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-95, Nb-95, I-131, Cs-134, Cs-137, Ba-140 and La-140. Gross beta analysis results were trended for drinking water and gross beta trending for air particulates was initiated in 1996. Other radionuclides detected that are the result of plant operation, but not required for reporting, are trended.

A comparison of annual mean concentrations of effluent-based detected radionuclides to historical results provided trending bases. Frequency of detection and concentrations related to SLC reporting levels (Table 2.2-A) were used as criteria for trending conclusions. All 2009 maximum percentages of reporting levels were well below the 100% action level. The highest value noted during 2009 was 3.53% for Co-60 in surface water.

Selected Licensee Commitment section 16.11-13 addresses actions to be taken if radionuclides other than those required are detected in samples collected. The occurrences of these radionuclides are the result of CNS liquid effluents which contained the radionuclides.

During 1979-1986, all net activity results (sample minus background), both positive and negative were included in calculation of sample mean. A change in the EnRad gamma spectroscopy system on September 1, 1987, decreased the number of measurements yielding detectable low-level activity for indicator and control location samples. It was thought that the method used by the previous system was vulnerable to false-positive results.

All 2009 sample analysis results were reviewed to detect and identify any significant trends. Tables and graphs are used throughout this section to display data from effluent-based radionuclides identified since the system change in late 1987. All negative concentration values were replaced with zero for calculation purposes. Any zero concentrations used in tables or graphs represent activity measurements less than detectable levels.

Review of all 2009 data presented in this section supports the conclusion that there were no significant changes in environmental sample radionuclide concentrations of samples collected and analyzed from CNS site and surrounding areas that were attributable to plant operations.

3.1 AIRBORNE RADIOIODINE AND PARTICULATES

In 2009, 257 radioiodine and particulate samples were analyzed, 206 from four indicator locations and 51 at the control location. Particulate samples were analyzed weekly for gamma and gross beta. Radioiodine samples received a weekly gamma analysis.

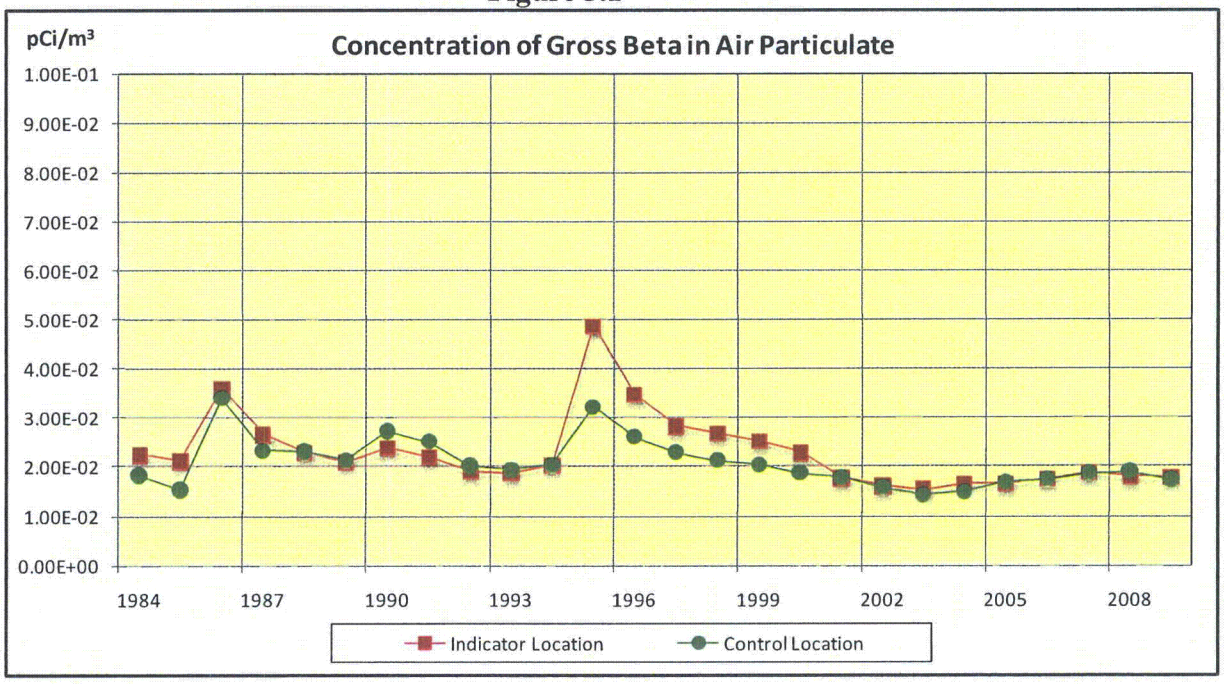
Figure 3.1 shows individual sample gross beta results for the indicator location with highest annual mean and the control location samples during 2009. The two sample locations' results are similar in concentration and have varied negligibly since preoperational periods.

There were no detectable gamma emitters identified for particulate filters analyzed during 2009. Table 3.1-A shows the highest indicator annual mean and control location annual mean for gross beta in air particulate.

There was no detectable I-131 in air radioiodine samples analyzed in 2009. Table 3.1-B shows the highest indicator annual mean and control location annual mean for I-131 since 1984 (preoperational period).

K-40 and Be-7 that occur naturally were routinely detected in charcoal cartridges collected during the year. Cs-137 detection on the charcoal cartridge was determined in 1990 to be an active constituent of the charcoal. A similar study was performed in 2001 again yielding this conclusion. Therefore, any Cs-137 activities were not used in any dose calculations in Section 4.0 of this report.

Figure 3.1



There is no reporting level for gross beta in air particulate

Table 3.1-A Mean Concentration of Gross Beta in Air Particulate

Year	Indicator Location (pCi/m^3)	Control Location (pCi/m^3)
1984	2.25E-2	1.82E-2
1985	2.12E-2	1.53E-2
1986	3.62E-2	3.41E-2
1987	2.67E-2	2.32E-2
1988	2.29E-2	2.30E-2
1989	2.11E-2	2.13E-2
1990	2.39E-2	2.72E-2
1991	2.19E-2	2.51E-2
1992	1.90E-2	2.01E-2
1993	1.87E-2	1.94E-2
1994	2.03E-2	2.03E-2
1995	4.88E-2	3.23E-2
1996	3.49E-2	2.60E-2
1997	2.83E-2	2.28E-2
1998	2.69E-2	2.12E-2
1999	2.53E-2	2.04E-2
2000	2.28E-2	1.86E-2
2001	1.76E-2	1.78E-2
2002	1.60E-2	1.57E-2
2003	1.54E-2	1.42E-2
2004	1.65E-2	1.49E-2
2005	1.66E-2	1.68E-2
2006	1.74E-2	1.74E-2
2007	1.88E-2	1.86E-2
2008	1.80E-2	1.90E-2
Average (1999 - 2008)	1.84E-2	1.73E-2
2009	1.78E-2	1.72E-2

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

Year	Indicator Location (pCi/m^3)	Control Location (pCi/m^3)
1984	1.30E-3	1.46E-2
1985	4.75E-3	2.38E-2
1986	1.43E-2	1.02E-2
1987	1.38E-2	0.00E0
1988	0.00E0	0.00E0
1989	0.00E0	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
2000	0.00E0	0.00E0
2001	0.00E0	0.00E0
2002	0.00E0	0.00E0
2003	0.00E0	0.00E0
2004	0.00E0	0.00E0
2005	0.00E0	0.00E0
2006	0.00E0	0.00E0
2007	0.00E0	0.00E0
2008	0.00E0	0.00E0
2009	0.00E0	0.00E0

0.00E0 = no detectable measurements

3.2 DRINKING WATER

Gross beta and gamma spectroscopy were performed on 26 drinking water samples. The samples were composited to create 8 quarterly samples that were analyzed for tritium. One indicator location was sampled, along with one control location.

No gamma emitting radionuclides were identified in 2009 drinking water samples. There have been no gamma emitting radionuclides identified in drinking water samples since 1988.

Table 3.2 shows highest annual mean gross beta concentrations for the indicator location and control location since preoperation. The indicator location (downstream of the plant effluent release point) average concentration was 2.07 pCi/l in 2009 and the control location concentration was 1.99 pCi/l. The 2008 indicator mean was 2.81 pCi/l. The table shows that current gross beta levels are not statistically different from preoperational concentrations.

Tritium was detected in the four indicator samples and the four control samples during 2009. The mean indicator tritium concentration for 2009 was 634 pCi/l, 3.17% of reporting level. The mean control tritium concentration for 2009 was 681 pCi/l, 3.41% of reporting level. Figure 3.2 and Table 3.2 display the highest indicator and control location annual mean concentrations for tritium since 1984.

The concentration of tritium in drinking water is affected by releases from the Catawba plant and the McGuire Nuclear Station, located approximately 40 miles upstream of the Catawba plant on the Catawba River. Tritium in drinking water indicator samples was lower in 2009 than in previous years. During 2009, tritium released from Catawba was lower than the previous year due to a plant modification that was designed to capture Boron from the primary system. This modification is addressed in reference 6.14. Tritium was identified at the nearest drinking water location but was lower than tritium in the control location. Because of this, no dose from drinking water was attributed to releases from Catawba.

The dose for consumption of water was less than one mrem per year, historically and for 2009; therefore low-level iodine analysis is not required.

Figure 3.2

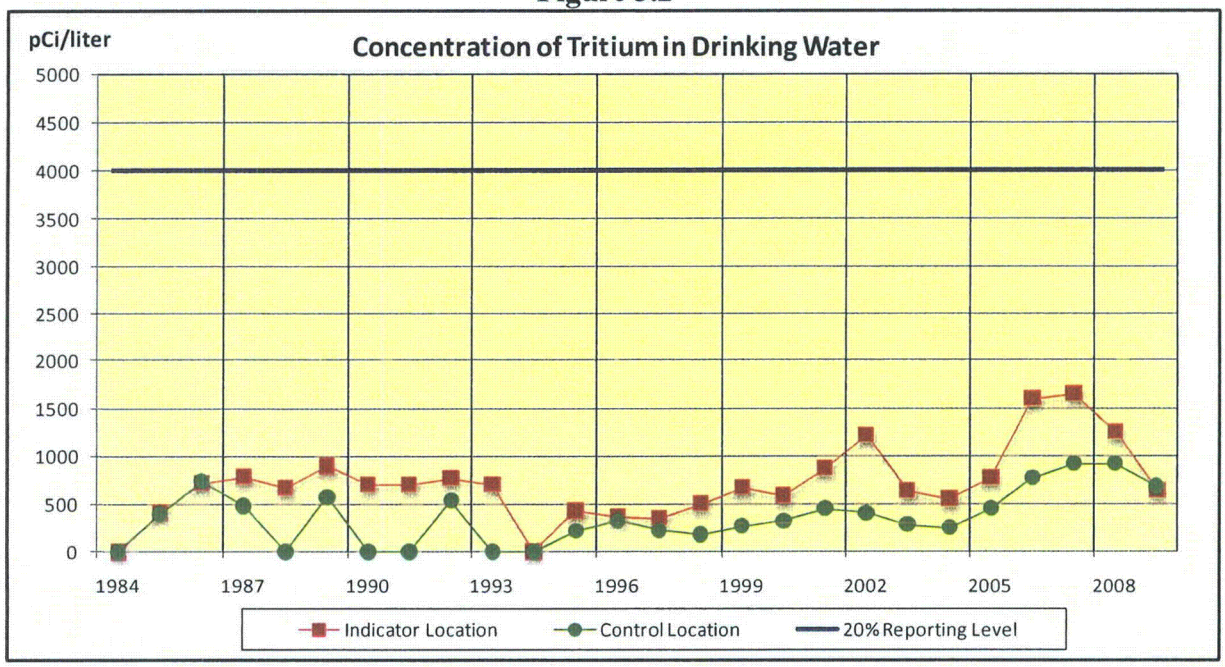


Table 3.2 Mean Concentration of Radionuclides in Drinking Water

YEAR	Gross Beta (pCi/l)		Tritium (pCi/l)	
	Indicator Location	Control Location	Indicator Location	Control Location
1984	4.72	1.83	3.10E-2	3.10E-2
1985	2.70	2.24	4.13E2	4.00E2
1986	3.11	2.26	7.23E2	7.33E2
1987	3.10	2.40	7.80E2	4.80E2
1988	3.60	2.60	6.64E2	0.00E0
1989	3.60	2.90	8.91E2	5.72E2
1990	4.50	3.20	7.03E2	0.00E0
1991	3.70	2.20	7.04E2	0.00E0
1992	3.20	2.40	7.65E2	5.38E2
1993	3.50	2.50	7.06E2	0.00E0
1994	3.30	2.70	0.00E0	0.00E0
1995	4.80	4.50	4.28E2	2.21E2
1996	3.08	3.14	3.71E2	3.27E2
1997	3.74	3.15	3.54E2	2.28E2
1998	2.51	2.44	5.07E2	1.83E2
1999	3.55	2.48	6.71E2	2.70E2
2000	3.04	2.27	5.87E2	3.26E2
2001	3.49	2.30	8.66E2	4.50E2
2002	3.44	2.36	1.22E3	4.11E2
2003	2.27	2.02	6.36E2	2.88E2
2004	1.88	1.69	5.47E2	2.54E2
2005	2.05	1.84	7.69E2	4.50E2
2006	2.30	2.17	1.59E3	7.70E2
2007	2.34	2.21	1.65E3	9.18E2
2008	2.81	2.16	1.25E3	9.16E2
2009	2.07	1.99	6.34E2	6.81E2

0.00E0 = no detectable measurements
1984 - 1986 mean based on all net activity

3.3 SURFACE WATER

A total of 39 monthly surface water samples was analyzed for gamma emitting radionuclides. The samples were composited to create 12 quarterly samples for tritium analysis. Two indicator locations and one control location were sampled. One indicator location (208) is located near the liquid effluent discharge point.

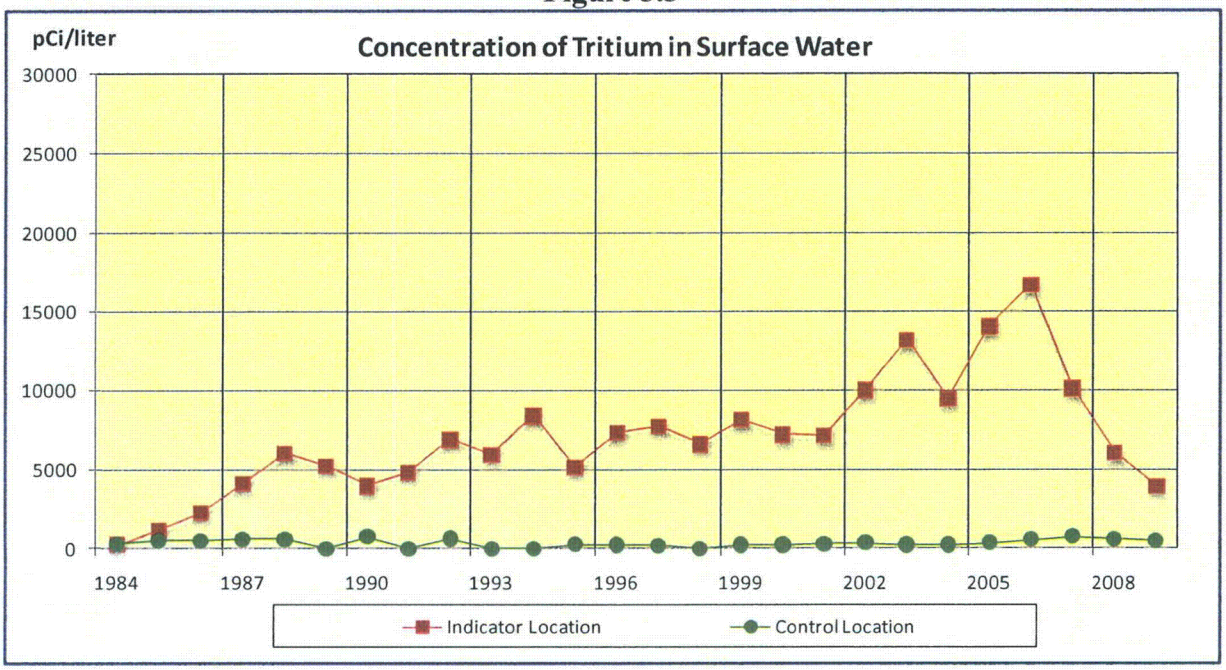
All 2009 indicator location samples contained tritium with an average concentration of 2292 pCi/l. Indicator Location 208 (Discharge Canal) showed a range of activities from 3530 to 4420 pCi/l which had the highest mean concentration of 3930 pCi/l. Tritium was detected in all four control samples during 2009 with an average concentration of 529 pCi/l.

Gamma spectroscopy analysis detected Co-58 in four indicator samples and Co-60 in one indicator sample during 2009. Co-58 was detected at indicator location 208 and showed a range of Co-58 activities from 5.43 pCi/l to 18.7 pCi/l with an average concentration of 9.40 pCi/l which represents 0.94% of the reporting level. Co-60 was detected at location 208 at 10.6 pCi/l which represents 3.53% of the reporting level. An investigation of these results was performed to document the review of sample collection and analysis methods and the review of effluent releases (reference 6.15). Co-58 and Co-60 were released in effluents from Catawba in 2009. Co-58 and Co-60 were also identified in a REMP sample in 2008. No problems were identified with the collection or analysis process. Gamma spectroscopy analysis has not detected any other activity in surface water samples since 1993. Table 3.3 summarizes the indicator annual means of radionuclides detected since the change in the gamma spectroscopy analysis system in 1987. Visual inspection of the tabular data did not reveal any increasing trends.

Figure 3.3 displays the indicator and control annual means for tritium since 1984. Table 3.3 lists indicator annual means.

The concentration of tritium in surface water is affected by releases from the Catawba plant and the McGuire Nuclear Station, located approximately 40 miles upstream of the Catawba plant on the Catawba River. Tritium in surface water indicator samples was lower in 2009 than in previous years. During 2009, tritium released from Catawba was lower than the previous year due to a plant modification that was designed to capture Boron from the primary system. This modification is addressed in reference 6.14.

Figure 3.3



There is no reporting level for tritium in surface water, however, if no drinking water pathway exists, a value of 30,000 pCi/l may be used. A drinking water pathway exists for Catawba Nuclear Station, so this limit does not apply for surface water. See section 3.2 for drinking water results.

Table 3.3 Mean Concentrations of Radionuclides in Surface Water (pCi/l)

YEAR	Co-58	Co-60	Nb-95	Cs-137	H-3 Indicator	H-3 Control
1984	4.59E-1	5.71E-1	6.48E-1	9.08E-1	3.35E2	3.18E2
1985	3.46E0	4.83E-2	2.70E0	8.19E-1	1.19E3	5.05E2
1986	3.10E-1	-4.12E-2	2.05E0	4.85E-1	2.34E3	5.05E2
1987	0.00E0	3.10E0	4.30E0	9.90E0	4.17E3	6.20E2
1988	9.20E0	0.00E0	0.00E0	0.00E0	6.03E3	6.07E2
1989	0.00E0	0.00E0	0.00E0	0.00E0	5.27E3	0.00E0
1990	6.50E0	0.00E0	0.00E0	0.00E0	3.98E3	7.73E2
1991	0.00E0	0.00E0	0.00E0	0.00E0	4.87E3	0.00E0
1992	0.00E0	0.00E0	0.00E0	0.00E0	6.91E3	6.64E2
1993	4.70E0	1.80E0	0.00E0	0.00E0	5.98E3	0.00E0
1994	0.00E0	0.00E0	0.00E0	0.00E0	8.42E3	0.00E0
1995	0.00E0	0.00E0	0.00E0	0.00E0	5.13E3	2.89E2
1996	0.00E0	0.00E0	0.00E0	0.00E0	7.36E3	2.61E2
1997	0.00E0	0.00E0	0.00E0	0.00E0	7.77E3	2.20E2
1998	0.00E0	0.00E0	0.00E0	0.00E0	6.61E3	0.00E0
1999	0.00E0	0.00E0	0.00E0	0.00E0	8.13E3	2.41E2
2000	0.00E0	0.00E0	0.00E0	0.00E0	7.19E3	2.56E2
2001	0.00E0	0.00E0	0.00E0	0.00E0	7.13E3	3.28E2
2002	0.00E0	0.00E0	0.00E0	0.00E0	1.00E4	3.80E2
2003	0.00E0	0.00E0	0.00E0	0.00E0	1.31E4	2.37E2
2004	0.00E0	0.00E0	0.00E0	0.00E0	9.43E3	2.60E2
2005	0.00E0	0.00E0	0.00E0	0.00E0	1.40E4	3.78E2
2006	0.00E0	0.00E0	0.00E0	0.00E0	1.67E4	5.83E2
2007	0.00E0	0.00E0	0.00E0	0.00E0	1.01E4	7.82E2
2008	6.80E0	1.16E1	0.00E0	0.00E0	6.02E3	6.31E2
2009	9.40E0	1.06E1	0.00E0	0.00E0	3.93E3	5.29E2

0.00E0 = no detectable measurements
1984 - 1986 mean based on all net activity

3.4 GROUND WATER

A total of eight ground water samples was collected and analyzed for gamma emitters and tritium. There are two indicator locations and no control locations. Naturally occurring K-40 was the only radionuclide identified during 2009.

There have been no radionuclides identified in ground water samples since 1988. Only naturally occurring K-40 and Be-7 were noted.

3.5 MILK

A total of 26 milk samples was analyzed by gamma spectroscopy and low level iodine during 2009. There was one control location sampled. No indicator dairies were identified by the 2009 land use census.

There were no gamma emitting radionuclides identified in milk during 2009. Airborne Cs-137 has not been released from the plant since 1992.

Cs-137 was last detected in an indicator sample during 1996. The occurrence of Cs-137 in milk samples has been noted several times since 1984. Cs-137 attributable to past nuclear weapons testing is known to exist in many environmental media at low, highly variable levels.

Table 3.5 lists highest indicator location annual mean and control location annual mean for Cs-137 since the preoperational period. Concentrations are similar for the two sample types. Cs-137 is the only radionuclide, other than K-40 and Be-7, reported in milk samples since 1988.

Table 3.5 Mean Concentration of Radionuclides in Milk

YEAR	Cs-137 Indicator (pCi/l)	Cs-137 Control (pCi/l)
1984	2.95E0	2.98E0
1985	2.11E0	2.12E0
1986	3.76E0	4.54E0
1987	5.00E0	5.50E0
1988	3.20E0	3.80E0
1989	0.00E0	0.00E0
1990	8.00E0	6.70E0
1991	0.00E0	0.00E0
1992	3.40E0	5.00E0
1993	5.00E0	0.00E0
1994	2.80E0	0.00E0
1995	8.60E0	0.00E0
1996	6.05E0	0.00E0
1997	0.00E0	0.00E0
1998	0.00E0	0.00E0
1999	0.00E0	0.00E0
2000	0.00E0	0.00E0
2001	0.00E0	0.00E0
2002	0.00E0	0.00E0
2003	0.00E0	0.00E0
2004	NO INDICATOR LOCATION	0.00E0
2005	NO INDICATOR LOCATION	0.00E0
2006	NO INDICATOR LOCATION	0.00E0
2007	NO INDICATOR LOCATION	0.00E0
2008	NO INDICATOR LOCATION	0.00E0
2009	NO INDICATOR LOCATION	0.00E0

0.00E0 = no detectable measurements
1984 - 1986 mean based on all net activity

3.6 BROADLEAF VEGETATION

Gamma spectroscopy was performed on 60 broadleaf vegetation samples during 2009. Four indicator locations and one control location were sampled.

One of the forty-eight samples collected at indicator locations contained detectable Cs-137 activity. Cs-137 was detected in one of the twelve samples collected at Location 201. The highest concentration detected at Location 201 was 42.5 pCi/kg which is 2.13% of the reporting level. Cs-137 was not detected in any of the twelve control location samples.

Figure 3.6 shows indicator and control annual means for Cs-137 in vegetation since 1984. Table 3.6 lists indicator and annual means. Values shown from 1984 to 2009 show a stable trend for Cs-137 in vegetation.

No airborne Cs-137 has been released from the plant since 1992. Cs-137 attributable to past nuclear weapons testing is known to exist in many environmental media at low and highly variable levels.

K-40 and Be-7 were observed in broadleaf vegetation samples.

Figure 3.6

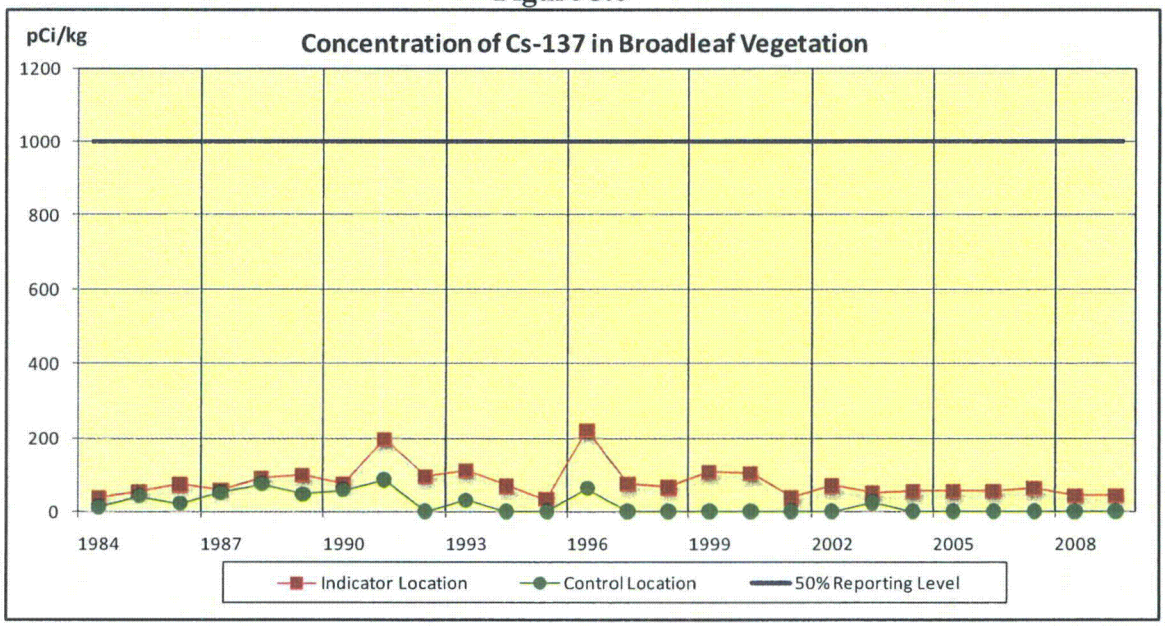


Table 3.6 Mean Concentration of Radionuclides in Broadleaf Vegetation

YEAR	Cs-137 Indicator (pCi/kg)	Cs-137 Control (pCi/kg)
1984	3.76E1	1.30E1
1985	5.48E1	4.16E1
1986	7.42E1	2.22E1
1987	6.10E1	5.10E1
1988	9.10E1	7.40E1
1989	1.00E2	4.80E1
1990	7.70E1	5.80E1
1991	1.98E2	8.60E1
1992	9.70E1	0.00E0
1993	1.13E2	3.20E1
1994	7.00E1	0.00E0
1995	3.60E1	0.00E0
1996	2.23E2	6.22E1
1997	7.57E1	0.00E0
1998	6.53E1	0.00E0
1999	1.08E2	0.00E0
2000	1.04E2	0.00E0
2001	3.76E1	0.00E0
2002	7.02E1	0.00E0
2003	4.96E1	2.40E1
2004	5.45E1	0.00E0
2005	5.48E1	0.00E0
2006	5.79E1	0.00E0
2007	6.31E1	0.00E0
2008	4.44E1	0.00E0
2009	4.25E1	0.00E0

0.00E0 = no detectable measurements
1984 - 1986 mean based on all net activity

3.7 FOOD PRODUCTS

Collection of food product samples (crops) from an irrigated garden began in 1989. The garden is located on Lake Wylie downstream from CNS, Location 253. During the 2009 growing season, seven samples were collected and analyzed for gamma radionuclides. There is no control location for this media type.

Table 3.7 shows Cs-137 indicator location highest annual mean concentrations since 1989.

Table 3.7 Mean Concentration of Radionuclides in Food Products

YEAR	Cs-137 Indicator (pCi/kg)
1989	0.00E0
1990	0.00E0
1991	0.00E0
1992	0.00E0
1993	2.50E1
1994	0.00E0
1995	0.00E0
1996	0.00E0
1997	0.00E0
1998	0.00E0
1999	0.00E0
2000	0.00E0
2001	0.00E0
2002	0.00E0
2003	0.00E0
2004	0.00E0
2005	0.00E0
2006	0.00E0
2007	0.00E0
2008	0.00E0
2009	0.00E0

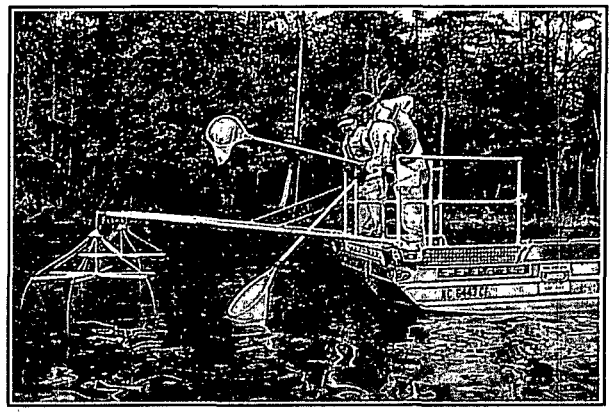
0.00E0 = no detectable measurements
There is no control location for Food Products.

3.8 FISH

Gamma spectroscopy was performed on 12 fish samples collected during 2009. One downstream indicator location and one control location were sampled.

Co-58, Co-60, and Cs-137 are normally the predominant radionuclides identified in fish samples. There were no gamma emitting radionuclides identified in any indicator location or control location fish samples during 2009.

Figures 3.8-1 and 3.8-2 are graphs displaying annual mean concentrations for Co-58 and Co-60. Table 3.8 depicts the highest indicator location annual mean for radionuclides detected. In addition, radionuclides identified in fish samples since 1988 have been included in the table. Overall, radionuclides have not shown a significant trend or accumulation.



K-40 was observed in fish samples collected during 2009.

Figure 3.8-1

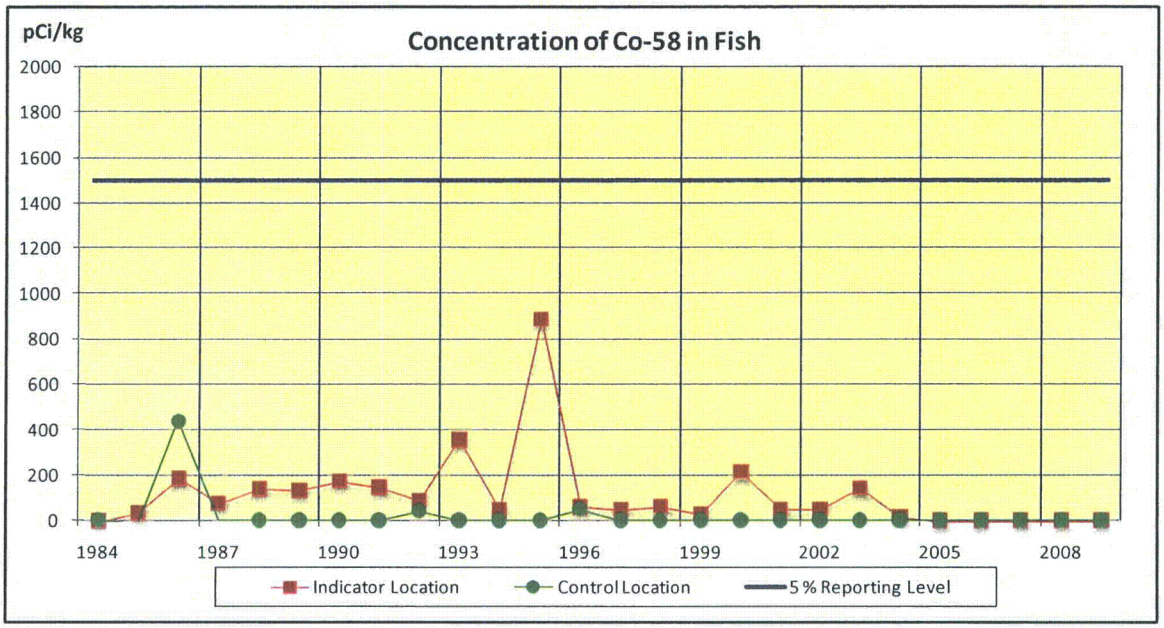


Figure 3.8-2

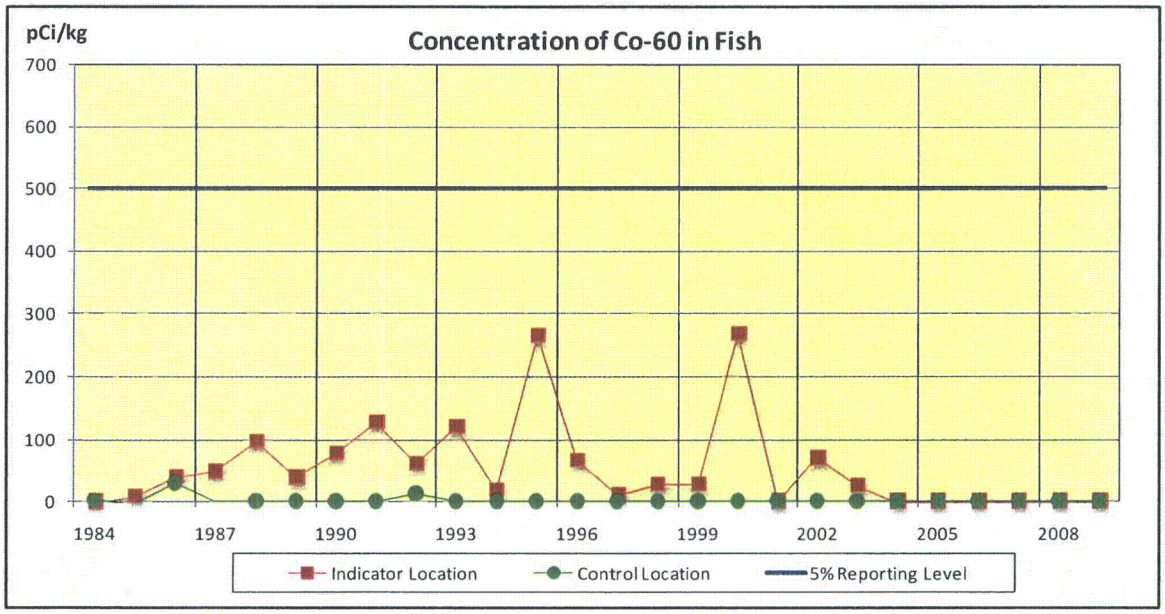


Table 3.8 Mean Concentrations of Radionuclides in Fish (pCi/kg)

Year	Mn-54	Co-58	Co-60	Cs-134	Cs-137	Nb-95	Fe-59	Sb-122	Sb-125
1984	3.07E0	3.00E0	6.11E-1	-5.32E0	1.83E0	0.00E0	0.00E0	0.00E0	0.00E0
1985	7.68E-1	3.40E1	9.11E0	3.22E0	1.28E1	5.07E0	0.00E0	0.00E0	0.00E0
1986	2.01E1	1.86E2	4.01E1	3.51E1	9.29E1	0.00E0	7.30E0	0.00E0	0.00E0
1987	7.24E0	7.57E1	4.81E1	3.83E0	4.27E1	5.40E0	0.00E0	0.00E0	0.00E0
1988	2.85E1	1.40E2	9.70E1	1.67E1	8.24E1	0.00E0	0.00E0	0.00E0	0.00E0
1989	8.28E0	1.33E2	3.83E1	1.47E1	4.37E1	8.58E-1	0.00E0	0.00E0	0.00E0
1990	2.51E1	1.75E2	7.77E1	1.32E1	4.66E1	3.33E0	0.00E0	7.00E0	9.25E0
1991	3.15E1	1.46E2	1.29E2	1.03E1	4.60E1	7.90E-1	2.30E0	0.00E0	7.45E0
1992	1.34E1	9.02E1	6.20E1	1.27E1	4.61E1	0.00E0	0.00E0	0.00E0	0.00E0
1993	2.14E1	3.58E2	1.21E2	2.73E0	2.56E1	0.00E0	0.00E0	0.00E0	0.00E0
1994	1.91E0	4.75E1	1.81E1	0.00E0	1.75E1	0.00E0	0.00E0	0.00E0	1.45E1
1995	5.65E1	8.90E2	2.66E2	0.00E0	6.77E1	1.38E1	0.00E0	0.00E0	0.00E0
1996	0.00E0	5.95E1	6.68E1	0.00E0	3.02E1	0.00E0	0.00E0	0.00E0	0.00E0
1997	0.00E0	4.93E1	9.88E0	0.00E0	2.74E1	0.00E0	0.00E0	0.00E0	0.00E0
1998	0.00E0	6.44E1	2.86E1	0.00E0	1.58E1	0.00E0	0.00E0	0.00E0	0.00E0
1999	0.00E0	3.12E1	2.71E1	0.00E0	1.87E1	0.00E0	0.00E0	0.00E0	0.00E0
2000	0.00E0	2.13E2	2.69E2	0.00E0	1.52E1	0.00E0	0.00E0	0.00E0	0.00E0
2001	0.00E0	4.66E1	0.00E0	0.00E0	2.08E1	0.00E0	0.00E0	0.00E0	0.00E0
2002	0.00E0	5.23E1	7.00E1	0.00E0	1.73E1	0.00E0	0.00E0	0.00E0	0.00E0
2003	0.00E0	1.43E2	2.61E1	0.00E0	1.19E1	0.00E0	0.00E0	0.00E0	0.00E0
2004	4.92E1	1.81E1	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0
2005	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0
2006	0.00E0	0.00E0	0.00E0	0.00E0	1.44E1	0.00E0	0.00E0	0.00E0	0.00E0
2007	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0
2008	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0
2009	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0

0.00E0 = no detectable measurements

3.9 SHORELINE SEDIMENT

During 2009, a total of 6 shoreline sediment samples was analyzed, four from two indicator locations and two from the control location.

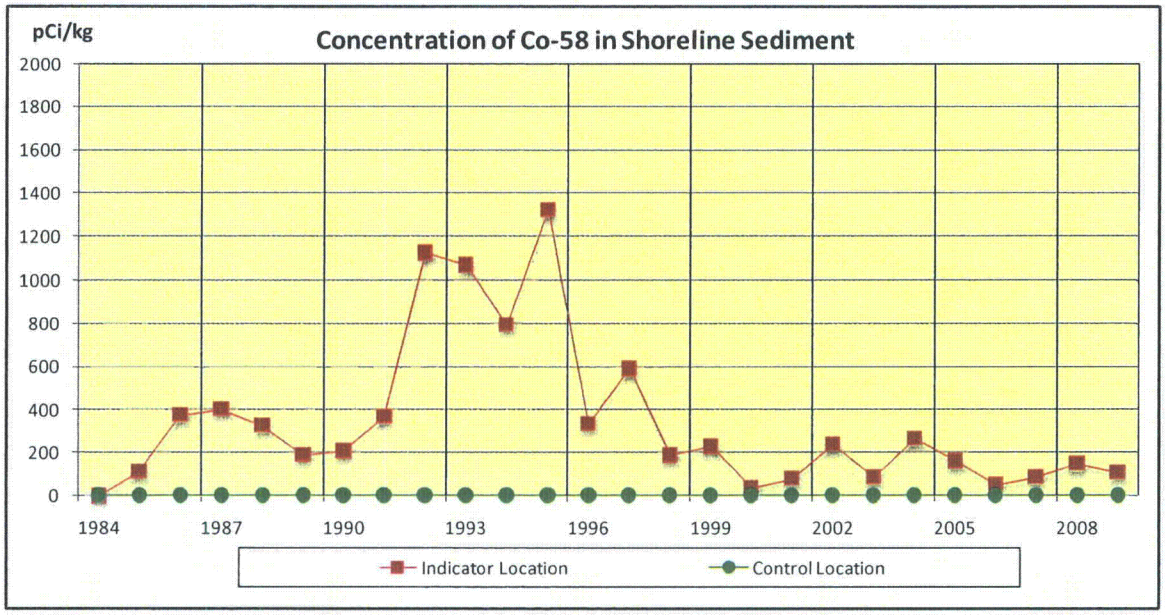
Co-58 was identified in two samples and Co-60 was identified in one sample collected from indicator location 208-1S, which is closest to the plant's liquid effluent release point. Cs-137 was identified in one sample collected from location 208-1S. Naturally occurring K-40 was identified in many of the indicator and control locations. Activity released in plant effluents has decreased since 1996 and as a result decreased activity has been measured in the environment.

The shoreline sediment location with the highest annual mean for all detectable radionuclides was location 208-1S. Co-58 was identified at location 208-1S with an annual mean concentration of 110 pCi/kg. Co-60 was identified with an annual mean concentration of 104 pCi/kg. Cs-137 was identified with an annual mean concentration of 22.7 pCi/kg. Naturally occurring K-40 and Be-7 were also identified in samples from this location.

Table 3.9 lists highest indicator location annual mean since 1984. Included in the table are radionuclides that have been identified in shoreline sediment samples since 1988.

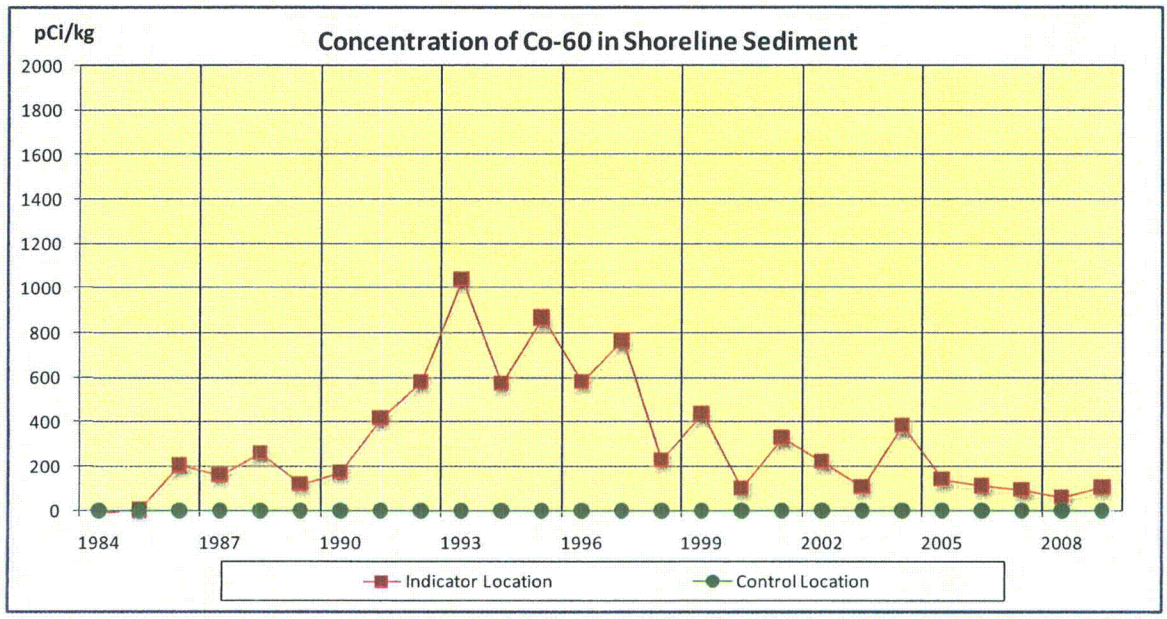
Figure 3.9-1 graphically depicts Co-58 annual mean concentrations. Figure 3.9-2 depicts Co-60 annual mean concentrations.

Figure 3.9-1



There is no reporting level for Co-58 in Shoreline Sediment

Figure 3.9-2



There is no reporting level for Co-60 in Shoreline Sediment

Table 3.9 Mean Concentrations of Radionuclides in Shoreline Sediment (pCi/kg)

Year	Mn-54	Co-58	Co-60	Nb-95	Zr-95	Cs-134	Cs-137	Co-57	Sb-125
1984	1.03E0	4.40E0	-2.34E0	0.00E0	0.00E0	3.19E1	1.07E2	0.00E0	0.00E0
1985	-3.12E0	1.16E2	5.18E0	0.00E0	0.00E0	2.11E2	2.97E2	0.00E0	0.00E0
1986	1.09E2	3.79E2	2.05E2	0.00E0	3.96E1	6.50E1	1.61E2	0.00E0	0.00E0
1987	8.83E1	4.08E2	1.61E2	4.22E1	0.00E0	6.08E1	1.26E2	0.00E0	0.00E0
1988	1.07E2	3.29E2	2.63E2	2.28E1	7.54E0	2.59E1	1.07E2	7.65E-1	3.68E0
1989	4.58E1	1.94E2	1.21E2	5.02E0	0.00E0	1.65E1	5.77E1	0.00E0	1.57E1
1990	5.39E1	2.08E2	1.77E2	0.00E0	0.00E0	1.66E1	8.18E1	0.00E0	7.15E0
1991	8.50E1	3.70E2	4.19E2	5.30E0	0.00E0	1.82E1	8.33E1	1.20E0	1.50E1
1992	1.17E2	1.13E3	5.80E2	3.50E0	0.00E0	1.69E1	1.07E2	3.00E0	2.70E1
1993	1.33E2	1.07E3	1.04E3	0.00E0	0.00E0	2.80E1	1.26E2	2.47E1	2.16E2
1994	4.93E1	7.98E2	5.73E2	0.00E0	0.00E0	5.67E0	1.07E2	4.38E0	4.60E1
1995	1.02E2	1.33E3	8.65E2	1.13E2	0.00E0	0.00E0	8.50E1	3.69E1	1.49E2
1996	8.73E1	3.39E2	5.81E2	0.00E0	0.00E0	0.00E0	8.30E1	0.00E0	1.96E2
1997	6.96E1	5.90E2	7.64E2	0.00E0	0.00E0	0.00E0	1.43E2	0.00E0	1.76E2
1998	3.07E1	1.88E2	2.30E2	0.00E0	0.00E0	0.00E0	7.11E1	0.00E0	0.00E0
1999	7.28E1	2.29E2	4.39E2	0.00E0	0.00E0	0.00E0	9.42E1	0.00E0	1.40E2
2000	0.00E0	3.90E1	1.03E2	0.00E0	0.00E0	0.00E0	4.96E1	0.00E0	0.00E0
2001	3.86E1	8.27E1	3.29E2	0.00E0	0.00E0	0.00E0	5.58E1	0.00E0	0.00E0
2002	3.51E1	2.41E2	2.22E2	0.00E0	0.00E0	0.00E0	8.83E1	0.00E0	0.00E0
2003	2.17E1	8.75E1	1.08E2	0.00E0	0.00E0	0.00E0	2.69E1	0.00E0	0.00E0
2004	6.60E1	2.67E2	3.83E2	0.00E0	0.00E0	0.00E0	3.79E1	0.00E0	0.00E0
2005	0.00E0	1.61E2	1.41E2	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0
2006	0.00E0	5.40E1	1.11E2	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0	0.00E0
2007	0.00E0	8.77E1	9.46E1	0.00E0	0.00E0	0.00E0	6.13E1	0.00E0	0.00E0
2008	0.00E0	1.48E2	6.24E1	0.00E0	0.00E0	0.00E0	2.57E1	0.00E0	0.00E0
2009	0.00E0	1.10E2	1.04E2	0.00E0	0.00E0	0.00E0	2.27E1	0.00E0	0.00E0

0.00E0 = no detectable measurements
1984 - 1986 mean based on all net activity
Negative values are calculated as zeroes

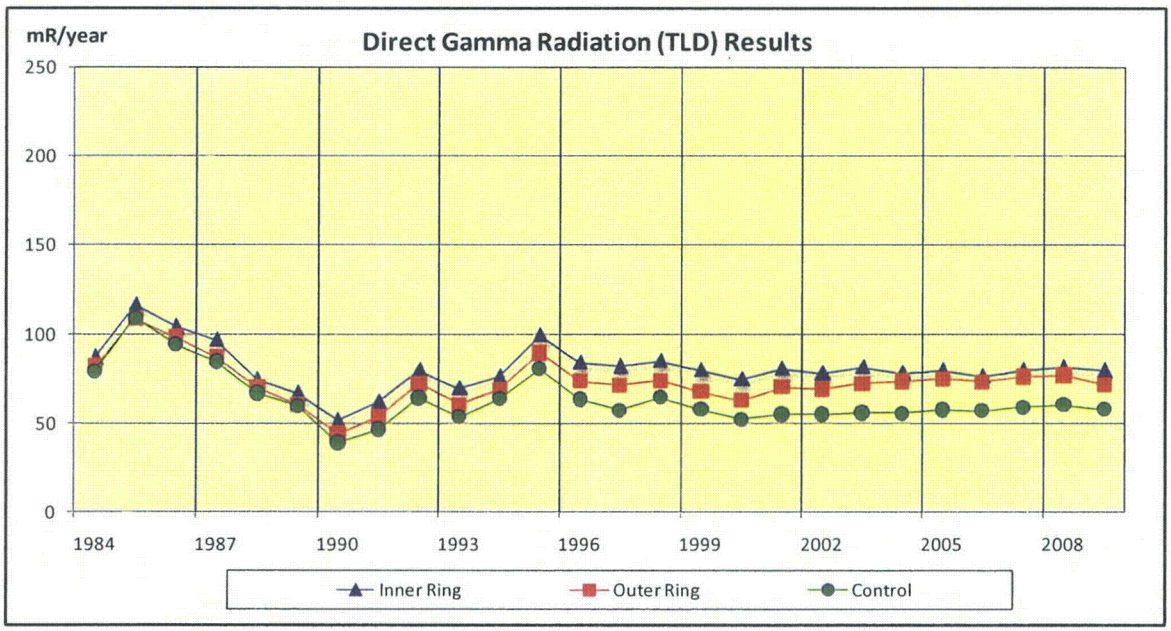
3.10 DIRECT GAMMA RADIATION

In 2009, 162 TLDs were analyzed, 150 at indicator locations and 12 at control locations. TLDs are collected and analyzed quarterly. The highest annual mean exposure for an indicator location was 95.6 milliroentgen. The annual mean exposure for the control locations was 58.0 milliroentgen.

Figure 3.10 and Table 3.10 show TLD inner ring (site boundary), outer ring (4-5 miles), and control location annual averages in milliroentgen per year. Preoperational data and rolling ten year operational data averages are also given. As shown in the graph, inner ring, outer ring, and control data averages historically compare closely. Inner and outer ring averages comprise a number of data points with control averages representing only three locations.

The calculated total body dose (from gaseous effluents) for 2009 was 1.54E0 mrem, which is 1.93% of the average inner ring TLD values. Therefore, it can be concluded that discharges from the plant had very little impact upon the measured TLD values.

Figure 3.10



There is no reporting level for Direct Radiation (TLD)

Table 3.10 Direct Gamma Radiation (TLD) Results

Year	Inner Ring Average (mR/yr)	Outer Ring Average (mR/yr)	Control Average (mR/yr)
1984*	87.5	82.6	79.3
1985	116.9	108.7	108.9
1986	104.3	98.5	94.4
1987	97.0	87.4	84.7
1988	74.6	70.3	67.1
1989	67.1	60.8	60.0
1990	52.0	44.5	39.1
1991	62.0	54.1	46.7
1992	80.4	72.5	64.5
1993	70.3	60.9	53.6
1994	76.3	69.3	63.9
1995	99.6	89.7	80.8
1996	84.3	73.9	63.6
1997	82.4	71.9	57.4
1998	85.3	74.2	64.6
1999	80.0	68.1	57.8
2000	75.0	63.0	52.4
2001	81.0	70.5	55.2
2002	78.8	69.5	55.2
2003	81.7	72.6	56.0
2004	78.6	73.8	55.6
2005	79.8	75.2	57.7
2006	76.9	73.6	57.2
2007	80.5	76.4	59.2
2008	81.5	77.1	60.4
Average (1999 – 2008)	79.4	72.0	56.7
2009	79.9	71.9	58.0

* Preoperational Data

3.11 LAND USE CENSUS

The 2009 Annual Land Use Census was conducted July 15, and July 16, 2009 as required by SLC 16.11-14. Table 3.11 summarizes census results. A map indicating identified locations is shown in Figure 3.11.

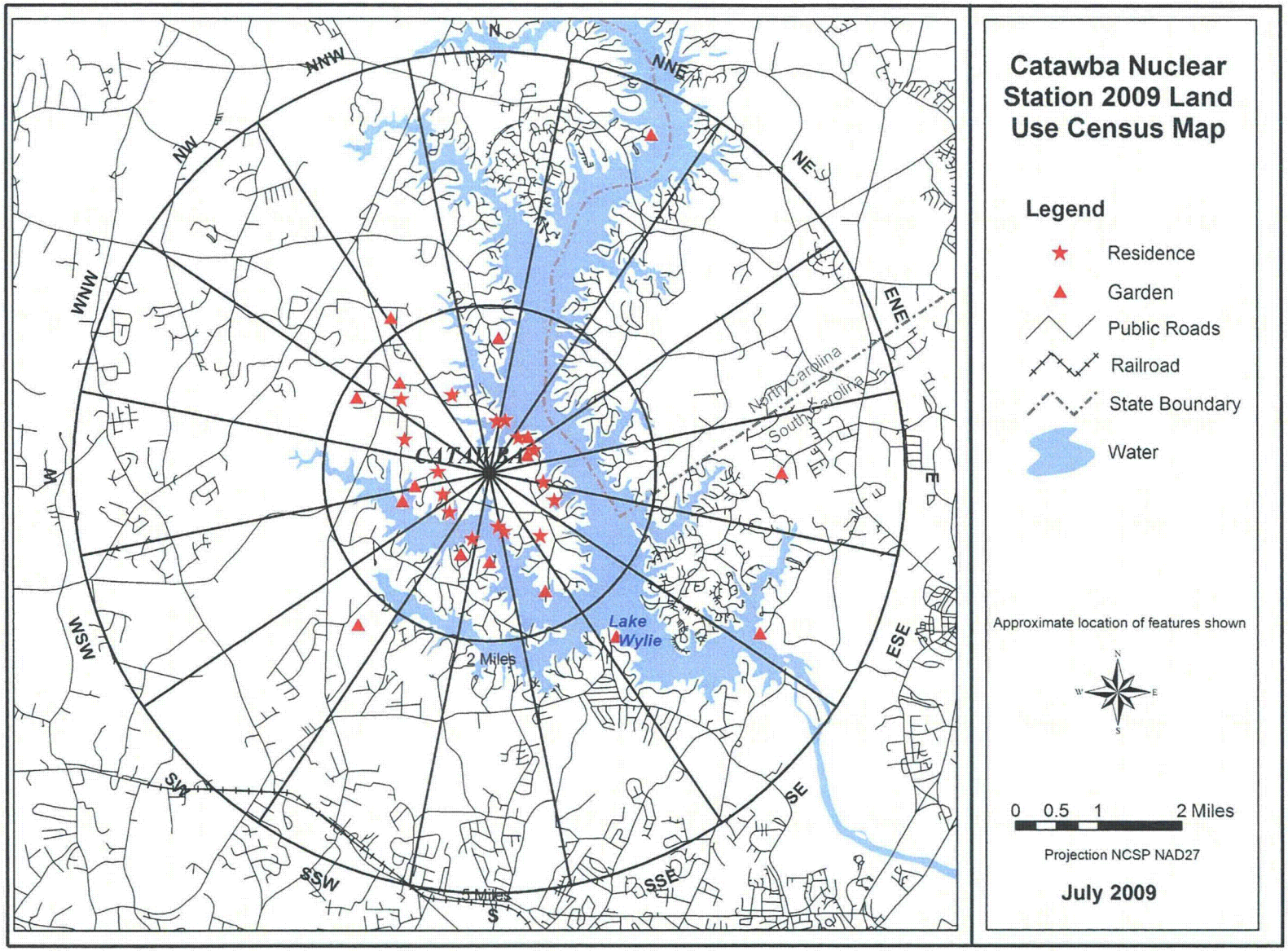
During the 2009 census, no new residences, irrigated gardens (superior to existing gardens) or milk locations were identified. The nearest residence is located in the NE sector at 0.56 miles. No environmental program changes were required as a result of the 2009 land use census.

Table 3.11 Catawba 2009 Land Use Census Results

Sector		Distance (Miles)	Sector		Distance (Miles)
N	Nearest Residence	0.63	S	Nearest Residence	0.63
	Nearest Garden (irrigated)	1.55		Nearest Garden	0.80
	Nearest Milk Animal	-		Nearest Milk Animal	-
NNE	Nearest Residence	0.66	SSW	Nearest Residence	0.81
	Nearest Garden	4.39		Nearest Garden	1.02
	Nearest Milk Animal	-		Nearest Milk Animal	-
NE	Nearest Residence	0.56	SW	Nearest Residence	0.66
	Nearest Garden	0.68		Nearest Garden	2.29
	Nearest Milk Animal	-		Nearest Milk Animal	-
ENE	Nearest Residence	0.61	WSW	Nearest Residence	0.61
	Nearest Garden (irrigated)	0.61		Nearest Garden	1.10
	Nearest Milk Animal	-		Nearest Milk Animal	-
E	Nearest Residence	0.65	W	Nearest Residence	0.68
	Nearest Garden	3.51		Nearest Garden	0.96
	Nearest Milk Animal	-		Nearest Milk Animal	-
ESE	Nearest Residence	0.84	WNW	Nearest Residence	1.10
	Nearest Garden	3.70		Nearest Garden	1.87
	Nearest Milk Animal	-		Nearest Milk Animal	-
SE	Nearest Residence	0.97	NW	Nearest Residence	1.39
	Nearest Garden (irrigated)	2.55		Nearest Garden	1.54
	Nearest Milk Animal	-		Nearest Milk Animal	-
SSE	Nearest Residence	0.74	NNW	Nearest Residence	0.91
	Nearest Garden	1.64		Nearest Garden	2.21
	Nearest Milk Animal	-		Nearest Milk Animal	-

"-" indicates no occurrences within the 5 mile radius

Figure 3.11


Catawba Nuclear Station 2009 Land Use Census Map
Legend
Residence
Garden
Public Roads
Railroad
State Boundary
Water
Approximate location of features shown
0 0.5 1 2 Miles
Projection NCSP NAD27
July 2009
CATAWBA
Lake Wylie
North Carolina
South Carolina
2 Miles
5 Miles
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
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WSW
W
WNW
NW
NNW

4.0 EVALUATION OF DOSE

4.1 DOSE FROM ENVIRONMENTAL MEASUREMENTS

Annual doses to maximum exposed individuals were estimated based on measured concentrations of radionuclides in 2009 CNS REMP samples. The primary purpose of estimating doses based on sample results is to allow comparison to effluent program dose estimates.

Doses based on sample results were calculated using the methodology and data presented in NRC Regulatory Guide 1.109. Measured radionuclide concentrations, averaged over the entire year for a specific radionuclide, indicator location and sample type, were used to calculate REMP-based doses. Where applicable, average background concentration at the corresponding control location was subtracted. Regulatory Guide 1.109 consumption rates for the maximum exposed individual were used in the calculations. When the guide listed "NO DATA" as the dose factor for a given radionuclide and organ, a dose factor of zero was assumed.

Maximum dose estimates (Highest Annual Mean Concentration) based on broadleaf vegetation, fish, and shoreline sediment sample results are reported in Table 4.1-A. The individual critical population and pathway dose calculations are reported in Table 4.1-B.

REMP-based dose estimates are not reported for airborne radioiodine, airborne particulate, milk, or ground water sample types because no radionuclides other than naturally occurring K-40 and Be-7 were detected in the samples. Dose estimates are not reported for surface water because sampled surface water is not considered to be a potable drinking water source although surface water tritium concentrations are used in calculating doses from fish. Exposure estimates based upon REMP TLD results are discussed in Section 3.10.

The maximum environmental organ dose estimate for any single sample type (other than direct radiation from gaseous effluents) collected during 2009 was 3.61E-1 mrem to the maximum exposed child bone from consuming broadleaf vegetation.

4.2 ESTIMATED DOSE FROM RELEASES

Throughout the year, dose estimates were calculated based on actual 2009 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. These doses are shown in Table 4.1-A along with the corresponding REMP-based dose estimates. Summaries of RETDAS dose calculations are reported in the Annual Radioactive Effluent Release Report (reference 6.6).

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, milk and vegetation pathways.

4.3 COMPARISON OF DOSES

The environmental and effluent dose estimates 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.

There are some differences in how effluent and environmental doses are calculated that affect the comparison. Doses calculated from environmental data are conservative because they are based on a mean that includes only samples with a net positive activity versus a mean that includes all sample results (i.e. zero results are not included in the mean). Also, airborne tritium is not measured in environmental samples but is used to calculate effluent doses.

In calculations based on liquid release pathways, drinking water, fish, and shoreline sediment were the predominant dose pathways based on environmental and effluent data. The maximum total organ dose based on 2009 environmental sample results was 7.00E-3 mrem to the adult total body. The maximum total organ dose of 6.80E-2 mrem for liquid effluent-based estimates was to the adult GI-LLI.

In calculations based on gaseous release pathways, vegetation was the predominant dose pathway for effluent samples. The maximum total organ dose for gaseous effluent estimates was 1.54E0 mrem to the child's liver, total body, thyroid, kidney, lung, and GI-LLI. Vegetation was the predominant dose pathway for environmental samples. The maximum total organ dose for gaseous environmental estimates was 3.61E-1 mrem to the child bone.

Noble gas samples are not collected as part of the REMP, preventing an analogous comparison of effluent-based noble gas exposure estimates.

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 CNS are being maintained well within regulatory limits.

TABLE 4.1-A

CATAWBA NUCLEAR STATION
2009 ENVIRONMENTAL AND EFFLUENT DOSE COMPARISON

LIQUID RELEASE PATHWAY

Organ	Environmental or Effluent Data	Critical Age [1]	Critical Pathway [2]	Location	Maximum Dose [3] (mrem)
Skin	Environmental	Teen	Shoreline Sediment	208 (0.45 mi S)	1.66E-03
Skin	Effluent	Teen	Shoreline Sediment	Discharge Pt.	9.40E-03
Bone	Environmental	-	-	-	0.00E+00
Bone	Effluent	Teen	Shoreline Sediment	Discharge Pt.	1.49E-02
Liver	Environmental	Adult	Fish	208 (0.45 mi S)	6.75E-03
Liver	Effluent	Child	Drinking Water	7.30 mi SSE	5.38E-02
T. Body	Environmental	Adult	Fish	208 (0.45 mi S)	6.75E-03
T. Body	Effluent	Child	Drinking Water	7.30 mi SSE	4.74E-02
Thyroid	Environmental	Adult	Fish	208 (0.45 mi S)	6.75E-03
Thyroid	Effluent	Child	Drinking Water	7.30 mi SSE	4.45E-02
Kidney	Environmental	Adult	Fish	208 (0.45 mi S)	6.75E-03
Kidney	Effluent	Child	Drinking Water	7.30 mi SSE	4.75E-02
Lung	Environmental	Adult	Fish	208 (0.45 mi S)	6.75E-03
Lung	Effluent	Child	Drinking Water	7.30 mi SSE	4.55E-02
GI-LLI	Environmental	Adult	Fish	208 (0.45 mi S)	6.75E-03
GI-LLI	Effluent	Adult	Fish	7.30 mi SSE	6.80E-02

(1) Critical Age is the highest total dose (all pathways) to an age group.

(2) Critial Pathway is the highest individual dose within the identified Critical Age group.

(3) 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 [1]	Critical Pathway [2]	Location	Maximum Dose [3] (mrem)
Skin	Environmental	-	-	-	0.00E+00
Skin	Effluent	-	-	-	-
Bone	Environmental	Child	Vegetation	201 (0.53 mi NE)	3.61E-01
Bone	Effluent	-	-	-	-
Liver	Environmental	Child	Vegetation	201 (0.53 mi NE)	3.46E-01
Liver	Effluent	Child	Vegetation	0.68 mi NE	1.54E+00
T. Body	Environmental	Adult	Vegetation	201 (0.53 mi NE)	1.94E-01
T. Body	Effluent	Child	Vegetation	0.68 mi NE	1.54E+00
Thyroid	Environmental	-	-	-	0.00E+00
Thyroid	Effluent	Child	Vegetation	0.68 mi NE	1.54E+00
Kidney	Environmental	Child	Vegetation	201 (0.53 mi NE)	1.13E-01
Kidney	Effluent	Child	Vegetation	0.68 mi NE	1.54E+00
Lung	Environmental	Child	Vegetation	201 (0.53 mi NE)	4.06E-02
Lung	Effluent	Child	Vegetation	0.68 mi NE	1.54E+00
GI-LLI	Environmental	Adult	Vegetation	201 (0.53 mi NE)	5.74E-03
GI-LLI	Effluent	Child	Vegetation	0.68 mi NE	1.54E+00

(1) Critical Age is the highest total dose (all pathways) to an age group.

(2) Critial Pathway is the highest individual dose within the identified Critical Age group.

(3) 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	Environmental	-	-	-	Not Sampled
Beta	Effluent	N/A	Noble Gas	0.5 mi. NNE	1.23E-02
Gamma	Environmental	-	-	-	Not Sampled
Gamma	Effluent	N/A	Noble Gas	0.5 mi. NNE	3.21E-02

TABLE 4.1-B

Maximum Individual Dose for 2009 based on Environmental Measurements (mrem) for Catawba 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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	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
	TOTAL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	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	3.61E-01	3.46E-01	5.11E-02	0.00E+00	1.13E-01	4.06E-02	2.17E-03	0.00E+00
	Fish	0.00E+00	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	0.00E+00
	Shoreline Sediment	0.00E+00	0.00E+00	2.95E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.46E-04
	TOTAL	3.61E-01	3.50E-01	5.57E-02	4.29E-03	1.17E-01	4.49E-02	6.46E-03	3.46E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	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	2.00E-01	2.66E-01	9.26E-02	0.00E+00	9.05E-02	3.52E-02	3.78E-03	0.00E+00
	Fish	0.00E+00	5.19E-03	5.19E-03	5.19E-03	5.19E-03	5.19E-03	5.19E-03	0.00E+00
	Shoreline Sediment	0.00E+00	0.00E+00	1.41E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-03
	TOTAL	2.00E-01	2.71E-01	9.92E-02	5.19E-03	9.57E-02	4.04E-02	8.97E-03	1.66E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	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	2.17E-01	2.96E-01	1.94E-01	0.00E+00	1.01E-01	3.35E-02	5.74E-03	0.00E+00
	Fish	0.00E+00	6.75E-03	6.75E-03	6.75E-03	6.75E-03	6.75E-03	6.75E-03	0.00E+00
	Shoreline Sediment	0.00E+00	0.00E+00	2.53E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.97E-04
	TOTAL	2.17E-01	3.03E-01	2.01E-01	6.75E-03	1.08E-01	4.03E-02	1.25E-02	2.97E-04

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

Catawba Nuclear Station
Dose from Drinking Water Pathway for 2009 Data
Maximum Exposed Infant

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

Usage (intake in one year) = **330 l**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	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	ALL	0.00*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						Dose Commitment (mrem) =				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Tritium was identified at the indicator location; however because it was less than the control location, no dose was attributed to releases from Catawba.

Catawba Nuclear Station
Dose from Drinking Water Pathway for 2009 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**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	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	ALL	0.00*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						Dose Commitment (mrem) =				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Tritium was identified at the indicator location; however because it was less than the control location, no dose was attributed to releases from Catawba.

Catawba Nuclear Station
Dose from Broadleaf Vegetation Pathway for 2009 Data
Maximum Exposed Child

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

Usage (intake in one year) = **26 kg**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
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	201	42.5	3.61E-01	3.46E-01	5.11E-02	0.00E+00	1.13E-01	4.06E-02	2.17E-03
						Dose Commitment (mrem) =				3.61E-01	3.46E-01	5.11E-02	0.00E+00	1.13E-01	4.06E-02	2.17E-03

Catawba Nuclear Station
Dose from Fish Pathway for 2009 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 = 3401 pCi/l x 0.9 = 3061 pCi/kg

Usage (intake in one year) = 6.9 kg

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	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	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
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	0.0	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	208	3061	0.00E+00	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03
						Dose Commitment (mrem) =				0.00E+00	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03

Catawba Nuclear Station
Dose from Shoreline Sediment Pathway for 2009 Data
Maximum Exposed Child

Shoreline Recreation =	14	hr (in one year)
Shore Width Factor =	0.2	
Sediment Surface Mass =	40	kg/m^2

Child Dose from Shoreline Sediment Pathway (mrem) = Shoreline Recreation (hr) x External Dose Factor (mrem/hr per pCi/m^2) x Shore Width Factor x Sediment Surface Mass (kg/m^2) x Sediment Concentration (pCi/kg)

	External Dose Factor Standing on Contaminated Ground		Highest Annual Net Mean Concentration		Dose	
	(mrem/hr per pCi/m^2)		Indicator	Sediment	(mrem)	
Radionuclide	T. Body	Skin	Location	(pCi/kg)	T. Body	Skin
Mn-54	5.80E-09	6.80E-09	ALL	0.00	0.00E+00	0.00E+00
Co-58	7.00E-09	8.20E-09	208-1S	110.0	8.62E-05	1.01E-04
Co-60	1.70E-08	2.00E-08	208-1S	104.0	1.98E-04	2.33E-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	208-1S	22.7	1.07E-05	1.25E-05
		Dose Commitment (mrem) =			2.95E-04	3.46E-04

Catawba Nuclear Station
Dose from Drinking Water Pathway for 2009 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**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	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	ALL	0.00*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						Dose Commitment (mrem)=				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Tritium was identified at the indicator location; however because it was less than the control location, no dose was attributed to releases from Catawba.

Catawba Nuclear Station
Dose from Broadleaf Vegetation Pathway for 2009 Data
Maximum Exposed Teen

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

Usage (intake in one year) = **42 kg**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
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	201	42.5	2.00E-01	2.66E-01	9.26E-02	0.00E+00	9.05E-02	3.52E-02	3.78E-03
						Dose Commitment (mrem) =				2.00E-01	2.66E-01	9.26E-02	0.00E+00	9.05E-02	3.52E-02	3.78E-03

Catawba Nuclear Station
Dose from Fish Pathway for 2009 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 = 3401 pCi/l x 0.9 = 3061 pCi/kg

Usage (intake in one year) = **16 kg**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	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	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
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	208	3061	0.00E+00	5.19E-03	5.19E-03	5.19E-03	5.19E-03	5.19E-03	5.19E-03
						Dose Commitment (mrem) =				0.00E+00	5.19E-03	5.19E-03	5.19E-03	5.19E-03	5.19E-03	5.19E-03

Catawba Nuclear Station
Dose from Shoreline Sediment Pathway for 2009 Data
Maximum Exposed Teen

Shoreline Recreation = 67 **hr (in one year)**
Shore Width Factor = 0.2
Sediment Surface Mass : 40 **kg/m^2**

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/m^2) x Sediment Concentration (pCi/kg)

	External Dose Factor Standing on Contaminated Ground (mrem/hr per pCi/m^2)		Highest Annual Net Mean Concentration		Dose (mrem)	
Radionuclide	T. Body	Skin	Indicator Location	Sediment (pCi/kg)	T. Body	Skin
Mn-54	5.80E-09	6.80E-09	ALL	0.00	0.00E+00	0.00E+00
Co-58	7.00E-09	8.20E-09	208-1S	110.0	4.13E-04	4.83E-04
Co-60	1.70E-08	2.00E-08	208-1S	104.0	9.48E-04	1.11E-03
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	208-1S	22.7	5.11E-05	5.96E-05
	Dose Commitment (mrem) =				1.41E-03	1.66E-03

Catawba Nuclear Station
Dose from Drinking Water Pathway for 2009 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

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	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	ALL	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						Dose Commitment (mrem) =				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Tritium was identified at the indicator location; however because it was less than the control location, no dose was attributed to releases from Catawba.

Catawba Nuclear Station
Dose from Broadleaf Vegetation Pathway for 2009 Data
Maximum Exposed Adult

Adult Dose from Vegetation (mrem) = Usage (kg) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

Usage (intake in one year) = **64 kg**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
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	201	42.5	2.17E-01	2.96E-01	1.94E-01	0.00E+00	1.01E-01	3.35E-02	5.74E-03
						Dose Commitment (mrem) =				2.17E-01	2.96E-01	1.94E-01	0.00E+00	1.01E-01	3.35E-02	5.74E-03

Catawba Nuclear Station
Dose from Fish Pathway for 2009 Data
Maximum Exposed Adult

Adult 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 = 3401 pCi/l x 0.9 = 3061 pCi/kg

Usage (intake in one year) = **21 kg**

	Ingestion Dose Factor							Highest Annual Net Mean Concentration		Dose (mrem)						
Radionuclide	**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	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
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	208	3061	0.00E+00	6.75E-03	6.75E-03	6.75E-03	6.75E-03	6.75E-03	6.75E-03
						Dose Commitment (mrem) =				0.00E+00	6.75E-03	6.75E-03	6.75E-03	6.75E-03	6.75E-03	6.75E-03

Catawba Nuclear Station
Dose from Shoreline Sediment Pathway for 2009 Data
Maximum Exposed Adult

Shoreline Recreation = 12 **hr (in one year)**
Shore Width Factor = 0.2
Sediment Surface Mass = 40 **kg/m^2**

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/m^2) x Sediment Concentration (pCi/kg)

	External Dose Factor Standing on Contaminated Ground (mrem/hr per pCi/m^2)		Highest Annual Net Mean Concentration		Dose (mrem)	
Radionuclide	T. Body	Skin	Indicator Location	Sediment (pCi/kg)	T. Body	Skin
Mn-54	5.80E-09	6.80E-09	ALL	0.00	0.00E+00	0.00E+00
Co-58	7.00E-09	8.20E-09	208-1S	110.0	7.39E-05	8.66E-05
Co-60	1.70E-08	2.00E-08	208-1S	104.0	1.70E-04	2.00E-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	208-1S	22.7	9.15E-06	1.07E-05
Dose Commitment (mrem) =					2.53E-04	2.97E-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 Energy Corporation's Environmental Center.

Duke Energy Corporation'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 tritium analyses.

5.5 DUKE ENERGY INTERCOMPARISON PROGRAM

EnRad Laboratories participated in the Duke Energy Nuclear Generation Department Intercomparison Program during 2009. 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. A summary of the EnRad Laboratory program results for 2009 is documented in Table 5.0-A.

5.6 ERA PROFICIENCY TESTING

EnRad Laboratories performed method proficiency testing through a program administered by Environmental Resource Associates (ERA) of Arvada, CO. ERA supplied requested method proficiency samples for analysis and nuclide concentration determination. ERA reported proficiency test results to the North Carolina Department of Health and Human Services, North Carolina Public Health Drinking Water Laboratory Certification Program. A summary of these proficiency test data for 2009 is documented in Table 5.0-B.

5.7 DUKE ENERGY AUDITS

The Catawba Radiation Protection Section was not audited by the Quality Assurance Group in 2009, but was audited in 2008 (reference 6.16). There were no REMP recommendations as a result of the 2008 audit.

EnRad Laboratories was not audited by the Quality Assurance Group in 2009, but was audited in 2008 (reference 6.17). There were some REMP recommendations as a result of the 2008 audit.

5.8 U.S. NUCLEAR REGULATORY COMMISSION INSPECTIONS

The Catawba Nuclear Station Radiological Environmental Monitoring Program was audited by the NRC in 2009 (Reference 6.12). No findings were noted in the report.

5.9 STATE OF SOUTH CAROLINA INTERCOMPARISON PROGRAM

Catawba Nuclear Station routinely participates with the Bureau of Radiological Health of the State's Department of Health and Environmental Control (DHEC) in an

intercomparison program. The Memorandum of Agreement (MOA) between SC DHEC and Duke Energy describes the sampling frequency and analysis parameters for drinking water, surface water, milk, fish, vegetation, and shoreline sediment samples collected by EnRad Laboratories. Samples are routinely split with DHEC for intercomparison analysis. DHEC collects air samples near two of the locations sampled for air by CNS. Results of the analyses performed on split and duplicate samples are sent to DHEC.

5.10 TLD INTERCOMPARISON PROGRAM

5.10.1 NUCLEAR TECHNOLOGY SERVICES INTERCOMPARISON PROGRAM

Radiation Dosimetry and Records participates in a quarterly TLD intercomparison program administered by Nuclear Technology Services, Inc. of Roswell, GA. Nuclear Technology Services irradiates environmental dosimeters quarterly and sends them to the Radiation Dosimetry and Records group for analysis of the unknown estimated delivered exposure. A summary of the Nuclear Technology Services Intercomparison Report is documented in Table 5.0-C.

5.10.2 INTERNAL CROSSCHECK (DUKE ENERGY)

Radiation Dosimetry and Records participates in a quarterly TLD intracomparison program administered internally by the Dosimetry Lab. The Dosimetry Lab Staff irradiates environmental dosimeters quarterly and submits them for analysis of the unknown estimated delivered exposure. A summary of the Internal Cross Check (Duke Energy) Result is documented in Table 5.0-C.

TABLE 5.0-A
DUKE ENERGY
INTERLABORATORY COMPARISON PROGRAM

2009 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

If applicable, footnote explanations are included following this table.

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
3/5/2009	Q091GWL	Cr-51	1.54 - 2.73 E5	2.05 E5	2.06 E5	3 Pass
		Mn-54	4.68 - 8.30 E4	6.24 E4	6.47 E4	3 Pass
		Co-58	4.88 - 8.65 E4	6.50 E4	6.52 E4	3 Pass
		Fe-59	4.40 - 7.80 E4	5.87 E4	6.15 E4	3 Pass
		Co-60	5.08 - 9.02 E4	6.78 E4	7.05 E4	3 Pass
		Zn-65	5.79 - 10.26 E4	7.72 E4	8.01 E4	3 Pass
		Cs-134	3.38 - 5.99 E4	4.50 E4	4.13 E4	3 Pass
		Cs-137	3.96 - 7.03 E4	5.28 E4	5.05 E4	3 Pass
		Ce-141	4.55 - 8.07 E4	6.07 E4	5.99 E4	3 Pass
7/29/2009	Q093GWS	Co-57	1.22 - 2.16 E5	1.62 E5	1.73 E5	2 Pass
		Co-60	1.88 - 3.33 E5	2.50 E5	2.65 E5	2 Pass
		Y-88	1.22 - 2.16 E5	1.62 E5	1.63 E5	2 Pass
		Sn-113	1.91 - 3.38 E5	2.54 E5	2.46 E5	2 Pass
		Cs-137	3.28 - 5.81 E5	4.37 E5	4.46 E5	2 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
3/5/2009	Q091GWL	Cr-51	1.54 - 2.73 E5	2.05 E5	2.04 E5	3 Pass
		Mn-54	4.68 - 8.30 E4	6.24 E4	6.53 E4	3 Pass
		Co-58	4.88 - 8.65 E4	6.50 E4	6.48 E4	3 Pass
		Fe-59	4.40 - 7.80 E4	5.87 E4	6.17 E4	3 Pass
		Co-60	5.08 - 9.02 E4	6.78 E4	6.96 E4	3 Pass
		Zn-65	5.79 - 10.26 E4	7.72 E4	7.98 E4	3 Pass
		Cs-134	3.38 - 5.99 E4	4.50 E4	4.03 E4	3 Pass
		Cs-137	3.96 - 7.03 E4	5.28 E4	5.03 E4	3 Pass
		Ce-141	4.55 - 8.07 E4	6.07 E4	5.94 E4	3 Pass

Gamma in Water 1.0 liter, continued

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
7/29/2009	Q093GWS	Co-57	1.22 - 2.16 E5	1.62 E5	1.64 E5	3 Pass
		Co-60	1.88 - 3.33 E5	2.50 E5	2.59 E5	3 Pass
		Y-88	1.22 - 2.16 E5	1.62 E5	1.58 E5	3 Pass
		Sn-113	1.91 - 3.38 E5	2.54 E5	2.40 E5	3 Pass
		Cs-137	3.28 - 5.81 E5	4.37 E5	4.28 E5	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
3/5/2009	Q091GWL	Cr-51	1.54 - 2.73 E5	2.05 E5	2.05 E5	3 Pass
		Mn-54	4.68 - 8.30 E4	6.24 E4	6.35 E4	3 Pass
		Co-58	4.88 - 8.65 E4	6.50 E4	6.27 E4	3 Pass
		Fe-59	4.40 - 7.80 E4	5.87 E4	6.10 E4	3 Pass
		Co-60	5.08 - 9.02 E4	6.78 E4	6.94 E4	3 Pass
		Zn-65	5.79 - 10.26 E4	7.72 E4	8.01 E4	3 Pass
		Cs-134	3.38 - 5.99 E4	4.50 E4	3.88 E4	3 Pass
		Cs-137	3.96 - 7.03 E4	5.28 E4	4.90 E4	3 Pass
		Ce-141	4.55 - 8.07 E4	6.07 E4	5.80 E4	3 Pass
7/29/2009	Q093GWS	Co-57	1.22 - 2.16 E5	1.62 E5	1.61 E5	3 Pass
		Co-60	1.88 - 3.33 E5	2.50 E5	2.55 E5	3 Pass
		Y-88	1.22 - 2.16 E5	1.62 E5	1.58 E5	3 Pass
		Sn-113	1.91 - 3.38 E5	2.54 E5	2.36 E5	3 Pass
		Cs-137	3.28 - 5.81 E5	4.37 E5	4.27 E5	3 Pass

Gamma in Water 0.25 liter

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
3/5/2009	Q091GWL	Cr-51	1.54 - 2.73 E5	2.05 E5	2.08 E5	3 Pass
		Mn-54	4.68 - 8.30 E4	6.24 E4	6.51 E4	3 Pass
		Co-58	4.88 - 8.65 E4	6.50 E4	6.43 E4	3 Pass
		Fe-59	4.40 - 7.80 E4	5.87 E4	6.15 E4	3 Pass
		Co-60	5.08 - 9.02 E4	6.78 E4	7.13 E4	3 Pass
		Zn-65	5.79 - 10.26 E4	7.72 E4	7.93 E4	3 Pass
		Cs-134	3.38 - 5.99 E4	4.50 E4	4.00 E4	3 Pass
		Cs-137	3.96 - 7.03 E4	5.28 E4	5.07 E4	3 Pass
		Ce-141	4.55 - 8.07 E4	6.07 E4	5.97 E4	3 Pass

Gamma in Water 0.25 liter, continued

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Mean Reported Value pCi/l	Cross Check Status
7/29/2009	Q093GWS	Co-57	1.22 - 2.16 E5	1.62 E5	1.58 E5	2 Pass
		Co-60	1.88 - 3.33 E5	2.50 E5	2.57 E5	2 Pass
		Y-88	1.22 - 2.16 E5	1.62 E5	1.58 E5	2 Pass
		Sn-113	1.91 - 3.38 E5	2.54 E5	2.32 E5	2 Pass
		Cs-137	3.28 - 5.81 E5	4.37 E5	4.13 E5	2 Pass

Gamma in Filter

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi	Reference Value pCi	Mean Reported Value pCi	Cross Check Status
6/18/2009	E6701-37	Cr-51	0.29 - 10.17 E2	1.73 E2	1.61 E2	2 Pass
		Mn-54	4.45 - 7.89 E1	5.93 E1	5.96 E1	2 Pass
		Co-58	2.94 - 5.36 E1	3.97 E1	3.95 E1	2 Pass
		Fe-59	2.06 - 13.54 E1	5.29 E1	4.50 E1	2 Pass
		Co-60	1.01 - 1.80 E2	1.35 E2	1.36 E2	2 Pass
		Zn-65	5.68 - 10.07 E1	7.57 E1	8.01 E1	2 Pass
		Cs-134	5.38 - 9.54 E1	7.17 E1	6.50 E1	2 Pass
		Cs-137	6.23 - 11.04 E1	8.30 E1	7.61 E1	2 Pass
		Ce-141	0.92 - 1.64 E2	1.23 E2	1.30 E2	2 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
7/21/2009	Q093LIW1	I-131	1.99 - 3.53 E2	2.65 E2	2.29 E2	3 Pass
7/21/2009	Q093LIW2	I-131	0.87 - 1.55 E1	1.16 E1	0.89 E1	1/3 Low [1]
7/21/2009	Q093LIW3	I-131	5.09 - 9.03 E2	6.79 E2	5.99 E2	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
3/4/2009	Q091LIM2	I-131	3.30 - 5.85 E3	4.40 E3	2.65 E3	3/3 Low [2]
3/4/2009	Q091LIM3	I-131	1.41 - 2.51 E2	1.88 E2	1.38 E2	2/3 Low [3]
6/8/2009	Q092LIM1	I-131	3.36 - 5.95 E2	4.48 E2	4.54 E2	3 Pass
6/8/2009	Q092LIM2	I-131	0.86 - 1.53 E3	1.15 E3	1.08 E3	3 Pass
6/8/2009	Q092LIM3	I-131	7.49 - 13.28 E1	9.99 E1	9.61 E1	3 Pass

Iodine on Cartridge

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi	Reference Value pCi	Mean Reported Value pCi	Cross Check Status
6/18/2009	E6702-37	I-131	7.24 - 12.83 E1	9.65 E1	9.53 E1	3 Pass

Beta Air Particulate

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi	Reference Value pCi	Mean Reported Value pCi	Cross Check Status
12/10/2009	E6903-37	Cs-137	1.97 - 3.50 E2	2.63 E2	2.36 E2	3 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
1/28/2009	Q091TWR1	H-3	4.30 - 7.62 E3	5.73 E3	5.54 E3	3 Pass
1/28/2009	Q091TWR2	H-3	0.86 - 1.53 E4	1.15 E4	1.09 E4	3 Pass
7/22/2009	Q093TWS1	H-3	0.88 - 1.56 E4	1.18 E4	1.13 E4	3 Pass
7/22/2009	Q093TWS2	H-3	3.43 - 6.61 E2	4.76 E2	5.10 E2	3 Pass
11/12/2009	Q094TWS1	H-3	5.30 - 9.40 E8	7.07 E8	7.82 E8	3 Pass
11/12/2009	Q094TWS2	H-3	0.77 - 1.36 E5	1.02 E5	0.97 E5	3 Pass

Table 5.0-A Footnote Explanations

(1) Iodine in Water, Sample ID Q093LIW2, Reference Date 7/21/2009

One of three results was outside of the acceptance range (reference 6.18).

(2) Iodine in Milk, Sample ID Q091LIM2, Reference Date 3/4/2009

Three results for this cross-check were reported. All three of the reported results trended low and were outside of the acceptance range (reference 6.19).

(3) Iodine in Milk, Sample ID Q091LIM3, Reference Date 3/4/2009

Three results for this cross-check were reported. Two of the three reported results trended low and were outside of the acceptance range (reference 6.19).

TABLE 5.0-B

ENVIRONMENTAL RESOURCE ASSOCIATES (ERA)
QUIK™ RESPONSE PROGRAM

2009 PROFICIENCY TEST RESULTS FOR
ENRAD LABORATORIES

ERA LABORATORY CODE: D242401

Proficiency test samples are received, prepared, analyzed, and reported to Environmental Resource Associates as described in the "Quik" Response instruction package within the study period. Proficiency test data are reported to ERA for evaluation. ERA reports proficiency test results to the North Carolina Department of Health and Human Services, North Carolina Public Drinking Water Laboratory Certification Program.

If applicable, footnote explanations are included following this data table.

Gamma Emitters in Water

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Reported Value pCi/l	Proficiency Check Status
4/6/2009	RAD-77*	Ba-133	4.34 - 5.83 E1	5.27 E1	6.18 E1	High [1]
		Cs-134	5.95 - 8.02 E1	7.29 E1	6.86 E1	Pass
		Cs-137	1.51 - 1.87 E2	1.68 E2	1.52 E2	Pass
		Co-60	8.00 - 10.0 E1	8.89 E1	9.56 E1	Pass
		Zn-65	7.60 - 10.1 E1	8.44 E1	9.97 E1	Pass
10/5/2009	RAD-79**	Ba-133	7.83 - 10.2 E1	9.29 E1	9.35 E1	Pass
		Cs-134	6.50 - 8.73 E1	7.94 E1	7.60 E1	Pass
		Cs-137	4.91 - 6.29 E1	5.46 E1	5.51 E1	Pass
		Co-60	1.05 - 1.31 E2	1.17 E2	1.15 E2	Pass
		Zn-65	8.96 - 11.9 E1	9.95 E1	1.11 E2	Pass

Tritium in Water

Reference Date	Sample I.D.	Nuclide	Acceptance Range pCi/l	Reference Value pCi/l	Reported Value pCi/l	Proficiency Check Status
4/6/2009	RAD-77*	H-3	1.78 - 2.23 E4	2.03 E4	1.87 E4	Pass
10/5/2009	RAD-79**	H-3	1.43 - 1.80 E4	1.64 E4	1.53 E4	Pass

** ERA study period 4/6/2009 - 5/21/2009, ERA data report issue date 6/3/2009*

*** ERA study period 10/5/2009 - 11/19/2009, ERA data report issue date 12/4/2009*

Table 5.0-B Footnote Explanations

(1) Gamma Emitters in Water, Sample ID RAD-77, Reference Date 4/6/2009

Reported result for Ba-133 was above the acceptance range limit (reference 6.20).

TABLE 5.0-C
2009 ENVIRONMENTAL DOSIMETER CROSS-CHECK RESULTS

Nuclear Technology Services

1st Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
100125	110.1	104.0	5.87	<+/-15%	Pass
100203	109.2	104.0	5.00	<+/-15%	Pass
101141	105.4	104.0	1.35	<+/-15%	Pass
100210	104.5	104.0	0.48	<+/-15%	Pass
100386	108.6	104.0	4.42	<+/-15%	Pass
		Average Bias (B)	3.42		
		Standard Deviation (S)	2.37		
		Measure Performance |B|+S	5.79	<15%	Pass

2nd Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
102077	106	101.0	4.95	<+/-15%	Pass
102243	100	101.0	-0.99	<+/-15%	Pass
102244	108	101.0	6.93	<+/-15%	Pass
102323	102	101.0	0.99	<+/-15%	Pass
102329	101	101.0	0.00	<+/-15%	Pass
		Average Bias (B)	2.38		
		Standard Deviation (S)	3.40		
		Measure Performance |B|+S	5.78	<15%	Pass

3rd Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
102228	69.5	70.2	-1.00	<+/-15%	Pass
102492	71.1	70.2	1.28	<+/-15%	Pass
102007	69.9	70.2	-0.43	<+/-15%	Pass
102041	73.4	70.2	4.56	<+/-15%	Pass
102078	70.6	70.2	0.57	<+/-15%	Pass
		Average Bias (B)	1.00		
		Standard Deviation (S)	2.18		
		Measure Performance |B|+S	3.17	<15%	Pass

4th Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
100140	14.0	14.0	0.00	<+/-15%	Pass
100358	14.0	14.0	0.00	<+/-15%	Pass
100404	13.0	14.0	-7.14	<+/-15%	Pass
100405	14.0	14.0	0.00	<+/-15%	Pass
100415	15.0	14.0	7.14	<+/-15%	Pass
		Average Bias (B)	0.00		
		Standard Deviation (S)	5.05		
		Measure Performance |B|+S	5.05	<15%	Pass

Internal Crosscheck (Duke Energy)

1st Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
101297	18.3	19.0	-3.95	<+/-15%	Pass
101286	18.5	19.0	-2.58	<+/-15%	Pass
101258	18.2	19.0	-4.26	<+/-15%	Pass
101216	18.4	19.0	-3.42	<+/-15%	Pass
101252	18.1	19.0	-4.74	<+/-15%	Pass
101356	18.7	19.0	-1.74	<+/-15%	Pass
101339	18.2	19.0	-4.32	<+/-15%	Pass
101127	17.6	19.0	-7.47	<+/-15%	Pass
101278	19.4	19.0	1.89	<+/-15%	Pass
101305	18.4	19.0	-3.05	<+/-15%	Pass
		Average Bias (B)	-3.36		
		Standard Deviation (S)	2.40		
		Measure Performance |B|+S	5.76	<15%	Pass

2nd Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
102325	49.1	50.0	-1.78	<+/-15%	Pass
102491	48.7	50.0	-2.68	<+/-15%	Pass
102374	48.4	50.0	-3.26	<+/-15%	Pass
102084	47.6	50.0	-4.88	<+/-15%	Pass
102404	51.3	50.0	2.56	<+/-15%	Pass
102396	47.8	50.0	-4.32	<+/-15%	Pass
102346	48.7	50.0	-2.60	<+/-15%	Pass
102485	48.6	50.0	-2.80	<+/-15%	Pass
102059	48.2	50.0	-3.68	<+/-15%	Pass
102263	50.0	50.0	-0.08	<+/-15%	Pass
		Average Bias (B)	-2.35		
		Standard Deviation (S)	2.18		
		Measure Performance |B|+S	4.53	<15%	Pass

3rd Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
102400	25.9	27.0	-3.93	<+/-15%	Pass
102486	25.7	27.0	-4.70	<+/-15%	Pass
102402	25.9	27.0	-4.04	<+/-15%	Pass
102406	26.9	27.0	-0.44	<+/-15%	Pass
102435	26.6	27.0	-1.63	<+/-15%	Pass
102442	25.3	27.0	-6.48	<+/-15%	Pass
102436	25.9	27.0	-3.93	<+/-15%	Pass
102440	25.1	27.0	-7.19	<+/-15%	Pass
102479	25.2	27.0	-6.81	<+/-15%	Pass
102384	26.0	27.0	-3.67	<+/-15%	Pass
		Average Bias (B)	-4.28		
		Standard Deviation (S)	2.17		
		Measure Performance |B|+S	6.45	<15%	Pass

4th Quarter 2009

TLD Number	Delivered (mrem)	Reported (mrem)	Bias (% diff)	Pass/Fail Criteria	Pass/Fail
100955	20.4	22.0	-7.14	<+/-15%	Pass
100050	20.0	22.0	-9.18	<+/-15%	Pass
100885	21.2	22.0	-3.68	<+/-15%	Pass
101409	19.2	22.0	-12.77	<+/-15%	Pass
100389	20.3	22.0	-7.82	<+/-15%	Pass
100401	20.4	22.0	-7.18	<+/-15%	Pass
101383	21.0	22.0	-4.45	<+/-15%	Pass
100551	20.4	22.0	-7.14	<+/-15%	Pass
100748	20.9	22.0	-4.95	<+/-15%	Pass
100263	20.9	22.0	-4.91	<+/-15%	Pass
		Average Bias (B)	-6.92		
		Standard Deviation (S)	2.68		
		Measure Performance |B|+S	9.61	<15%	Pass

6.0 REFERENCES

6.1 Catawba Selected License Commitment Report

6.2 Catawba Technical Specifications

6.3 Catawba Updated Final Safety Analysis Review

6.4 Catawba Offsite Dose Calculation Manual

6.5 Catawba Annual Environmental Operating Report 1985 - 2008

6.6 Catawba Annual Effluent Report 1985 - 2008

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, Canberra Version 3.5.1, DPC Revision #4.0

6.12 NRC Integrated Inspection Report 05000413/2009003 and 05000414/2009003

6.13 Duke Energy Corporation EnRad Laboratory Charcoal Cartridge Study, performed 2001

6.14 Catawba Modifications CN-18103 (Unit 1), CN-28103 (Unit 2)

6.15 Problem Investigation Process Database, V 3.2.27, Duke Power Company, G-09-00688, G-09-00913

6.16 Radiological Effluents Controls Audit 08-20(INOS)(REC)(CNS)

6.17 Radiological Effluent Controls Audit 08-23(INOS)(REC)(NGO)

6.18 Problem Investigation Process Database, V 3.2.27, Duke Power Company, G-09-01278

6.19 Problem Investigation Process Database, V 3.2.27, Duke Power Company, G-09-00423

6.20 Problem Investigation Process Database, V 3.2.27, Duke Power Company, G-09-01295

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 Catawba 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, Fisheries and Aquatic Ecology.

This appendix describes the environmental sampling frequencies and analysis procedures by media type.

I. CHANGE OF SAMPLING PROCEDURES

No changes were made to the sampling procedure during 2009.

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.

Low-level iodine analyses are performed by passing a designated sample aliquot through a pre-weighed amount of ion exchange resin to remove and concentrate any iodine in the aqueous sample (milk). The resin is then dried, mixed thoroughly, and a net resin weight determined before being 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 or Perkin-Elmer 2900TR liquid scintillation system. Tritium samples are distilled and batch processed with a tritium spike and blank 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 Tennelec XLB Series 5 gas-flow proportional counters. Samples are batch processed with a blank to ensure sample contamination has not occurred.

III. CHANGE OF ANALYSIS PROCEDURES

No analysis procedures were changed during 2009.

IV. SAMPLING AND ANALYSIS PROCEDURES

A.1 AIRBORNE PARTICULATE AND RADIOIODINE

Airborne particulate and radioiodine samples at each of five 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 positioned 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 separate weekly gamma analysis was performed on each charcoal cartridge and air particulate. A weekly gross beta analysis was performed on each filter. The continuous composite samples were collected from the locations listed below.

Location 200	=	Site Boundary (0.63 mi. NNE)
Location 201	=	Site Boundary (0.53 mi. NE)
Location 205	=	Site Boundary (0.23 mi. SW)
Location 212	=	Tega Cay (3.32 mi. E)
Location 258	=	Fairhope Road (9.84 mi. W)

A.2 DRINKING WATER

Monthly composite drinking water samples were collected at each of two locations. A gross beta and gamma analysis was performed on monthly composites. Tritium analysis was performed on the quarterly composites. The composites were collected monthly from the locations listed below.

Location 214	=	Rock Hill Water Supply (7.30 mi. SSE)
Location 218	=	Belmont Water Supply (13.5 mi. NNE)

A.3 SURFACE WATER

Monthly composite samples were collected at each of three locations. A gamma analysis was performed on the monthly composites. Tritium analysis was

performed on the quarterly composites. The composites were collected monthly from the locations listed below.

Location 208	=	Discharge Canal (0.45 mi. S)
Location 211	=	Wylie Dam (4.06 mi. ESE)
Location 215	=	River Pointe - Hwy 49 (4.21 mi. NNE)

A.4 GROUND WATER

Grab samples were collected quarterly from residential wells at each of two locations. A gamma analysis and tritium analysis were performed on each sample. The samples were collected from the locations listed below.

Location 252	=	Residence (0.64 mi. SW)
Location 254	=	Residence (0.82 mi. N)

A.5 MILK

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

Location 221	=	Dairy (14.5 mi. NW)

A.6 BROADLEAF VEGETATION

Monthly samples were collected at each of five locations. A gamma analysis was performed on each sample. The samples were collected from the locations listed below.

Location 200	=	Site Boundary (0.63 mi. NNE)
Location 201	=	Site Boundary (0.53 mi. NE)
Location 222	=	Site Boundary (0.70 mi. N)
Location 226	=	Site Boundary (0.48 mi. S)
Location 258	=	Fairhope Road (9.84 mi. W)

A.7 FOOD PRODUCTS

Monthly samples were collected when available during the harvest season at one location. A gamma analysis was performed on each sample. The samples were collected from the location listed below.

Location 253	=	Irrigated Gardens (1.90 mi. SSE)

A.8 FISH

Semiannual samples were collected at each of two locations. 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 208	=	Discharge Canal (0.45 mi. S)
Location 216	=	Hwy 49 Bridge (4.19 mi. NNE)

A.9 SHORELINE SEDIMENT

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

Location 208	=	Discharge Canal (0.45 mi. S)
Location 210	=	Ebenezer Access (2.31 mi. SE)
Location 215	=	River Pointe - Hwy 49 (4.21 mi. NNE)

A.10 DIRECT GAMMA RADIATION (TLD)

Thermoluminescent dosimeters (TLD) were collected quarterly at forty-one locations. A gamma exposure rate was determined for each TLD. TLD locations are listed in Table 2.1-B. The TLDs were placed as indicated below.

* An inner ring of 16 TLDs, one in each meteorological sector in the general area of the site boundary.

* 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 at three control locations.

A.11 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 Garden greater than 50 square meters or 500 square feet

* The Nearest Milk-giving Animal (cow, goat, etc.)

The census was conducted during the growing season from 7/15 to 7/16/2009. Results are shown in Table 3.11. No changes were made to the sampling procedures during 2009 as a result of the 2009 census.

V. GLOBAL POSITIONING SYSTEM (GPS) ANALYSIS

The Catawba site centerline used for GPS measurements was referenced from the Catawba Nuclear Station Updated Final Safety Analysis Report (UFSAR), section 2.1.1.1, Specification of Location. Waypoint coordinates used for CNS GPS measurements were latitude 35°-3'-5"N and longitude 81°-4'-10"W. Maps and tables were generated using North American Datum (NAD) 27. Data normally reflect accuracy to within 2 to 5 meters from point of measurement. All GPS field measurements were taken as close as possible to the item of interest. Distances for the locations are displayed using three significant figures.

APPENDIX B

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SUMMARY OF RESULTS

2009

Environmental Radiological Monitoring Program Summary

Facility: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Air Particulate (pCi/m3)						258 (9.84 mi W)	
BETA	257	1.00E-02	1.74E-2 (206/206)	212	1.78E-2 (52/52)	1.72E-2 (51/51)	0
			5.43E-3 - 3.36E-2	(3.32 mi E)	9.20E-03 - 3.01E-2	5.77E-3 - 2.90E-2	
CS-134	257	5.00E-02	0.00 (0/206)		0.00 (0/52)	0.00 (0/51)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-137	257	6.00E-02	0.00 (0/206)		0.00 (0/52)	0.00 (0/51)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
I-131	257	7.00E-02	0.00 (0/206)		0.00 (0/52)	0.00 (0/51)	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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled / Unit of Measurement	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	Location with Highest Annual Mean Name, Distance, Direction Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Air Radioiodine (pCi/m3)						258 (9.84 mi W)	
CS-134	257	5.00E-02	0.00 (0/206)		0.00 (0/52)	0.00 (0/51)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-137	257	6.00E-02	0.00 (0/206)		0.00 (0/52)	0.00 (0/51)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
I-131	257	7.00E-02	0.00 (0/206)		0.00 (0/52)	0.00 (0/51)	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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Drinking Water (pCi/liter)						218 (13.5 mi NNE)	
BALA-140	26	15	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
BETA	26	4	2.07 (13/13)	214	2.07 (13/13)	1.99 (13/13)	0
			0.88 - 2.96	(7.30 mi SSE)	0.88 - 2.96	0.95 - 3.86	
CO-58	26	15	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CO-60	26	15	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-134	26	15	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-137	26	18	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
FE-59	26	30	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
H-3	8	2000	634 (4/4)	214	634 (4/4)	681 (4/4)	0
			439 - 879	(7.30 mi SSE)	439 - 879	509 - 885	
I-131	26	15	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
MN-54	26	15	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
NB-95	26	15	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
ZN-65	26	30	0.00 (0/13)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
ZR-95	26	15	0.00 (0/13)		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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Surface Water (pCi/liter)						215 (4.21 mi NNE)	
BALA-140	39	15	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CO-58	39	15	9.40 (4/26)	208	9.40 (4/13)	0.00 (0/13)	0
			5.43 - 18.7	(0.45 mi S)	5.43 - 18.7	0.00 - 0.00	
CO-60	39	15	10.6 (1/26)	208	10.6 (1/13)	0.00 (0/13)	0
			10.6 - 10.6	(0.45 mi S)	10.6 - 10.6	0.00 - 0.00	
CS-134	39	15	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
CS-137	39	18	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
FE-59	39	30	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
H-3	12	2000	2292 (8/8)	208	3930 (4/4)	529 (4/4)	0
			475 - 4420	(0.45 mi S)	3530 - 4420	367 - 729	
I-131	39	15	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
MN-54	39	15	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
NB-95	39	15	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
ZN-65	39	30	0.00 (0/26)		0.00 (0/13)	0.00 (0/13)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
ZR-95	39	15	0.00 (0/26)		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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Ground Water (pCi/liter)						NO CONTROL LOCATION	
	BALA-140 8	15	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CO-58 8	15	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CO-60 8	15	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-134 8	15	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-137 8	18	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	FE-59 8	30	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	H-3 8	2000	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	I-131 8	15	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	MN-54 8	15	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	NB-95 8	15	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	ZN-65 8	30	0.00 (0/8)		0.00 (0/8)	0.00 (0/0)	0
			0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	ZR-95 8	15	0.00 (0/8)		0.00 (0/8)	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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

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)				NO INDICATOR LOCATION			221 (14.5 mi NW)	
	BALA-140	26	15	0.00 (0/0)		0.00 (0/0)	0.00 (0/26)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-134	26	15	0.00 (0/0)		0.00 (0/0)	0.00 (0/26)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-137	26	18	0.00 (0/0)		0.00 (0/0)	0.00 (0/26)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	I-131	26	15	0.00 (0/0)		0.00 (0/0)	0.00 (0/26)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	LLI-131	26	1	0.00 (0/0)		0.00 (0/0)	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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Broadleaf Vegetation (pCi/kg-wet)							258 (9.84 mi W)	
	CS-134	60	60	0.00 (0/48)		0.00 (0/12)	0.00 (0/12)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-137	60	80	42.5 (1/48)	201	42.5 (1/12)	0.00 (0/12)	0
				42.5 - 42.5	(0.53 mi NE)	42.5 - 42.5	0.00 - 0.00	
	I-131	60	60	0.00 (0/48)		0.00 (0/12)	0.00 (0/12)	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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Food Products (pCi/kg-wet)							NO CONTROL LOCATION	
	CS-134	7	60	0.00 (0/7)		0.00 (0/7)	0.00 (0/0)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-137	7	80	0.00 (0/7)		0.00 (0/7)	0.00 (0/0)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	I-131	7	60	0.00 (0/7)		0.00 (0/7)	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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Fish (pCi/kg-wet)							216 (4.19 mi NNE)	
	CO-58	12	130	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)	0
				0.00 - 0.00		0.00 (0/6)	0.00 - 0.00	
	CO-60	12	130	0.00 (0/6)		0.00 - 0.00	0.00 (0/6)	0
				0.00 - 0.00		0.00 (0/6)	0.00 - 0.00	
	CS-134	12	130	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CS-137	12	150	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)	0
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	FE-59	12	260	0.00 (0/6)		0.00 (0/6)	0.00 (0/6)	0
				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
				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
				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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Shoreline Sediment (pCi/kg-dry)							215 (4.21 mi NNE)	
	MN-54	6	0	0.00 (0/4)		0.00 (0/2)	0.00 (0/2)	
				0.00 - 0.00		0.00 - 0.00	0.00 - 0.00	
	CO-58	6	0	110 (2/4)	208-1S	110 (2/2)	0.00 (0/2)	0
				35.3 - 184	(0.45 mi S)	35.3 - 184	0.00 - 0.00	
	CO-60	6	0	104 (1/4)	208-1S	104 (1/2)	0.00 (0/2)	0
				104 - 104	(0.45 mi S)	104 - 104	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	22.7 (1/4)	208-1S	22.7 (1/2)	0.00 (0/2)	0
				22.7 - 22.7	(0.45 mi S)	22.7 - 22.7	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: Catawba Nuclear Station **Docket No. 50-413,414**

Location: York County, South Carolina **Report Period: 01-JAN-2009 to 31-DEC-2009**

Medium or Pathway Sampled Unit of Measurement	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Annual Mean Name, Distance, Direction Location Code	 Mean (Fraction) Range	Control Location Mean (Fraction) Range	No. of Non-Routine Report Meas.
Direct Radiation TLD (mR/standard quarter)						217 (10.3 mi SSE) 247 (7.33 mi ESE) 251 (9.72 mi WNW)	
	162	0.00E+00	18.7 (150/150) 10.2 - 29.6	235 (4.07 mi ESE)	23.9 (3/3) 17.0 - 29.6	14.5 (12/12) 10.2 - 20.6	0

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

CATAWBA 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	CN	Construction

C.1 SAMPLING DEVIATIONS

Air Particulate and Air Radioiodines

Location	Scheduled Collection Dates	Actual Collection Dates	Reason Code	Corrective Action
258	5/19 - 5/27/2009	5/19 - 5/24/2009	PO	Power interruption due to breaker trip. Thunderstorm was suspected cause. Breaker reset, normal sampling resumed.
200	5/19 - 5/27/2009	5/19 - 5/27/2009	PI	Work request 68178 (written from the previous composite period) requested site services investigate reliability of location's power delivery system. Breaker replaced during composite period interrupting power to equipment for approximately 30 minutes.
201[(1)]	7/14 - 7/21/2009	7/14 - 7/18/2009	PI	Power interruption due to breaker trip. Thunderstorm was suspected cause. Breaker reset, normal sampling resumed.
258	8/11 - 8/18/2009	8/11 - 8/13/2009	PO	Power interruption due to breaker trip. Thunderstorm was suspected cause. Breaker reset, normal sampling resumed.
201[(1)]	9/1 - 9/9/2009	9/1 - 9/6/2009	PO	Power interruption due to breaker trip. Thunderstorm was suspected cause. Breaker reset, normal sampling resumed.
201[(1)]	10/6 - 10/13/2009	10/6 - 10/12/2009	PO	Power interruption due to breaker trip. Work request 72688 initiated to verify electrical supply stability. Breaker reset, normal sampling resumed.

(1) PIP G-09-01248 initiated to investigate power reliability issues at location 201.

Air Particulate and Air Radioiodines, continued

201[1]	11/10 - 11/17/2009	11/10 - 11/17/2009	PI	Power interruption due to breaker trip. Breaker reset, normal sampling resumed.
258	11/10 - 11/17/2009	11/10 - 11/11/2009	PO	Power interruption due to breaker trip. Breaker reset, normal sampling resumed.

C.2 UNAVAILABLE ANALYSES

Air Particulate and Air Radioiodines

Location	Scheduled Collection Dates	Reason Code	Corrective Action
200	5/12 - 5/19/2009	PI	Power interruption due to breaker trip. Insufficient volume collected. Work request 68178 written to determine reliability of power supply. Breaker reset, normal sampling resumed.
201[1]	7/21 - 7/28/2009	PO	Power outage due to breaker trip. Suspected cause was thunderstorm. Insufficient volume collected. Breaker reset, normal sampling resumed.
258	11/17 - 11/24/2009	PO	Power outage due to breaker trip. Insufficient volume collected. Breaker reset, normal sampling resumed.

TLD

Location	Scheduled Collection Dates	Reason Code	Corrective Action
235	6/10 - 9/16/2009	CN	TLD missing. 4th quarter 2009 TLD placed in field.
249	9/16 - 12/16/2009	VN	TLD missing. 1st quarter 2009 TLD placed in field.

(1) PIP G-09-01248 initiated to investigate power reliability issues at location 201.

APPENDIX D

ANALYTICAL DEVIATIONS

No Analytical deviations were incurred for the
2009 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 2009. Appendix E is located separately from this report and is permanently archived at the Duke Energy Corporation Environmental Center radiological environmental master file, located at the McGuire Nuclear Station Site in Huntersville, North Carolina.